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Abbreviations

AC	Agricultural Censuses
AWU	Annual Work Unit
CA	Compensatory Allowance
CAP	Common Agricultural Policy
CATS	Clearance Audit Trail System
CMO	Common Market Organisation
COP	Cereals, oil seeds and protein crops
EC	European Commission
EI	Extensification index
EQ	Evaluation Question
EU	European Union
FADN	Farm Accountancy Data Network
FSS	Farm Structure Survey - Eurostat
LSU	Livestock unit
MS	Member State
NUTS	Nomenclature of Territorial Units for Statistics
OGA	Other gainful activities
SGM	Standard Gross Margin
SO	Standard output
SS	Sample surveys
SAPS	Single Area Payment Scheme
SFP	Single Farm Payment
SPS	Single Payment Scheme
TF	Type of Farming
UAA	Utilised Agricultural Area

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1. INTRODUCTION

This evaluation examines the effects of the direct support schemes laid down in Council Regulation (EC) No 1782/2003 of 29 September 2003 (later Council Regulation (EC) No 73/09) on farm structural changes.

None of the key objectives expressly assigned to the CAP by the article 39 of the EU Treaty is related to farm structures. However, the changes in the support tools, introduced with Regulation (EC) No 1782/2003, may have affected farmers' behaviour, particularly in the use of production factors: land, labour, capital, with likely subsequent effects on key structural features of European farms.

The 2003 CAP reform constituted a fundamental change in the instruments applied in the CAP, with a switch from coupled income supports to a single decoupled support. This new system of direct support, under which aid is no longer linked to production (decoupling), is known as the Single Payment Scheme (SPS). At the time of the introduction of decoupling, some aids were, however, maintained totally/partially coupled.

The present evaluation covers all direct support schemes governed by Council Regulation (EC) No 1782/2003: decoupled and coupled payments (including Complementary National Direct Payments), and all implementation models: Single Payment Scheme (historical, regional and hybrid models) and Single Area Payment Scheme. The models of implementation of the 2003 reform, as well as the types of direct support (coupled or decoupled) represent a key factor to be taken into account when analysing the relationship between direct support and structural changes.

The methodology used allow to make a clear distinction between the effects of direct payments on structural changes and the effects of other drivers such as other policies measures, in particular the measures under the Single Market Organisation (Single CMO) and the 2nd Pillar of the CAP, policy factors at national level (legal and institutional framework) and non-policy factors (i.e. market development, change in the economic environment).

The geographical scope of the analysis is EU27 and the coverage is regional (NUTS 2). The analysis was developed at two different levels: macroterritoral and farm level. Furthermore, 12 regional case studies represented a third level of analysis in the answer to some evaluation question. The main data sources used are the EU Farm Structure Survey (FSS: agricultural census and intermediate sample surveys. Source: Eurostat) and the Farm Accountancy Data Network (FADN).

The evaluation covered the period from 1 January 2005, when Council Regulation (EC) No 1782/2003 came into force, until the last year for which statistics are available. In order to clearly identify the effects of policy changes on the evolution of farm structures, the observation period has been prolonged starting thus from 1995.

2. THE POLICY FRAMEWORK

2.1 Objectives and policy instruments of the 2003 reform

Council Regulation (EC) 1782/2003 of 29 September 2003 introduces a radical change to the logic of the CAP. According to the 2003 reform, it is the free market that determines production levels and quality of agricultural production. Specific measures are established for aspects that the market is unable to deal with in an optimal manner, taking into account non-market effects of agricultural activities in order to protect the environment, public health, etc.

In this context, Regulation (EC) No 1782/2003 introduced the Single Payment Scheme (SPS) which represents a fundamental change in the support instruments. The tools used until 2003 (price support, area payment, animal payment) have gradually been dropped in favour of a single payment. This aid is decoupled, since it is not bound to production levels (unlike price support), or to production (unlike the area payment), or to market conditions, and thus the production decisions of farmers (both in terms of output levels and quality) are responding to market demand. New Member States have the possibility, during a transitional period, to apply a Single Area Payment Scheme (SAPS), i.e. a decoupled support system based on two fixed elements at the national level: a national financial envelope and a national agricultural area.

The decoupled payments are calculated by multiplying the number of eligible hectares and the single payment entitlement. The Member States (MS) could choose from three basic SPS models on how to calculate the reference amount for an individual farm: decoupling based on historical farm data (historic model), decoupling based on regional historical data (regional model) and hybrid systems.

Regulation (EC) No 1782/2003 introduces also the possibility of partial decoupling that may or may not be used by Member States (articles 66 to 68b). Furthermore, Article 69 also allowed Member States to keep up to 10% of the funds available (under national ceilings) for each sector, and to assign it in the form of an additional coupled payment to farmers using special farming methods.

In January 2009, following the Health Check of the CAP, Regulation 1782/2003 was replaced by Council Regulation (EC) 73/2009 of 19th January 2009. The Health Check decided on the further integration of coupled measures into the decoupled direct support. Furthermore, the regulation provides assistance to sectors or regions with particular difficulties (the so-called 'Article 68' measures), abolishes arable set-aside, increases milk quotas gradually leading up to their abolition in 2015, and converts market intervention into a genuine safety net. It was also agreed to increase modulation, whereby direct payments to farmers are reduced and the corresponding amounts are transferred to the Rural Development Fund.

With regard to the new Member States, direct payments are phased in from 2004 to 2013 for the ten members entering in 2004 and from 2007 to 2016 for Bulgaria and Romania. By the date of accession, the new Member States had to make a decision whether they wanted to apply the SPS or the SAPS. Only Slovenia and Malta chose the SPS. The new Member States may grant complementary national direct payments (CNDP) subject to the authorisation of the Commission and within specific limits. These CNDPs may be decoupled or coupled (to production, or to land use). Moreover, certain new Member States may decide to grant a separate sugar payment to historical producers of sugar beet as well as a separate fruit and vegetable payment and a transitional fruit and vegetable payment to SAPS eligible farmers.

2.2 The Single Payment Scheme

Title III of (EC) Regulation 1782/2003 fixes the reference amount, payment entitlements (according to agricultural surface or special conditions), land use and set-aside rights, as well as principles for its regional and partial implementation.

Aid under the Single Payment Scheme and other direct support schemes (coupled) is subject to usage conditions and the principle of modulation:

- Cross-compliance is a mechanism that encourages compliance with statutory requirements for

farmers receiving direct payments. This mechanism (Title II chapter I of Regulation (EC) No 1782/2003) establishes, as from 2005, a reduction or elimination of direct payments if Statutory Management Requirements (SMR) are not met in the areas of the environment, public, animals and plants health, animal welfare and minimum Good Agricultural and Environmental Conditions (GAEC) needs are not met;

- the principle of modulation: a percentage of payments, beyond a ceiling fixed by rules, is used to help finance rural development.

The principle for calculating payments to be received under the SPS is that of the number of eligible hectares declared in the first year of the implementation of the SPS multiplied by the value of payment entitlement. The Member States could choose from three basic models of the SPS on how to calculate the reference amount for an individual farm and by that the value of payment entitlements:

- the historic model, in which payments are purely based on historical payments received by individual farms during the reference period from 2000 to 2002;
- the regional model, in which payments are made as flat rate payments per hectare and the level of support thus being the same for all farms within a region;
- a so-called hybrid model, in which a part of the payment is based on historical reference data (2000–2002) and another part on a flat rate payment per hectare.

2.2.1 The Historical model

The value of payment entitlements per hectare, the number of payment entitlements, the number of eligible hectares are defined for each crop.

- Eligible parties (beneficiaries) (article 33) are farmers that were granted payments between 2000 and 2002, or have received a holding (by way of inheritance) that was granted payments in the same period or have received a payment entitlement from the national reserve (especially farmers starting up an agricultural business after the reference period).
- The value of the payment entitlement is calculated according to the reference amount divided by the average number of hectares entitling the farmer to the payment during a reference period (the calendar years 2000, 2001 and 2002). The total reference amounts are limited by the member State's national ceiling for the SPS.
- The reference amount of a farm is the average payment received during the reference period under one of the following systems: arable crops; potato starch; grain legumes; rice; beef and veal; milk and dairy produce; sheep and goat production; dried fodder; cotton ; olive oil; tobacco; hops; sugar beet, cane and chicory used to produce sugar or insulin syrup, wine, seeds and bananas. These systems have not all been introduced in the SPS at the same time. The number of payment entitlements corresponds to the average number of hectares entitling the farmer to the payment in the reference period, as well as all forage areas and areas for dried fodder, potato starch, seeds, olive groves and tobacco that were granted aid in the reference period.
- The number of eligible hectares for allocation and, in subsequent years, activation of entitlements: eligible hectares correspond to the agricultural area occupied by arable land and permanent grassland and subsequently, if chosen by the Member State, also land under permanent crops. Eligible hectares do not include: forests, or land used for non-agricultural activities. On the other hand, agricultural parcels planted with short rotation coppice are included, in the same way as land planted with permanent crops subject to an application for aid for energy crops.
- Set-aside entitlements: land set aside during the reference period had to remain fallow at least from 15 January to 31 August. Set-aside areas are eligible for the set-aside entitlement. Thus they are not included in the calculation of normal entitlement (article 54, paragraph 3).

The Health Check (Regulation 73/2009, articles 45-48) gives to Member States that have applied the historic model the opportunity to review their choice and change over to a regionalised application of the single payment scheme, similar to the options already provided for in Regulation 1782/2003.

2.2.2 The Regional model

This corresponds to the regionalised method with total equalisation of support between farmers. If the MS decides to regionalise the single payment scheme, the national ceiling is distributed among the regions (according to criteria set by the MS).

- Eligible parties (beneficiaries): the regional amount is divided among all eligible hectares declared in the region in the first year of the application of the SPS, also by farmers who were not granted payments between 2000 and 2002. For this reason, the MS can divide all or a part of this amount by the number of hectares of arable land and permanent grassland in the region in order to differentiate the value of payment entitlements for grassland and for other land.
- The value of the payment entitlement corresponds to the regional ceiling divided by the number of declared eligible hectares. The MS may also distinguish values of payment entitlements for grassland and arable land. The value for one type of entitlement is thus the same for all farmers in a given region. Farmer aid thus depends on the number of entitlements.
- The number of payment entitlements corresponds to the number of hectares eligible for aid during the first year of application of the Regulation.
- Eligible hectares for allocation and activation of payment entitlements are arable land and permanent grassland, as used in the historical calculation.
- Set-aside entitlements: land set aside during the reference period had to remain fallow at least from 15 January to 31 August. Set-aside areas entitlements are the same as those for the classic entitlements. The number of set-aside entitlements is defined by a set-aside rate that corresponds to the mandatory set-aside percentage (10%), multiplied by the arable crops surface area (granted per hectare payments) during the reference period.

2.2.3 The Hybrid model

The hybrid model is similar to the regional model, but the MS decides on the degree of equalisation. Member States may apply adequate calculation systems for each region and may also calculate SPS payments (the value of payment entitlements) on the basis of a part-historical and part-flat rate approach. There are two sub-types of this model:

- the static hybrid model, in which the split between historic and flat-rate regional component of the payment entitlement remains stable over time;
- the dynamic hybrid model, in which the historic components are gradually reduced in favour of a flat-rate regional component of the payment entitlement.

The main difference from the regional model thus relates to the value of the payment entitlement of each farmer, whereas other rules are applied in the same way. Namely, the value of the entitlement payment comprises two elements: a equalised element (flat-rate) and an element based to individual farmers' reference amount:

- the equalised element is calculated by dividing the portion of the regional ceiling by the surface area of declared eligible land (arable land and permanent grassland);
- the individual reference component of the value of entitlement corresponds to the farmer's reference amount divided by the number of eligible hectares declared during the first year of application of the SPS (or later when relevant sector is integrated into the SPS).

2.2.4 National reserve and transfer of payment entitlements

In all implementation models, a National reserve and entitlement transfer procedures are established.

- National reserve (article 42): the national reserve serves to allocate entitlements to farmers in special situations (e.g. newcomers, special conditions due to transition etc). The reserve is formed through a reduction in the national ceiling for the SPS (in case of the old MS it is limited to 3%).
- Transfer of entitlements (article 46): transfers may be effected within MSs only, and MSs may decide that payment entitlements may only be transferred within single regions. The sale may be with or without land, while lease of payment entitlements is bound to land. Transfers may be effected by subrogation in cases of mergers, scissions, inheritance (etc.) or contractually. A certain number of clauses limits entitlement transfers.

2.2.5 Partial implementation

Regulation 1782/2003 introduced the possibility of partial decoupling that may or may not be used by the MS. If partial decoupling was adopted, a percentage of SPS budgets was coupled within the limits of ceilings defined by the Regulation (articles 66 to 68*b* of Regulation (EC) No 1782/2003). The sectors for which Regulation 1782/2003 provides for partial implementation are: arable crops (article 66); sheep and goats (article 67); beef and veal (article 68), hops (article 68a), certain fruit and vegetables (article 68b).

According to Regulation 73/2009 (Health Check) these remaining coupled payments are decoupled and shifted into the Single Payment Scheme, with the exception of suckler cow premium and sheep and goats payments, for which the Member States may maintain coupled support. For the dates of integration of these schemes into the SPS, please see Annex XI of Regulation 73/2009.

2.2.6 Other aid schemes

Other coupled support schemes (some depending on the choice of the Member State whether or not to adopt such schemes, some decided by the Council) have been established or maintained for the following products: durum wheat, protein crops, rice, nuts, energy crops, potato starch, dairy products, seeds, cotton, tobacco, olive groves, grain legumes, separate payment for sugar (only for new member States adopting the SAPS). The year of their integration into the SPS varies, except for cotton schemes which may remain coupled.

2.2.7 Payments relative to the application of Art. 69 (Regulation (EC) No 1782/2003) and of the new article 68 (Regulation (EC) No 73/2009)

Regulation 1782/2003 gave to Member States the opportunity to grant additional payments to support agricultural activities that encourage the protection or enhancement of the environment or for improving the quality and marketing of agricultural products. Additional payments may use up to 10% of the funds available (under national ceilings) in the SPS, thus reducing the funds available for SPS payments and product specific coupled direct aids. Additional payments granted under article 69 were coupled, with the provision that they were not granted to all producers of a sector but were based on certain eligibility criteria decided by the MS.

The Health Check revised article 69, to allow more flexibility in Member State responses to the needs stemming from the overall orientation of the CAP. The new article 68 of Regulation (EC) 73/2009 allows all Member States to retain up to 10 per cent of their national ceilings for Single Payment Scheme (Annex VIII to the same regulation) to provide support to specific sectors, for an expanded range of purposes.

From 2010 funds can be used for the following purposes: protecting or enhancing the environment, improving the quality of agricultural products, improving the marketing of agricultural products, practising enhanced animal welfare standards, specific agricultural activities entailing additional agri-environmental benefits, payments for specific disadvantages affecting farmers in specific sectors in economically vulnerable or environmentally sensitive areas, or, in the same sectors, for economically vulnerable types of farming, top-ups to existing entitlements in areas where land abandonment is a threat, support for risk assurance in the form of contributions to crop insurance premiums. contributions to mutual funds for animal and plant diseases.

2.2.8 Support schemes in the new Member States

New Member States must apply a single payment scheme on a regional basis (article 71f of Regulation 1782/2003). However, they also have the possibility, in a transitional period[1], of applying a Single Area Payment Scheme (SAPS) (article 143a). The SAPS is also a decoupled support system (with no obligation to produce), however without payment entitlements. Instead , the SAPS is based on two elements fixed at the national level: a national financial envelope for direct support (the sum of all direct payments that the member State will receive within the framework of «normal» direct payment systems) and a national agricultural surface area, equivalent to the used agricultural area that was in

[1] Initially until 2009 but extended by the Health Check to 2013 (2016 for Bulgaria and Romania).

«good agricultural condition» in June 2003. Payments granted within the SAPS are also subject to the cross compliance mechanism, introduced gradually.

New Member States that adopt the SAPS may decide to grant a separate payment for sugar for the years 2006 to 2010, as well as a separate payment and a transitional payment for fruit and vegetables to eligible farmers within the framework of the SAPS (article 143ba and article 143bb).

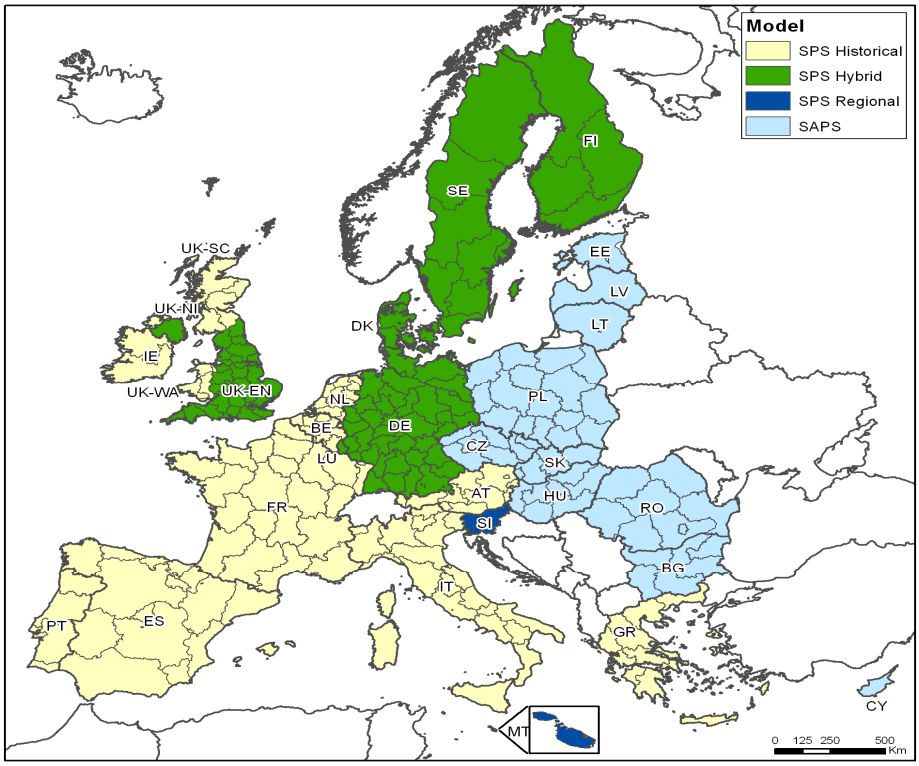
New Member States have also the possibility to supplement their direct payments by granting, in the transitional period, complementary national direct payments (CNDP, also called "top-up" payments). CNDP are linked to the phasing-in of direct payments and it allows to increase the direct support level above the phasing-in level applicable in the given year.

CNDP may be decoupled or coupled, pending the authorisation of the Commission and within given limits. The CNDP should respect the maximum level of support in the EU15 Member States as well as the eligibility criteria and any limits on coupled support in the EU15 Member States.

2.2.9 Terms of implementation across the Member States

The implementation of single payment scheme is not uniform across Member States. Indeed, the Member States had room for manoeuvre in the application of decoupling (e.g. choice of the date of activation, choice of the extent of decoupling, partial or total, choice of redistribution of the single payment among farmers). It follows that various choices made by Member States have to be taken into account in the analysis.

Fig. 1 – SFP implementation model by Member States and regions



Source: DG AGRI

Moreover, the next table provides an overview of the implementation of the 2003 reform and subsequent changes decided by the MSs. The table refers to the period of analysis of this evaluation (2005-2010). The analysis takes into account that several coupled aids have been integrated into the single payment scheme only from 2010. Therefore, the aids that have been decoupled in 2010 have been maintained in the table and indicated in italics.

The second table provides an overview of the implementation of article 69 and article 68 specific support. In view of the period of analysis of this evaluation (2005-2010), data on article 68 refers only to year 2010. Application of article 69 ended on 31/12/2009 and article 68 entered into force in 2010. Member States could review article 68 measures for the year 2012 and onwards.

Tab. 1 - Overview of the implementation of direct payments under the CAP in Member States during the examined period (2005-2010)[2]

Member State	Start SPS/SAPS	Regions	Implementation model	Minimum requirements	Sectors with coupled direct payments
Austria	2005	-	SPS historical	100 €	Suckler cow premium (100%), Protein crops, Nuts, Starch potato, Dried fodder, Flax for fibre *Durum Wheat (traditional areas), Slaughter premium calves (100%)* *Slaughter premium bovine adults (40%, Hops (25%)*
Belgium	2005	Flanders + Brussels Wallonia	SPS historical	100 €	Suckler cow premium (100%), Slaughter premium calves (100%) Protein crops, Flax for fibre, Seeds (some species, 100%), Nuts
Bulgaria	2007	-	SAPS	0,5 Ha, 100 €	Transitional soft fruit payments (from 2008, 100%)
Cyprus	2004	-	SAPS	0,3 Ha	Citrus fruits intended for processing (from 2008, 100%)
Czech Republic	2004	-	SAPS	1 Ha	none
Denmark	2005	-	SPS dynamic hybrid[3]	2 Ha 300 €	Special male bovine premium (75%) Sheep and goat premium (50%) Protein crops, Starch potato, Dried fodder, Flax for fibre
Estonia	2004	-	SAPS	1 Ha	none
Finland	2006	3 regions (based on regional yields)	SPS dynamic hybrid[4]	200 €	Sheep and goat premium (50%), Seeds (timothy seed, 100%), Protein crops, Starch Potato, Dried Fodder, Flax for fibre. *Special male bovine premium (75%)*
France	2006	-	SPS historical	100 €	Suckler cow premium (100%), Seeds (some species, 100%), Protein crops, Rice, Nuts, Starch Potato, Dried fodder, Flax for fibre, Tomatoes intended for processing (from 2008, 50%) prunes, peaches, and pears intended for processing (98%) *Durum Wheat (traditional areas), Slaughter premium calves (100%), Slaughter premium bovine adults (40%), Sheep and goat premium (50%), Arable crops (25%), Tobacco (from 2006 until 2009, 60%), Hops (25%)*
Germany	2005	Bundesländer	SPS dynamic hybrid[5]	1 Ha	Protein crops, Dried fodder, Starch Potato, Nuts, Flax for fibre *Hops (25%), Tobacco (from 2006 until 2009, 60%)*

[2] Coupled aids that have been integrated into the single payment scheme only from 2010 are indicated *in italics*

[3] Support is provided as a flat-rate payment per hectare, with a supplement for farmers who have been producing beef and milk on historical basis. Aid is being introduced for permanent pasture areas too, increasing over time to reach the same rate as standard entitlements.

[4] The Finnish model comprises a regional flat rate and historical payments, based on the support a farm received during the reference period 2000–2002. Within the SPS, around 86 % of all payments are made as flat rate payments and 14 % of payments are based on historical payments (2006). A gradual reduction of the historical payments will end in 2019.

[5] Germany selected a regionalised dynamic hybrid model, which will evolve to a purely regional model by 2013. The evolution started in 2010. In 2006, around 69% of the decoupled farm payments were paid as flat-rate regional payments and the remaining 31% were paid through historical payment.

Member State	Start SPS/SAPS	Regions	Implementation model	Minimum requirements	Sectors with coupled direct payments
Greece	2006	-	SPS historical	100 €	Seeds (100%), Protein Crops, Rice, Nuts, Cotton, Dried fodder, Flax for fibre; Citrus fruits intended for processing (from 2008 until 2010, 60%) *Durum Wheat (traditional areas); Tomatoes for processing (from 2008 until 2010, 30%)*
Hungary	2004	-	SAPS	1 Ha or 0,3 Ha orchards /vineyards	Transitional soft fruit payments (from 2008, 100%)
Ireland	2005	-	SPS historical	100 €	Protein Crops, Dried fodder
Italy	2005	-	SPS historical	100 €	Seeds (100%), Protein Crops, Rice, Nuts, Dried fodder, Flax for fibre, Prunes, peaches, and pears intended for processing (100%) *Durum Wheat (traditional areas), Tobacco (from 2006 until 2010, 60% - Apulia, total decoupling from 2006), Tomatoes intended for processing (from 2008 until 2010, 50%)*
Latvia	2004	-	SAPS	1 Ha	Transitional soft fruit payments (from 2008, 100%)
Lithuania	2004	-	SAPS	1 Ha	Transitional soft fruit payments (from 2008, 100%)
Luxembourg	2005	one region	SPS static hybrid[6]	100 €	Protein Crops, Nuts
Malta	2007	one region	SPS regional	0,1 Ha, 100 €	None
Netherlands	2006	-	SPS historical	500 €	Seeds for fibre flax (100%), Starch Potato, Nuts, Dried fodder, Flax for fibre *Slaughter premium bovine adults (100%), Slaughter premium calves (100%)*
Poland	2004	-	SAPS	1 Ha	Transitional soft fruit payments (from 2008, 100%)
Portugal	2005	-	SPS historical	0,3 Ha	Suckler cow premium (100%), Slaughter premium calves (100%) Slaughter premium bovine adults (40%), Sheep and goat premium (50%) Tomatoes intended for processing (from 2008, 50%) Seeds (100%), Protein Crops, Rice, Nuts, Dried fodder, Cotton *Tobacco (from 2006 until 2009, 50%) Durum Wheat (traditional areas)*
Romania	2007	-	SAPS	1 Ha	none
Sweden	2005	3 regions (based on regional yields)	SPS static hybrid[7]	4 Ha, 100 €	Special male bovine premium (74,55%) Protein Crops, Starch Potato, Dried fodder
Slovakia	2004	-	SAPS	1 Ha	none
Slovenia	2007	One region	SPS regional[8]	0,3 Ha / 100 €	Special male bovine premium (75%), Protein Crops, Nuts *Sheep and goat premium (50%), Hops (25%)*

[6] About 30% based on area and 70% on historical basis.

[7] 80% based on area and 20% on historical basis.

[8] This regional model is hybrid dynamic one. Entitlements comprise of a flat rate and, for farmers who were in beef, dairy or sugar beet sector, of historical top-ups (nearly 30% of the SPS ceiling).

Member State	Start SPS/SAPS	Regions	Implementation model	Minimum requirements	Sectors with coupled direct payments
Spain	2006	-	SPS historical	100 €	Suckler cow premium (100%), Slaughter premium calves (100%) Slaughter premium bovine adults (40%) Seeds (100%) Protein Crops, Rice, Nuts, Cotton, Dried fodder, Flax for fibre, Starch Potato (60%) *Sheep and goat premium (50%), Arable crops (25%, Durum Wheat (traditional areas), Tobacco (60%; from 2009, total decoupling), Citrus fruits intended for processing (from 2008 until 2009, 100%) Tomatoes intended for processing (from 2008 until 2010, 50%)*
United Kingdom [9]	2005	England	SPS dynamic hybrid[10]	1 Ha, 200 €	Dried fodder, Flax for Fibre, Protein Crops, Nuts
		Scotland	SPS historical	3 Ha, 100 €	Dried fodder, Flax for Fibre
		Wales	SPS historical	1 Ha, 100 €	Dried fodder, Flax for Fibre
		Northern Ireland	SPS static hybrid[11]	100 €	Dried fodder, Flax for Fibre

Source: Regulations, DG AGRI

[9] The United Kingdom was the only Member State to implement the scheme separately on a regional basis in England, Scotland, Wales and Northern Ireland.

[10] In England the Single Payment was implemented within three defined regions: moorland within the Severely Disadvantaged Areas (SDA), non-moorland SDA and non SDA, with different flat rates applying in each of the three regions. There is a period of transition ending in 2012. During this period, entitlements have been based upon a sliding scale of flat rate and historical payments: 2005: 10% Flat rate - 90% Historical; 2006: 15% - 85%; 2007: 30% - 70%; 2008: 45% - 55%; 2009: 60% - 40%; 2010: 75%; 25%; 2011: 90% - 10%; 2012: 100% - 0%.

[11] 20% on area basis, 80% on historical basis.

Tab. 2 - Overview of the implementation of article 69 and article 68 specific support

Member State	Article 69 measures and % of the ceiling	Article 68 specific support measures
Austria	-	Dairy cow premium – Art. 68(1)(b) (including state aid under Art. 182(7) of Reg. 1234/2007)
Belgium	-	For a better quality–all sectors 68(1)(a)(ii) South: Grassland premium – breeding 68(1)(b)
Bulgaria	n.a.	In the dairy sector - 68(1)(b)
Cyprus	n.a.	-
Czech Republic	n.a.	Aid for dairy farmers - 68(1)(b)
Denmark	-	Establishment/production of perennial Energy Crops - 68(1)(a)(i) Agri-environment Measures - 68(1)(a)(v)
Estonia	n.a.	In the dairy sector - 68(1)(b)
Finland	2,1% of arable sector 10% of bovine sector	Ex-Art 69 measures (arable crops) - Art. 72(3) Supporting beef and veal production; dairy cow premium - 68(1)(b) (including state aid for dairy under Art. 182(7) of Reg. 1234/2007)
France	-	Additional aid for protein crops - 68(1)(a)(i) Aid for quality of durum wheat - 68(1)(a)(ii) To maintain organic farming - 68(1)(a)(v) Diversification of crop rotation 68(1)(a)(v) Aid for calves from suckling cows and for organic labelled calves; aid for sheep and goat producers; aid for milk producers in mountain areas - 68(1)(b) Crop harvest insurance - 68(1)(d)
Germany	-	Grassland premium in dairy sector 68(1)(b), including state aid (Art. 182(7) of Reg. 1234/2007)
Greece	10% of arable sector 10% of bovine sector 5% of sheep & goat 2% of tobacco sector 4% of olive oil sector 10% of sugar sector	Improvement of quality of olive oil, durum wheat - 68(1)(a)(ii) LFA producers in meat sectors (beef, sheep and goat) - 68(1)(b) Restructuring programmes in LFA/mountainous areas - 68(1)(c)
Hungary	n.a.	In the dairy sector and in the rice sector - 68(1)(b) For tobacco, fresh fruit and vegetables growing areas subject to restructuring and development programmes - 68(1)(c)
Ireland	-	Conservation in the Burren (livestock) - 68(1)(a)(i) Grassland Sheep Scheme - 68(1)(b) Grassland Dairy Efficiency - 68(1)(b)
Italy	8% of arable sector 7% of bovine sector 5% of sheep & goat 8% of sugar sector 8% of energy crops	Improvement of quality (beef and veal; sheep and goat meat; olive oil; dairy products; tobacco; sugar; floricultural products) - 68(1)(a)(ii) Crops rotation - 68(1)(a)(v) Insurance payments for harvests, animals and plants - 68(1)(d)
Latvia	n.a.	In the dairy sector - 68(1)(b)
Lithuania	n.a.	-
Luxembourg	-	-
Malta	-	-

Member State	Article 69 measures and % of the ceiling	Article 68 specific support measures
Netherlands	-	Water transport allowance - 68(1)(a)(i) Animal welfare - 68(1)(a)(iv) Electronic I&R for sheep - 68(1)(b) Weather insurance - 68(1)(d)
Poland	n.a.	For cultivating pulses and herbage legumes - 68(1)(a)(i) For keeping cows in South-eastern Poland and sheep in Southern Poland - 68(1)(b)
Portugal	1% of arable sector 1% of bovine sector 1% of sheep & goat 10% of sugar sector 10% olive oil sector	Extensive handling systems for autochthonnous races (beef, sheep, goats) 68(1)(a)(i) Quality improvement of agricultural products (crops and animals) 68(1)(a)(ii) Agri-environmental measures for protection of olive national patrimony and support to extensive pasturing 68(1)(a)(v) To economic vulnerable types of agriculture in milk and sheep sectors 68(1)(b)
Romania	n.a.	For improving quality in the organic farming sector - 68(1)(a)(ii) For the milk in LFA - 68(1)(b)
Sweden	0,45% all sectors	Ex-Art 69 measures: Improving quality and marketing (all sectors) - Art. 72(3)
Slovakia	n.a.	In the dairy sector - 68(1)(b)
Slovenia	10% of bovine sector	For extensive rearing of female bovine animals and dairy payment for farmers in mountain areas and on steep hills - 68(1)(b) Preserving animal rearing on farms with permanent pastures - 68(1)(c)
Spain	7% of bovine sector 10% dairy payments 5% of tobacco sector 10% of cotton sector 10% of sugar sector	Improving quality of legumes, tobacco sheep and goat farmers and milk products 68(1)(a)(ii) National programme crop rotation 68(1)(a)(v) Aid to sheep and goat producers and milk producers in LFA 68(1)(b) Ex article 69 measures (beef ,cotton, sugar, milk) 72(3)
United Kingdom	10% of bovine sector	Ex-Art 69 measures (beef sector in Scotland) - Art. 72(3)

Source: Regulations, DG AGRI

2.2.10 Distribution of direct payments between Member States and beneficiaries

In this section we report the distribution of direct payments between Member States, the distribution of beneficiaries and of direct payments by amount received as well as the average level of support for the period of analysis. This information represents a key element when analysing the effects of direct payments on structural change.

2.2.10.1 Methodological approach used for the computation of the total amount of aids and of paid aid classes (EU direct aids and CNDP) in the EU12 Member States

The European Commission (AGRI L.2) yearly publishes the breakdown of direct payments by MS and size of payment. The notes cover the expenditure from the EU budget as paid direct aid according to Regulations (EC) No 1259/1999, No 1782/2003 and No 73/2009 for the policy period 2005-2010. Figures are based on the total amounts aggregated by every individual beneficiary identification code

("unique identifier"). DG AGRI services recommend to carefully consider some limitations when consulting the figures (please refer to http://ec.europa.eu/agriculture/funding/directaid/distribution_en.htm).

AGRI L.2 data on the amount of direct aids by classes only cover the support provided from the EU budget and do not cover Complementary National Direct Payments (CNDP) allowed in the new Member States. In order to provide a complete picture of direct payments (EU budget + CNDP), as requested by the scope of the evaluation, AGRI L.2 data analysis has been integrated with DG AGRI data on Complementary National Direct Payments in new Member States.

On this basis, we estimated a new distribution of the amounts paid to beneficiaries by size classes. For the estimation, taking into consideration that the only information available is the total amount of CNDP paid in each Member State (source: DG AGRI), the following hypotheses have been considered: i) in each Member State, CNDP payments are received by the same beneficiaries of direct aids provided by the EU budget. In other words, the total number of CNDP beneficiaries is equal to the number of EU direct aid beneficiaries; ii) in each Member State, the CNDP total amount is distributed among the beneficiaries in the same proportion as the total amount of EU direct aid.

Therefore the estimation has been carried out through the following steps:

- based on the proportionality hypothesis, the amount of CNDP payments has been calculated for each class of EU direct aid paid to beneficiaries;
- for each direct aid class, we computed the total amount received by beneficiaries originally belonging to that class (EU direct aids + estimated CNDP aids);
- considering that the number of beneficiaries is (according to the hypothesis) the same, each of them has received an amount higher than the one limited to EU direct payments. Consequently, it is foreseeable that a certain number of beneficiaries has moved from a class to the next one. Therefore, we made the hypothesis that the passage from a class to the next class has concerned only half of the beneficiaries originally belonging to that class, whereas the other 50% has remained in the same class even if the unitary amount is higher. On the basis of this hypothesis, we have re-calculated the number of beneficiaries within each size class;
- with the same criteria, for each class, we estimated the total amount of direct aids (EU + CNDP) and the average amount received by beneficiary.

2.2.10.2 Distribution of direct payments between Member States and between beneficiaries

In 2010 direct payments reached 42.466 million Euro (2.280 million paid as CNDP included). Expenditure increased by 7.527 million Euro between 2005 and 2010 (+21.5%). This augmentation is mainly due to the accession of Bulgaria and Romania and to the increase of the phasing-in level in the EU-12 Member States (from 25% of EU-15 level in 2004 to 100% in 2014 at the latest; for Bulgaria and Romania: from 25% in 2007 to 100% in 2017).

Tab. 3 shows the distribution of direct payments among Member States and the average amounts received by beneficiary by Member State for the years 2005 and 2010. Tab. 4 and Tab. 5 show the distribution of direct aid between MS and beneficiaries by size-class of aid (data are aggregated according to four aid size-classes) in 2005 and 2010.

Tab. 3 - Distribution of direct payments and average amounts received by beneficiary by Member State (2005, 2010)

	Direct payments in 2005					Direct payments in 2010				
	Total amount (000 €)	of which CNDP	Share of decoupling	Total beneficiaries (000)	Average amount (000 €)	Total amount (000 €)	of which CNDP	Share of decoupling	Total beneficiaries (000)	Average amount (000 €)
BE	466 904		63%	43.8	10.66	575 665		83%	37.9	15.19
CZ	487 463	231 513	53%	20.2	24.12	803 346	146 353	86%	26.0	30.95
DK	924 064		95%	70.6	13.09	942 809		97%	48.2	19.58
DE	5 050 192		99%	377.6	13.37	5 342 079		100%	334.5	15.97
EE	49 253	21 621	56%	19.1	2.58	106 234	34 521	88%	16.1	6.59
EL	1 616 494		3%	868.1	1.86	2 353 723		89%	740.8	3.18
ES	4 462 939		1%	897.2	4.97	5 209 606		66%	909.2	5.73
FR	7 615 739		1%	426.7	17.85	8 009 695		72%	372.5	21.50
IE	1 202 657		99%	129.5	9.29	1 269 903		99%	124.4	10.21
IT	3 455 994		62%	1 580.2	2.19	4 040 005		87%	1 236.7	3.27
CY	36 103	22 564	38%	37.8	0.96	50 603	16 689	57%	41.1	1.23
LV	88 341	49 995	43%	78.5	1.13	174 871	69 687	88%	65.3	2.68
LT	169 322	66 836	61%	225.2	0.75	354 251	82 875	85%	170.2	2.08
LU	32 307		100%	2.0	16.15	34 243		101%	2.0	17.12
HU	728 607	361 422	50%	202.8	3.59	1 048 844	94 974	85%	178.3	5.88
MT	775		0%	4.0	0.19	4 248	498	92%	4.8	0.88
NL	648 819		1%	102.1	6.35	817 428		84%	52.2	15.65
AT	664 644		77%	133.0	5.00	717 035		86%	115.8	6.19
PL	1 740 304	933 286	46%	1 465.0	1.19	3 200 597	1 023 600	89%	1 368.7	2.34
PT	538 365		51%	239.6	2.25	655 627		60%	180.2	3.64
SI	85 277	55 385	0%	52.5	1.63	140 765	38527.3335	75%	58.5	2.41
SK	181 112	79 033	56%	13.8	13.13	344 710	61 650	86%	15.9	21.75
FI	500 605		1%	65.0	7.70	538 898		92%	61.8	8.72
SE	669 097		87%	83.0	8.06	694 408		95%	66.0	10.51
UK	3 523 571		99%	195.1	18.06	3 296 924		99%	178.9	18.43
EU25	**34 938 946**	**1 821 653**	**47%**	**7 332.2**	**4.77**	**40 726 518**	**1 569 375**	**85%**	**6 406.0**	**6.36**
EU15	**31 372 391**	**-**	**46%**	**5 213.5**	**6.02**	**34 498 048**		**84%**	**4 461.2**	**7.73**
EU10	**3 566 555**	**1 821 653**	**48%**	**2 118.8**	**1.68**	**6 228 470**	**1 569 375**	**87%**	**1 944.8**	**3.20**
BG						516 296	216 015	93%	93.3	5.53
RO						1 223 537	494 727	86%	1 112.2	1.10
EU27						**42 466 351**	**2 280 117**	**85%**	**7 611.5**	**5.58**
EU12						**7 968 303**	**2 280 117**	**87%**	**3 150.3**	**2.53**

Source: DG AGRI - The columns "share of decoupling" include the decoupled support from the EU budget and CNDP

Tab. 4 - Distribution of direct aid between MS and beneficiaries by size-class of aid, 2005

	Direct aid paid to beneficiaries (€)	Share of value per range of expenditure				Share of beneficiaries per range of expenditure			
		≥ 0 and <2.000 €	≥ 2.000 and < 10.000 €	≥ 10.000 and < 100.000 €	≥ 100.000	≥ 0 and <2.000 €	≥ 2.000 and < 10.000	≥ 10.000 and < 100.000 €	≥ 100.000
BE	466 904	1.9%	18.2%	77.5%	2.4%	24.8%	35.9%	36.9%	0.2%
CZ	487 463	2.8%	7.9%	31.4%	58.0%	49.2%	29.1%	16.2%	5.5%
DK	924 064	1.8%	12.2%	73.9%	12.3%	35.5%	31.3%	31.9%	1.1%
DE	5 050 192	1.9%	13.7%	56.0%	28.4%	32.4%	35.3%	30.9%	1.3%
EE	49 253	22.1%	21.1%	46.2%	10.7%	86.5%	9.6%	3.8%	0.2%
EL	1 616 494	23.9%	51.8%	23.9%	0.3%	74.4%	22.8%	2.7%	0.0%
ES	4 462 939	7.2%	25.7%	55.9%	11.3%	59.9%	27.5%	12.2%	0.3%
FR	7 615 739	0.9%	8.1%	84.3%	6.7%	21.3%	26.1%	51.1%	0.8%
IE	1 202 657	2.2%	27.7%	67.3%	2.8%	21.5%	48.7%	29.6%	0.2%
IT	3 455 994	16.7%	29.8%	41.5%	12.1%	80.9%	15.0%	3.9%	0.1%
CY	36 103	59.8%	25.7%	14.5%	0.0%	96.3%	3.2%	0.4%	0.0%
LV	88 341	52.5%	21.7%	23.8%	2.0%	95.5%	3.7%	0.8%	0.0%
LT	169 322	53.6%	20.3%	20.7%	5.4%	96.0%	3.3%	0.6%	0.0%
LU	32 307	0.7%	8.5%	89.1%	1.7%	14.5%	24.5%	60.5%	0.5%
HU	728 607	23.5%	25.2%	42.6%	33.7%	84.1%	11.7%	3.9%	0.3%
MT	775	33.7%	53.5%	12.8%	0.0%	97.2%	2.5%	0.3%	0.0%
NL	648 819	3.6%	19.4%	73.4%	3.6%	52.9%	24.4%	22.3%	0.1%
AT	664 644	6.9%	46.1%	45.2%	1.9%	39.5%	47.1%	13.2%	0.0%
PL	1 740 304	63.1%	18.9%	13.6%	4.4%	95.2%	4.3%	0.5%	0.0%
PT	538 365	17.1%	23.0%	43.8%	16.1%	84.0%	12.0%	3.6%	0.2%
SI	85 277	65.9%	24.4%	4.6%	5.0%	93.8%	6.0%	0.2%	0.0%
SK	181 112	3.3%	4.9%	38.0%	53.9%	76.6%	10.2%	10.0%	3.3%
FI	500 605	2.9%	37.4%	58.8%	0.8%	20.9%	54.4%	24.7%	0.0%
SE	669 097	4.5%	20.4%	68.0%	7.0%	43.3%	33.6%	22.7%	0.4%
UK	3 523 571	1.2%	6.8%	65.1%	26.9%	36.6%	23.5%	36.3%	2.9%
EU25	**34 938 946**	**9.4%**	**19.0%**	**58.3%**	**14.0%**	**70.3%**	**18.6%**	**10.7%**	**0.3%**
EU15	**31 372 391**	**5.6%**	**19.0%**	**62.2%**	**13.2%**	**60.8%**	**24.0%**	**14.6%**	**0.4%**
EU10	**3 566 555**	**42.5%**	**18.3%**	**24.0%**	**20.3%**	**93.6%**	**5.2%**	**1.0%**	**0.1%**

Source : Elaborations based on DG AGRI data

Tab. 5 - Distribution of aid payments between MS and beneficiaries by size-class of aid, 2010

	Direct aid paid to beneficiaries (€)	Share of value per range of expenditure				Share of beneficiaries per range of expenditure			
		≥ 0 and <2.000 €	≥ 2.000 and < 10.000 €	≥ 10.000 and < 100.000 €	≥ 100.000	≥ 0 and <2.000 €	≥ 2.000 and < 10.000	≥ 10.000 and < 100.000 €	≥ 100.000
BE	575 665	1.2%	10.8%	83.4%	4.7%	22.5%	31.6%	45.4%	0.5%
BG	516 296	7.6%	11.5%	37.0%	44.0%	82.5%	10.9%	5.4%	1.1%
CZ	803 346	1.1%	4.5%	18.8%	75.5%	38.4%	31.0%	22.5%	8.0%
DK	942 809	1.4%	9.2%	64.1%	25.4%	24.2%	36.4%	36.1%	3.2%
DE	5 342 079	1.5%	11.0%	58.6%	29.0%	29.5%	33.2%	35.5%	1.7%
EE	106 234	8.9%	15.0%	47.2%	28.8%	67.9%	20.4%	10.4%	1.2%
EL	2 353 723	15.3%	46.6%	37.8%	0.3%	61.2%	32.2%	6.6%	0.0%
ES	5 209 606	7.1%	23.4%	58.0%	11.5%	57.0%	28.6%	14.0%	0.4%
FR	8 009 695	0.7%	5.4%	85.3%	8.5%	19.0%	21.4%	58.4%	1.2%
IE	1 269 903	1.8%	25.7%	69.8%	2.7%	17.6%	48.9%	33.2%	0.2%
IT	4 040 005	13.2%	26.7%	45.4%	14.7%	74.0%	19.7%	6.1%	0.3%
CY	50 603	30.3%	28.3%	33.1%	8.4%	88.1%	9.4%	2.5%	0.1%
LV	174 871	26.3%	22.4%	35.1%	16.2%	84.4%	12.0%	3.4%	0.2%
LT	354 251	25.5%	24.0%	34.2%	16.3%	83.9%	12.3%	3.5%	0.2%
LU	34 243	0.9%	6.9%	89.9%	2.3%	18.0%	22.5%	59.0%	0.5%
HU	1 048 844	7.3%	15.0%	35.9%	41.9%	64.2%	24.5%	10.3%	1.0%
MT	4 248	30.3%	24.5%	44.5%	0.8%	91.3%	6.3%	2.4%	0.0%
NL	817 428	1.4%	9.7%	81.2%	7.7%	21.3%	29.5%	48.5%	0.7%
AT	717 035	4.9%	39.0%	54.0%	2.0%	33.9%	47.6%	18.4%	0.1%
PL	3 200 597	30.3%	37.1%	22.3%	10.3%	76.0%	21.2%	2.7%	0.1%
PT	655 627	12.1%	20.5%	47.5%	20.0%	76.4%	16.6%	6.6%	0.4%
RO	1 223 537	38.0%	11.4%	31.7%	19.0%	96.5%	2.4%	1.0%	0.1%
SI	140 765	26.0%	44.2%	24.2%	5.7%	70.1%	25.9%	3.9%	0.0%
SK	344 710	1.9%	3.3%	16.7%	78.1%	63.8%	17.7%	12.1%	6.5%
FI	538 898	2.8%	30.4%	65.3%	1.5%	20.7%	50.2%	28.9%	0.1%
SE	694 408	3.7%	17.2%	68.6%	10.5%	34.7%	37.8%	26.9%	0.7%
UK	3 296 924	1.3%	8.7%	66.2%	23.9%	26.7%	31.1%	39.7%	2.5%
EU27	**42 466 351**	**8.1%**	**18.3%**	**57.1%**	**16.6%**	**65.5%**	**21.9%**	**12.1%**	**0.5%**
EU15	**34 498 048**	**4.8%**	**17.3%**	**64.0%**	**13.9%**	**53.1%**	**27.7%**	**18.6%**	**0.6%**
EU12	**7 968 303**	**22.2%**	**22.7%**	**27.1%**	**28.0%**	**83.0%**	**13.7%**	**3.0%**	**0.3%**

Source : Elaborations based on DG AGRI data

2.3 The Single Common Market Organisation

The Single Common Market Organisation (Council Regulation (EC) 1234/2007 of 22 October 2007) brings together in one single document more than 40 separate regulations governing the various agricultural market in the EU.

The main measures of the Single CMO are:

- Market intervention for the following products: cereals, paddy rice, white and brown sugar, beef and veal, milk, butter, skimmed-milk powder and pig meat[12].
- Special measures of an exceptional nature, namely the financing of half of expenses incurred by Member States in the event of animal diseases and loss of consumer confidence. Some sectors (cereals, rice and sugar) benefit from specific measures. In some sectors (in particular nursery plants, beef and veal, pig meat, sheep and goat meats, eggs and poultry), Community measures may be adopted to encourage the adaptation of supply to market needs.
- Quota systems and production potential: sugar, milk and potato starch. The Regulation defines the methods for transferring national quotas among holdings and the management of surplus production. This includes, among other things, levies collected from producers by Member States.
- Aid schemes for the following processing and production activities in the following sectors: dried fodder and flax/hemp grown for the production of fibre, production of starch and sugar; milk and dairy products, hops, olive oil and table olives, fruit and vegetables and apiculture products; silk culture, wine; and for tobacco through the Community Tobacco Fund.

[12] Regulation 72/2009 reduces to zero the quantitative ceiling of intervention for durum wheat and rice. Intervention has been stopped in the case of pig meat and was available for a limited period for sugar.

- Marketing and production: the Commission may establish marketing rules for the sale of olive oil and table olives, fruit and vegetables, bananas and nursery plants. Specific marketing rules are established for the marketing of fruits and vegetables, some types of beef products and wine. Other specific rules may also be introduced for milk and dairy products, fats, eggs and poultry meat, hops, olive oils and olive cake, cheeses and ethyl alcohol. The Regulation defines the methods of adoption, application and exceptions.
- Producers' and inter-branch organisations may be set up in the hops, olive oil and table olives, fruits and vegetables and silkworms sectors. Inter-branch organisations bringing together representatives of economic activities tied up with production, commerce and/or product processing may be created in the olive oil, table olives, tobacco and wine-growing sectors. Certain conditions must be met before these organisations can be formed.

With regard to trade with non-EU countries, in principle all charges having an effect equivalent to a custom duty and all quantitative restrictions or equivalent measures are prohibited in trading with non-EU countries.

Imports: the Commission may require the presentation of import certificates for products in certain sectors: cereals, rice, sugar, seeds, olive oil and table olives, flax and hemp, fresh and processed fruit and vegetables, bananas, nursery plants, beef and veal, pig meat, sheep and goat meats, poultry, milk and dairy products, eggs and ethyl alcohol of agricultural origin. Import duties of the common customs tariff apply to products covered by the Single CMO, although special provisions are in place for some products (e.g. cereals, rice, fruit and vegetables). Moreover, in some cases, these duties may be suspended, or additional duties may be applied. Import tariff quotas are managed by the Commission and administered in such a way as to avoid discrimination and give due weight to supply requirements and the equilibrium of the market.

Special provisions are applied for the classification and the establishment of the import duty for the imports of mixed cereals, rice or cereals and rice. Besides, specific provisions apply for the imports of sugar, and some import conditions are fixed for hemp, hops and wine.

The Commission may also take further protection measures for imports such as safeguard measures. In some cases, it may also suspend recourse to inward processing for products in the following sectors: cereals, rice, sugar, olive oil and table olives, fresh and processed fruit and vegetables, beef and veal, milk and dairy products, pig meat, sheep and goat meats, eggs, poultry and ethyl alcohol of agricultural origin.

Exports: the Commission may require the presentation of export certificates for products in certain sectors: cereals, rice, sugar, olive oil and table olives, fresh and processed fruit and vegetables, beef and veal, pig meat, sheep and goat meats, poultry, milk and dairy products, eggs and ethyl alcohol of agricultural origin.

The exporting of some products may be supported by export refunds that cover the difference between world market prices and those of the EU. Special provisions govern export refunds for malt in stock, cereals and beef and veal. Pursuant to international commitments, rules on exports are also established.

The management of export quotas in the milk and dairy products sector and special import treatment involving export to non-EU countries are also regulated. In some cases the Commission may suspend recourse to inward processing for products in the sectors: cereals, rice, fresh and processed fruit and vegetables, beef and veal, pig meat, sheep and goat meats and poultry.

2.4 EU Rural Development Policy

The 2003 reform also brought about a review of the EU rural development policy, which was reinforced and given extra financial resources and new measures designed to promote the environment and animal quality and welfare and help farmers to apply Community production rules as from 2005.

Earlier, Agenda 2000 had already changed the rural development approach and introduced a sustainable policy that guaranteed greater consistency between rural development (the second pillar of

the CAP) and price and market policies (first pillar). This approach was defined by Council Regulation (EC) No 1257/1999, regulating the programming period 2000-2006[13].

Nine distinct actions were foreseen, many of which already performed in the past (the first rural development measures dating back to 1972) and often modified, with a variable percentage of EU funding according to the type of measure and geographic location[14]. In particular: investments in agricultural holdings; setting up aid to facilitate the establishment of young farmers; support for vocational training; support for early retirement from farming; compensation for naturally less favoured areas (LFA) and for areas with environmental restrictions; support for agricultural production methods designed to protect the environment and to maintain the countryside; investments to improve processing and marketing of agricultural products, thereby increasing the competitiveness and added value of such products; support for forestry, contributing to maintenance and development of the economic, ecological and social functions of forests in rural areas; support aimed at promoting the adaptation and development of rural areas.

Also worthy of mention is the Community initiative Leader +, financed by EAGGF Guidance Section, which encouraged the implementation of integrated local development strategies.

The 2003 reform increased the importance of the role of rural development, conceived as an instrument aimed at the restructuring of the agricultural sector and promotion of diversification and innovation in the rural context. Council Regulation (EC) No 1698/2005 of 20 September 2005 concerning support for rural development by the European Agricultural Fund for Rural Development (EAFRD)[15], following the conclusions of the Council meetings of Göteborg and Lisbon, set in motion the new phase of rural development policy for the period 2007-2013, with the support and integration of market policies and of direct payments under the 1st pillar.

The primary change relates to the strategic approach: according to strategic guidelines drawn up by the Council in Council Decision 2006/144/EC of 20 February 2006, each MS has defined a National Strategic Plan that is the reference instrument for preparing the Rural Development Programme(s).

Regulation (EC) No 1698/2005 requires that Programmes centre on three themes: improving the competitiveness of the agricultural and forestry sector, improving the environment and the countryside, improving the quality of life in rural areas and encouraging diversification of the rural economy (plus a methodological theme dedicated to the Leader initiative).

Following the Health Check, Council Decision 2009/61/EC of 19 January 2009 (amending Decision 2006/144/EC) modifies, in view of the new challenges for European agriculture and in accordance with article 16b of Regulation (EC) No 1698/2005, the priorities of the Community on the issues of climate change, renewable energies, water management, biodiversity and the restructuring of the dairy sector.

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[13] This evaluation covers two periods of rural development policy programming: 2000-2006 and 2007-2013.

[14] Following the regulation of Structural Funds (Regulation (EC) No 1260/1999), the source of Community funding for rural development measures 2000-2006 differed according to the concerned geographical areas: in objective 1 regions, they were integrated with measures designed to promote regional development, to be financed by the EAGGF – Guidance Section; in objective 2 zones, they accompanied support measures and were charged to EAGGF – Guarantee Section; in the rest of the territory, they had to be integrated with the programming of rural development plans (except for «accompanying measures», which were financed by the EAGGF – Guarantee Section in the whole of the Community).

[15] Lately amended by Council Regulation (EC) No 74/2009 of 19th January 2009

3. THEORETICAL ANALYSIS

3.1 Introduction

The theoretical analysis focuses on the economics of structural change in agriculture. The analysis moves from the definitions of structural change of the farm sector and a brief review of the main theories that can be used to explain such phenomenon. After this, the Chapter focuses on two theoretical approaches that consider the factors affecting the structural change of a single farm relying on simplified but formal representations of this complex topic. Indeed, the utilised approaches permit to consider the impact of several factors including agricultural policy. The analysis is then extended to the impact of the same factors on structural change of the whole farming sector. In this case, the analysis is less formal and relies on the main general theories developed on this subject.

Structural change is a complex phenomenon that can affect several structural attributes at the same time. The analysis covers some of the most important of them but the main focus is on the following attributes: labour allocation decisions (on and off-farm, including part-time vs. full-time farming) and number of farms; investment decisions and substitution of capital for labour; farm size. The evolution of farm size is directly related to the evolution of the number of farms and is strongly influenced by the substitution of capital for labour. Reducing the number of farms by maintaining fixed the amount of utilised land implies an increase of physical farm size. Increasing the amount of capital invested in the farming sector, maintaining all other factors constant, also implies an increase of the economic dimension of farms. Therefore, studying these two aspects (i.e. evolution of number of farms and substitution of capital for labour) feeds the discussion regarding the evolution of farm size.

The theoretical analysis focuses on the role of agricultural policy and, in particular, of direct payments that are the subject of the evaluation. Indeed, agricultural support policies are drivers of structural change (OECD, 2011), to the extent that they affect production incentives and farm income. In this respect, they can influence labour use as well as other structural attributes. However, it is important to stress from the beginning that the literature on how agricultural programmes influence farm structure often derives conflicting results (Tweeten, 1993). While some studies support the idea that farm commodity programmes accelerate farm structural change and reduce farm number, other studies support the opposite idea that these programmes retard the consolidation of farms structures; a residual group of studies conclude that programmes have no impact. Therefore, theoretical models have not been able to provide a unique and definitive answer to this complex question, but the answer should rather be researched by means of empirical analysis.

This large heterogeneity of views derives from the complexity of structural changes but also from the large heterogeneity of farm policies. For example, Leathers (1992) has suggested that if maintaining farm numbers is a policy objective, "… it may have to be pursued directly, trough such instruments as income transfers, rather than indirectly through programs such as price support." (Leathers, 1992: page 298) because these two sets of policies may have different implications for structural change. This suggests that it is important to develop the analysis also by differentiating, when possible, between coupled and decoupled forms of support.

The theoretical analysis is organised in the following sections:

- Definition of structural change of the agricultural sector (§ 3.2)
- Theories explaining structural change (§ 3.3)
- Representation and discussion of the role of agricultural policies and other factors on:
  - labour allocation decisions and farm exit (§ 3.4.2)
  - substitution of capital for labour (§ 3.4.3)
- Other themes covered by the evaluation (§3.5).

The objective of the theoretical analysis is to develop a consistent framework to be used in the various parts of the evaluation. Therefore, while providing a general overview of the subject and exploring structural change from a wider perspective, it is focused on the specific themes of the evaluation.

The theoretical analysis provides a framework useful to overcome some of the difficulties that characterise the analysis of structural change. One of the complexities of analysing structural changes is that there are many drivers of change and these are highly interactive. This makes it difficult to attribute structural changes to individual driving forces (Lobley et al., 2002). The theoretical framework helps to identify what drives the decision making process of farmers, what are the causative factors of structural change and to distinguish between the effects of the different drivers of structural change, including direct payments. Another complexity stems from the fact that some driving forces have only an indirect impact on farm structural change because they influence factor markets and this, in turn, affects farm structures. A typical case, discussed in the theoretical analysis, is the impact of agricultural policies on the land market.

The analysis provided in section 3.4 is aimed at discussing the role of agricultural policy on two of the main aspects of structural change that are covered the evaluation questions. This analysis, while less comprehensive than the one developed on the theories (§ 3.3), is aimed at identifying a preliminary list of explanatory variables that can be correlated to the visible effects of structural change (e.g. change in labour use and substitution of capital for labour). Furthermore, this analysis is aimed at highlighting, from a theoretical point of view, the expected sign of the relationships between such variables and the considered aspects of structural change. In this way, the analysis paves the way for the empirical analysis planned to answer the evaluation questions.

3.2 Definition of structural change and main structural attributes it affects

In economics, structural change is defined as "a complex, intertwined phenomenon, not only because economic growth brings about complementary changes in various aspects of the economy, such as the sector compositions of output and employment and the organization of industry, but also because these changes in turn affect the growth process" (Kiminori, 2008).

The complex nature of structural change makes it difficult to reach a common definition of this phenomenon even if there is agreement on some of its basic characteristics. Structural change encompasses both organizational and institutional changes, must be permanent and irreversible to qualify as structural and is a normal evolution in an economy (Goddard et al., 1993). Three characteristics of structural change adds complexity to the topic. First, structural change is a long term phenomenon that occurs over a relatively long period of time. Second, it affects several structural attributes of the sector at the same time. Third, the evolution of farm structure is part of a complex evolution of the farm sector and its role in a global economy (Chavas, 2001).

Brinkman and Warley (1983) delineate a number of attributes that can be affected by structural change. Structural changes in the farm sector is often considered as causing changes in number of farms, scale and intensity of farm business, and changes in farmers' reliance on non-agricultural income sources (FPD Savills, 2001). This process is generally the result of recombining or redeploying of the factors of production used on the farm (i.e. land, labour and capital) (Lobley et al., 2002). The structure of agricultural production has changed drastically since the beginning of the twentieth century (Chavas, 2001). The first change is the out-migration of labour from the farm sector (Harris and Todaro, 1970). This processes have been associated with a sharp increase in farm labour productivity, the growth of the share of farm household labour employed off-farm, a trend towards mechanisation, significant increases in farm size and reductions in number of farms (Chavas, 2001). Farm exits cause resources (especially land) to be reallocated among the remaining farms allowing the processes of farm consolidation (Haynes-Young and McNally, 2001; Weiss, 1999). In this way, surviving farms have the opportunity to grow in size. Indeed, size growth is highly negatively correlated with the reduction of farm number (Tweeten, 1993).

These processes have also the consequence of increasing production and land concentration in a relatively small number of large size farms. This suggests that structural change also has implications on equity issues in agriculture as well as for regional development and rural employment, maintenance of rural landscapes, biodiversity and the protection of the environment (Piet et al., 2011).

Furthermore, in developed countries, farms have evolved toward greater product specialisation that can be the result of a strategy aimed at attaining size and scope economies or to reach a labour

organisation that is compatible with part-time farming (Chavas, 2001). Indeed, farm structural change occurred also through diversification as it is the case of on-farm diversification that has been defined as a strategy aimed at integrating farm household income and at reducing income risk.

Additional relevant changes are that the agricultural sector has been increasingly relying on trade and market mechanisms. Finally, it also worth to note the increasing role of contracts in agriculture that has also been associated with the development of vertical integration (Chavas, 2001).

3.3 Theories explaining structural change

The complexity of the topic is probably the reason why most of the empirical work on structural change in agriculture provide a very broad concept of structural change while the focus goes immediately to the forces driving it (Goddard et al, 1993; Harrington and Reinsel, 1995). However, because structural change is the result of recombining or redeploying of the factors of production used on the farm (i.e. land, labour and capital) (Lobley et al., 2002), it seems better to approach this topic by relying on theoretical models of economic behaviour that explain producers' decisions to change the structure of their firms and, in this way, generating structural change. A wide range of theories explore this issue and may shed light on the process of structural change.

This paragraph considers the main models of economic behaviour that explain producers' decisions to change the structure of their firm. A wide range of theories explore this issue and this paragraph provides a brief review of contributions from several theoretical areas including not just the neoclassical model, but also evolutionary economics, transaction cost economics and industrial organization. This is because these latter economic theories have shed light on the decision processes of producers and may shed light on the process of structural change.

3.3.1 The neoclassical model of structural change

The neoclassical model emphasises the relationships between farm size, returns to scale and efficiency. The focus is on whether returns to scale in production can help in explaining the relationship between farm size and economic efficiency and the identification of the “optimal” farm size (Chavas, 2001). Farm size growth can have positive consequences on farm competitiveness when this permits to reach economies of size and, in turns, to reduce production costs. In particular, under the assumption of free entry and exit, increasing returns to scale provide an incentive for farms to either exit the industry or expand (Chavas, 2001). Farm size may provide a further competitive advantage given that technical innovation is often biased in favour of large farms. This is because some new technologies (e.g. mechanical) are found to be convenient only in farms operating over a given scale of production (Glauben et al., 2006).

While the process of farm consolidation based on the exit of farms from the sector has been widely witnessed in the last century, it is also true that still there is a fairly wide range of farm sizes. This may be due to the fact that the average cost function has been found to have a L shape implying that there is a wide range of farm sizes where average cost is approximately constant (Kisley and Peterson, 1996). Furthermore, this may also result from the fact that farmers have the option of choosing among different technologies, each one adapted to particular farm sizes (Chavas, 2001).

Besides technology, it has been suggested to examine the role of imperfect resource mobility in order to understand size choice because this can strongly affect entry-exit decisions in agriculture (Chavas, 2001).

3.3.2 Alternative models of structural change

The economic factors able to influence structural change have been analysed by other alternative models. For example, Boehlje (1992) reviews four alternative models explaining structural change in agriculture other than the technology model that mainly refers to economies of size and adoption and diffusion of technology: the human capital model, the financial model, the sociological models and the institutional model. The first model is based on the assumption that managerial input is critical to underlying cost and production relationships of any firm and that managerial capacity can be a fixed

factor and is generally heterogeneous across firms. Therefore, the availability of such managerial input influences the ability to process information and to evaluate and implement new technologies (Boehlje, 1992). The financial model combines concepts of production theory and financial theory into an integrated model of firm behaviour. The basic idea is that the entrepreneur maximises wealth which is a function of annual income plus capital gains (or losses). The financial model thus allows to explore the possibility that the decision regarding the amount of durable (and nondurable) inputs used in the farming activities is not just a function of relative factor prices but also of the expected relative capital gains or losses (Boehlje, 1992).

The sociological model refers to the very common category of family farms. This model is described by the family firm life cycle that refers mainly to three important stages: the entry or establishment stage; the growth and survival stage; the exit or disinvestment stage. Two processes are involved in this latter stage: retirement and intergenerational transfer of property. The sociological model tries to explore the fact that farm family characteristics strongly influence farm decisions and economic results. Furthermore, this model explains why important decisions are not subject to frequent renegotiation. This provides a reason for restricted resource mobility (at least in the short run) in agriculture and for the fact that the dynamic adjustments of land, capital and farm labour tend to take place over many years in this sector (Chavas, 2001).

Boehlje (1992) refers to the institutional model as the structure-conduct-performance paradigm of industrial organization and its variants. However, the institutional model can be seen from a broader perspective than by referring only to this paradigm because in much of the industrial organization research based on it "The distribution of transactions between firm and market is mainly taken as a datum" (Williamson, 1975: page 8). Indeed, the institutional model is rooted on a wider set of theoretical bodies developed by the theory of the firm, transaction cost economics and evolutionary economics. Therefore, it seems important to at least briefly review these theories in order to improve the framework of structural change analysis.

3.3.3 Theory of the firm, transaction cost economics and evolutionary economics

A key aspect of New Institutional Economics is the role of transaction costs in determining behaviour within and between organisations (Hubbard, 1997). The theory of the firm explores the nature of the firm and analyses the reasons behind its existence, structure, behaviour and relationships. In doing so, Coase (1937) suggests that rationale for the existence of a firm under its current internal organisational form has to be found in the attempt to economizing some of the transaction costs of using the price mechanism.

Transaction costs stem from several activities needed in order to participate in a market. These include: search and analysis of the information needed to establish a transaction, the process of bargaining to define the contract that refers to the transaction, policy and enforcement of the contract. Therefore, when the external transaction costs are higher than the internal transaction costs, the activities are better performed in the firm. However, if the opposite is true, the firm will prefer external transactions. It is worth noting that this may also explain change in the firm structure over time and, in particular, its size. Indeed, when the first situation occurs, the firm has an incentive to grow while in the other situation the firm could decrease its size by, for example, outsourcing.

The reasoning regarding transaction costs has been further developed in a body of theories named as Transaction Cost Economics (TCE) that have been used to analyse a number of different behaviours and topics. Indeed TCE has been developed further to consider the transaction as the basic unit of analysis and to enlarge this term to embrace several transactions apart from the "cost of using the price mechanism" to which Coase (1937) referred to.

TCE turns critically on two main attributes of the contracting process that are the behavioural assumptions of bounded rationality and opportunism (Williamson, 1987):

- Under bounded rationality, behaviour of human agents is only intendedly rational (i.e. limited by the information they possess) and comprehensive contracting is not a realistic organizational alternative. Under this condition, "the cost of planning, adapting, and monitoring transactions need expressly to be considered".

- Opportunism "is a condition of self interest seeking with guile" (Williamson, 1987: page 3) that refers to incomplete or distorted disclosure of information and that is responsible for the well known condition of information asymmetry between economic agents.

These two assumptions distinguish TCE theory from the assumptions of rational and profit maximising behaviour and of complete information embedded in the neoclassical models. However, TCE theory is useful to understand that transactions are organised in order to economise on the implicit and explicit costs (time and effort) that arise from the transaction. Such costs arise because of bounded rationality while simultaneously safeguarding agents against the hazards of opportunism (Williamson, 1985: page 32).

TCE has been used to explain the economic reasons for organising different types of transactions in different ways, under the assumption that the magnitude of transaction costs is largely determined by the characteristics of the transactions. The three principal dimensions of transactions are asset specificity, uncertainty and frequency of the transaction (Williamson, 1987):

- Asset specificity refers to the fact that parties to a transaction commonly have a choice between special purpose and general purpose investments. While the former, in theory, could permit larger cost savings than the latter form of investment, special purpose investments are also risky. This is because, in the case the contract should be interrupted, specialised assets cannot be redeployed without sacrifice of productive value. This means that "exchanges that are supported by transaction-specific investments are neither faceless nor instantaneous" (Williamson, 1987: page 56). Indeed, asset specificity influences several firm choices including the structure of vertical relationships (Joskow, 1991).
- Uncertainty is an important characteristic of transactions because economic organizations adapt to changes in a process of adaptive and sequential decision process. Furthermore, TCE accounts not only for the uncertainty considered by the neoclassical economic theory arising from a simple and non-strategic lack of information. It also accounts for a strategic kind of uncertainty that is generated by lack of communication from one party to another. This kind of strategic uncertainty is motivated by opportunism and is referred to as behavioural uncertainty (Williamson, 1987).
- Frequency is another important dimension of transactions. The benefits of specialised governance structures are greater for transactions supported by considerable investment in transaction-specific assets. However, because such governance structures come at a cost that is generally greater than that of alternative structures, this cost will be easier to recover for large transactions of a recurring kind. Thus, ceteris paribus, more frequent is the transaction, more preferable is a specialised governance structure.

This very brief review of the basic aspects of TCE has focused on marketing decisions and contractual arrangements that have been the topics considered also in empirical and theoretical analysis related to the farm sector such as De Bruyn et al. (2001), Dorward (2001), Foltz et al. (2002), Goetz (1992), Gray (1994), Otsuka et al. (1992) and Vermimmen et al. (2000). However, this literature, while referring to the general problem of economic transactions, can also be usefully applied to better understand the specific problem of structural change in agricultural production. Indeed, because agricultural investments in human and physical capital can be location-specific, there are significant costs of moving capital and labour over space and this generates a situation of "asset fixity" (Johnson and Quance, 1972). This situation can be linked to the existence of sunk investment costs that arise if the unit value of investment is higher than the unit value of disinvestment. Such costs provide an incentive to avoid reversing any decision (Chavas, 2001). Furthermore, because the degree of sunk costs in the agricultural activity differ between farms with different production patterns, the impact of asset fixity should vary among types of farms.

The topic of the evolution over time of farm structural characteristics can also be analysed from the point of view of evolutionary economics (EVE). While other economic theories account for the evolution over time of economic institutions, EVE is inspired by evolutionary biology. Evolutionary economics deals with the dynamic analysis of economic phenomena that are characterised by an increasing variety due to innovations and a selection (or sorting) mechanism that works systematically on this variety (Nelson 1995, pp. 54-56). In particular, the radical evolutionary perspective proposed

by Schumpeter is focused on the process that transform firms, institutions, industries and generates growth by means of the introduction of innovations and the interactive actions of diverse agents. The basic idea is that the evolutionary process of economic institutions stems from generating and testing innovations that disturb the normal flow of economic life. This concept strongly resemble the evolutionary biology concept because it assumes that the evolution comes from those ideas which accumulate more relative survival values than alternative ideas.

In traditional economic models, the focus is on the stability of a steady state, which is an equilibrium characterised by constant structures. On the contrary, evolutionary economics looks at structural change as a feature of an equilibrium path in which structural change may be considered as an open process (Knottenbauer, 2001). In particular, the innovation process forces some of the existing technologies (and the used means of production) to become obsolete and is responsible for the evolution of the firms over time. In this competitive game, firms that are not able to innovate lose their market share, see their economic results to decline and have to either restructure or to exit the market. In this framework, because the capacity to innovate is strongly related to the quality and quantity of human capital, EVE seems to suggest that investments in farm human capital can be a very important way to enhance the ability to survive due to higher innovation capability.

3.4 Models to represent the role of agricultural policies and other factors

3.4.1 Introduction

The previous paragraph has considered a wide range of theories that explain producers' decisions to change the structure of their firm. This has been done by looking at structural change from a broad perspective. This paragraph is more focused on specific models that seem to be useful in order to represent and discuss the role of agricultural policies on structural change. Indeed, this exercise is aimed at supporting the empirical analysis at least in two way: to select a set of possible explanatory variables that may be proved to affect structural change and to analyse from a theoretical point of view the likely impact of different agricultural policies.

The models presented in this paragraph have been selected considering two aspects. The first refers to the structural attributes on which the models are focused on the basis of what required by the evaluation questions. The second refers to the causative factors of structural change: the selected models specifically represent the role of agricultural policies.

Before moving into the details of the considered models, it seems useful to briefly discuss these two aspects in order to motivate our choices.

A. Structural attributes on which the models of structural change are focused

The considered models are aimed at identifying the forces affecting the evolution of specific attributes of structural change. The literature on structural change in agriculture generally considers a limited number of attributes of structural change.

The analysis of the literature has shown that the most considered attributes are: on and off-farm labour allocation decisions, number of farm, farm size, investment and substitution of capital for labour.

On and off-farm labour allocation decisions are important because when a given amount of farm household labour is used off-farm, the farm becomes managed on a part-time basis. This can have profound implications for farm investment decisions and the possibility to survive in the future (Weiss, 1999).

The outmigration of farm labour is perceived as one of the main causes of the declining number of farms. Indeed, when the amount of labour used on-farm reaches a given low critical level, it is more likely to quit farming generating a decline in the number of farms (Goetz and Debertin, 2001). This latter phenomenon is generally studied by considering the net exit rate that is the difference between exit and entry from the farm sector. However, in most cases, the entry into farming is way less important quantitatively than the exit from farming. Therefore, in many cases, the reduction of farm number over time is driven by farm exits.

The introduction of new technologies has often accelerated the substitution of capital for labour, a process that have been the focus of a large body of theoretical and empirical analysis. This is because it has relevant implications for the evolution of other structural attributes including farm size. Indeed, the reduction on the demand for labour resulting from such substitution requires farms to grow in order to justify a given level of management and labour costs (Weiss, 1999).

B. Causative factors of structural change

Structural change are caused by a large set of factors that have been classified by Brinkman and Warley (1983) in the following groups: sector factors, public factors, macro factors, other factors.

Given the topic of the evaluation, it has been decided to focus on those models that explicitly account for the role of agricultural policy. However, within this group of theories, it has been decided to select those models that allow for the inclusion of what are perceived as the most important non-policy drivers of structural change. In this way it is possible to consider a large set of drivers into a coherent theoretical framework suitable for analysing the role of agricultural policy and to separate the impact of this from the impact of non-policy factors.

A non negligible number of studies account for the role of agricultural policies. However, none of these theoretical studies explicitly account for the heterogeneity of forms characterising existing direct payments. In particular, it has not been found theoretical literature analysing separately coupled and decoupled payments. Therefore, the considered theories of structural change have been further developed in order to account for this aspect that seems relevant for the current evaluation.

On the basis of the previous considerations, it has been chosen to use two main models that explain the role of agricultural policies (including direct payments), as well as other non-policy factors, on the following two main aspects of structural change:

- labour allocation decisions and farm exit
- substitution of capital for labour and expansion of continuing farms.

3.4.2 Labour allocation decisions and farm exit

A special emphasis has been given by several Authors to the theory of net farm exits (e.g. Goetz and Debertin, 2001; Kimhi, 2000; Kimhi and Bollman, 1999). The approach proposed by Goetz and Debertin (2001) has a number of attractive characteristics. First, as it is generally done by the household economics literature, it considers the on/off-farm labour allocation decisions. Indeed, on/off-farm labour allocation decisions have direct consequences in shaping the whole organisation of the farm and, thus, its structure.

Second, it considers the role of several causative factors including: product and factor prices, riskiness of farming activities, government payments, off-farm wage level, non-pecuniary benefits of being self-employed, regional unemployment rate, off-farm work transaction costs due to, for example, transport costs from farm to off-farm working place. Note that the last two factors are linked to farm location. Farms located in very remote areas with high unemployment rate or where job opportunities are available only far away from the farm should have, all other things held constant, a relatively higher level of on-farm use of labour than similar farm households located in other areas.

Third, the considered model allows for a relatively simple representation of the problems at stake by considering farmer's decision using a static diagram that highlights the effect of the previously described factors on on-farm and off-farm work choice and, in turn, farm exit. This can also have negative consequences on the total amount of labour used in the sector and, in general, to the decline of rural population and the viability of rural economies (Goetz and Debertin, 1996).

3.4.2.1 Description of the theoretical model

In deciding whether to quit or to continue farming, farm proprietors compare the utility derived from continuing to farm with the utility deriving from quitting and becoming fully employed off-farm, relocating, or retiring.

This decision can be presented by comparing the present value of expected utility in the following way. Let's denote the present value of expected future utility derived from farming at time t as Vtf, while that from quitting as Vtq. The farmer quits if: Vtf < Vtq. He (she) continues to farm if: Vtf > Vtq. Note that in the following period (say, t+1), a new comparison should be made to decide whether to continue or quit farming.

Utility depends on consumption levels, which, in turn, depend on income or returns to labour (and capital) invested per unit of time in agriculture or in off-farm work. Utility is maximised subject to the following constraints:

- a budget constraint considering farm income (including direct payments), off-farm wage and non-labour income;
- a time allocation constraint that allows to use all available labour into farm, off-farm and leisure time;
- existing farm production technology.

The considered model focuses on farm allocation decisions considering that farm proprietor households maximise a utility function (U) containing as arguments: goods consumed (c), leisure time (dl), non-pecuniary benefits of being self-employed (su), and exogenous shifters (α) (i.e. other factors not explicitly accounted for that can affect the position of the utility function such as, for example, change in individual preferences):

(1) $U = U(c, dl, su; \alpha)$

This function is maximised subject to the following income (2) and time (3) constraints:

(2) $p\,Q(K, df; \beta) + G - pk\,K + wm\,do - f(T) + A = c$

(3) $D = dl + df + do$

Where:

p denotes farm output price

Q(K, df; β) is the farm production function in which: K is the quantity of variable non-labour inputs, df is the amount of days worked on-farm; β is a vector representing other fixed characteristics of the farm and its proprietor

G denotes total farm government program payments such as direct payments

pk is the vector of prices of variable non-labour inputs

wm denotes the daily off-farm market wage

do is the amount of days spent in off-farm employment

f(T) is total transaction costs associated with working off the farm

A denotes unearned (i.e. non labour) household income

D is the total time available (days) [16].

Non-pecuniary benefits of being self-employed are included in the representation of the utility function (By means of the parameter su in equation 1) because Hamilton (2000) finds that self-employed individuals behave as if there are sizeable nonmonetary benefits to work in a self-employed business. This is because the median earnings "are always less than the predicted starting wage (for zero job tenure) available from an employer" (Hamilton, 2000: page 606). This condition could be also found in the context of farming (Huffman, 1996).

Because consumption is expected to increase utility and its level is constrained by income (Constraint 2), it is likely that the farm proprietor households look to reach a satisfying level of income. Assume by now that their objective is to maximise their household income (Constraint 2). In this case the

[16] Variables c, K, d_l, d_f, d_o are restricted to be non negative.

optimal labour allocation requires to equate the marginal value product of the labour used on-farm (MVP) with the expected level of (off-farm) market wage.

Assuming decreasing marginal productivity of labour and a perfectly competitive market for the farm product (i.e. a price taker farm), the considered problem can be represented by the following diagram (Fig. 2).

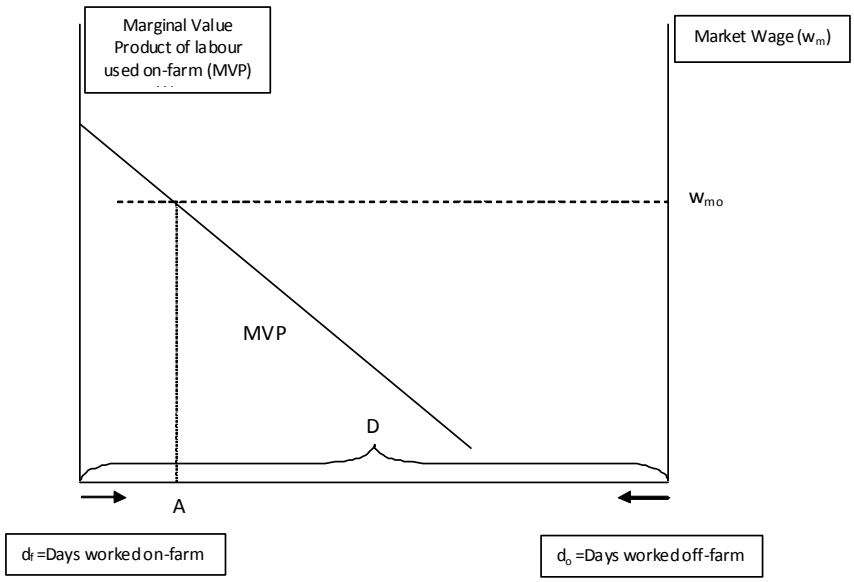
The horizontal axis represent the total amount of available working days (D). A given point on this axis moving from the left to the right represents the amount of days worked on farm (df), while the remaining part of the axis at the right of this point represents the sum of the remaining days used for leisure and to work off-farm (do). Shifting the point to the left means reducing the amount of days worked on-farm and increasing the amount of days worked off-farm plus leisure days. Therefore, movements from the right to the left could involve the decision to shift the organisation of the farm from a full-time to a part-time basis. When the optimal allocation point reach the left corner, it means that no days are spent working on-farm (df = 0), thereby exiting from production agriculture.

The value of on-farm labour marginal product (MVP) (i.e. the increase of revenues coming from an additional day worked on-farm) assumes the following form:

$$MVP = p \ MPP$$

where $MPP = \partial Q / \partial df$ represents the physical marginal productivity of farm labour. It is very common to assume decreasing marginal productivity (i.e. marginal productivity declines as the use of the input increases).

Fig. 2 - Farm and off-farm labour allocation decisions. Baseline conditions



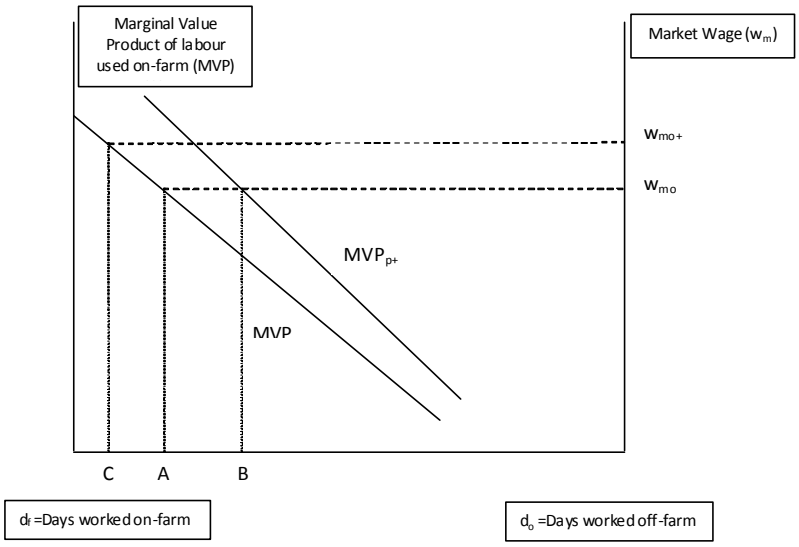
Under the previous assumption and assuming the farmer is a price taker (i.e. his/her behaviour cannot influence the level of market prices), MVP declines when increasing the number of days worked on-farm. The level of MVP is measured in the left-side vertical axis.

The right-side vertical axis represents the level of market wage (wm). Assuming that the level wmo represents the expected market wage, the optimal (i.e. to ensure the maximum income) labour allocation is represented by point A.

3.4.2.2 Effect of changes in farm product price and market wage

The diagram in Fig. 3 can be used to represent first the impact of changing the level of the farm product price. For example, increasing the farm product price shifts up and to the right the MVP (MVPp+). This, ceteris paribus, has the effect of increasing the amount of days worked on-farm (point B).

Fig. 3 - Farm and off-farm labour allocation decisions. Impact of changes in farm product price and market wage



This diagram can also be used to show the impact of changing level of market wage. For example, considering the original level of the output price (i.e. the original MVP), an increase of the level of market wage (wm+) has the effect of decreasing the amount of days worked on-farm (point C), ceteris paribus (Fig. 3). Indeed, the difference between expected earnings from farming and from other economic activities has been claimed to be one of the main causes of outmigration of labour from the farm sector (Harris and Todaro, 1970). Empirical evidence has been provided that farm labour is responsive to changes in the returns to agricultural labour relative to non-farm labour returns (Barkley, 1990).

Thus, an increase of market wage (a commonly encountered effect of the general economic development), ceteris paribus, should have the effect of pushing some full-time farm households to organise their farms on a part-time basis. In other cases, this trend could push some farm households to quit farming. This is the main way in which economic development has been seen as reducing farm number and affecting the structural change of the sector.

3.4.2.3 Effect of factors affecting the access to off-farm labour market

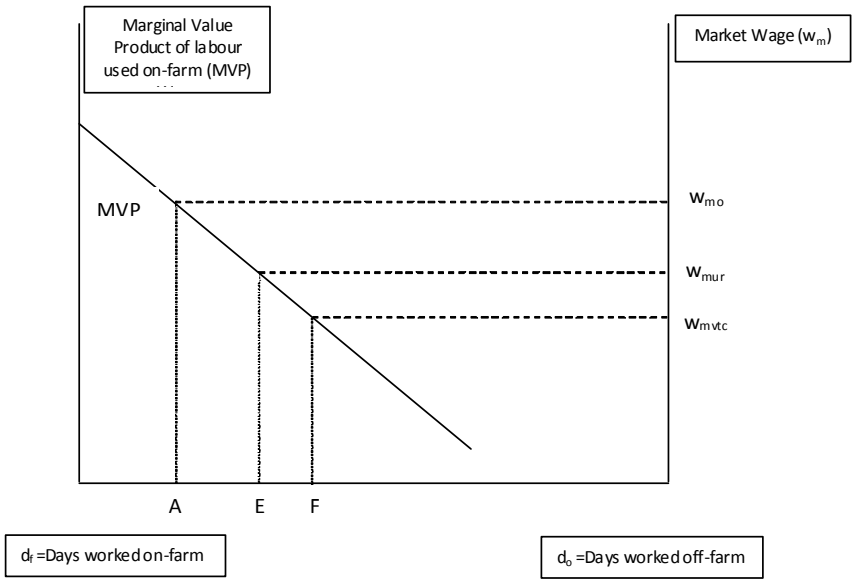
The expected net market wage is affected by two additional factors: the conditions prevailing in the labour market in terms of unemployment rate; the transaction costs associated with working off-farm.

In the migration literature, the expected wage rate (E(w)) is estimated taking into account the market wage (wm) and the unemployment rate (ur) in the following way (Harris and Todaro, 1970):

$$E(w) = (1 - ur)\ wm$$

In this way, unemployment rate can be seen as a measure of the odds of finding work or remaining employed. Under this framework, the unemployment rate affects the expected wage rate and, in turn, labour allocation decisions.

Fig. 4 - Farm and off-farm labour allocation decisions. Impact of changes in unemployment rate and transaction costs for off-farm employment.



For example, if a decline in economic growth causes the unemployment rate to increase, this reduces the expected wage to the level indicated as wmur in Fig. 4. If compared to the original level (also considered in Fig. 2 Point A), this results in an increase of the amount of labour used on-farm as shown by point E (see Fig. 4).

Another aspect that may limit the access to off-farm labour are transaction costs associated with off-farm work (f(T)). These costs can be subdivided in fixed and variable transaction costs and can take the following form (Goetz and Debertin, 2001):

$$f(T) = To + do\ \tau$$

where To is fixed transaction costs and τ is unitary (i.e. per day worked off-farm) variable transaction costs.

Fixed transaction costs do not depend very much on the number of days worked off-farm (Huffman, 1996). This is because they include expenses associated with job searches and interviews, as well as with acquiring transportation, wardrobe, etc. (Goetz and Debertin, 2001). This category of costs has important implications on the choice to start working off-farm (e.g. moving from full-time to part-time farming), but does not affect the amount of days worked off-farm when a decision to do so has been taken.

The other way round, variable transaction costs are positively correlated with the number of days worked off-farms and mainly include costs of commuting from the farm to the working place. Variable transaction costs have the impact of reducing the effective wage earned from off-farm employment. This reduces the amount of days worked off-farm and increases the days worked on-farm. The level of variable transaction costs is strongly influenced by farm location. Thus, a farm household located in a remote farm area where off-farm working opportunities are only available at a relevant travel distance from the farm is facing a relatively lower effective wage than better located farm households. Therefore, ceteris paribus, farm household members living in a remote area should have an incentive to work a larger share of their available days on-farm than a better located farm family. Furthermore, this category of costs may also influence the decision of quit farming if, for instance, relocating into a city or industrial area sufficiently reduces travel time and costs.

The effect of a change of variable transaction costs on labour allocation decision can be represented in Fig. 4 as the effect of a decrease of the effective wage rate (say at level wmvtc). Therefore, the graphical representation is very similar to that previously described and referred to as an increase of unemployment rate (e.g. point F).

3.4.2.4 Effect of agricultural policies

Agricultural policies can affect labour allocation decisions in two main ways. The first is by decreasing the level of risk associated with farming. The second is by directly supporting farm income. Here the discussion is extended to cover two of the main categories in which agricultural policies are supporting farm income: price support and direct payments. Indeed, to keep the discussion simple, the analysis is developed by taking into consideration first a one-product farm model and then moving to the multi-product case.

A. Price policies

Price policies increase and stabilise the level of output prices. In this way they increase farm returns and income, and provide an incentive to increase production level. This latter increase is pursued by increasing the amount of resources (e.g. labour and land) used in the production process. Therefore, in general terms, this should have a non negligible impact on labour allocation decision, too. Indeed, given that the support can be seen as a supplement to unitary prices, this policy affects the original labour allocation optimal condition as an increase of product price. Indeed, the unitary price support provided by the price policy (pp) enters in the marginal value product of labour in the following way:

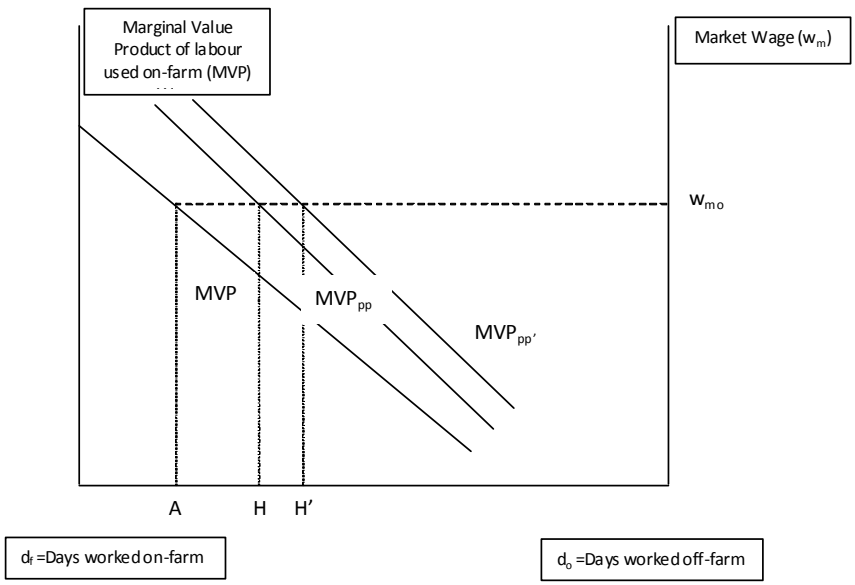
$$MVPpp=(p+ps)\ MPP$$

Therefore, the impact of price support can be represented as an up-ward shift of the marginal value product as depicted in Fig. 5 (VMPpp).

In the considered simplified setting, a price support should result in an increase of the number of days worked on-farm (from point A to point H, in Fig. 5).

However, price policies also have the effect of reducing price variability because they generally prevent the prices from getting below given thresholds. Mishra and Goodwin (1997) show that, under given assumptions[17], a decrease of the variability of farm output price generates an increase of the amount of labour worked on-farm for a risk-averse farm proprietor. Because this type of economic agents generally discount the marginal value product of labour, for them price policies, by means of their stabilising role, further shift up the marginal value product curve (MVPpp') resulting in a further increase of the number of days worked on-farm (H') (Fig. 5).

Fig. 5 - Farm and off-farm labour allocation decisions. Impact of price policies



[17] This is to assume farmers' behaviour can be represented as the result of having a Neuman-Morgenstern utility function (Mishra and Goodwin, 1997).

B. Direct payments

Direct payments affect labour allocation decisions in a more indirect way than price policies. Furthermore, their effect changes according to the nature of direct payments. This is because direct payments can be coupled to the production level, to the amount of land or heads of livestock (i.e. partially coupled) or can be decoupled from production.

Let's assume that the total amount of direct payment a farm receives (G) may be affected, directly or indirectly, by the amount of days worked on-farm (df) and by other farm specific characteristics (γ) (e.g. current and past production patterns, farm location) yielding the following generic and very simplified form:

$$G = g(df; \gamma)$$

If direct payments are coupled to production (coupled direct payment, cdp), this results in an incentive to produce and to use more resources, including labour.

Under this conditions, it is likely that increasing the use of labour on-farm may result in an increase of the total amount of direct payments received by the farm:

$$(\partial G/\partial df>0)$$

In this case, the marginal value product of labour results to be:

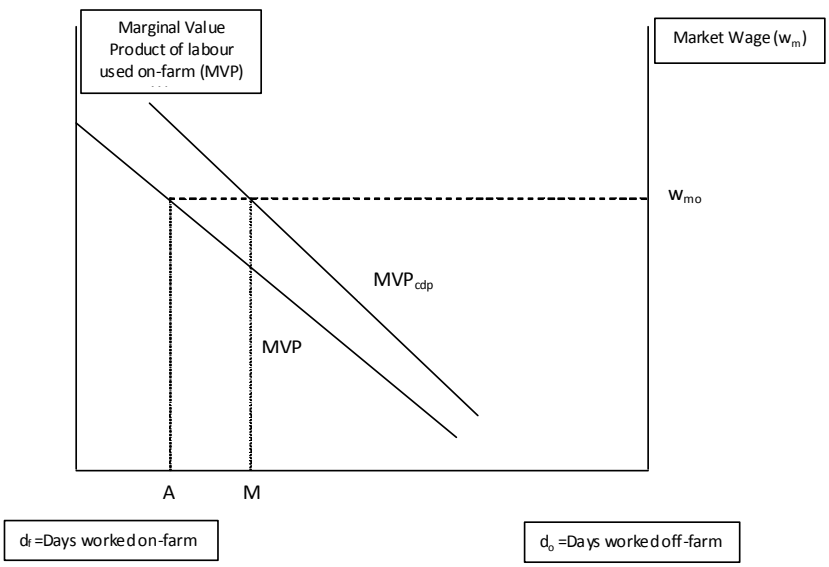
$$MVPcdp=p\ MPP+\partial G/\partial df$$

Under such conditions, the coupled direct payments should result in an up-ward shift of the marginal value product (MVPcdp, in Fig. 6). This, ceteris paribus, generates an increase of days worked on-farm say to level M in Fig. 6.

Very similar considerations can be made regarding those payments that are provided on the basis of the amount of cropped land or heads of livestock. In this case, the introduction of the payment induces the farmer to increase the cropped area or the number of heads. Given that some work is needed to do so, it is likely that, under the one-product farm assumption, this results in an increase of days worked on-farm.

Moving to the multiple-product farm case complicates the analysis. This is because the introduction of the payment (coupled or partially coupled) could result in a change of production mix. Under these circumstances, it is difficult to ascertain whether the payment induces the farmer to use a greater amount of labour on-farm. Indeed, if the payment provides an incentive to increase the level of an activity that is relatively less labour intensive than the other performed on-farm, this should result in a decrease of the overall number of days used on-farm.

Fig. 6 - Farm and off-farm labour allocation decisions. Impact of coupled and partially coupled direct aids



The case of a fully decoupled payment is easier to treat. Indeed, because a decoupled payment does not affect production choices, it is likely that the marginal value product of labour is not affected by the level of the payment. However, it is worth noting that decoupled payments in the EU are granted in full only if farmers retain land and fulfil conditionality requirements. This requires a minimum use of labour on-farm (even if all land is left idle) and requires to not quit farming.

Therefore, substituting a decoupled payment for a coupled payment can have an impact on labour allocation decisions. In particular, if the coupled payment has been inducing an increase of labour use, decoupling should induce a decline of the number of days worked on-farm. This can have the effect of reducing labour intensity (expressed as labour to land ratio) in the case farmers reduce the amount of available land to a lower extent than labour use. This may be very much the case when farmers decide to leave some land uncultivated but they keep it in order to receive the decoupled payment.

3.4.2.5 Hired vs. family labour

So far it has been considered only one type of labour. However, it is also interesting to extend the analysis by considering that labour can be provided by different sources. Indeed, while a large share of the labour in the EU farm sector is provided by family members, in some types of farming (e.g. large farms) the relative importance of hired labour is relevant. One of the labour related decisions on farm is to substitute hired labour for family labour or vice-versa. This choice could be influenced by several factors including the relative price of hired labour.

The factors affecting the level of use of labour on farm, including agricultural policies, can affect not just the total amount of labour used on farm, but also the relative importance of this two types of labour. In particular, it is possible that, if some external factors create an incentive to reduce the amount of labour to be used on-farm, this will affect more the hired workers than family members. Therefore, it could be useful to empirically analyse not only the total amount of labour used on farm (e.g. intensity of labour use per unit of land), but also the relative importance of hired labour on the total amount of labour used in the sector.

3.4.2.6 Synthesis of the main results derived from the model regarding labour allocation and farm exit

The theoretical analysis developed so far on the basis of the approach proposed by Goetz and Debertin (2001) suggests that, under the considered conditions:

- Higher off-farm wage levels decrease the amount of days worked on farm;
- Lower unemployment rates decrease the amount of days worked on farm;
- Higher off-farm work transaction costs increase the amount of days worked on farm;
- Higher farm product prices increase the amount of days worked on farm.

Regarding agricultural policy, the analysis shows that higher direct payments generate a less variable and higher income. In this way, it is plausible that these payments increase the share of days worked on-farm and, under the simplified conditions considered so far, this reduces the rate of exit from agriculture.

However, there is a difference between the effects of coupled and decoupled payments. Because the latter provide a very limited incentive to increase production level and/or the use of resources on farm, decoupled payments should result to have a more limited impact on labour allocation and farm exits.

The role of both types of direct payments should be analysed also from a different perspective. Indeed, direct payments provide additional income that could be invested on farm. This topic is developed in the next sections that consider the determinants of investment behaviour and the process of substitution of capital for labour and growth of farm size.

3.4.3 Substitution of capital for labour and expansion of continuing farms

This section deals with the impact of farm policies in the substitution of capital for labour. The substitution of capital for labour is one of the main topic considered by the literature on agricultural structural change. Indeed, Tweeten (1989, page 9) writes: “Among the numerous elements identifying

the structural transformation of American agriculture, none is more basic than the substitution of capital for labour". This topic is clearly linked to investment process. Therefore, this section starts with a paragraph that briefly explains the determinants of investment behaviour while the following paragraph explores the process of substitution of capital for labour and link this to the expansion of continuing farms.

3.4.3.1 Determinants of investment behaviour

This section briefly introduces some concepts referring to the process of farm investment and to the main determinants of this process, including agricultural policy. The investment process is one of the main factors affecting structural change and the determinants of farm structure are to a large extent the same that affect investment (Atwood et al., 2002). Indeed, because "land and capital are to some extent complements and land itself is commonly included among investment options, ..., much of the reasoning concerned with farm structure is applicable to explaining the choice of capital stock." (Gallerani et al., 2008: page 34). In particular, when capital stock is allowed to change, investment decisions allow for the entry and exit from the sector, for the change in farm size, for the introduction of innovations on the farm and for the substitution of capital for labour. This latter topic is further developed in the next section, while the following paragraphs focus on the factors affecting investment decisions strongly relying on the work developed by Gallerani et al. (2008), Viaggi et al. (2011a, 2011b, 2011c).

Farmers have to take a number of decisions regarding investments, including: which investment to undertake, when, with what intensity, where, how investments are funded (Gallerani et al., 2008). This decision process may be represented as a cyclical process influenced by the external business environment including government policies (Hay and Morris, 1991). Indeed, many are the factors that can affect investment behaviour and a review of empirical work on this topic is provided by Gallerani et al. (2008: page 27). These factors can be grouped into investment characteristics, farm characteristics, product and factor markets, household characteristics and farmer's attitudes, and policy. The review by Gallerani et al. (2008) shows that a very limited number of empirical work explicitly account for this latter factor even if policies affect product and factor markets through coupled and decoupled measures, general taxation and government farm payments that, according to Serra et al. (2008), are found to discouraging off-farm investment.

The issue of investment behaviour is dealt by the literature that has been classified by Gallerani et al. (2008) under the following different aspects: Multiple objectives of investment decisions; Farm perspectives; Household perspectives; Financial perspectives; Other issues.

The first perspective deals with the fact that decision-makers may pursue objectives other than profit maximisation such as, for example, risk reduction and household-oriented objectives. The investment literature explaining the sluggishness observed in the adaptation of capital over time can be classified under two broad branches (Gardebroeck and Oude Lansik, 2004): analysis based on adjustment costs and analysis based on asset fixity[18] . Adjustment costs is one way to explain why firms in each period only partially adapt their capital stock to the optimal level (Gallerani et al., 2008). Their size can be affected by a number of interlinked factors including transaction costs. As already discussed earlier, asset fixity is caused by the existence of a difference between the acquisition cost and the salvage value of capital. This difference can be due to the specificity of the investment and to the transaction costs that arise from such specificity. This explains why investment decisions have been considered also in studies on the contract theory of investment to explain phenomena such as the incentive provided by long-term contracts or the reasons for vertical integration. Uncertainty affects investment decisions. The literature on investment-related uncertainty has supported the idea that "increasing uncertainty can lead to reduced investment" (Gallerani et al., 2008: page 33). The problem of uncertainty is also linked to investment irreversibility, to the description of the investment process as a learning process and to efficiency issues (Gallerani et al., 2008).

[18] However, Abel and Eberly (1994) combine the two approaches in a unified model of farm investment under uncertainty.

Few recent studies have focused on the effect of agricultural policy on investment and most of these focus on decoupling (Gallerani et al, 2008). Decoupling can have at least three potential effects that are relevant for investment behaviour (Andersson, 2004). It can: a) increase the propensity to invest if this relaxes financial constraints, b) increase the propensity to consumption, c) decrease the propensity to technological innovation relative to coupled support that can provide a stronger incentive than decoupled support. The extent of the first effect largely depends on the degree of imperfection in the credit market. Indeed, under imperfect capital markets (e.g. binding debt constraints for farmers willing to invest), policies that increase income translate into a higher propensity to invest (Gallerani et al., 2008).

A recent body of empirical analysis has investigated the effects of decoupling on investment decisions (OECD, 2005a, 2005b, 2005c; Sckokai and Moro, 2006; Viaggi et al., 2001a, 2011b, 2011c). These studies ascertain that policies have a significant impact on investment in machinery, buildings and equipment and confirm the risk aversion hypothesis. However, different policy designs may lead to contrasting effects on investment. Additional complexity arises from the fact that different farmers can use the funds provided by decoupled subsidies in a different way. Goodwin and Mishra (2005) found that a large share of decoupled payments is generally used on the farm. However, only part is used for farm investment and the remaining share of decoupled support is used for other purposes including household consumption.

Policies affect farm investment decisions also by changing farmer's policy expectations and the degree of certainty involved in future policy settings (Gallerani et al., 2008). As an example, Lagerkvist (2005) studied how farmland investments can be affected by the uncertainty regarding an expected policy reform considering the case of the introduction of a single farm payment.

3.4.3.2 Substitution of capital for labour and expansion of continuing farms

Several factors, including the evolution of relative factor prices, technological change and agricultural policy, affect this process. Given the topic of this evaluation, this section of the theoretical analysis considers all these three factors placing more emphasis on the impact of agricultural policies.

The substitution of capital for labour has been incentivised by the growing opportunity cost of labour relative to the price of other factors of production (Tweeten, 1989). The rise of non-farm incomes serves as an incentive to leave agriculture while the remaining land is left to fewer but larger farms. Therefore, out-migration of farm labour and the growth of farm size are two aspects of the same economic process (Kislev and Peterson, 1982). Technological innovations have made available labour saving technologies and have made easier to substitute other factors for labour. The change in the relative weight of labour vs. capital represents one of the main aspects of structural change not only per-se, but also because it could induce growth in farm size.

The increase of farm size has also been claimed to be caused by the goal of exploiting scale economies. While some doubts have been raised on the real magnitude of such scale economies (Goddard et al., 1993), it is also true that technological innovation is biased in favour of large farms because some new technologies (e.g. mechanical) are found to be convenient only in farm operating over a given scale of production (Weiss, 1999). Indeed, the adoption of such labour-saving technologies has been easier for larger farms (Glauben et al., 2006) that are often characterized by a low labour/capital ratio.

The following section deals with the role of farm policies in the substitution of capital for labour, technical innovation and growth in farm size. This is done by considering first a single farm model. Given the heterogeneity of farm structures (e.g. in terms of size) and the fact that agricultural policies affect a large share of farms in the sector, the analysis is than extended to consider these two aspects.

A. Effects of agricultural policies in the substitution of capital for labour and investment decisions at the farm level

Both Pillar 1 and Pillar 2 policies of the CAP affect investment decisions. In particular, some measures of Pillar 2 policy directly provide an incentive to farm investments by way of reducing the investment

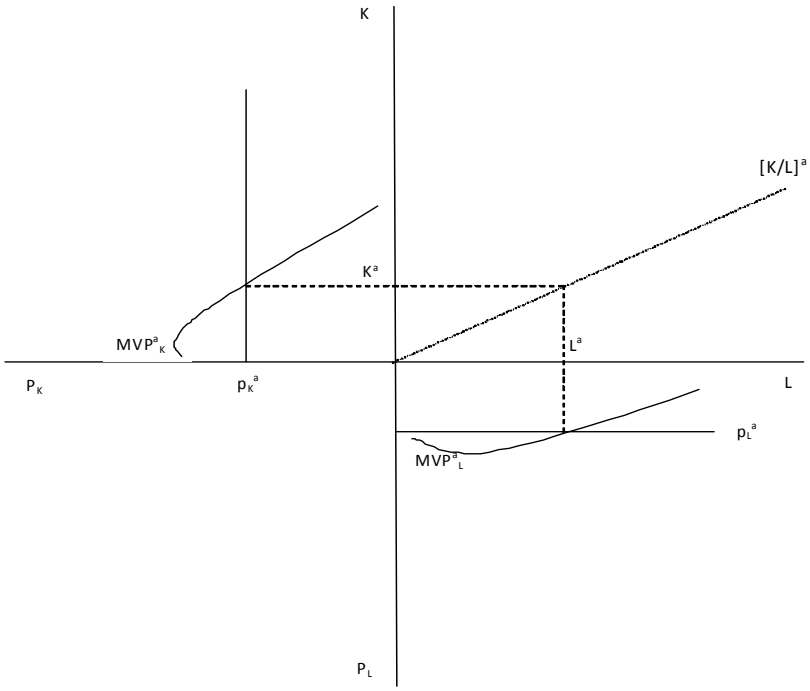
costs. When this allows for the introduction of labour-saving technologies, it could also reinforce the substitution of capital for labour, thus increasing capital intensity (i.e. per annual work unit).

Other measures of Pillar 2 policy provide an incentive to move to a more extensive use of land that may cause a decrease of capital intensity in terms of capital per utilized agricultural area. However, given that the evaluation focuses on direct payments, the analysis is focused on Pillar 1 policies.

The analysis is based ona theoretical model on capital and labour utilisation on farm presented by Goetz and Debertin (1996) that explicitly accounts for the role of farm policies. Fig. 7 represents an hypothetical equilibrium reached by a single-product profit-maximizing farmer in terms of the use of the only two factors: labour (L) and capital (K).

Let's assume that the farmer operates in a perfectly competitive market framework in which product, capital and labour prices are exogenously determined (i.e. not influenced by farmer's behaviour) and denoted by py , pL , pK. For example, the level of labour and capital prices, reported in the axes of the third quadrant (lower left side) of the Fig. 7 could be placed at the levels pLa and pKa.

Fig. 7 - Capital and labour utilisation on a single farm



MVP_L and MVP_K : Marginal Value Product of labour and capital

L and K : used level of labour and capital

p_L and p_K : prices of labour and capital

Under these conditions, marginal value products for labour and capital take the following form:

$$MVPL = MPPL \ py$$

$$MVPK = MPPk \ py$$

Where MPPL and MPPk represent the marginal physical product of labour and capital (i.e. $\partial Q/\partial L$ and $\partial Q/\partial K$ where Q denotes the quantity produced). Assuming a decreasing marginal product of both inputs, the graphical representation of MVPL and MVPK could be those represented in the second (lower right) and fourth (upper left) quadrants of Fig. 7.

Assuming that there is not government intervention, the optimal is reached when labour and capital reach the levels that satisfy the following equilibrium condition:

$$MVPaL / paL = MVPaK / paK$$

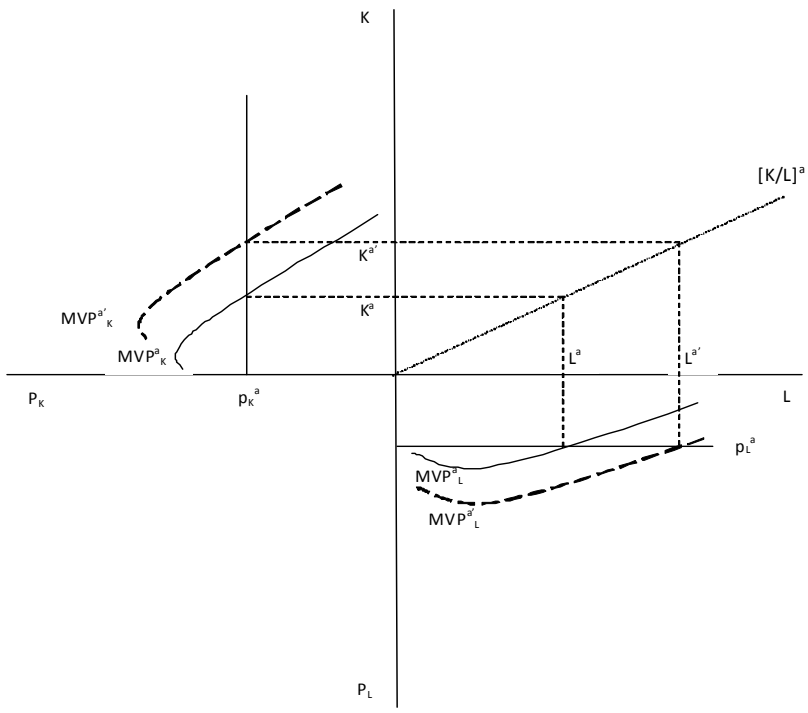
Graphically, this requires the use of labour and capital at the levels indicated by La and Ka respectively on the x-axis and on the y-axis of the first quadrant (upper right side) in Fig. 7. This initial equilibrium corresponds to the capital-labour ratio ([K/L]a) represented in the first quadrant as a straight line exiting from the origin.

The initial effect of a direct payments, when converted into euros per unit of output (f), is to shift both labour and capital MVPs schedules upward to the levels indicated by MVPa'L and MVPa'K (Fig. 8). This is because:

$$MVPL = MPPL\ (py + f) \quad \text{and} \quad MVPK = MPPK\ (py + f)$$

As already pointed out by Johnson (1991), this results in an increase of farm income and of the use of both factors that now reach the levels indicated as La' and Ka' (Fig. 8).

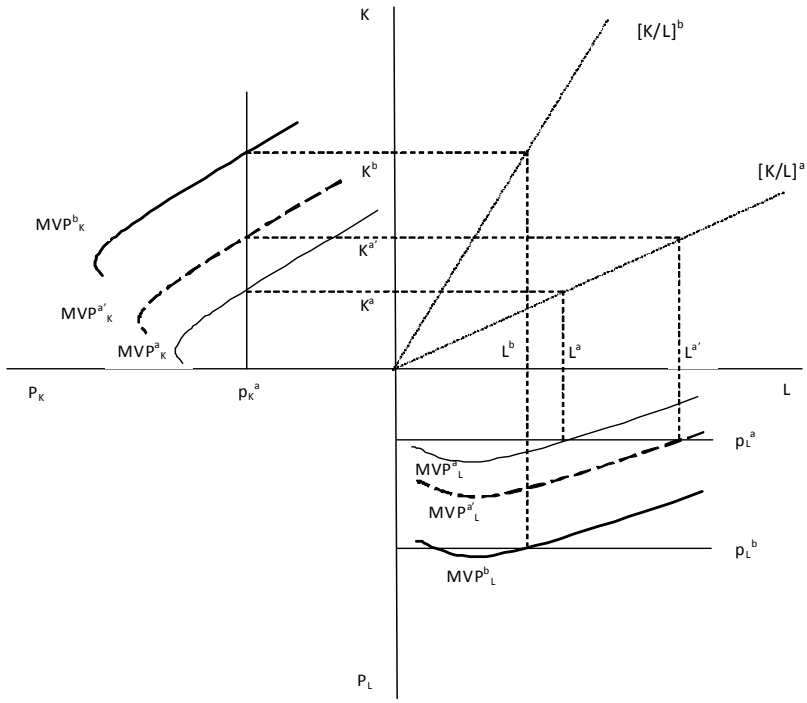
Fig. 8 - Direct impact of farm program payments on capital and labour utilisation



The introduction of a direct payment does also have an additional effect. The area between MVPa'L and MVPaL as well as the area between MVPa'K and MVPaK (Fig. 8) represent surpluses available to the farmer for his/her needs including for reinvestment in the following production periods. This generates a further outward shift in the MVP curves of both inputs (MVPbL and MVPbK) (Fig. 9).

However, empirical evidences suggest that farmers are more likely to invest in labour-saving equipment (e.g. machinery) (Johnson, 1991; Tweeten, 1989). Thus, the reinvestment is likely going to introduce labour-saving technologies that increase the optimal capital-labour ratio. This phenomenon is represented by a rotation to the left of the capital-labour ratio line from [K/L]a) to ([K/L]b) (Fig. 9).

Fig. 9 - Final impact of farm program payments on capital and labour utilisation



The forces that lead to the adoption of labour-saving technologies are also interconnected with the often observed trend of increasing the relative price of labour over time (Kisley and Peterson, 1982). Indeed, as observed by Johnson (1991, page 89): "The flow of innovations available to agriculture will not diminish so long as such innovations offer prospects for profit. Since it is inevitable that farm labour will continue to become more expensive relative to output prices, there will be a continuing incentive for the creation of innovations that will provide effective substitutes for labour". Thus, it is likely that this process drives the labour price up as it is represented by the new level pLb in Fig. 9.

All these elements result in a reduction of labour utilization to level Lb and in an increase of capital utilization to level Kb (Fig. 9).

On the basis the results derived by using the theoretical model developed by Goetz and Debertin (1996), it is possible to conclude that, in the short-run, direct payments may contribute to maintaining a level of labour used on-farm higher than in the case such payments were not granted.

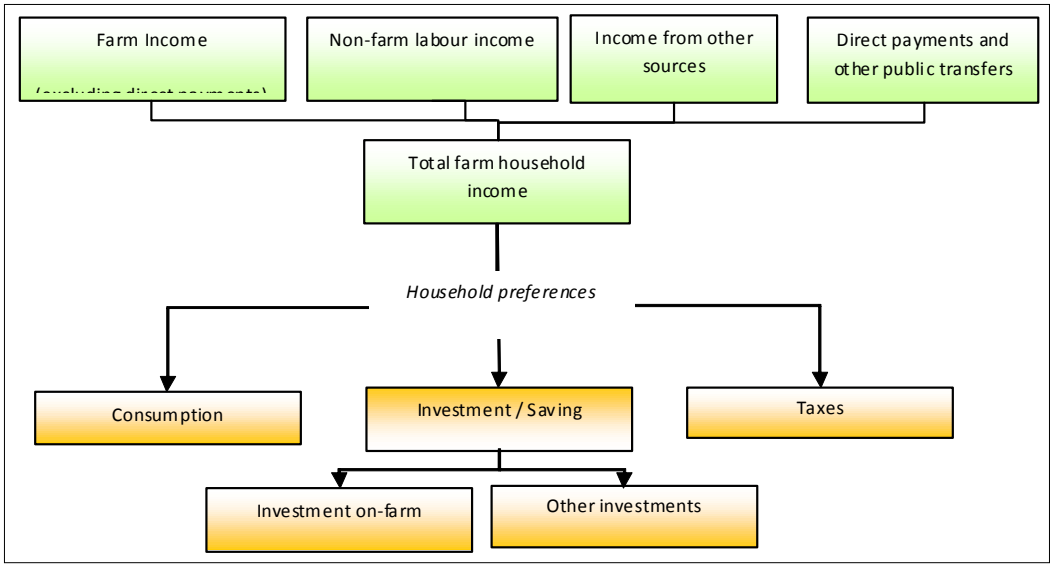
However, in the longer run, direct payments may contribute to a reduction in farm labour use over time because they generate a surplus available for the farmer to invest in new labour-saving technologies. This increases the speed of the restructuring of the farm in terms of labour use and farm number. Investing in labour-saving technologies reduces the labour to capital ratio and, when a family farm is not able or willing to lay off family members, this creates pressure to purchase or rent more land and expand production. This provides an incentive to increase farm size and to reduce the number of farms in a region. This is consistent with the results of empirical analysis that have found positive relationships between government payments and farm size (Ahearn et al., 2005; Key and Roberts, 2007; Yee and Ahearn, 2005).

So far, we have considered that all surplus generated by direct support policies will be reinvested on farm. However, it is important to stress that this is not necessarily true given that farm households have a multiple set of possible uses for this surplus. Furthermore, it seems that the way such support is given can influence this choice. In particular, it is important to consider possible differences in the impact of coupled and decoupled payments.

The support provided by direct payments (as well as by other measures of support) positively affects farm income. This increases the capacity to consume and to invest according to the amount of

payments and the time horizon in which these payments will be granted. However, the choice of how much to increase consumption and investment depends on household preferences and characteristics. A graphical representation of the possible use of the income in farm households is provided by Fig. 10.

Fig. 10 - Possible use of the income in farm household



Only a share of the surplus provided by direct payments is directed towards investment and only a share of this is used to invest on-farm. The amount of resources invested on-farm depends on several factors including the relative profitability of farming and the way the support is provided. Investing on-farm is a way to decrease production cost and to increase farm economic performances. However, if the opportunities to increase farm income are not very attractive, a large share of resources could be used for off-farm investments. The possibility to rely on a flow of direct payments (even if decoupled) clearly enhances the possibility to invest on farm. This is particularly true when the farm is facing financial constraints that may have reduced on-farm investments in the past. While this increases the self-financing possibility, it also increases the possibility of access to credit because the possibility to count on a relatively constant flow of payments increases farm income, reduces income variability and the riskiness of farm investments. All these factors provide an incentive to increase on-farm investments and positively influence the likelihood of farmers to obtain credit.

The amount of surplus to be used for on-farm investment can also be affected by how the support is provided. Here, the difference between coupled and decoupled direct payments is important to be mentioned.

If direct payments are coupled to production, farmers can increase the amount of payments received by increasing the production level (if the payment is proportional to production level) or by increasing the amount of land or the number of livestock heads on which the payments are granted. This provides an incentive to use the surplus generated by the policy on farm. Indeed, this strategy allows for increasing the amount of payments the farmer receives in the future. Therefore, direct payments provide an incentive to invest on farm that is additional to the usual forces that may drive on-farm investments.

However, if the payments are decoupled from production, there is a lower incentive to invest on farm. While investing on farm could generate an increase of farm economic performance, it is not going to increase the amount of payments received[19]. On the basis of this reasoning, a given amount of

[19] When decoupled payments are tradable, the farmers could use the surplus to buy additional entitlements. While this is going to increase the amount of payments the farmer will receive, it is likely that he/she will pay each entitlement a price that is approximately the discounted value of future flow of payments each entitlement will generate (considering also the uncertainty on the future level of payments and the fact that the entitlement will expire as a new CAP reform will take place). Therefore, the scope for this peculiar investment seems relatively limited (Swinnen et al., 2010).

decoupled payments could not generate an incentive strong enough as the one that is provided by the same amount of coupled payments. Moreover, in those farms where the profitability is limited, the availability of decoupled payments could provide an incentive for investing off-farm in order to accelerate the reorientation of farm resources out of a relatively less attractive farm business.

B. Substitution of capital for labour: implications for the farm sector

So far, the analysis has focused on the implications of direct payments on the restructuring of a single farm. Here the analysis is extended to consider that in the sector there is a large heterogeneity of farm structures (e.g. small and large farms), that farms compete for the available resources, and that the adjustment process affect a large number of farms at the same time. This latter aspect underlines that agricultural policies can affect the markets for all inputs used on-farm, noticeably, the land market.

Farms can have different size, therefore the forces behind their restructuring can act in a very heterogeneous way. In particular, Robinson (1975) has supported the idea that agricultural policies can preserve the inefficient farms, reducing the number of farms that could have quit without such policies. Following this reasoning, it is possible to say that agricultural policies reduce the pace of structural change. This theory relies on the hypothesis that smaller farms are less efficient and have higher costs than larger farms due to the presence of economies of scale (Robinson, 1975). For this reason, periodic (i.e. recurring over time) low farm product prices cause farms with limited net income to exit and to make available their resources including land. These resources could be consolidated into larger farms that could continue to grow in size. Agricultural policies such as price policies prevent the reduction of the income of all farms but, according to Robinson (1975), their impact is more relevant for small farms. Indeed, such policies prevent the periodic wringing out of less efficient farms and, in turns, retard the consolidation process.

A very different conclusion stems from the so called "cannibalization" mechanism proposed by Cochrane (1979). When policy support is positively correlated with farm size, the residual profits generated by this support may be larger for larger farms. This allows larger farms to bid resources away from smaller farms and raises the value of assets, primarily farm-land, beyond the bidding ability of smaller farms. This mechanism seems consistent with what has been described in the previous section regarding the impact of agricultural policies on the substitution of capital for labour at the farm level. Indeed, larger and more efficient farms may obtain larger surpluses from subsidy programs because they have relatively higher market income levels.

The "cannibalisation" mechanism is very likely to be present when support is provided by price policies, given that the support is proportional to production and that a larger share of production is generated by large farms. However, according to Harrington and Reisel (1995), the tendency to "cannibalisation" remains also when the support is decoupled from current production because it is based on historical production and it is still capitalised into the value of land, a topic that is developed further in the next paragraph. The main implication of this theory is that support, especially if coupled to production, accelerates farm structural change. However, given that most of the support provided by direct payments is decoupled, it is important to empirically test how influential they are.

The very different conclusions from the previous two mentioned theories come with no surprise, given the complexity of the process of structural change. Indeed, empirical evidences have been found supporting both the Robinson's and the Cochrane's hypotheses (Harrington and Reinsel, 1995). While in the short-run agricultural policies keep smaller or less efficient farms from being forced out of business, in the long run the same policies may accelerate farm structural change in terms of reducing the number of small farms and increasing the size of surviving farms.

An additional component of structural change comes from the implications of farm investment decisions on market prices. Two cases are considered here: the implications of agricultural policies on product prices and on land price levels.

The Cochrane "technological treadmill" theory is a well-know explanation of structural change that focuses on the adoption and diffusion of technology (Cochrane, 1958). An innovation reduces the expected production cost shifting the farm's marginal cost function down and/or to the right. This provides an incentive to adopt the innovation because, as output prices remain unchanged, this results

in temporary benefits for early adopters. However, diffusion of the innovation increases market supply making farm commodity prices fall. This forces other farmers to adopt the innovation even if this allows them only to remain competitive. However, some of these farms may not succeed in making the required changes, thus becoming uncompetitive and, in the long-run, exiting from the sector. Furthermore, the resulting decline of output prices reduces the benefits for early adopter.

To summarise, the "technological treadmill" theory supports the idea that each individual farmer has an incentive to adopt the new technology, even though their collective adoption decisions will make them no better off. The support provided by agricultural policy may accelerate this process providing resources to invest in the new technology and by increasing production level. However, this latter element applies only to coupled policies such as price support and coupled payments and not to decoupled payments.

A large body of literature suggests that a share of the benefits deriving from agricultural policies are capitalised into the value of land (see, for example, Johnson (1991), Cochrane (1965)). The farm based model previously discussed has shown that the surplus generated by direct payments is used to reinvest on-farm. This means that it could also be used to acquire more land. This increases the demand for land and, given that the supply of land is relatively fixed at the local level, this could lead to an increase of land prices and rental rates (Harris, 1977)[20].

Increasing land prices has direct implications for structural change. High land prices increase the funds needed to expand farm size and, according to Johnson (1991), this leads to less farm consolidation and a larger farm population. Thus, agricultural policies that increase land prices are expected to slow down the reduction in farm number, retard farm labour out-migration and structural change (Goetz and Debertin, 1996).

However, some counterarguments have been provided against this way of reasoning. First, the capitalisation of farm program benefits into land prices could constitute a barrier to entry into farming and this increases the net exit rate and leads to more rapid farm consolidation given that entry farms are often relatively small in size. Second, given that farms can have a very different bidding ability, the increase of land price does not affect all farms in the same way. In particular, this may negatively affect the position of small farms provided they often have a bidding ability smaller than larger farms. This could support the restructuring of the sector.

It is worth noting that, while this process could have positive consequences on the competitiveness of the farm sector, the reduction of the number of farms and the increase of their size, increases the concentration of production and land (Roberts and Key, 2008) on a relatively small number of large farms. A recent work by Piet et al. (2011) has analysed the role of different drivers, including agricultural policies, on the concentration of land in France. The main findings of this study are that policy measures significantly affected farm size inequality. In particular, the analysis has shown that CAP direct payments, as well as agro-environmental and LFA payments, have contributed to decreasing the inequality of the distribution of farm size in the considered period (Piet et al., 2011). This process has been claimed to threaten the existence of family farming in Europe (CSA, 2011).

The impact of agricultural policies changes according to how the policies are designed. For example, recent analysis have discussed and produced some qualitative evidences on the influence of CAP on the EU land market (OECD, 2011; Swinnen, Ciaian, d'Artis, 2010). While it is difficult to draw general conclusion, due to high heterogeneity of conditions and the effect of many relevant factors affecting land prices (e.g. the institutional and legal framework), Swinnen et al. (2010) suggest that the capitalisation of direct payment support into land prices: is higher with hybrid than historical models of implementation; is stronger in marginal less fertile lands (e.g. grassland); affects rental rates more than it affects sale prices.

[20] This mechanism could apply to fixed assets other than land. However, the case of land is the more relevant.

3.4.3.3 Synthesis of the main results derived from the model regarding substitution of capital for labour and farm growth

The support provided by direct payments increases the capacity to consume and to invest as well as the likelihood to access credit. In this way, direct payments provide an incentive to invest on farm. Given the labour-saving bias of innovations introduced through investments, it seems logical to expect an increase of capital over labour ratio and a decline in the demand for farm labour. This latter phenomenon requires farms to grow in size in order to justify a given level of management and labour costs (Weiss, 1999). While both coupled and decoupled payments increase the possibility to invest on-farm, the incentive provided by decoupled payments is expected to be lower in comparison to the one provided by coupled payments.

The introduction of innovations has relevant implications for the overall farming sector. Provided that such innovations decrease the marginal costs of production, the resulting increase of supply should cause a decline in output prices.

This adds an additional pressure on small farms, that generally perform less well than for larger farms. and lessens their possibility to invest on-farm. According to the "cannibalization" mechanism proposed by Cochrane (1979), the support provided by agricultural policy could accelerate this process, provided that the residual profits generated by this support being larger for larger farms. In this case, larger farms can bid resources away from smaller farms. This could increase the demand for land and land prices (sale price or rental rate) even if this process is again expected to be more pronounced for coupled than for decoupled forms of support.

The increase of land price induced by farm policies can have different implications for structural change. Therefore, theoretical analysis is not able to provide a unique answer to the role of these policies on structural change. For this reason, the effect of these policies should be analysed empirically on a case by case approach.

Most of the elements considered so far are likely to accelerate the process of structural change in the direction of a reduction of the labour over capital ratio, a strong decline in the number of small farms and a consolidation of large farms. However, it is important to recall that in the short-run agricultural policies can preserve the inefficient farms reducing the number of exiting farms. Furthermore, small farms can survive provided that they use off-farm income (Gardner, 1992) and/or that, as it is often the case in small farms and in semi-subsistence farm households, farmers have a more complex set of objectives than maximising profit (Fritzsch et al., 2010).

The role of direct payments in supporting on-farm investment can differ according to whether these payments are coupled or decoupled to production. The former type of payments are perceived to provide a stronger incentive to on-farm investment than decoupled payments. Moreover, in those farms where profitability is limited, the availability of decoupled payments could provide an incentive for investing off-farm in order to accelerate the reorientation of resources off-farm.

Furthermore, if decoupled payments are granted under the condition that farmers should hold a given amount of land, this could result in a decrease of capital intensity in terms of capital per unit of utilized agricultural area. It is worth noting that the impact of decoupling in terms of capital intensity per unit of work cannot be assessed theoretically because decoupling also changes the use of labour.

3.5 Other themes covered by the evaluation

The theoretical analysis has served to develop a consistent framework considering together several factors affecting structural change and its main attributes. Particular emphasis has been given to labour allocation, number of farms, substitution of capital for labour, farm size growth because these are considered to be the most important structural attributes. However, because the evaluation questions focus on several structural attributes, it seems useful to develop further the discussion covering some themes that, although linked to the topics covered by the theoretical models, have not been directly analysed so far. In particular, this section analyses the organisation of labour on-farm and farm competitiveness. This allows to consider relevant topics including the organisation of part-time and pluriactive farmers, and the role of specialisation and diversification.

3.5.1 Organisation of labour used on farm: part-time and pluriactive farmers

The out-migration of farm labour could cause a decline in farm numbers but also an increase of part-time farming. While part-time farming is very important because it represents one way in which farm families can survive on their holdings (Gasson, 1991), it is also true that the analysis of part-time farming does not benefit from a universally agreed definition of this term (Martens, 1980). This is because it is a multivariate construct depending on, at least, three main actors: the farm, the household, the farm holder/manager (Martens, 1980). Furthermore, part-time farming can be defined according to the length of time spent on farm or according to the relative importance of on-farm income on the overall farm household income (Lund, 1991).

Analysis of part-time farming often focuses on the occupational status of the farm holder/manager. This is first due to data availability limitations, as an harmonised EU database on farm household is not available. Second, it is not easy to define who is belonging to the farm household. This is because the household should be considered as formed not just by those family members living under the same roof, but by those members who also put their resources in common (Martens, 1980).

The analysis of part-time farming is also linked to two topics that are important for the structural change of the farm sector: age structure of farm holders/managers and pluriactivity.

The out-migration of farm labour could be strongly biased towards specific classes of farmers. Given that off-farm employment opportunities are generally higher for younger farmers than for older farmers, this could result in an increase of the share of farms managed by older farmers. In this case the farm can be managed by using a limited amount of the available working days but the remaining days may not be fully used in off-farm occupations. A particular case of it is that of retired persons who manage small farms that require a limited amount of work. In this case, the farms result managed on a part-time basis but farmers do not have additional income coming from off-farm occupations. This is a very different category of part-time farming if compared with part-time farmers having off-farm employment therefore it should be analysed as a sub-category of part-time farming, if possible.

The age structure of farmers is also very important for structural change because life-cycle decisions may be important to farmers' choices regarding on and off-farm labour and investment decisions (Kimhi, 2000). Indeed, it is worth noting that some agricultural policies in Pillar 2 are specifically aimed at fostering the intergenerational transfer of holdings providing an incentive: a) for older farmers to pass their farms to younger farmers; b) for young farmers to enter in the farm business.

Another important aspect of part-time farming is pluriactivity (Gasson, 1991). This is a strategy that the farm sector has developed in order to adapt to changes in the economic and social conditions including the declining relative remuneration of farm labour and the impact of labour-saving technologies. While this often refers to the participation of farm family members to the off-farm labour market (Huffman, 1980), the availability of off-farm income can influence farm strategies including investment decisions on-farm (McNamara and Weiss, 2005). This clearly interacts with the decision to run a farm on a part-time or full-time basis (Gasson and Errington, 1993).

The possibility to pursue a pluriactivity strategy depends on several factors including:

- the availability of a surplus of labour to use off-farm. This factor is strongly affected by the structural and productive characteristics of the farms.
- the ability of farm family members to meet the needs of the off-farm demand for labour in terms of labour characteristics. This is mostly influenced by specific education, skills and age structure of the farm family members.
- the presence of a strong enough demand for non-farm labour. This is mainly influenced by general economic conditions.

Note that not having the possibility to find off-farm employment may result in an increase of the use of labour on-farm even if it receives a very limited remuneration in this activity.

A large body of literature has been developed on the role played by part-time farming on structural change. The shift from full to part-time farming offers a source of off-farm income that can have a stabilising influence and can prevent a more rapid disappearance of small farms (Weiss, 1999).

However, it is still not clear if part-time farming is a stepping stone on the way out of the farm sector or not. Some studies support the idea that off-farm work is seen as a stable long-run combination with farming rather than a step towards exiting the sector (Kimhi, 2000). The relative stability of part-time farming has been seen by its opponents as having a negative impact because part-time farmers occupy land and delay land consolidation (Martens, 1980). In this sense, any factor, including policy, increasing the number of part-time farmers can be seen as detrimental to structural change.

Agricultural policy can also influence the extent of part-time farming. The theoretical model of labour allocation already discussed has shown that the support provided by direct payments can increase the amount of work used on farm and delay the exit of farms, also allowing part-time farming to survive. However, as already pointed out, the impact of direct payments depends very much on how these payments are granted. In particular, the decoupling of payments may encourage the move to part-time farming. Because the payments are granted only if land is available, but their level is not influenced by the production level, a farmer can choose to run the farm on a part-time basis. Indeed, this allows to allocate a larger share of his/her time to off-farm occupations and to maintain the land in order to continue receiving the payments.

3.5.2 Farm competitiveness: specialisation and diversification

The concept of competitiveness is linked to the capability of a farm to maintain the necessary conditions for staying in business whilst carrying on its activities. The conditions for staying in business are determined by cost and revenue balances from farming activities, also taking into account farm subsidies. The role of direct payments on investment decisions has been already discussed considering the substitution of capital for labour in the farm production process that is also connected with the process of technological innovation. Therefore, here the concept of farm competitiveness is approached in a broader sense.

Indeed, the possibility to continue farming can also be influenced by the amount of income generated by non-farming activities carried out both on-farm and off-farm. In particular, it seems relevant to consider whether direct payments have influenced farm business strategies in terms of specialisation and diversification.

Specialisation has been claimed to be another way of exploiting economies of scale and scope. Indeed, given that increasing farm size is often constrained by several factors (e.g. land market imperfections and financial constraints), scale economies can be reached by farm specialisation. However, this has implications on the organisation of work and in the use of capital. Furthermore, specialisation can have the effect of increasing farm risk. Agricultural policies supporting specific products (i.e. coupled) can induce further specialisation on farm. This is particularly the case when such policies also provide a way of stabilising farm returns such as it is the case for price policies and direct payments. However, decoupled payments should not provide an incentive for specific production and, thus, for specialisation.

Alternative farm business strategies (marketing or diversification) could be an instrument to develop farming activities in order to reach economic viability.

The concept of diversification has been defined in different ways. The definition by OCSE (2009) is based on a net distinction between on and off-farm activities and on the analysis of allocation decisions of land, capital and labour. However, other studies place more emphasis on farm business strategies. The concept of diversification by Van der Ploeg and Roep (2003) considers both conventional and unconventional activities carried out by farm families referring to 3 mains strategies:

- Deepening: it refers to strategies of valorisation of unconventional farm productions (e.g. organic farming, typical products) or different marketing strategies and forms of transformations of farm products.
- Broadening: it refers to strategies aimed at enlarging the number of activities that may not be linked to the production of farm products (e.g. farm tourism, landscape management)
- Regrounding: the allocation of family-own factors also in off-farm activities.

3.6 List of References

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4. REVIEW OF NATIONAL LEGAL AND INSTITUTIONAL FRAMEWORKS

The Review was aimed at identifying the most relevant policies besides EU agricultural policy that may have had effects on the structure of the farming sector in the EU27 Member States in the period of analysis. Where relevant, the analysis tries to take into account policy and legislation changes introduced after 2005. The main findings helped to interpret observed structural change and to distinguish the effects of direct payments from the impact of other national policies.

The results of the analysis were organised into 27 comprehensive country reports. Here we provide a synthesis containing relevant information about most sensitive policy areas.

4.1 Methodology implemented for the Review and limitations

The Review of national legal and institutional frameworks entailed extensive research and should represent a fairly comprehensive reference tool for policies implemented by each of the EU27 MS. However, a word of caution is necessary, as the Review cannot be considered to be exhaustive of all national instruments that may be relevant in terms of their structural effects on national farming sectors. Other limitations are due to lack of up-to-date information for all countries in the analysed policy areas and the heterogeneous level of detail across countries and for each policy measure.

The relevant policy areas and relative instruments that have been identified and examined are:

Policy area	Policy instruments
Land consolidation	Measures used to remove fragmentation by land re-parcelling and adjusting farm structures; land consolidation at farm or rural community level; land consolidation as rural development tool; land consolidation in support of land markets and in support of farm competitiveness
Land planning and use	Measures to solve conflict between rural land use and urban /industrial expansion; measures to indicate most suitable rural use: arable land, grazing, forestry, wildlife, tourism; preservation of agricultural activity; soil protection; nature conservation.
Land markets	Mechanisms to regulate land sale and land sale price. Taxation of land acquisition, property and inheritance: partial and total exemptions . Mechanisms to regulate land rental (rental prices, contract duration, taxation, farm succession, tax exemptions)
Credit and insurance	National measures to facilitate farm access to credit Incentives for use of crop and other type farm insurance
Labour and social security	Labour contracts; collective agreements; exemption from social security contributions; special treatment of family labour; employment flexibility
Agricultural taxation	Direct taxation (partial or total exemptions in agriculture) and Indirect taxation (partial or total exemptions in agriculture, reduced VAT and excise duties)
Diversification	Measures to support development of diversified (agricultural and non-agricultural) activities on farms (farm tourism, direct sales, processing of farm produce, energy production/supply; Organic agriculture; etc.). In general, any activity able to improve the economic viability of farms by reducing their dependence on primary agricultural production
National Programmes	Specific measures for specific national issues.

The needed information was collected using various sources: extensive review of published literature and national legal and policy documents (38 cross-country and 97 country-level literature and legislation references, see § List of references, page 80); interviews with 12 national legal/policy experts; 68 questionnaires sent out to agricultural professional organisations and national authorities in all EU27 MS (responses were collected from Austria, Estonia, Finland, Netherlands, Portugal, Slovakia, Slovenia and the UK).

Furthermore, State aids[21] data have been collected for each MS from the European Commission - DG Competition database. Several selection criteria have been applied in order to obtain a useful pool of data for the evaluation's purposes[22]. As a result of the selection procedure, we analysed information for a total of 270 State aids schemes over 1632 collected. The following table shows for each objective, the MS granting subsidies under one or more schemes and the size of the annual budget (total budget per year in the period 2005-2011).

Tab. 6 - MS adopting State aid schemes related to farm structural change

Objectives	AU	BE	BG	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SK	SI	SP	SE	UK
Support to agricultural holdings/SMEs	•			•••	•	•••	•		•••	•••	•••	•	•	•••	•	•	•		•••				•		•••	•	•••
Dismantling/relocation of farm buildings				•					•										•								
Land reparcelling				•				•					•														•••
Early retirement								•••	•••		•••																
Setting up of young farmers														•••													•
Agroenvironmental commitments		•		•	•	•							•••		•	•			•				•		•••		•••
Support for livestock sector			•				•		•	•••		•	•••		•		•		•••			•••			•••		
Support to quality production		•	•			•	•		•				•	•	•		•		•						•		•••
Support to producers groups														•			•								•		
Support for forestry sector						•	•			•••			•						•		•						•
Remedy for a serious disturbance in the economy	•	•	•••					•	•••	•••				•••					•				•	•			•••
Insurance premiums				•			•		•••					•	•		•••			•••		•••		•			
Reimbursement of credit interest																	•		•								
Investments in renewable energy sector						•		•		•							•••										
R&D in the agricultural sector		•			•	•	•••		•••	•			•	•			•		•		•	•••					
Tax exemption/reduction					•••			•••	•••	•••				•••	•••				•••	•		•••	•••				•••

Source: Elaborations based on EU-DG Competition database

Legend: • = 0.01-5.00 M euro year; •• 5.01-20.00 M euro year; ••• more than 20.01 M euro year

4.2 National policies with potential impact on structural change

This section provides a synthesis of the policy areas and instruments that we have identified as the most likely to influence different structural characteristics of farms in each MS. For each State, most sensitive policy areas are summarised in the table below and briefly described in the pages that follow.

Tab. 7 - Policy areas with potential effects on structural changes in the EU27 Member States

	Land consolidation	Land use	Land market	Credit & Insurance	Labour & social sec.	Agricultural taxation	Diversifi-cation	National Programmes
Austria		■					■	
Belgium		■	■					
Bulgaria	■		■					■
Cyprus	■			■				
Czech Rep.		■		■				

[21] State aid is defined as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities (subsidies granted to individuals or general measures open to all enterprises do not constitute State aid). The EC Treaty leaves room for a number of policy objectives for which State aid can be considered compatible. The European Commission has established a system of rules under which State aid is monitored and assessed in the EU.

[22] Only State aids included in economic sectors A1 (Crop and animal production, hunting and related service activities) and A2 (Forestry and logging) have been selected. All selected aid schemes have been published between 2005/01/01 and 2010/12/31. Only State aids having national coverage have been selected. We have excluded aids pursuing objectives not directly related to structural change: Natural disasters or exceptional occurrences; Adverse weather conditions / climatic events; Animal diseases; Plant diseases, pest infestation; Technical support; Advertising; Training. Finally, we have also excluded aids directed to the non-productive forestry sector.

	Land consolidation	Land use	Land market	Credit & Insurance	Labour & social sec.	Agricultural taxation	Diversifi-cation	National Programmes
Denmark			■			■		
Estonia							■	
Finland			■					■
France	■		■		■	■		
Germany	■		■	■	■	■	■	
Greece	■							
Hungary			■	■		■		
Ireland				■	■	■	■	
Italy	■		■			■	■	
Latvia		■		■				
Lithuania	■		■					
Luxembourg							■	
Malta			■					■
Netherlands	■	■	■					
Poland			■	■	■	■		
Portugal				■				
Romania	■		■		■	■		
Slovakia		■	■	■				
Slovenia	■		■					
Spain	■			■		■		
Sweden			■				■	
U. Kingdom		■	■				■	

It should be mentioned that the Central and Eastern European countries accessing the EU in 2004 and 2007 experienced a remarkable transition from a centrally-planned economy towards a market economy after 1989 when the Iron Curtain was lifted. Land reforms aimed at privatising state-owned agricultural land, managed by large-scale collective and state farms, were introduced in most of these countries at the beginning of the transition. Over 20 years later, some countries have completed land reforms, others are still in the process. Such land policies (restoration of property rights, land consolidation, etc.) are likely to have had (and still have) an important effect in shaping farm structures after EU accession and simultaneous introduction of the Single Farm Payment.

AUSTRIA

In Austria two policy areas seem the most likely to bear an impact on the structure of the farming sector: policies regulating land use and diversification of farm activities.

Land use policy. The Federal Spatial Planning Laws identify the "priority agricultural areas" and/or "protected green areas". Soil quality is the most important criterion to define "priority agricultural areas". Prevention of landscape fragmentation is the key objective to delineate "protected green areas". Both area types are protected from conversion into building /development land.

Diversification. In Austria about 50% of all employed in agriculture are engaged in off-farm activities and the share of farm household income generated by non-agricultural activities is about 47% (BMLFUW, 2007). Most Austrian farms diversify into on-farm food processing, including direct marketing (44%). Important proportions of farms are engaged in farm tourism (35%) and service contracting (29%).

Farm diversification policies have a strong focus on direct marketing of agricultural products and also on renewable energy. Farm-gate sale and farmers' markets are the most frequent ways of direct marketing. "Green Stock Exchanges", established in almost all Federal Provinces, encourage cooperation between farm producers and the catering industry.

Renewable energies satisfy just over a quarter of Austria's energy needs - the third highest level of renewable energy consumption in the EU after Sweden and Latvia (Eurostat). In 2009, biomass and waste represent the largest share of renewable energy production and consumption of Austria. This sector has experienced considerable expansion during the past few years as Austria has set itself ambitious targets in terms of energy production from biomass from agriculture and forestry by introducing an obligation for the oil industry to substitute a specific percentage of fuels based on mineral oil with biofuels. A number of facilities have been built for processing agriculture biomass into fuels. Several facilities produce biodiesel from plant oils, in particular rapeseed.

BELGIUM

After the Federal Ministry of Agriculture ceased to exist in 2001, agricultural policy is set at the regional level. The policies that may have impact on farm structures are those regulating land use and lease of agricultural land.

Land use/zoning regulations. Both Flemish and Walloon regions have land use policies in place. For the period 1997-2007, the Spatial Structure Plan for Flanders established a limitation for new developments, with 60 % to be realised in urban areas and 40 % in rural regions. The Plan was subsequently revised in 2004 and 2010 by introducing even stricter development targets and providing a more integrated approach to urban development. According to the annual Environment Report (2007), land take in rural areas has been decreasing. In the Walloon Region, 23 Plans on land use aim to manage the pressure from urbanisation puts on the territory by defining development zones and zones to be used for agriculture, forests, or wildlife. Since 2005, any new zone to be urbanised must be compensated either by a modification in the Plan (i.e. for a similar-sized agricultural, forest or natural area not to be urbanised), or by alternative measure defined by the Walloon Government. Furthermore, the implementation of urbanisation projects depends on approval of an impact report.

National provisions regulating rental of agricultural land. In relation with the high proportion of rented agricultural land (about 67%), Belgium has developed a number of policies to protect tenant farmers thus preserving the continuation of farming activity. The Law of 4.11.1969 (amended in 1988) regulates agricultural land rental and establishes long-term contracts (minimum 9 years). However, very long-term contracts from 27 up to 99 years are common. Maximum rental price determined for a 9 year rental contract is equal to the (non indexed) cadastral income of the plot, multiplied by a tenancy coefficient. The coefficient is increased by fix percentages in case of longer contracts. Rental contracts are automatically renewed for the same duration of the initial contract, unless tenant or landlord gives notice. In case of land sale, tenants have pre-emptive right to purchase the land.

BULGARIA

Bulgaria suffers from various problems relating to lack of a unified strategy for land use planning (including agricultural land). Formal land consolidation policy was only introduced in 2007. The fragmentation of land ownership, created by the land restitution process, and under-developed rural infrastructure represent a significant barrier to long-term investments, to land improvements and to the proper development of a land sale market.

The responsibility for land policy has been split between three ministries, resulting in conflicting aims, no comprehensive policy and lack of transparency in the registration of property rights (Bulgaria has never had title-based property rights). Inheritance law also contributes to land fragmentation: Bulgaria still follows a Napoleonic Code (all heirs receive a share fixed by the law). In 2007 the Land Act (1991) was amended to include voluntary land consolidation. The amendments include procedures for land re-parcelling, infrastructures and irrigation, and environmental measures.

The main obstacles hampering the development of the land market are: land fragmentation (according to expert assessment, land fragmentation keeps land prices 30% lower than they would be) and the

lack of reliable information about land value and prices. Capital values of farmland published under the Local Taxes and Fees Act are frequently higher than actual market prices and the tax is assessed on the higher values. Transaction costs are too high and reduce the attractiveness of land sales, especially in case of small holdings 0.5-1 ha. Furthermore, in Bulgaria the land restitution process was completed in 2000 and prior to that time, the many claims to land caused insecure land tenure. At this time, while land tenure is legally secure, landowners do not have confidence in the security of their rights because the restitution law has changed many times. However, most agricultural land in Bulgaria is rented (79%) and the rental market seems to be better regulated than the sale market.

National Programmes. In addition to EU policies, the Ministry of Agriculture directly finances national programmes. Some of these programmes may have implications for farm structures: the Agricultural Land Programme (BGN 71m) aims to ensure sustainable use of land resources through policy for protection and consolidation of agricultural land and the creation of the Land Parcel Identification System (LPIS is the admin and control system used for CAP area payments), the Hydro-amelioration Programme (BGN 8.9m), the Food Quality Programme (BGN 1.7m).

CYPRUS

In Cyprus the defective land tenure structure seems to be a major structural obstacle to the development of agriculture. Land consolidation policy (Consolidation and Reallocation of Agricultural Land Laws 1969 to 2003) includes measures to increase the size of holdings, to eliminate dual ownership of land, to reallocate agricultural land so as to form holdings of adequate size and regular shape suitable for cultivation and to carry out land improvement work. 2010 marks the completion of 72 land consolidation schemes (17,481 ha), the implementation of another 14 schemes (3,265 ha) and the initiation of further 36 schemes (5,126 ha). Another factor to be takein in account when analysing farm structures in Cyprus could be the Agricultural Insurance Scheme, subsidised at 50% by the Government. Its main objectives are to safeguard farmers' welfare and stabilise farm income. According to an assessment of his effectiveness, these objectives were achieved in a satisfactory way. Every year the Government adopts ad hoc measures for crops not included in the scheme.

CZECH REPUBLIC

Even though from 1991 the Land law opened up the possibility for private family farming, very often the large collective and state farms broke up into smaller (but still large) co-operative farms and continued as before through lease agreements with private landowners who had withdrawn their land from the cooperatives[23]. As a result of the land reform process, Czech agriculture is characterised by a dual structure: about 90% of farming units are small family farms controlling only 10% of the total land, whereas large collective or corporate farms (10% of farming units) control 90% of the land.

Today, two policy areas are identified as the most likely to impact on the structure of the farming sector in the period of analysis: land use policy and farm access to credit.

Land use policy. Until the early 1990s, the loss of agricultural land was constantly increasing in Czechoslovakia. The Act on Protection of Agricultural Land Resources was enforced in the former Czechoslovakia in 1992 and one year later, when Czechoslovakia dissolved, both Czech Republic and Slovakia retained it. Preservation of the best agricultural land and high quality soils in outer city belts is one of the main objectives of the Spatial Development Policy. Based on the Act on Protection of Agricultural Land, the conversion of high quality agricultural land to building land requires a compensation fee. The system defines five classes of agricultural land of which the classes I and II are the most fertile. Conversion of Class I and II soils requires a special permit and a fee to the State Environment Funds. The fee ranges from 828 €/ha to 2,776 €/ha, depending on soil fertility. Since the implementation of this mechanism, a decreasing trend of soil consumption was observed (2000-2008). However, according to national experts, the fee is too small to represent a barrier for new

[23] As the land of cooperative members was often not formally expropriated, in most cases after 1991 the owners or their successors were able to regain possession of their land through an informal procedure of withdrawal from the cooperative. On the other hand, legal restitution procedures had to be set up in the case of state farms, in which the land had been formally expropriated from the owners. The Land Fund was established in 1992 to manage the restitution process.

developments. The Czech Ministries for Agriculture and Environment are currently preparing an amendment to the Act in order to increase the compensation fees (European Commission, 2011).

Farm access to credit. The Czech Republic has a system of financial services for agricultural holdings dating back to the end of the communist era. Credit subsidies and loan guarantees, which are administered by the Support and Guarantee Fund for Farmers and Forestry (SGFFF), play an important role in facilitating structural adjustment. Credit facilities are available for investment as well as for working capital needs. The SGFFF provide collateral guarantees and interest-rate subsidies for long-term credit. A significant initiative in the administration of mortgage credit and agricultural land collateral came with the State programme "SOIL" (2004), aimed to enable farmers to purchase land from private. All the same, small and medium-sized farms face significant problems in accessing credit because of lack of capital and inefficient farm management.

DENMARK

The policy instruments likely to have had effect on the structure of the Danish farm sector are those regulating land markets, closely related to land use and planning policies, and agricultural taxation.

Land market. 62% of the area of Denmark has been designated as agricultural land, and registered in the Cadastre as farming obligation, thus subject to the Agricultural Act on acquisition (Act no. 435/2004). The Act includes provisions on duty of residence, rules on joint operation and tenant farming. License from the land authorities is required if the holding owner wishes to purchase a new property above 30 ha (but a family property can be sold to relatives without any constraints on the properties already owned). Until recently, land ownership was restricted to Danish citizens only, rules have recently been relaxed to allow other EU citizens and corporate farms to own land.

Denmark has also specific policy in place that strongly regulates rental of whole farm properties. Tenancy of whole farms only concerns 2.4% of total agricultural area (19% of the total agricultural area of the country is rented). According to the agricultural Holdings Act, 1989, the maximum term of lease of whole farms is 30 years. Tenants must live on the holding whether they manage the farm or not. Tenants must not own or farm land from more than five holdings. Maximum holding size is 125 ha unless there is proof that more land is needed to dispose of manure. To help tenants become landowners, the government set up state funds to subsidize land purchase by tenants, either directly or through regulating prices, subsidized loan conditions or tax benefits.

Agricultural taxation. Denmark has high environmental taxes. Farmers pay tax for the use of herbicides (13% of the sales price) and pesticides (27% of the sales price). With the aim of improving the health of the population, in October 2011 the Danish government has introduced a controversial fat tax on food products, the first of its kind in the EU. The tax affects dairy products, vegetable oils and meat. The fat tax rate is DKK 16 per kg of saturated fat and applies to domestic and imported food products with saturated fat content exceeding 2.3%.

ESTONIA

Soon after Estonia gained independence, the Law on Land Reform in 1991 and the Law on Agricultural Reform in 1992 were established to re-distribute land to former owners or users. However, the process of land restitution and privatization has been very slow. Nowadays, Estonia carries a large stock of fallow agricultural land as in many cases land was restored to owners who did not intend to farm it. Potential tenants willing to lease the land are also scarce, since rural regions are heavily affected by out-migration. At the same time, there are no legal provisions regulating the use of agricultural land as urban sprawl is not competing with agricultural activity (most cities are situated in areas characterised by sandy soils not appropriate for agriculture).

The review of instruments implemented within the analysed policy areas do not highlight the existence of important drivers of structural change (or, *vice versa*, policies hampering structural change). The only policy area worth mentioning is that concerning diversification. The renewable energy sector has also rapidly developed; the majority of investments (2005-2009) were made for the establishment of combined heat and power plants and wind farms. Too, in 2005 a market development measure was

introduced to cover costs associated with market promotion and research, product development and quality improvement to increase marketing possibilities for (processed) agricultural products.

FINLAND

Based on interview carried out at the national level and other data, the early retirement programme for farmers, the start-up aid for young farmers and state aid for investments (lower loan rate, grants and direct support for certain investments) have been the most important measures producing a significant impact in terms of accelerating farm structural change. On the contrary, the following elements are deemed to have had effect in terms of hindering structural change: no exemption for inheritance tax; farm land and forests are valued as all other property; increased land price and rental price (direct support increases land lease process[24]); right of municipalities to buy arable land if it is close to land owned or of interest for the same municipality.

The farm land market has been dynamic, especially in the years introducing the SPS. The average area interested by transactions was 47,000 ha per year over the period 1998 - 2007. However, 2005 was an exceptional year, when almost twice as many land transactions were registered compared to 2004. This exceptional year could be related to changes in investment support programmes, regulations for generational transfer and farmers' expectations about CAP changes, as well as uncertainty over the continuation of the temporary early retirement programme (which has encouraged farmers to exit the sector before the end of the programme. Moreover, the introduction of support grants for new farmers in 2005 boosted inter-generational land transfers remarkably (i.e. sales between relatives). After 2005, land transactions have been steadily decreasing as well as inter-generational transfers.

National Programmes. At the time of EU accession negotiations, Finland had negotiated the right to pay extra, nationally financed aids. Aids may not be used to increase production, nor may the total amount of support exceed the level in existence prior to EU membership. There are six national support areas: 1) Northern aid to areas north of the 62nd parallel and adjacent areas, which represent 55.5% of the arable area in Finland; 2) National aid for southern Finland; 3) National aid for crop production; 4) National supplement to environmental support; 5) National supplement to LFA support (the whole agricultural area of the country is classified as LFA); 6) Other national aids.

FRANCE

In France, structural policy and land policy have been historically important (Agricultural Modernisation Plan in 1947, the first Law of Agricultural Orientation in 1960). The following paragraphs concisely describe new or revised measures regulating farm installation policy, agricultural land markets, labour contracts and the agricultural tax system.

Support to generational change and setting-up of young farmers. Young farmers meeting established conditions may benefit from Young Farmer Grants and reduced rate medium-term loans. These loans serve to finance the take-over of farm capital, land acquisition and working capital requirements (Decree no 2007/1261). The Law no 2006/11 provides the opportunity for young farmers who buy a farm to stipulate a special contract (*progressif*, i.e. a deferred acquisition of property), for which the payment of half of the purchase can be spread over a period of 8 to 12 years. The seller also benefits from a tax reduction. Financial assistance can be provided to farm managers without successors and aged 56 to 65 years, who transmit all or part of their farm to one or more young people outside the family circle who benefit from Young Farmers Grants.

Land sale market. In France agricultural land cannot be purchased freely, the SAFER agencies *(Sociétés d'Aménagement Foncier et d'Etablissement Rural,* 29 agencies throughout the country), regulate the land market and represent one of the key components of the French structural policy.

[24] According to the European Court of Auditors (Special Report 5/2001) under the regional and hybrid models, the number of payment entitlements is very close to the overall number of hectares of eligible agricultural land. This situation had an important effect on land lesse prices, because farmers with more payment entitlements than land were prompted to lease land for the purpose of activating the largest part possible of their payment entitlements. This pushes up the overall demand for leased land and results in higher land lease prices.

Created in 1960, SAFER was designed to purchase farm land in order to reorganise land parcels and enlarge farms that were below the threshold of profitability and to equip and settle young farmers. Nowadays, SAFER's purpose is "to ameliorate agricultural structures, increase the surface area of certain farms and assist farmers as they settle in and begin to cultivate the land". The agencies have pre-emptive right on most rural property (each department has a minimal land area determined by the prefecture below which SAFERs do not have pre-emptive right; however, the thresholds are very low). SAFER can pre-empt at the sales price and on the other terms stated in the sales contract. However, if they disagree with the price, they can resort to legal action.

The land purchase tax is 5.09% of the land price, reduced for non built agricultural land. For young farmers tax is 0.715% of the land price. Transactions from or via SAFER are exempted from tax.

National provisions regulating rental of agricultural land. The *statut du fermage* defines the terms of rental contracts. Rental contracts usually are for at least 9 years (*bail rural*), there is also the *bail de long terme* (18 years), and the *bail de carrière* (25 years). The tenant benefits from pre-emptive rights, with the possibility to have the price reduced via SAFER intervention. In case of tenant's retirement or decease, contracts are inheritable. Law no 2005-5 introduced a new type of rental transferable contract (*bail cessible*): tenants without successor can transfer the contract to whom they want. In this case the rental price increases (50% at most). Such contracts can be only for 18 years and do not entail automatic renewal. Rental prices of agricultural land are also regulated: each department sets a price index for built and non-built land, used to set minimum and maximum prices.

Labour contracts. There are various instruments in place to facilitate agricultural employment. Law no 2006-11 encourages the creation of employer groups: an employee working for several farmers can have a single employer; farmers who are members of an employer group may benefit from reduced social contribution rates for the employment of casual workers (art. 26), and the reduction of social charges (art. 27). Law no 2006-11 also establishes the possibility of employing one month per year workers under 26 years exempt from social security contributions. The same law establishes the status of collaborating spouse for the farmer spouse/partner. Job-training contracts (*contrat emploi-formation en agriculture*: Decree 151-2006, Art. 1) facilitate agricultural employment by combining work with training, allowing seasonal employees to have access to training during periods of low activity. The maximum permitted length is 18 months. France has bilateral agreements for seasonal workers with Poland, Tunisia and Morocco, under which workers are admitted for a maximum of 6/8 months. Terms must meet French standards.

Agricultural taxation. The agricultural income tax system is composed of three core tax regimes and numerous options, differentiated according to farming income and structure (there is a separate regime for forestry). The applicable regime is determined on the basis of revenue (receipts), including subsidies and allowances, calculated over two years. Young farmers that start farming are allowed to reduce their taxable agricultural income for 5 consecutive years by 50%.

GERMANY

Germany has long-standing experience in policy programmes to support development of rural areas. Such programmes started in the 1960s and were almost entirely focused on agriculture, including improvements of local natural and infrastructure conditions and land consolidation. The Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) is of primary importance.

Land consolidation. The German Land Consolidation Act (lastly amended in August 2008) establishes that to improve production, working conditions in agriculture and forestry, as well as general land use planning and land development, owned land may be consolidated. This is executed by means of official procedures with the participation of the totality of land owners and competent authorities[25]. East German Länders abide an additional Law on Adjustment of Agriculture (1990) that

[25] A number of tools are applied in both East and West Germany: comprehensive land consolidation (main approach); voluntary land exchange; accelerated land consolidation; simplified land consolidation; land consolidation in case of permissible compulsory purchase. Two measures apply to East Germany alone: procedure on restitution of ownership; joining of land and building ownership. (Thomas 2004)

regulates re-arrangement and adjustment of farms and serves the purpose of integrating the former legal system into West German Civil Code concerning land ownership[26].

Land sale market. The Law on Sale of Agricultural Land regulates land transactions. Sale of agricultural land bigger than a certain minimum size requires a permit by the regulatory authority. The minimum size is set by each Federal State (e.g. 2 ha in Bavaria). The regulatory authority examines the existence of pre-emptive rights and has power to stop transactions in case of inefficient allocation of agricultural land, reduction of agricultural parcels and too high/too low sales price. A regulation which in some areas has an impact on land prices is the Hartz IV law (taking effect on January 1, 2005), which regulates benefits for long-term unemployment. The law establishes that unemployed people can receive no aid as long as they own any property. In regions with high unemployment rate this law leads to unemployed people having to sell their land. In East German Länders additional land sale regulations concern the ongoing privatisation of state-owned land being carried out by the trust company BVVG, created in 1992 as a subsidiary of the Treuhand (the agency that privatized East German enterprises). BVVG was involved in the restitution of land ownership rights and holds the mandate to privatise about 1.8 million parcels of state-owned land for a total area of 2.3 million ha.

Sales price is also regulated: the Compensation and Indemnity Act gives former land owners (current tenants) who lost their agricultural land in the collectivisation of the 1950s and 60s an opportunity to buy land at 65% of the current market price. The amount of agricultural land that can be purchased at the lower price depends on soil quality[27]. For land sales that do not fall under the conditions of the Compensation and Indemnity Act, the BVVG established a new tool, the invitation bid. Public land under contracts with remaining duration of two years has to be publicly offered for sale or rental. As the highest bid will receive the land, the former tenant must buy the land if he does not wish to lose it.

Land rental market. In Germany transfers of agricultural land mostly take place on the rental market (CEPS, 2010). Although prices have been relatively stable at the aggregate level (2005-2010), in East Germany they increased in 2006-2007 (the use of invitation bids by BVVG caused an average rise by 22 %), while in the Western regions they have edged down.

Agricultural insurance. Ad-hoc measures for large-scale disasters (fully State funding) and animal disease funds (partial State funding) are available. Insurance funds provided by the government to affected farmers concern: emergency measure; lease extensions or waivers for areas leased from the State; advances or early pay-out of direct payments; early pay-out of compensatory allowance for LFA; remission of land tax by the local authorities due to considerable decrease in yield; government subsidies for holdings at risk of bankruptcy in the case of national crises.

Social security & agricultural taxation. A special system operates for farmers, their spouses and family members working on the farm covering pensions, health and injury insurance. Government-subsidised social contributions to farmers represent an incentive to stay in the sector. Germany stands out for the highest level of social contributions in the EU-15 and among the lowest direct and indirect taxes. Income tax rates for farmers are the same as for other unincorporated businesses but there is a simplifying and possibly beneficial procedures for farmers (flat-rate system applied below an area ceiling of 20 ha/other ceilings are in place for animal production, vineyards and other highly profitable activities; intermediate cash-based procedure is available for farms with profit, turnover or an imputed economic value below € 25,000 in order to limit the administrative burden on very small farms. Agricultural land is given a reduced county real estate tax rate (in 2004, 0.43% opposed to 1% for other land) and a reduced municipal tax rate: max 1.2% for agricultural land and 2.4% for other land.

Diversification: biogas production. The 2000 German Act on Granting Priority to Renewable Energy Sources (last amended in 2009) regulates guaranteed feed-in prices and premiums for

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[26] Three factors are particularly relevant for land consolidation in East Germany: 1) privatisation of state-owned land confiscated in 1946 (BVVG Land Fund); 2) transformation of large collective or state-owned farms into smaller private farms, partnerships or corporations; 3) reduction of old debts from the Communist system.

[27] With the current 600,000 hectares of agricultural land, the BVVG is still the biggest land owner in the newly formed German States. It is estimated that 42% (250,000 ha) of this land will be sold at the reduced price. The remaining land (approx. 350,000 ha) will be sold at market value, but not exceeding 25,000 ha annually, therefore not ending until 2020.

electricity produced from renewable energy sources, including biogas. Payment is guaranteed for 20 years. Thanks to this policy, energy production from agricultural biogas experienced a boom in Germany, encouraging primarily medium scale farms (5-50 ha) to invest in biogas[28].

GREECE

In spite of policies to prevent abandonment of rural areas and to improve land consolidation dating back to the 1950's, the agricultural sector is still fragmented in Greece, with low average farm size. The main measures likely to preserve agricultural activity in Greece appear to be the follow.

- Since 1979, the subdivision of agricultural land below the minimum parcel size of 0.4 ha is forbidden. The State promote land re-distribution at a rate of 7 000 ha per year between 1996 and 2003 (one-third of agricultural land is owned by the State and a significant acreage is owned by the Orthodox Church). However, in 2006 there still were about 750 000 ha to be re-distributed.
- The Agricultural Bank of Greece offers loans at special conditions for the purchase of agricultural land to benefit, in particular, young farmers.
- Law no 2961/2001, amended by Law no 3091/2002, establishes exemptions to transfers of farm land so as to maintain activity. Exemptions are also granted on the real estate transfer tax for the purchase of farm land. Conditions for exemption include being a young farmer under 40 years of age and the purchase of land adjoining agricultural land already owned by the buyer. Farmers are also granted tax exemption for inheritance or inter-generational transfer of agricultural land.

HUNGARY

Hungary's post-communist land reform has generated a great diversity of agricultural holdings[29]: large incorporated privately owned farms (land is leased); cooperatives operating on owned land; individual private farms and household farms. The sector is characterised by a dual structure: 10% (collective and corporate farms) of farming units control about 90% of the land.

Land lease market. Land concentration is pursued primarily through the lease market: surveys conducted by the World Bank have shown that individual farms with leased land are significantly larger than farms using only their own land. The lease system is, however, imperfect (e.g. the minimum lease term is not regulated by the law, and in 95% of cases the lease is less than 5 years) and may not promote long-term investment in farms. Moreover, according to the European Court of Auditors (Special Report 16/2012) SAPS payments have had an effect on lease conditions and prices. The Court observed a strong increase of lease prices for state owned land of low agricultural value such as marginal grassland. Before 2004 sheep breeders traditionally using this land had paid no or very low lease fees but with the introduction of SAPS demand for such land increased. This is explained by the fact that SAPS payments being proportional to area guarantee a high level of aid in relation to the low productive value of the land. The authorities started organising public tenders for awarding lease contracts which resulted in significantly higher lease fees that affected all farmers working on this type of land. The Court identified lease contracts where the lease was directly expressed as a percentage of SAPS and/or complementary national direct payments and was thus increasing proportionally to the evolution of these payments[30].

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[28] Germany is the EU leader in biogas production with 5 300 plants in operation in 2010, requiring 800 000 hectares (compared to 3.3 million ha for wheat production). The production of energy and raw materials derived from agriculture for industrial production has become an additional source of income in agriculture. The area devoted to all renewable resources from agriculture has doubled since 2003. The impact of bio-energy production on land sale prices and rents was assessed as strong in West Germany but as very small in East Germany (due to the different average farm size)

[29] Hungary's land privatisation programme was based on compensation of former owners, rather than land restitution, with landless workers on state farms and cooperatives also receiving small land grants. 50% of the country's land area was interested by compensation claims, and over 2.1 million new land units were created during this process.

[30] The Court also observed that, in Hungary, tenant farmers could only sign or prolong land lease contracts under the condition that they transfer the payment entitlements to be allocated to them in the case of a future introduction of a new support scheme, free of charge, to the owner of the land

Land sales market. In Hungary, land markets have been slow to develop due in part to legal restraints on land sales to legal persons and foreigners. Hungary restricts private land owners to holdings of no more than 300 hectares. Hungary also agreed during EU accession negotiations that foreign legal persons will be able to buy arable land, but not until 2011[31] (the Ministry of Agriculture requested an extension until 2014: one of the arguments for this measure is the low market price of farmland).

Farm access to credit. Since 2000, Hungary has developed a system of farmers' credit programmes (harmonised with EU regulations after accession). The Agricultural Development Credit Programme (Government Regulation 39/2005) supports the sector with preferential medium and long-term credit. Credit may be used for the setting-up of young farmers, the improvement of production and modernisation of existing facilities, the processing and marketing of own products (except for milk/dairy substitutes and sugar processing/marketing activities). Furthermore, the farmers' credit line programme (Government Regulation 30/2000) provides interest subsidy and state guarantee to diminishing the indebtedness of agricultural producers and establishing an effective farming structure.

Agricultural taxation. Farmers' income is not taxed if agricultural revenue is less than €2 384 (Act CXVII of 1995). Farmers with crop production pay 15% taxes and animal breeders pay only 6%. If farmers have more than 60% costs, which is often the case, no income tax is due.

IRELAND

The policy instruments likely to have had effect on the structure of the Irish farm sector in terms of maintaining farming activity are those concerning social security and agricultural taxation:

- Ireland has established a number of social protection measures for those engaging in farming activities with the objective of preserving agricultural employment. Farm Assist Scheme is a weekly means-tested payment for low income farmers aged between 18 and 66 years.
- Several provisions in place from 2010 onwards impact on the taxation of income from farming. Among other: Income tax deductions apply to farms increasing the value of trading stock (higher for young trained farmers). Furthermore, farmers paying tax on their farming profits may claim a 7-years allowance for capital expenditure on the construction of farm buildings other than dwelling and certain other works. Farmers can also benefit from allowances for capital expenditure on construction of farm buildings for pollution control (waste storage facilities and winter housing for cattle and sheep). Individual full-time farmers may elect to be charged income tax on the basis of the average of farming profits and losses of 3 years.

On the contrary, access to credit is deemed as one of the main economic barriers to the development of Irish agriculture together with low family farm income. Indeed, Ireland does not have any specific policy to facilitate farm access to credit[32].

Diversification: Energy recovery. The Bioenergy Establishment Scheme provides grants to farmers to plant willow and miscanthus to produce biomass suitable as a renewable source of heat and energy. The scheme provides establishment grants of up to €1,300/ha or 50% of the cost. The scheme was launched on a pilot basis in 2007 and supported the planting of 2,500 ha by the end of 2009.

ITALY

In Italy, changes introduced in 2001 (Law no 228/2001) and in 2004 (Law no 99/2004) to civil and fiscal regulation of agricultural holdings appear to be particularly relevant. In particular, Decree 99/2004 defines and regulates legal entities and business activities in agriculture and introduces the Professional Agricultural Entrepreneur (*Imprenditore Agricolo Professionale*-IAP). IAP qualification gives farmers the opportunity to access various tax and credit benefits, particularly for the purchase of

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[31] However, foreign citizens will be able to purchase land if they have been residents for at least three years, farm for a living, pay taxes and if Hungarian farmers renounce their purchase option.

[32] I n July 2011, the Bank of Ireland announced a €200 million Agri Farm Investment Fund to support the financial needs of the agricultural sector. The new fund is available for a variety of investments including purchase of machinery and land, upgrading housing and other facilities, construction of farming buildings and for purchasing stock.

land. The IAP must have relevant knowledge and professional skills, devoting at least 50% of his working time to agricultural activity and obtaining from it at least 50% of his working income (before, both rates were set at 33%). In addition, the law extends to companies that exclusively exercise farming activity the benefits already applying by law to natural person farmers.

Several measures aim at **consolidation of agricultural land parcels** and enlargement of holdings: Law 99/2004 provides incentives to land transfers to achieve the minimum level of profitability required by EU legislation for access to investment aids. Artt. 9 and 10 establish tax reductions for farmland mergers, exchange of parcels, correction of land boundaries, rental of adjacent lands. Law 296/2006 modifies inheritance tax rates, making them less burdensome than they were in the past. In mountain areas, less onerous inheritance tax rates are in place (Law 97/1994).

Furthermore ISMEA, a public economic institution, manages measures such as: i) takeover in agriculture: granting of loans (90%, up to a max of €1,032,000) for investments fostering generational change (Decree 185/2000); Setting-up of young farmers: setting-up aid for the purchase of land by young farmers aged 18-39 subject to certain eligibility criteria (Aid scheme XA 259/2009 replacing XA 110/2001); iii) granting of loans (at a 2% rate) for the purchase of land by professionally qualified farmers. ISMEA is also involved in public land privatisation.

Land market. Rules on transfer of land are based on laws dating back to 1965 and 1982 respectively and are modelled around two legal entities: small farmer and agricultural entrepreneur (now replaced by IAP)[33]. Provisions in place since 2005 for agricultural land purchase/sale regulate the different taxes on land transfers depending on the subjects: 15% registration tax, + 2% mortgage dues + 1% land registry tax, but grants the following tax reliefs: fixed tax rate for small farmers, reduction to 8% for IAPs. These benefits are extended to agricultural enterprises with IAPs. Art. 5bis of Law 97/1994 grants tax relief for the purchase of land in mountain areas.

Agricultural taxation. The system provides for the cadastral taxation of agricultural incomeon the basis of agrarian income and farmland income[34], with a tax exemption ceiling at 7,000 euro. Law 80/2005 created a special VAT system applied to all agricultural producers who, in the previous calendar year, had turnover in excess of 20,658.28 euro, while maintaining the option for the standard VAT regime, irrespective of turnover.

Diversification. Law 228 /2001 has re-drafted the definition of agricultural activity to include related activities[35]. Farm diversification policies have a strong focus on:

- Direct sales and farmer's markets. Law 228 /2001 has enabled agricultural enterprises to exploit direct sales channels, to benefit from tax relief, and to sell non-farm products. A simplified scheme for authorisations has been introduced. Law 296/2006 establishes requirements and standards for the creation of a farmer's market (sales methods, price transparency) and eligibility criteria for farmers to participate.
- Rural tourism activities. Law 96/2006 draft the definition of rural tourism activities: hospitality in dwellings or open spaces; the offering of meals and beverages, consisting mainly of own products and products of farms operating in the same area; product tasting initiatives; the organisation, also outside the enterprise, of recreational, cultural, didactic, sport and touring activities.
- Energy recovery. Legislation relative to energy generation dates back to 1999. Law 266/2005, art. 1 § 423, establishes economic incentives to agro-energy activities and methods for guaranteeing

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[33] Art. 8 of Law 590/1965 establishes pre-emptive rights to purchase for current tenants and neighbour farmers. Also the rental market was heavily regulated for many years and is still subject to certain rental price regulations. Rules were modified several times in order to balance the contract positions of tenant and landowner. Until 2002 the duration of the contract and the value of the rental was based on the "*equo canone*" (fair rent) agreement: the rental price is not negotiated between the parts but it is defined by a technical commission which determines the rental value based on prices of agricultural products, production costs and farmer's income. Given that the "*equo canone*" value usually was underestimated and fixed for several years, owners were discouraged to rent out land.

[34] Farmland income consists of land-based revenue, agrarian income refers to revenue deriving from land use.

[35] Recently, Law 266/2005 states that "generation and sale of electricity and heat from renewable agricultural, forestry and photovoltaic sources and of fuels obtained from vegetable products and of chemical products derived from agriculture constitute farm-related are deemed to produce agrarian income".

traceability of biomass to be used for power generation. Decree Law 159 /2007 introduced a scheme for power generation deriving from facilities fuelled by biomass of agricultural origin. The provision also promotes agricultural products and by-products used for energy supply, with specific incentives for energy produced from biomass. Law 244/2007 revamps the green certificates system and defines incentives relating to the average rated power of the facility.

LATVIA

Land consolidation. When the post-soviet Land Reform started in Latvia, state farms and collective farms accounted for 92% of all agricultural land. The first stage of the reform (1992-1994) concerned farms' privatisation through establishment of limited liability and corporate companies, whereas restitution of land ownership started after 1993. Land privatization and restoration of property rights are now completed. A "second wave" of land reform is planned, concerning re-parcelling and consolidation of agricultural properties.

Land use. Almost half of Latvia's territory is covered in forests (45.7%) and agricultural land covers a further 37.7% , down from 38.5% in 2000 (EEA, 2010). The slight decrease of the agricultural area is related to forestation and the transformation of agricultural land for development. There does not seem to be conflict between different land uses as the agricultural production potential is twice as high as Latvia's consumption rate suggesting that there is no particular pressure to preserve a certain quota of agricultural area. Nonetheless, there is special government policy concerning transformation of agricultural and forest land through the Agriculture and Rural Development Law of 2004 by which changes of land use are subject to a state fee. Between 2006 and 2007 the Rural Support Service of the Ministry of Agriculture issued permits for transformation of 7,064 ha and further 7,958 ha of agricultural land. About 77% of this land was planned to be transformed into forest land.

Policies for development of renewable energy sources. The development of renewable energy sources may be related to changes in the transformation of agricultural land into forests. Biomass is in fact the most important renewable energy source of Latvia (production of wood for energy represented 30.4% of the total consumed energy in 2007 and this proportion would be higher, but considerable volumes of wood for energy production are exported) and is probably likely to grow further.

LITHUANIA

One of the most serious problems afflicting Lithuanian rural areas is the abandonment of agricultural land. It is estimated that about 3.4 million hectares of agricultural land are farmed, whereas 500 to 600 thousand hectares of agricultural land are currently not in use[36] . In this context, the policies likely to influence farm structures are those concerning land consolidation and regulation of land markets.

Land consolidation. Land consolidation is still an ongoing process in Lithuania (land consolidation legislation was adopted in January 2004). Between 2005 and 2008 the first 14 land consolidation projects have been carried out on an area of 4,827 ha with the participation of 388 landowners. In 2008 a second phase started through a Government Programme 2008-2012 and the establishment of a State Land Fund, financed through the 2007-2013 RDP.

Land market. In Lithuania a large proportion of agricultural area is rented. However, after 2000 the land sales market has been strongly affected by public sales under the land privatisation programme (about 1 million ha have been privatised between 2002 and 2006, Swinnen and Vranken, 2010). With the increase of land sales, land rentals slightly decreased. The share of privately owned land increased by more than 60% from 2000 to 2006. By 2011 privatisation of an additional 0.9 million ha was foreseen. In Lithuania there is an upper limit of 500 ha for the amount of agricultural land that can be owned by one person. Lithuania was granted a transitional period during which restrictions apply to

[36] Various causes for abandonment are reported: i) with the land reform, land ownership was restored to owners not living in rural areas and not interested in farming who hold on to the land because it is an investment or security for the future; ii) outmigration from rural to urban areas, especially of young people; iii) fragmentation / bad quality / inaccessibility / small size of agricultural land remaining unsold after the land reform. The result of the restitution process has been an agricultural structure with an average farm size (12 ha) less than the average farm size in 1939 before WWII.

foreigners for acquisition of agricultural real estate. However, there are exceptions for those foreigners who have been permanently living and farming in Lithuania for at least 3 years or who marry a Lithuanian citizen (provided s/he becomes a Lithuanian citizen).

LUXEMBOURG

The review do not highlight the existence of important drivers of structural change. The only policy area worth mentioning is that of diversification into organic farming. The national plan developed for the purpose of increasing organic acreage to 6,000 ha allocates funds for a range of measures.

MALTA

Two thirds of the agricultural land in the Maltese Islands is owned by the State and the remaining by the private sector. 80.4% of UAA is rented, the present **land tenure system**, which is meant to protect farmers and cultivation, is actually proving to be a heavy deterrent to new entrants[37].

National programmes. Until EU accession the agricultural sector was protected through trade barriers. Malta negotiated a special transition aid that incorporates 9 specific aid schemes (tomatoes, fresh fruits, fresh vegetables, potatoes, wine, pigs, dairy, poultry and egg farming). All sector schemes provide price subsidies to compensate for the eliminated import levies. In addition, some sector schemes contain support for restructuring and marketing as well as area payments: restructuring (investment) assistance for wine and livestock sectors, marketing aid for tomatoes and potatoes, and area payments for wine grapes and potatoes.

NETHERLANDS

Land is a scarce resource in the Netherlands. Land available for farming is decreasing, with increased pressure from non-agricultural uses. Policies regulating land use and land rental market appear as the most relevant in terms of possible structural effects on agriculture.

Policies for agricultural land use and consolidation. Farms have changed over recent years from mixed production to specialisation in arable crops, horticulture, intensive greenhouse horticulture and animal production. The intensification of production has had a negative impact on wildlife and land consolidation has been considered to be a major contributing cause. At present, the government has designated a limited number of areas for these sectors aimed at reducing impact on landscape and the environment[38]. In environmentally sensitive areas, land management plans are now adopted and, where appropriate, compensation is paid to farmers for any loss of income they suffer by taking land out of production, or restricting the use of the land.

Land market. Agricultural land transactions have always been relatively free. On the contrary, the rental market has always been heavily regulated (Tenure law introduced in 1958) and strongly orientated to protect tenants' rights (i.e. regional rent ceilings were established by the government allowing for only modest annual adjustments; tenants hade pre-emptive right to buy the land). This policy has restrained the development of agricultural land lease. From September 2007 onwards rental agreements for less than 6 years are not subject to any of the historic constraints.

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[37] According to the Agricultural Leases (Re-letting) Act (1967), both State and private land is automatically re-let to the existing tenant or his/her descendants. This Law effectively impedes the eviction of tenants or any substantial rent increases, even on privately owned land. Given the cheap prices at which land is rented, both tenants and private landowners tend to hold on to their land resulting in shortage of land for new agricultural ventures.

[38] In 2002 the Concentration Areas Reconstruction Act introduced measures for geographical concentration of intensive livestock farming. This Act, originally intended for the layout of pig-free areas following the outbreak of swine fever in 1997, has become an instrument for spatial improvement of the five provinces in which intensive livestock farms are concentrated. The objective of the Act is to relocate farms from areas in which intensive livestock farming is regarded as undesirable and to oppose expansion of farms in these areas. The implementation of this programme has encountered serious difficulties: land prices tend to increase sharply in areas designated as agricultural development areas; resistance from environmental groups and local citizen initiatives. In 2005 the Dutch government decided to aggregate greenhouse horticulture in three so-called 'Greenports'. These accommodate over 3,800 ha of greenhouses, 38% of the total greenhouse area. The Greenports are supplemented with 18 project locations, smaller areas of concentration, distributed across the country. These are intended as alternative areas for farms who wish/are forced to leave the Greenports.

POLAND

Differently from most other Eastern European countries, in Poland as much as 75% of the agricultural land remained in private ownership (i.e. family farms) throughout the socialist era. However, from 1982 onwards, Poland applied land consolidation as an instrument to address the severe structural problems of land fragmentation and small farm sizes, mainly affecting southern and eastern regions. Privatisation of agricultural land owned by state farms is close to completion by the Agricultural Property Agency (APA).

Still today the agricultural sector is dominated by owned family farms with 80% of total area (family farms are defined as farms with no more than 300 ha of arable land leading by an individual farmer). The policy instruments likely to bear an impact on farm structures through the preserving of farming activity are those regulating land markets, taxation system, social security and agricultural insurance.

Land sales market. The land sales market in Poland is specific, as there exist two parallel markets. The land market comprises private land and State-owned land managed by the Agricultural Property Agency (APA), which offers for sale real estate owned by the State Treasury. The sales of state-owned farmland are mainly achieved by the means of tendering. Auctions are usually held so that the highest land prices are obtained. It is ever more common for the limited tendering to take place, this being solely open to small farmers intent on increasing their family holdings. Private land transactions are free[39], but pre-emption right applies in case transactions occur between family members or the farm is purchased by a tenant renting for at least 3 years and in case the purchase contributes to enlarging the family farm to 300 ha.

Land lease market. As in Hungary, the European Court of Auditors noted the capitalisation of part of the SAPS support in land lease prices (i.e. increase of lease prices for land of low agricultural value).

Taxes. Polish farmers pay land taxes depending on the acreage and quality of the soil, but they may be exempted from taxes in a number of ways (e.g. if the farmer has increased the size of the farm to 100 ha, if the land is bought or leased from APA). Corporate and personal income taxes are not levied on income from revenue generated by agricultural activity (Ministry of Finance, 2004). Income tax is only applied to specific agricultural products: greenhouse production, poultry, mushroom production, bee keeping, large-scale pig farming, fur animals, silkworms.

Insurance & Social security. In the period 2003-2013, the Government covers up to 50% of the cost of crop and livestock insurance against natural disaster. Large holdings are excluded from the aid. The Act of 21/12/1997 concerning social insurance payments for farmers (OJ. 1998, No. 7) created a social security fund for farmers (known as KRUS) which provides retirement payments, over 90% of which comes directly from the state budget. Contributions into the KRUS are lower than under the normal scheme. All residents of Poland owning over 1 ha of agricultural land may register for KRUS).

PORTUGAL

Portugal has developed various measures to facilitate access to credit for farmers, either landowners or farmers renting the land. Legislative Decree 298/1998 of 28/09/1998 regulates Short-Term Credit for agriculture, forestry and livestock supporting farm investments. The financing Programme to Tenant Farmers used to provide rural tenants with the possibility of acquiring agricultural land which was under their direct exploitation; refunds to direct heirs; funding for land consolidation. Beneficiaries were all tenant farmers, with priority given to young farmers. The Programme ended on 1st September 2005. Since 2008, various credit systems have been set up specifically for micro, small and medium-sized enterprises, operating in agriculture, livestock, forestry and agro-industry to provide resources for investments in tangible or intangible fixed assets; strengthen the working capital needed to develop the activity; settle debts with credit institutions or suppliers of production inputs including capital.

[39] There are limitations for foreigners: EU inhabitants are allowed to buy land after 3 or 7 years lease. Citizens of other countries will be allowed to acquire lands not until 2016. EU inhabitants can by land in Poland without special permission if: plots are under 1 ha and are not near the border, buyer lives in Poland from 5 years or he is married with a polish citizen. The foreign individuals can inherit land. Legal entities can buy lands after getting permission.

Despite the lack of studies on the effect of credit policies, it is opinion of the Confederation of Agricultural Producers (CAP) that these measures are undoubtedly important, contributing to structural adjustment by creating assets for agricultural enterprises and promoting investments.

ROMANIA

The land reform process[40] (dismantling of the majority of cooperative farms and restitution of land to former owners) resulted in significant land fragmentation: the sector assumed a dual structure with many small-scale farms on the one hand, and few large-scale farms on the other hand. Similarly to what happened in other new EU Member States, a sharp increase in land prices was observed in 2005 when the Act of Accession was signed. Between 2004 and 2005, agricultural land sale prices increased by more than 200%. Further land price increase occurred with actual accession into the EU: from around 900 euro/ha in 2005 to 1,400 euro/ha in 2008.

Land sales market. The Land Sale and Purchase Law (no. 54/1998) posed some restrictions on the size of farm properties (acquired property could not be more than 200 ha in arable equivalent per family) and on ownership rights by foreigners. Law no. 312/2005 establishes that EU citizens and stateless persons with domicile in a Member State or in Romania, as well as legal entities established in EU, can acquire ownership rights on agricultural land, forests and forestland after 7 years from the date of Romania's accession to the EU[41]. Law no 247/2005 eliminates the pre-emption right.

Land lease market. The ECA Special Report 16/2012 identified in Romania too the phenomenon of capitalisation of SAPS direct payments in land lease price: the Court founded lease contracts where the lease was expressed as a percentage of SAPS and/or CNDP and was thus increasing proportionally to the evolution of these payments

Social security. Romania had a separate scheme for farmers until 2000. This optional scheme did not work as intended, as only a small number of farmers subscribed to it. From 2000, farmers are fully integrated into a reformed mandatory public pension scheme (certain administrative details may be different for farmers though). The new unemployment insurance system Law (76/2002) came into force on 1 March 2002. The law is oriented to reduce unemployment, and to assist unemployed persons to find a job. The reference in earlier legislation excluding farmers with more than a minimum area of land from unemployment benefit has been removed.

Agricultural taxation. Income from agricultural activities is determined either on a fixed income quota basis, or by single entry accounting, by applying a flat rate of 16% to taxable income. The tax due for income earned by taxpayers from selling their products to certain designated collection units is calculated and withheld at the source and amounts to 2% (flat rate) of the value of the products sold.

SLOVAKIA

Consolidation of agricultural land is still seriously hindered by the unfinished process of restitution of ownership rights due to unsettled outstanding claims. It is estimated that about 360,000 ha (one quarter of the total agricultural area) is affected by uncertain legal status. The result is persisting high fragmentation and very small size of farm holdings (less than 2 ha).

Land use. Slovakia has a number of measures in place aimed at preserving the best agricultural soils and agricultural activity (Decree No 1141/2001 on Rules of the State Soil Policy, Act No 220/2004 on Protection and Utilisation of Agricultural Soil). This protection regime entails a compensation system for agricultural land. In total there are 9 soil classes, the best of which are protected. The conversion of

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[40] Land Law n. 18/1991 and subsequent Law no 1/2000, Law no 247/2005. Property rights were returned to each landowner who was forced to join a collective farm. The Law stipulated that each former owner can reclaim land up to a limit of 10 ha (Law no 1/2000 raised the limit to 50 ha). The Law no 247/2005 resulted in new provisions on the circulation of land in order to liberalize the land market and speed up trials related to the land properties restitution. The new law practically restarted the land restitution process. By 2009, 10.5 million hectares of land were returned. By 2005 almost 95% of land was privately owned (up from 9% in 1990).

[41] With a number of exceptions (residence permit, inheritance; ecc.)

such land into building land is charged with a fee ranging from 6 – 15 Euro per m², depending on soil quality. Currently 21% of agricultural land is interested by this regime, regulated at regional level.

Land sales market. Slovakia has a fairly heavily regulated land market, pre-emptive right for purchase exists if there are more owners to the same rented land. The aim is to simplify the process of reallocation of land and reduce fragmentation. At the time of EU accession, Slovakia was granted a 7 years transitional period during which it could maintain existing provisions restricting the acquisition of agricultural land by foreigners[42]. Upon request of the Slovak Republic, the European Commission granted a three years extension until 30 April 2014 (Decision 2011/241/EU of 14 April 2011). The property tax paid on agricultural land has reduced rates of 0.75% on arable land, hop gardens, vineyards and orchards and 0.25% on permanent grass lands, forest lands, fishponds and other water plots. Since 1992 individual farmers who were new entrants have been exempt from the land property tax for a 5 year period. Act No. 595/2003 on income tax confirms the 0% tax rate for the first 5 years after purchasing the land. After the first 5 years, though, the property tax rate is 20%.

Land lease market[43]. The Act no. 504/2003 regulating rental of agricultural land establishes the minimum price of the rented land. Contract duration is minimum 5 years and maximum 15 years. The tenant has no pre-emptive right on re-rental or purchase of the land he/she occupies. According to professional organisations, this regulation has the effect of protecting landlords' interests but also to contribute to securing the use of rented land for agricultural purposes.

Farm access to credit. Act. No 144/1998 establishes support to the interest rate paid by farmers for commodity loans secured by warehouse receipts. This support system was maintained until 2006.

SLOVENIA

Land consolidation policy. Land consolidation policy dates back in the 1980s, but between 1990 and 1995 the process came to a halt due to lack of financial resources. Land consolidation was necessary because of the dispersion of agricultural parcels, the very small size and a problem with oddly shaped parcels and no road access. In 1995 the Ministry of Agriculture re-established financing for consolidation of agricultural parcels (Agricultural Land Act No. 59/96 last updated in 2011, No. 71/11). In 2006 there were 950,000 ha of agricultural land in use, of which approximately 59,000 ha have been consolidated.

The role of the Farmland and Forest Fund. The Farmland and Forest Fund acts as a market trader with the objective of land consolidation through sale and lease and restrictions to prevent fragmentation. The Fund controls state land not yet returned to owners and can lease it to small private farmers as well as large enterprises. The Fund also buys oddly shaped parcels, parcels difficult to access, and land adjacent to existing farms, at the request of farmers, and then leases the land to them. Agricultural land units over 5 ha must be conveyed as whole units and cannot be subdivided.

Land sales market. The size of the sales market is small: land prices are very high, particularly in relation to land profitability prospects Some argue that low land taxes have encouraged land ownership to the detriment of land sales and that land markets have been hampered by the lack of a mortgage banking infrastructure. The Agricultural Land Act regulates transactions: Art. 19 stipulates that the acquisition of title to agricultural land through legal transactions may only be possible subject to approval of the relevant administration. In addition, art. 18, 19 and 23 stipulate restrictions such as sub-division of farms, inheritance rights, permitted parcel size. Art. 23 establishes the order of pre-emption right. There are no national provisions for price setting in sale of agricultural land. Inherited or donated agricultural land is exempt from inheritance tax.

Land lease market. The Agricultural Land Act establishes pre-emptive rights for land rental in favour of neighbouring farmers. Furthermore, the Act establishes the length of contracts depending on type

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[42] Similarly to other EU12 States, there are exceptions

[43] Renting of land is important in Slovakia (over 90% of the utilised agricultural area is rented). Corporate farms account for the vast majority of rented land. Between 2001 and 2005, real rental prices increased by more than 90% in Slovakia as an effect of EU accession. Still, in 2005 Slovakia had the lowest rental prices among the new EU Member States (18€/ha), whereas sales prices were the highest (over 5,000€/ha). (Swinnen and Vranken, 2010).

of crop: 25 years for vineyards, orchards or hop gardens; 15 years for fast-growing hardwood plantations; 10 years, for other purposes. The Farmland and Forest Fund annually establishes a maximum and a minimum rental price of state-owned land in order to standardise rental fees.

SPAIN

Land consolidation. In the past the magnitude of the rural exodus[44] pushed the government to undertake a programme of land consolidation, to bring together small scattered plots that characterized the *minifundio* sector. The Act no 19/1995 (Modernisation of Agricultural Holdings), amending Act 118/1973, was introduced to correct imbalances and structural weaknesses that affect the competitiveness of farms. The Act uses as a baseline the concept of "priority farm", so as to ensure economic viability and in order to justify the granting of preferential public support. As the limited size of many farms was one of the problems affecting viability, the Act introduced measures to boost land markets, allow easier access to property and leasing through tax incentives in the case of formation or consolidation of priority farms and special incentives to benefit young farmers. The Act foresees also incentives for long-term rentals (over 8 years) for priority farms. It consists of an annual aid for 8 years and tax relief in the transmission of forest areas.

Irrigation policy. The use of irrigation water depends on two legal texts: the Water Framework Directive and the New Text of the Water Law. This situation has led to an in-depth review of the National Irrigation Plan (PNR) known as the Action Plan for the Modernisation of Irrigation, which is being applied in 2006 and 2007. The objective of the review is to find ways of making important efficiency gains in the consumption of water.

Insurance system. The Government annually establishes the Agricultural Insurance Annual Plan. The Plan contains assurance from the Government not to bestow extraordinary aids to the farmers affected by damages on production caused by insurable risks. The main characteristics of the agricultural insurance system are the following: the participation of farmers in the system is voluntary; the average subsidy is 50% of the total insurance premium. Subsidies positively discriminate some groups, such as: professional farmers, priority holdings, young farmers and women farmers; all insurance companies operating within a pool, assume the risk in a co-insurance regime. This avoids insurance companies to compete in prices.

Agricultural taxation. A special VAT system exists for farmers. The standard VAT rate is 18% (16% before July 2010). A reduced rate of 8% (7% before July 2010) applies to food, animals, some goods used in agricultural activities, water, ecc. A super-reduced rate of 4% applies to various basic necessities. Under the special system for farmers, agricultural goods are taxable at a rate of 8% whether farm supplies are taxed at the standard rates. Excise duties, taxes on production and environmental taxes are among the EU lowest.

SWEDEN

Policies regulating land markets (sales and rental) as well as the Swedish government strategy for the production of energy from renewable sources appear to be the most likely to impact farms structures.

Land market. The land sale market in Sweden has never been a very dynamic one and a respectable proportion of agricultural land is rented (around 40%). However, the land market has been recently affected by changes in the taxation system. The abolition of the wealth tax in 2007 has made agricultural estate an attractive investment. Acquiring farm properties is becoming more and more popular among large companies for tax reasons. Inheritance tax was also abolished in 2004.

The introduction of the SPS has had effect on the land rental system. In Sweden both formal (written) contracts and informal land rental contracts are used. The introduction of the SPS represented an advantage for tenants in case of long-term rental contracts (in most cases the contracts could not be terminated in time for the landowner to apply for SPS entitlements that were then allocated to those

[44] The economic transformation in the 1970s caused outmigration from rural areas. Moreover, between 1976 and 1985, when the economy was experiencing serious difficulties, the fall in farm employment averaged 4% per year: the decreased size of the rural work force affected Spanish agriculture because of its traditionally labour-intensive practices.

farming the land). In the case of short-term or informal contracts, the SPS created conflict between tenants and landowners. It is possible that the SPS has affected the average duration of rental contracts, as contracts now tend to be shorter. One year contracts have become more common than they were in the past. In 2005, when the SPS was introduced, rental prices in the north increased by as much as 76%, whereas in the western part of south Sweden rental prices in some cases decreased. In particular, land rental prices appear to have increased in the regions where payments were redistributed from cattle to arable land due to decoupling.

Renewable energy sources. On June 16, 2009, the Swedish Parliament approved the Government's new energy and climate strategy, described as Europe's most ambitious strategy to improve energy efficiency and cut greenhouse gas emissions: by 2020 50% of all energy produced to come from renewable sources. The share of bio-fuels produced from agricultural products in Sweden is still rather small. About 3% of Sweden's agricultural land is used for energy production. The main crops are wheat for ethanol production, willow (Salix) for heating and rapeseed for bio-diesel.

UNITED KINGDOM

In the UK, policies regulating land use and planning, agricultural land rental markets as well as farm diversification are the most relevant in terms of potential impact on the structure of the farming sector.

Land use. The national government issues guidance notes called Planning Policy Statements - PPS which have to be followed in the design of local Action Area Plans. The implications of PPS for farms are not negligible, as nearly any change of use of agricultural land[45] or buildings requires permission by local planning authorities. Changes in agricultural operations or for the use of existing farm buildings for agricultural purposes do not require planning permission. Farm diversification for non-farming use requires planning permission. Environmental Impact Assessment (EIA, 2006) protects uncultivated land and semi-natural areas from being damaged by agricultural activity and guard against possible negative environmental effects from the restructuring of rural land holdings. EIA will not normally be required for most small scale development but is mandatory in certain developments, such as large installations for intensive rearing of poultry and pigs.

Provisions regulating rental of agricultural land: England and Wales. Due to policy orientation, until 1984 the land lease market in England and Wales was not important. In 1984 the Government removed the rights of succession for new tenancies, introduced various retirement provisions, and adjusted the rent assessment formula. But the real turning point came with the Agricultural Tenancies Act in 1995 (ATA). The ATA allowed greater flexibility for landowners and tenants to draw up tenancy agreements to suit their particular circumstances: any length of time can be agreed (long term leases could be used to encourage tenants to invest capital in the business), for a wide range of activities, including non-agricultural activities; provisions for notices to quit provide reasonable safeguards to the tenant; tenants are entitled to compensation for improvements which increase the value of the property; freedom to choose whether and when to have rent reviews, with provision for arbitration on an open market rental basis; landlords and tenants have right to arbitration on disputes.

The Regulatory Reform (Agricultural Tenancies) Order 2006 amended the ATA 1995 in order to encourage farm diversification, maintain and improve viability, allow restructuring of holdings, improve flexibility and maintain a balance between landlord and tenant interests. The right to succeed in a farm tenancy helps maintain farm size and avoid splitting up farm properties.

Provisions regulating rental of agricultural land: Scotland. In Scotland there are 4 forms of lease: "traditional", grazing or mowing lease (no more than 364 days), 5 years Short Limited Duration Tenancies, Limited Duration Tenancies (at least 15 years). The Agricultural Holding Act of Scotland 2003 introduced changes for tenants holding "traditional" tenancy: pre-emptive right to buy the land they lease. In addition, it is possible to diversify: if a tenant intends to diversify activities or plant and harvest woodland s/he must notify the landlord, who can seek further information or impose reasonable conditions relating to the proposed new use.

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[45] Since the 1980s, the UK has a system of Agricultural Land Classification (ALC), by which land is graded from 1-excellent to 6-very poor quality agricultural land. The best quality agricultural land is defined as Grade 1, 2 and 3A.

Provisions regulating rental of agricultural land: Northern Ireland. In Northern Ireland the *conacre* system is in place, for which land is let on a seasonal basis (nominally for 11 months or 364 days) without entering into long-term commitment.

Diversification. When food processing, farm sales and farm tourism are limited, small scale and directly related to the products grown or raised on the farm, they are considered ancillary to the agricultural enterprise. Processing activities would include egg packing on a poultry unit, but not an abattoir. Small scale use of a farmhouse for tourist accommodation/catering does not require planning permission. Regular use and conversion of farm buildings require planning permission.

The Town and Country Planning Act does not define production or supply of energy as agricultural activity. The national legislation makes general provisions to stimulate production and supply of energy from renewable sources, not restricted to the agricultural sector. In addition, until 2011, limited support was available in the form of capital grants for renewable energy projects through Pillar II of the CAP. While the National Farmers Union expects the profitability of some farms to increase as a result of these policy measures (energy generation through solar photo-voltaic ground- and field-mounted; small scale production of biofuels such as vegetable oil and biodiesel; biomass heating), they are not expected to result in significant structural change.

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5. METHODOLOGY AND LIMITS OF THE EVALUATION

The evaluation methodology is based on the results of the structuring phase which derived from the theoretical analysis focusing on the economics of structural change in agriculture. The theoretical analysis allowed to formulate the hypothesis that have been compared to the results of quantitative analysis and allowed to draft the answers to the evaluation questions.

The methodology applied in this report is mainly based on quantitative analysis, via modelling and other quantitative methods, and has been complemented by a review of national legal and institutional frameworks and CATI survey.

The major data sources used are: Eurostat, Clearance of Audit Trail System and FADN.

In the following paragraphs we present a detailed description of the methods and approaches used in the framework of this evaluation indicating their limitations.

5.1 Evaluation tools

5.1.1 Statistical analysis

The statistical analysis was conducted at two levels: a macro-territorial level and a farm level.

To ensure consistency of statistical analysis of different secondary sources data to answer the evaluation questions, the indicators used are presented for 55 macro-regions covering the whole EU. The following 55 regions and macro-regions classified according to NUTS and FADN codes are[46]:

Tab. 8 - Regions and macro-regions covering the whole EU27

MS and no. of regions/macro-regions		Regions/macro-regions	Eurostat Code	FADN Code
AUSTRIA (AT)	1	ÖSTERREICH	AT	660
GERMANY (DE)	4	BADEN-WÜRTTEMBERG + BAYERN	DE1+DE2	80+90
		BERLIN+BRANDENBURG + MECKLENBURG-VORPOMMERN + SACHSEN-ANHALT + SACHSEN + THUERINGEN	DE3+DE4+DE8+DED+DEE+DEG	110+112+113+114+115+116
		SCHLESWIG-HOLSTEIN + BREMEN+HAMBURG+NIEDERSACHSEN + NORDRHEIN-WESTFALEN	DEF+ DE5+DE6+DE9+DEA	10+20+40+30+50
		HESSEN + RHEINLAND-PFALZ + SAARLAND	DE7+DEB+ DEC	60+70+100
BELGIUM (BE)	2	BRUXELLES-CAPITALE+REGION FLAMANDE	BE1+BE2	341+342
		REGION WALLONNE	BE3	343
BULGARIA (BG)	2	SEVERNA I IZTOCHNA BULGARIA	BG3	831+832+833+836
		YUGOZAPADNA I YUZHNA CENTRALNA BULGARIA	BG4	834 + 835
CYPRUS (CY)	1	KIBRIS	CY0	740
DENMARK (DK)	1	DANMARK	DK0	370
SPAIN (ES)	5	NOROESTE	ES1	500+505+510
		NORESTE	ES2	515+520+525+530
		CENTRO + COMUNIDAD DE MADRID	ES4+ES3	545+555+570+550
		ESTE	ES5	535+540+560
		SUR	ES6	565+575
ESTONIA (EE)	1	EESTI	EE0	755
FRANCE (FR)	7	ILE DE FRANCE+ BASSIN PARISIEN	FR1+FR2	121+131+132+133+134+135+136
		NORD — PAS-DE-CALAIS	FR3	141
		EST	FR4	151+152+153
		OUEST	FR5	162+163+164

[46] In few cases there is not a perfect correspondence between NUTS and FADN regions. In such cases, we considered either macro-regions (e.g. Greece) or data at the national level (e.g. Finland, Sweden and Portugal).

MS and no. of regions/macro-regions		Regions/macro-regions	Eurostat Code	FADN Code
		SUD-OUEST	FR6	182+183+184
		CENTRE-EST	FR7	192+193
		MÉDITERRANÉE	FR8	201+203+204
FINLAND (FI)	1	MANNER-SUOMI + ALAND	FI1 + FI2	670+680+690+700
GREECE (GR)	2	VOREIA ELLADA	GR1	450 + 470
		KENTRIKI ELLADA + ATTIKI + NISIA AIGAIOU, KRITI	GR2+GR3+GR4	460+480
HUNGARY (HU)	2	DUNÁNTÚL	HU2	761+762+763
		ALFÖLD ÉS ÉSZAK+ KÖZÉP-MAGYARORSZÁG	HU3+HU1	764+765+766+760
ITALY (IT)	5	NORD-OVEST	ITC	222+221+250+230
		NORD-EST	ITD	241+242+243+244+260
		CENTRO	ITE	282+281+291+270
		SUD	ITF	292+301+302+311+312+303
		ISOLE	ITG	320+330
IRELAND (IE)	1	IRELAND	IE0	380
LATVIA	1	LATVIJA	LV0	770
LITHUANIA	1	LIETUVA	LT0	775
LUXEMBOURG (LU)	1	LUXEMBOURG	LU0	350
MALTA (MT)	1	MALTA	MT0	780
NETHERLANDS (NL)	1	NEDERLAND	NL	360
POLAND (PL)	2	REGION CENTRALNY + REGION POŁUDNIOWY + REGION WSCHODNI	PL4+PL5+PL6	785+790
		REGION PÓŁNOCNO-ZACHODNI + REGION POŁUDNIOWO-ZACHODNI + REGION PÓŁNOCNY	PL1+PL2+PL3	795+800
PORTUGAL (PT)	1	CONTINENTE	PT1	615+630+640
CZECH REPUBLIC (CZ)	1	ČESKÁ REPUBLIKA	CZ0	745
ROMANIA (RO)	4	MACROREGIUNEA UNU	RO1	845+846
		MACROREGIUNEA DOI	RO2	840+841
		MACROREGIUNEA TREI	RO3	842+847
		MACROREGIUNEA PATRU	RO4	843+844
UNITED KINGDOM (UK)	4	NORTH EAST + NORTH WEST + YORKSHIRE AND THE HUMBER + EAST MIDLANDS + WEST MIDLANDS + EAST OF ENGLAND + LONDON + SOUTH EAST (England)	UKC + UKD + UKE + UK F + UKG + UKH + UKI + UKJ + UKK	411+412+413
		WALES	UKL	421
		SCOTLAND	UKM	431
		NORTHERN IRELAND	UKN	441
SLOVENIA (SI)	1	SLOVENIJA	SI0	820
SLOVAK REPUBLIC (SK)	1	SLOVENSKÁ REPUBLIKA	SK0	810
SWEDEN (SE)	1	ÖSTRA SVERIGE + SÖDRA SV. + NORRA SVERIGE	SE	710+720+730

5.1.1.1 Macro-territorial level

At macro-territorial level the analysis is based on Eurostat Farm Structure Survey (FSS) data from 1995 to 2010[47], with specific focus on the last five years (2005 to 2010). The geographical coverage is the EU27, with data computed for macro-regions (as shown above – Tab.5) constructed on the basis of NUTS2 or NUTS3 level data (depending on availability of individual sets of data for the various holding characteristics collected in the FSSs). Depending on specific analytical needs in different parts

[47] FSS comprises two types of survey, a basic survey every 10 years (Agricultural Census) and sample-based intermediate surveys every 2-3 years in between.

of the evaluation, the analysis considers either the single macro-regions or groups them according to the SFP model implemented: SPS Historical, SPS Hybrid, SPS Regional and SAPS.

The sets of variables (i.e. characteristics) needed to derive indicators instrumental to answer the evaluation questions have been directly downloaded from the on-line Eurostat database. In some cases, though, where specific data where not available at the required NUTS level, ad hoc regional data have been requested directly to Eurostat services.

The criteria applied for the inclusion of holdings in Farm Structure Surveys is determined at the EU level by regulation and adopted by the individual MSs. Every Member State produces a National Methodological Report (NMR) for each FSS year describing the applied survey methodology and related criteria used. Accurate analysis of NMRs (years 2000, 2003, 2005, 2007 and 2010[48]) and EU regulations was undertaken in order to identify the changes introduced in different FSS survey years.

Important methodological changes have been introduced with the 2010 Agricultural Census, that can have a considerable impact on the comparability of FSS data over time and across geographical areas. Careful examination of the available documentation and extensive exchange of information with EUROSTAT services have been instrumental in this respect. In the sub-sections that follow, we give count of the intervened changes and describe the methodological choices made to ensure sound analysis and data comparability.

Changes in the European classification of farm typology

Starting from the 2010 Agricultural Census, farm typology classification is based on the Standard Output[49] (SO – defined as the monetary value of agricultural output, including sales, re-use, self-consumption, changes in the stock of products, evaluated at farm-gate prices and not including direct support), which replaces the Standard Gross Margin (SGM – defined as the difference between value of output from one hectare or from one animal including direct support and the cost of variable inputs required to produce that output).

This change has two important implications on data comparability over time. The first implication is for farm classification according to economic size. The SGM represents an income measure (value of production net of specific costs), whereas the SO measures sales receipts or turnover (i.e. the value of production at farm-gate prices), thus there is no correspondence between economic size classification based on SGM and on SO.

The new farm economic size classification comprises 11 classes of Standard Output. The economic size based on the value of SO is measured in euro and no longer in European Size Units (ESU = 1 200 euro of Standard Gross Margin). The eleven classes are: zero euro[50]; less than 2 000 euro; 2 000-3 999 euro; 4 000-7 999 euro; 8 000-14 999 euro; 15 000-24 999 euro; 25 000-49 000 euro; 50 000-99 999 euro; 100 000-249 999 euro; 250 000-499 999 euro; 500 000 euro and over).

Three aggregated economic size classes were constructed on the basis of observation of farm distributions with respect to SO classes across macro-regions:

- Small size farms: Less than 24,999 euro of SO (excluding farms with SO equal to zero euro);
- Medium size farms: 25 000 – 249 999 euro of SO;

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[48] However, NMRs for the 2010 Census are not currently available for all MSs (see also the following sections).

[49] Regulation (EC) No 1242/2008 of 8 December 2008 establishing a Community typology for agricultural holdings.

[50] Holdings for which SO is equal to zero fall within a "Special cases" class as defined in Annex IV of Commission Regulation (EC) No 1242/2008. This class comprises the following types of holdings:

- With fallow land without any subsidies and no other positive SOs on the holding;
- With fallow land subject to the payment of subsidies with no economic use and permanent grassland no longer used for production purposes and eligible for the payment of subsidies;
- With kitchen gardens (since the produce of kitchen gardens is normally intended for the holder's own consumption and not for sale).

Holdings for which SO is equal to zero cannot be classified according to production specialisation, they are instead clustered in a separate farm type group (TF9 – Non classifiable) (Tab. 10). These holdings are treated separately in the analysis.

- Large size farms: 250 000 euro and over.

The change from SGM to SO also has an important implication for farm classification according to type of farming (TF), as farm type is determined by the relative contribution of different products to the total SGM or SO of the holding. In this case too, there is no correspondence between TF classification based on SGM and on SO: farms can be assigned to a different TF depending on the classification method applied, as shown in the table below. The comparison shown below is based on FSS 2007 data, the most recent year for which both SGM and SO classifications are available.

Tab. 9 - Number of holdings distributed by TF based on SGM and on SO (EU27, 2007)

General TF	Base SGM	Base SO	Abs. difference	% difference
TF1 - Specialist field crops	2 743 760	3 392 840	649 080	23.7
TF2 - Specialist horticulture	230 930	263 960	33 030	14.3
TF3 - Specialist permanent crops	2 416 800	2 396 450	- 20 350	-0.8
TF4 - Specialist grazing livestock	2 220 930	2 188 890	- 32 040	-1.4
TF5 - Specialist granivore	725 630	1 305 090	579 460	79.9
TF6 - Mixed cropping	1 584 970	662 920	- 922 050	-58.2
TF7 - Mixed livestock	1 553 040	972 470	- 580 570	-37.4
TF8 - Mixed crops-livestock	1 952 920	2 151 300	198 380	10.2
TF9 - Non-classified	271 460	293 380	21 920	8.1
Total	13 700 440	13 627 300	73 140	-0.5

Source: Eurostat – FSS 2007

EUROSTAT has calculated the SO for the FSS 2007 and 2005 data. Therefore, the analysis of farm structure data disaggregated according to economic size classes and type of farming can only be carried out for 2005, 2007 and 2010, as the data from previous surveys cannot be compared.

Similarly, the analysis conducted at the regional level to evaluate the effects of direct support on economic size and farm specialization will only be possible for the years between 2005 and 2010. The General Type of Farming (1-digit Eurostat classification) is used for the analysis of holdings according to their specialisation.

It is noteworthy that in both 2005 and 2007 FSS data the total number of farms in some regions/ Member States differs depending on the database used, i.e. the historical SGM-based or the new SO-based dataset. The data presented above in Tab. 9 show the difference in 2007 data at the EU level. The most striking case is that of UK 2007, where SO-based data count 73 140 holdings less than the number of holdings in the historical database based on SGM.

Changes in sector coverage and survey thresholds

Until 2007, national Farm Structure Surveys had to be representative of at least 99% of the total SGM produced by agricultural activity in a given Member State[51]. Starting from 2010, the FSS must be representative of at least 98% of the UAA excluding common land and 98% of the total number of livestock units[52]. Although the target population in statistical terms remains the same, i.e. the universe of agricultural holdings, this change has implications for the number of farms selected by a Member State to be included in the survey, which, in turn, again poses a problem of comparability over time.

Farm selection is also linked to the survey thresholds applied by the Member States. Although the basic thresholds do not change after 1988 (art. 6 of Reg. (EC) No 571/1988 and art.3 of Reg. (EC) No 1166/2008):

- agricultural holdings where the agricultural area utilised for farming is one hectare or more;

[51] Council Regulation EEC No 571/88 of 29 February 1988 on the organization of Community surveys on the structure of agricultural holdings, modified by Commission Decision 98/377/EC of 18 May 1998 adapting Annex I to Council Regulation (EEC) No 571/88 in view of the organisation of the Community surveys on the structure of agricultural holdings.

[52] Regulation (EC) No 1166/2008 of the European Parliament and of the Council of 19 November 2008 on farm structure surveys and the survey on agricultural production methods and repealing Council Regulation (EEC) No 571/88.

- agricultural holdings where the agricultural area utilised for farming is less than one hectare, if those holdings produce a certain proportion for sale or if their production unit exceeds certain physical thresholds,

the 2008 EC regulation introduces the possibility for Member States to raise the threshold for certain utilised agricultural area (arable land, kitchen gardens, permanent grassland and permanent crops) to 5 ha in the 2010 Agricultural Census (Annex II of Reg. (EC) No 1166/2008), as well as indicating additional thresholds that can be applied to various crop types and to livestock.

It must also be noted that even before 2010 certain Member States were granted permission to apply UAA thresholds higher than 1 ha. For example, Germany and Sweden have applied a 2 ha UAA threshold since 2000, but while Sweden did not change the threshold in 2010, Germany increased it to 5 ha. The available information indicates that only few Member States have decided to apply the 5 ha threshold in 2010: Czech Republic, Germany and the UK[53].

The table below summarises threshold changes implemented across the Member States between 2000 and 2010. This information was collated from the National Methodological Reports, only available from 2000 onwards and from information available from national statistics institutes (i.e. BG, UK-England for 2010). National Methodological Reports for the 2010 Agricultural Census are currently available for 20 Member States[54]: AT, CZ, DE, EE, ES, FI, FR, HU, IE, IT, LU, LV, LT, MT, NL, PL, PT, SE, SI and SK.

For Denmark there is no information about thresholds applied for the inclusion of holdings in the FSS in any of the available NMR, with the only exception of the 2000 FSS.

[53] For example, in UK-Scotland the number of holdings between 5-20 ha increases remarkably from 2007 to 2010. The Scottish Government explains that the main reason for such a "jump" is due to the change in the threshold criteria for inclusion in the structure survey. In 2007 holdings larger than 1 hectare and greater than 1 and 2/3 ESU were included (as well as smaller holdings with significant pig and poultry activity). This was changed in 2010 with the increase of the basic threshold to 5 hectares. This resulted in the inclusion of more holdings in 2010 with relatively large area but low output (particularly grazing holdings and upland cattle and sheep holdings). Correspondingly, the number of holdings with less than 5 hectares fell in 2010.

[54] Last checked on 26/04/13.

Tab. 10 - Summary of FSS thresholds applied by the Member States, 2000-2003-2005-2007-2010

	2000	2003	2005	2007	2010
No threshold	BE, IE	BE, BG, IE, MT, RO	BE, IE, MT, RO	BE, IE, MT, RO, UK_Eng & Wal	IE, MT
Thresholds - UAA arable					
UAA < 1 ha	GR, ES, HU, SK,	BG, GR, CY, HU, PL, SK,	BG, GR, CY, HU, PL, SK,	BG, GR, CY, HU, PL, SK,	BG, HU
UAA => 1 ha	FR, IT, LV, LU, AT, PT, SI, FI, UK-N Ire, UK-Sco	CZ, EE, ES, FR, IT, LV, LT, LU, AT, PT, SI, FI, UK-Eng & Wal, UK-N Ire, UK-Sco	CZ, EE, ES, FR, IT, LV, LT, LU, AT, PT, SI, FI, UK-Eng & Wal, UK-N Ire, UK-Sco	CZ, EE, ES, FR, IT, LT, LU, AT, PT, SI, FI, UK-N Ire, UK-Sco	EE, ES, FI, FR, IT, LV, LT, LU, AT, PL, PT, SI, SK, FI
UAA > 1 ha	DE, SE (2ha)	DE, SE (2 ha)	DE, SE (2 ha)	DE, SE (2 ha)	LU (3 ha); SE (2 ha);
UAA => 5 ha	DK				CZ, DE, UK-Eng (5 ha)
Thresholds - Livestocks					
Livestock but no specific threshold / livestock type	FR, IT, LU, SI, UK-N Ire	FR, LU, SI, FI, UK-N Ire	FI, FR, LU, UK-N Ire	SI, FI, FR, LU, UK-N Ire	ES, FI (1 LSU), SI (2 LSU)
Cattle					
< 5 heads	ES, GR, HU, AT, PT, SK	CY, CZ, GR, HU, AT, PL, PT, SK	AT, BG, CY, CZ, GR, HU, PL, PT, SK	AT, BG, CY, CZ, GR, HU, PL, PT, SK	AT, BG, FR, HU, PT, SK
≥ 5 heads	DE, SE	DE, SE	DE, SE	DE, SE	CZ, DE, LU, PL, SE
Sheep, goats					
< 5 heads	HU, SK	CZ, HU, PL, SK	BG, CZ, HU, PL, SK	BG, CZ, HU, PL, SK	HU
≥ 5 heads	DE, ES, GR, AT, PT, SE	CY, DE, GR, AT, PT, SE	AT, CY, DE, GR, PT, SE	AT, CY, DE, GR, PT, SE	AT, BG, CZ, DE, FR, LU, PL, PT, SK, SE
Pigs					
< 5 heads	ES, HU, PT, SK	CZ, HU, PL, PT, SK	BG, CZ, HU, PL, PT, SK	BG, CZ, HU, PL, PT, SK	HU, PT, SK
≥ 5 heads	DE, GR, AT, SE	CY, DE, GR, AT, SE	AT, CY, DE, GR, SE	AT, CY, DE, GR, SE	AT, BG, CZ, DE, LU, PL, SE
Poultry					
< 100 heads	ES, GR, HU, SK	CY, CZ, GR, HU, AT, PL, SK	CY, CZ, GR, HU, PL, SK	CY, CZ, GR, HU, PL, SK	HU
≥ 100 heads	DE, AT, SE	DE, AT, PT, SE	BG, DE, AT, PT, SE	BG, AT, DE, PT, SE	AT, BG, CZ, DE, FR, LU, PL, PT, SK, SE
Other (rabbits, fur animals, ostriches, beehives, fish ponds)	ES, GR, HU, PT, SI, SK	CY, CZ, GR, HU, AT, PL, PT, SI, SK	BG, CY, CZ, HU, PL, PT, SK, SI	BG, CY, CZ, HU, PL, PT, SK, SI	BG, FR, LU, PL, PT, SI
Thresholds - Other					
UAA Other crops	DE, FR, GR, IT, LU, HU, AT, PT, SI, SK, SE, UK-N Ire	DE, CY, CZ, ES, FR, GR, HU, LU, AT, PL, PT, SI, SK, FI, SE, UK-N Ire	BG, AT, CZ, DE, ES, FR, GR, HU, FI, LU, PT, SK, SE, UK-N Ire	BG, CZ, DE, ES, FR, GR, HU, LU, AT, PT, FI, SK, SI, SE, UK-N Ire	BG, CZ, DE, ES, FR, HU, LU, AT, IT*, PL, PT, SK, SI, SE, UK-Eng
Economic size /Value of market production	DK, IT, LV, FI NL, UK-Eng & Wal, UK-Sco	EE, ES, IT, LV, LT, FI, NL, UK-Eng & Wal, UK-Sco	EE, ES, IT, LV, LT, FI, NL, UK-Eng & Wal, UK-Sco	EE, IT, LV, LT, NL, UK-Sco	ES, LV, LT, NL
Marketable production	HU, PT, SI	HU, PT, SI, FI	PT, SI, FI	PT, SI, FI	EE, FR, PT, FI, SI

* Minimum thresholds below 1ha are established at the regional level, they apply to all crops with exception of fruit and vegetable crops, vineyards and nurseries.

Source: Eurostat – National Methodological Reports; National Statistics (BG, UK-England)

The changes introduced in 2010 regarding survey coverage and thresholds represent a limit for the comparability of utilised agricultural areas (UAA) over time, notably in some EU Member States and at the EU overall level. The evolution of the number of holdings and UAA according to UAA size classes shows a sharp decline in the class of holdings with less than 5 hectares between 2000 and 2010 in the Member States that have adopted the new 5 ha minimum threshold: Czech Republic, Germany and the UK (i.e. for arable land, kitchen gardens, permanent grassland and permanent crops).

Therefore, all analysis finalised to answering the evaluation questions is carried out distinguishing between holdings with UAA below and above 5 hectares.

Changes in the registration of Common land

Common land is defined as "... the utilised agricultural area used by the agricultural holding but not belonging directly to it, i.e. on which common rights apply. The choice of implementation method to cover this common land is a matter for the Member States"[55].

Until 2007, certain Member States have been recording Common land in the FSS, whereas other MS have not. It is possible to identify three distinct situations: a group of Member States where Common land simply does not exist; a group of MS where Common land exists and has always been recorded; a group of MS where Common land exists and it was not included in the FSS until 2007, but it is recorded in the 2010 FSS. The methodology used to record Common land also differs across the Member States: it can be measured or estimated as individual area in each holding; or recorded as separate area of a "special Common land holding" by which Common land used by a group of holdings is gathered together in a special holding; or recorded by municipality. The table below summarizes the methodology used to collect Common land information across the MSs and the changes introduced in 2010.

	Counted individually in each holding / Estimated according to LSU	**Special holding**	**Common land by municipality**
No Common land	BE, CZ, DK, EE, LV, LT, LU, MT, NL, PL, SK, FI, SE		
Common land has always been recorded in FSS	CY, ES, DE[1]	AT, ES, IT, PT, RO, DE[1]	
Common land is recorded from 2010 onwards	SI	FR	BG, EL, HU, IE, UK

[1] Common Land in Bayern not included. Source: Eurostat

Since FSS data include Common land area in the UAA, in the MS where Common land was not recorded until 2010, data for this year are not comparable to previous FSS years. To overcome this problem, Common land area was removed from the UAA in the MS for which such information was recorded for the first time in 2010: Bulgaria, France, Hungary, Ireland and Slovenia. In addition, based on information provided *ad hoc* by Eurostat we corrected the UAA for common land area also for data distinguishing between UAA size classes, types of land use, types of farming and SO classes. For the remaining two MSs in which Common land data is recorded for the first time in 2010 (UK and Greece), the data published by Eurostat do not include Common land area in the total UAA, therefore there is no problem for comparability of 2010 data with previous years.

The analysis of common land data across the MSs interested by change in 2010 shows that in some cases this area represents a non-negligible share of total UAA, notably in Bulgaria (19.2%) and Ireland (8.5%), as reported in the table below.

[55] Regulation (EC) No 1200/2009 of 30 November 2009 implementing Regulation (EC) No 1166/2008 of the European Parliament and of the Council on farm structure surveys and the survey on agricultural production methods, as regards livestock unit coefficients and definitions of the characteristics (Annex II).

Tab. 11 – Common land area and share of common land over total UAA, 2010

	Tot UAA	UAA of Common land holdings	Common land/Tot UAA (%)	Agricultural Area utilized for shared farming and other modes	UAA shared farming/Tot UAA (%)
France	27 712 790	749 490	2.7	101 140	
Ireland	4 991 350	422 410	8.5	422 410	
Hungary	4 686 340	73 970	1.6	73 970	
Bulgaria	4 475 530	858 560	19.2	0	
Slovenia	482 650			8 220	1.7

Source: Eurostat

In the case of UAA under organic farming, common land can be identified only for the Member States recording it as a separate area of "special holdings", therefore we were not able to correct UAA under organic farming (2010). The few available figures, however, suggest that organic common land area does only represent a negligible share of total UAA under organic farming in the concerned Member States (i.e. it does not reach 1 000 ha at the national level except in Slovenia).

Changes in the definition of "Processing of farm products"

The FSS defines processing of farm products as all processing of a primary agricultural product to a processed secondary product on the holding, regardless of whether the raw material is produced on the holding or bought from outside. This includes processing meat, making cheese, etc.

Until 2007, wine making and olive oil making were considered as processing activities other than the main agricultural activities, whereas in 2010 the definition changes: " All processing of farm products … unless the processing is regarded as a part of agricultural activity. Wine processing and olive oil production are therefore excluded unless the bought-in proportion of wine or olive oil is significant[56]".

The change in the definition of what constitutes a processing activity on the farm generates a comparability problem between 2010 census data and FSS data of previous years. It is indeed observed that the number of holdings having "processing of farm products" among their other gainful activities (OGA) considerably decreases in 2010 compared to previous years in the MS where wine and olive oil production are important activities.

In order to overcome the problem of comparability of 2010 data with previous years, analysis involving holdings with OGA (EQ1, EQ6) and OGA of the farm holder-manager (EQ6) excludes all holdings with vineyards and olive groves in the 2005 data to improve comparability with 2010 data.

Other changes

Besides the changes introduced with the 2010 FSS illustrated in the previous paragraphs, further changes were brought in at various times in the past survey years. Here we list the main changes that may have implications for data analysis to be carried out in order to answer the evaluation questions:

- FSS 2000 introduced "Group holdings" among the available types of holding with effect on the classification between family and non-family labour force;
- NUTS classification changes have been introduced in the past in various Member States (e.g. Italy, Germany). From FSS 1999/2000 to 2005 the data are displayed according to the NUTS 2006 classification. The FSS 2007 and 2010 data are displayed according to the current NUTS classification (NUTS 2010);
- As a consequence of the 2003 CAP reform, from FSS 2007 onwards, "Maintaining land in good agricultural and environmental conditions" is considered as an agricultural activity;
- From FSS 2010 onwards, the location of holdings is defined according to their geographical coordinates through a new georeferencing system. The location of a holding is defined by its latitude and longitude coordinates within an arc of 5 minutes to avoid direct identification of the

[56] Commission Regulation (EC) No 1200/2009 of 30 November 2009 implementing Regulation (EC) No 1166/2008 of the European Parliament and of the Council.

holding. If a latitude-longitude location only contains one holding, that holding is re-assigned to a neighbouring location that already contains at least one other holding. The Member States apply different methodologies to attribute geographical coordinates to holdings. In Portugal, the geographical coordinates of a holding coincide with the coordinates of the main town of each "Freguesias" (i.e. the smallest administrative unit).

5.1.1.2 Farm level

The statistical analysis at farm level based on data from the FADN database (EU-FADN-DG AGRI L-3) was carried out to answer to some evaluation questions. The level of the analysis, the time period and the geographical coverage are, however, different according to the evaluation question. The table bellow synthesises the levels of analysis used for each evaluation question.

EQ	Level of the analysis	Time period	Geographical coverage
Maintenance of farming in marginal areas - EQ2	Full sample of farms	2004/2009	12 case study regions
Labour force and capital - EQ3 and EQ4	Full sample	2004-2009	EU27
	Constant sample	2004/2009	12 case study regions
Farm business strategies - EQ5 and EQ6	Constant sample	2004-2009	EU27

The specific methodological approaches used for each indicator and relative limitations of the analysis are detailed in the answer to each evaluation question.

5.1.2 Econometric analysis

As the statistical analysis, also the econometric analysis was carried out on two levels according to the evaluation questions:

- at macro-territorial level based on regional sample where data are provided by Eurostat statistics and CATS data for the answer to EQ1
- at farm level based on a farm sample where data are provided by FADN for answering to EQ3, EQ4, EQ6 and to EQ5.

In the first case the analysis has covered the whole EU27 at a second level of the Nomenclature of Territorial Units for Statistics (NUTS 2) and covers the period 2005-2010 and in the second case the analysis is based on constant sample identified over the period 2004-2009.

5.1.2.1 Econometric analysis at macro-territorial level

The structure of farms is a typically multidimensional phenomenon consisting of a number of variables and characteristics, all of them contributing to define a specific structural profile. In this sense, "farm structure" is considered as a combination of structural characteristics (size, holder's characteristics, type of tenure, labour use, etc). The econometric approach adopted for answering EQ1 - namely to assess the extent to which direct payments have affected farm structure - is based on such a synthetic variable.

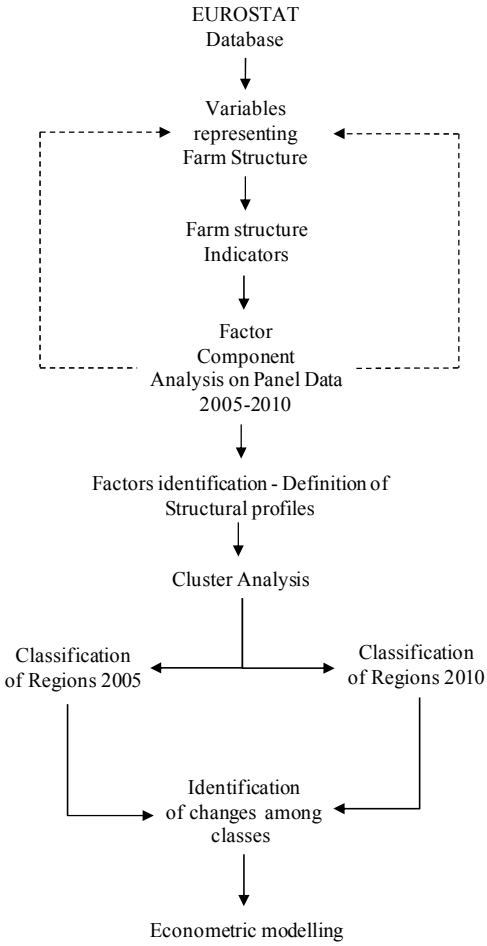
The analysis covers the years 2005-2010 and is conducted at subsequent stages applying two sets of tools:

- Multivariate analysis with the scope of identifying a finite number of farm structure profiles through Factor analysis, followed by Cluster analysis to identify homogenous groups of regions having the same typology of farm structure;
- Regression models (Probit model applied to explain the behaviour of binary dependent variables that can assume only two possible values Y=0,1; Ordinary Least Squares - OLS used when the dependent variable is continuous; Multinomial Logit models used when the dependent variable is categorical and may assume several discrete values) in order to assess whether and to what extent a relationship between direct payments and structural change does exist (statistical significance,

sign and magnitude of estimated direct payment parameters).

The figure below illustrates the main analytical steps of this approach.

Fig. 11 – Main analytical steps of multivariate analysis and econometric modelling for EQ1



The analysis started from the identification of all the variables reflecting the structure of farms, based on the information provided by Eurostat (FSS and Regional Statistics) for all EU Member States, at the second level of the Nomenclature of Territorial Units for Statistics (NUTS 2)[57]. CATS data on CAP expenditure at regional level[58] have been later integrated into the Eurostat database.

The total database covers 25 EU Member States for a total of 430 observations, i.e. 215 regions both in 2005 and 2010. Changes introduced between 2005 and 2010 in the Nomenclature of Territorial Units have been taken into account. Regions for which the relevant variables presented missing values were eliminated from the analysis (i.e. all regions belonging to Bulgaria and Romania; BE10 Région de Bruxelles-Capitale, UKI1 Inner London, ES63 Ciudad Autónoma de Ceuta and ES64 Ciudad Autónoma de Melilla).

After completion of this first data set, it was possible to design 39 indicators concerning the main farm characteristics, on which the Factor Component Analysis was subsequently applied (Tab. 12).

[57] Where data were not available at NUTS2 level, information was extracted at the higher geographic level. This was the case for Germany as the 2010 Agriculture Census data are available only at the NUTS1 level. Where 2010 data were not available, information on 2009 has been utilised (i.e. GDP per capita and Total GVA).

[58] Except for Denmark and Slovenia, for which data were aggregated at country level, because information for 2005 was available at NUTS0 level.

Tab. 12 - Farm structural dimensions and indicators

Farm Structural Characteristics	N.	Indicators	U. of M.
Livestock	1	Percentage of holdings with livestock on Total Holdings	%
Land Use Specialisation[59]	2	Specialization Index: Arable Land	(-1;+1)
	3	Specialization Index: Grass Land	(-1;+1)
	4	Specialization Index: Crops	(-1;+1)
	5	Specialization Index: Kitchen Garden	(-1;+1)
Holding Dynamics	6	Variation of holdings 2005 on holdings 2003	%
	7	Ln Ratio of holdings 2005 on holdings 2003	
Physical farm dimension	8	Average Farm size	ha
	9	Percentage of holdings under 5 UAA	%
	10	Percentage of holdings with 5-10 UAA	%
	11	Percentage of holdings with 10-20 UAA	%
	12	Percentage of holdings with 20-30 UAA	%
	13	Percentage of holdings with 30-50 UAA	%
	14	Percentage of holdings with 50 UAA	%
Economic farm dimension	15	Average Farm Standard Output	Euros
Ownership Form	16	Percentage of UAA owner farmed	%
	17	Percentage of UAA tenant farmed	%
	18	Percentage of UAA share farmed or in other modes of tenure	%
Labour Force	19	Labour Force per UAA	AWU
	20	Labour Force per Holding	AWU
	21	Family Labour Force	AWU
	22	Hired no Regular Workers	AWU
	23	Percentage of Hired no regular workers on Labour Force	%
	24	Hired workers	AWU
	25	Percentage of Hired workers on LF	%
Age of holder	26	Holder's being a natural person age < 35 years/Holders	%

[59] The SI represents the relative percentage share of each land use typology on the total land use at the regional level over the share of the same land use typology present at the national level. The Specialization Index can be formally written as:

$$SI = \frac{\dfrac{a_{ij}}{\sum_j a_{ij}} - \dfrac{\sum_i a_{ij}}{\sum_{ij} a_{ij}}}{\left(1 - \dfrac{a_{ij}}{\sum_j a_{ij}}\right) \cdot \dfrac{\sum_i a_{ij}}{\sum_{ij} a_{ij}} + \left(1 - \dfrac{\sum_i a_{ij}}{\sum_{ij} a_{ij}}\right) \cdot \dfrac{a_{ij}}{\sum_j a_{ij}}}$$

where a_{ij} represents the j-th (j=1,….,k) typology of land use of the i-th (i=1,…,n) region. The SI ranges from a minimum of -1 to a maximum 1 (-1≤ SI ≥1); therefore a region can be considered as specialized (non-specialized) on the j-th typology of land use if the share of this category of land use at the regional level is higher (lower) than the same share showed by the whole country.

Farm Structural Characteristics	N.	Indicators	U. of M.
	27	Holder's being a natural person age 35-44 years/Holders	%
	28	Holder's being a natural person age 45-54 years/Holders	%
	29	Holder's being a natural person age 55-64 years/Holders	%
	30	Holder's being a natural person over 64 years/Holders	%
Gender	31	Percentage of Holder's being a natural person sex = male	%
	32	Percentage of Holder's being a natural person sex = female	%
Farm working time	33	Percentage of Holder's work time > 0 to < 50%	%
	34	Percentage of Holder's work time > 50 to < 100%	%
	35	Percentage of Holder's work time 100%	%
Other Gainful Activities (OGA)[60]	36	Percentage of holdings with OGA on Total Holdings	%
Irrigation	37	Percentage of holdings with irrigable land on Total Holdings	%
Agricultural Accounts	38	Incidence of Gross Value Added at basic price (Agriculture) on Agriculture Output	%
	39	Incidence of Agriculture Output on Gross Value Added at basic price (Total Activity)	%

As second step of the study, a **Factor Component Analysis (FCA)** has been applied to this multidimensional dataset.

The aim of the FCA has been to reduce the number of original structural variables into a new smaller set of variables (n principal factors), extracted from the original ones. In particular, the factor representation assumes that the vector of the observed variables can be written as

$$x = \Lambda f + u + \mu$$

where x, u, and μ are vectors of p elements, while f is the column vector of $n < p$ factors and Λ is the p x n matrix of factor loadings. The number of principal factors extracted for the identification of farm structural profiles has been determined by the amount of variance explained by the model; in other words, the greater is the variance, the better the model is able to represent the original data set. The original variables are expressed as linear combinations of the common factors, where the weights are given by the factor loadings. Therefore, zero or large factor loadings may help in interpreting the factors, on the basis of their "association" with the original variables.

The FCA has been run on two year panel data (2005 and 2010). The observed differences between 2005 and 2010 factor scores associated to each region show the changes occurred in farm structures, as factor loadings are the same for both periods.

Once the factors representing farm structural profiles have been identified, the clustering procedures have been applied.

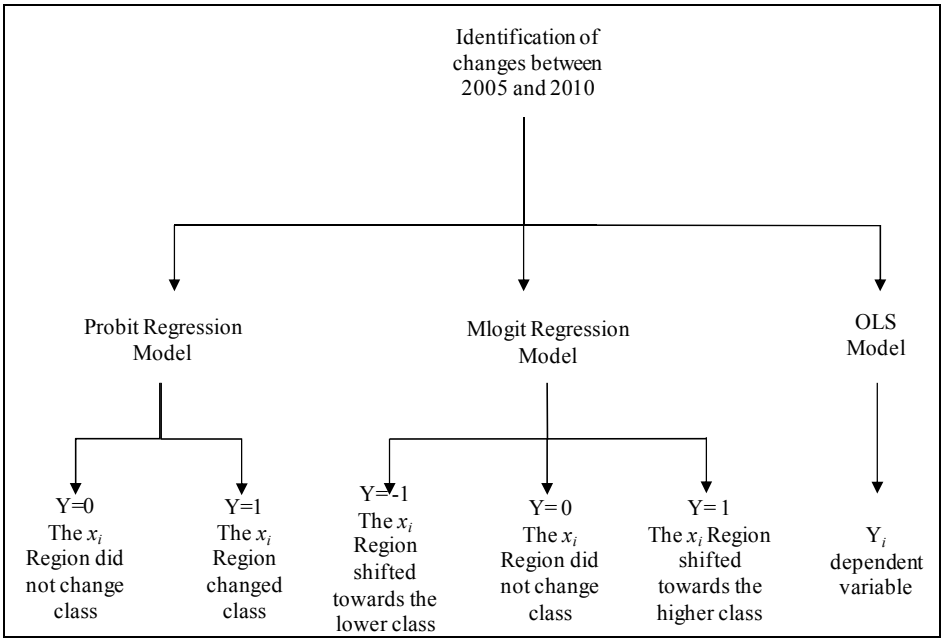
Cluster analysis aims to detect distinct groups of homogeneous EU regions with respect to their farm structure model. This approach is generally used as an exploratory tool rather than as a tool for testing specified hypotheses (Lawrence C. Halminton, 2009). The clustering method adopted for this study is based on the Centroid Linkage Method, which consists of a process of agglomeration of groups of observations whose means are closest. This procedure continues until a specified "end-point" is reached.

[60] In order to guarantee consistency between 2005 and 2010 data, the number of holdings with OGA for 2005 is corrected, removing those farms with processing when they are specialized in wine and olive oil.

Once the classification of the EU regions in *n* classes for both years has been obtained, it has been possible to assess whether changes occurred among classes between 2005 and 2010. Such shifts from one class to another represent the changes occurred in the regions' structural profiles. Two Logistic Regression models, namely Probit and Multinomial Logistic Regression Models have been used to estimate the role played by direct payments (decoupled and coupled) in class shifts. As we will detail later on, in the case of analysing only the most important Factor (Factor 1) OLS regression analysis has been directly applied on factor scores.

An illustration of the methodological steps followed in this specific phase of the study is proposed in Fig. 12.

Fig. 12 – Application of the Probit, Multinomial Logit Regression and OLS Model for EQ1



A more detailed description of the three models and their computational procedures is described below.

Probit Models are formally defined as:

$$\Pr(Y=1 \mid X) = \Phi\,(X'\,\beta)$$

Where Φ (.) is the standard normal cumulative distribution function and X*s* are the explicative variables included in the model.

Probit Models are adopted to understand the behaviour of binary dependent variables that can assume only two possible values, (Y=0 or Y=1), depending on the particular specification designed. In reporting the estimation results, the average marginal effect of each explanatory variable is evaluated. The mean marginal effect of an explanatory variable can be thought of as the average change in the probability of class shift corresponding to a unit change of that explanatory variable, or to the discrete change of value if the explanatory variable is a dummy variable.

In this study, the dependent dichotomous variable represents the change (or no change) among classes of each European region, observed between 2005 and 2010. The dependent assumes value of zero (Y=0) in case of no change or one (Y=1), in case of change (Fig.2).

The **Multinomial Logistic Regression Model** is instead used when the dependent variable is categorical and it may assume several discrete values.

As it is shown in Fig. 12, the dependent variable assumes three values on the basis of the probable response to be analysed:

Y= -1, in case the Region x_i shifts towards the lower class

Y= 0, in case the Region does not change class

Y= 1, in case the Region x_i shifts towards the higher class.

According to the Multinomial Logit model, the probability that region *Xi* experiences a change of type *j* (with *j* = -1, 0, 1) given the explanatory variables *X,* is equal to

$$P(y_i = j \mid X_i) = \frac{\exp(X_i \beta_j)}{\sum_j (X_i \beta_l)}.$$

For identification purposes it is useful to consider one of the alternatives as the reference one. For example, when y = 0 (no change) is taken as the baseline, the identification restrictions are such that the model can be written as:

$$P(y_i = j \mid X_i) = \frac{\exp(X_i \beta_j)}{1 + \sum_{j \neq 0} \exp(X_i \beta_l)} \quad for j \in \{-1,0,1\}$$

$$P(y_i = 0 \mid X_i) = \frac{1}{1 + \sum_{j \neq 0} \exp(X_i \beta_l)}$$

Using the Multinomial Logit model, it is possible to estimate a set of coefficients, β_j for the alternatives y = -1 and y = 1.

Since in the present analysis the option "0 - no change" is treated as the baseline, the remaining coefficients (corresponding to alternatives y = -1 and y = 1, respectively) will measure the change relative to the "no change" group.

The odds ratio of two alternatives measures the ratio of the probabilities of the two alternatives occurring, given the explanatory variables. In particular, the odds ratio with respect to the baseline alternative is given by:

$$\Omega_{j|0}(X_i) = \frac{P(y_i = j \mid X_i)}{P(y_i = 0 \mid X_i)} = \exp(X_i \beta_j) \quad for j \in \{-1,0,1\}$$

so that the log odds ratio becomes $\log \Omega_{j|0} = X_i \beta_j$.

The odds ratio and the log odds ratio can be used to measure the relative probability of regions to remain in the same class or to shift to one of the two other classes.

The Ordinary Least Squared (OLS) Model allows to explain a statistical relationship between the dependent variable farm structure (Y_i) and a number of explanatory variables (X_i). The model can be expressed as follows:

$$Y_i = \mathrm{B}_0 + \mathrm{B}_1 X_{1i} + \mathrm{B}_2 X_{2i} + ... + \mathrm{B}_n X_{ni} + \varepsilon_i$$

where Yi refers to the dependent variable representing farm structure (index i indicates the i-th observation); β_0, , …, β_n are parameters to be estimated by means of the regression techniques Ordinary Least Squared (OLS); X_{1i}, $X_{2i,}$ …, X_{ni}, refer to n explanatory variables; ε_ι is the error term.

Assuming the existence of a linear relationship between the dependent variable and the explanatory variables, the β_n parameters measure how much a unitary change in each explanatory variable affects the Y_i value.

As illustrated in the Theoretical Analysis (see § 3), in the literature there is no theoretical approach able to explain whether a relationship exists between policy and structural change as a whole. The working hypothesis behind our analysis is that changes in farm structure can be explained by agricultural policy intervention (namely CAP) and by the socio-economic context.

Therefore, in this part of the analysis we have adopted an empirical approach where a set of econometric models are designed to test the impact of direct payments on farm structural changes following the fundamental reform of the CAP entered into force in 2005.

Information related to CAP expenditure (direct coupled payments, direct decoupled payments and rural development aids) and to socio-economic context has been included into the regression models as explanatory variables X_i. The design of these variables has taken into account the peculiar character of the phenomenon here analysed: farm structure is defined in the form of a latent variable, as a combination of a large number of structural indicators and variables.

In particular, the variables describing policy support has been divided into three groups have been designed to express size, composition and intensity of CAP intervention:

Size: we assume that structural changes can be affected by the level of decoupled direct payments: the higher the level of decoupled payments, the more free farmers are to make decisions that influence farm structure.

Composition: different distribution of the amount of aids among the three typologies of CAP expenditure (decoupled direct payments, coupled direct payments and rural development aids) identifies different regional policies. This diversity could generate differentiated structural effects.

Intensity: two types of indicators of intensity have been introduced in the models:
i) intensity of payments relative to regional agricultural characteristics: number of holdings, standard output and utilised agricultural area.
ii) intensity of payments relative to the Gross Value Added (GVA) at regional level

Socio-economic context variables included are:

- General economic variables: Gross Domestic Product (GDP) and unemployment
- Context variables: Per capita GDP, Unemployment rate, GDP per capita annual growth rate

Although it is difficult to predict and to interpret the behaviour of the variables included in these models without the support of a consolidated theory, it is possible to advance some preliminary observations. Considering the different nature of direct aids, decoupled and coupled payments are expected to have different effects on farm structure. A significant relationship may also be expected between structural change and the annual growth rate of GDP per capita, describing the role played by economic growth in dynamic Regions in terms of changing the structure of production in all sectors.

The complete list of explanatory variables considered for inclusion in the designed econometric models (EQ1) is presented in the two tables below.

Finally, the inclusion of the explanatory variables into the econometric models is based on the values assumed by z test, VIF collinearity test and correlation matrix, in order to overcome multicollinearity problems (collinearity refers to an exact or approximate linear relationship between two explanatory variables, and multicollinearity extends the concept to more than two explanatory variables).

The Breusch-Pagan test was also conducted to verify the presence of heteroskedasticity (heteroskedasticity occurs when the variance of the error terms differ across observations, e.g. if there are sub-populations that have different variabilities from others on a set of variables. The presence of heteroskedasticity is a concern in the application of regression analysis because it can invalidate statistical tests of significance).

Tab. 13 - Explanatory variables relative to CAP expenditure

N.	CAP Variables	Description
1	DDP	Sum of Decoupled direct payments from 2005 to 2010
2	CDP	Sum of Coupled direct payments from 2005 to 2010
3	TotDP	Sum of Total direct payments from 2005 to 2010
4	RD	Sum of Rural development aids from 2005 to 2010
5	CAP	Sum of Total Direct payments and Rural development aids from 2005 to 2010

N.	CAP Variables	Description
6	DDP_CAP	% Sum of Decoupled direct payments on Sum of total CAP expenditure
7	CDP_CAP	% Sum of Coupled direct payments on Sum of total CAP expenditure
8	TotDP_CAP	% Sum of Total direct payments on Sum of total CAP expenditure
9	RD_CAP	% Sum of Rural Development aids on Sum of total CAP expenditure
10	DDP _GVA	Ratio of Sum of Decoupled direct payments on GVA2005
11	CDP _GVA	Ratio of Sum of Coupled direct payments on GVA2005
12	TotDP_GVA	Ratio of Sum of Total direct payments on GVA2005
13	RD _GVA	Ratio of Sum of Rural development aids on GVA2005
14	CAP_GVA	Ratio of Sum of total CAP expenditure on GVA 2005
15	DDP _SO	Ratio of Sum of Decoupled direct payments on Standard Output at the initial year 2005
16	CDP _SO	Ratio of Sum of Coupled direct payments on Standard Output at the initial year 2005
17	TotDP_SO	Ratio of Sum of Total direct payments on Standard Output at the initial year 2005
18	RD _SO	Ratio of Sum of Rural development aids on Standard Output at the initial year 2005
19	DDP _UAA	Ratio of Sum of Decoupled direct payments on UAA at the initial year 2005
20	CDP _UAA	Ratio of Sum of Coupled direct payments on UAA at the initial year 2005
21	TotDP_UAA	Ratio of Sum of Total direct payments on UAA at the initial year 2005
22	RD _UAA	Ratio of Sum of Rural development aids on UAA at the initial year 2005
23	DDP _N.Holdings	Ratio of Sum of Decoupled direct payments on N. Holdings at the initial year 2005
24	CDP _ N.Holdings	Ratio of Sum of Coupled direct payments on N. Holdings at the initial year 2005
25	TotDP_ N.Holdings	Ratio of Sum of Total direct payments on N. Holdings at the initial year 2005
26	RD _ N.Holdings	Ratio of Sum of Rural development aids on N. Holdings at the initial year 2005

Tab. 14 - Explanatory variables relative to socio-economic context

N.	Socio-economic Variables	Description
1	Unemp05	Unemployment Rate 2005
2	Unemp10	Unemployment Rate 2010
3	GDPpc05	GDP per capita 2005
4	GDPpc09	GDP per capita 2009
5	GDPagr0509	GDP per capita Annual Growth Rate 2005-2009
6	GVAagr0509	GVA Annual Growth Rate 2005-2009
7	GDPagr0005	GDP per capita Annual Growth Rate 2000-2005
8	GVAagr0005	GVA Annual Growth Rate 2000-2005

Finally, the general form of the model can be represented as:

$$CFS = f(Size, Com, Int_{farm}, Int_{cont}, Cont)$$

Where:

CFS	Changes in Farm Structure
Size	Size
Com	Composition
Int_{Farm}	Intensity on farm variables
Int_{Cont}	Intensity on general economic variables
Cont	Context variables

And the resulting linear relationship of the general model, will be:

$$CFS = \beta_0 + \sum_i \beta_i Size_i + \sum_j \gamma_j Com_j + \sum_k \delta_k Int_k^{Farm} + \sum_l \eta_l Int_l^{Cont} + \sum_m \pi_m Cont_m$$

For the probit model, the relationship becomes:

$$\Pr(CFS = 1 \mid X) = \phi(Size'\beta + Com'\gamma + Int'^{Farm}\delta + Int'^{Cont}\eta + Cont'\pi)$$

5.1.2.2 Econometric analysis at farm level

5.1.2.2.1 Single Equation econometric approach used to answer EQ3, EQ4 (labour and capital) and EQ6 (farm competitiveness)

The micro-econometric analysis to answer EQ3, EQ4 and EQ6 is based on a strongly balanced data panel consisting of 25 EU member States (UE25, N=191.325 farms) comprising five years from 2005 (the first year of SFP implementation) to 2009 (T=5). The data source is the FADN database containing individual farm records.

The analysis has been developed on the basis of single equation models in order to estimate the statistical relationships existing between the farm-specific dependent variables (Y) and a number of explanatory variables (X).

Specifically, panel regression models have been designed, since the existence of repeated observations on individual farms opens onto the possibility of using panel data techniques to estimate the effects of direct payments (i.e. coupled and decoupled) on farms' characteristics.

The use of appropriate estimators for panel data allows us to obtain increased precision in the estimation and, at the same time, permits to treat unobserved individual heterogeneity that may be correlated with regressors (a setting that would give rise to omitted variables bias and inconsistent estimation in ordinary regressions estimated by OLS).

Although more general models exist, the starting point for the analysis is an unobserved effects model defined by the following equation:

[1] $$y_{it}=\alpha+\beta' x_{it}+\mu_i+\varepsilon_{it}$$

where i is the farm index (i = 1, 2,…, N), t is the time index (t = 1, 2,…, T), y_{it} is the structural variable to be modelled, x_{it} are the explanatory variables (including the various types of CAP payments), and α and β are parameters to be estimated. In general, β is a k-vector (with k>1): if both the dependent and the explanatory variables are expressed in logarithms, then β coefficients measure the elasticity with respect to the relevant variables. μ_i are unobserved farm characteristics (unobserved effects) that are variable across observations, but constant in time. In general μ_i may be correlated with x_{it}, rendering the OLS estimator inconsistent. ε_{it} are idiosyncratic disturbances that are serially uncorrelated and uncorrelated with the regressors.

A possible way to deal with the unobserved heterogeneity implicit in this model is to treat the unobserved effects μ_i as additional variables to be estimated, as in

[2] $$y_{it}=\alpha_i+\beta' x_{it}+\varepsilon_{it}$$

where $\alpha_i=\alpha+\mu_i \quad \forall i$. This is the so-called *fixed effects model*. Given its characteristics, the fixed effects estimator is chosen as the basic reference model in the empirical analysis of farm-level variables. The model is amenable to various re-parameterisations, extensions, and generalisations, the appropriateness of which have been taken into account in the modelling process.

For example, under some special circumstances, and especially if the ε_{it} are strongly persistent, it has also been considered to use the form:

[3] $$y_{i,t-1}=\alpha_i+\beta' x_{i,t-1}+\varepsilon_{i,t-1}$$

from which

[4] $$y_{it}-y_{i,t-1}=\beta'(x_{it}-x_{i,t-1})+\varepsilon_{it}-\varepsilon_{i,t-1}$$

or, using the conventional first difference operator Δ

[5] $$\Delta y_{it}=\beta' \Delta x_{it}+\Delta\varepsilon_{it}$$

This form of the model may be convenient because, if the ε_{it} are highly serially correlated, their first differences $\Delta\varepsilon_{it}$ tend to be uncorrelated. Expressed in this way, the model is easy to be estimated using

the so-called *first-difference estimator*. However, if the ε_{it} are uncorrelated, then writing the model in this form leads to an inefficient estimator, as compared to other available estimators for the fixed effects model. It is also possible (although unlikely) that the unobserved fixed effects μ_i are in fact independent from the explanatory variables x_{it}, so that they can be embodied in the disturbances ε_{it} giving rise to the so-called *random effects model*

[6] $$y_{it} = \alpha + \beta' x_{it} + u_{it}$$

where $u_{it} = \varepsilon_{it} + \mu_i$.

It should be noticed that the random effects model needs to satisfy more stringent restrictions for the estimator to be consistent. However, if the restrictions are met (in particular, the absence of correlation between the unobserved factors and the errors) the random effects model is more efficient than the fixed effects model. Ultimately, for all developed models to answer EQ3, EQ4 and EQ6 the Hausman test has been run in order to assess the performance of random *vs.* fixed effects models. This test assesses whether the errors (u_{it}) are correlated with the regressors.

Furthermore, the option of extending the fixed effects model by including *time dummies* that aim at capturing possible unobserved effects that are constant across individuals and varying in time (e.g. common macroeconomic shocks) has been considered.

According to the obtained test results, for the available data a fixed effect model has to be preferred. In conclusion, an approach based on panel linear regression, as expressed in equation [2] has been developed.

Depending on the structural variable to be analysed, the model can be specified in different forms.

When investigating the statistical relationship between farm labour force or capital intensity (Evaluation Questions 3 and 4) and direct payments, a linear model in logarithmic form is used:

[7] $$\ln y_{it} = \ln \alpha_i + \sum_k \beta_k \ln S_{ikt} + \sum_h \gamma_h \ln AV_{iht} + \sum_m \theta_m \ln C_{imt} + \varepsilon_{it}$$

where k represents the public subsidies[61] variables (S) index (k = 1, 2,…, K), h represents the farm characteristics (AV) index (h = 1, 2,…, H) and m represents the socio-economic context variables (C) index (m = 1, 2,…, M). The parameters β, γ, θ, measure the size of the effects of each explanatory variable on the dependent variable. This equation takes the form of a Cobb-Douglas production function.

In this case, in order to answer evaluation question EQ3, "*To what extent have direct payments affected farm labour force?*", the dependent variable labour force is defined as:

- Farm Labour Force: Ln[62] Total labour input in hours per ha of utilised agricultural area (UAA)

And the dependent variables expressing capital intensity as:

- Farm Capital Intensity (agricultural area): Ln Capital[63] per ha of UAA
- Farm Capital Intensity (labour): Ln Capital per labour in hours

These last two specifications are used to answer evaluation question EQ4 "*To what extent have direct payments affected farm capital intensity?*".

In order to test the hypothesis that direct payments have contributed to the changes observed in farm investment decisions, which is the focus of Evaluation Question 6 "*To what extent have direct payments affected farm competitiveness*?", the model has been specified as shown below:

---

61 Public subsidies include Coupled and Decoupled direct payments, Rural development aids and Subsidies on investments.

62 Natural logarithm.

63 Computed as the difference between FADN variables "Total fixed assets" (SE441) and "Land, permanent crops and quotas" (SE446) (per ha of UAA, variable SE025).

[8] $$y_{it} = \alpha_i + \sum_k \beta_k S_{ikt} + \sum_h \gamma_h AV_{iht-1} + \sum_m \theta_m C_{imt} + \varepsilon_{it}$$

Also in this case, *k* represents the public subsidies variables (S) index (*k* = 1, 2,…, K), *h* represents the farm characteristics (AV) index (*h* = 1, 2,…, H) and *m* represents the socio-economic context variables (C) index (*m* = 1, 2,…, M). The parameters β, γ, θ, measure the size of the effects of each explanatory variable on the farm investments.

For this model, the dependent variable is defined as

- Farm Investments: Gross investments on fixed assets[64] per ha of UAA

A synthesis of the dependent variables designed for the micro econometric models are reported in the table below.

Evaluation question	**Dependent variable**	**Description of dependent variable**
EQ3 To what extent have direct payments affected farm labour force?	Farm Labour Force	Ln Total labour input in hours per ha of utilised agricultural area (UAA)
EQ4 To what extent have direct payments affected farm capital intensity?	Farm Capital Intensity (agricultural area)	Ln Capital per ha of UAA
	Farm Capital Intensity (labour)	Ln Capital per annual work unit in hours
EQ6 To what extent have direct payments affected farm competitiveness?	Farm investment decisions	Gross investments on fixed assets per ha of UAA

Explanatory variables in all model specifications represent three main analytical dimensions: i) the contribution of public subsidies; ii) the effect of farm structural and economic characteristics; iii) the influence of the social and macro-economic context.

The first set of variables includes: i) coupled direct payments, ii) decoupled direct payments, iii) rural development aids65 and iv) subsidies on investments.

For the second group of regressors, aspects related to economic and structural farm characteristics have been considered, namely:

- Labour.
- Investment on fixed assets.
- Net worth. This variable is obtained by the value of total assets excluding liabilities66
- Total output. It includes values of total output of crops and crop products, livestock and livestock products and of other products.
- Cash Flow. This variable describes the holding's capacity for saving and self-financing.
- Long & Medium-Terms Loans. It refers to loans contracted for a period of more than one year.
- Short loans. It refers to loans contracted for less than one year and outstanding cash.
- Age. This variable indicates the age of the holder.
- Organisational form. This is a categorical variable indicating: 1-Individual (family) farm; 2-Partnerships and 3- Other form of organization.
- Agricultural specialisation (i.e. Type of Farming – TF General). This is a categorical variable indicating: 1- Field crops (TF1); 2 - Horticulture (TF2); 3 - Wine (TF3); 4 – Other permanent

[64] FADN variable "Gross Investment on fixed assets" (SE516) is used, obtained as: Purchases – Sales of fixed assets + Breeding livestock change of valuation.

[65] The variable Rural Development aids includes: Environmental subsidies (SE621), LFA subsidies (SE622), Other rural development payments (SE623), excluding Support for food quality schemes (JC840).

[66] FADN variable "Liabilities" (SE485) represents the value at closing valuation of total loans (long, medium or short terms) still to be repaid.

crops (TF4); 5 - Milk (TF5); 6 - Other grazing livestock (TF6); 7 - Granivores (TF7); 8 -Mixed (TF8).

The macro-economic variable Gross Domestic Product (GDP) per capita has also been included as explanatory variable in all regressions.

All variables used for modelling labour force and capital intensity behaviour are reported in logarithmic form. The regression model applied to estimate farm investment decisions considers lagged values (T – 1) of the explanatory variable "Farm capital"[67].

The complete list of explanatory variables used in the micro econometric models is shown in the following table.

Tab. 15 - Explanatory variables included in the regression models

Explanatory variables of the econometric models		
Public subsidies (*S*)	**Farm structural and financial characteristics (*AV*)**	**Macro-economic context (*C*)**
Coupled Direct Payments	Labour	Gross Domestic Product per capita
Decoupled Direct Payments	Investment	
Rural Development aids	Net Worth	
Subsidies on investments	Total output	
	Cash Flow	
	Loans	
	Age of farm holder	
	Organisational Form	
	Type of farming	

A description of the FADN panel data used for the micro econometric analysis is shown in the table below.

Tab. 16 - Panel data 2005-2009

N.	Countries	Freq.	Percent
1	BEL	4,380	2.29
2	CYP	658	0.34
3	CZE	2,250	1.18
4	DAN	2,804	1.47
5	DEU	21,810	11.4
6	ELL	11,626	6.08
7	ESP	21,009	10.98
8	EST	1,654	0.86
9	FRA	19,789	10.34
10	HUN	5,785	3.02
11	IRE	4,085	2.14
12	ITA	23,125	12.09
13	LTU	660	0.34
14	LUX	1,420	0.74
15	LVA	2,375	1.24
16	MLT	1,007	0.53
17	NED	4,430	2.32
18	OST	7,140	3.73
19	POL	34,948	18.27
20	POR	5,038	2.63
21	SUO	3,040	1.59
22	SVE	2,944	1.54
23	SVK	1,180	0.62
24	SVN	1,680	0.88
25	UKI	6,488	3.39
	EU-25	**191,325**	**100**

[67] i.e. Difference between FADN variables "Total fixed assets" (SE441) and "Land, permanent crops and quotas" (SE446).

5.1.2.2.2 Econometric analysis used to answer EQ 5 (farm specialisation)

The modelling approach is aimed at assessing whether and to what extent direct payments have affected changes in farm specialisation (Type of Farming – TF). The analysis is based on a FADN constant sample of farms observed over the time interval 2005-2009, with farms classified according to the 8 groups of TF-General. The model is estimated over a sample overall comprising 38 697 observations.

The evaluation of the contribution of direct payments to changes in farm specialisation is based on a Multinomial logistic regression approach to the transitions observed between TF groups from 2005 to 2009 (for the description of the general Multinomial Logistic model specification please refer to § 5.1.2.1).

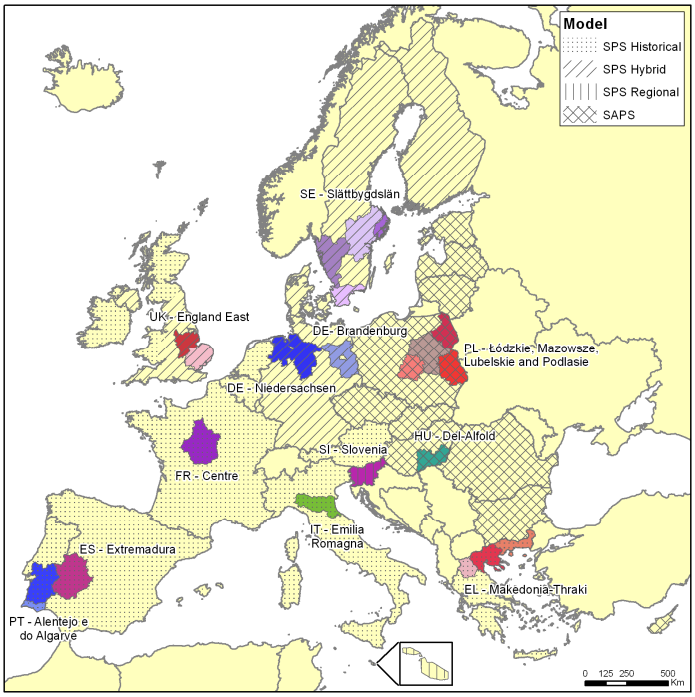
The model adopts the farms' specialisation structure (i.e. TF) observed in 2009 as the dependent variable.

The explanatory variables are divided into three sets:

- variables expressing public support expenditure, including coupled direct payments, decoupled direct payments, rural development aids and subsidies on investments (i.e. sum over the five considered years 2005-2009);
- farm characteristics including capital per hectare, age of holder, organisational form and type of farming at the initial year 2005;
- gross domestic product per capita at regional level in 2005, as a variable describing the regions' economic context.

5.1.3 Regional case studies

The case studies represent a third level of analysis, alongside macro-territorial and farm-level analysis, in the answer to some evaluation question. Regional cases studies permit a more in-depth analysis as they allow to integrate information about the behaviour of the farmers with the quantitative data of the empirical analysis. The case study regions are the following:



The choice of the case study regions is based on the following criteria:

- main types of farming benefiting from direct support;
- regions applying various implementation models of SPS (historical, regional, hybrid) and the

regions applying SAPS;

- different choices made by Member States in terms of degree of decoupling;
- regions with farms located in- and outside less favoured areas; e) regions with fast/slow structural change; f) regions with large/small farms.

Case studies rely on two main tools and data sources, statistical analysis of FADN data and field analysis undertaken by means of a CATI survey, as shown in the table below.

EQ	Statistical analysis	CATI survey
EQ2	✓	
EQ3	✓	
EQ4	✓	
EQ5		✓
EQ6		✓

5.1.4 CATI survey

The CATI survey (Computer Assisted Telephone Interviewing) was aimed at collecting information on the effects of direct support on farm business strategies, not otherwise available in the EU or national statistics. The survey was conducted in twelve case study regions with the objective of involving 1 000 farms beneficiaries of direct payments.

The survey targets randomly selected farms in the case study regions and was conducted on family farms or farms with simple organisational forms. The method for the selection was limited by the fact that there are no updated lists of direct payments beneficiaries. Regulation (EC) No 259/2008 on transparency, obliged Member States to publish information on the beneficiaries of funds, however following the 2010 sentence of the Court of Justice of the European Union, this obligation is applied only to legal persons . For the purpose of this survey, we used the available lists of 2009 recipients (natural and legal persons).

Each interview lasted 15 to 20 minutes and was carried out at the most productive times of day, according to assessment made during a pre-test. The interviews were conducted only by mother-tongue interviewers for each Member State involved in the survey. Interviewers have been briefed as appropriate before the survey started. The interviews use an electronic questionnaire supported by the CATI system and telephone contacts are managed according to automatic procedures.

The following tables show the number and composition of interviews by region. The objective was collecting information of 1 000 farmers, about 83 farms for each of the 12 regions. Despite low response rates in some regions, this goal was achieved. We were just forced to re-direct some of the interviews planned in the Swedish region towards the other regions. Indeed, in Sweden many farmers do not live on the farm during the winter season. When possible, they were contacted on their mobile phones, but at last the evaluation time frame obliged us to pass on. Because of the number of respondents, Sweden questionnaires have been excluded from the quantitative treatment of data at regional level.

Tab. 17 - CATI survey: number and composition of interviews by region

Region	SFP model	Total no of interviewees	DP in 2009 (Euros)		Location		Farm size (*)		
			4,000-8,000	8,001-40,000	LFA	not LFA	Small	Medium	Large
Del-Alfold (HU)	SAPS	91	61	30	28	63	20	41	30
Łódzkie, Mazowsze, Lubelskie, Podlasie (PL)	SAPS	90	60	30	34	56	10	25	51
Alentejo/Algarve (PT)	SPS Historical	90	60	30	37	53	18	38	33
Centre (FR)	SPS Historical	90	60	30	14	76	10	55	25
Emilia Romagna (IT)	SPS Historical	90	60	30	40	50	28	38	22
Extremadura (SP)	SPS Historical	90	60	30	29	61	21	21	47
Makedonia-Thraki (GR)	SPS Historical	90	61	29	34	56	4	15	62
Brandenburg (DE)	SPS Hybrid	93	63	30	4	89	21	44	28
England East (UK)	SPS Hybrid	90	60	30	15	75	4	38	47
Niedersachsen (DE)	SPS Hybrid	87	57	30	3	84	6	38	43
Slattbygdslan (SE)	SPS Hybrid	13	7	6	1	12	2	5	6
Slovenia	SPS Regional	80	55	25	56	24	25	42	9
Total Sample		**994**	**664**	**330**	**295**	**699**	**169**	**400**	**403**
			67%	*33%*	*30%*	*70%*	*17%*	*41%*	*41%*

(*) Small: up to 19.9 ha; Medium: from 20 to 49.9 ha: Large: 50 ha or over

Region	SFP model	Total no of interviewees	Age of the holder			Working time of the holder	
			< 35 years-old	35-64 years-old	> 65 years-old	full time	part time (*)
Del-Alfold (HU)	SAPS	91	1	63	27	78	13
Łódzkie, Mazowsze, Lubelskie, Podlasie (PL)	SAPS	90	7	81	2	85	5
Alentejo/Algarve (PT)	SPS Historical	90	1	67	22	83	7
Centre (FR)	SPS Historical	90	13	63	14	83	7
Emilia Romagna (IT)	SPS Historical	90	4	62	24	84	6
Extremadura (SP)	SPS Historical	90	1	47	42	77	13
Makedonia-Thraki (GR)	SPS Historical	90	4	60	26	88	2
Brandenburg (DE)	SPS Hybrid	93	8	66	19	81	12
England East (UK)	SPS Hybrid	90		46	44	87	3
Niedersachsen (DE)	SPS Hybrid	87	7	67	13	77	10
Slattbygdslan (SE)	SPS Hybrid	13	2	7	4	9	4
Slovenia	SPS Regional	80		74	6	78	2
Total Sample		**994**	**48**	**703**	**243**	**910**	**84**
			5%	*71%*	*24%*	*92%*	*8%*

(*) part time: holder providing no more than half of his working time on farm

6. Theme 1 – Farm Structure: To what extent have direct payments affected farm structures? (EQ1)

6.1 Comprehension and interpretation of the evaluation question

The evaluation question requires an assessment of whether and to what extent direct support schemes as introduced by the 2003 CAP reform (Regulation (EC) No 1782/2003, modified by subsequent reforms and lately replaced by Regulation (EC) No 73/09), have affected farm structural changes in terms of i) concentration; ii) land use and iii) management structure of holdings.

The reform introduced a new system of direct support to farmers, the Single Payment Scheme (SPS), replacing most previous existing agricultural schemes linked to specific sectors (coupled aids). Under this new scheme, support is no longer linked to production (decoupled aids). The main objectives of direct support are to provide basic income support to farmers and to contribute, in combination with cross-compliance, to providing basic public goods delivered through sustainable farming.

Decoupled payments are awarded independently from production choices made on a farm, and they do not affect the marginal profitability of crops. This gives farmers the freedom to produce according to market demands, whilst guaranteeing them a more stable income, independently of what and how much they produce. Since 2005, all farmers receiving direct payments are, in any case, subject to compulsory cross-compliance (i.e. farmers have to comply with basic standards concerning the environment, food safety, animal and plant health and animal welfare, as well as the requirement of maintaining land in good agricultural and environmental condition).

As a consequence, the system of direct payments in place since 1 January 2005 has induced farms to seek a more efficient allocation of production factors, adopting adaptation strategies, e.g. changing structure, organisation and production choices, including the possible abandonment of farming as an option.

On this basis, the evaluation question requests to assess the impact of direct payments on the structural characteristics of farms, considering that the "farm structure" is a typically multidimensional phenomenon consisting of a number of variables and characteristics, all of them contributing to define a specific farm structure. Furthermore, farms having different structural characteristics, and operating in different social-economic contexts, can be influenced differently to policy changes.

In this sense, the key element of the analysis is the definition of the structural characteristics of farm and of the related measurement methods. Therefore, the evaluation question requires analysis at two levels:

- The first one through analysis of single structural indicators (number of holdings; farm size; organisational form of holdings; type of occupation; land use; livestock numbers. Given that certain trends (decrease in the number of holdings) are ongoing for a long time, it is necessary to ascertain whether the change in policy and in particular in direct payments have amplified or mitigated the process of farm concentration.
- The second one through multivariate analysis based on different types of variables: CAP variables and context variables (GDP, unemployment, etc.). In this case, the analysis aims to assess the changes in the structural profile of agricultural holdings as a result of the policy change and, subsequently, whether direct payments have had an effect on such structural changes.

6.2 Methodological approach, data sources and limits

The methodology comprises two main analytical approaches: statistical analysis and econometric modelling. The different methodologies are described separately. Below we detail the methodology adopted for the statistical analysis. For the description of the methodology developed for the econometric analysis, please refer to § 5.1.2.1.

Both methods have been implemented at the macro-territorial level (regional level NUTS II) and are based on data from FSS (Farm Structure Survey, Eurostat). The analysis has been conducted for the

observation period corresponding to the years 1995 onwards, with special focus on the years 2005 onwards.

The **statistical analysis** of structural indicators computed at the regional level (geographical coverage is the EU27, with data computed for macro-regions constructed on the basis of NUTS 2 regions) and based on data available from Eurostat FSS, compares, through the calculation of the average annual growth rate (%), the periods before and after the reform. Furthermore, in order to assess differences across regions that have implemented the 2003 reform according to different Single Farm Payment models of implementation, a distinction across the alternative models (Historical, Regional, Hybrid and SAPS) has been made.

The macro-regions constructed on the basis of NUTS 2 regions and relative codes used in the analysis are the following:

SPS Historical	
AT	AT Austria
BE1	BE Region Flamande
BE2	BE Region Wallonne
FR1	FR Bassin Parisien
FR2	FR Nord Pas-de-Calais
FR3	FR Est
FR4	FR Ouest
FR5	FR Sud-Ouest
FR6	FR Centre-Est
FR7	FR Méditerranée
GR1	GR North
GR2	GR Centre-South
IE	IE Ireland
IT1	IT Nord-Ovest
IT2	IT Nord-Est
IT3	IT Centro
IT4	IT Sud
IT5	IT Isole
NL	NL Netherlands
PT	PT Continente
ES1	ES Noroeste
ES2	ES Noreste
ES3	ES Este
ES4	ES Centro
ES5	ES Sur
UK1	UK Scotland
UK2	UK Wales

SPS Hybrid	
DK	DK Denmark
FI	FI Finland
DE1	DE North-West
DE2	DE West
DE3	DE South
DE4	DE East & North-East
LU	LU Luxembourg
SE	SE Sweden
UK3	UK England
UK4	UK Northern Ireland

SPS Regional	
MT	MT Malta
SI	SI Slovenia

SAPS	
BG1	BG Severna I Iztochna
BG2	BG Yugozapadna Yuzhina Centralna
CY	CY Cyprus
CZ	CZ Czech Republic
EE	EE Estonia
HU1	HU Dunántúl
HU2	HU Alföld és Észak
LT	LT Lithuania
LV	LV Latvia
PL1	PL West
PL2	PL East
RO1	RO Macroregiunea Unu
RO2	RO Macroregiunea Doi
RO3	RO Macroregiunea Trei
RO4	RO Macroregiunea Patru
SK	SK Slovakia

Concerning the statistical analysis, it is important to underline the following aspects:

- Total number of farms and other related indicators: in chapter 5.1.1.1 we reported that the minimum size threshold adopted for farms in structural surveys and censuses is not uniform in Member States, since each member made use of the possibilities provided for by the regulations. Nevertheless, most MSs have kept this threshold constant during the period under study. Germany, the UK and the Czech Republic are major exceptions: these MSs have decided to exclude from the 2010 census farms having an arable UAA below 5 ha. As a result, changes to the number of farms and other related indicators (i.e. average UAA per farm) are affected by this decision. The size of the decrease in the total number of farms for instance is overestimated, as is the growth of average farm size. While this overestimation is modest at EU27 level, it is naturally more significant when looking at single models of SFP implementation, and in particular the Hybrid model, for which 6 regions out of 10 (four in Germany and two in the UK) have been affected by the change in the UAA threshold. For this reason, where possible, the analysis of changes in the number of farms and other related indicators has been carried out on both the total and for farms with UAA > 5 Ha.
- UAA: in chapter 5.1.1.1 we mentioned the different criteria adopted by MSs to record common land in the UAA and the changes introduced by certain MSs in 2010. To get around the problem of non-comparable data, UAA data does not include common land in those Member States for which information is available in 2010 (Bulgaria, France, Hungary, Ireland, Slovenia)[68].

[68] The published data for UK and Greece do not include Common land area in the total UAA in 2010, therefore there is no problem of comparability of 2010 data with previous years.

6.3 Judgment criteria and indicators

In order to reply to this question, we base our judgement on the following criteria:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, in the EU27 regions, there has been an increase/decrease of speed in the process of concentration of agricultural holdings**
Change in number of holdings with UAA 1995-2010 (total holdings and ≥ 5ha): EU and by SFP model; comparison average annual growth rate (%) pre and post-reform periods, by region and by SFP model
Change in UAA 1995-2010: EU and by SFP model; comparison average annual growth rate (%) pre and post-reform periods, by region and by SFP model
Change in average UAA by holding 1995-2010: EU and by SFP model (total holdings and holdings ≥ 5ha); comparison average annual growth rate (%) pre and post-reform periods, by region and by SFP model (total holdings and ≥ 5ha)
Change of distribution of farms by size class (%): comparison 2003 with 2010 by SFP model (total farms and farms > 5 ha)
Average size of farming with UAA >100 ha (2010) and % Variation 2003-2010 of the number of holdings and average UAA by holding > 100 ha: by region and by SFP model
Change in the number of holdings by type of farming 2005-2010 and % variation by SFP model
Change in the number of holdings by economic size 2005-2010 and % variation by SFP model
Share of holdings with LSU on total number of holdings 2010 (%) by region and SFP model
Change in size of livestock; comparison average annual growth rate (%) pre and post-reform periods by region and model of SFP
Change in the distribution of LSU by size of farm (%) by SFP model
Regions with livestock without land (%) 2003-2010
UAA/holdings concentration ratio (Lorenz curve) by region and SFP model 2003 and 2010
UAA/holdings Gini coefficient by region and SFP model 2003 and 2010 (%)
LSU/holdings concentration ratio (Lorenz curve) by region and SFP model (2010)
LSU/holdings Gini coefficient by region and SFP model (2010)
Judgment criterion no. 2 **Over the examined time period, in the EU27 regions, land use and livestock numbers have (have not) changed**
Changes in UAA used for different crop classes 2003 and 2010 by SFP model
Number of regions with changes of areas by type of land utilisation: variation % 2003/2010
Index of extensification: (UAA in permanent grassland and meadow + fallow land without subsidies, + set-aside areas under incentive schemes)/(total UAA)*100: comparison 2003-2005/2005-2010 by region and SFP model
Changes in the total and different types of livestock
Regions with changes in livestock numbers by type of livestock: % variation 2003/2010
Judgment criterion no. 3 **Over the examined time period, in the EU27 regions, the observed increase/decrease of speed in the process of concentration of agricultural holdings has (has not) entailed a change in the structure of farm management**
% Ratio Single holder holding/Total holdings (2003) and differences between 2010 and 2003 ratios by region and SFP model
Change 2003-2010 % of holdings by type of organisational form
Ratio (Σ type of organisational forms/total holdings) in 2003 and % variation 2003/10 by region and average by SFP model
Change 2003-2010 % of UAA by type of organisational form
Judgment criterion no. 4

Criteria and indicators
In the EU regions, direct payments have contributed (they have not) to affect farm structures during the examined time period
Multinomial Logit parameter estimated for Direct Payments (DP)

6.4 Analysis of the speed in the process of concentration of agricultural holdings

This section reports the results of the analysis of the process of agricultural holding concentration in the EU. The results are discussed by SFP model and at regional level. Indeed, the models of implementation of the 2003 reform represent a key factor to be taken into account when analysing the relationship between direct support and structural changes.

For some variables under study (e.g. number of holdings, average UAA, etc.) the Average Annual Growth Rates (AAGR) for the two sub-periods, pre- and post-reform, were compared. To facilitate interpretation, the regions (grouped by SFP model) have been placed in maps representing AAGR values before and after the reform. Four quadrants are identified in each map, depending on whether the AAGRs concerning the different considered variables are positive (Increasing) or negative (Decreasing)

- Increasing-Increasing (I-I): AAGRs are positive in both sub-periods. All the regions whose analysed variables were growing in the previous period and have continued to grow after the reform have been placed in this quadrant.
- Decreasing-Increasing (D-I): AAGRs are negative prior to the reform and positive after the reform. All the regions undergoing a trend reversal (positive) after the reform have been placed in this quadrant.
- Decreasing-Decreasing (D-D): AAGRs are negative in both sub-periods. All the regions whose analysed variables were decreasing in the previous period and have continued to diminish after the reform have been placed in this quadrant.
- Increasing-Decreasing (I-D): AAGRs are positive prior to the reform and negative after the reform. All the regions undergoing a trend reversal (negative) after the reform have been placed in this quadrant.

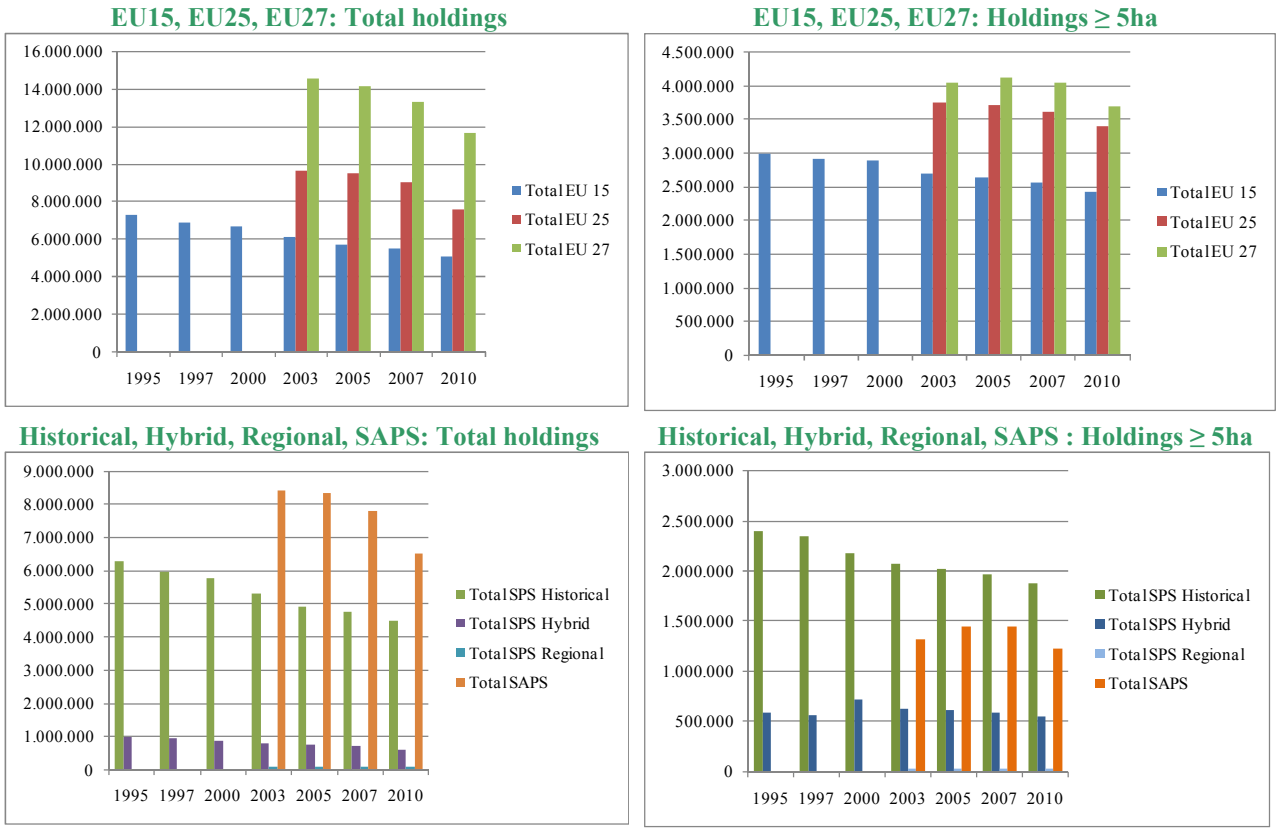
The quadrants I-I and D-D are moreover separated by a bisector. In the quadrant I-I, regions in which the considered variables undergo a growth acceleration after the reform have been placed above the bisector (and *vice versa*). In quadrant D-D the regions in which the considered variables undergo a decrease slowdown after the reform are again placed above the bisector (and *vice versa*).

6.4.1 Changes in the number of holdings

The analysis of this first structural indicator makes it possible to assess whether the 2003 CAP reform has affected changes to the number of farms, i.e. whether the policy change has accelerated or reduced the entry/exit rate of farms.

This part of the analysis examines only farms with UAA and UAA greater than 5 ha. The analysis of long-term changes is possible only for EU15 (thus for the Historical and Hybrid models), while for EU25 and EU27, and for Regional and SAPS models (including Bulgaria and Romania) the analysis is possible for a shorter period only (2003-2010).

Fig. 13 – Number of holdings with UAA 1995-2010: Total holdings and holdings ≥ 5ha



Source: Elaborations based on data from Eurostat

For EU15 the fall in the total number of farms with UAA has been uninterrupted over the whole considered period: between 1995 and 2010 it was -29.9% (2.17 million holdings, from 7.28 to 5.10 million). In percentage terms, the strongest reduction was for farms in the Hybrid model (-39.9%, approx. 998,000 to 600,000[69]), with lower figures for the Historical model (-28.3%, from 6.30 to 4.50 million). This overall trend is mirrored in the group of farms > 5ha: for EU15, between 1995 and 2010 about 556,000 farms were lost (-18.6%). In this case, the biggest fall concerns regions implementing the Historical model (-21.6%), while reduction for the Hybrid model was limited to -6.8% (contrasting trends are observed, with a rise from 1995 to 2000 and constant decrease until 2010).

For EU12, bearing in mind the shorter period of analysis (2003-2010), the drop in the total number of farms was higher compared to EU15: from 8.4 to 6.5 million, -22.4% (-16.2% in the same period for EU15). Using all due caution due to the change in the threshold for farm inclusion, the reduction (in just seven years) appears to be very large, in particular in some member States of the EU12: -45.4% in Bulgaria, -47% in Estonia, -30.1% in Poland. On the other hand, the decrease in the number of farms >5ha appears to be much lower, even compared to EU15: just -7.1% (from 1.36 to 1.26 million), compared with -9.8% for EU15 over the same period[70]. It should also be noted that this more modest reduction is the result of an initial rise (from 2003 to 2007) followed by a reverse in trend (from 2007 to 2010, -15.1%).

In the EU27, therefore, between 2003 and 2010 the drop in the total number of farms was 19.8%, and in farms >5ha 8.9%.

Since the overall fall in the number of farms is a long-term phenomenon, we should now examine whether and to what extent the change in policy, with special reference to direct payments introduced

[69] The size of the reduction is over-estimated for the reasons given in the general notes above.

[70] It is to be noted that this is the result of opposing trends in different EU12 Member States, with a marked fall in some (Estonia, Lithuania, Latvia, Cyprus) and a significant increase in others (Bulgaria, Slovakia).

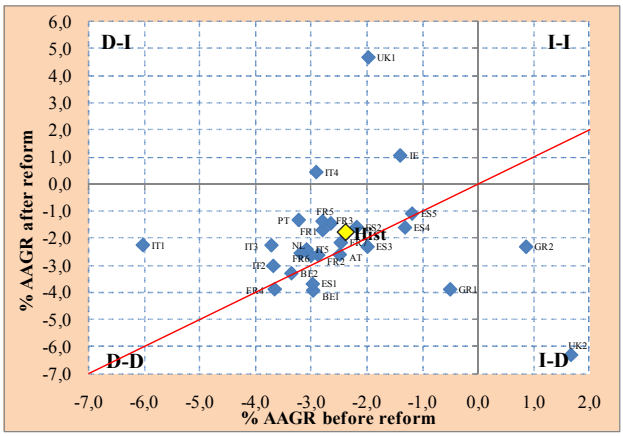
by the 2003 CAP reform, has contributed to the acceleration or slowdown of this trend. To this end, we calculated Average Annual Growth Rates (AAGR) for the two sub-periods, pre- and post-reform[71].

The results of the analysis for the different SFP models are rather mixed. Indeed, concerning total holdings there is a slowdown of the decrease in the Historical model and in the Historical and Regional models for holdings > 5 ha. In all other cases, we observe an acceleration in the fall, or even a trend reversal after the reform (from growth of the number of holdings until 2005 to a decrease from 2005 onwards). This reversal concerns the total holdings of the Regional model and holdings > 5 ha of the Hybrid and SAPS models.

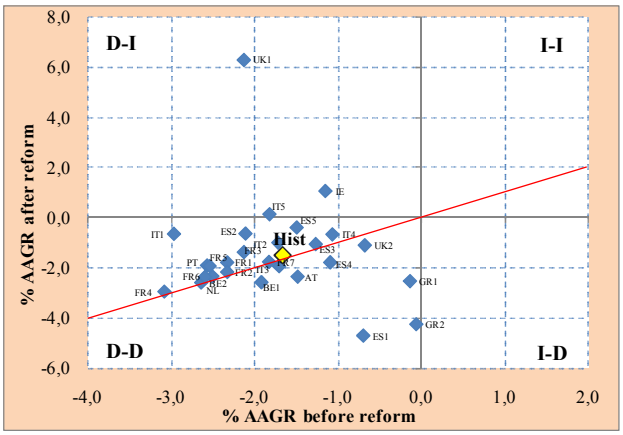
These results are the effect of different developments at regional level, as shown in the maps.

Fig. 14 – Average annual growth of the number of holdings with UAA, before and after the reform[72], by region and SFP model: total holdings and holdings ≥ 5 ha (%)

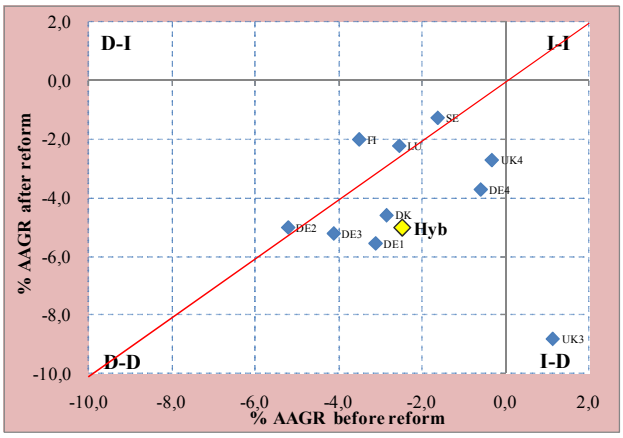
SPS Historical regions: Total holdings



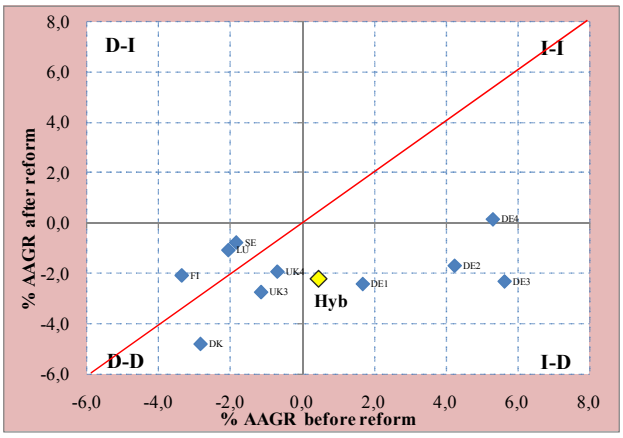
SPS Historical regions: Holdings ≥ 5ha



SPS Hybrid regions: Total holdings



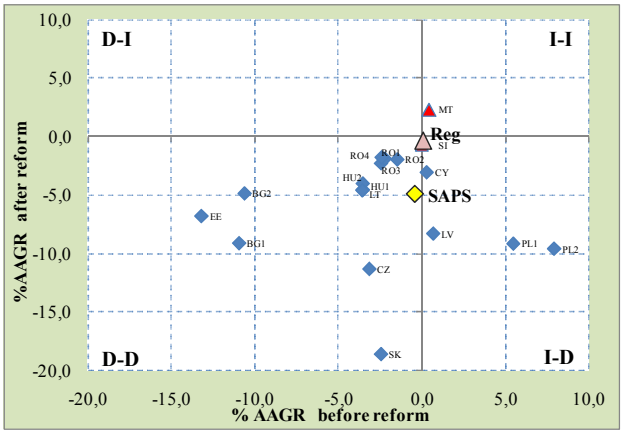
SPS Hybrid regions: Holdings ≥ 5ha



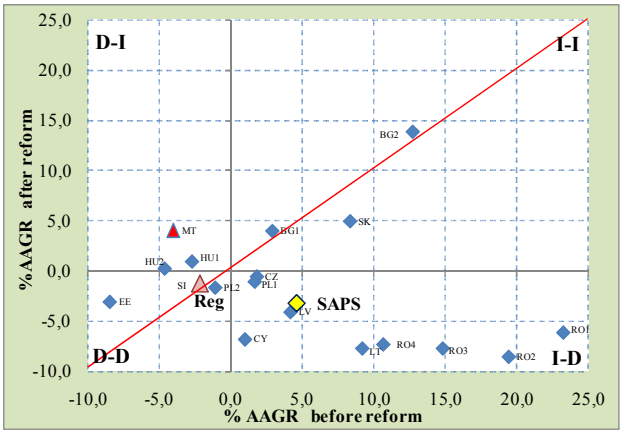
[71] The length of the pre-reform period (specified in subsequent specific notes) depends on data availability: 1995-05 for historical model, hybrid model and EU15. 2003-05 for other groups. For the post-reform period, 2005-2010 for all groups.

[72] Before the reform: for historical model regions and hybrid model regions: % AAGR 1995/05. For German regions % AAGR 2003/05. For regional model regions and SAPS regions: % AAGR 2003/05. After the reform: for all the other regions % AAGR 2005/2010.

SPS Regional and SAPS regions: Total holdings



SPS Regional and SAPS regions: Holdings ≥ 5ha



Source: Elaborations based on data from Eurostat

From the observation of the dispersion of regions in the respective maps, the following can be noted:

- Historical model: most regions saw a slowdown in the reduction(15/27 regions for all farms; 16/27 for farms > 5 ha) or a trend reversal from negative to positive (3/27 regions in both cases). For most regions however, the variations (positive or negative) in AAGRs are quite small, with the significant exception of the two UK regions (Scotland in particular, going from -2% prior to the reform to +4.7% after) and the two Greek regions.
- Hybrid model: Most regions saw an acceleration of the reduction or a trend reversal from positive to negative (6/10) for all farms. In the same way, with regard to holdings > 5ha, most regions saw a speeding up of the fall or slowdown in the rise or a trend reversal from positive to negative (7/10). The difficulty in staying in business concerns farms in the four German regions and the two UK regions (in particular England) plus Denmark.
- EU12 (Regional model + SAPS): In the same way as the Hybrid model, most regions saw an acceleration in the fall or a trend reversal from positive to negative. This is generally true for all farms (10/18) and for farms > 5 ha (10/18). Also to be noted is the fact that the extent of AAGR variations is particularly large for numerous regions, specifically the two Polish regions, Slovakia, Czech Republic and Latvia when all farms are analysed and the four Romanian regions and Lithuania for farms > 5ha.

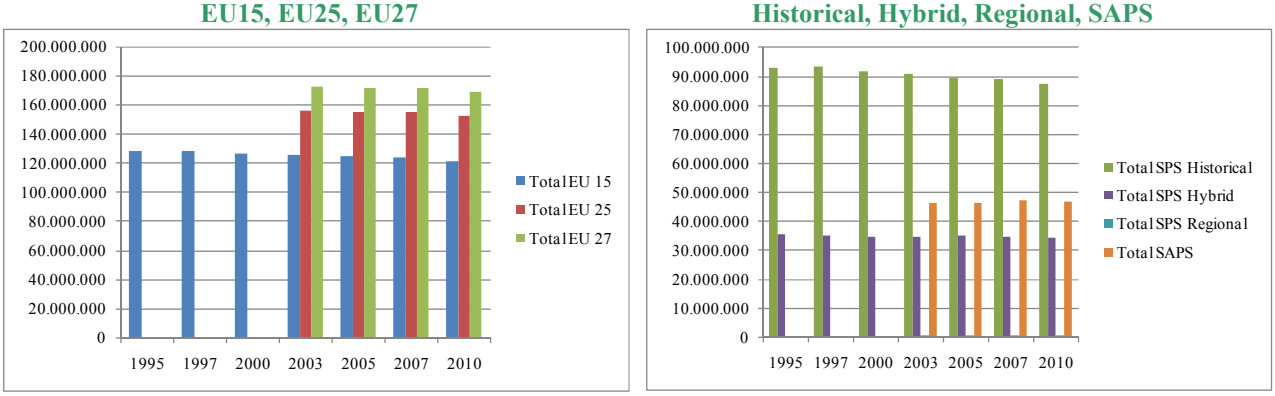
6.4.2 Changes in the utilised agricultural area

Compared with trends concerning the evolution of number of farms, changes to UAA in the same period appear to be much more modest:

- In the EU15, between 1995 and 2010 there was an overall decrease by 5.1%, larger for the Historical model (-5.8%) and smaller for the Hybrid model (-3.3%). This reduction concerns in particular some Member States, among which Italy and Austria.
- In the EU12, on the other hand, and bearing in mind the shorter period of analysis (2003-2010), a 1.3% rise in UAA is observed, attributable mainly to the positive trend in Bulgaria and in the three Baltic states.
- In the EU27, therefore, between 2003 and 2010 there was a 1.9% reduction in UAA.

Fig. 15 – UAA 1995-2010 in the EU and by SFP model (No)

EU15, EU25, EU27 | **Historical, Hybrid, Regional, SAPS**



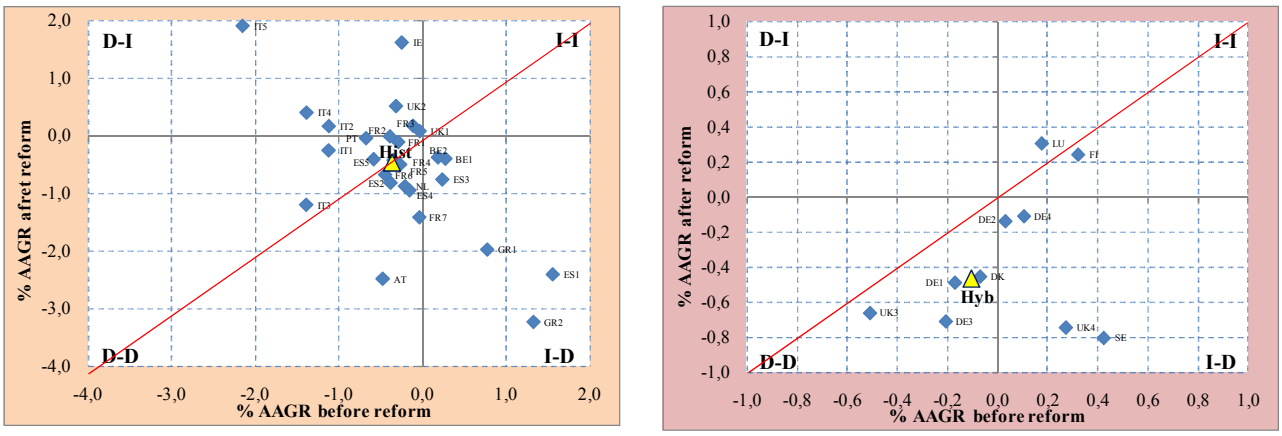
Source: Elaborations based on data from Eurostat

With regard to pre- and post-reform trends at regional level, the analysis of average Annual Growth Rates of UAA for the two periods shows:

- Historical model: the situation appears to be evenly distributed, without a marked propensity to move in one or the other direction. The group of regions that have seen an acceleration in UAA reduction or a trend reversal from positive to negative (14/27) is basically balanced by the group of regions that have seen a slowdown in the decrease or trend reversal from negative to positive (13/27). Nevertheless, for most regions, variations (positive or negative) have been modest, with the significant exception of the two Greek regions, ES Noroeste and Austria (downward trend), Southern Italy and Ireland (upward trend).
- Hybrid model: Most regions have seen an acceleration in UAA reduction or a trend reversal from positive to negative (8/10). The two UK regions, Southern Germany and Sweden show the most negative trends.
- EU12 (Regional model + SAPS): In this case too, trends do not follow a single direction. A third of the regions saw a trend reversal from negative to positive (6/18), while in two regions UAA decrease slowed down. The two regions of Bulgaria show the largest UAA growth after 2005, while the Baltic states (in particular Latvia and Lithuania), saw an abrupt slowdown in their growth rate after 2005.

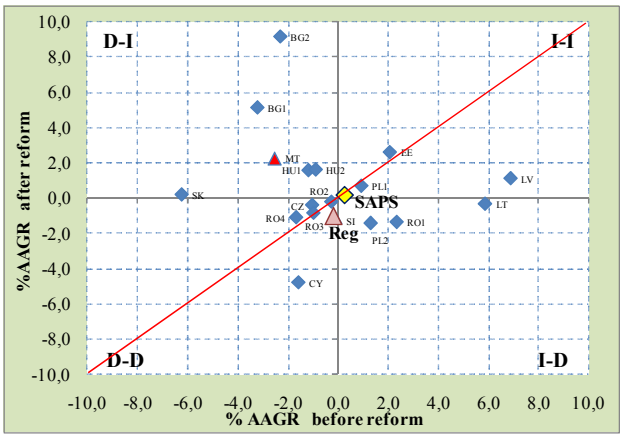
Fig. 16 – Average annual growth rate of the UAA, before and after the reform, by region and by SFP model[73] (%)

SPS Historical regions | **SPS Hybrid regions**



[73] Before the reform: for historical model regions and hybrid model regions: % AAGR 1995/05. For German regions % AAGR 2003/05. For regional model regions and SAPS regions: % AAGR 2003/05. After the reform: for all the other regions % AAGR 2005/2010.

SPS Regional and SAPS regions



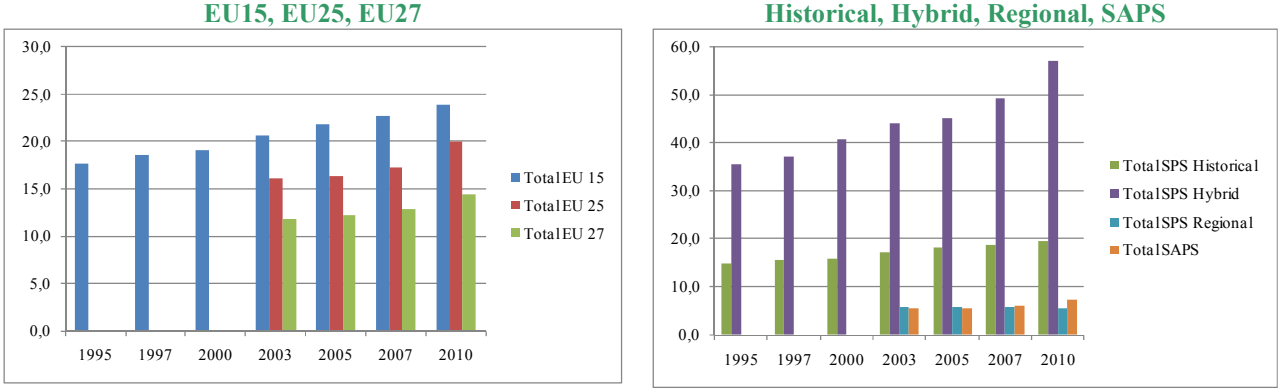
Source: Elaborations based on data from Eurostat

6.4.3 Changes in the average farm UAA

The combination of different trends concerning the number of farms and UAA leads to rather diverse changes in average UAA across the examined groups of EU regions.

Fig. 17 – Average UAA of total holdings 1995-2010 for the EU and by SFP (ha)

EU15, EU25, EU27 | **Historical, Hybrid, Regional, SAPS**



Source: Elaborations based on data from Eurostat

In EU15 the average size of farms continued to grow throughout the period: between 1995 and 2010 the rise was 35.3% (from 17.6 to 23.9 ha). In percentage terms, the highest growth occurred in the Hybrid group (60.8%, from 35.5 to 57.1 ha[74]), whereas growth in the Historical model was lower (31.3%, from 14.8 to 23.9 ha).

The growth in average size was confirmed for holdings >5ha: for EU15, between 2003 and 2010[75] it was 8.5% (from 44.4 to 48.2 ha). In this case too, the highest growth occurred in the Hybrid model (12.2%, from 55.2 to 62.0 ha), while it was lower for the Historical model (7.3%, from 41.1 to 44.1 ha).

For the EU12, again in the period 2003-2010, the increase in the average size of all farms was over 30%, even though initial (and final) values were particularly low: from 5.5 to 7.2 ha. It is noted that the low average size is due to the large number of farms < 5 ha in almost all regions/MSs (with the significant exception of the Czech Rep.). On the other hand, the increase in the average size of holdings >5ha appears to be more modest (14.9%, from 27.9 to 32.0 ha). It is also to be noted that this growth is the result of a downward period (from 2003 to 2005) followed by a trend reversal in the next period.

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74 The size of the average growth is over-estimated for the reasons given in the general notes above.

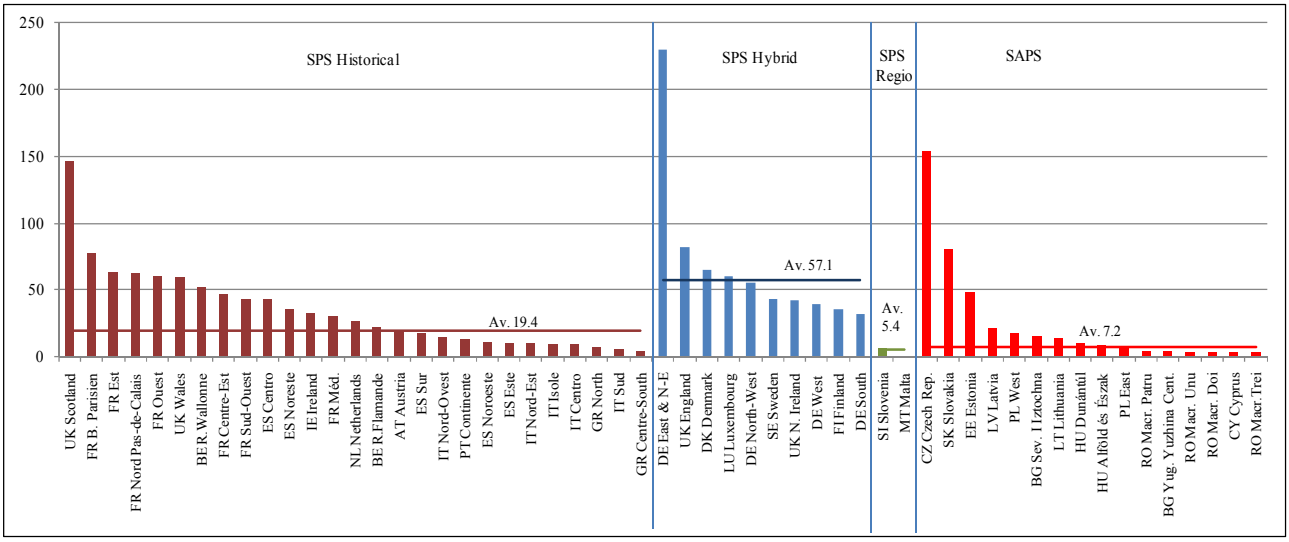
75 The period is limited to 2003-2010 due to the lack of information for German regions for the previous period.

For the EU27 as a whole, therefore, between 2003 and 2010 the average size of all farms rose by 22.4%, and that of holdings >5ha rose by 9.7%.

In this case too we calculated Average Annual Growth Rates (AAGR) for the two sub-periods prior to and after the reform in order to ascertain whether and to what extent the change in policy contributed to accelerating or slowing down average size growth.

Before discussing the results of the analysis of trends in the two sub-periods, and in order to gain a better understanding of possible variations, we believe it is useful to illustrate overall and average structural differences in the regions under study (in 2010).

Fig. 18 – Average farm UAA by region and SFP model (ha, 2010)

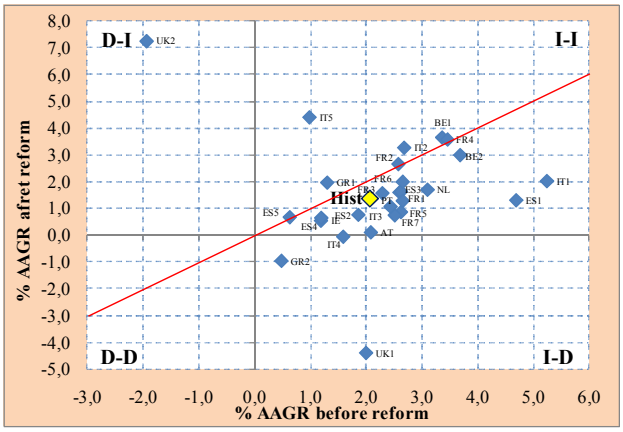


Source: Elaborations based on data from Eurostat

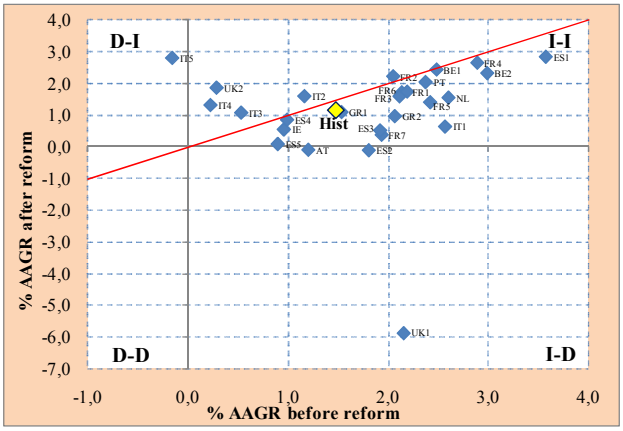
The results of the analysis of the Average Annual Growth Rates for different SFP models are quite uneven. There was a slowdown in growth in the Historical model for all farms, but only in holdings > 5 ha in the Regional model. In all other cases, after the reform there was an acceleration in the increase of farm size, or a trend reversal (from a decline up to 2005 to a rise after 2005). This reversal applies to holdings > 5 ha of the SAPS[76] model.

Fig. 19 – Average annual growth of the average farm UAA, before and after the reform, by region and SFP model: total holdings and holdings ≥ 5 ha (%)

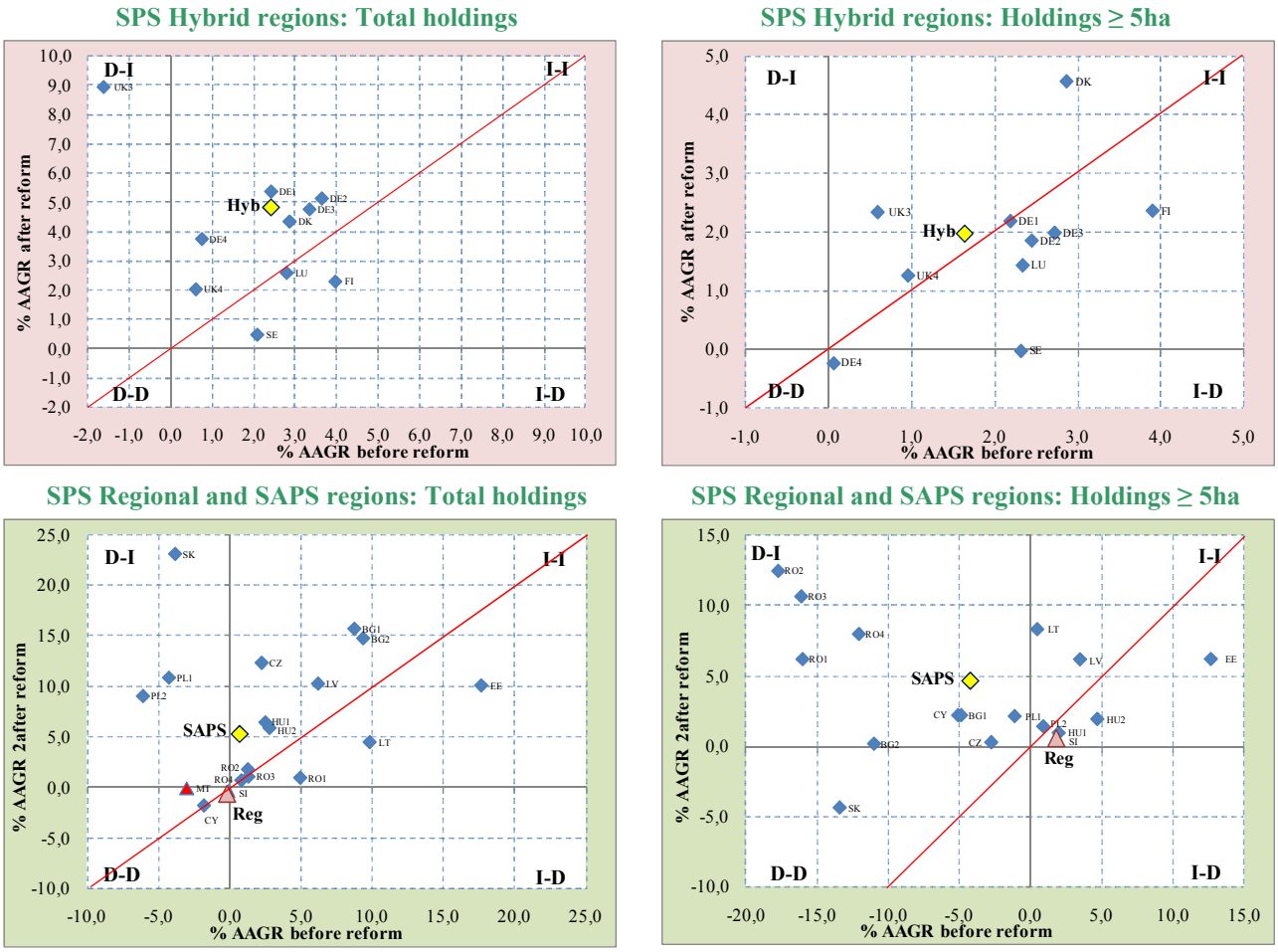
SPS Historical regions: Total holdings



SPS Historical regions: Holdings ≥ 5ha



76 The "anomalous" evolution of average UAA of holdings >5ha in the set of regions of the SAPS group is due to two distinct "historical" phases. In the first, the dividing up of large state-controlled farms/cooperatives in some countries, after the collapse of the planned economy model (leading to a rise in the number of holdings, but smaller sized, therefore a drop in average UAA); in the second, from the resulting expulsion of farms that were too small (leading to a rise in average UAA).



Source: Elaborations based on data from Eurostat

It should be noted that these results are the combined effect of different regional trends, plus a high variability in average farm sizes among regions within each aggregate group.

The results of the analysis at regional level highlight the following:

- Historical model: after the reform, according to analysis on all holdings and holdings > 5 ha, almost all regions (23/27) maintain the upward trend already present in the pre-reform period. Nevertheless, most regions saw a slowdown in growth, for both all farms (16/27) and holdings > 5 ha (18/27). We observe, however, that for almost all regions differences (positive or negative) between AAGRs prior to and after the reform are quite small (between -1.5 and 1.5 points)[77] .
- Hybrid model: the situation is similar to that of the Historical model: all regions continue to show a positive growth rate (9/10), but some regions (three for total holdings and five regions for holdings > 5 ha) saw a slowdown in their growth rate compared to the earlier period[78]. In this case too, however, differences between AAGRs appear to be modest, with the exception of UK England (for total holdings).
- EU12 (Regional model + SAPS): the situation in EU12 regions appears to be less simple.
  - With regard to total holdings, the situation is fairly similar to the cases analysed above: 12/18 regions continued to grow, maintaining the trend already present before 2005. Of these 12 regions however, seven saw an acceleration in the growth of average UAA, whereas five

[77] Exceptions being, in particular, UK Wales, UK Scotland, Italia Isole, Italia Nord Ovest, Spain Noroeste and Austria for all holdings and UK Scotland and Italia Isole for holdings > 5 ha. It is noted that at either end of the scale were UK Scotland (large decline), the region in the historical group having the largest average size, and IT Isole (large growth), one of the regions having the lowest average size.

[78] Of these, UK England and Denmark, the second and third region in the hybrid group having the largest average UAA. There has therefore been a further rise in average size that was already very high.

regions saw a slowdown. It must be noted, however, a trend reversal (from negative to positive) in the two Polish regions and Slovakia. Variations are not significant for the two Regional model regions.

- For holdings > 5 ha, the situation appears to be very different: most regions showed a reversal from negative to positive (9/18) affecting all regions of Romania, Bulgaria and Cyprus[79]. On the other hand, all regions of Poland, Hungary and the Baltic area maintained positive growth rates (either accelerating or slowing down).
- Finally, it is noted that for EU12 regions, differences (positive or negative) between AAGRs prior to and after 2005 are considerably higher (i.e. less/greater than -1.5 / 1.5 points) in most regions (12/18 regions for total holdings[80] and 14/18 for holdings > 5 ha)[81].

6.4.3.1 Changes in the number of holdings by size of farm

In a general context in which the number of farms is decreasing, we will now ascertain whether and to what extent there have been shifts between farm size classes, for each group of regions according to SFP model implementation and for the whole EU27. To this end, for the years 2003 and 2010 we have calculated the percentage distribution of farms according to size class, and the percentage differences (between 2010 and 2003) for each size class. This calculation was done for all holdings and for size classes > 5 ha.

Fig. 20 – % distribution of farms by size class, and by SFP model, in 2003 and 2010 – Total holdings

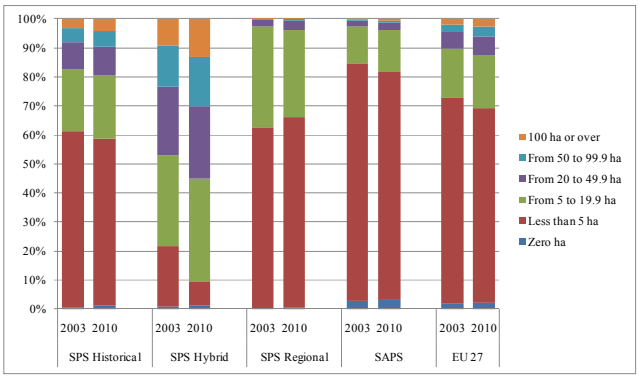
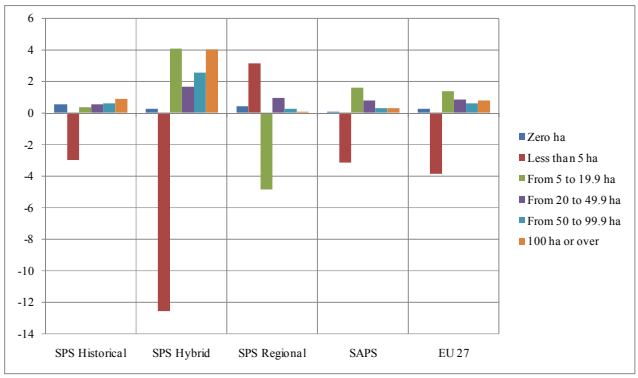


Fig. 21 – Differences between 2010 and 2003 in % of farm size class, by SFP model and EU27 (*) – Total holdings



(*) the sum of the differences is zero

Source: Elaborations based on data from Eurostat

As far as all farms are concerned, and with reference to the initial situation (2003), there were two extreme cases: on the one hand, the SAPS group, for which the percentage distribution of the number of holdings was very much biased towards the two lowest classes, and in particular the class up to 5 ha. It can be seen that the sum of the first three classes (from zero to 19.9 ha) represented in 2003 97.1% of the total. On the other hand, we find the Hybrid model where the distribution across classes appears to be much more balanced. In between these two extreme structural situations are the Regional model (very close to SAPS model) and the Historical model (quite close to the Hybrid model).

Given these structural differences, the period 2003 to 2010 has led to quite similar (but not identical) distribution changes. Firstly, the number of landless holdings increases for all models, albeit growth was modest. Secondly, there was a significant fall[82] in the share of holdings up to 5 ha, resulting in an increase in the share of other classes. This is explained by the exit from the sector of smaller farms

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79 It is noted that the regions of Romania, Cyprus and BG Yugozapadna Yuzhina Centralna are those having the lowest average size in the SAPS group, and among regions having the lowest average size in the entire EU27.

80 In particular Slovakia, the two regions of Poland and the Czech Republic.

81 To a greater extent in the four regions of Romania and Yugozapadna Yuzhina Centralna (BG). These five regions, together with Cyprus and Malta, have the lowest average UAA among EU12 regions. The high growth rates after 2005 therefore come as no surprise.

82 The large apparent fall (-12 points) in holdings < 5 ha in the hybrid model is partly due, as already mentioned, to the change in UUA thresholds in some Member States, specifically Germany and the UK.

and/or their shift to a larger size class. The exception to this "rule" is the Regional model, for which the percentage of holdings < 5ha grew whilst there was a fall in the percentage of holdings in the class from 5 to 19.9 ha.

Excluding landless farms and those < 5 ha from the farm population under study, the distribution by size classes is as follows.

Fig. 22 – % distribution of holdings > 5 ha by size class and by SFP model and EU27, in 2003 and 2010 – Holdings > 5 ha

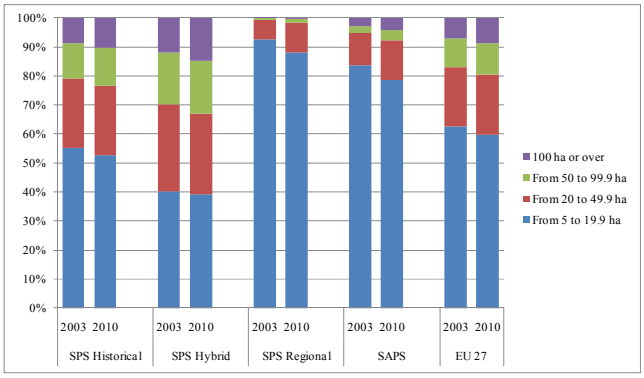
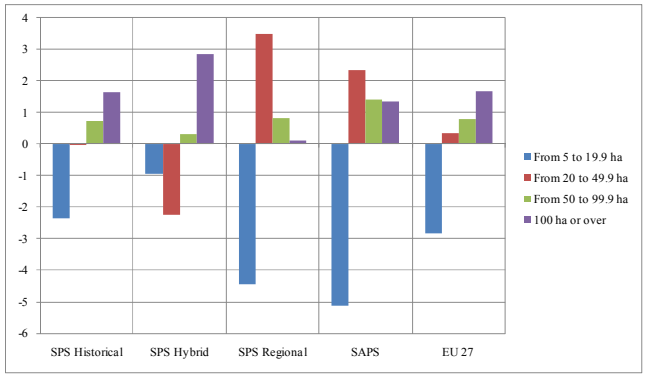


Fig. 23 – Differences between 2010 and 2003 as % of size class for holdings > 5 ha, by SFP model and EU27 (*) – Holdings > 5 ha



(*) the sum of the differences is zero

Source: Elaborations based on data from Eurostat

In this case too, two extreme situations can be seen: on the one hand the Regional model, for which farms in the lowest class (5 to 19.9 ha) represented in 2003 almost 93% of the total. On the other, the Hybrid model, with a balanced distribution.

With regard to trends 2003 to 2010, in this case too there was a generalised fall in the number of farms in the lowest class, benefiting the other classes (with their shares increasing except for the class 20 to 49.9 ha for the Hybrid model).

However, while in the Historical and Hybrid models the highest class (> 100 ha) gains the biggest share, for the Regional and SAPS models the second to lowest class (from 20 to 49.9 ha) showed the biggest rise.

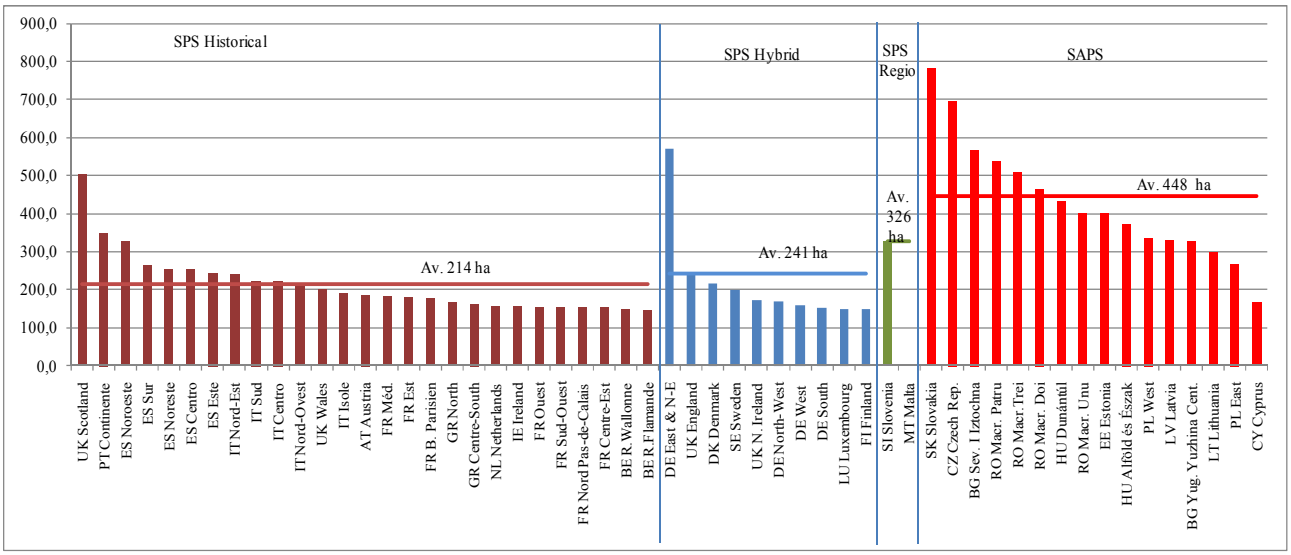
However, and given the initial diversity of regional structures, for all SFP models (thus for EU27 as a whole) the analysis makes it possible to observe that structural changes lead towards a greater balance in the distribution of different size classes.

To complete the analysis, however, we believe it is useful to examine in more detail the farm class > 100 ha, as this class does not have an upper boundary (differently from the other size classes), thus it is not clear in which ways it may differ from region to region, nor the structural changes occurring within this class.

Observation of the average size of holdings of the UAA class >100 ha (with regions grouped together by SFP model) highlights in 2010 the existence of generally very high values in regions implementing SAPS (in particular Slovakia and Czech Republic) and, on the other hand, much lower values in the regions implementing the historical and the hybrid models. Within these two models exceptions are the East & North East regions of Germany (former DDR) and Scotland (UK)[83]. It is noteworthy that the average farm size in Slovakia (781 ha in 2010) is 5.3 times the average surface area of farms in the Flamande region (146 ha).

[83] The larger average size of farms in SAPS regions/countries and in DE East&North East is clearly a structural vestige of past regimes (large state-controlled farms).

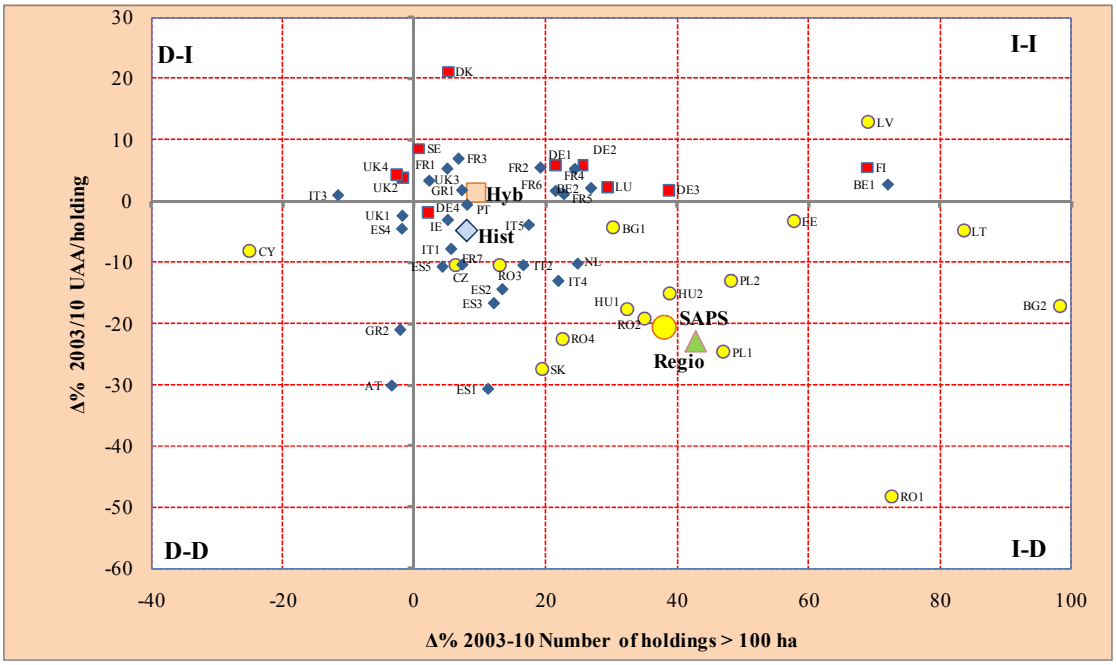
Fig. 24 – Average size of holdings with UAA>100 ha, by region and SFP model (ha, 2010)[84]



Source: Elaborations based on data from Eurostat

In order to study the trends for farms in the UAA class > 100 ha, for each region we have compared the percentage variations 2003/2005 in the number of farms in this class with the percentage variations of the average UAA per farm in the same period. The distribution of regions (and of each SFP model and of the EU27 average) according to these two indicators is given in the chart below[85].

Fig. 25 – Holdings with > 100 ha: Δ % 2003-2010 of the number of holdings and average farm UAA, in the regions and by SFP model



Source: Elaborations based on data from Eurostat

[84] In the regional model, Malta has not farms > 100 ha.

[85] It must be pointed out that for some regions the strong % variation in the number of holdings> 100 ha is also influenced by the low number of holdings present in this class in 2003 (less than 1000). This is the case of Région Flammande, Yugozapadna Yuzhina Centralna, Slovenia, Luxembourg (regions showing strong growth) and Cyprus (region showing sharp decline).

The four quadrants of the map suggest as many possible trends. In particular[86]:

- In the quadrant I-I it can be assumed that a certain number of farms that belonged to the next lower size classes in 2003 have increased their size (by buying and/or renting land), moving up to the class > 100 ha. This should have been accompanied by a further size increase in farms previously belonging to this class.
- In the quadrant I-D it can be assumed that, as in the above case, there has been an inflow of farms which in 2003 had been in the lower class, but not an expansion of existing farms. On the other hand, it can be assumed that a certain number of farms have decreased their size (e.g. dividing up farms that were "too" large, but retaining an area > 100 ha). All of this explains the reduction in the average size, and may have contributed to the rise in the number of farms[87] .
- In the quadrant D-D it can be assumed that quite a few larger-sized farms have left the sector. Furthermore, a non-quantifiable percentage of farms may have sold off some of their land and/or not renewed rental contracts. In this case, the effect would result in these farms moving into the size class immediately below, with a reduction in average size.

Bearing in mind that Malta is the only Region that does not have farms > 100 ha, it is noted that about 85% of regions (46/54) have seen an increase (to a lesser or greater extent) in the number of farms (quadrants I-I and I-D)[88], but the percentage of regions in which there has been a rise in average size is slightly lower than that in which size has diminished.

It is interesting to observe that the first case (quadrant I-I) applies to 7/10 of regions of the Hybrid model (with the sole exception of DE East & North-East, UK England and UK Northern Ireland) and to 10/27 of regions of the Historical model, but only to one SAPS region (Latvia). On the other hand, the second case (quadrant I-D) applies to 15/17 of regions[89] implementing Regional+SAPS, and 13 regions implementing historical + hybrid models.

The most "negative" trend (quadrant D-D) affects about 9% of regions (5/54), of which 15% of regions implementing the historical model.

6.4.4 Changes in the number of farms by type of farming

As seen in Chap. 6.4.1, between 2005 and 2010 the total number of farms decreased (albeit to varying extents) for all SFP models. It is now appropriate to ascertain whether and to what extent the decline was concentrated in any of the nine Types of Farming (TF) by which, since 2005, Eurostat classifies farm holdings. To this end we conducted the analysis of size trends (2005-2010) for each TF and for each SFP model.

To make data comparisons more uniform and to facilitate the interpretation of trends, for each SFP model the total number of farms in 2005 was set to 100. The weight of farms belonging to each different TF adding up to the total number of farms ($\Sigma\ TF_i = 100$) was then calculated. For 2010 the number of farms belonging to different TF was related to the total number of farms in 2005[90].

Taking into account the changes in thresholds for farm inclusion in the FSS that were adopted by some MSs (as already mentioned), the results are summarised in the graph below, in which, for each model, the composition of total holdings distinguishing by TF was calculated for 2005 and 2010.

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86 The quadrant D-I is not taken into consideration due to the almost total absence of regions placed there.

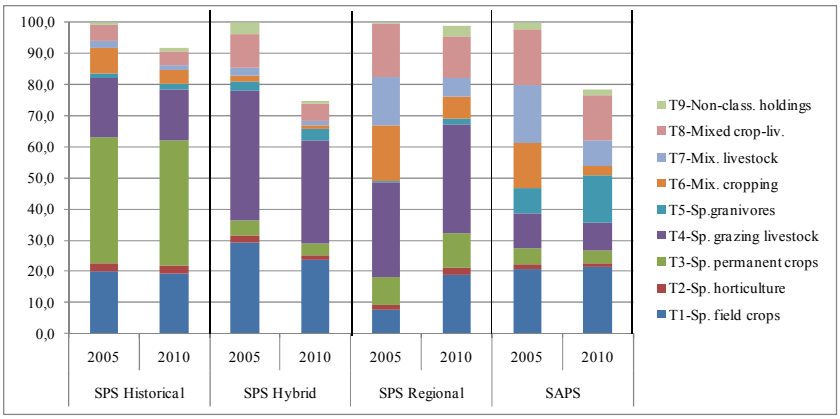
87 For instance, a 1,000 ha holding could be divided into two 500 ha farms: the total number of holdings in the class would increase, but average UAA would fall. This appears to have happened in some Member States of the EU12 and in DE East & N-E.

88 The Baltic states, together with Finland and BG Yugozapadna Yuzhina Centralna, are the regions in which the number of holdings is growing most quickly (from 50% to over 90%).

89 This quadrant includes Slovenia, the only regional model region with holdings > 100 ha.

90 As a result, since the total number of holdings has fallen between 2005 and 2010 in all models, the sum of values obtained by the various TF in 2010 is less than 100.

Fig. 26 – Number of farms by type of farming 2005-2010 (2005=100, %)



Source: Elaborations based on data from Eurostat

With reference to the start year (2005), there were evident differences in the TF composition across the four SFP models. In particular:

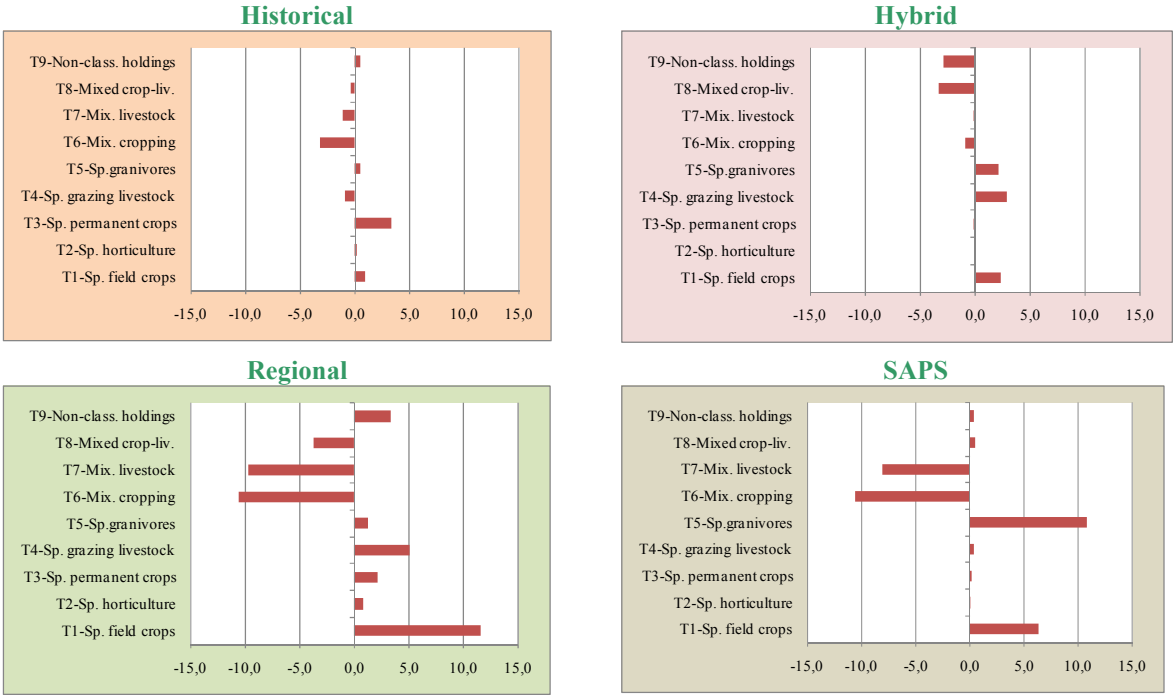
- in the Historical model, about 41% of farms specialised in permanent crops (TF3), about 20% in Field crops (TF1) and about 19% in grazing livestock. The other TF made up the remaining 21% of farms.
- in the Hybrid model, about 42% of farms specialised in grazing livestock, about 29% in Field crops and about 10% in Mixed crops-livestock (TF8). The other TF accounted for the remaining 18% of farms.
- In the Regional model (taking into due account the diversity of the two comprised regions), about 30% of farms specialised in grazing livestock, about 18% in Mixed cropping (TF6), 17% in Mixed crops-livestock and 15.5% in Mixed livestock (TF7). The other TF represented the remaining 19% of farms.
- In the SAPS model, about 21% of farms specialised in Field crops, 19% in Mixed livestock, 18% in Mixed crops-livestock, 14% in Mixed cropping and 11% in Grazing livestock. The other TF accounted for the remaining 17% of farms.

It, therefore, emerges that farms belonging to Historical and Hybrid models have, overall, a high degree of specialisation, in particular in permanent crops and grazing livestock. The opposite is true for Regional and SAPS models, for which farms are more evenly distributed in the various TF. Furthermore, the lower specialisation of farms in these two models appears to be confirmed by the (relatively) large presence of farms in "Mixed" TF (TF6, TF7 and TF8).

In 2010 the decline (in absolute terms) in the total number of farms applies to almost all TF in all models, with the significant exception of TF5 (Specialist granivores), in which the number of farms rises for all models. Furthermore, not all TF show the same rate of decline: in general, farms in the three "mixed" TF (TF6, TF7 and TF8) fell in numbers by more than the average decrease, whereas more "specialised" farms (TF1; TF2; TF3 and TF4) have declined by less than the average, or there has been no reduction at all in numbers (this applies to TF2 and TF3 in the Historical model).

The changes (in relative terms) from 2005 to 2010 are highlighted in the graphs below, showing the differences between the percentage weight of each TF in 2010 and 2005. In this case, the percentage values of each TF are calculated setting the total number of farms in 2005=100 and for 2010=100. These differences thus express the relative variations in weight of each TF out of all farms referring to the specific year (and not absolute variations, regardless of the decline in the number of farms between 2005 and 2010).

Fig. 27 – Variations in percentage of farms belonging to different TF (difference in percentage points between 2010 and 2005) [91]



Source: Elaborations based on data from Eurostat

The analysis of relative variations confirms what has already been observed, in particular the negative variations (with almost no exception) in all models and in all "mixed" TF (from TF6 to TF8), offset by positive variations in the more specialised TF (TF1 to TF5). Furthermore, it is noted that in the Regional and SAPS models variations in the composition of some TF are much greater (more than 10 percentage points) than those of the Historical and Hybrid models (always below 5 points).

Accordingly, it may be concluded that in all SFP models farms are going through a process towards increased specialisation: to a lesser extent in EU15, where already in 2005 most farms were concentrated in the more specialised TF (about 85%); to a greater extent in EU12, where in 2005 more than half of the farms belonged to the Mixed TF[92].

6.4.5 Changes in the number of farms by economic size

Similarly to the analysis for farm types (TF), here we develop the analysis to ascertain whether and to what extent the variations in the number of farms between 2005 and 2010 occurred in any specific SO class in which they have been grouped since 2005. In this respect we analysed farm number trends (2005-2010) for each SO class by SFP model.

To facilitate the interpretation, we identified 3 classes: Small (SO less than 24,999 euro), Medium (SO from 25,000 to 249,999 euro) and Large (SO 250,000 euro and over). Moreover, the Eurostat classification includes a class called "Zero euro".

For the analysis of changes to the number of farms by SO size we applied the same method used (with the same limits) for analysing farm trends by TF.

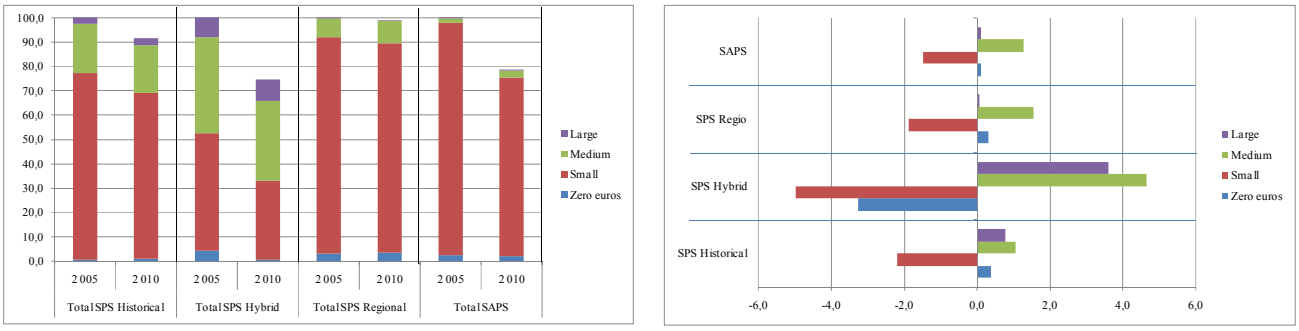
The graphs below show the results of the analysis.

[91] The algebraic sum of variations = 0.

[92] In the regional model from 50.6% to 26.6%; in SAPS from 50.8% to 32.7%.

Fig. 28 – 2005-2010 changes to the number of holdings belonging to different SO classes (Total holdings 2005=100) and percentage variations of holdings by SO classes (difference in percentage points between 2010 and 2005: Total holdings 2005 = 100; total holdings 2010 = 100)

2005-2010 changes. Total holdings 2005=100 **Δ percentage points between 2010 and 2005 (*)**



(*) the sum of the differences is zero

Source: Elaborations based on data from Eurostat

With reference to the start year (2005), there clearly is a very large presence of Small farms in the two EU12 models (about 89% in Regional and 95% in SAPS). On the other hand, the situation is more evenly balanced in the Hybrid model, where Small farms represent about 48%, Medium farms 39%, and Large farms 8.1% of the total.

In 2010, the decline (in absolute terms) in the number of holdings is reflected in SO groups in a variety of ways**:** farms in the Small group have decreased in number in all SFP models; farms in the Medium group have decreased in both EU15 models, but have risen in the two EU12 models; Large farms have grown in number in all models. Zero euro farms have risen in number in the Historical and Regional models, but reduced in the others.

In all models, therefore, the exit of farms from the sector has involved almost exclusively Small holdings, while a varying percentage of holdings in 2005 (presumably) belonging to the Medium class shifted upwards to the Large class in 2010.

The changes between 2005 and 2010 are confirmed by the analysis of relative variations. In this case it is observed that farms belonging to both Large and Medium classes have increased their weight in all models (and to a greater extent in the Hybrid model), and in all models Small farms saw a drop in their relative weight (again to a greater extent for the Hybrid model[93]).

It may accordingly be concluded that in all models there has been an increase in the economic size of farms (in absolute and relative terms). This process appears however to be faster in the two EU15 models compared to the two EU12 models.

6.4.6 Changes in holdings with livestock

Livestock breeding farms (or more correctly farms with livestock, or LSU) are a subset of farm holdings, and are generally subject to the same trends as those already analysed in chapter 6.4.1. For this reason we believe it is a good idea to analyse the evolution of this subset of holdings in relative terms (i.e. relative to the more general evolution of all farm holdings), by calculating the ratio *number of farms with livestock*[94]*/total number of farms*[95].

Before looking at this aspect in detail, we believe it useful to contextualise livestock rearing and breeding activity in the regions under study. The graph below shows the values of the indicator across regions in 2010.

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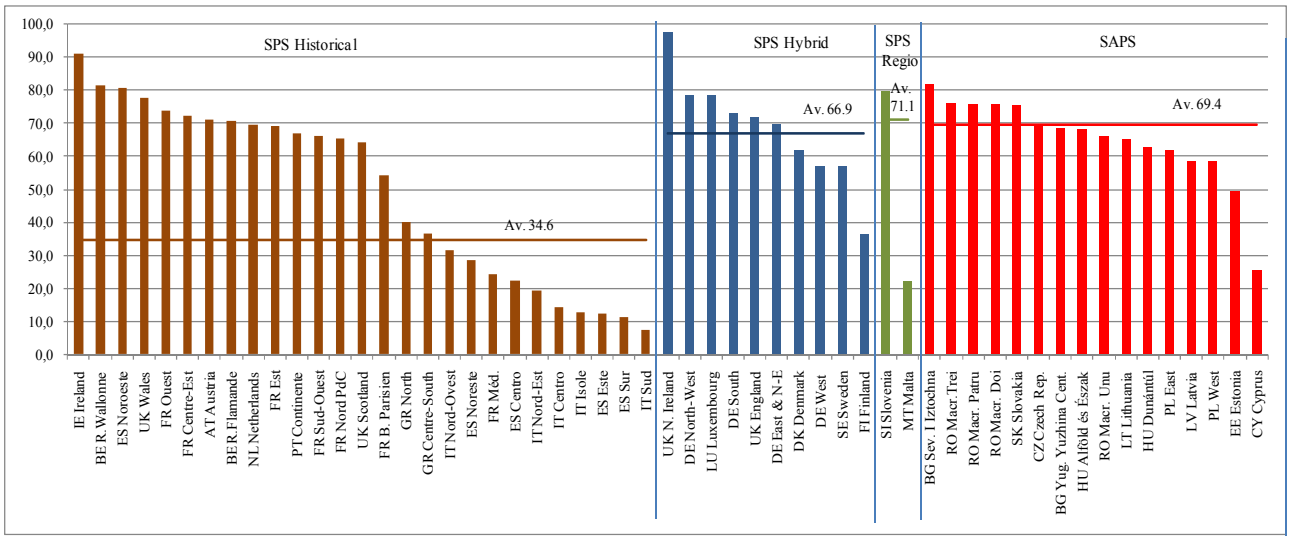
93 This result for the hybrid model is clearly affected by the change in arable UAA threshold, specifically in Germany and the UK. As might be expected, a good portion of the Small class of 2005 also belonged to the class < 5 Ha.

94 Regardless of the number of LSU.

95 In this case, all holdings including those without UAA.

Fig. 29 – Ratio Holdings with LSU/ Total Holdings by SFP model (2010, %)



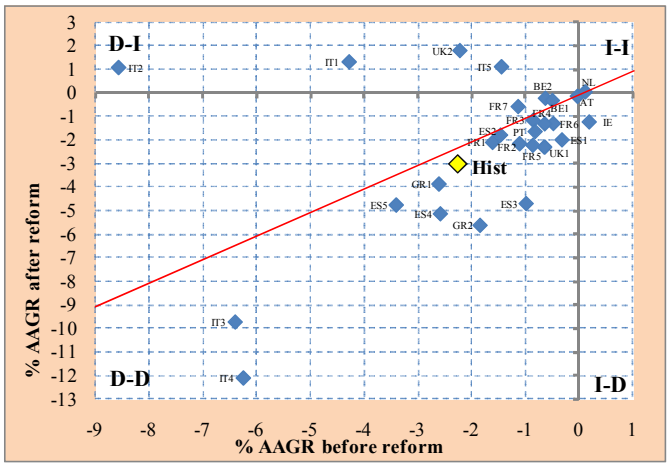
Source: Elaborations based on data from Eurostat

There is a lot of diversity among regions, ranging from more than 90% of holdings with LSU out of the total (Ireland and Northern Ireland) and a minimum below 10% (Southern Italy). In general, there seems to be (in the Historical, Regional and SAPS models) a clear distinction between most Mediterranean regions (low values, with the exception of ES Noroeste and PT continent) and other regions (high values).

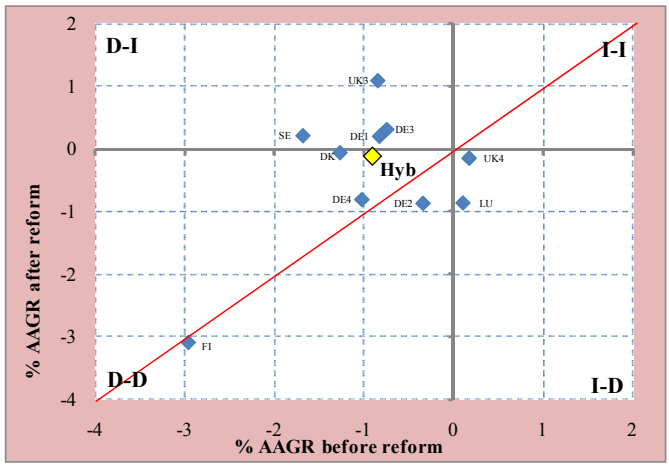
In light of this general picture (in 2010), we now examine the trends across regions and groups of regions according to SFP model. This analysis is based on a comparison of Average Annual Growth Rates in the pre- and post-reform periods.

Fig. 30 – Ratio % holdings with LSU/total holdings average annual growth, before and after the reform, by region and SFP model

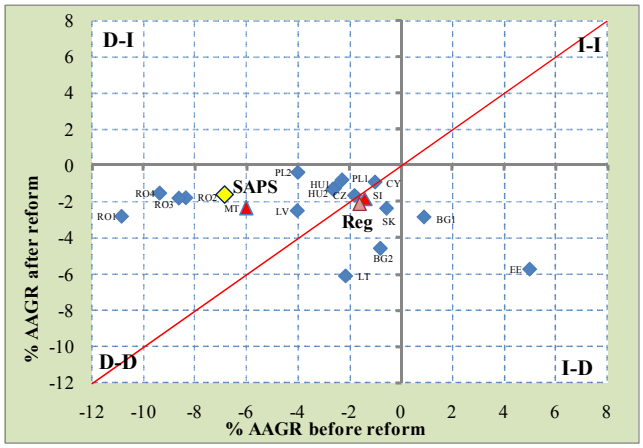
SPS Historical regions



SPS Hybrid regions



SPS Regional and SAPS regions



Source: Elaborations based on data from Eurostat

It should first be stressed that in the period before 2005, 89% of the 55 analysed regions had a negative annual average variation. This means that in most regions, already prior to the reform, the drop in the number of holdings with LSU was larger than the overall decline in the number of holdings. This trend changed little after 2005: about 84% of regions continued to show a negative annual average variation. Again in general, livestock breeding activity (all livestock types) appears to be performed by fewer and fewer holdings.

In greater detail, the only regions showing an opposite trend (i.e. share of Holdings with LSU/Total Holdings increases) are Finland and to a lesser extent two of the four German regions (Hybrid model). On the other hand, two regions implementing the SAPS (Estonia and BG Severna I Iztochna) which had positive average annual growth rates until 2005, subsequently witnessed a trend reversal. In the same way, four Italian regions and UK Wales (Historical model), UK England, the other two German regions and Sweden (Hybrid model) saw the end or even a reversal of the negative trend seen before 2005[96].

Finally, it is noted that in most regions implementing the Historical model the downward trend was emphasised after the reform, and that this acceleration was more marked in Mediterranean regions. On the other hand, in SAPS and Regional models, most regions saw a slowdown in the growth of this ratio after 2005.

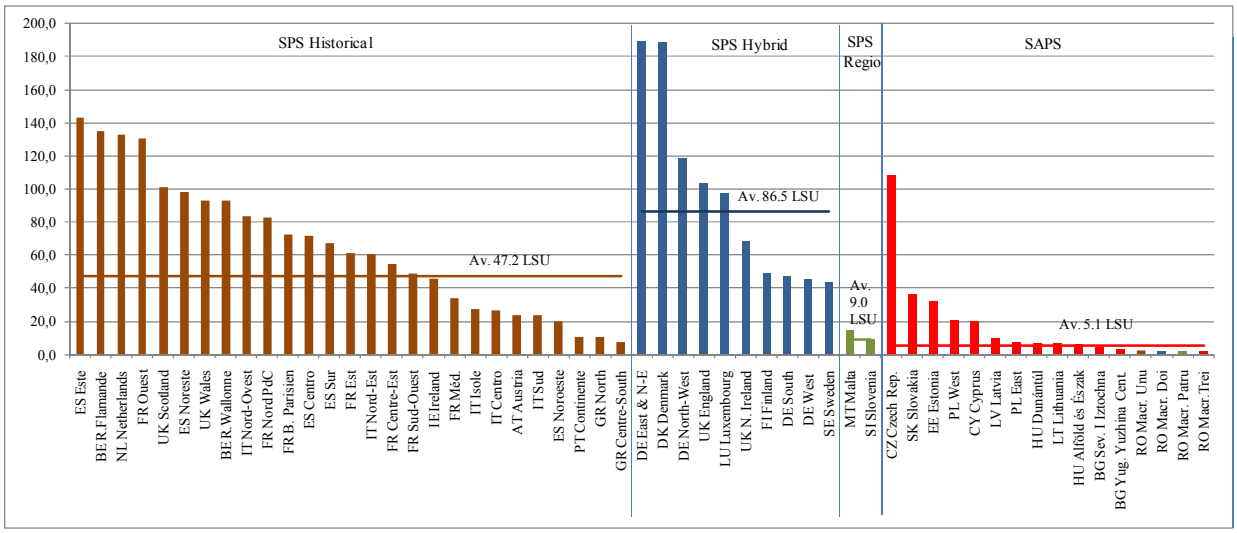
6.4.6.1 Average size of livestock

Before looking at the average size of LSU holdings, we should consider the striking regional differences, with a maximum of over 180 LSU on average per farm in DE East & North-East and in Denmark, compared with a minimum of 1.5 LSU in RO Macroregiunea Trei.

On average, regions implementing the Hybrid model have medium to large-size livestock farms. On the other hand, most of the regions implementing SAPS and Regional models have a very low average size, albeit with some significant exceptions (in particular, Czech Republic).

[96] To be noted that Italian regions have some of the lowest values for this ratio in 2010. In addition, the change in livestock data collection between 2000 and 2010 in Italian regions must be taken into account. In 2000, the census had surveyed all livestock units (sheep, goats, pigs, poultry, rabbits, etc.), including farms with few animals intended for self-consumption. Subsequently, the survey system was modified to cover only livestock intended for sale. The sharp decline in the number of farms with livestock in 2010 must be interpreted taking into account the different survey system.

Fig. 31 – LSU/ holdings with LSU by region and SFP model (2010, No)



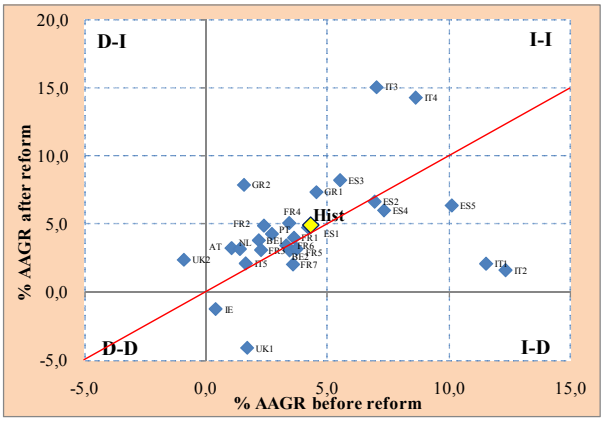
Source: Elaborations based on data from Eurostat

Taking these structural differences into account, the analysis of trends shows that in general, even prior to 2005 there was a trend towards increasing average size, applying to about 84% of the 55 regions under study. This growth process has continued after 2005 in 86% of the regions.

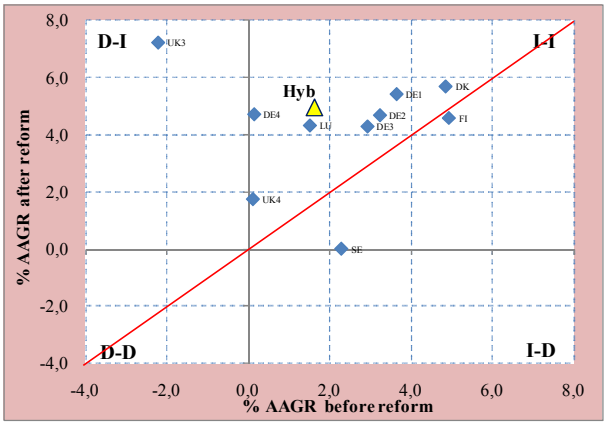
The different SFP models are positioned in quadrant I-I of the graph and an acceleration in the growth of average size is observed after 2005, the exception being the Regional model, for which the post-2005 years show growth nevertheless.

Fig. 32 – Average annual growth rate of the average farm LSU, before and after the reform, by SFP model

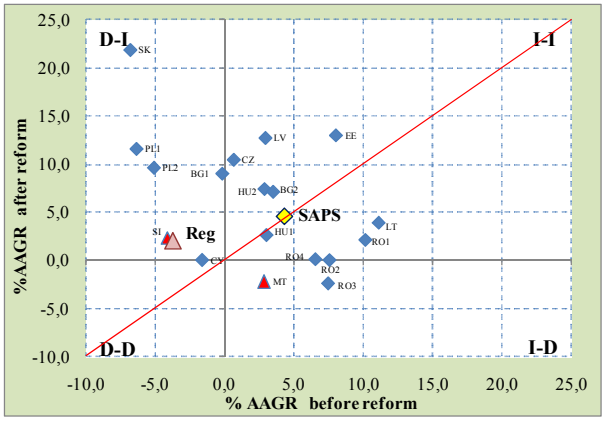
SPS Historical regions



SPS Hybrid regions



SPS Regional and SAPS regions



Source: Elaborations based on data from Eurostat

At regional level, it can be seen that:

- Only two regions implementing the Historical model (Ireland and Scotland) show a decrease after the reform. On the other hand, 24/27 regions maintained upward change rates, of which 16/27 saw an acceleration in growth and 8/27 a slowdown. In general, it is noted that Southern regions had the largest growth rates, whilst for other regions AAGR levels and variations were more modest.
- All regions implementing the Hybrid model confirmed or started a growth process in average size after 2005, with the only (and partial) exception of Sweden. Furthermore, 7/10 regions saw an acceleration in growth that had already been in place prior to the reform. There was a (slight) slowdown only for Finland. Finally, there was a significant trend reversal (from negative to positive) for UK England.
- In the regions implementing the Regional and SAPS model, 16/18 confirmed or started a growth process in average size. The only cases of deterioration (from positive to negative) were found in RO Macroregiunea Trei (SAPS) and Malta (Regional model). On the other hand, 5/18 regions (including the two Polish regions) witnessed a trend reversal from negative to positive after 2005.

Finally, the results of the two previous indicators (LSU / LSU holdings in 2010 and maps for Average Annual Growth Rate of average LSU) show that, contrary to what we might have expected, there is no significant relationship between the average size of LSU holdings and growth rate. Regions with the highest average size in 2005 showed both high and low growth rates, in the same way as regions characterised by the lowest average size. This applies to all SFP models.

6.4.6.2 Number of holdings with livestock by size of farm

The generalised growth in the average size of livestock holdings conceals a range of structural situations within the groups of regions subdivided according to SFP model.

The first of the two graphs below highlights the trends (between 2003 and 2010) of LSU distribution among livestock holdings according to size classes.

In 2003 two extreme situations were observed: the first (Regional model) holdings' distribution was heavily skewed towards the lower classes (from zero to 20 LSU); the second (Hybrid model) was much more skewed towards the higher classes (50 LSU and above). In 2010 these two extremes were basically unchanged, but there was a reduction in the relative weight of the smaller-sized classes. This decline is common to all models (albeit to varying extents). However, the class of landless LSU holdings grew in the Historical and Hybrid models, decreased in the Regional model and remained quite stable in the SAPS.

Finally (in the second graph) a significant difference was observed between the Historical and Hybrid models on the one hand, and Regional and SAPS models on the other. In the former, all size classes saw a decline with the exception of the classes > 100 ha and zero; in the latter, trends were more varied: a large fall for the lowest class, and regular increases for all others for SAPS, and growth (albeit less than proportional) for the three higher classes for the Regional model.

Fig. 33 – % distribution of LSU by size class of livestock holding, by SFP model, in 2003 and 2010

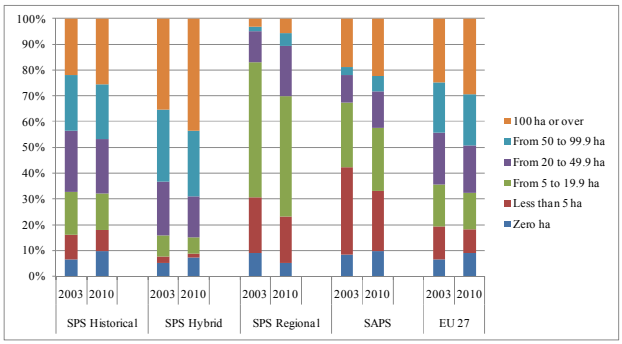
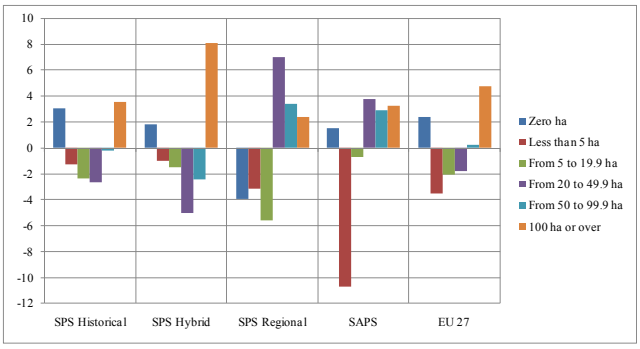


Fig. 34 – % differences between 2010 and 2003 of LSU by size class of livestock holding, by SFP model and EU27 (*)



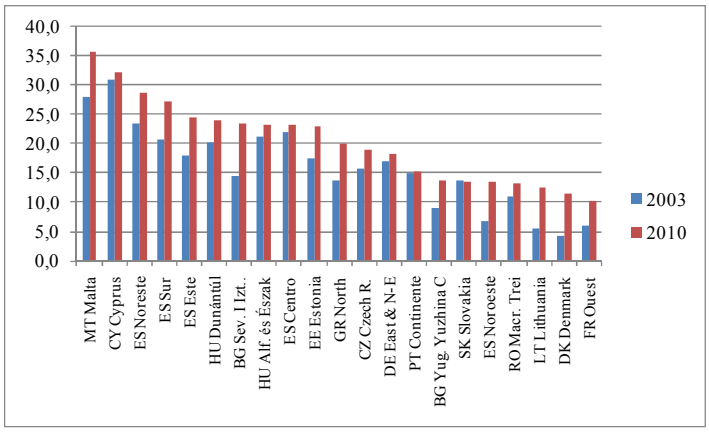
Source: Elaborations based on data from Eurostat

6.4.6.3 LSU growth in holdings without land

The growth of LSU in landless holdings is a phenomenon that deserves attention. It should firstly be noted that the presence of landless livestock holdings is particularly significant in some regions. The graph below shows all regions where LSU in landless holdings exceed (in 2010) 10% of total LSU for the region. These include, among others, all five regions of Spain and Portugal Continent, both regions of Bulgaria and of Hungary, Malta and Cyprus. In the latter two regions the weight of LSU in landless holdings exceeds 30%.

Secondly, in all regions (with the exception of Slovakia) the weight of LSU in landless holdings over the total rose between 2003 and 2010, and in some regions it rose considerably (by 9 points in BG Severna I Iztochna; about 7 points in Denmark, Malta and Lithuania; 6.6 points in Spanish regions Sur, Este and Noroeste.

Fig. 35 – Regions with a ratio No holdings without land/Total No of holdings > 10% (2010, %)



Source: Elaborations based on data from Eurostat

In almost all regions, the high percentage of LSU in landless holdings is due to the large presence of granivores (Pigs & Poultry) among farm livestock. These are thus "industrial" holdings, usually large-sized, that do not produce their own feed for livestock, which is totally purchased outside the farm[97].

Nevertheless, some regions are (partial) exceptions:

- In Cyprus, Greece North, PT Continente, BG Yugozapadna Yuzhina Centralna there is prevalence of Sheep & Goats: it is therefore highly likely that in these regions "landless" holdings use common land for grazing.
- In the Spanish regions (Noreste, Centro and Sur), and in BG Severna I Iztochna, in addition to pigs (and poultry), there is a large presence of sheep. In this case too the consideration just made is valid, with the addition that pigs too are (partly) raised using extensive grazing on common land[98].

6.4.7 Analysis of concentration of holdings

6.4.7.1 Concentration of the farms UAA

In this part of the analysis we seek to ascertain whether and to what extent a process of structural concentration has occurred.

[97] In many cases they are livestock farms supplied by and/or directly controlled by animal feed producers.

[98] For instance, Spanish "Pata Negra" pigs reared on "dehesas" grazing land.

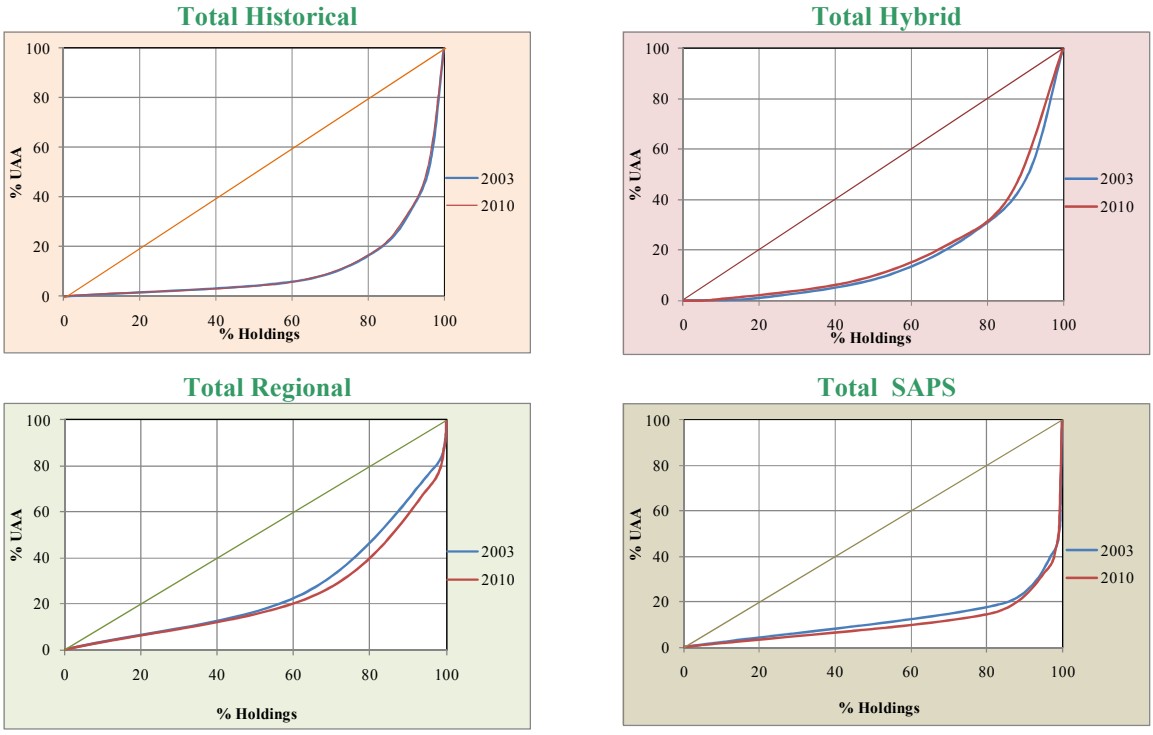
We have thus conducted:

- an initial analysis, with the aim of verifying in what way UAA is distributed among holdings (grouped by UAA class). We have done this by constructing a Lorenz curve[99] for the groups of regions distinguished by SFP model. For each group, the Lorenz curve was produced for the years 2003 and 2010.
- a second analysis, with the aim of verifying the degree of concentration in the years 2003 and 2010 and the differences in concentration in the two years. The degree of concentration is measured by the Gini coefficient[100], applied to all regions belonging to different models.

6.4.7.1.1 Lorenz curves by Single Farm Payment model

Below are the Lorenz curves for the combination % *Holdings with UAA and % UAA*, for the various implementation models.

Fig. 36 – Lorenz curve in 2003 and 2010 by SFP model



Source: Elaborations based on data from Eurostat

[99] In this case the Lorenz curve is a combination of the cumulative percentages of the number of holdings by size class and the cumulative percentages of UAA for the same size classes. The actual situation (the real curve) should be compared with the equi-distribution line. The more the real curve moves away from the equidistribution line, the more the distribution is uneven (concentration being greater), and vice versa.

[100] The Gini coefficient is a measure of statistical dispersion. Based on the Lorenz curve (referred to in the previous note) is calculated as:

$$G = 1 - \sum_{j=1}^{n-1} Qj \,/\, \sum_{i=1}^{n-1} Pi$$

Where:
Q_j = cumulative share Holding by size of farms
P_i = cumulative share UAA by size of farms
As it is well known, the Gini coefficient is a number between 0 and 1. Low values indicate a quite even distribution, with 0 corresponding to pure equidistribution; high values of the coefficient indicate a more uneven distribution, with the value 1 corresponding to the maximum concentration (in this case, the situation in which a single holding concentrates 100% of available UAA.

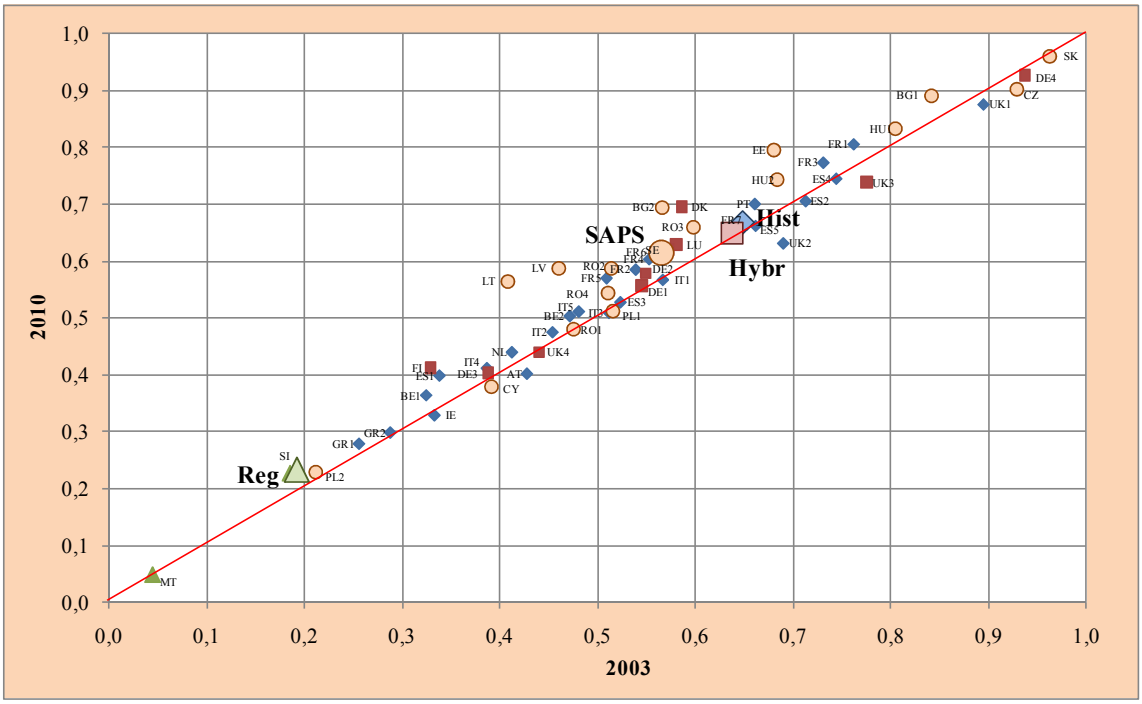
The following considerations can now be made:

- The first concerns the (general) shape of the curves. There are some important differences within two extremes: on the one hand is the Regional model, where the curve is the closest to the equidistribution line (thus concentration is lowest); on the other hand the SAPS model, for which the curve is furthest away from the equidistribution line, and flattened on the axes (thus heavily biased towards the two extreme classes). With regard to SAPS, there is an evident and considerable structural dualism: on the one hand, a very high percentage of very small farms which taken together concentrate a small percentage of UAA (in 2010 holdings < 5 Ha accounted for 81% of the total, but only 15% of UAA); on the other, a very low percentage of large holdings, concentrating a very high percentage of UAA (in 2010 holdings > 100 Ha made up 0.8% of the total, but about 49% of UAA).
- It should also be noted that a certain structural dualism (albeit not in the forms expressed by SAPS holdings) is also to be found in the Historical model (mainly due to the large share of holdings < 5Ha (58% of the total) in which only 5.2% of UAA is concentrated). Distribution is more even in the Hybrid model.
- The second relates to the difference in curves between 2003 and 2010. With regard to the Historical model the 2010 curve was little different from the 2003 curve. For the Hybrid model there was a slight shift of the 2010 curve towards the equidistribution line (thus, lesser concentration). This may however be attributable to the change in UAA threshold criteria adopted in the 2010 census in some countries of this groups (no recording of holdings < 5Ha). On the other hand, in both the other models, the 2010 curve was noticeably closer to the axes (this denotes a rise in concentration). For the Regional model the 2010 curve appears to be lower on the right-hand side (representing the larger-sized holdings), while for the SAPS model it was lower on the left-hand side (representing smaller-sized farms). In these two models therefore, greater concentration occurs in opposite ways.

6.4.7.1.2 Gini concentration coefficient in Regions and by SFP model

The diagram below shows Gini coefficient values (from 0 to 1) across regions in 2003 and 2005. In the diagram, all the regions in which the level of concentration was higher in 2010 compared to 2003 are above the bisector (and *vice versa*).

Fig. 37 – GINI coefficient in the EU regions and by SFP model: 2003 and 2010



Source: Elaborations based on data from Eurostat

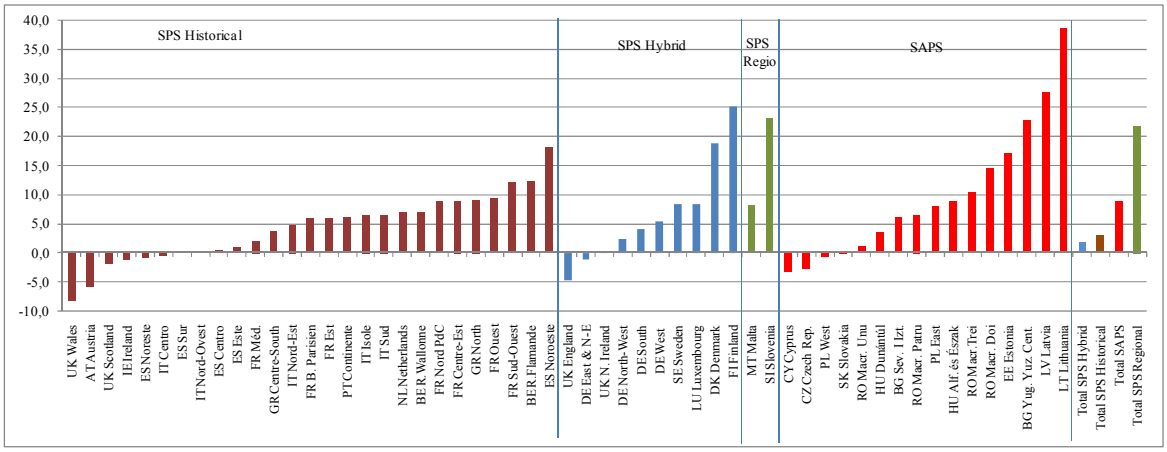
As it might be expected, the Gini coefficient values of the different SFP models are the expression of a very wide range of regional situations. In the case of the Historical model, the coefficient ranges from minimum concentration in GR North (about 0.3) to a maximum in UK Scotland (about 0.88). For the Hybrid model, from a minimum in Finland (about 0.3-0.4) to a maximum in DE East & North-East (about 0.93)[101]. Furthermore, 18/27 regions of the Historical model and 7/10 regions of the Hybrid model (in 2010) had a coefficient with a value above 0.5.

Within Regional and SAPS models, the range of values is even more pronounced: from the minimum concentration of about 0.05 in Malta to maximum concentration of 0.96 in Slovakia. Furthermore, 13/16 regions in the SAPS model have a coefficient (in 2010) above 0.5, while both regions of the Regional model were well below that level.

Between 2003 and 2010, most regions saw a growth in the coefficients (i.e. concentration levels rose). In particular, concentration increased in 21/27 regions of the Historical model, 8/10 of the Hybrid model, 2/2 of the Regional model and 12/16 of the SAPS model.

The variations between 2003 and 2010 are uneven: there are Regions where coefficient variations are low (e.g. ES Sur, UK North Ireland, Slovakia) and Regions where they are very large (e.g. Spain Noroeste, Finland, Slovenia, Lithuania). The graph below shows the percentage variations of the coefficient in the examined regions and for SFP models.

Fig. 38 – % variation of Gini coefficient values between 2003 and 2010 in Regions and by SFP model (%, in ascending order)



Source: Elaborations based on data from Eurostat

6.4.7.2 Concentration of LSU in farms with livestock

In a similar way to UAA concentration, we also analysed the existence of concentration levels for LSU in holdings with livestock (using the same methods). To this end we used agricultural census information on the distribution of the number of holdings by LSU class, as well as LSU for each class.

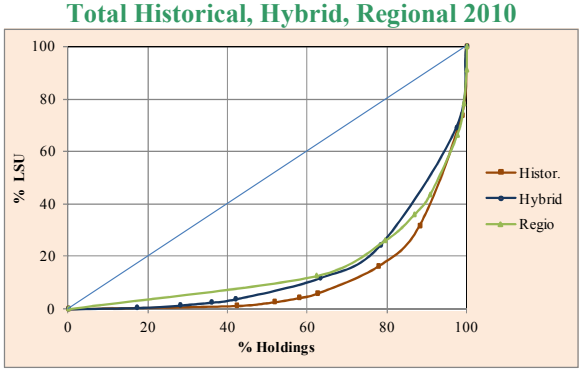
6.4.7.2.1 Lorenz curves by Single Farm Payment model

The graph below shows the Lorenz curve of the distributions *% Holdings with LSU and % LSU*, according to SFP models.

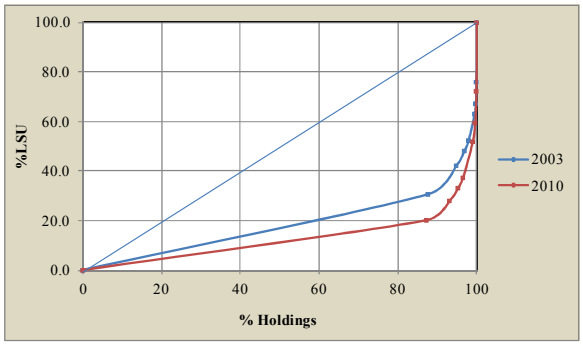
[101] It should also be noted that the Historical and Hybrid models average is quite similar: around 0.65 for both models.

Fig. 39 – Lorenz curve of livestock by SFP model[102]

Total Historical, Hybrid, Regional 2010



Total SAPS 2003-2010



Source: Elaborations based on data from Eurostat

Before discussing the differences between the general trends of the curves in different SFP models, it is necessary to emphasize that in the SPS Historical, Hybrid and Regional models (above graph on the left) the differences between evolution in 2003 and in 2010 are minimal, therefore, only very limited changes can be detected. On the contrary, in SAPS significant changes occur between 2003 and 2010 (above graph on the right).

Lorenz curves highlight very different situations among SFP models. A very biased trend to the right characterises the SAPS model (and, partially, the Regional model), whereas the curve is much more balanced for the other two models. This despite the fact that, on average, the Gini coefficient is higher in the Historical (from 0.69 in 2003 to 0.72 in 2010) and Hybrid (from 0.65 to 0.69) models compared with Regional models (from 0.42 to 0.43) and the SAPS (from 0.44 to 0.55).

Therefore, for the distribution of LSU in livestock holdings too, for the SAPS model we observe a very marked structural dualism that is basically absent in the Historical and Hybrid models.

Looking at the SAPS model, it can be seen moreover that this structural dualism has been accentuated between 2003 and 2010: in 2003 holdings with fewer than 5 LSU represented 87.6% of all holdings, and about 30.6% of total LSU; in 2010 these represent 87.3% of all holdings, and 20.2% of total LSU. On the opposite side, in 2003 holdings with more than 100 LSU account for 0.2% of all holdings, and 33% of total LSU ; in 2010 these account for 0.4% of all holdings, and 40% of total LSU.

At the same time, in the Hybrid model holdings with fewer than 5 LSU represented in 2003 about 22% of all holdings, and 0.7% of total LSU; in 2010 about 17% of all holdings, and 0.5% of total LSU. Holdings with more than 100 LSU account in 2003 for 17% of all holdings, and 68% of total LSU and in 2010 for 22% of all holdings, and 76% of total LSU[103].

6.4.7.2.2 Gini concentration coefficient in Regions and by SFP model

The diagram below shows Gini coefficient values (from 0 to 1) across regions in 2003 and 2005.

In this case too, the indices calculated for SFP models are the sum of quite a wide range of concentration values at regional level (but less broad than for UAA concentration). For the Historical model we have a minimum concentration (in 2010) in IT Isole (0.43) and a maximum in IT Nord-Ovest (0.83). For the Hybrid model, the coefficient ranges from a minimum in DE South (0.5 circa) to a maximum in Denmark and DE East & North-East (about 0.88). Furthermore, 23/27 regions of the Historical model and 9/10 of the Hybrid model recorded a coefficient above 0.5 (in 2010).

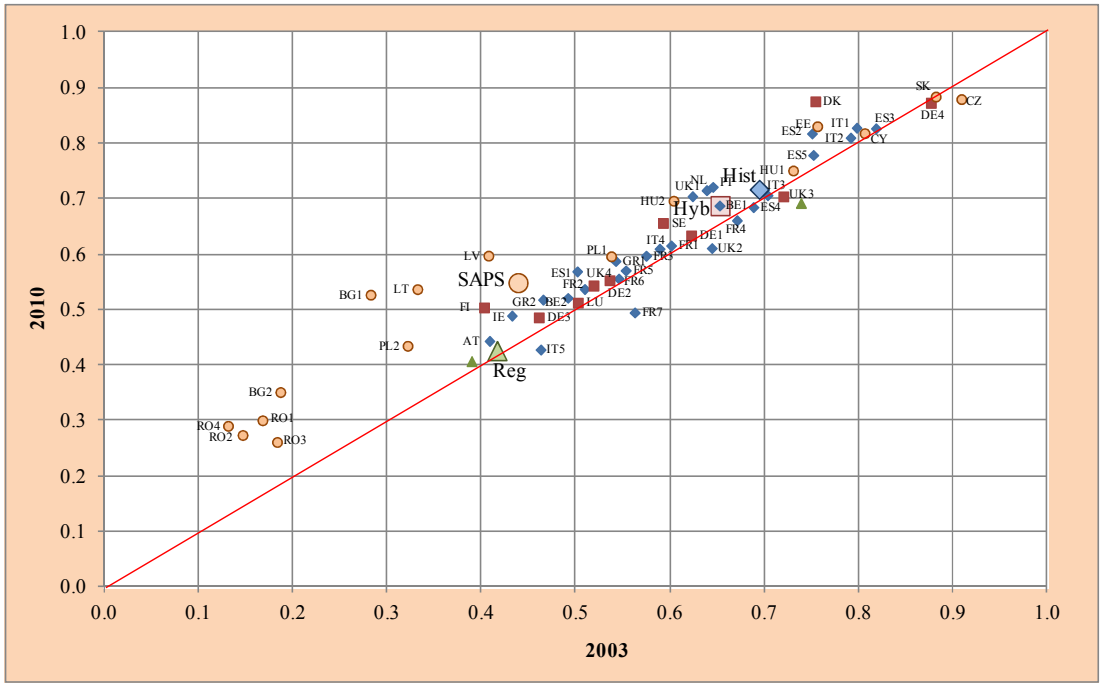
In the Regional and SAPS models, the range of values was broader, from minimum concentration of about 0.2- 0.3 (RO Regions) to a maximum of about 0.9 (Czech Republic and Slovakia). Moreover,

[102] Since for the SPS Historical, Hybrid and Regional models the 2003 and 2010 curves are almost completely overlapping, the corresponding graph includes the sole 2010 curve. On the contrary, for SAPS both 2003 and 2010 curves are shown.

[103] In short, in the SAPS (and Regional) models a relatively low number of LSUs are concentrated in the central classes, whereas these classes have a greater relevance in the Hybrid model (and Historical model).

10/16 regions of the SAPS model have a coefficient in excess of 0.5, whereas in the Hybrid model only Slovenia is above 0.5 (in 2010).

Fig. 40 – Gini coefficient of livestock in the EU regions and by SFP model: 2003 and 2010

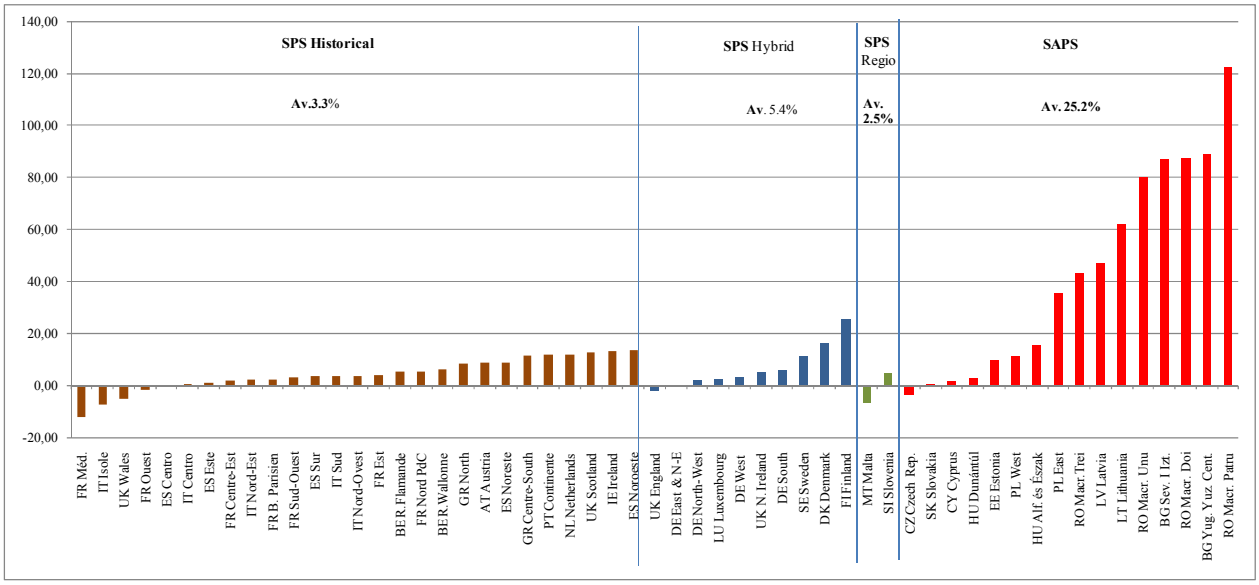


Source: Elaborations based on data from Eurostat

Between 2003 and 2010, most regions saw a growth in the coefficients (i.e. concentration levels rose). In particular, concentration increased in 22/27 regions of the Historical model, 8/10 of the Hybrid model, 1/2 of the Regional model and 15/16 of the SAPS model.

The variations between 2003 and 2010 are uneven. Index variations are particularly high (> 30%) in 9/16 of the regions implementing SAPS, and in particular in all four Romanian regions, in two of the three Baltic regions, in one of the two Polish regions and in the two Bulgarian regions. However, in all these regions the value of the index was particularly low in 2003, and it still remains low for a large part of these in 2010.

Fig. 41 – % variation of Gini coefficient values of livestock between 2003 and 2010 in Regions and by SFP model (%, in ascending order)



Source: Elaborations based on data from Eurostat

6.5 Analysis of the changes in land use and livestock levels

6.5.1 Changes in land use

In chapter 6.4.2 we examined UAA trends by SFP implementation model. We observed in particular the existence of different trends, with a (moderate) decline in the Historical, Hybrid and Regional models and a slight increase in the SAPS model. We also established that in the EU27 UAA fell by 1.9% between 2003 and 2010.

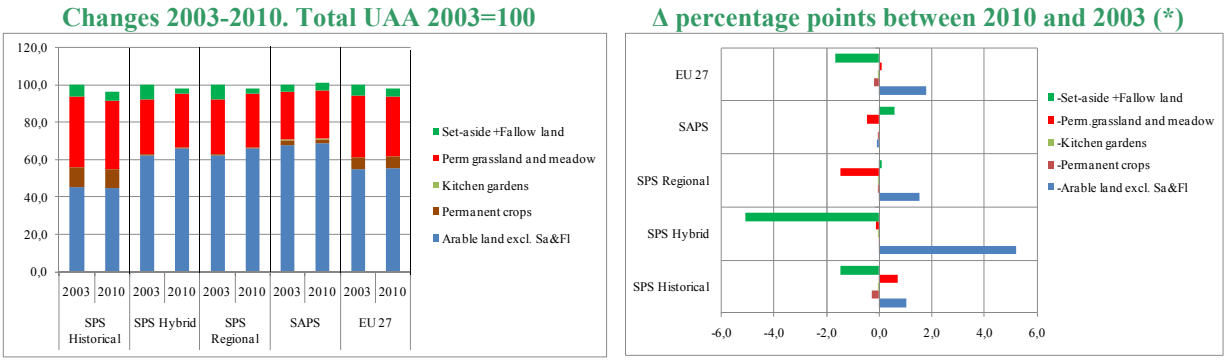
In light of these trends, we now move on to ascertain whether and to what extent the use of land for different crop classes has undergone variations over the same period. To this end we based the analysis on 5 classes: i) Arable land excluding Set-aside areas under incentive schemes and Fallow land; ii) Permanent crops; iii) Kitchen gardens; iv) Permanent grassland and meadow; v) Set-aside areas under incentive schemes and Fallow land.

It should be remembered that aid for Set-aside[104] was temporarily suspended during the 2007/08 season, and was definitively stopped in 2009 following decisions taken within the Health Check (accordingly, in 2010 set-aside no longer appears in land use statistics). As a result, farmers have been able to decide on the use of such land: for farming activity and/or not to use it (in any case respecting cross-compliance). In order to have at our disposal observations that are as homogeneous as possible along the examined period, we put Set-aside areas under incentive schemes and Fallow land areas into a single class.

With regard to regions grouped by SFP model, we first observe a rather uneven distribution of land use. In 2003, arable land (excluding set-aside and fallow land) represented the biggest use of land in all models, with a maximum for the SAPS model (67.8% of total UAA) and a minimum for the Historical model (45.3%). Permanent grassland and meadow land was in second place, here with a maximum for the Historical model (37.3%) and a minimum for SAPS (25.6%). Land used for permanent crops was significant only for Historical model (10.8%), and to a very limited or negligible extent for other models. Finally, Kitchen gardens occupied a very marginal surface area for all models (0.5% at most, for SAPS).

Between 2003 and 2005 relative variations (i.e. without taking into account absolute variations in UAA in the period under review) in land use appear to be quite modest in all models (below 2 points), with the significant exception of the Hybrid model, where shifts in the relative weight of different crops exceed 4 points.

Fig. 42 – Changes in UAA used for different crop classes, 2003-2010 (Total UAA 2003=100) and variations in percentage weights of crop classes (percentage point differences 2010/2003: Total UAA 2003 = 100; total UAA 2010 = 100)



(*) the sum of the differences is zero

Source: Elaborations based on data from Eurostat

[104] It is recalled that compulsory Set-aside was applied to the extent of 10% of UAA in arable land (with exceptions in some seasons).

It is in any case observed that variations are almost non-existent in Kitchen gardens and Permanent crops.

For other uses, growth in the relative weight of Arable land is observed at EU27 level, attributable almost exclusively to the recovery of UAA that was not previously not used for production (Set-aside + Fallow land). This change appears to be significantly larger in regions implementing the Hybrid model. An opposite trend (albeit limited) was observed for SAPS (slight rise in Set-aside and Fallow land, with a parallel decline for Permanent grassland and meadows and Arable land).

In short, the change in Set-aside policy appears to have played the most important role in land use changes. Set-aside land has mostly been used for its original purpose, and only in some cases it is used as fallow land. An exception is the SAPS model, for which the growth in the percentage of fallow land out of total UAA went against the general trend observed in other SFP models.

Results at a more aggregate level conceal more complex situations in single regions. For each SFP implementation model and for the EU27 as a whole, the table below shows the number of regions in which different crop classes have increased their relative weight between 2003 and 2010.

Tab. 18 - Regions in which % of land use for different farming types rose between 2003 and 2010, by SFP model and total EU27 (% of all regions)

		Arable land excl. SA&FL	Kitchen gardens	Permanent crops	Perm. grassland & meadow	Set-aside +Fallow land
SpS Historical	Total regions	27	24	27	27	27
	Increased	17	2	15	12	9
	% Incr/ Total	63.0	8.3	55.6	44.4	33.3
SPS Hybrid	Total regions	10	5	10	10	10
	Increased	8	0	4	6	1
	% Incr/ Total	80.0	0.0	40.0	60.0	10.0
SPS Regio + SAPS	Total regions	18	17	18	17	18
	Increased	7	8	7	11	11
	% Incr/ Total	38.9	47.1	38.9	64.7	61.1
EU 27	Total regions	55	46	55	54	55
	Increased	32	10	26	29	21
	% Incr/ Total	58.2	21.7	47.3	53.7	38.2

Source: Elaborations based on data from Eurostat

It can be seen, for instance, that:

- although in the SAPS and Regional models the share of Set-aside + Fallow land has grown, this only applies to 61% of regions. On the other hand, in the Historical model where an overall decrease was observed, the relative weight of Set-aside and fallow land actually rose in 33% of regions, in particular in most southern regions (all 5 Spanish regions, both Greek regions and two Italian regions).
- similarly, although in the Historical model the relative share of Arable land has grown, the increase only applies to 63% of regions. In this case too, southern regions oppose the general trend: the share fell in three Spanish regions, three Italian regions and two Greek regions. Furthermore, again in the Historical model, the relative area increase in Permanent grassland and meadows applies to 44% of regions, mainly in the South.

It may thus be inferred that in the Historical model southern regions, crops farmed in arable lands have lost their appeal between 2003 and 2010 (probably as a result of the introduction of the reform[105]), and part of the areas previously used for this type of crops has been transformed into Permanent grassland and meadow and/or has not been farmed any longer.

It is worthy of note the fact that the same phenomenon occurs in the two Mediterranean regions of EU12 (Malta and Cyprus), and also (in the SAPS model and presumably for different reasons) in the two Polish regions, in two of the four Romanian regions and one of the two Hungarian regions.

[105] It is recalled that Italy and Greece opted for decoupling of support to arable crops (in 2005 for the former and 2006 for the latter), while Spain chose partial decoupling (75%) of arable crops aid (2006). Moreover in 2006 the Sugar CMO is reformed: in the southern regions, durum wheat and sugar beet land has been significantly reduced.

With regard to crop classes for which variations have generally been small, an increase is observed:

- for Kitchen gardens, especially in regions implementing the SAPS (47%), and in particular in all four Romanian regions and two Polish regions;
- for Permanent crops, in a more widespread way, without particular concentrations in groups of regions clustered by policy model and/or geographic location.

6.5.2 Trends towards extensification

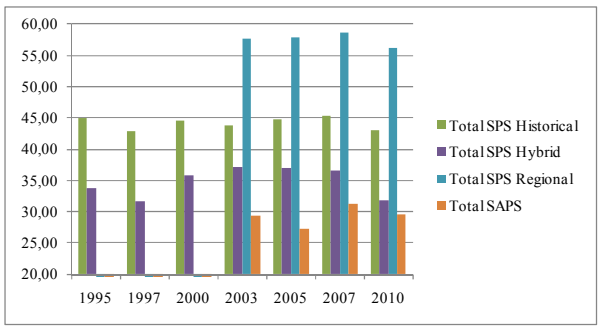
In light of the changes occurred between 2003 and 2010 concerning land use, we now seek to ascertain whether and to what extent the agricultural systems in individual regions and region groupings by SFP model have been oriented towards intensification rather than extensification.

To this end, the extensification index adopted here measures the percentage of utilised agricultural area used for non-farming activity (Permanent grassland and meadow) and/or unfarmed due to regulations (set-aside areas under incentive schemes) or farmers' choice (fallow land and voluntary set-aside):

*EI = (UAA in Permanent grassland and meadow+ Set-aside areas under incentive schemes + Fallow land and voluntary set-aside) / (total UAA)*100*

The graphs below show the index trend across SFP implementation models.

Fig. 43 – Extensification Index (EI) trends by SFP model



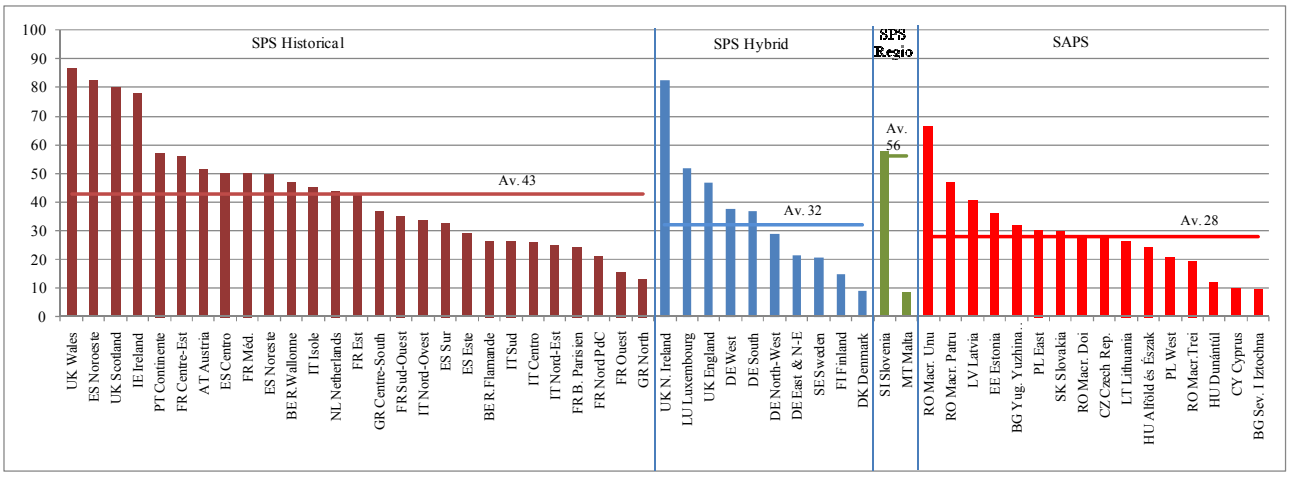
Source: Elaborations based on data from Eurostat

With regard to the magnitude of the indicator, there are some significant differences among SFP models: for instance, the EI for Regional model (56%) is about double the index of SAPS (29%).

With regard to trends - leaving on the side the decrease registered in 1997 in the two EU15 models (Historical and Hybrid), a slight growth can be seen up to 2007. Between 2007 and 2010 the extensification index trend is reversed for all models, in coincidence with the abolition of Set-aside aid. The fall in the EI is quite large for Hybrid model (-4.8 points) and smaller for SAPS (-1.8 points)

In this case too, aggregate results are the sum of initial situations and trends that differ at the Regional level. It should firstly be noted that the indicator shows high variability among regions within each model. With reference to 2010, the indicator ranged from a maximum of over 80% in three UK regions and in Spain Noroeste, to a minimum of below 10% in Denmark, Malta, Cyprus and one Bulgarian region.

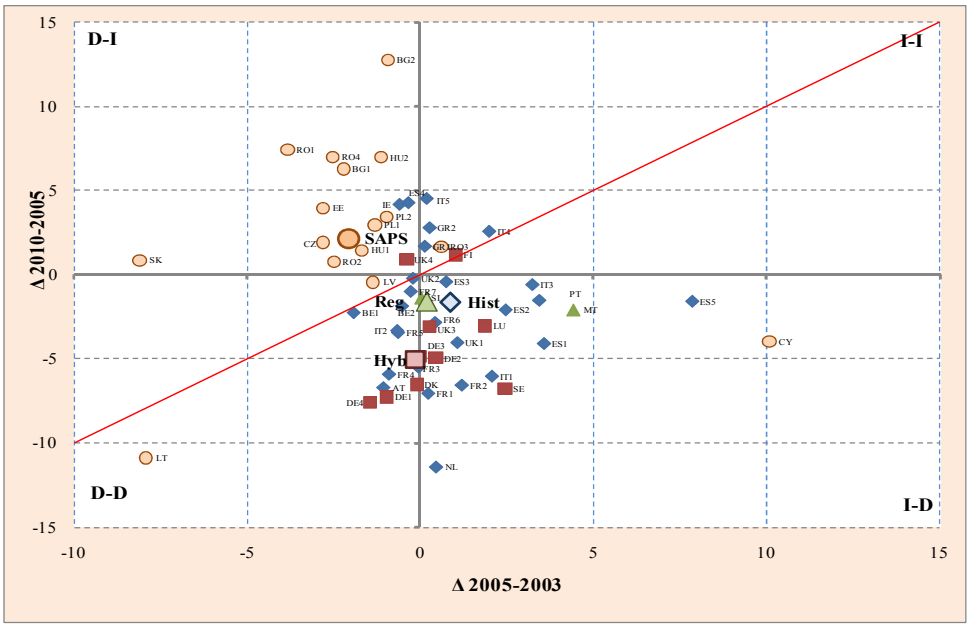
Fig. 44 – Extensification index in the EU regions (2010, %)



Source: Elaborations based on data from Eurostat

In view of this final structural situation registered in 2010, we sought to ascertain the extent to which the change in policy contributed to speeding up or slowing down the evolution. The chart below shows the difference between extensification indices in the periods 2003-05 and 2005-10[106] by region.

Fig. 45 – Difference between extensification indices for the periods 2003-2005 and 2005-2010 (point difference) by SFP model



Source: Elaborations based on data from Eurostat

With regard to the Historical and Hybrid models, for most regions the degree of extensification fell, either through the acceleration of an ongoing downward trend prior to the reform or through a reverse in trend (from positive to negative). There are few regions for which the indicator is rising (two Italian regions and the two Greek regions for the Historical model; Finland for the Hybrid model). The four French regions, Italy Nord Occidentale, Austria and above all the Netherlands are the regions that have recorded the biggest reductions in the degree of extensification within the Historical model after the reform. The same is observed in the German regions and Denmark in the Hybrid model.

Regions implementing the SAPS show an overall opposite trend compared to the other models: after 2005 most regions reverse their previously negative trend, with the extensification index rising

[106] A complete dataset on regions implementing SAPS is available only from 2003.

considerably. It is important to note that in Member States implementing SAPS, the set-aside requirement has never been applied.

6.5.3 Changes in livestock types

In chapters 6.4.6 and 6.4.6.1 we have analysed the evolution of holdings with livestock and changes in the average size of livestock.

Here we analyse the evolution of the size of herds, expressed in LSU, total and according to species. In this regard, the available Eurostat data report (for each region), the number of animals of each species, total LSU, but not the number of LSU for each species.

Thus we had to estimate the number of LSU for each species, based on the application of appropriate coefficients to the number of livestock heads. We know that herds consist of different types of animals of different age, sex and size, to which different LSU coefficients are assigned[107]. Furthermore, within each type, the proportion between animals of larger size and smaller size varies depending on the MS, according to traditional production and / or consumption[108] and different usage function of the product[109]. For this reason, we have chosen to perform the analysis only at the aggregate level of SFP implementation model within the EU27.

We have used the following average coefficients, developed taking into account as much as possible the combination of livestock characteristics (age, sex, size, etc.). All this, being well aware that the complexity of the mix of characteristics in itself represents a limit of the analysis and the results should be interpreted with some caution[110].

Tab. 19 - Average coefficients used to estimate the number of livestock heads

	Average LSU/heads
Equidae	0.75
Cattle	0.75
Sheep	0.15
Goats	0.15
Pigs	0.27
Poultry (1000 heads)	7
Rabbits (breeding females)	0.025
Beehives	0.15

Source: Elaborations based on EUROSTAT Glossary - LSU

The results of the estimates for 2003 and 2010 are shown in the figures below. The results show the following evidence:

- The first is the different composition of total LSU in the different models (in 2003): biased towards granivores (Pigs & Poultry) in SAPS and towards herbivores (Cattle, Ships & Goats) in other models.
- The second is the overall reduction, between 2003 and 2010, of total LSU in EU27 (-4.9%) resulting from a decrease common to all SFP models, although to differing extents (from a minimum of -1.4% in SPS Historical to a maximum of -15.8% in SAPS).

[107] For example, in the Cattle group, bulls and 3-year old cows correspond to 1 LSU, whereas the LSU coefficient for calves is 0.4.

[108] For example, concerning sheep categories: in the UK production is focalised on heavy lambs; in Italy is focalised lighter weight lambs.

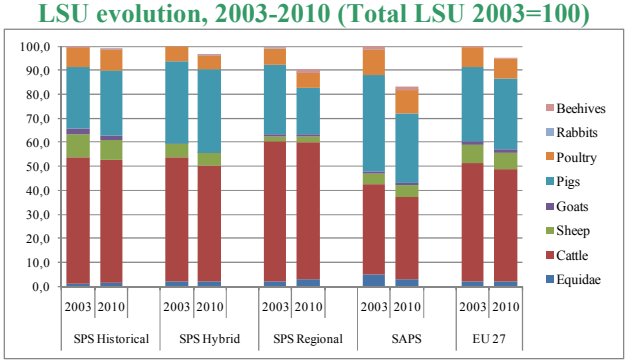
[109] For example, in the Pigs category, heavy animals used for the production of hams compared to lighter animals intended for the production / consumption of fresh meat.

[110] However, in relation to the total number of LSU reported by Eurostat, the application of these coefficients has led to a slight overestimation of LSU calculated for the SPS Hybrid model (about 1%) and SPS Regional (about 1 %), and an underestimation in SAPS (-4%) and for EU27 as a whole (about -1%). LSU estimates for SPS Historical coincide almost perfectly with Eurostat data.

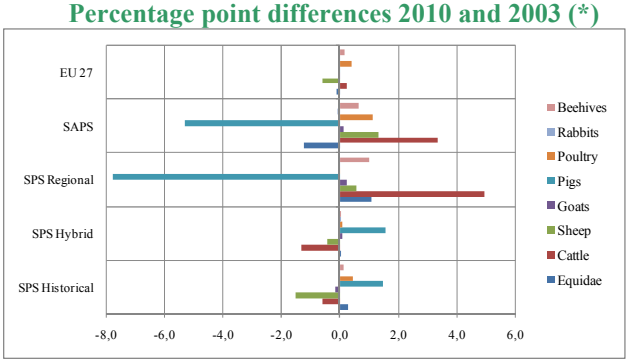
- At the EU27 level, the number of LSU of all types of animals show a decrease, with the sole exception of Beehives. In absolute terms, the largest reduction in 2010 LSU composition regards Cattle (-2.1 % points) and Pigs (-1.47 % points). The smallest decrease concerns Poultry and Rabbits (few tenths of one % point only);
- Cattle are the only type of animals whose share on total LSU decreases in all models (from -1.04 % points in SPS Regional to -3.5 points in SAPS);
- Pigs are the type of animals whose share over total LSU shows the highest growth in SPS Historical (+1.23 points) and SPS Hybrid (+0.22 points), accompanied by a remarkable decrease in SPS Regional (-9.8 points) and especially in SAPS (-11.0 points). Therefore, the results show opposite trends in EU15 and in EU12.
- Conversely, Sheep show an increase in SPS Regional (0.31 points) and in SAPS (0.41 points), but a decrease in the Historical (-1.59) and Hybrid (0.62) models. Here too, therefore, EU15 and EU12 show opposite trends.

Fig. 46 – Evolution 2003-2010 of total and different species LSU, 2003-2010 (Total LSU 2003 = 100) and percentage changes of LSU of different species (percentage points differences 2010/2003: Total LSU 2003 = 100; Total LSU 2010 = 100)

LSU evolution, 2003-2010 (Total LSU 2003=100)



Percentage point differences 2010 and 2003 (*)



(*) the algebraic sum of differences =0

Source: estimates based on Eurostat data

The sharp contrast between EU15 on one side and EU12 on the other (% relative increase of the % share of PIGS LSU and decrease Sheep and Cattle LSU in EU15, and *vice versa* in EU12) is shown more clearly in the second of the two graphs, where the LSU composition of the different types is calculated as a percentage of total LSU respectively in 2003 and 2010 (thus, net of the decrease in total LSU between the two years).

Furthermore, the decrease (in both absolute and relative terms) of herbivores in Hystorical and Hybrid models does not seem unrelated to the role played by the decoupling of direct aid per head for different types animals of these species[111]. On the other hand, the relative increase of herbivores in SAPS (not subject to specific direct aid/head) and the simultaneous reduction of Pigs seem to be more likely related to product (meat) and production factors (cereals) market changes (cereals)[112].

It is observed, however, that these contrasting changes lead (in 2010) towards a better balance between the different types of LSU, correcting imbalances existing in 2003 in both EU15 and EU12.

At the regional level, a more differentiated picture emerges. The table below shows, for each SFP model and for the whole EU-27, the number of regions (and percentage share over total regions) where different types of animals have increased their relative share over total LSU between 2003 and 2010.

[111] Suckler cow premium, slaughter premium, special premium for bovine males. Premium to Sheep & Goats.

[112] For more details please refer to : i) Evaluation of market effects of partial decoupling – Agrosynergie, October 2010 ; ii) Evaluation of direct aid in the beef and veal sector – AND International, October 2010; iii) Evaluation of CAP measures for the sheep and goat sector – AND International, November 2011.

Tab. 20 - Regions where LSU of different species and total LSU have increased between 2003 and 2010, by SFP model and for EU27 (% of total regions)

		Equidae	Cattle	Sheep	Goats	Pigs	Poultry	Rabbits	Beehives	T.LSU
SpS Historical	Total regions	27	27	27	27	27	27	23	23	27
	Increased	21	8	4	15	12	7	13	13	8
	% Incr/ Total	77.8	29.6	14.8	55.6	44.4	25.9	56.5	56.5	29.6
SPS Hybrid	Total regions	10	10	10	9	10	10	2	2	10
	Increased	7	1	3	7	3	1	2	2	2
	% Incr/ Total	70.0	10.0	30.0	77.8	30.0	10.0	100.0	100.0	20.0
SPS Regio + SAPS	Total regions	18	18	18	18	18	18	18	18	18
	Increased	8	4	12	9	1	0	11	11	2
	% Incr/ Total	44.4	22.2	66.7	50.0	5.6	0.0	61.1	61.1	11.1
EU 27	Total regions	55	55	55	54	55	55	43	43	55
	Increased	36	13	19	31	16	8	26	26	12
	% Incr/ Total	65.5	23.6	34.5	57.4	29.1	14.5	60.5	60.5	21.8

Source: estimates based on Eurostat data

6.6 Analysis of the changes in the structure of the management

This part of the work seeks to gauge whether and to what extent the changes that have affected agricultural holdings following the change in policy (with special reference to direct support) have had a bearing on their management structure. To this end, we have examined two specific aspects: the first concerning the legal status of holdings; the second regarding the types of organisational form adopted by holdings. For this analysis we examined the 2003-2010 period.

6.6.1 Changes in the number of farms by legal status

FSS data makes it possible to group together holdings into two legal status categories:

- Single holder holding
- Legal entity or group holding

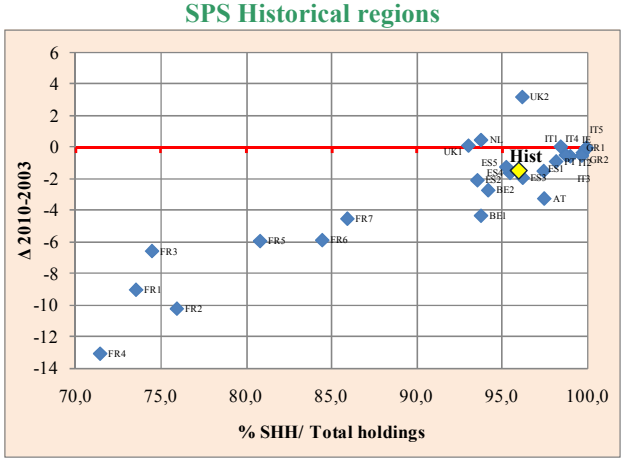
With just two mutually exclusive groups (holdings belong to either the first or second category), it is possible to evaluate changes occurring in the period under examination by using an indicator that represents the evolution of relations (in percentage terms) between one of the two categories and total holdings. We have chosen the % ratio *Single holder holding / No. total holdings* and its change between 2003 and 2010. The indicator represents the % share of Single holder holdings (SHH) out of total holdings, with the difference to 100 representing the share of Legal entities or group holdings.

The diagrams below show:

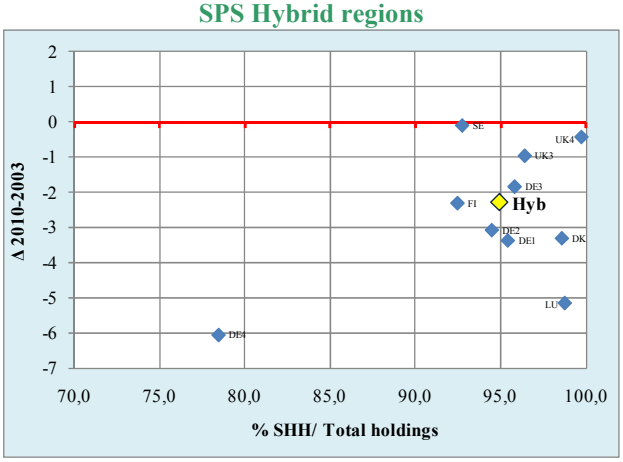
- on the x-axis, the level (%) of the existing ratio in regions (and in each group of regions according to SFP implementation model) in 2003
- on the y-axis, the difference between the value of the ratio in 2003 and in 2010

Fig. 47 – Percentage ratio of Single holder holdings/Total holdings in 2003 and 2010/2003 ratio difference, by region and SFP model

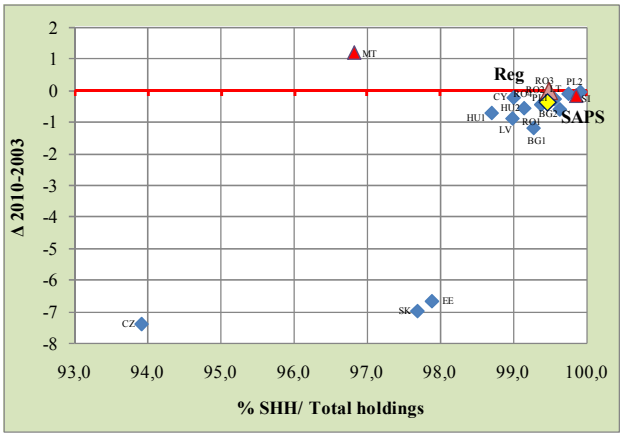
SPS Historical regions



SPS Hybrid regions



SPS Regional and SAPS regions



Source: Elaborations based on data from Eurostat

The results of the analysis highlight the following:

- In almost all regions of all models, Single holder holding is the most common legal status: in 47 regions of the 55 studied (over 85% of the total), it was characteristic of at least 90% of holdings in 2003. Only the seven French regions (Historical model) and DE East & North-East (Hybrid model) had a percentage below 90%, but in any case this form was prevalent.
- Between 2003 and 2010 the value of the ratio decreased in 50 of the 55 regions analysed (9%), with the exception of IT Nord-Ovest, UK Scotland and Wales, the Netherlands (all in Historical model) and Malta (Regional model).
- Nevertheless, this reduction was extremely small in regions implementing the SAPS (with the exception of Czech Republic, Slovakia and Estonia) and Slovenia (Regional model), and relatively small in all other regions, with the significant exception of the seven French regions and DE East & North-East. Therefore, these eight regions, which already had the lowest share of sole holder holdings, significantly increased the shares of Legal entities or group holdings.
- Overall, in 2010 the Single holder holding was used by at least 90% of holdings in 45 regions out of the 55 analysed (82%).

It may thus be concluded that the structural changes analysed in previous chapters did not have an effect on the legal status of holdings. The very small rise in the Legal entity / group holding form does not appear to be correlated with trends concerning holding concentration, even in regions where growth has been strongest. Accordingly, other reasons for such evolution are to be found.

6.6.2 Changes concerning the type of organizational form

Census data and structural surveys group holdings into three Types of Organisational Form (TOF):

- Farming by owner
- Farming by tenant
- Shared farming or other modes

The analysis of TOF trends has been conducted in relation to the number of holdings adopting a certain form and the corresponding interested agricultural areas.

6.6.2.1 Evolution of holdings by Type of Organisational Form

In this case, the three Types of Organisational Form are not mutually exclusive, since each holding may use more than one form at the same time. It follows that the sum of the number of holdings surveyed in the three Types of Organisational Form is greater than the total number of holdings (the sum of percentages is therefore greater than 100% of total holdings).

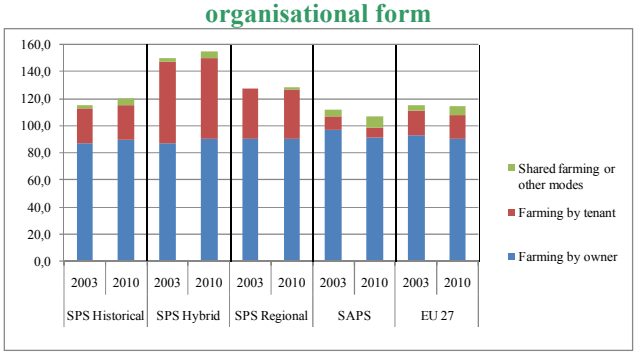
This fact is highlighted in the first of the two graphs below, where the sum of holdings is a little above 110% for SAPS and over 150% for the Hybrid model.

It is observed that:

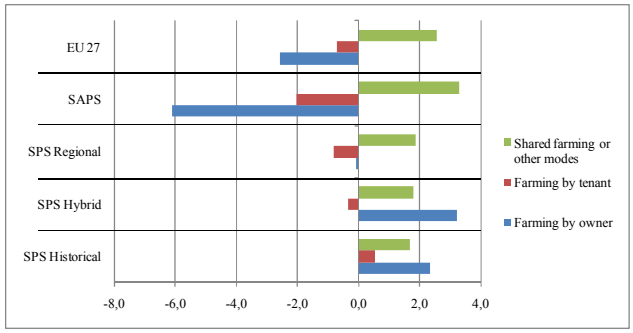
- Farming by owner is the most common Type of Organisational Form in all SFP models, with a maximum of over 97% for SAPS and a minimum of 87% for Hybrid model in 2003.
- Farming by tenant is less common and diverse across the examined groups: it applies to a maximum percentage of farms for the Hybrid model (about 60%) and a minimum percentage for SAPS (about 10%).
- Shared farming or other modes[113] are the least common organisational form, applying (again in 2003) to only 5% of holdings for SAPS (and no holding at all for the Regional model).

Fig. 48 – Changes in share of holdings by TOF, 2003-2010 (total holdings 2003=100%; 2010=100%) and difference between 2010 and 2003 percentage shares (% points)

Changes 2003-2010 % holdings by type of organisational form



Δ percentage points between 2010 and 2003 (*)



Source: Elaborations based on data from Eurostat

Between 2003 and 2010 changes with respect to the three types of organisational forms showed some trends common to all implementation models, and others that differ.

- In all SFP models there was a growth in Shared farming or other modes, to a greater extent for SAPS (for which the percentage of holdings almost doubled) and the Regional model, for which this organisational form is used by about 2% of farms (0% in 2003);
- Farming by owner increased its already high share in both EU15 models (Historical and Hybrid models), whereas it significantly decreased in the SAPS model (especially in Poland, Czech Republic and Slovakia);
- Farming by tenant fell in all models except for Historical model. In the SAPS model the fall was larger (about 2 points), especially in Bulgaria.

It was also seen that Historical is the only model for which all three organisational forms grew in number.

Since, as we have seen, holdings may use more than one TOF, it is interesting to ascertain whether and to what extent there has been an increase (or a decline) during the period under study.

To this end we used the indicator *Σ Type of Organisational Form / Total no. holdings*. This represents the average number of TOFs per holding; if the value of this indicator rises, there is a greater diversification of TOF. If on the other hand it falls, there is a greater concentration in one particular TOF.

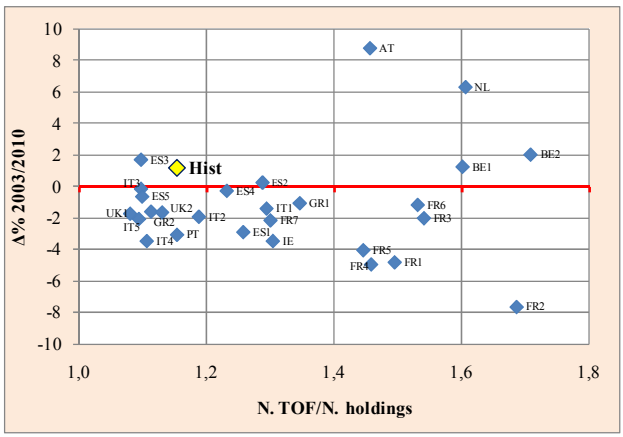
This analysis was conducted by region and by SFP implementation model, again between 2003 and 2010.

[113] As defined in Regulation EC No 1200/2009, share farming or other modes: "(a) Share-farmed agricultural area is the utilised agricultural area (which may constitute a complete holding) farmed in partnership by the landlord and the sharecropper under a written or oral share-farming contract. The output (either economic or physical) of the share cropped area is shared between the two parties on an agreed basis. (b) Utilised agricultural area used under other modes of tenure is the utilised agricultural area not covered elsewhere under the previous items"

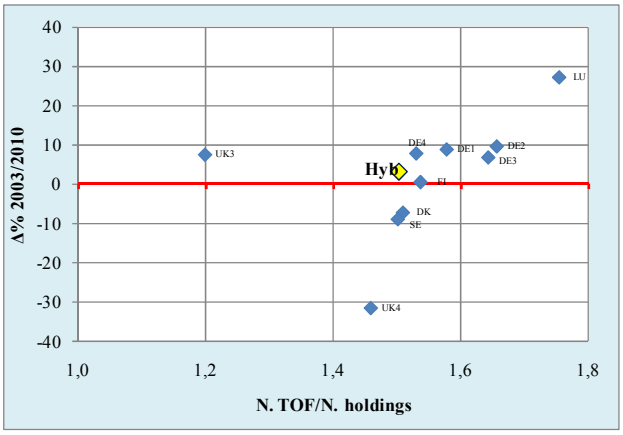
The diagrams below show, on the x-axis, the value of the indicator for each region studied (and the average by SFP model) in 2003. On the y-axis is the percentage variation between the values of the indicator in 2010 and 2003.

Fig. 49 – Ratio of Σ TOF and Total no. holdings in 2003 and % variation 2010/03 by region, and average by SFP model

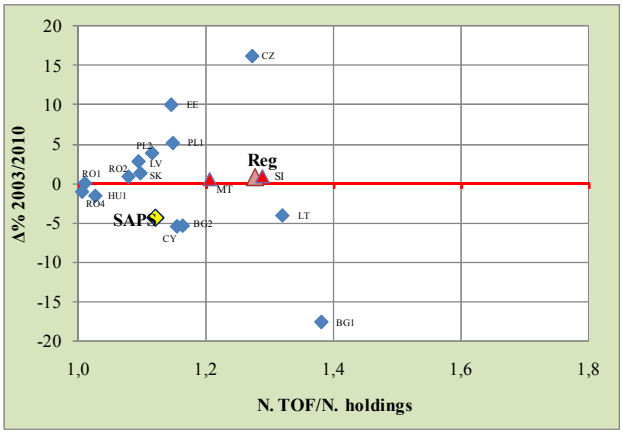
SPS Historical regions



SPS Hybrid regions



SPS Regional and SAPS regions



Source: Elaborations based on data from Eurostat

It can be concluded from the analysis results that:

- the Hybrid model had and maintains the highest indicator value (about 1.5 TOF on average per holding), while the SAPS model has the lowest value (about 1.1). Accordingly, for the SAPS model, organisational forms are on average mutually exclusive (and vice versa for Hybrid model). For all models, (average) variations between 2003 and 2010 were modest: positive (around 3-4%) for Historical and Hybrid models, and negative for SAPS and for Regional models (respectively around -4% and -1%);
- within individual models, the regional situations are quite diverse, both in relation to the 2003 value of the indicator and to the subsequent variations over the period. In each SFP model, there appears to be a direct relationship between the size of the indicator in 2003 and the degree of variation (positive or negative) between 2003 and 2010. With regard to trends:
  - for the Historical model, in 21/27 regions the indicator decreased (pointing therefore to a strategy aimed at reducing the number of TOF). Only in the Netherlands, Austria and the two Belgian regions the indicator significantly increased, despite being already high in 2003;
  - on the other hand, the value rose in 7/10 regions of the Hybrid model. The exceptions were Denmark, Sweden and, above all, UK-Northern Ireland;
  - similarly, in SAPS and Regional models the indicator rose for 12/18 regions. In this case there was a significant rise in the Czech Republic (+16.2%) and a large decline in BG Severna I Iztochna (17.6%).

In conclusion, the analysis of changes in the organisational forms adopted by holdings (affecting in a similar way the regions in all SFP models) does not point to particularly close links between observed trends and the ways in which the direct aid system has been implemented). It is more likely that the levels of this indicator and its variations are more closely related to characteristics and/or benefits of a local/national nature[114].

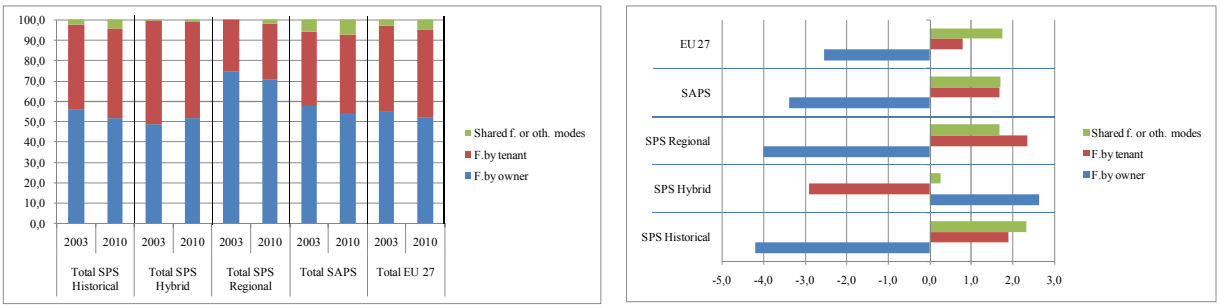
6.6.2.2 Evolution of agricultural area by holdings' organisational form

In addition to changes in holdings, we believed it would be of interest to develop the analysis of agricultural areas related to different types of organisational forms. In this case, there is no problem of duplication (i.e. each hectare is subject to only one TOF)[115]. The first of the two graphs below provides an overall picture of the distribution of hectares (in 2003 and 2010) by type of organisational form.

Compared with the distribution of the number of holdings, the distribution of UAA is much more balanced. For the EU27 as a whole, in 2003 the area farmed by the owner was just over 55% of total UAA (max 74% in the Regional model; min 49% in Hybrid), whereas the UAA farmed by tenant exceeded 42% (max 50.5% in the Hybrid model; min 26% in Regional model). Finally, UAA for Shared farming or other modes was a little less than 3% (max 5.7% in SAPS; min 0% in Regional model)[116].

Fig. 50 – Changes of UAA by TOF, 2003-2010 (total UAA 2003=100%; 2010=100%) and difference between 2010 and 2003 percentage shares (% points)

Changes 2003-2010 % UAA by TOF | **Δ percentage points between 2010 and 2003 (*)**



(*) the sum of the differences is zero

Source: Elaborations based on data from Eurostat

Between 2003 and 2010, changes of UAA for each TOF were quite even across all SFP models (albeit with different trends and basically within a range of -4 points - +2.7 points), except for the Hybrid model. The rising share of Shared farming or other modes and of Farming by tenant is balanced by a parallel decline in the share of Farming by owner (significantly higher in the Historical model, reducing from 56% to about 51%).

As already noted, regions of the Hybrid model appear to move in the opposite direction, with a decline in Farming by tenant and an increase in Farming by owner. Nevertheless, this evolution is almost

[114] Such as, for instance, different fiscal policies applied to enterprises/individual entrepreneurs; different rules concerning land lease contracts; regulations governing the real estate market, etc.

[115] In this case the sum of percentages of all three TOF is thus 100%

[116] Furthermore, the analysis show that, as always, within the various models there is great variability among regions. For instance (with reference to 2010), in the SPS Historical model the incidence of UAA under Farming by owner was less than 20% in four of the six French regions, and a little less than 90% in UK Wales; in the SPS Hybrid model it ranged from a minimum of 25% in DE East & North-East to a maximum of 100% in UK N. Ireland; for SAPS it was between 12% in Slovakia and 79% in PL East. In the same way, Shared farming or other modes reached in the SPS Historical model a maximum share in Netherlands (14%) but was zero in UK Wales. For SPS Hybrid, a maximum in DE West (2.8%) and zero in all northern regions. For SAPS a maximum in two Romanian regions (MR Doi and Trei) and zero in Czech Rep., Slovakia and the two Bulgarian regions.

exclusively the result of trends in the DE East & North-East (former DDR) region, where the land privatisation process has continued at a rapid pace also in recent years[117].

The joint analysis of TOF trends concerning the number of holdings and UAA leads us to consider that Farming by owner is the most common form of farming among small size holdings (many in number, but with quite small UAA - see Lorenz curves in 6.4.7.1).

On the other hand, the other two forms, in particular Farming by tenant, are more characteristic (in most cases) of larger-sized holdings[118] (which use both their own land and leased land). The analysis of structural changes between 2003 and 2010 (large fall in number of small-sized farms and increase in larger holdings, accompanied by a limited decline in UAA) leads us to believe that, in the main, the agricultural area freed up by holdings that have left the sector has been taken up by larger size farms predominantly through land lease agreements (not purchases).

It seems thus possible to conclude that trends concerning farm concentration have to some extent had an influence on changes related to the organisational form of holdings.

6.7 Analysis of the role of direct payments in farm structure changes

This part of the analysis consists of assessing whether regions have changed their farm structural profile between 2005 and 2010 and, subsequently, whether direct payments have had an effect on such changes. In this case, "farm structure" is seen as a latent variable(s) expressed as a combination of structural characteristics (size, specialisation, holder's characteristics, type of tenure, labour used, other gainful activities).

The overall structure of the analysis comprises three subsequent stages:

1. Factor analysis[119], aimed at identifying a finite number of farm structural profiles
2. Cluster analysis, aimed at classifying EU regions into homogenous groups according to their farm structural profile, in 2005 and 2010
3. Construction of transition matrices and econometric modelling, to estimate whether direct payments have had an effect on such changes.

6.7.1 Factor Analysis

As described in the methodological section (§ 5.1.2.1), the factor analysis is developed on two years balanced panel dataset (2005 and 2010) of indicators describing the characteristics of farm structure in the different European regions. The sample consists of 430 observations, 215 European regions in 25 Member States for both 2005 and 2010.

Ultimately, Factor Component Analysis (FCA) on panel data produces, for each identified factor, a factor score associated to each EU region in the two years, on the basis of the same factor loadings. As explained (§ 5.1.2.1), if factor loadings are the same for both years, the differences between factor scores (2005 and 2010), represent the occurred changes.

The analysis, based on a correlation matrix, shows that the first three factors, explaining 80% of the total variance of the sample, can be considered as a good multivariate representation of the phenomena actually described by the 23 variables selected from the original 39[120]. In particular, the first factor is

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[117] In this macro-region, UAA under Farming by owner was 465,000 ha in 1995 (8% of total UAA); 774,000 ha in 2003 (14%) and 1,372,000 ha in 2010 (24.7%)

[118] In addition, the analysis show that, in most regions, the high % of UAA under Farming by owner appears to be inversely proportional to the average holding size. Nevertheless, this is not quite true, for instance, in UK regions. Clearly, history and tradition play a role in the structure of holdings and real estate relations at a local level.

[119] Factor analysis is a multivariate statistical technique that allows to obtain a reduction of the number of variables that explain a phenomenon. Thus, it aims to identify a smaller number of latent variables ("factors") that synthesize the original variables.

[120] The selection procedure of the variables (from the original 39 to the current 23 variables) has followed the criterion of uniqueness, according to which variables showing high value of the variance that is unique to the variable and not shared with others can be excluded.

able to explain 48% of the total variance, while the second and the third factors explain, respectively, 18% and 14% (Tab. 21).

Tab. 21 - Eigenvalues and total variance explained by the three principal factors

Factor analysis/correlation			Number of obs. = 430	
Method: principal factors			Retained factors = 3	
Rotation: (unrotated)				
Factor	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Factor1	8.46	5.31	0.48	0.48
Factor2	3.15	0.78	0.18	0.66
Factor3	2.37	1.32	0.14	0.80

The factor loadings matrix shows the correlation between factors and variables. This matrix allows to draw a profile for each factor and consequently to assign them a specific identity. The number of factors to be extracted is determined according to the Kaiser criterion, which suggests to retain factors whose eigenvalue is equal or higher than 1. This denotes that each factor explains at least the variance of one variable. Following this criterion, three factors are retained.

The pattern matrix reported below shows only values of factor loadings higher than 0.4 (0.30 for Factor 3), highlighting the stronger relationships between variables and factors so as to facilitate the interpretation of the factors. The Kaiser-Meyer-Olkin estimation gives the value of 0.80, which allows to consider as good the sampling adequacy of the model.

Tab. 22 - Factor loadings (pattern matrix) Panel Data 2005 and 2010

Factor loadings – Correlation Thresholds	**0.4**	**0.4**	**0.3**
Variable	**Factor1**	**Factor2**	**Factor3**
Holdings with livestock/Total	0.55		
Average farm size in UAA	0.64		-0.60
Average farm size in standard output	0.72		-0.30
Holdings < 5 UAA/Total holdings	-0.91		
Holdings 20-30 UAA/Total holdings	0.73		0.37
Holdings 30-50 UAA/Total holdings	0.82		0.33
Holdings > 50 UAA/Total holdings	0.78		
Owner (as opposite to Tenant)[121]/Total	-0.45		0.44
Labour force per UAA	-0.57		
Labour force per holding	0.59		-0.56
Family labour force (as opposite to hired[122])/Total labour force	-0.48		0.70
Hired no regular workers/Labour force			
Holders < 35 years/Total holders		0.86	
Holders 35-44 years/Total holders	0.43	0.72	0.30
Holders 45-54 years/Total holders	0.60	0.58	
Holders over64 years/Total holders	-0.61	-0.72	
Holders female (as opposite to male) /Total holders	-0.70		
Work time 0-50 % (part time)/Total holders	-0.77		

[121] Because of redundancy of information, "tenant" is not explicitly included into the model, but it has to be considered when interpreting the type of tenure (def. Eurostat).

[122] The variable "hired labour" is built as complement to "family labour". Due to redundancy, it is not explicitly included into the model, but it has to be considered when interpreting results associated to the family labour force variable.

Factor loadings – Correlation Thresholds	0.4	0.4	0.3
Variable	**Factor1**	**Factor2**	**Factor3**
Work time 100% (full time)/Total holders	0.78		
GDP per capita 2009	0.44	-0.46	0.34
GDP pc growth rate 2005-2009		0.45	
Unemployment rate			
Holdings with other gainful activity/Total	0.63		
Kaiser-Meyer-Olkin measure of sampling adequacy		**0.8**	

6.7.1.1 Factors interpretation and definition

The interpretation of FCA results is based on the factor loading values, which represent the correlation between each variable and the factors. Positive factor loadings describe direct relationships and, vice versa, negative loading values describe an inverse relationship with a factor. The variables showing higher loadings (values over the thresholds shown in the previous tables) are those that allow to draw the profile of each factor. The further step in the process of interpretation is to assign a name to the new multidimensional variables.

Factor 1 - Structural and organisational profile

The first factor explains 48% of the total variance in the sample and can be considered as a strong representation of the main structural and organisational aspects of the farm system. On the positive side of the axis, Factor 1 is characterized by medium-to-very large size farms, full-time holders, professional farms (due to high values of economic and physical farm size) and holdings not strictly oriented to agricultural activities but open to other market opportunities (other gainful activities - OGA). The negative side of the axis describes small size farms managed by older and part-time holders.

According to its characterisation, the first factor seems to identify a core "Structural and organisational profile".

Factor 1 - Structural and organisational profile

Positive Axis	Negative Axis
From Large & Professional Farm	**To Small & Semi-subsistence Farm**
Medium-Large-Very Large size farm Full Time holder Professional farm Other Gainful Activities	Small size farm Part Time holder Old Holder

Factor 2 - Age and economic context

The second factor explains 18% of the total variance. We observe that in this case, only variables related to age of the holder and economic context present high factor loadings. The positive side of the axis clearly describes farms with young to middle age holders operating in dynamic transition economies. On the opposite side there are holdings located in developed economic contexts and managed by old holders. Factor 2 can therefore be identified in relation to "*Age and economic context*".

Factor 2 – Age and economic context

Positive Axis	Negative Axis
From Young Farmers & Dynamic regions	**To Old Farmers & Stable regions**
Young to Middle Age Holder Economic context (Transition economies)	Old Holder Economic context (Developed economies)

Factor 3 –Production management system flexibility

The last factor explains 14% of the total variance and it is mainly related to two important structural characteristics, labour force and type of farm tenure. On the positive side of the axis, there are farms where the holder is also the farm owner and family labour force is employed. This side of the factor axis is also characterised by the presence of medium size farms operating in developed economic contexts. On the other side of the axis, Factor 3 is represented by farms where land is rented (tenant holder) and hired labour is employed.

According to these elements, the third new variable appears to describe the degree of flexibility of production factors and farm management systems. In other words, on the positive side, the factor represents a rigid production system based on fixed amount of land (due to land ownership) and fixed human resources (family labour force). Whilst, on the negative side, the factor embodies a more flexible production system, due to the choice of renting land and hiring labour force. For this reasons the third factor is defined as "Production management system flexibility".

Factor 3 –Production management system flexibility

Positive Axis	Negative Axis
From Constrained production factors (Land and Labour Force)	**To Flexible production factors (Land and Labour Force)**
Family Farm Owner Medium size Farm Economic context (Developed economies)	Hired Labour Force Tenant

Factor analysis allowed to identify in three new variables ("factors") the main structural properties of farms and to reduce the number of dimensions to be analysed.

These results paved the way for two different paths of analysis:

1. A first analysis considers all three factors (F1+F2+F3) and applies cluster analysis to identify homogeneous groups of EU regions relative to their farm structure profile, in 2005 and 2010. This allows to observe whether regions change their structural profile between the two years. Subsequently, econometric modelling is applied to test the effects of direct payments on such structural changes.

2. A second analysis replicates the same exercise on the first factor that explains a very high percentage of the total variance of the sample (48%).

6.7.2 Estimation of the effects of direct payments on changes of EU regions structural profiles (three extracted factors)

6.7.2.1 Cluster Analysis

Cluster analysis based on all three extracted factors (80% of total variance explained) adopting the Centroid Linkage Method (as described in the Methodology, see 5.1.2.1) allowed to identify 7 clusters of regions (k=7). The statistics associated to each cluster are presented in the table below[123].

[123] For the computational procedure, cluster analysis uses standardized value scores, so zero represents the sample mean.

Tab. 23 - Clusters of regions based on the first three factors, F1, F2, F3.

Cluster	Variable	Obs.	Mean	Std. Dev.	Min	Max
Cluster 1	F1	153	0,63	0,51	-0,80	1,96
	F2	153	0,35	0,49	-0,98	1,48
	F3	153	0,64	0,76	-1,21	2,06
Cluster 2	F1	82	0,60	0,28	-0,28	1,17
	F2	82	-1,27	0,40	-2,18	0,08
	F3	82	-0,13	0,51	-1,14	0,87
Cluster 3	F1	129	-1,19	0,41	-1,84	-0,01
	F2	129	-0,31	0,65	-2,10	0,92
	F3	129	-0,21	0,35	-1,25	0,69
Cluster 4	F1	32	-0,74	0,45	-1,61	0,07
	F2	32	1,89	0,32	1,02	2,36
	F3	32	0,55	0,34	-0,18	1,23
Cluster 5	F1	26	1,36	0,31	0,28	1,90
	F2	26	0,97	0,25	0,59	1,43
	F3	26	-2,37	0,51	-3,42	-1,48
Cluster 6	F1	1	1,60		1,60	1,60
	F2	1	0,01		0,01	0,01
	F3	1	-3,98		-3,98	-3,98
Cluster 7	F1	7	-0,84	0,39	-1,18	-0,21
	F2	7	0,81	0,31	0,16	1,01
	F3	7	-1,80	0,34	-2,28	-1,38
Total		**430**				

The first cluster contains the largest group of observations (153). It is characterized by positive values of all factors, with a stronger relevance of the first and third factors (1.96 and 2.06 max values, respectively). Regions belonging to this group show an agricultural model marked by professional farms with constrained production factors. This is the case of large farms, mainly managed by full time holders, based on family labour force and located mostly in developed economic context. The name associated to this class is “Rigid and professional farm”.

The second cluster counts 82 regions and is characterised by negative values for the second factor (-1.27 mean and -2.18 min value). The structural farm model related to this group of regions can be identified as “Old farmer in stable economic context”.

The third cluster groups 129 observations. They can be distinguished mainly for negative values of the first component (-1.19 mean and -1.84 min), which is characterized by the presence of small farms managed by aged and part time holders. On the basis of these features, the structural model emerging from this group can be defined as “Small and marginal farm”.

The fourth cluster includes 32 regions showing high positive values of the second factor (1.89 mean and 2.36 max). This points to a farm profile characterised by holdings with young holders operating in growing economic contexts. Therefore, regions belonging in this class can be distinguished by a “Young farmer and dynamic context” farm model.

The fifth cluster groups together 26 regions presenting negative values of the third factor and positive values of the first factor (-2.37 mean and 1.36 mean, respectively). The farm model in this case is based on the flexible use of production factors, on the large size and professional status. Indeed, the profile emerged can be defined as “Professional and flexible farm”.

The sixth cluster counts only one observation, which, according to its features, can be related to the previous farm model described.

The last cluster covers only 7 observations. In this case, structure appears to be characterised by negative terms of both first (-0.84 mean and -1.18 min) and third factor (-1.80 mean and -2.28 min). The regions belonging to this group show a combination of two main features, flexible production factors and small and semi-subsistence farms. The definition of this class can be therefore “Flexible, small and semi-subsistence farm”.

Table below summarises the relevant properties found in each cluster, on the basis of which, clusters are named.

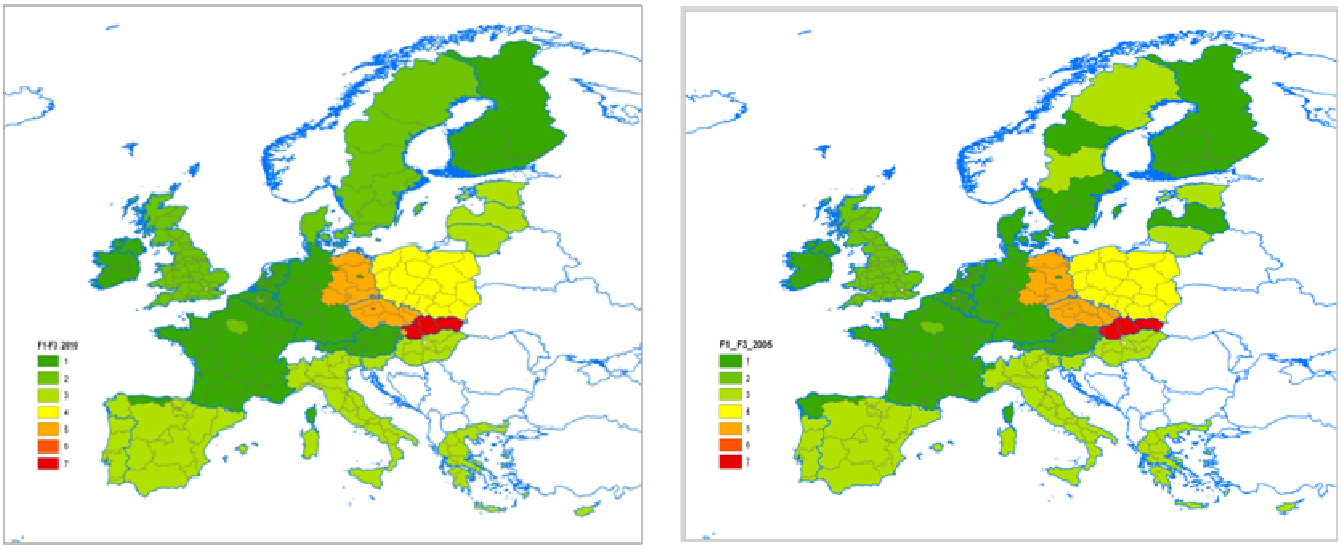
Tab. 24 - Main properties and definition of the 7 cluster identified by Cluster analysis on the first three factors F1, F2, F3

Cluster	Obs.	Factor means			Main properties	Definition
		F1	F2	F3		
1	153	0.63	0.35	0.64	Family Farm; Owner; Medium-Large Size; Professional Farm	"Rigid & professional Farms"
2	82	0.60	-1.27	-0.13	Holdings in developed economic contexts; managed by old holders	"Aged farmers in stable economic context"
3	129	-1.19	-0.31	-0.21	Small size; Part time; Old Holder	"Small and marginal Farm"
4	32	-0.74	1.89	0.55	Young to middle age; transitional economies	"Young farmers in dynamic economic context"
5	26	1.36	0.97	-2.37	Professional Farm; Hired labour force; Tenant	"Professional and flexible farm"
6	1	1.60	0.01	-3.98	Professional Farm; Hired labour force; Tenant	"Professional and flexible farm"
7	7	-0.84	0.81	-1.80	Flexible production factors; Small size Farm	"Flexible, small & marginal farms"

6.7.2.2 Observing changes in the regions structural profiles

A transition matrix was constructed to represent the changes in the regions structural profiles between 2005 and 2010. The transition matrix resulted in 15[124] out of 215 regions changing cluster, equal to 7%. The maps below illustrate the classification of EU regions in the seven identified clusters in 2005 and 2010.

Fig. 51 – Clusters of regions based on F1, F2, F3 – 2005 and 2010



Source: Estimates based on Eurostat data

[124] BE31 Prov.Brabant Wallon from cluster 1 to cluster 2; CZ01 Praha from cluster 5 to cluster 6; DK00 Danmark from cluster 1 to cluster 2; ES11 Galicia from cluster 1 to cluster 3; ITC2 Valle d'Aosta/Vallée d'Aoste from cluster 1 to cluster 3; LV00 Latvija from cluster 1 to cluster 3; SE11 Stockholm from cluster 1 to cluster 2; SE12 ÖstraMellansverige from cluster 1 to cluster 2; SE21 Smålandmedöarna from cluster 1 to cluster 2; SE22 Sydsverige from cluster 1 to cluster 2; SE23 Västsverige from cluster 1 to cluster 2; SE31 NorraMellansverige from cluster 3 to cluster 2; SE32 MellerstaNorrland from cluster 1 to cluster 2; SE33 ÖvreNorrland from cluster 3 to cluster 2; SK01 Bratislavskýkraj from cluster 7 to cluster 5

It is worth mentioning that the whole of Sweden, Denmark and Latvia (8 regions in total) have changed cluster between 2005 and 2010, plus seven regions in various other Member States. Probit regression was utilised in order to estimate the role played by direct payments in determining those transitions.

6.7.2.3 Probit regression

Three different Probit regressions models were developed at this stage including different sets of variables (see §5.1.2.1 for the complete list of variables):

1. The first regression adopts absolute value variables as explanatory variables (Tab.25);
2. The second regression adopts the dynamics of variables as explanatory variables (Tab.26);
3. The third regression adopts a very large set of variables including all types of variables described above in the methodological chapter (Tab. 18).

Each regression above includes a first model (model 1) with the complete set of considered variables and a second restricted model (model 2) only including the most significant ones. The variables' selection process is based on the values assumed by the z test, the VIF collinearity[125] test and the correlation matrix. The dependent variable is always the same, assuming value 1 when the change occurs and 0 when the region does not change class. In two out of three models (see Tables 25 and 27) the LR test clearly confirms that the constrained model is a valid restriction of the complete one.

All three regressions (both complete and restricted models) resulted to be of overall unsatisfactory quality, with no significant parameters (apart from those associated with few structural variables: see tables 25 to 27).

The short time interval (2005-2010) together with the complexity of the latent variables representing farm structure, probably explain the small number of regional transitions and the low significance of the regressions.

Given the constraint on the time interval, the only way to improve the analysis could be to simplify the variable representing farm structure. Thus, the introduction of a less complex variable, i.e. the first factor only, could lead to a greater number of transitions. This approach is developed in the following section.

For the sake of providing complete information, the probit regression results are anyway shown in the following tables.

Tab. 25 - Probit regression adopting absolute value variables as explanatory variables

Dependent variable: Class transition (Y=0,1)	Model 1		Model 2	
	Parameters	z-test	Parameters	z-test
Total Agricultural Area - 2005	4.80E-07	(1.020)		
Total Standard Output - 2005	-1.70E-10	(-.740)		
Sum of Direct decoupled payments	6.90E-11	(.20)		
Sum of Rural development aids	-6.90E-10	(-.690)		
Sum of Direct coupled payments	-1.40E-09	(-1.410)		
Rate of variation in GDP pc 2005-2009	6.5203	(1.630)		
GDP per capita - 2005	0.03115**	(2.40)	0.0247**	(2.090)
Constant	-8.7448**	(-2.10)	-2.08***	(-6.340)
Number of obs.	215		215	
Log Likelihood	-49.105		-52.351	
Model degrees of freedom	5		1	
$\chi 2$	10.739		4.2484	
Probability > χ^2	0.0568		0.039286	

[125] Collinearity refers to an exact or approximate linear relationship between explanatory variables (cf 5.1.2).

Dependent variable: Class transition (Y=0,1)	Model 1		Model 2	
	Parameters	z-test	Parameters	z-test
Pseudo R^2	0.098571		0.038994	
*legend: * p<.1; ** p<.05; *** p<.01*				

Tab. 26 - Probit regression adopting dynamic variables as explanatory variables

Dependent variable: Class transition (Y=0,1)	Model 1		Model 2	
	Parameters	z-test	Parameters	z-test
Growth rate of Decoupled direct payments (2005-2010)	(-.064)	(-.320)		
Growth rate of Coupled direct payments (2005-2010)	(-.011)	(-.030)		
Growth rate of Rural development aids (2005-2010)	-0.3292*	(-1.90)		
Growth rate of GDP per capita (2005-2009)	-11.662	(-1.320)		
Growth rate of Standard Output (2005-2010)	-1.685	(-1.630)		
Growth rate of Utilised Agricultural Area (2005-2010)	-5.546*	(-1.890)	-2.4968*	(-1.950)
Constant	10.634	(1.190)	-1.605***	(-10.560)
Number of obs.	112		215	
Log Likelihood	-30.318		-52.324	
Model degrees of freedom	6		1	
$\chi 2$	11.3		4.3021	
Probability > χ^2	0.07954		0.038066	
Pseudo R^2	0.15708		0.039487	
*legend: * p<.1; ** p<.05; *** p<.01*				

Tab. 27 - Probit regression adopting the largest set of variables as explanatory variables

	Dependent variable: Class transition (Y=0,1)	Model 1		Model 2	
		Parameters	z-test	Parameters	z-test
Absolute values	Sum of Decoupled direct payments	1.70E-10	(.340)		
	Sum of Coupled direct payments	-3.30E-10	(-.250)		
	Sum of Rural development aids	-1.30E-09	(-.810)		
	Utilised Agricultural Area	3.10E-07	(.480)		
	Standard Output	-5.40E-11	(-.170)		
Intensity on context	Sum of Decoupled direct payments / GVA in 2005	-8.30E-06	(-.440)		
	Sum of Coupled direct payments / GVA in 2005	-4.40E-06	(-.080)		
	Sum of Rural development aids / GVA in 2005	-1.90E-06	(-.050)		
Composition	Sum of decoupled payments / Sum of total CAP payments	1.0718	(.80)		
	Sum of rural payments / Sum of total CAP payments	-1.2716	(-.60)		
Intensity on farm characteristics	Sum of Decoupled direct payments / UAA in 2005	-0.35608	(-.530)		
	Sum of Coupled direct payments / UAA in 2005	-0.081474	(-.040)		
	Sum of Rural development aids / UAA in 2005	-0.35583	(-.720)		
	Sum of Coupled direct aids / Standard output in 2005	-1.3215	(-.460)		
	Sum of Decoupled direct aids / Standard output in 2005	0.56152	(.590)		
	Sum of Decoupled direct aids /number of holdings in 2005	-1.4435	(-1.520)		
	Sum of Coupled direct aids /number of holdings in 2005	1.9625	(.590)		
	Sum of Rural development aids /number of holdings in 2005	1.2031	(.950)		
Context	Unemployment rate 2005	-0.007091	(-.130)		
	Rate of variation in GDP pc 2005-2009	4.8228	(.80)		
Significant variables	Sum of Rural development aids / Standard output in 2005	1.2047	(1.250)	1.2115***	(3.60)
	GDP per capita 2005	0.04627**	(1.970)	0.04589***	(3.170)
	Constant	-7.1001	(-1.140)	-3.0398***	(-6.640)
Statistics	Number of obs.	215		215	
	Log Likelihood	-40.312		-45.4	
	Model degrees of freedom	20		2	
	$\chi 2$	28.182		18.006	
	Probability > χ^2	0.10515		0.000123	
	Pseudo R^2	0.25902		0.16549	
*legend: * p<.1; ** p<.05; *** p<.01*					

6.7.3 Estimation of the effects of direct payments on changes of EU regions structural profiles (first extracted factor)

In this section the analysis focuses on the effects of direct payments on changes in the structural profiles of EU regions based on the first factor. This factor (Structural and Organisational Profile) represents a very important component of the overall farm structure, with medium-to-very large size professional farms managed by full time holders on the positive side of the factor, and small size farms managed by older and part-time farmers on the negative side.

Differences between factor scores in 2005 and 2010 for each region identify the changes in the Structural and Organisation profile (continuous variable). A simple linear regression model (OLS)

was applied to identify the statistical relationship between observed changes and a number of explanatory variables expected to have an impact (decoupled direct payments, coupled direct payments, rural development aids[126], context variables). Table 28 below reports the results the OLS regression (complete Model 1 and restricted Model 2).

Tab. 28 - Results of OLS regression – Factor 1

Dependent variable: 2005-2010 differences in Factor 1	**Model 1**		**Model 2**	
	Parameters	**t-value**	**Parameters**	**t-value**
Sum of decoupled direct payments	2.80E-11	(0.76)		
Sum of coupled direct payments	8.00E-11	(0.99)		
Sum of rural development aids	6.40E-11	(0.49)		
Sum of decoupled direct payments / number of holdings in 2005	0.00934	(0.28)		
Sum of rural development aids / Standard output in 1005	0.0452	(0.42)		
Total Agricultural Area - 2005	-9.6e-08*	(-1.79)		
Total Standard Output - 2005	1.30E-11	(0.58)		
Total number of holdings - 2005	-0.0000005	(-1.27)		
GDP per capita 2005	-0.00408	(-1.56)		
Sum of rural development aids / number of holdings in 2005	-0.178	(-1.26)		
Sum of rural development aids / Sum of total CAP expenditure	0.215	(1.44)	0.01704***	(2.28)
Sum of decoupled direct payments / Sum of total CAP expenditure	0.266***	(5.05)	0.2282***	(6.94)
Sum of decoupled direct payments / Standard output in 2005	-0.111**	(-1.97)	-0.121***	(-3.52)
Unemployment rate 2005	.0222***	(4.48)	0.02365***	(6.83)
Constant	-0.0732	(-0.78)	-0.1696***	(-4.53)
Statistics				
Number of obs.	214		214	
Model degree of freedom	14		4	
R^2	0.44136		0.3884	
F			23.02	
VIF (mean)	3.86		1.21	
*legend: * p<.1; ** p<.05; *** p<.01 - Robust standard errors*				

For parameters statistically different from zero and positive in sign, it can be assumed that direct payments (as well as other explanatory variables) have an effect translating in shifts towards a structure characterised by larger and more professional farms. Conversely, statistically significant parameters negative in sign indicate an effect translating in shifts towards a structure characterised by smaller and less professional farms.

The results of the OLS regression suggest that:

- the higher the share of decoupled payments on total CAP expenditure, the stronger the change towards a structure characterised by larger and more professional farms (the estimated parameter "Sum of decoupled payments / Sum of total CAP payments" is statistically significant and positive in sign);
- the higher the importance of decoupled direct payments relative to the value of agricultural output (SO) at regional level, the less competitive regional agriculture appears to be because heavily dependent on support (i.e. change is towards a structure characterised by smaller and less professional farms);
- the estimated parameter "Sum of rural aids / Sum of total CAP payments" is statistically significant and positive in sign, however the parameter value is very low;

[126] Rural development aids are not directly evaluated here but are considered in the modelling exercise with the purpose of isolating the net effects of direct payments. The variable "rural development aids" includes the expenditure from the EU budget without distinguishing by axis/measure.

- CAP payments (decoupled, coupled and rural aids) considered in absolute values do not appear to have an impact on structural changes;
- the higher the unemployment rate in 2005, the stronger the change towards a structure characterised by larger and more professional farms.

Concerning the estimated parameter for unemployment rate in 2005, we made an in-depth analysis correlating, for each region, the 2005-2010 changes of Factor 1 with 2005-2010 changes of:

- the GDP per capita;
- the unemployment rate.

Fig. 52 – Comparison between differences in Factor1 and changes in GDP per capita 2005-2010

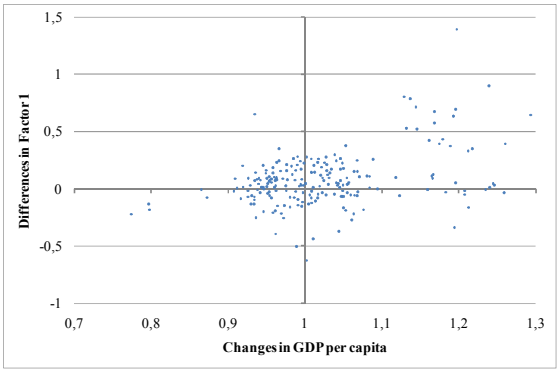
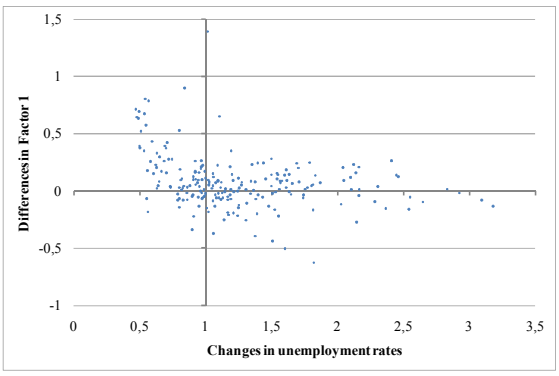


Fig. 53 – Comparison between differences in Factor1 and changes in unemployment rate 2005-2010



As shown in the graphs above, positive variations of GDP per capita (negative variations of the unemployment rate) are directly (inversely) correlated with the variation of factor scores of Factor 1 in the years 2005-2010. Bearing in mind the interpretation given to Factor 1, it is possible to assume that the economic growth of a region, in the years 2005-2010, is actually accompanied by a change towards a structure characterised by larger and more professional farms.

The dependent variable in the OLS model is the result of factor analysis and, as such, does not possess a measurement unit. This implies that the meaning of the estimated parameters can be difficult to assess, apart from their sign and statistical significance. Furthermore, this approach does not identify in which regions the structural changes occur.

On the other hand, if the estimated values of the constructed "Farm structure" variable are divided into classes identified on the basis of the distribution quantiles, the parameters of a multinomial logit in which the values of the dependent variable reflect the transition from a class to another, would be directly interpretable in terms of log-odds ratios. This exercise also permits to identify the regions where structural changes are likely to occur.

6.7.3.1 Regional clusters based on the first factor

The first step is thus to define regional clusters on the basis of the "Farm structure" variable (factor scores of F1). Factor scores have been sub-divided in seven classes of fixed width, grouping the regions where the predominant farm structure ranges from "Very large and professional farms" (Class 7) to "Very small and semi-subsistence farms" (Class 1). The results are reported in the table below.

Tab. 29 - Main properties and definition of the 7 classes identified on the first factor (F1)

Mean	-2E-08	Class number	7
Min	-1,84	Class width	0,54
Max	1,96	Standard dev.	0,99
Range	3,80		

Cluster	Class range F1	Obs.	Main properties	Definition
Class 1	-1.30	64	Small Size Farm, Part Time and Old Holder	Very Small & Semi-subsistence Farm
Class 2	-0.75	64	Small Size Farm, Part Time and Old Holder	Very Small & Semi-subsistence Farm
Class 3	-0.21	43	Small Size Farm, Part Time and Old Holder	Small & Semi-subsistence Farm
Class 4	0.33	44	Medium-Large size farm; Professional Farm, Full-Time, OGA	Slightly Large & Professional Farm
Class 5	0.88	122	Medium-Large size farm; Professional Farm, Full-Time, OGA	Large & Professional Farm
Class 6	1.42	77	Medium-Large size farm; Professional Farm, Full-Time, OGA	Very Large & Professional Farm
Class 7	1.96	16	Medium-Large size farm; Professional Farm, Full-Time, OGA	Very Large & Professional Farm

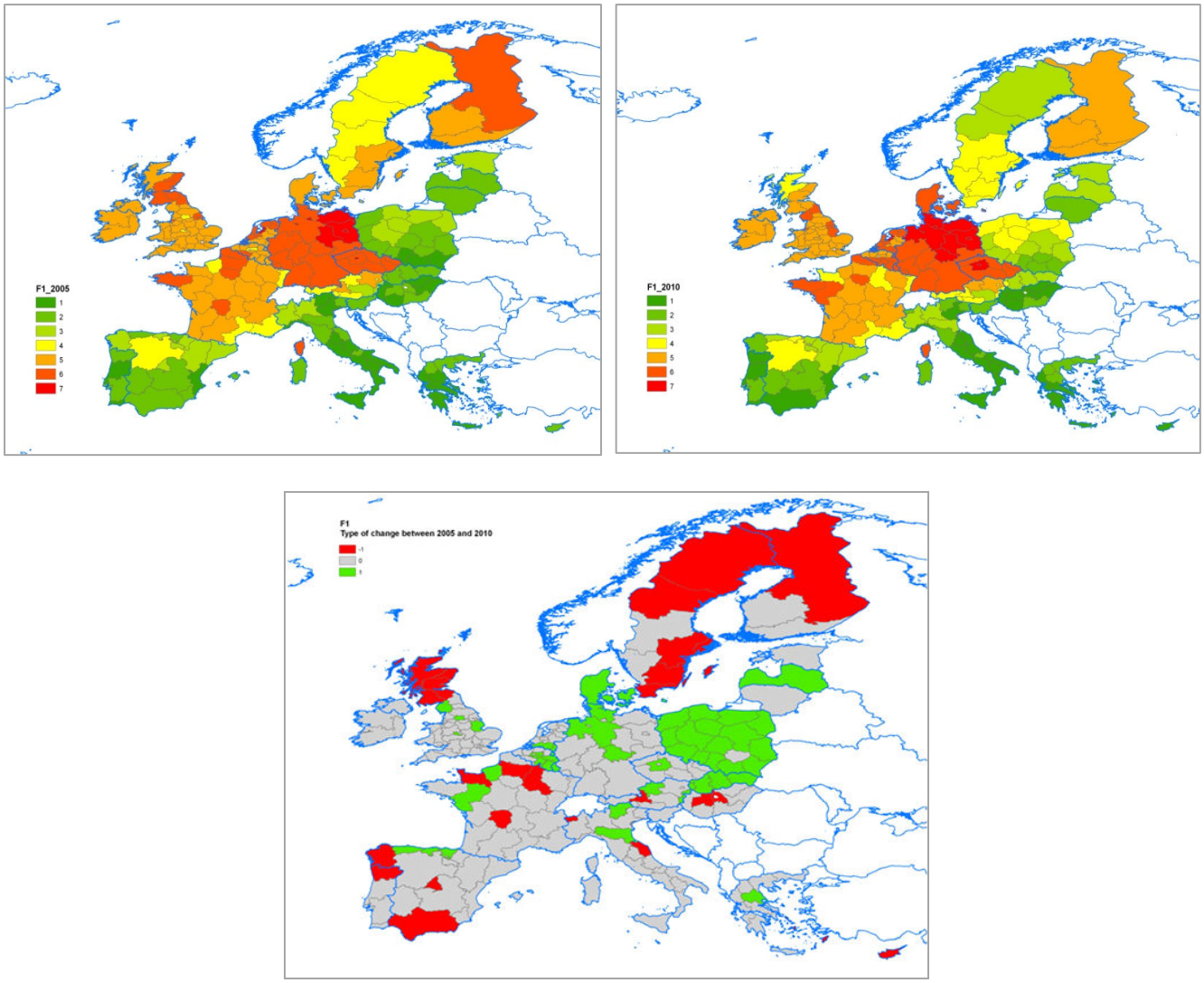
A transition matrix was constructed to represent the changes in the regions structural profiles between 2005 and 2010. In this case, 73 transitions were detected, equal to 34% of the observed cases, 26 of which (12% of the total) show a transition towards classes with lower values of the factor and the remaining 47 (22% of the total) show a transition towards classes with higher values of the factor.

Tab. 30 - Identification of class changes based on the first factor (F1)

Type of transition	Class 2005	Class 2010	N. of Regions changing class
Toward higher values of F1	2	3	13 out of 39 belonging to class 2 in 2005
	5	6	11 out of 65 belonging to class 5 in 2005
	3	4	7 out of 19 belonging to class 3 in 2005
	1	2	5 out of 31 belonging to class 1 in 2005
	4	5	5 out of 17 belonging to class 4 in 2005
	6	7	4 out of 38 belonging to class 6 in 2005
	2	4	2 out of 39 belonging to class 2 in 2005
Sub-Total			*47*
Toward lower values of F1	5	4	8 out of 65 belonging to class 5 in 2005
	2	1	7 out of 39 belonging to class 2 in 2005
	6	5	6 out of 38 belonging to class 6 in 2005
	3	2	3 out of 19 belonging to class 3 in 2005
	4	3	2 out of 17 belonging to class 4 in 2005
Sub-Total			*26*
Total changes of class			**73**
No change of class			**142**
Total			**215**

Class shifts between 2005 and 2010 are graphically represented in the maps below.

Fig. 54 – Clusters of regions based on F1 – 2005, 2010 and regions changing class in 2010



Source: Estimates based on Eurostat data

6.7.3.2 Multinomial Logistic regression

Multinomial logistic regression was applied on the transition matrix to investigate the role of direct payments in defining the probabilities of transition in different classes. Such probabilities are represented through a variable taking value equal to -1 in case of transition towards classes with lower factor scores; 0 in case of permanence in the same class; +1 in case of transition towards classes with higher factor scores.

The regression was carried out by introducing in the model the same explanatory variables that were statistically significant in the previous OLS regression model.

The method estimates the parameters for each explanatory variable in the case of transition towards classes with lower values (dependent variable equals -1), and in the case of transition towards classes with higher values (dependent variable equals +1).

The difference ($\beta_{k,1}$ - $\beta_{k,-1}$), with $\beta_{k,1}$ and $\beta_{k,-1}$ being respectively the parameter of the k-th explanatory variable relative to the sub-model for the "-1" and "+1" transitions, represents the change in the log-odds ratio for a unit change in x_k. Therefore, regions with larger values of x_k tend to have a larger probability of a "+1" transition (with respect to a "-1" transition) when($\beta_{k,1}$ - $\beta_{k,-1}$) > 0 .

The results of the multinomial logistic regression are reported in table 31.

Tab. 31 - Multinomial logistic regression on transition variable – First factor. Two cases of transition (-1;1)

Multinomial logistic regression - Explanatory variables	-1	1
Sum of Decoupled direct payments / Sum of total CAP expenditure	-1.77**	2.07***
	(-1.99)	(2.60)
Sum of Rural development aids / Sum of total CAP expenditure	3.35**	0.731
	(2.55)	(0.72)
Sum of Decoupled direct payments / Standard output 2005	1.15**	-0.677
	(2.44)	(-1.21)
Unemployment rate 2005	-0.0246	0.0826**
	(-0.41)	(2.25)
Constant	-1.765***	-3.250***
	(1.55)	(-3.58)
Statistics		
Number of observations	215	
Log Likelihood	-155.01	
Model degree of freedom	10	
c2	48.318	
Probability > c^2	5.40E-07	
Pseudo R^2	0.16342	
*legend: * p<.1; ** p<.05; *** p<.01 - Robust standard errors*		

The results of logistic regression largely confirm the results of the previous OLS regression analysis. Indeed, most of the explanatory variables included in the model appear to contribute to explain structural changes and, in particular, transitions towards higher classes (larger sized and more professional farms). At the same time, the results of logistic regression provide better insight into the nature of the effects of direct payments on structural changes.

In synthesis, the results lead to affirm that:

- decoupled direct payments play a role in explaining structural changes, and, in particular, in the transition towards regional profiles characterised by larger sized and more professional farms;
- indeed, a larger share of decoupled direct payments on total CAP expenditure is associated to higher probability of regions moving towards higher classes. This result is confirmed by the negative sign of the parameter estimate associated to the probability of shifting towards lower classes (-1): a larger share of decoupled direct payments on total CAP expenditure reduces the probability of regions moving towards an agricultural structure characterized by smaller and less professional farms;
- the higher the importance of decoupled direct payments relative to the value of agricultural output (SO) at regional level, the less competitive regional agriculture is because heavily dependent on support (thus leading to higher probability of shift towards a structure characterised by smaller and less professional farms). These results confirm those produced by the OLS regression.

The estimated parameter for the share of rural development aids on total CAP expenditure takes a positive sign in correspondence of shifts towards lower classes. However, the interpretation of this particular parameter estimate could be misleading as the "Rural development aids" variable includes total expenditure from the EU budget without distinguishing by axis/measure. Therefore, the parameter estimates the role played by rural development aids as a whole on structural changes, without distinguishing the effects of RD measures more/less focused on farms competitiveness from the effects of measures more/less focused on improving the quality of life in rural areas and on diversification of the rural economy.

6.8 Evaluation judgement

The evaluation question required to assess to what extent direct support schemes as introduced by the Regulation (EC) No 1782/2003 have affected farm structural changes and in particular: i) have affected the process of concentration; ii) the land use and iii) the management structure of holdings.

The analysis was carried out using two methodological approaches: a) statistical analysis; b) econometric models. The first one analysed the development of the main structural indicators and it was instrumental for interpreting the observed phenomena on the period 2005-2010. The second one provided a quantitative estimation of the impact of the direct support scheme on farm structural change considering the farm structure as a multidimensional phenomenon consisting of a number of variables and characteristics.

The analysis was carried out at macro-territorial level (regional level NUTS 2) and is based on data from FSS, completed, in the case of the econometric analysis, with CATS database on CAP expenditure at regional level.

Main results concerning the development of structural indicators

The results of the statistical analysis are discussed for each SFP model and at regional level in order to assess differences across regions and according to the different Single Farm Payment models. The latter represent a key factor to be taken into account when analysing the relationship between direct support and structural changes.

The analyses are influenced by some aspects that need to be taken into due account if results are to be correctly evaluated. In particular:

- For the 2010 census Germany, United Kingdom and Czech Republic decided to exclude holdings having arable UAA of less than 5 ha. As a result, the indicators for which it was not possible to exclude holdings < 5 ha have been affected by this decision[127].
- MSs have adopted different criteria to take into account the (possible) existence of common land in the UAA. Accordingly, the UAA of MSs/Regions for which information is available in 2010 does not include data on common land[128].
- In each of the implementation models the indicators used at a regional level[129] are always subject to a great deal of variability. Average data for models are thus affected by this lack of internal uniformity.

Bearing these points in mind, the following conclusions can be drawn from the results of our analyses:

1. Role of CAP reform on the holding concentration process

Concerning the **evolution of the number of farms**, the decline in the **number of agricultural holdings** (with UAA) has been a long-term process, occurring also before the 2003 policy reform. In the EU27, between 2003 and 2010 the overall number of farms has decreased by 19.8% and the number of holdings >5 ha by 8.9%.

Within this general downward trend, the change in policy (in particular that regarding direct payments) appears to have played a role that differs for each SFP implementation model. **For the SPS Historical model, in most regions the decline occurring already in the pre-reform period in farm numbers continues in post-reform years at a slower pace.** This applies to agricultural holdings taken as a whole and to holdings > 5 ha. On the other hand, **in all the other three models, in most regions there was an acceleration in the decline, or a trend reversal (from rise to decline)**. In this

[127] In the Hybrid model in particular, for which 6 regions out of 10 (four of Germany and two of UK) were affected by changes to the calculation method.

[128] See paragraph 6.2 for details.

[129] Average size of holdings and LSU, % of farms with livestock/total holdings, concentration coefficient, extensification index, etc.

case too, such trends apply to all agricultural holdings and to holdings > 5 ha. Furthermore, for some regions in the SAPS model the variation is particularly important[130].

The analysis of the number of holdings by size of farms shows that the change in policy may generally be said to have led to a more rigorous selection of the agricultural holding structure. In all models a significant fall in the share of holdings up to 5 ha resulted in an increase in the share of other classes. This is explained by the exit from the sector of smaller farms and/or their shift to a larger size class. The exception to this "rule" is the Regional model, for which the percentage of holdings < 5ha grew whilst there was a fall in the percentage of holdings in the class from 5 to 19.9 ha. **In conclusion, in general, the implementation of the reform has contributed to speeding up the exit from the sector of smaller-sized farms and/or has encouraged some of these farms to grow in size (i.e. moving from a lower to a higher size class).**

Finally, as a result of these trends, and bearing in mind the uneven distribution of farms by size class in the different implementation models, the analysis has made it possible to conclude that **structural changes have led to a greater equilibrium in the distribution of size classes**. This holds true for all models, and therefore for the EU27 as a whole.

Concerning **average size of farms**, since variations in UAA in the studied regions were modest in the period under review (and negative in most regions), **trends relating to the number of holdings also resulted (again in most regions) in a rise in average UAA per holding**, both for all holdings (+22.4% in EU27 between 2003 and 2010), and for holdings > 5 Ha (+9.7%). In this case, for the SPS Historical model the growth in average UAA slowed down after the reform was introduced (both all holdings and holdings > 5 ha), while in the other models growth accelerated or a trend reversal occurred (from decline to rise), with the sole exception of SPS Regional for holdings > 5 ha[131].

The analysis of **farm number by economic size of holdings** showed that, in all models, the exit of farms from the sector applied almost exclusively to small farms (< 25,000€ of SO): this should come as no surprise, since there is a clear relationship between small physical size and small economic size: On the other hand, a (varying) percentage of holdings belonging to the medium size class (25,000 to 250,000 €) in 2005 had (presumably) moved up to the large class (> 250,000€) in 2010.

Bearing in mind the change in arable UAA threshold criteria for inclusion in the 2010 FSS adopted in some regions (in particular in the SPS Hybrid model), **it may be concluded that for all models the average economic size of holdings has been increasing**. This process appears however to be faster for the two models applied in the EU15 than the two models applied in the EU12.

In light of these trends, the **process of structural concentration** regarding holdings and agricultural area was analysed using two analytical tools: the Lorenz curve[132] and Gini coefficient[133]. Variations in concentration may be seen from the comparison between 2003 and 2010.

Results show a wide variety of contexts: on the one extreme, **a very balanced situation for the SPS Regional model (characterised by low concentration), on the other, a structural dualism was observed for the SAPS model which was already existing before the reform** (on the one hand, a very high percentage of very small farms which taken together concentrate a small percentage of UAA; on the other, a very low percentage of large holdings, concentrating a very high percentage of UAA). **In both these models, concentration rose between 2003 and 2010, albeit in different ways. However, in particular in Member States applying the SAPS model, structural changes leading**

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[130] The two Polish regions, Slovakia, Czech Republic and Latvia for all holdings; the four Romanian regions and Lithuania for holdings > 5ha.

[131] The analysis did however highlight the fact that these trends result from significantly diverse structural situations at regional level, for which average holding size lies within a range of 0.9 ha (Malta) to 230 ha (DE East & North-East)

[132] Constructed from the combination of cumulative % of the number of holdings by size class and cumulative % of UAA expressed by the same size classes.

[133] The Gini coefficient is a measure of statistical dispersion. Based on the Lorenz curve, the Gini coefficient is a number between 0 and 1. Low values indicate a quite even distribution, with 0 corresponding to pure equidistribution; high values of the coefficient indicate a more uneven distribution, with the value 1 corresponding to the maximum concentration (in this case, the situation in which a single holding concentrates 100% of available UAA.

to a greater concentration may also have been the effect of other factors (i.e. end of central planning, land reforms, etc). The other two models were less extreme: a little more balanced the SPS Historical model, and a little more concentrated the SPS Hybrid model. In both these models, concentration did not vary significantly between 2003 and 2010.

At the regional level, the comparison of Gini coefficients (covering a very wide range of values)[134] shows that **most regions saw a rise in concentration between 2003 and 2010** (in particular, 21/27 regions of the Historical, 8/10 SPS Hybrid, 2/2 Regional and 12/16 SAPS models). Nevertheless, the size of the increase again varied considerably from region to region.

The **subset of holdings with livestock** were also analysed. Results showed that in most regions the reduction in the number of holdings with livestock was greater than in agricultural holdings in general, also prior to the reform. After the introduction of the reform this trend intensified in most regions of the SPS Historical model, and to a greater extent in Mediterranean regions. On the contrary, after 2005 in the SAPS and Regional models the reduction in the number of holdings with livestock slowed down in most regions.

In this case too, exits from the sector mainly affected farms in the smaller size classes. Nevertheless, the class of landless holdings with livestock[135] (forming a large share of all holdings with livestock in some regions) saw a growth in the Historical and Hybrid models, a decreased in the Regional model and remained quite stable in the SAPS.

The process of **structural concentration regarding holdings and LSU**, always evaluated through comparison of the Lorenz curve[136] and the Gini coefficient between 2003 and 2010, **shows minimal changes in all SFP models, with the exception of SAPS where concentration increases to an appreciable extent**. This is largely due to the strong growth (> 30%) in nine of the sixteen examined regions. **Moreover**, **regions implementing SAPS, also in this case show a structural dualism[137], which existed already before the reform and becomes more accentuated in 2010 compared to 2003**".

With the aim of verifying the existence of different structural trends in terms of **farm specialisation**, an analysis was conducted on farm number trends (as well as size class trends) based on the Type of Farming (period 2005-2010). Bearing in mind the different percentage distribution of holdings by Type of Farming in the four implementation models, **the results showed negative trends of farm number for almost all TF in all models, with the significant exception of TF5 (Specialist granivores)**.

Nevertheless, in all other TF the speed of decline in farm numbers was not the same: in general, in the three "mixed" TF (TF6- Mixed cropping; TF7- Mixed livestock; TF8- Mixed crop-livestock) there was a large drop in farm numbers compared with the overall average, while the decline of holdings in more "specialised" TF (TF1- Specialist field crops; TF2- Specialist horticulture; TF3- Specialist permanent crops; TF4- Specialist grazing livestock) was less pronounced.

It may be concluded that the **change in policy has led to a selection of the agricultural production structure to the detriment of less specialised farms**. Accordingly, after the reform there has been an ongoing farm specialisation process in all models (on average): to a lesser extent in the SPS models applied in the EU15 (for which already in 2005 about 85% of holdings were concentrated in the more specialised TF) and to a greater extent in the models applied in the EU12 , for which in 2005 more than 50% of holdings belonged to the Mixed TF.

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[134] From close to zero for Malta to close to 1 for the Czech Republic

[135] These are chiefly "industrial" holdings, with a large presence of granivores (Pigs & Poultry), but also (in some regions) other animals probably reared on common land.

[136] Built on the combination of the cumulative % of the number of farms by size classes and cumulative % of LSU.

[137] On the one hand, a very high percentage of very small farms which taken together concentrate a small percentage of LSU; on the other, a very low percentage of large holdings, concentrating a very high percentage of LSU.

2. Changes in agricultural land use

With regard to land use, the analysis was based on 5 classes: i) Arable land, except for Set-aside areas under incentive schemes and Fallow land; ii) Permanent crops; iii) Kitchen gardens; iv) Permanent grassland and meadow; v) Set-aside areas under incentive schemes and Fallow land.

Taking into account the different weight distribution of the five crop classes in the four implementation models, the changes between 2003 and 2010 appear to be rather modest in all models (except for SPS Hybrid). Variations are negligible in Permanent crops and Kitchen gardens and more perceptible in Arable crops (positive), and Set-aside + Fallow land (negative).

The analysis highlighted the role played by the withdrawal (in 2009) of compulsory Set-aside aid in the EU15. **Set-aside land was largely returned to its original use, and only a small share has been used as fallow land. As a result, the withdrawal of Set-aside aid led to a fall in the extensification index[138] for the two EU15 models (and for most regions)**. **Conversely, in Member States implementing SAPS model, where set-aside requirement has never been applied, there was a rise in the share of fallow land over total UAA, and a rise of the extensification index (for most regions).**

Finally, the analysis shows that **some regions have moved against this general trend**. In particular, in most southern regions of the SPS Historical model, the relative share of Set-aside + Fallow land and of Permanent grassland and meadows rose, while the share of Arable crops decreased. It may be concluded therefore that in these regions **some arable crops lost their appeal between 2003 and 2010, probably also as a result of the introduction of the reform, and a part of agricultural area previously used for this type of farming was transformed into Permanent grassland and meadows and/or no longer farmed**.

3. Effects on holdings' management structure

With regard to the impact of trends affecting agricultural holdings, in part due to the change in policy, on farm management structures, the analysis focused on two aspects: i) the legal status of holdings[139]; ii) the types of organisational form adopted by holdings[140].

Results relating to the **legal status of holdings showed that status has not been influenced by policy change**. The modest growth of the Legal entity or group holding form (and consequently slight decline of the Single holder holding form) in some regions does not appear to be correlated with farm concentration trends, not even in regions where growth is largest (all French regions, DE East & North-East, Czech Republic, Slovakia, Estonia and Slovenia). Accordingly, other factors are likely to be cause of this evolution.

With regard to **types of organisational form**, the analysis centred on trends in farm numbers and agricultural area, distinguishing between the different organisational forms of holdings.

Results regarding the evolution of agricultural area by type of organisational form showed a growing incidence of land under Shared farming or other modes and Farming by tenant, balanced by a decreasing share of land under Farming by owner. This holds true in all models except for SPS Hybrid (where drop in the share of land under Farming by tenant and increase for Farming by owner[141] was observed).

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[138] The extensification index measures the percentage of utilisable agricultural area set aside for non-farming activities (Permanent grassland and meadow) and/or unfarmed due to regulations (set-aside areas under incentive schemes) or so decided by farmers (fallow land) over total UAA.

[139] FSS data makes it possible to group together holdings into two legal status categories: (i) single holder holding and (ii) legal entity or group holding.

[140] The types of organisational forms are: farming by owner; farming by tenant and shared farming or other modes.

[141] This trend is almost exclusively caused by changes in the DE East & North-East region (former DDR), where the land restitution/privatisation process started in 1992 and continued even in recent years (cf Chap. 4 "Review of National and Institutional Frameworks").

The joint analysis of these results leads to the conclusion that **Farming by owner is the most common form among small holdings, whereas the other two forms (in particular Farming by tenant) are adopted more frequently by larger holdings (that have both their own and leased land**). The large fall in the number of small farms and parallel rise in the number of larger farms together with the modest decrease of the UAA leads us to believe that, in general, the land made vacant by the exit of small farms from the sector has been taken up by larger farms through land lease agreements (and not through purchases).

Accordingly, **it may be concluded that farm concentration trends have to some extent had an impact on changes to Types of Organisational Form**.

Effects of direct payments on farm structure changes

This part of the analysis consists of assessing whether regions have changed their farm structural profile between 2005 and 2010 and, subsequently, whether direct payments have had an effect on such changes. "Farm structure" is considered as a combination of structural characteristics (size, specialisation, holder's characteristics, type of tenure, labour used, other gainful activities).

The analysis comprises three subsequent stages: i) Factor analysis run on two year panel dataset (2005 and 2010), aimed at identifying a finite number of farm structural profiles; ii) Classification of EU regions into homogenous groups according to their farm structural profile, in 2005 and 2010; iii) Construction of transition matrices and econometric modelling to estimate whether direct payments have had an effect on regions structural profiles.

The first factor obtained from the Factor Analysis describes the Structural and organisational farm profile (high factor scores identify medium-to-very large size professional farms managed by full-time holders, conversely low factor scores identify small size farms managed by older and part-time farmers). Subsequently, a simple linear regression model (OLS) was applied to estimate the impact of a number of explanatory variables (decoupled direct payments, coupled direct payments, rural development aids, context variables) on the observed structural changes[142].

On the basis of the Factor Analysis results, EU regions were classified into homogeneous classes according to their agricultural structure profile. The transition matrix constructed to represent the changes in the structural profiles between 2005 and 2010 shows 73 regions changing class, equal to 34% of the observed cases, 26 of which show a transition towards a structure characterised by small and semi-subsistence farms and the remaining 47 a transition towards larger and professional farms.

On this transition matrix it was possible to apply a multinomial logistic regression to investigate the role of direct payments in defining the probabilities of transition to different classes between 2005 and 2010.

The results lead to conclude that **decoupled direct payments could play a role in explaining structural changes**:

- a larger share of **decoupled direct payments on total CAP expenditure is associated to higher probability of regions changing class, i.e. moving towards an agricultural structure characterized by larger and professional farms**. Simultaneously, **a larger share of decoupled direct payments on total CAP expenditure reduces the probability of regions moving towards smaller and less professional farms**.
- the **higher the importance of decoupled direct payments relative to the value of agricultural output (SO) at regional level**, the less competitive regional agriculture is because heavily dependent on support, thus leading to **higher probability of class shift towards a structure characterised by smaller and less professional farms**.

[142] Measured by the differences between factor scores in 2005 and 2010 for each region.

7. Theme 2 – Maintenance of farming in marginal areas: To what extent have direct payments contributed to maintaining of farming in marginal areas? (EQ2)

7.1 Comprehension and interpretation of the evaluation question

The evaluation question expands on the analysis carried out in EQ1. The aim to investigate whether direct payments have had an impact on the evolution of farm structures in Less Favoured Areas (LFAs) as defined by Council Regulation (EC) No 1257/1999 of 17 May 1999.

Regulation 1257/1999, still in force, classifies agricultural areas with natural handicaps according to three categories: mountain areas, less favoured areas other than mountain (the so-called 'intermediate LFAs') and areas affected by specific handicaps . Each category is characterised by a specific cluster of handicaps, common to certain areas across the EU, and which threaten the continuation of agricultural activity. These marginal areas have a concentration of permanent natural disadvantages and environmental constraints that make the performance of farming activity more difficult and less profitable. The preservation of agriculture in these areas, in other words the preservation of agro-systems under stable conditions, has always been a central theme of the CAP.

The regions (part of regions) selected and classified as less favoured are eligible to receive special support, the most important of which is the annual compensatory allowance (i.e.: LFA scheme under rural development policy) aimed at compensating certain handicaps respect farms located in non LFA areas. Council Regulation (EC) No 1698/2005 (Recital 33) describes the objective of the LFA scheme as follows: *Natural handicap payments in mountain areas and payments in other areas with handicaps should contribute, through continued use of agricultural land, to maintaining the countryside, as well as to maintaining and promoting sustainable farming systems*. These payments, in place since 1975, consist of a compensatory allowance granted annually per hectare of utilised agricultural area, the unit value of which is established by the Member States. Not all farms within an LFA receive this compensatory allowance

Therefore, LFA payments (2nd pillar) are interlinked with direct payments (1st pillar): the single farm payment aims at sustaining/stabilising farmers income, LFA scheme aims at preventing farmland abandonment in areas with natural handicaps, for sustainable land management purposes.

7.2 Methodological approach, data sources and limits

In order to answer the evaluation question, the analysis was conducted across the EU27 Member States for the observation period corresponding to the years 2000 onwards. The analysis was carried out at the macro-territorial level (regional level NUTS II) and based on data from Eurostat FSS.

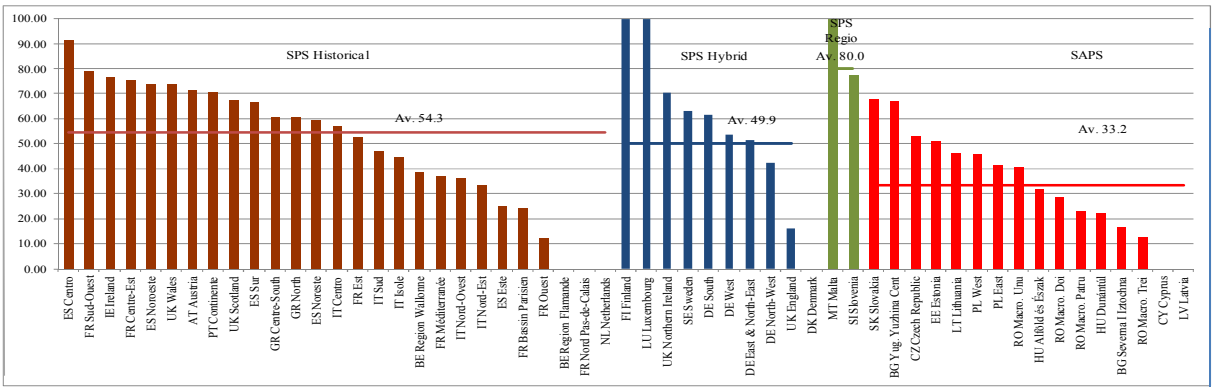
LFA farms are a subset of total agricultural farms (and, thus, are subject to the same trends as those analysed for the total farms), so we analysed the evolution of LFA farms indicators in relative terms (i.e. compared to the evolution of all farms), by calculating the % *LFA holdings*[143]*/total holdings* and then comparing the difference of the ratio is computed in 2007 with the same ratio in 2000[144].

For this reason it is useful to give an overview at EU27 of the share of the number of holdings with UAA located in LFA areas across regions.

[143] In order to allow comparability of the results with the results of EQ1, this part of the analysis examines only farms with UAA.

[144] For the Spanish regions the analysed period is 2003-2007 since between 2000 and 2003 criteria for the classification of LFA areas seem to have changed.

Fig. 55 – Share of holdings with UAA in LFAs on the total number of holdings with UAA 2007 (%)



Source: Elaborations based on data from Eurostat

The share of LFA farms on the total number of farms (with UAA) varies considerably across Member States and regions. The maximum share (100%) and the minimum share (0%) correspond obviously to those regions where the LFA designation applies respectively to the whole country or does not apply at all.

Therefore, some regions have been excluded from the analysis:

- In Denmark, Netherlands, Cyprus, Latvia, BE Flamande and FR Nord Pas de Calais LFA areas are very small (not registered in FSS data) or there is not LFA areas at all.
- In Finland, Luxembourg and Malta the whole country is classified as LFA.

Therefore the analysis done in EQ1 shows already the structural changes occurred in these Member States/regions.

The analysis should have included 2010 FSS data on LFAs. However at the moment, the information on the location (LFA, not LFA) by farm is not available for this year. Therefore, estimates are being undertaken by EUROSTAT and DG AGRI and reliability of the 2010 LFA data is being investigated. At present, according to EUROSTAT and DG AGRI, reliable 2010 FSS Census data on LFAs are available only for a limited number of Member States: Finland, France, Portugal, Spain, Bulgaria, Cyprus, Malta, Romania. Nevertheless, as reported above, Cyprus, Malta and Finland are not under study in this part of the evaluation. Thus, 2010 data have been considered in the analysis only for Spain, France and Portugal as regards the EU15 and for Bulgaria and Romania in the case of EU12.

The analysis 2000-2007 was possible only for EU15 (Historical and Hybrid model). Indeed, FSS data on the 10 Member States that entered the EU on 2004 are available only from 2005 onwards and data of Bulgaria and Romania only for the years 2007 and 2010. Therefore, for the Regional and SAPS models (excluding Bulgaria and Romania) the analysis could only compare 2005 with 2007, and for Bulgaria and Romania only 2007 with 2010. Consequently, EU15 and EU12 have been analysed separately.

The short time period is a strong limitation of the analysis of structural changes both for EU15 Member States and EU12 Member States. Indeed, in the answer to the present evaluation question, the analysis done in EQ1 that compares the two sub-periods, pre- and post-reform, is not possible given the shortness of the period after the reform (only two years 2005 and 2007).

The answer to the evaluation question was completed with an in-depth analysis conducted at farm level for the 12 case study regions[145]. The analysis was developed on the full sample of FADN farms belonging to the regions selected for the case studies, comparing the years 2004 and 2009. The database provides for each farm a weight that measures the relative importance of each observation in

[145] The case study regions (as detailed in §5.1.3) are: France: Centre; Germany: Niedersachsen; Germany: Brandenburg; Greece: Makedonia-Thraki; Hungary: Del-Alfold; Italy: Emilia Romagna; Poland: Łódzkie, Mazowsze, Lubelskie and Podlasie; Portugal: Alentejo and Algarve; Slovenia; Spain: Extremadura; Sweden: Slättbygdslän; United Kingdom: England East.

the sample. FADN farm weights (variable SYS02) were used to weigh the sample data to the reference population.

FADN farms have been classified according to whether they are located in LFAs or not, using the variable A39. LFA farms were further divided in two groups: those that have received the compensatory allowance and those that have not received the compensatory allowance, using the FADN variable SE 622. The analysis focused on the comparison for the years 2004 and 2009 of the evolution of the number of farms, UAA, number of LSU and AWU.

7.3 Judgment criteria and indicators

The reply to this question is based on the following criteria:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, in regions with LFA areas, the speed of structural changes has (has not) been slower/faster respect regional structural changes**
Change in % share of No of holdings with UAA located in LFAs/total No of holdings with UAA 2000-2007 in UE 15: by regions and SFP model
Change in % share of No of holdings with UAA located in LFAs/total No of holdings with UAA in the period 2007-2010 for FR, PT and ES: by region
Change in % share of LFA UAA /total UAA in the period 2000-2007 in UE 15: by region and SFP model
Change in % share of LFA UAA /total UAA in the period 2007-2010 for FR, PT and ES: by region
Change in % LFA average size farm /total average size farm in the period 2000-2007 in UE 15: by region and SFP model
Change in % LFA average size farm /total average size farm in the period 2007-2010 for FR, PT and ES: by region
% Share of holdings with LSU in LFAs on the total number of holdings in 2007: by region
Change in % LFA farms with LSU /total farms with LSU in the period 2000-2007 in UE 15: by region and SFP model
Change in % LFA farms with LSU /total farms with LSU in the period 2007-2010 for FR, PT and ES: by region
Change in % LFA AWU /total AWU in the period 2000-2007 in UE 15: by region and SFP model
Change in % LFA AWU /total AWU in the period 2007-2010 for FR, PT and ES: by region
Change in % share of LFA farms/total farms of the main structural indicators in the period 2005-2007 for Member States that entered the EU on 2004
Change in % share of LFA farms/total farms of the main structural indicators in the period 2007-2010 for BG and RO
Comparison of changes in the main structural indicators by groups of farms according to whether they are located in LFAs or not, and those that have received the compensatory allowance and those that have not received the compensatory allowance

7.4 Analysis of structural changes of agricultural holdings in marginal areas

This section reports the results of the analysis of the structural changes occurred in holdings located in Less Favoured Areas (LFAs).

The results are discussed at regional level and by SFP model of implementation. Due to the difference in time intervals, the analysis for EU15 and EU12 have been done separately.

7.4.1 LFA structural changes in the EU15

In this part of the analysis we look at the evolution of each structural indicator in LFA farms in relation to the trends observed for the same indicators in EQ1 across regions and groups of regions in the UE15.

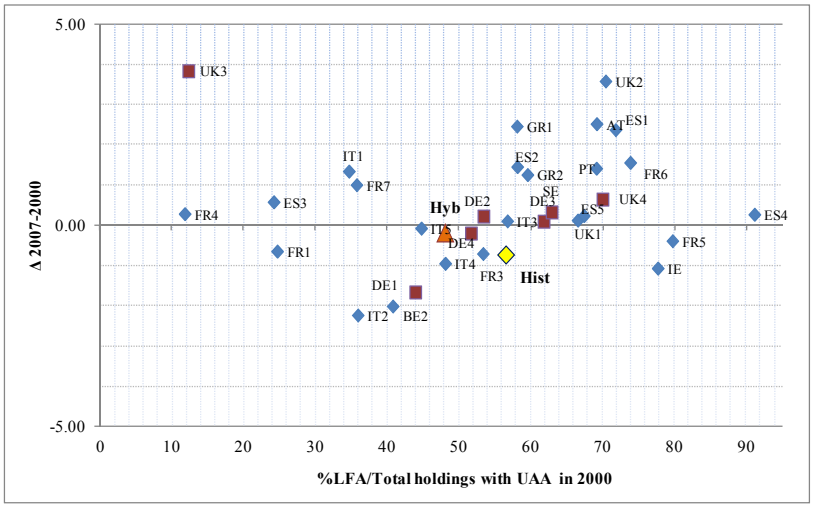
7.4.1.1 Changes in the number of LFA holdings

As we have seen in EQ1 (§ 6.4.1), the decrease in the total number of farms (with UAA) in the EU15 is a long-term phenomenon started before the 2003 reform and, within this general downward trend, the change in policy (in particular that regarding direct payments) appears to have played a role that differs for each SFP implementation model.

Between 2000 and 2007, in UE15 the number of farms with UAA located in LFA areas decreased by almost 18.3% (from 3.52 million holdings to 2.87 million). The decline was more or less the same for LFA regions implementing the Historical model and regions implementing the Hybrid model (respectively -18.4% and - 17.7%).

Results of the comparison 2007-2000 are shown in the graph.

Fig. 56 – % share of LFA holdings/total holdings with UAA in 2000 and difference of the ratio 2007-2000 by EU15 region and model of implementation



Source: Elaborations based on data from Eurostat

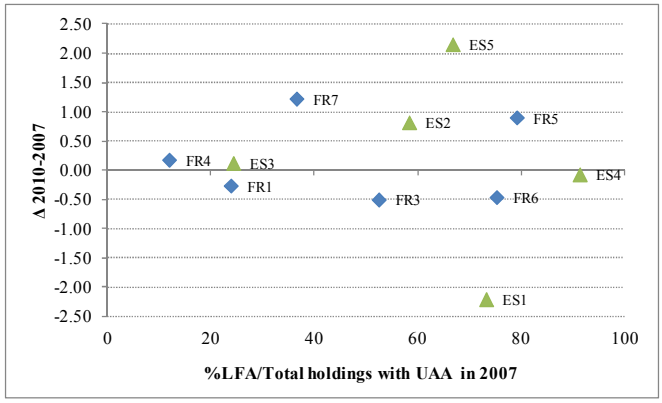
The results show that in the Hybrid model group of regions, the number of holdings in LFA areas decreased at the same speed of the total number of farms, while the regions implementing the Historical model saw a faster decrease in LFA farms. At regional level, however, we find rather uneven situations:

- Historical model: on the one hand, 12 regions out of 24 saw a slower decrease in the number of farms with UAA in LFAs and 3 regions (the two Greek regions and UK Wales) saw an increase in LFA farms compared to the downward trend of total number of agricultural farms. On the other hand 8 regions saw a more important decrease in LFA farms relative to total holdings. Finally, only Scotland saw an increase in the total number of farms against a decrease in the number of LFA farms.
- Hybrid model: in this case too, changes do not follow a single direction. In 4 regions out of 7, the decline of LFA farms is less important than the decrease in the total number of regional farms and therefore the share of farms located in LFAs increased. In 1 region (England) there was an increase in the number of farms in LFAs despite the regional decreasing trend of the number holdings. Conversely, in two regions the fall in the number of LFA holdings is larger than the fall in total farms (DE North-West and DE East & North-East).

Box No 1 – 2010 data concerning the number of holdings with UAA

For the three Member States for which 2010 FSS LFA data are available at present, we have extended the analysis to the year 2010. For that reason we have, using the same approach, calculated the difference of the ratio (LFA holdings/Total holdings) in 2010 and the same ratio in 2007 in order to verify the evolution in relation to 2007 situation. The table below summarises results obtained at regional level.

Fig. 57 – %LFA/total holdings in 2007 and difference 2010-2007



Source: Elaborations based on data from Eurostat

As we can see (see Fig. 56), most regions maintained the same trends between 2007 and 2010 in relation to the situation observed until 2007:

- a slower decrease in the number of holdings in LFA areas compared to the total regional holdings (ES Noreste, ES Est and ES Sur, FR Ouest, FR Méditerranée[146]);
- a faster decrease in the number of holdings in LFA areas compared to the total regional holdings (ES Noroeste, ES Centre, FR Bassin Parisien and FR Est) or an higher increase in LFA farms compared to the total (Portugal[147]).

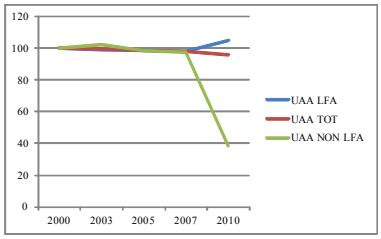
Only two French regions have reversed their positions: FR Sud-Ouest and FR Centre-Est.

7.4.1.2 Changes in the utilised agricultural area in LFAs holdings

The changes in UAA within LFA areas in the EU15 are modest compared with the trends observed in the number of LFA farms. Between 2000 and 2007, the UAA in LFA areas decreased by 3% but, the two models (Historical and Hybrid) saw opposite trends: UAA reduction in LFAs in the case of the Historical model (-3.69%) and a little increase in the Hybrid model (+0.27%).

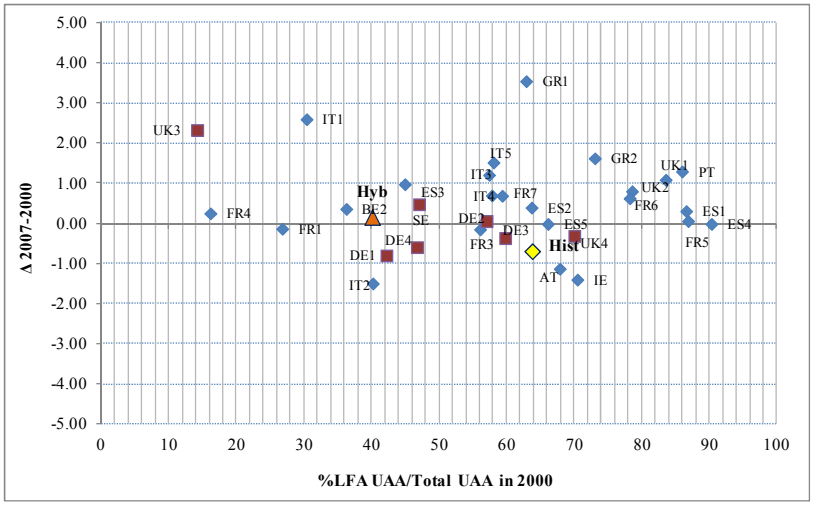
The evolution of UAA in LFA areas in relation to the trend of the total UAA across regions and groups of regions according to the SFP model of implementation for the EU15 regions is shown in the graph below.

146 Concerning the French regions, results should be taken with caution as from the analysis of data it seems that between 2007 and 2010 there was a change in the criteria of classification of LFA areas respect the past with non LFA areas being classified as LFA. Therefore 2007 and 2010 are not comparable. As example, the graph here below shows the evolution of the UAA in the FR Sud Ouest region (Index number 2000=100).



147 In the period 2000-2007, Portugal saw a slower decrease of LFA farms compared to the general downward trend.

Fig. 58 – % share of LFA UAA/total UAA in 2000 and difference of the ratio 2007-2000 by EU15 region and model of implementation[148]



Source: Elaborations based on data from Eurostat

The utilized agricultural area located in LFAs implementing the Hybrid model followed the trend of the total regional UAA. On the contrary the LFAs UAA of the group of regions implementing the Historical model saw a faster decrease compared to the total area. This result hides different situations at regional level:

- Historical model: in most regions (17/24) the share of UAA in LFA areas on total regional UAA increases but this result hides different situations:
  - six of these regions show both an increase in the UAA located in LFA areas and an increase in the total UAA (GR North, GR Centre-South, IT Isole, ES Noroeste, ES Noreste and Scotland);
  - four regions show an increase in the UAA in LFA areas and a decrease in the total UAA (BE Wallonne, FR Ouest, IT Nord-Ovest and ES Este)
  - finally seven regions show a smaller decrease in UAA in LFA areas when compared to the decrease in the total UAA (FR Sud-Ouest, FR Centre-Est, FR Méditerrannée, IT Centro, IT Sud, PT Continente and UK Wales).

  On the contrary, in five regions implementing the Historical model the UAA in LFA areas decreased more than the total agricultural area. This was the case in Austria, in two French regions (Bassin Parisien and FR Est), in Ireland and in IT Nord-Est.

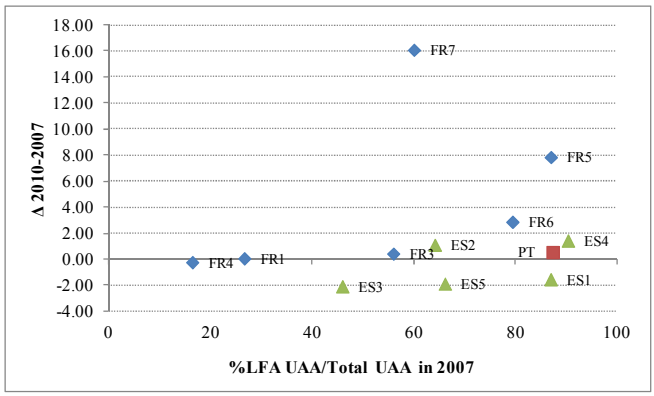
  In two Spanish regions (ES Centro and Sur) the trend of UAA in LFA areas follows the general trend.
- Hybrid model: the situation is rather mixed with four regions out of seven where UAA in LFA areas lost weight compared to the total UAA (DE North-West, DE South, DE East & N-E, and Ireland) and three regions with a positive trend (DE West, Sweden and England). In these latter regions we observe an increase in LFAs agricultural area as well as an increase in the total area but in all cases the increase in the UAA located in LFAs slightly higher relative to the increase in the total UAA.

[148] Spanish regions: 2003-2007

Box No 2 –2010 data concerning the UAA

Three Spanish regions (ES Noroeste, ES Este and ES Sur) show faster decline in the UAA in LFA areas compared with total UAA which represents a reversal of the trend observed before (in the period 2000-2007 the LFA decrease was slower). French regions changes should be taken with caution (see box No 1).

Fig. 59 – %LFA UUA/total UAA in 2007 and difference 2010-2007



Source: Elaborations based on data from Eurostat

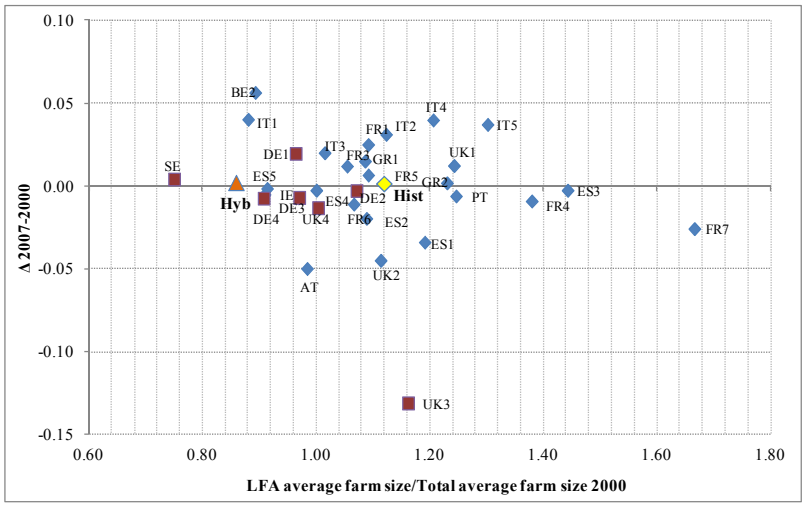
7.4.1.3 Changes in the average farm UAA in LFAs holdings

In a great number of regions the LFA average farm size is larger than the average size of total farms (ratio LFA average farm size /total average farm size > 1). Indeed LFA farms are usually characterised by a more extensive use of land.

In the period 2000-2007, the average size of UE15 farms located in LFAs rise by 18.8% (from 19.4 ha in 2000 to 23.1 in 2007). The highest growth occurred in the regions implementing the Hybrid model (21.8%, from 34.8 to 42.4 ha) and the growth in the regions implementing the Historical model was a little lower (18.1%, from 17.7 to 20.9 ha).

The smaller changes observed in the LFA UAA relative to the changes observed in the number of LFA holdings show that land abandonment did not occur to a higher degree in LFA which resulted in a rise of the average UAA in LFA farms.

Fig. 60 –LFA average size farm/total average farm size in 2000 and difference 2007-2000 by EU15 region and model of implementation[149]



Source: Elaborations based on data from Eurostat

In a context where the LFA average size of farms has increased in 2007 compared to 2000 in almost all regions (the only exceptions are UK Wales, DE East & North-East and England), the analysis

[149] Spanish regions: 2003-2007.

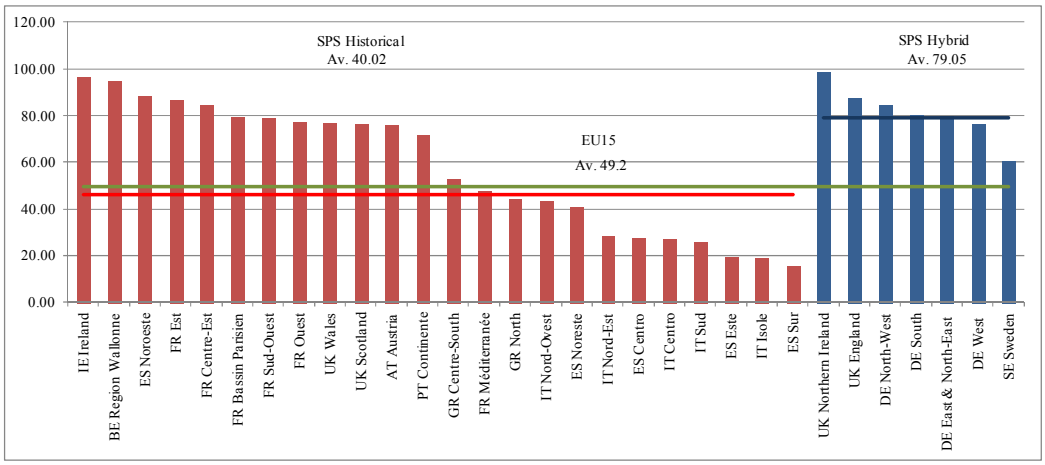
shows that, when compared with the trend of the average size of the total farms, variations both positive and negative, are minimal (comprised in a range between +0.06 points -0.13 points). The speed of increase of the average size was the same for both LFA farms and total farms and regardless of the SFP model implemented.

7.4.1.4 Changes in LFAs farms with livestock

In EQ 1, we have seen that, in most regions, already prior to the reform, the drop in the number of holdings with LSU was larger than the overall decline. LFA farms with livestock are a subset of total farms with livestock and, therefore, should be subject to the same downward trend. We thus analysed the evolution of LFA farms with livestock in relative terms comparing it to the general evolution of all farms with livestock and the differences that have occurred between 2000 and 2007.

Before looking at the results of the analysis of trends, it is useful to give an overview of the share of LFA holdings with LSU on the total number of LFA holdings, to gain a better understandings of the possible variations.

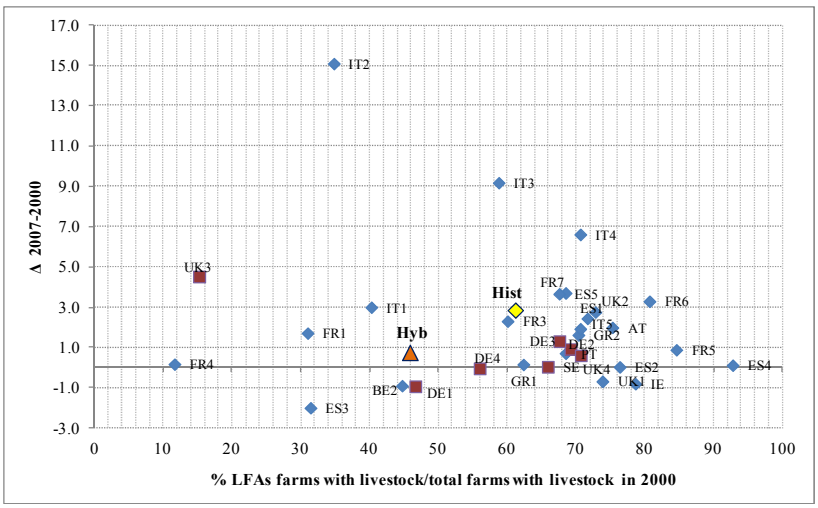
Fig. 61 – Share of holdings with LSU in LFAs on the total number of holdings by region in 2007 (%)



Source: Elaborations based on data from Eurostat

As we can see, in the EU15 the share of farms with LSU located in LFA areas represents around 50% of the total number of LFA farms, reaching 79.05% of the LFAs farms in the group of regions implementing the Hybrid model.

Fig. 62 – %LFA farms with LSU/total farms with LSU in 2000 and difference 2007-2000 by EU15 region and model of implementation



Source: Elaborations based on data from Eurostat

In a context of a generalised decline in farms with LSU, the results of the analysis show that the decline in the number of LFA farms with LSU was slower than the decline in the total farms. This

trend is common to both analysed models of implementation albeit the Historical model saw a better performance (+2.9 difference points) relative to the Hybrid model (+0.8 difference points).

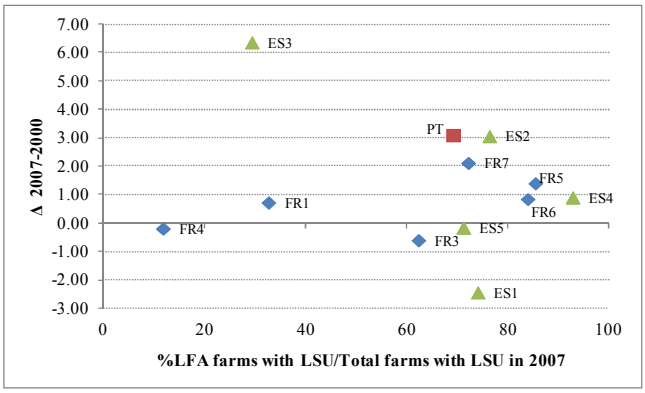
In detail, we can see that:

- Historical model: most regions applying this SFP model (18/24) show a lower reduction in the number of farms with livestock located in LFAs and 3 regions a larger decrease than the total number of the regional farms with LSU. UK Wales, ES Este and ES Sur saw an increase in both LFA and total farms with LSU, however in the case of ES Este the increase in the total number of farms with LSU was larger than the increase in LFA farms with LSU. The extent of the differences 2007-2000 is in most cases quite limited[150].
- Hybrid model: among the seven analysed regions of this model, four show a slower decrease in LFA farms with LSU compared to the general decreasing trend of the regional number of farms with LSU and one region (England) shows an increase in LFA farms with LSU in a regional context of general decrease in the total farms. In only one region we observed a faster decrease LFA farms relative to total farms (DE North-West). In Sweden the decrease in LFA farms with livestock followed the same trend of total livestock farms.

Box No 3 –2010 data concerning the number of farms with LSU

Between 2007 and 2010, FR Est, FR Ouest, ES Noroeste and ES Sur saw a reversal of the trend from positive to negative showing an acceleration of the decrease in LFA farms with LSU in relation to the decrease in the total number of farms with LSU. On the contrary, the Spanish region ES Sur saw the reversal of the trend from negative to positive with a greater increase in LFA farms with LSU compared to the total number of farms with LSU. Portugal maintained the same positive trend observed in the previous period.

Fig. 63 – %LFA farms with LSU/total farms with LSU in 2007 and difference 2010-2007



Source: Elaborations based on data from Eurostat

7.4.1.5 Changes in the number of annual working units in LFA areas

Finally it is useful to examine whether LFA labour force levels were maintained in relation to the general trends observed in the evolution of labour force in general.

The total labour force directly employed by holdings in the EU15 has been decreasing in the EU15: between 2000 and 2007 the decrease was -10.7% (in 2007, 624,010 AWU less than in 2000). In percentage terms, the strongest AWU reduction was found in the Historical model (-11.8%). The labour force of regions applying the Hybrid model declined less (-5,3%).

In this context, we examine whether the decrease of labour force in LFA areas was a faster or slower in relation to the general downward trend.

[150] The only regions with noticeable differences are three Italian regions (IT Nord-Est, IT Centro and IT Sud) but data of 2000 both on total farms with LSU and LFA farms with LSU should be taken with caution (see EQ1, § 6.4.6.1).

Fig. 64 – %LFA AWU/total AWU in 2000 and difference 2007-2000 by EU15 region and model of implementation[151]

Source: Elaborations based on data from Eurostat

Again the two SFP models show different trends: in the Hybrid model group there was a slower decrease in LFA AWU compared to the total AWU and in the Historical model a larger decrease in LFA AWU. At regional level, however, situations are rather mixed:

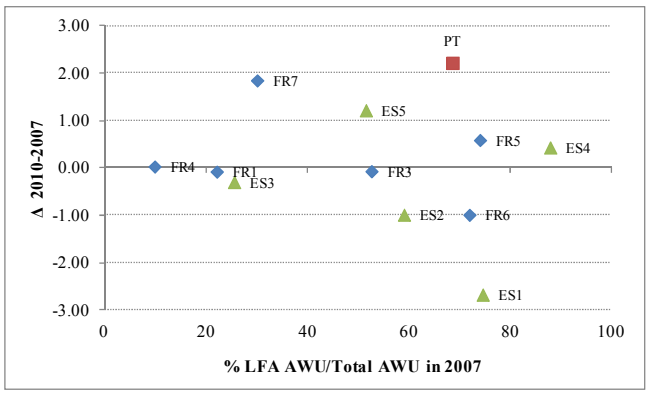
Historical model: 14 regions saw an increase in the LFA AWU share on total AWU. Among these 11 regions LFA AWU saw a slower decrease compared with the general trend of agricultural AWU; 2 Italian regions (Nord-Ovest and Sud) and ES Sur saw an increase in AWU in LFA areas despite the decrease in the total AWU. GR Centre-South shows a larger increase of total AWU compared to the increase in LFA AWU. In the remaining 9 regions LFA AWU decreased faster than total AWU.

- Hybrid model: in all German LFA areas the labour force reduction has been higher than the total regional AWU reduction. Conversely in Sweden and Northern Ireland the LFA labour force decreased lesser than the total regional labour force. England is the only region showing an increase in the total labour force and a decrease in the LFA AWU.

Box No 4 –2010 data concerning labour force

Relative to 2007 situation, most regions show a slower decrease in labour force in LFA areas compared to the total regional labour force. FR Centre-Este and ES Noroeste, that until 2007 saw a slower decline in the labour force in LFA areas, show instead after 2007 a faster decrease in LFA AWU.

Fig. 65 – %LFA AWU/total AWU in 2007 and difference 2010-2007



Source: Elaborations based on data from Eurostat

[151] Spanish regions: 2003-2007.

7.4.2 LFA structural changes in the EU12

As we have already mentioned, data on the 10 Member States that entered the EU in 2004 are available only for the years 2005 and 2007 and data for Bulgaria and Romania only for the years 2007 and 2010. Therefore the analysis for these Member States could only compare two years which is too short a period to see any structural change. Therefore, the results should be taken with due caution.

In EQ1 we have seen that also in EU12 Member States there is a long-term phenomenon of decline in the number of farms and that, in the period 2003-2010, the decrease in the total number of farms was larger compared to the EU15. As in the case of EU15 Member States, we should now examine whether the trends observed in LFA areas were more or less accentuated when compared to the general trends. Thus, for the 10 Member States that entered the EU in 2004, we have calculated for each structural indicator (i.e. number of holdings, UAA, average farm size, number of holdings with LSU, number of LSU and AWU) the % share LFA /total for the years 2005 and 2007 and then the difference 2007-2005[152].

The same analysis has been carried out for Bulgaria and Romania for the years 2007 and 2010.

Tab. 32 – Difference 2007-2005 between the %share LFA/total by structural indicator for EU10 Member States by region and model of implementation

		No holdings with UAA	UAA	Average farm size	No holdings with LSU	LSU	AWU
SPS Regional	SI Slovenia	2.00	0.76	-0.01	1.44	-0.04	0.01
SAPS	CZ Czech Republic	0.31	-0.10	-0.01	1.88	0.30	1.01
	EE Estonia	0.07	0.16	0.00	-1.34	1.46	1.54
	HU Dunántúl	-3.63	-1.92	0.17	-4.99	-5.97	-4.73
	HU Alföld és Észak	2.27	2.47	-0.06	-4.03	-7.92	-1.34
	LT Lithuania	-0.02	-0.76	-0.02	-0.77	-2.73	-0.53
	PL West	-0.72	0.33	0.02	-2.55	-1.29	-2.00
	PL East	2.08	-0.99	-0.09	0.47	-0.66	0.13
	SK Slovakia	2.20	7.76	0.08	-0.61	-0.26	4.13

Source: Elaborations based on data from Eurostat. In red are indicated the values of the difference > 0

The results of the analysis show clearly that there is no common trend either across regions or across the different indicators. However, some considerations can be made:

- when compared to the general decline observed in the total number of farms with UAA, in most regions (6/9) the decrease in the number of LFA farms was slower and in PL East, Slovenia, Slovakia there was even an increase in the number of farms in LFA areas. On the contrary, in farms with LSU[153], that have decreased in both cases, the decrease in the number of farms located in LFA has been larger than the total number of farms with only three exceptions (Slovenia, Czech Republic and PL East);
- 5/9 regions saw both an increase in the total UAA and in the UAA in LFA areas with a larger increase in the latter (only in PL East the total UAA increased more than the UAA in LFA areas). In the regions where there was a decrease in the total UAA (Czech Republic, the two Hungarian regions and Lithuania) the decrease in the UAA in LFA areas was larger with the exception of HU Dunántúl where the LFA UAA increased;
- the downward declining trend in the number of farms (total al LFA farms) and the general increasing trend in the total and UAA in LFA areas led to an increase in average farm size in both cases. However in half of the studied regions there was a larger increase in total farms average size compared to the LFA average size and the in the other half the contrary has happened.
- finally, the reduction in LFA areas labour force, when compared to the general decrease in the total regional labour force employed in agriculture (only the region PL West saw an increase in the total AWU), was slower in 5 regions and faster in 4 regions.

[152] We recall that Member States with the whole territory classified as LFA (Malta) and obviously Member States with no LFA areas (Cyprus, Latvia) are not included in the analysis.

[153] It is worth to mention that in the EU12, in 2007, the share of LFA farms with LSU on the LFA total number of farms was 78.2%.

Tab. 33 – Difference 2010-2007 between the %share LFA/total by structural indicator for BG and RO regions

		No holdings with UAA	UAA	Average farm size	No holdings with LSU	LSU	AWU
SAPS	BG Severna I Iztochna	-5.08	0.40	0.19	-4.67	-5.44	-2.73
	BG Yug. Yuzhina Cent.	-11.45	28.80	0.68	-10.35	-8.76	-12.97
	RO Macroregiunea Unu	3.02	0.68	-0.06	2.29	-0.40	-0.14
	RO Macroregiunea Doi	0.67	1.43	0.02	0.40	2.63	1.21
	RO Macroregiunea Trei	4.00	1.70	-0.08	1.63	0.18	3.82
	RO Macroregiunea Patru	1.24	-2.38	-0.16	0.65	-1.58	0.03

Source: Elaborations based on data from Eurostat. In red are indicated the values of the difference > 0

Romanian regions show in most cases a slower decrease (in some cases even an increase, i.e. LFA number of holdings in three of the four regions, LFA UAA in two regions) in LFA areas in relation to the overall downwards trends. Conversely Bulgarian regions saw a faster decrease in most structural indicators of LFA areas compared with the general regional trends, only the UAA and average farm size saw, in both LFA areas and total regional area, an increase[154].

7.5 Role of the LFA scheme in preserving farming in LFA areas

In the previous paragraphs we have examined the evolution of structural indicators in less favoured areas in relation to the general trends observed in the EU farming. We now verify if there is a relationship between LFA scheme (i.e. compensatory scheme) and the evolution of the structural indicators in LFA areas.

This part of the answer to the evaluation question is based on farm level analysis for the 12 case study regions. This analysis was developed on the full sample of FADN farms in the case study regions and focuses on the comparison of years 2004 and 2009. The sample data are extrapolated to the reference population using the weighting factors provided by FADN (variable SYS02).

The data for the 12 case study regions presented in the next page compare the key structural characteristics of farms located in LFAs of the considered regions in 2004 and in 2009, also operating a distinction between LFA farms that receive Compensatory Allowance (CA) from those that do not.

As shown in Tab. 34 there are rather different situations across regions in relation to the number of farms receiving the Compensatory Allowance[155]: in 2004 the share of LFA holdings receiving CA was comprised in a range from 100% of farms in Brandenburg region to 0.7% in the other German region and in 2009 in a range from 1% in DE-Niedersachsen to almost 95% in Slovenia.

The results of the analysis show three groups with different dynamics when comparing 2004 with 2009:

- A group of regions where the compensatory allowance seems to play a role in preserving farming in marginal areas. The regions of ES-Extremadura, SE- Slättbygdslän, HU-Del-Alfold, PL-Mazowsze-Podlasie, SI-Slovenia (and to a lesser extent DE Niedersachsen) belong to this group. These regions show, on the one hand an increase in the number of LFA farms receiving CA and on the other hand an increase in the share of LFA farms in relation to total regional holdings in all indicators. This indicates a slower decrease in LFA indicators compared to the decrease in those of the total farms.
- A group showing the opposite situation: i.e. regions where the share of most of LFA farms indicators on total regional holdings declined which indicates a faster decline in LFA holdings in relation to total agricultural holdings. This group is composed by DE-Brandenburg, FR-Centre, IT-Emilia Romagna, UK-England-East. In this group compensatory allowance does not seems to

[154] The 2010 data relative to the Bulgarian region BG Yugozapadna Yuzhina Centralna should, however, be taken with great caution: according to data between 2007 and 2010 there was an increase of LFA UAA of 89.6%.

[155] The Emilia Romagna region shows no holding receiving compensatory allowance. This is explained by the fact that the FADN questionnaire used in this Italian region records such payments as "Other payments". Moreover, the Hungarian region (Del-Alfold) shows no farm receiving compensatory allowance in 2004.

have played a role in preserving LFA farming.

- A group where there is no clear indication about the relationship between LFA scheme and the evolution of the different structural indicators in LFA areas. This is the case of EL-Makedonia-Thraki and of the Portuguese region Alentejo e do Algarve.

Tab. 34 – Case study regions: Share of holdings, UAA, LSU, AWU in LFA and LFA with compensatory allowance (2004, 2009)

	Number LFA holdings / Tot number holdings			Number LFA holdings with CA* / Tot number LFA holdings			UAA in LFA holdings / Tot UAA			UAA of LFA holdings with CA / Tot UAA of LFA holdings			LSU in LFA holdings / Tot LSU			LSU of LFA holdings with CA / Tot LSU of LFA holdings			AWU of LFA holdings / Tot AWU			AWU of LFA holdings with CA / Tot AWU of LFA holdings		
	%		Diff.	%		Diff.	%		Diff.	%		Diff.	%		Diff.	%		Diff.	%		Diff.	%		Diff.
	2004	**2009**		**2004**	**2009**		**2004**	**2009**		**2004**	**2009**		**2004**	**2009**		**2004**	**2009**		**2004**	**2009**		**2004**	**2009**	
DE-Niedersachsen	24.6	24.6	0.0	0.7	1.0	0.3	22.4	22.8	0.4	0.8	1.3	0.5	28.2	28.7	0.5	0.9	1.2	0.3	23.5	22.6	-0.9	0.8	1.3	0.5
DE-Brandenburg	67.0	64.5	-2.5	100.0	79.2	-20.8	74.7	69.5	-5.2	100.0	83.9	-16.1	83.5	84.0	0.4	100.0	97.9	-2.1	72.5	68.0	-4.4	100.0	88.2	-11.8
FR-Centre	41.2	40.5	-0.7	49.3	35.4	-14.0	43.4	44.0	0.6	50.7	38.8	-11.9	69.7	69.2	-0.5	75.7	56.6	-19.1	37.9	39.4	1.5	44.3	33.6	-10.7
IT-Emilia Romagna	30.0	28.2	-1.7	0.0	0.0	0.0	32.9	27.7	-5.2	0.0	0.0	0.0	31.9	44.2	12.3	0.0	0.0	0.0	31.0	26.6	-4.4	0.0	0.0	0.0
UK-England-East	4.3	3.3	-1.0	79.1	69.5	-9.6	3.8	3.2	-0.7	85.2	79.7	-5.5	6.5	6.0	-0.6	73.7	72.2	-1.5	2.9	2.4	-0.4	74.9	68.2	-6.8
EL-Makedonia-Thraki	69.8	62.8	-7.0	34.7	38.7	4.0	76.3	73.3	-3.0	44.4	51.5	7.1	88.8	85.7	-3.1	67.1	78.1	11.0	70.1	62.4	-7.8	41.5	47.0	5.5
ES-Extremadura	92.5	93.6	1.1	14.7	37.9	23.2	78.7	86.3	7.6	14.4	38.1	23.7	85.0	92.3	7.4	17.6	38.9	21.3	89.4	90.8	1.3	12.9	37.0	24.1
PT-Alentejo e do Algarve	74.7	95.0	20.3	61.4	47.2	-14.1	93.8	96.0	2.2	39.0	29.2	-9.8	97.9	97.5	-0.3	40.5	25.1	-15.4	79.1	92.9	13.8	45.9	41.9	-4.0
SE-Slättbygdslän	31.7	33.2	1.5	57.0	71.1	14.2	33.3	34.6	1.3	59.7	63.2	3.5	36.2	38.6	2.4	66.3	70.2	3.9	36.9	36.9	0.1	62.6	70.0	7.3
HU-Del-Alfold	52.7	55.0	2.3	0.0	5.5	5.5	49.6	52.0	2.4	0.0	15.3	15.3	55.4	75.9	20.5	0.0	10.9	10.9	46.3	48.8	2.5	0.0	7.2	7.2
PL-Mazowsze-Podlasie	57.8	66.5	8.7	5.3	92.8	87.5	61.6	69.6	8.0	6.4	93.2	86.8	63.1	75.1	11.9	4.9	92.6	87.8	55.5	65.2	9.8	5.7	92.8	87.0
SI-Slovenia	86.1	88.8	2.7	92.8	94.8	1.9	85.8	87.1	1.2	90.1	94.1	4.0	83.0	85.8	2.8	89.9	93.8	4.0	84.7	88.7	4.0	90.8	94.8	3.9

* CA = Compensatory Allowance

In red are indicated the values of the difference > 0

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

7.6 Evaluation judgment

The evaluation question aimed at investigating whether direct payments have had an impact on the evolution of farm structures in Less Favoured Areas (LFAs) as defined by Council Regulation (EC) No 1257/1999 of 17 May 1999.

The methodological approach is based on statistical analysis of the evolution of the main structural indicators of LFA farms, in relation to the trends previously observed in EQ1 for all agricultural farms across regions and groups of regions according to SFP model. The following structural indicators were analysed: number of holdings with UAA, utilised agricultural area, average farm size, labour force, number of holdings with LSU and number of LSU.

Currently, 2010 FSS data on LFAs are available only for a limited number of Member States. For that reason, the analysis for the EU15 covers the years 2000-2007, whereas for the 10 Member States that entered the EU in 2004 it was only possible to compare the years 2005 and 2007 and for Bulgaria and Romania only 2007 with 2010 .

The short time interval is a strong limitation of the analysis of structural changes both for EU15 and EU12. Indeed, it is not possible to compare the two sub-periods, pre- and post-reform. Therefore, **it is not possible to draw any conclusions on the role of direct payments in LFAs**. However it is possible to highlight certain trends.

In the years 2000-2007, the trends observed in Less Favoured Areas of the EU15 appear to be different depending on the SFP model implemented. The table below presents a synthesis of the main results regarding the evolution of structural indicators of LFA areas in relation to the overall trends observed for the same indicators on all farms.

Model of implementation	No holdings with UAA	UAA	Average farm size	Holdings with LSU	AWU
Historical	Faster ↓	Faster ↓	=	Slower ↓	Faster ↓
Hybrid	=	=	=	Slower ↓	Slower ↓

Overall, for the regions applying **the Historical model, LFA areas show** in three of the five examined indicators **a slightly faster decrease in relation to the general downward trends observed in all agricultural holdings (differentials are usually small) and the same or slower decrease is observed in LFA areas of the regions implementing the Hybrid model relative to the overall trends**.

Conversely, **the number of farms with LSU declined to a lesser extent in LFA areas when compared to the decline in the total number of farms with LSU in both models**. Bearing in mind that the analysis carried out in EQ 1 led to conclude that in most regions the drop in the number of holdings with LSU (already observed prior to the reform) was larger than the overall decline and that LFA farms with LSU represent on average 50% (2000-2007) of the total number of LFA farms in the EU15, it seems that livestock farming has been preserved in LFA areas vis-à-vis the overall decline in the total number of farms with LSU.

In the EU12, the analysis based on two years only (2005-2007, and 2007/2010 for Bulgaria and Romania) shows no clear trends across regions, but **in general the decrease in the number of farms in LFAs was slower than the overall agricultural holdings' decline**. Contrary to what observed in the EU15, in the EU12 the **decrease in the number of farms with LSU located in LFA has been larger than the decrease in total livestock farm numbers** (with the exception of Slovenia, Czech Republic, PL East and the Romanian regions).

An in-depth analysis conducted in 12 case study regions, based on FADN farm data (full sample) and distinguishing farms that have received compensatory allowance from those that have not received it, shows again rather mixed results across regions when comparing 2004 with 2009: i) a group of regions where compensatory allowance seems to play a role in preserving farming in marginal areas (ES-Extremadura, SE- Slättbygdslän, HU-Del-Alfold, PL-Mazowsze-Podlasie, SI-Slovenia, and to a lesser

extent DE Niedersachsen) ; ii) a group of regions where compensatory allowance does not seem to have played a role in preserving LFA farming (DE-Brandenburg, FR-Centre, IT-Emilia Romagna, UK-England-East) and iii) a group where there is no clear indication about the relationship between LFA scheme and the evolution of the different structural indicators in LFA areas (EL-Makedonia-Thraki and the Portuguese region Alentejo e do Algarve).

8. Theme 3 – Labour force and capital: To what extent have direct payments affected farm labour force (EQ3)

8.1 Comprehension and interpretation of the evaluation question

The evaluation question requires to assess to what extent direct payments have affected farm labour force. The theoretical analysis has already discussed the way in which direct payments can affect labour allocation decisions as well as the substitution of capital for labour. Here the key terms of the evaluation question are reviewed considering the structural characteristics related to labour on which the analysis will focus on.

The labour force can change over time in terms of quantity (i.e. amount) and quality.

Quantity. The aggregate number of persons engaged in agriculture is generally analysed at the national or regional level. However, a common approach is to look at the evolution of the amount of labour utilised per unit of land in order to assess the relative change. Indeed, because the amount of land is generally stable over time, this provides an accurate indication of the change in the relative intensity of labour.

Quality. One important aspect regarding the quality of labour refers to the source of labour used on the farm, which can be provided by family members or by other persons generally hired and paid by the farm holder. The relative importance of family labour with respect to the total amount of labour can change over time and this evolution can occur together with the evolution of the total amount of farm labour. For example, any factor reducing the total amount of labour could also induce an increase of the relative importance of family labour. This is because the holders may be less willing to lay-off family members than external paid workers.

Another important farm structural characteristic related to labour is the organisation of the farm in terms of part-time or full-time labour. The outmigration of farm labour could cause a decline in farm numbers but also a change in the number of part-time farmers that still manage a farm even if a large share of their working time is used off-farm. This latter strategy may be chosen whenever the farmer does not want to lose the opportunity to receive direct payments and, in order to do so, he/she needs to hold on to farm land. While this topic could be approached in different ways, the availability of data and several conceptual problems suggest to focus the analysis on farm holders only. Therefore, as it is common in this type of analysis, it has been decided to define part-time farming as the case in which farm holders provide only a share (i.e. ≤ 50%) of their full availability of working days on the farm. This characteristic is frequently encountered in small farms because their economic size is not big enough to justify the presence of a full-time farmer. The analysis of this topic considers the evolution of the share of farms conducted by farm holders on a part-time basis over the total number of farms.

The decision of managing a farm part-time could also have very different implications according to the off-farm work status of farmers. In particular, retired persons could act as farm holders providing a very limited amount of working days on the farm but not having any off-farm occupation. This latter typology of farmers is different from that of holders who are also employed off-farm. Therefore, part-time farming has been analysed more in depth for the sub-group of retired part-time farmers, by considering the relative frequency of part-time holders ≥ 65 years old.

One final aspect that has been considered in the statistical analysis is the age structure of farm holders. As explained in the theoretical analysis, older holders may have less opportunity to find off-farm jobs. Therefore, any factor negatively affecting the amount of farm labour used could increase the share of labour provided by older holders. Furthermore, the age structure of farm holders is an important structural characteristic in itself, but also because of the consequences it can have on further structural developments. In particular, it can influence farmers' choices regarding both on- and off-farm labour and investment decisions[156]. In this respect, it is often perceived that younger farmers may be more dynamic, willing to innovate and to invest time and financial resources on the farm.

[156] Kimhi A. (2000).

8.2 Methodological approach, data sources and limits

The methodology comprises two main analytical approaches: statistical analysis and econometric modelling. The different methodologies are described separately. Below we detail the methodology adopted for the statistical analysis. For the description of the methodology developed for the econometric analysis, please refer to § 5.1.2.2)

The statistical analysis is conducted across the EU27 Member States for the observation period corresponding to the years 1995 onwards, with special focus on the years 2005 onwards. The aim of the statistical analysis is: i) to assess the evolution of labour use in the EU regions according to several dimensions, i.e. labour intensity, family labour intensity, age structure, part-time/full time organisation; ii) to identify possible relationships between direct payment policy and evolution of labour use.

The analysis is carried out at macro- and micro-economic level. At the macro level, the analysis is based on Eurostat data (FSS) and carried out at the NUTS II regional level. At the micro level, the analysis is based on FADN data by distinguishing between homogeneous groups of farms. The analysis is completed by a further investigation developed on samples of individual farms in the case study regions.

A description of developed methods of analysis and indicators follows.

Evolution of labour use in the EU regions (Eurostat data and FADN full sample)

The analysis is carried out at macro and micro-economic level and considers several aspects of labour use:

- Labour intensity. This is calculated as the ratio of Total Labour Force per unit of Utilised Agricultural Area (TLF/UAA) and it is expressed in terms of hours per hectare (h/ha). The analysis also distinguishes by farm type and economic size (see § 5.1.1.1. for the methodological choices made to ensure data comparability for these two classifications);
- Relative importance of labour provided by family members (including the holder). This is calculated as the ratio between units of family labour and Total Labour Force (FLF/TLF);
- Relative importance of farms with part-time holders. This is calculated as the ratio between the number of individual farms where holders provide less than 50% of one AWU on-farm, and the total number of farms in which holders are a natural person;
- Relative importance of farms managed by farmers aged ≤35 and by farmers aged ≥ 65. These two indicators are calculated in the following way: number of individual farms in which the holder is ≤ 35 years old/total number of individual farms; number of individual farms in which the holder is ≥ 65 years old/ total number of individual farms.

The intensity of the evolution over time of the above indicators is measured by average annual growth rate (%, AAGR)[157]. The use of AAGR makes it possible to compare changes occurred in time intervals of different length.

Regarding the policy side, two main dimensions have been considered in this part of the analysis:

- Changes occurred in the groups of regions implementing different SFP models: this dimension is considered by comparing the evolution of labour use in the groups of regions implementing the SPS Historical, Hybrid, and Regional models and the SAPS.
- Changes occurred after the implementation of the 2003 CAP reform: this dimension is considered by comparing the evolution of labour use in the pre-reform and post-reform periods.

The analysis uses both Eurostat and FADN data. Eurostat data collected in the Agricultural Census 2010 provide the most up-to-date and complete information on labour. Furthermore, this source refers to the universe of EU holdings and not to a sample as it is the case of FADN data. Therefore, while both databases have been analysed, only the results of the analysis based on Eurostat data are presented and discussed here. Indeed, this allows to study the evolution of labour use at the macro-

[157] This is calculated by means of the Compound Annual Growth Rate (CAGR) : $CAGR(t_0, t_n) = ((V(t_n)/V(t_0))\text{^}(1/(t_n-t_0)) - 1$ where: $V(t_n)$ and $V(t_0)$ are final and initial values.

territorial level in the EU27 regions in a period spanning from before the 2003 CAP reform to 2010. However, the FADN database has several properties that have been useful in the analysis. Indeed, this database:

- allows to bring the analysis to the individual farm level;
- contains data also on direct payments;
- contains data on capital intensity, allowing a combined reading of the analysis results on labour use and capital intensity (Chapter 9).

To ensure consistency of statistical analysis of different secondary sources, the indicators are computed for 55 macro-regions covering the whole EU (see § 5.1) Regional data are also aggregated into groups of regions according to the model of implementation of direct payment policy differentiating between regions and Member States implementing the SAPS and the three different implementation schemes of SPS: Historical, Regional and Hybrid.

Eurostat data

The Eurostat FSS/Census data is used to conduct the analysis of the evolution of labour use on the whole EU27 on the basis of regional data. This database provides aggregate regional information on total labour force (TLF), family labour force (FLF), number of farms managed by part-time holders and subdivided by age class of the holder. This database does not provide information on amount and characteristics of direct payments.

The analysis considers data for the period from 1995 to 2010. However, data availability is not homogeneous across the different Member States. Thus, the analysis focuses on the evolution over the whole period only for EU15 regions, and for the years 2003 – 2010 for all regions. This also allows analysis of the evolution of labour indicators in the sub-periods 2003-2005 and 2005-2010.

The analyses are influenced by some aspects that need to be taken into due account if results are to be correctly evaluated. In particular, as mentioned in Chapter 5.1.1.1:

- Germany, United Kingdom and Czech Republic have excluded from the 2010 census farms with arable UAA below 5 ha. As a result, changes to the number of farms and other related indicators (i.e. UAA per farm) are affected by this decision[158].
- In some Member states Common land was not recorded until 2010. Since Common land area is included within the UAA, in the MS where it was recorded for the first time in 2010, data for this year are not comparable to previous FSS years. In order to make the data comparable, we have subtracted Common land area from the UAA in the MS for which such information was recorded for the first time in 2010: Bulgaria, France, Hungary, Ireland and Slovenia[159].

Full FADN sample

The full sample of FADN farms has been used to study the evolution of labour use in the regions of the EU27 between 2004 - 2009 in all Member states but Bulgaria and Romania, where the analysis covers only the years 2007-2009.

The FADN database contains individual farm structural data (including those related to labour force) and it is made up of a different number of farms in every year, making the sample not constant (i.e. not containing the same farms). However, the database provides for each farm a weight that measures the relative importance of each observation in the sample. Farm weights have been used to report the sample data to the reference population. Also in this case, the analysis operates a distinction between models of SFP implementation, farm type and class of economic size.

Regional case studies (FADN constant samples)

This part of the analysis is aimed at verifying whether in the farms of each region:

- the level of direct payments (TDP/UAA) is correlated with the evolution over time of labour intensity (TLF/UAA);

[158] In the Hybrid model 6 regions out of 10 (four of Germany and two of UK) were affected by changes to the calculation method.

[159] United Kingdom and Greece also collected common land data for the first time in 2010, but it is not included in UAA.

- change in the relative importance of coupled direct payments (CDP/TDP) is correlated with the evolution over time of the labour intensity (TLF/UAA).

This analysis has been developed on constant FADN samples (2004 and 2009) selected in the 12 case study regions[160]. This analysis differs from the previous because of three main reasons. Indeed, it is:

- based on a constant sample, thus it allows to analyse the structural adjustments (due to changes in policy, market developments and other external factors) overcoming the influence of sample changes over time;
- based on single farm data: thus it is not affected by averaging individual data;
- developed within groups of farms located in the same region, thus the results are not affected by the differences between regions in terms of economic, policy and environmental regional specific factors.

These characteristics made the considered samples very useful to further the analysis in order to identify possible relationships between direct payment policy and labour-related structural change. In particular, the analysis is focused on the change over time (2004–2009) of labour intensity and on the following aspects of direct payment policy:

- Direct payment level. It is calculated in each farm as the amount of direct payment per unit of land (TDP/UAA). Direct payment level per unit of land is calculated on the basis of the average value for the years 2004 and 2009: (TDP2004 + TDP2009)/(UAA2004 + UAA2009). The use of both the first and the last year of the examined interval is particularly important in order to account for the positive trend in direct payment level that has occurred in the EU12 MSs because of the increase of the overall amount of direct payments generated by the phasing-in mechanism.
- Decoupling process, i.e. the relative importance of coupled payments (CDP/TDP). This ratio, calculated in each farm of the sample, provides information about the nature of direct payments. It seems very important to analyse the change in policy occurred after the 2003 reform (i.e. decoupling).

The correlation has been calculated by mean of Pearson's correlation coefficients and related statistical tests for their significance (for further details please refer to § 8.5).

The analysis has been developed in each region separately and, within each region, in the following groups of farms:

- whole constant sample;
- farms aggregated into 3 economic size classes based on ESU classification (1 ESU corresponds to a farm's Standard Gross Margin (SGM) of 1.200 Euro/year): small farms are below 16 ESU, medium farms are between 16 and 40 ESU and large farms are above 40 ESU:
- farms belonging to 8 farm types (TF) according to the "General TF" classification: Specialist field crops; Specialist horticulture; Specialist permanent crops; Specialist grazing livestock; Specialist granivores; Mixed cropping; Mixed livestock; Mixed crops-livestock.

The latter two aggregations have been developed on the basis of the characteristics of the farms in 2004. Furthermore, the analysis has been performed only when the groups contain at least 15 farms, according to confidentiality rules established for FADN data.

8.3 Judgment criteria and indicators

In order to reply to this question, we based our judgement on the following criteria and indicators:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, in the EU regions direct payments have (have not) affected farm labour allocation decisions in terms of labour use intensity**

[160] Niedersachsen (DE), Brandenburg (DE), Makedonia Traki (EL), Extremadura (ES), Centre (FR), Del Alfold (HU), Emilia Romagna (IT), Łódzkie, Mazowsze, Lubelskie and Podlasie (PL), Alentejo (PT), Slattbygldslandan (SE), England East (UK), Slovenia (SI).

Criteria and indicators
Labour intensity (Total Farm Labour/Utilised Agricultural Area) with respect to SFP implementation model, economic size class and type of farming (1995-2010 Eurostat, 2000-2009 FADN)
AAGR of labour intensity with respect to SFP implementation model, size class and type of farming (1995-2010 Eurostat, 2000-2009 FADN)
Comparison of the AAGR of labour intensity in the pre-reform and post-reform years with respect to SFP implementation model
Correlation between average level of direct payments and relative change of labour intensity at farm level in the case study regions (2004 and 2009)
Correlation between relative change of the share of coupled payments to total direct payments and labour intensity at farm level in the case study regions (2004 and 2009)
Regression parameter estimates for direct payments at the farm level
Judgment criterion no. 2 **Over the examined time period, in the EU regions there is (there is not) a relationship between direct payment policy and the relative importance of labour provided by family members**
Relative importance of labour provided by family members (Farm Family Labour Force/Total Labour Force) with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
AAGR of the ratio Family Labour Force/Total Labour Force with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
Comparison of the AAGR of the ratio Family Labour Force/Total Labour Force with respect to SFP implementation model in the pre-reform and post-reform years
Relative importance of labour provided by family members (Farm Family Labour Force/Total Labour Force) with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
AAGR of the ratio Family Labour Force/Total Labour with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
Comparison of the AAGR of the ratio Family Labour Force/Total Labour Force in the pre-reform and post-reform years with respect to SFP implementation model
Judgment criterion no. 3 **Over the examined time period, in the EU regions there is (there is not) a relationship between direct payment policy and the relative importance of farms managed by holders over 65 years old and of farms managed by holders younger than 35 years old**
Shares of farms with holders ≥65 years old and farms with holders ≤ 35 years old over the total number of individual farms (%) with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
AAGR of the share of farms with holders ≥ 65 years old and share of farms with holders ≤ 35 years years old with respect to SFP implementation model (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
Comparison of the AAGR of the share of farms with holders ≥ 65 years old and with holders ≤ 35 year old in the pre-reform and post-reform years with respect to SFP implementation model
Judgment criterion no. 4 **Over the examined time period, in the EU regions there is (there is not) a relationship between direct payment policy and the relative importance of farms managed by part-time holders**
Share of farms with part-time holders over the total number of individual farms (%) with respect to model of SFP implementation (1995-2010 Eurostat, 2000-2009 FADN, also by economic size class and type of farming)
AAGR of the share of farms with part-time holders over the total number of individual farms (%) with respect to model of SFP implementation and, for FADN data, also size class and type of farm (1995-2010 Eurostat, 2000-2009 FADN)
Comparison of the AAGR of the share of farms with part-time holders over the total number of individual farms in the pre-reform and post-reform years with respect to model of SFP implementation
Share of farms with part-time holders ≥ 65 years old over the total number of individual farms with part-time holders with respect to model of SFP implementation (1995-2010 Eurostat, 2000-2009 FADN)
AAGR of farms with part-time holders ≥ 65 years old over the total number individual farms with part-time

Criteria and indicators
holders with respect to model of SFP implementation (1995-2010 Eurostat, 2000-2009 FADN)
Comparison of the AAGR of the share of farms with part-time holders ≥ 65 years old over the total number individual farms with part-time holders in the pre-reform and post-reform years with respect to model of SFP implementation

8.4 Analysis of the evolution of labour use in the EU regions

The analysis of data regarding the use of labour is mainly aimed at identifying differences in the evolution of labour use in the EU regions. In particular, because of the topic of the evaluation, the main focus is on the comparison of: a) evolution in the pre-reform and in the post-reform years (2003-2005 and 2005-2010, however for EU15 regions the years 1995-2005 have also been considered to account for previous trends); b) evolution observed in groups of regions applying different SFP models.

These two approaches are aimed at identifying: a) if the evolution has been more or less intense after the CAP reform, b) if the model of SFP implemented may have influenced the evolution of the considered labour structural attributes.

The following sections present the main results for each labour use dimension under study.

In each section the analysis starts by considering data referring to the whole farm population and aggregated according to the SFP model of implementation. For sake of brevity, the discussion focuses on the macro-territorial level (Eurostat data). Results at farm level (FADN) are recalled when relevant. Further details of regional data inside each group are also provided. In particular, this is aimed at assessing if there is homogeneity in the evolution within the considered groups of regions or not. This information can be useful to shed light on whether there are relatively small or large differences in the behaviour of the regions applying different SFP models. The overall analysis is further detailed at the farm level analysing farms behaviour according to economic size and sector.

While the analysis shows results considering one aspect at the time, it is important to emphasize that most of these aspects are interlinked. Some of these relationships are recalled in the text when deemed important to understand the observed evolutions. Furthermore, some of the changes observed in the considered labour dimensions are due to changes of other farm structural attributes. For example, it is important to recall that changes in average farm size and in the relative importance of farms of different size (see Chapter 6, Farm structural changes) strongly affect some labour characteristics. Again, these aspects are recalled when considered useful to explain the observed changes. However, the relationships between changes in more than one structural dimension at the time are analysed in Chapter 10 (Farm specialisation).

8.4.1 Evolution of labour intensity

The level of labour intensity[161] varies among regions according to several factors including production patterns and their structural characteristics. Indeed, labour intensity is higher in the EU12 than in the EU15 (Tab. 35). Differences exist also among groups of regions implementing different SFP models, with regions of the SPS Regional and SAPS models presenting the highest values. A further difference can be seen within the remaining SPS groups: labour intensity reaches the lowest level in the regions of the SPS Hybrid model.

[161] Labour intensity is considered as the ratio Total Labour Force over Utilised Agricultural Area (TLF/UAA) and is expressed in terms of hours of work per ha of land (h/ha).

Tab. 35 – Evolution of labour intensity in the groups of EU regions

	Total Labour Force/Utilised Agricultural Area (h/ha)							Average annual growth rate (%)				
	1995	1997	2000	2003	2005	2007	2010	1995-05	2003-05	2005-10	1995-10	2003-10
SPS Historical	114	109	101	100	96	91	80	-1.7	-2.0	-3.6	-2.3	-3.2
SPS Hybrid	68	66	59	61	58	54	49	-1.6	-2.9	-3.4	-2.2	-3.3
SPS Regional				362	360	317	311		-0.3	-2.8		-2.1
SAPS				269	256	225	183		-2.4	-6.5		-5.4
EU-15	101	97	89	89	85	80	71	-1.6	-2.1	-3.6	-2.3	-3.2
EU-12				270	257	226	184		-2.4	-6.5		-5.3
EU 25				113	109	103	90		-1.8	-3.7		-3.2
EU-27				139	132	121	103		-2.5	-4.9		-4.3

Source: Elaborations based on data from Eurostat

A large heterogeneity can be found within each group of regions. In 2010, labour intensity is extremely high in Malta but is also very high in regions of Greece, Portugal, Spain and Italy (in the regions applying the SPS Historical model), in Slovenia and in several regions of Bulgaria, Romania, Poland and in Cyprus.

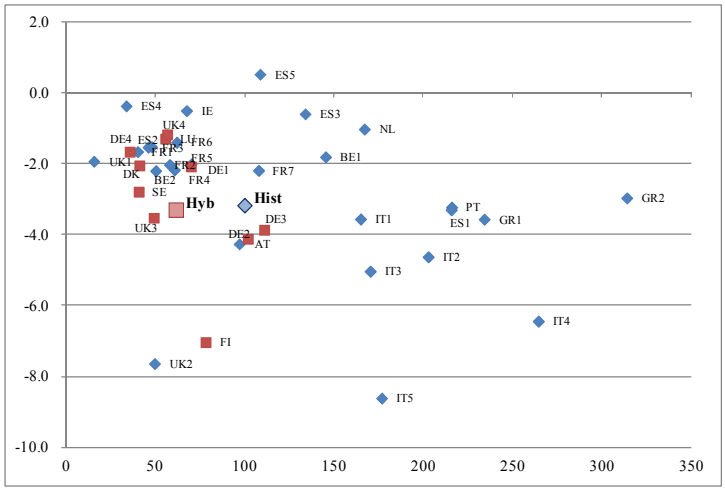
Labour intensity has declined steadily over the considered period in all EU regions. Indeed, according to Eurostat data, in the EU27 labour intensity has declined at around 4.3% each year between 2003 and 2010. The reduction of labour use has been a constant element of structural change in most EU regions also in earlier years (e.g. from 1995 in the EU15). However, because of the topic of the evaluation question, here it is more interesting to focus on the differences in the rates of change existing: a) between the groups of regions implementing different SFP models and b) before and after the 2003 CAP reform.

The decline of labour intensity has been greater in the EU12 regions around 5% per year, while in the EU15 is around 3% per year over the same period of time. The reduction of labour intensity is common to all regions also when grouped according to SFP model of implementation (Tab. 35). However, between 2003 and 2010, TLF/UAA declines by around 3% per year in the regions applying the SPS Historical and Hybrid models, but by over 5% in those implementing the SAPS.

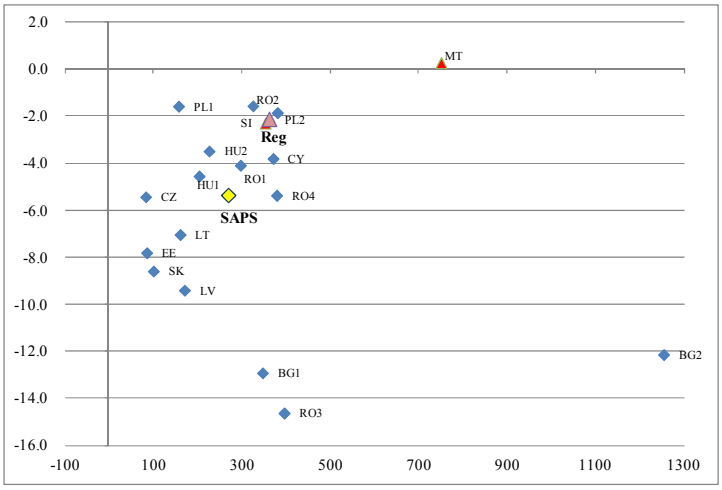
This difference in the evolution is consistent with the fact that in some of the regions of the latter group the average labour intensity at the beginning of the considered period (2003) was around 2.7 times larger than that of the SPS Historical regions and 4.4 times that of SPS Hybrid. Indeed, this can be appreciated by looking at Fig. 66 that represents, for each region and group of regions, the level of labour intensity in 2003 (x-axis) and its average annual growth rate over the years 2003-10 (y-axis). This graph shows that a small negative correlation exists between the level of labour intensity and its evolution over time (with the exception of Malta). This means that some of the regions with the highest labour intensity in 2003, have subsequently witnessed a strong decrease. While this is clearly the case only for one region of Romania (RO3) and of the two regions of Bulgaria, this is enough to justify the evolution observed for the whole group of regions applying the SAPS.

Fig. 66 – Level of labour intensity (2003) (x-axis) and evolution (2003-10) (y-axis) in the EU regions: Labour intensity (h/ha) and average annual growth rate (%)

SPS Historical and SPS Hybrid



SPS Regional and SAPS



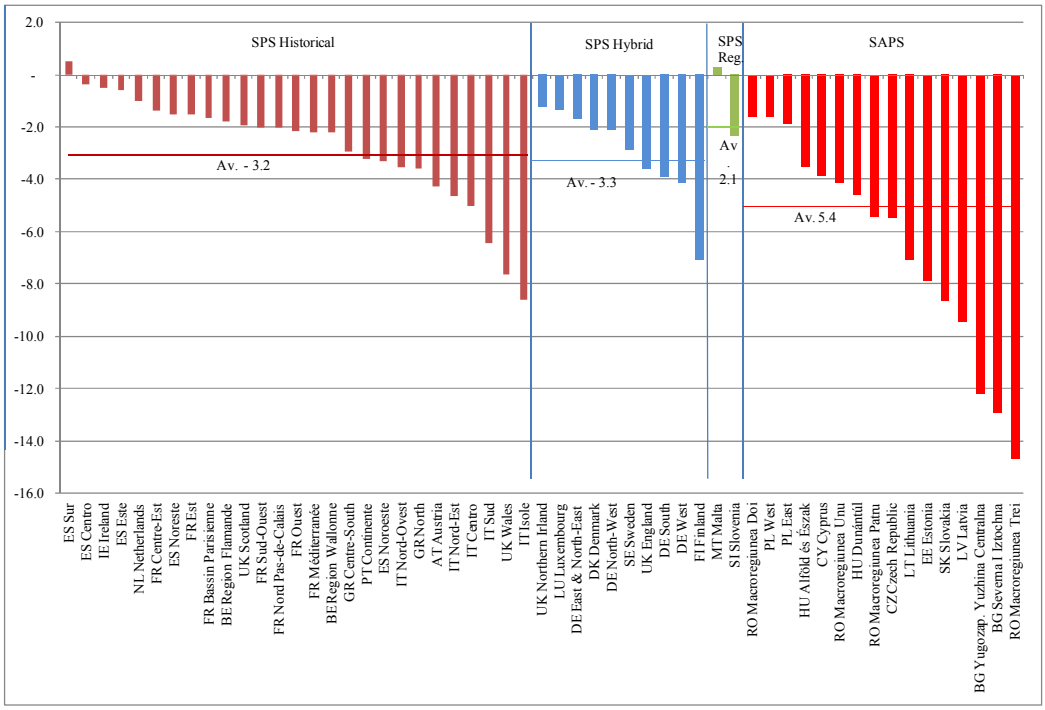
Source: Elaborations based on data from Eurostat

The faster decrease of labour intensity observed in the regions applying the SAPS has reduced the large difference in labour intensity levels between these regions and the other regions to decrease, albeit not very much: in 2010 labour intensity in the EU12 was still around 2.3 and 3.8 times that of the SPS Historical and SPS Hybrid regions respectively.

Labour intensity declines are mainly due to reduction of the total labour force: the relative reduction of labour intensity is approximately of the same magnitude of the relative decrease of the total labour force, at least considering the overall data for EU27. This is not exactly the case of SPS Historical and SAPS where Eurostat data show that the relative reduction of the total labour force has been slightly more severe than decrease of labour intensity.

While the average annual growth rates are of different magnitudes in the regions grouped by model of SFP implementation, it is important to mention that within each group a large heterogeneity exists (Fig. 67). This suggests that the differences in average values between groups should not be necessarily considered as statistically significant.

Fig. 67 – Evolution of labour intensity across EU regions. Average annual growth rate 2003-2010 (%)



Source: Elaborations based on data from Eurostat

According to Eurostat data, the decline in labour intensity has been more marked in the post-reform years than before the reform. In the EU27, the annual relative decrease has been 2,5% in the years 2003-05 and 4,9% in 2005-2010. This is true for all groups of regions even if, also in this case, the intensity of the reduction has increased the most in the group of SAPS regions than in the other groups of regions showing that this group has experienced the most relevant changes in labour intensity after the reform (Tab. 35).

Within the regions applying the SPS models, the greater increase in the relative decline can be found in those applying the SPS Historical. This suggests that the reform may have influenced the pace of the decline of labour use. Indeed, the analysis also suggests that in some regions – especially those where the SPS Historical model has been implemented, the decoupling process should have induced this change of pace. This may have occurred at least in those cases where some activities supported by coupled payments require a relatively high level of labour use per unit of land/livestock. Further considerations on this issue are reported in the following paragraph when discussing the evolution of labour intensity in farms belonging to different sectors.

However, it is important to underline that other factors – besides CAP reform - may have caused the acceleration in the reduction of labour intensity observed in the post-reform years. This is supported by a further result: the variability of relative reduction of labour intensity has strongly decreased in all groups of regions moving from the first to the second considered periods (2003-2005 and 2005-2010). In other words, while in the first period the evolution of labour intensity has been very heterogeneous among the regions, in the period after the implementation of the SFP the reduction has been way more similar in all regions belonging to the same model of implementation.

8.4.1.1 Results by class of economic size and by sector

The analysis by class of economic size and by sector provides further insights into the evolution of labour intensity.

Regarding economic size, in the EU regions labour intensity is two times the average value in small size farms (including those reporting zero Standard Output - SO), while it is around half the average value in the medium and large size farms (Tab. 36). This characteristic can be found in all groups of regions, albeit with some differences. Differences in labour intensity between small and larger farms are very large in the regions applying the SAPS and less pronounced in those applying the SPS Hybrid model. Furthermore, while in the regions applying the SPS Hybrid and the SAPS, labour intensity is slightly higher in medium size farms than in large farms, this is not the case in the other two groups of regions: indeed the opposite occurs in the regions of the SPS Historical model.

Tab. 36 – Labour intensity by farm economic size class in the groups of EU regions (h/ha and % average annual growth rate)

	Average values (h/ha)			AAGR (%)	Average values (h/ha)			AAGR (%)
	2005	**2007**	**2010**	**10/05**	**2005**	**2007**	**2010**	**10/05**
	EU15				**SPS Historical**			
Zero euros	332	144	60	-29.1	185	135	53	-22.3
Small	161	152	134	-3.6	173	166	146	-3.3
Medium	60	57	54	-2.4	62	60	55	-2.4
Large	65	59	58	-2.4	89	78	74	-3.6
Total	86	80	72	-3.5	97	92	81	-3.5
	EU12				**SPS Hybrid**			
Zero euros	271	333	95	-18.9	791	167	96	-34.4
Small	450	398	381	-3.3	98	82	71	-6.3
Medium	73	71	68	-1.3	56	50	50	-2.3
Large	58	51	45	-5.0	44	42	41	-1.4
Total	257	226	184	-6.5	58	51	49	-3.4
	EU25				**SPS Regional**			
Zero euros	425	241	120	-22.3	818	885	1 400	11.3
Small	224	212	195	-2.7	427	387	381	-2.3
Medium	63	60	58	-1.9	208	182	196	-1.2
Large	66	60	56	-3.0	220	174	189	-3.0
Total	110	103	91	-3.7	360	317	311	-2.8
	EU27				**SAPS**			
Zero euros	294	244	83	-22.4	269	332	93	-19.1
Small	290	263	239	-3.8	450	398	381	-3.3
Medium	62	60	56	-2.0	71	70	67	-1.3
Large	63	57	54	-3.1	58	51	45	-5.0
Total	133	122	104	-4.9	256	225	183	-6.5

Note: Small size: < 24 999 euro; Medium: 25 000-249 999 euro; Large: ≥250 000 euro.

Var (%) refers to average annual growth rates. Source: Elaborations based on data from Eurostat

As already discussed, labour intensity has declined over time in all considered groups even if at different paces. At EU level, labour intensity has decreased more or less at the same pace in all considered groups of farms. However, this is not the case in two of the considered groups of regions:

- In the regions applying the SPS Hybrid, the decline is stronger in small farms, than in medium and large farms. These differences are responsible for a non-negligible reduction of the differences in labour intensity among the three groups of farms, given that labour intensity is highest in small farms.
- In the regions applying the SAPS, a completely different situation occurs. Here the strongest reduction is experienced by large farms and this causes the differences between groups to increase.

Labour intensity strongly differs between farms operating in different sectors (i.e. production pattern) (Tab. 37). It is way higher in farms specialised in horticulture compared to the overall average across all farms, whereas it is relatively low in farms specialised in field crops and in grazing livestock. Farms specialised in permanent crops, in granivores and mixed livestock farms also have labour intensity higher than the average.

Tab. 37 – Labour intensity by production sector in the groups of EU regions (h/ha and % average annual growth rate)

	Average values (h/ha)			AAGR (%)	Average values (h/ha)			AAGR (%)
	2005	**2007**	**2010**	**10/05**	**2005**	**2007**	**2010**	**10/05**
	EU 15				**SPS Historical**			
Specialist field crops	44	39	34	-5.3	51	41	35	-7.2
Specialist horticulture	1219	758	838	-7.2	1176	741	844	-6.4
Specialist permanent crops	258	247	224	-2.8	256	244	221	-2.9
Specialist grazing livestock	63	62	55	-2.7	61	64	56	-1.6
Specialist granivores	260	105	101	-17.2	277	144	140	-12.8
Mixed cropping	106	135	113	1.2	117	138	116	-0.2
Mixed livestock	88	82	73	-3.7	86	92	82	-0.9
Mixed crop-livestock	62	67	56	-2.0	82	88	70	-3.2
Non-classifiable holdings	598	145	60	-36.9	255	136	53	-26.9
Total	85	81	71	-3.6	96	91	80	-3.6
	EU 12				**SPS Hybrid**			
Specialist field crops	121	99	82	-7.5	30	33	29	-0.9
Specialist horticulture	967	773	737	-5.3	1420	833	808	-10.7
Specialist permanent crops	373	477	410	1.9	317	376	287	-1.9
Specialist grazing livestock	263	248	212	-4.2	68	57	52	-5.3
Specialist granivores	1110	605	712	-8.5	230	66	64	-22.5
Mixed cropping	85	300	268	25.8	41	105	87	16.1
Mixed livestock	449	381	400	-2.3	95	59	55	-10.5
Mixed crop-livestock	351	271	224	-8.6	34	37	35	0.5
Non-classifiable holdings	303	333	95	-20.7	58120	170	96	-72.2
Total	257	226	184	-6.5	58	54	49	-3.4
	EU 25				**SPS Regional**			
Specialist field crops	55	51	50	-2.1	287	222	216	-5.6
Specialist horticulture	1184	743	784	-7.9	1057	854	969	-1.7
Specialist permanent crops	271	262	236	-2.7	519	570	588	2.5
Specialist grazing livestock	77	75	65	-3.3	392	271	271	-7.1
Specialist granivores	421	196	176	-15.9	2012	431	285	-32.4
Mixed cropping	96	156	142	8.3	211	466	410	14.2
Mixed livestock	223	192	152	-7.4	217	424	418	14.0
Mixed crop-livestock	112	114	104	-1.4	394	354	338	-3.1
Non-classifiable holdings	621	242	121	-27.9	5250	885	1400	-23.2
Total	109	103	90	-3.7	360	317	311	-2.8
	EU 27				**SAPS**			
Specialist field crops	67	58	51	-5.4	121	99	82	-7.5
Specialist horticulture	1148	762	810	-6.7	966	771	734	-5.3
Specialist permanent crops	269	265	240	-2.3	370	475	405	1.8
Specialist grazing livestock	91	90	77	-3.2	259	247	210	-4.1
Specialist granivores	588	257	261	-15.0	1108	606	716	-8.3
Mixed cropping	96	178	154	9.9	84	298	266	26.0
Mixed livestock	306	259	249	-4.1	452	381	400	-2.4
Mixed crop-livestock	173	160	129	-5.8	351	270	223	-8.7
Non-classifiable holdings	386	244	83	-26.5	300	332	93	-20.8
Total	132	121	103	-5.0	256	225	183	-6.5

Source: Elaborations based on data from Eurostat

These results are generally confirmed when looking at the four groups of regions aggregated according to the SFP model they implement. However, except for regions implementing the SPS Regional model, where the relative labour intensity (i.e. in comparison with the average value for the group) shows more similar values across the considered sectors, differences between groups of regions are small.

Labour intensity has decreased in all sectors and in all groups of regions (particularly in the SAPS) over the considered years. At EU level, strong reductions have been experienced by farms specialised in granivores. Farms specialised in field crops and in horticulture, as well as mixed crop-livestock farms have experienced reductions of labour intensity slightly higher than average. In all other groups, the reductions are below the average, whilst labour intensity has increased in mixed cropping farms.

While the strong reduction of labour intensity in farms specialised in granivores and horticulture does not seem related to the CAP reform, the reduction experienced by farms specialised in field crops may have been influenced by the reform. This may be the case when decoupling of direct payments has led to a reduction in the relative importance of labour intensive crops. However, the available data do not provide strong enough evidence to support this hypothesis. Further elaborations and empirical evidence on this issue are provided later when presenting the results of the analysis developed in the case study regions (again based on FADN individual farm data).

Also in this case, the observed changes do not differ very much in the groups of regions implementing different SFP models. Indeed, the reduction of labour intensity in farms specialised in granivores and horticulture is common to most of the considered groups of regions. Similarly, the increase of labour intensity in mixed-cropping farms can be found in all groups, except for the regions implementing the SPS Hybrid model. Indeed, in the regions of SPS Hybrid farms specialised in field crops have not experienced a similar reduction of labour intensity to that experienced by all other groups of regions. The trend appears to be different in the regions implementing the SPS Regional model, where a relevant increase of labour intensity in mixed-cropping and mixed-livestock farms is experienced.

8.4.2 Evolution of the relative importance of labour provided by family members

At EU level, a large number of farms are family-managed and a large share of labour force used in the farm sector is provided by family members. According to Eurostat data, in 2010 family labour accounted for around 78% of total farm labour in the EU27 (Tab. 38).

As explained in the theoretical analysis, the change of labour intensity may be associated with a change in the relative importance of the labour provided by family members. Indeed, it is possible that, if some external factor creates an incentive to reduce the amount of labour to be used on-farm, this will affect more hired labour than family labour, given that farm managers may be more willing to lay-off first non-family members. However, the relative importance of family labour also depends on farm size, as large farms often make use of relatively less family labour than medium and small size farms. Thus, any change in farm size and organization is expected to change the share of labour provided by family members.

Because of the structural and economic differences among EU MSs, the relative share of family labour is not at the same level in the considered groups of regions. In 2010, the relative importance of family labour in the regions applying the SPS Regional and the SAPS is higher than in those applying SPS Historical and Hybrid models.

Tab. 38 – Evolution of the relative importance of family labour in the groups of EU regions

	Family Labour/Total Labour (%)							Average annual growth rate (%)				
	1995	1997	2000	2003	2005	2007	2010	1995-05	2003-05	2005-10	1995-10	2003-10
SPS Historical	82.3	81.3	74.4	74.0	73.0	72.8	69.3	-1.2	-0.7	-1.0	-1.1	-0.9
SPS Hybrid	73.4	70.7	69.8	71.7	69.9	67.7	64.9	-0.5	-1.2	-1.5	-0.8	-1.4
SPS Regional				91.9	91.3	92.2	89.6		-0.3	-0.4		-0.3
SAPS				88.4	88.1	88.0	86.7		-0.2	-0.3		-0.3
EU-15	80.7	79.3	73.6	73.6	72.4	71.9	68.4	-1.1	-0.8	-1.1	-1.1	-1.0
EU-12				88.5	88.2	88.0	86.8		-0.2	-0.3		-0.3
EU 25				78.6	77.7	77.5	75.0		-0.5	-0.7		-0.7
EU-27				81.5	80.8	80.3	77.6		-0.4	-0.8		-0.7

Source: Elaborations based on data from Eurostat

However, within each group, the importance of family labour strongly differs between regions. For example, in the SPS Hybrid, it ranges from 20% in one region of Germany to 90% in some regions of the UK.

All considered groups of regions have experienced a decrease over time of the relative importance of family labour. However, this decrease has been small: less than -1% per year in the EU27 in the years

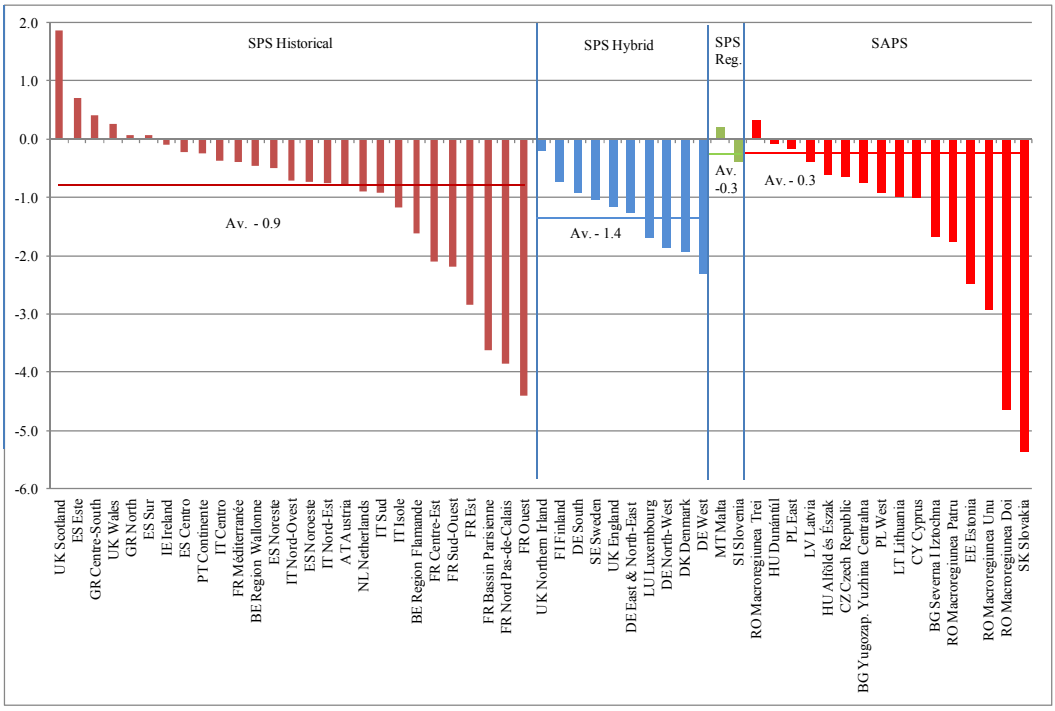
2003-2010. Furthermore, decrease has occurred at around the same pace in most of the considered groups of regions, however slightly less intense in regions applying the SPS Regional model and the SAPS where farm structures have peculiar characteristics that may explain this different behaviour.

This small reduction of the relative importance of family labour is probably due to factors having opposite effects. On the one hand, labour reduction could have affected mostly non-family labour: this is because, farmers managing family farms may be less willing to reduce the use of labour provided by family members than that provided by hired persons. On the other hand, an opposite impact could have been generated by the increase of the relative importance of large size farms that has been observed in the same period (See § 6.4.3.1). This is because, in those farms, the share of family labour is lower than in medium and small farms.

The analysis shows that at EU level, as well as for regions grouped according to the SFP model they implement, the relative importance of family labour has been relatively constant over the examined years: change has occurred at a similar pace in the years before and after 2005.

However, different evolutions over time can be identified across regions within each group. For example, within the SPS Historical group, some regions have experienced a strong decline (e.g. The Netherlands and some regions of Italy), while in others (e.g. of France, Spain and UK) family labour has increased (Fig. 68). A large heterogeneity also exists within the regions of the SAPS: most of the regions of Romania and Bulgaria have shown a strong decline in the share of family labour, whereas the Czech Republic and some regions of Hungary and Romania have experienced a completely different evolution.

Fig. 68 – Evolution of the relative importance of family labour in the EU regions, 2003-2010. Average annual growth rate (%)



Source: Elaborations based on data from Eurostat

Finally, the analysis at regional level does not support the hypothesis that the reduction in the relative importance of family labour has been more intense in those regions where it was higher at the beginning of the period.

8.4.3 Evolution of the relative importance of farms managed by holders ≤ 35 years old and by holders ≥ 65 years old

This section investigates whether the relative importance of farms managed by young and by more aged holders has changed over the considered years (i.e. pre- and post-reform) and if the regions, grouped according to the SFP model of implementation, have shown a different evolution in this respect.

The relative importance of these two classes of farms is assessed by considering their share relative to the whole number of individual farms. Holdings that are legal persons or group holdings are not considered because it is not relevant to consider the age of the holder in this groups of farms.

At EU level, a very large share of individual farms is managed by holders aged between 35 and 64 years (Tab. 39). In 2010, around 31% of the farms are managed by holder ≥ 65 years old and a very small number of farms are managed by young farmer ≤ 35 years of age.

It is important to note that FADN data (weighted) provide a very different picture from Eurostat data. Indeed, the relative importance of young farmers according to Eurostat is higher than according to FADN data, except for EU12 regions. Similarly, the relative importance of farm holder ≥ 65 years old is reported as higher in the Eurostat data than in the FADN data. This suggests that the FADN data includes a relatively larger number of holders between 35 and 65 years old, that is, holders that are probably more likely to be encountered in commercial farms (farms entering in the FADN sample should exceed a minimum threshold of economic size). This hypothesis is strongly supported by the fact that also the evolution over time of the relative importance of these two types of farms (with holder ≤35 and with holder ≥65) strongly differs in the two dataset (see footnote 140).

Tab. 39 – Relative share of individual farms by age of holder in the groups of EU regions (%)

	Shares of all individual farms (%)					Average annual growth rate (%)		
	2000	2003	2005	2007	2010	2003-10	2003-05	2005-10
Holders less than 35 year old.								
SPS Historical	7.5	6.0	5.3	4.8	5.5	-1.3	-6.6	0.9
SPS Hybrid	12.1	8.9	7.1	6.3	5.9	-5.7	-10.9	-3.5
SPS Regional		4.1	4.5	4.0	4.0	-0.3	4.8	-2.3
SAPS		10.0	7.5	6.9	8.8	-1.9	-13.3	3.1
EU 15	8.1	6.4	5.5	5.0	5.6	-2.0	-7.3	0.1
EU 12		10.0	7.5	6.9	8.7	-1.9	-13.2	3.1
EU 25		8.6	7.6	7.1	7.5	-1.9	-6.4	-0.1
EU 27		8.5	6.7	6.1	7.4	-2.0	-11.2	1.9
Holders between 35 and 64 year old.								
SPS Historical	61.3	60.0	59.2	58.5	60.7	0.2	-0.7	0.5
SPS Hybrid	74.4	77.3	77.2	78.1	79.4	0.4	-0.1	0.6
SPS Regional		63.2	62.8	62.3	63.3	0.0	-0.4	0.2
SAPS		58.5	58.9	58.7	60.5	0.5	0.4	0.5
EU 15	63.0	62.3	61.7	61.0	62.9	0.1	-0.5	0.4
EU 12		58.5	59.0	58.8	60.6	0.5	0.4	0.5
EU 25		63.9	64.4	64.0	65.6	0.4	0.4	0.4
EU 27		60.1	60.1	59.7	61.6	0.3	0.0	0.5
Holders 65 year old or more.								
SPS Historical	31.1	34.0	35.6	36.7	33.8	-0.1	2.3	-1.0
SPS Hybrid	12.2	13.8	15.7	15.6	14.7	0.9	6.7	-1.4
SPS Regional		32.6	32.7	33.7	32.7	0.0	0.1	0.0
SAPS		31.5	33.5	34.3	30.7	-0.4	3.2	-1.8
EU 15	28.7	31.3	32.8	34.0	31.5	0.1	2.3	-0.8
EU 12		31.5	33.5	34.3	30.7	-0.4	3.2	-1.7
EU 25		27.4	28.0	28.8	26.9	-0.3	1.1	-0.9
EU 27		31.4	33.2	34.2	31.1	-0.2	2.9	-1.3

Source: Elaborations based on data from Eurostat

According to Eurostat data, the class of young farmers is more represented in the regions applying the SAPS than in the other groups of regions and in particular more than in those applying the SPS Regional where these farms represent around 4% of the total number of individual farms (Tab. 39). Indeed, in the regions where the SPS Historical and Regional models are applied, it is also true that around 1/3 of the farms are managed by farmers ≥ 65 years old. On the contrary, this group of farms is way less represented (around 15%) in the regions applying the SPS Hybrid model.

The analysis at regional level reveals a large heterogeneity in terms of the relative importance of the three classes of farms. In 2010, the share of farms managed by young farmers within the regions applying the SPS Historical is very low in Portugal, some regions of the UK and the Netherlands, whereas it is high in many regions of France and in Austria. In the regions applying the SPS Hybrid model the relative importance of young farmers is low in England, Sweden and Northern Ireland,

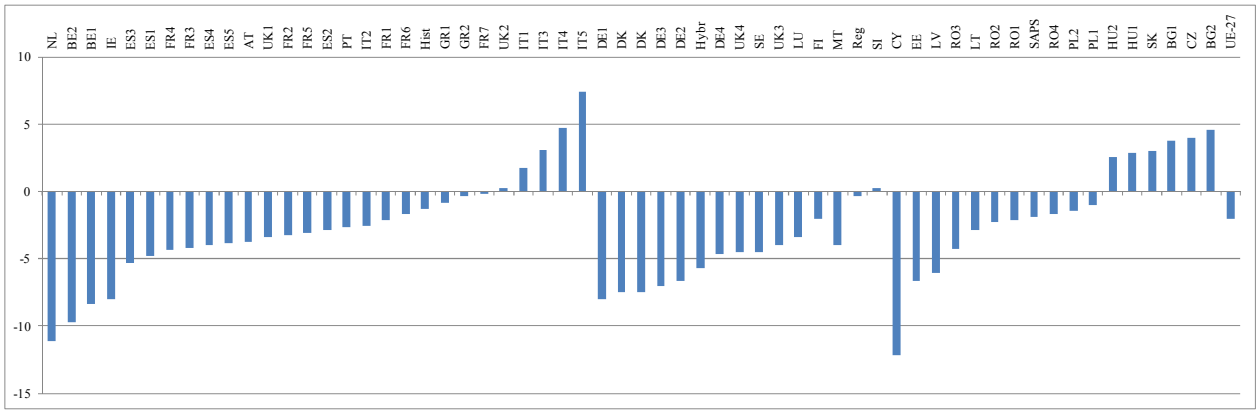
while it is relatively high in some regions of Germany and in Finland. A very high heterogeneity is found within the SAPS group as well: young farmers are underrepresented in Cyprus, Latvia, Lithuania and Estonia, while their share exceeds 12% in the Czech Republic and Poland.

The share of farms with holder ≥ 65 years old is also very heterogeneous within each group of regions. According to 2010 figures, in the regions applying the SPS Historical, the relative importance of this group of farms ranges from less than 10% (France Nord Pas-de-Calais and Austria) to over 40% (Spain Este, Italy Nord-Est and Centro, Portugal). A large variability exists also in the regions applying the SPS Hybrid model: in many regions of Germany and in Finland the relative importance of older farmers is lower than 10%, whereas in Sweden, Northern Ireland and England these farms represent more than ¼ of all individual farms. In the same way, the relative importance of this class of farmers is also very different within the SAPS regions with very low values in Poland (less than 10%), but very high in Romania, Bulgaria and Lithuania (greater than 35%).

The comparison of Eurostat data for the whole period shows that up to 2007, the relative importance of young farmers has declined steadily, that of farmers aged ≥65 has increased, while that of holders 35-65 years old has remained relatively constant (Tab. 39). However, between 2007 and 2010 the evolution has been relatively different: the share of farms managed by young farmers has increased, although remaining below the 2003 level[162].

The relative importance of young farmers has declined the most in the regions applying the SPS Hybrid model, to a lesser extent in those applying the SAPS and the SPS Historical, whereas it has remained almost constant in those applying the SPS Regional model. Also in this case a large heterogeneity of behaviour can be found within groups of regions implementing the same SPS model. In each of them, excluding the regions of SPS Hybrid, there are regions showing a decrease, but also regions with an increase in the relative importance of holders younger than 35 (Fig. 69). In the regions applying the SPS Historical, relevant reductions of this group of farms have been experienced by The Netherland, Belgium and Ireland, whereas the relative importance of holders younger than 35 has increased in most Italian regions. Relatively more homogeneous is the situation of SPS Hybrid regions that have experienced a more uniform decline of this group of farms. In the SAPS, some regions have experienced a decrease, while others an increase.

Fig. 69 – Evolution of the relative share of farms with holder ≤35 years old in the EU27 regions. Average annual growth rate 2003-2010 (%)

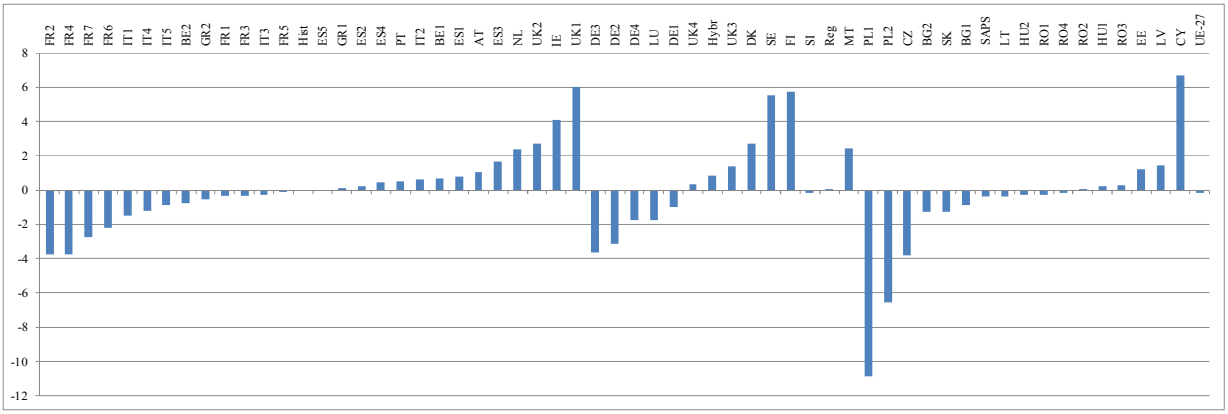


Source: Elaborations based on data from Eurostat

A large degree of heterogeneity can also be found in terms of evolution of the relative share of farms managed by holders ≥65 years old. This is true for all the considered groups of regions.

[162] As previously noted, there are non-negligible differences in terms of relative importance of farms with young and elderly holders between FADN and Eurostat data. However, the differences between these two data sets are even stronger in terms of the evolution over time of these two groups of farms. In particular, while Eurostat reports a limited reduction of the share of farms with holders ≤35 years old, FADN data report a very strong increase of the same share. Similarly, the relative importance of holders ≥65 years old has remained relatively constant according to Eurostat data, while it has strongly decreased according to FADN data.

Fig. 70 – Evolution of the relative share of farms with holder ≥65 years old in the EU27 regions. Average annual growth rate 2003-2010 (%)

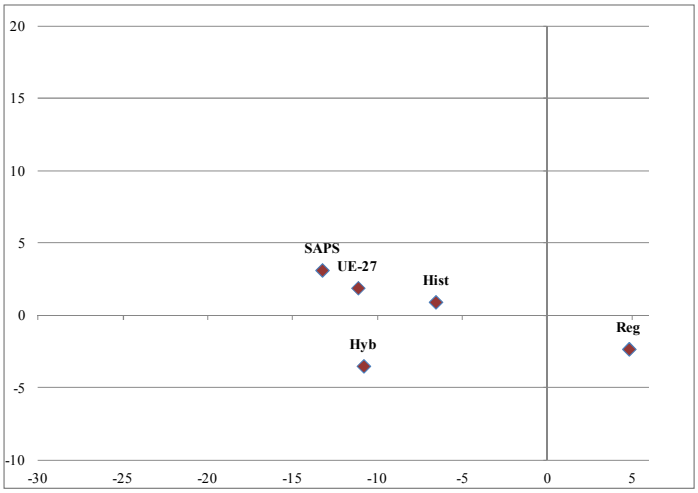


Source: Elaborations based on data from Eurostat

Finally, it seems also interesting to compare the evolution of the importance of the considered classes of farms over the sub-periods 2003-05 and 2005-10, in order to evaluate whether the evolution has been more or less intense in the years before and after the implementation of the new direct payment policy in the EU regions.

The graph below shows the relative position of groups of regions considering the average annual growth rate of the share of young farmers in the years 2003-05 (x-axis) and 2005-10 (y-axis). In the regions applying the SAPS and the SPS Historical, the relative importance of farms with young holders has decreased in the pre-reform years, whereas it has increased in the following period. This is not the case of regions applying the SPS Hybrid model. Here, the relative importance of young farmers has declined in both periods but to a relatively lower rate in the post-reform years. The situation of the group of regions applying the SPS Regional is completely different because, on average, the relative importance of farms with young holders increases in both periods.

Fig. 71 – Comparison of the average annual growth rates of change in the share of farms with holders ≤ 35 in the groups of EU27 regions. Average annual growth rate (%) in 2003-05 (x-axis) and 2005-10 (y-axis)



Source: Elaborations based on data from Eurostat

The analysis of the evolution at regional level shows a large heterogeneity within each group. This is particularly true for regions applying the SPS Historical and Regional models, and the SAPS. In the former groups, many regions have experienced relevant increases in the post-reform years (e.g. regions of Italy), while others have experienced the opposite trend (e.g. Belgium). An even larger heterogeneity exists within SAPS regions, although some homogeneity is present within individual Member States (e.g. Romania, Bulgaria and Poland). On the contrary, the evolution is relatively more similar among regions of the SPS Hybrid model. In this case too, it is possible to appreciate a larger regional homogeneity within some Member States (e.g. Germany).

Finally, the evolution of the relative share of farms managed by holder ≥65 is very similar in the considered groups of regions. While the years 2003-05 have seen a more or less intense increase of the

relative importance of this group of farms (with the stronger increase in the regions of the SPS Hybrid model), in the years 2005-10 its relative importance has not changed.

Furthermore, regional data show that heterogeneity of behaviour exists within each considered group of regions, especially in those applying the SAPS and the SPS Hybrid model.

The analysis has shown that the relative importance of farms managed by holder ≤35 years old has decreased in the years 2003-2010. However, while during the pre-reform years the decline has been very important, in the post-reform years the situation is partially reverted. In this latter period, whilst the decrease has become less intense in the groups of regions applying the SPS Hybrid, the regions applying the SPS Historical and the SAPS have experienced an increase in the share of farms managed by young holders. Thus, apart from the regions applying the SPS Hybrid model, where the trend has remained negative all the time, in many other cases the post-reform period has shown a positive (or less negative) evolution of the relative importance of young farmers. This evolution has been echoed by an opposite evolution of the relative importance of farms with holder ≥65 years old. While the relative importance of this class of farms has remained about the same between 2003 and 2010, in all considered groups of regions the post-reform years have been characterized by a decline in the relative importance of this latter group of farms.

8.4.4 Evolution of the relative importance of farms managed by part-time farmers

According to Eurostat data[163], around 70% of individual farms in the EU27 agricultural sector are managed by part-time holders (i.e. holders providing no more than half of their working time on the farm).

However, the relative importance of part-time farms is not the same in all considered groups of regions. It seems to be higher than average in the EU12 than in the EU15. In particular, the share of labour used on part-time farms is much higher in the regions applying the SAPS than in the regions applying the SPS. However, some differences exist: in 2010, the importance of part-time is high in the regions applying the SAPS, close to the EU27 average in those applying the SPS Historical and Regional models and lower than average in the regions applying the SPS Hybrid model (around 40%).

Tab. 40 – Relative importance of part-time farmers and evolution in the groups of EU27 regions (%)

	Part-time farms/Total individual farms (%)					Av. annual growth rate (%)		
	2000	2003	2005	2007	2010	2003-05	2005-10	2003-10
SPS Historical	65.1	62.2	60.5	61.8	65.4	-1.4	1.6	0.7
SPS Hybrid	48.8	40.4	45.0	42.5	40.6	5.5	-2.0	0.1
SPS Regional	53.0	56.4	54.4	59.4	61.8	-1.9	2.6	1.3
SAPS	73.8	69.4	71.2	72.6	75.5	1.3	1.2	1.2
EU-15	63.0	59.3	58.3	59.4	62.4	-0.8	1.4	0.7
EU-12	72.4	69.3	71.1	72.5	75.3	1.3	1.1	1.2
EU 25	64.5	58.8	60.3	61.0	60.2	1.3	-0.0	0.3
EU-27	64.5	65.2	66.1	67.3	69.9	0.6	1.1	1.0

Note: Data for some MSs are not available for previous years.

Source: Elaboration on Eurostat data

Across the regions applying the SPS Historical model, the share of part-time farms is very small (less than 25%) in Belgium, Ireland and The Netherlands, while it is relatively high (over 75%) in some regions of Greece, Italy and Spain, as well as in Malta (SPS Regional model). In the regions applying the SPS Hybrid the importance of part-time farms is lower even if in Finland and Sweden over half of individual farms are managed by a part-time holder. In the SAPS regions, the relative importance of part-time farming is very heterogeneous: part-time farms are very common in most of the regions of Romania, Hungary and in Cyprus, but definitively less common in Bulgaria and the Czech Republic.

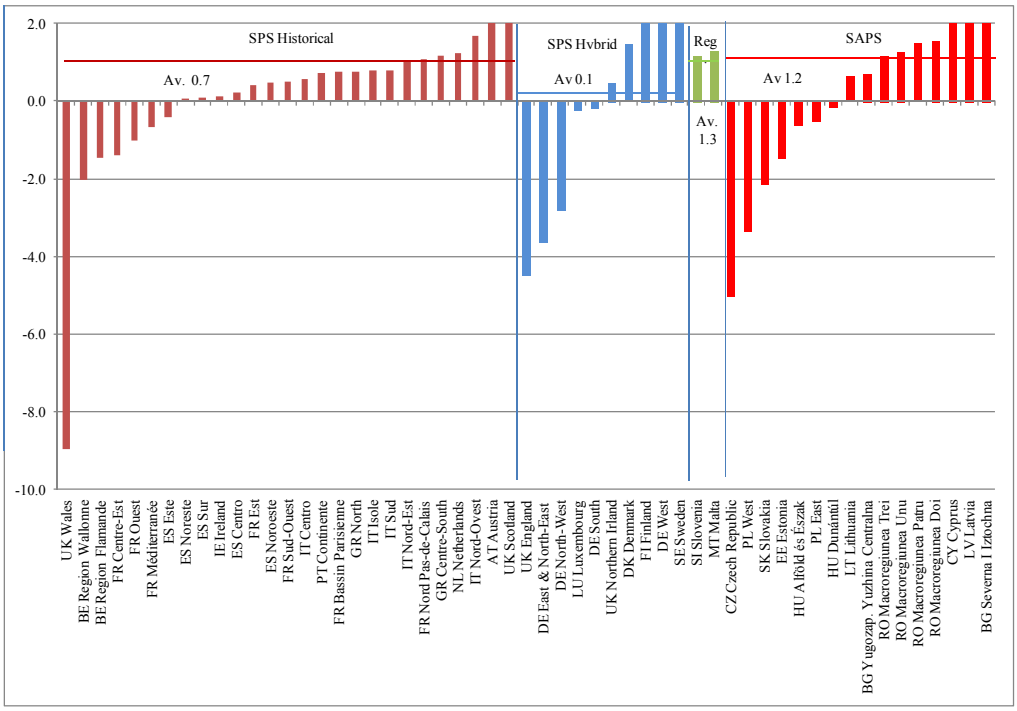
Overall, the relative importance of part-time farms has increased in the EU27 between 2003 and 2010, but not very much (Tab. 40). This increase has been slightly more marked in the regions of SAPS and

[163] Also for part-time farming Eurostat and FADN data provide very different figures. In particular, figures regarding the relative importance of part-time holders are way higher according to Eurostat than to FADN data.

SPS Regional models than in the other groups of regions. In particular, the share of part-time farms has not increased in the regions applying the SPS Hybrid model.

However, there is considerable heterogeneity within each group (Fig. 72). For example, while in most of the regions of SPS Historical the relative importance of part-time farming has increased over the years 2003-10, the opposite has occurred in some other regions (UK Wales, Belgium and France Ouest). Similarly, within the SPS Hybrid regions, UK England, Germany East and North-East have experienced a decline in part-time farming, vis-à-vis an increase in most other regions. Finally, while in the SAPS regions a positive evolution prevails, there are regions where the relative importance of part-time farming has strongly declined: Czech Republic, Poland West and Slovakia. This indicates that there is not homogeneity within groups of regions applying the same SFP model.

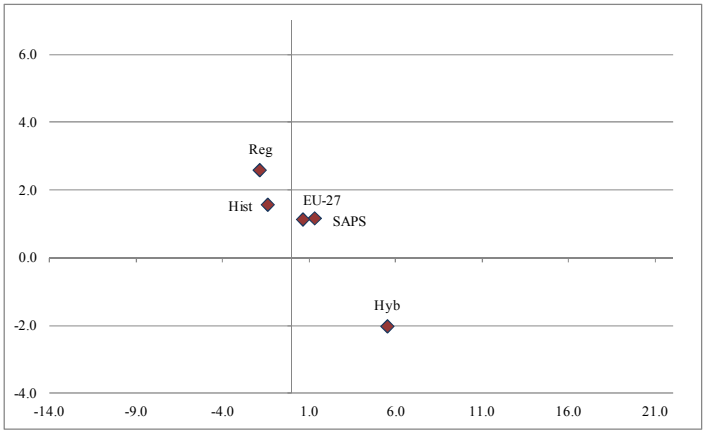
Fig. 72 – Change in the relative importance of part-time farmers across EU27 regions in the years 2003-2010. Average annual growth rate (%)



Source: Elaboration based on data from Eurostat

At this point it seems interesting to focus on the pace of the increase of the relative importance of part-time farming comparing evolution in the pre- and in the post-reform years. At an aggregate level, the relative importance of part-time farming has increased slightly faster between 2005 and 2010 than in the previous years (2003-2005). However, data for each of the considered groups shows very heterogeneous behaviours. The regions applying the SPS Historical and Regional models have experienced a decline of the importance of part-time farming in the pre-reform years and an increase in the post-reform years (Fig. 73). The opposite occurred in the regions of the SPS Hybrid model (i.e. strong increase before the reform and a decrease after). Finally, the group of SAPS regions has maintained the same pace of increase of part-time farming both in the pre- and in the post-reform years.

Fig. 73 – Comparison of the rates of change in the relative importance of part-time farmers in the groups of EU27 regions. Average annual growth rate (%) in 2003-05 (x-axis) and 2005-10 (y-axis)



Source: Elaboration based on data from Eurostat

However, also in this case, a large heterogeneity exists within each group of regions. Within each group, some regions have experienced very different evolutions in the two sub-periods, while others have experienced very similar trends. Thus, there is no evidence of homogeneity of behaviour within the groups of regions applying the same SFP model.

A further analysis has been developed on the sub-group of part-time farms where the holder is ≥65 years old. This allows verifying whether, within part-time farms, the relative importance of those managed by holders ≥65 is changing more or less compared to the other age groups of part-time farmers. As previously explained, this is a special interesting case because here most of the holders are probably retired. This means that they do not have a income from off-farm employment: in other words, they do not have an opportunity cost of labour other than the reservation value (i.e. the minimum return for being willing to work on-farm).

As expected, in around 1/3 of the farms with a part-time holder, he/she is ≥65 years old. The relative importance of this class of farms varies in the considered groups: it reaches 40% in the regions applying the SPS Historical, while it is only around 20% in those applying the SPS Hybrid model.

Tab. 41 – Relative importance of part-time farms with holders aged ≥ 65 and evolution in the groups of EU regions

	Farms with >=65 year/Total part-time farms (%).							Average annual growth rate (%)				
	1995	1997	2000	2003	2005	2007	2010	1995-05	2003-05	2005-10	1995-10	2003-10
SPS Historical	37.8	38.6	38.1	41.8	43.5	44.7	40.5	1.4	2.1	-1.4	0.5	-0.5
SPS Hybrid	25.8	22.8	15.3	20.1	21.0	20.3	19.4	-2.0	2.1	-1.6	-1.9	-0.6
SPS Regional			36.1	42.5	41.9	41.3	35.1		-0.8	-3.5		-2.7
SAPS			28.1	34.0	36.6	37.7	34.2		3.8	-1.3		0.1
EU-15	37.3	37.9	35.9	39.8	41.0	42.5	38.8	1.0	1.6	-1.1	0.3	-0.3
EU-12			28.5	34.1	36.7	37.7	34.2		3.8	-1.4		0.1
EU 25	37.3	37.9	34.5	34.6	34.3	35.4	33.6	-0.8	-0.5	-0.4	-0.7	-0.4
EU-27	37.3	37.9	34.5	36.2	38.2	39.4	36.0	0.2	2.8	-1.2	-0.2	-0.1

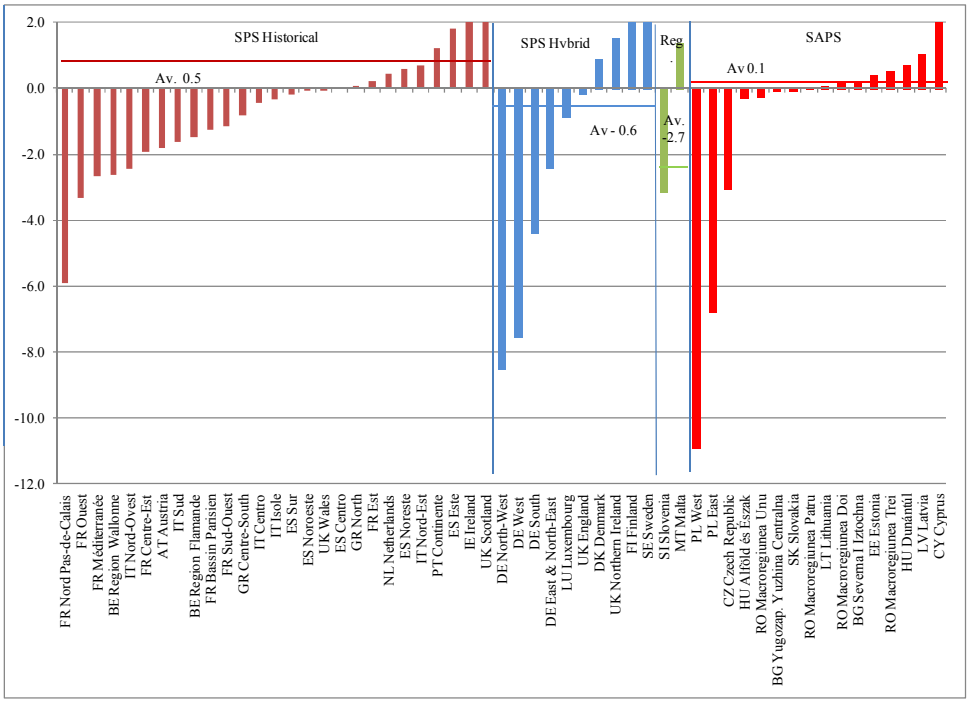
Source: Elaboration based on data from Eurostat

Also in this case, large heterogeneity exists within each group. In the regions of the SPS Historical, the share of holders aged ≥65 exceeds 40% in some regions of Belgium, Italy, Portugal and Spain, whereas it is less than 20% in Austria and France Nord Pas-de-Calais. A similar heterogeneity exists within the SPS Hybrid and the SAPS groups of regions. In the former, some regions of Germany show shares lower than 10% and some regions of UK and Luxemburg shares greater than 30%. In some of the SAPS regions ≥65 years old holders account for less than 20% of part-time farms (e.g. Czech Republic and Poland), whereas in regions Bulgaria and Romania these farms represent around 40% of all part-time farms.

The relative importance of part-time farms managed by holders ≥65 has not changed very much between 2003 and 2010 across the whole EU27 and the considered groups of regions all present similar evolutions except the regions of the SPS Regional where the share of farms managed by

holders ≥65 declines at a non-negligible pace. However, also in this case large heterogeneity exists within the considered groups.

Fig. 74 – Change in the relative importance of part-time farms in which the holder is ≥ 65 across EU27 regions in the years 2003-2010. Average annual growth rate (%)



Source: Elaboration based on data from Eurostat

The comparison of the average annual growth rates in the considered pre and post-reform years (2003–05 and 200 –10) shows that, in the whole EU27, the relative importance of these farms has increased in the pre-reform years and decreased afterwards. Again, a similar evolution occurs in all four groups of regions applying different SFP models, except in the regions of the SPS Hybrid model. Although here the relative importance of part-time farmers has strongly declined in the post-reform years, the evolution observed in this group of regions is probably mainly due to the UAA threshold change introduced in the 2010 agricultural census, by which in some MS, including Germany, in 2010 farms with less than 5 hectares of UAA have not been surveyed anymore. Because large shares of part-time farms are small in size, this has probably caused the observed decline in the relative importance of part-time faming. As it will be explained later, regional data support this hypothesis.

This seems to suggest that after the reform, in contrast with the pre-reform years, part-time farming has been chosen by younger holders who are able to allocate some of their working time off-farm. In other words, in the years following the CAP reform, part-time farming is increasingly a form of household income diversification strategy and not the mere result of not having other off-farm labour opportunities. However, it is important to keep in mind that, even at the end of the considered period, part-time holders ≥65 years old still represent the majority of part-time holders. Furthermore, the evolution can also be due to the overall change in the age structure of farm holders already discussed (i.e. involving not only part-time farms) as well as, at least in some cases, the result of increasing difficulty to find off-farm employment due to the economic crisis that has been affecting the EU.

Finally, it is important to underline that also in this case there is large heterogeneity within each group of regions. While most of the regions applying the SPS Historical model show similar changes, some regions of the UK, Ireland and Austria show a very different pattern of evolution. Even higher heterogeneity can be found within the groups of regions applying the SPS Hybrid and the SAPS. As already mentioned, the strong reduction observed in the second sub-period in the SPS Hybrid group is also due to the change in the population of farms in the 2010 agricultural census. This can be clearly observed in the German regions, where the 5 hectare threshold has been introduced, that have experienced a stronger decline than other regions between 2005 and 2010.

8.5 Evolution of labour use in the case study regions

The analysis now shifts to the data regarding the constant samples of farms in the 12 case study regions. This part of the analysis is aimed at evaluating whether and to what extent the observed evolution of labour intensity can be associated to direct payments, namely:

- To assess whether the level of direct payments is correlated with the evolution over time of labour intensity; in other words, if farms benefitting from high level of direct payments show relatively high/low rates of change in labour intensity;
- To assess whether the change in the relative importance of coupled direct payments is correlated with the evolution over time of labour intensity; in other words, if farms that have experienced the strongest reduction of coupled payments (i.e. decoupling process: transition from coupled to decoupled payments) have also experienced relatively high/low rates of change in labour intensity.

Thus, the analysis is focused on the following dimensions:

- Unitary direct payments level (Total Direct Payments/Utilised Agricultural Area)
- Relative importance of coupled direct payments (Coupled Direct Payments/Total Direct Payments)
- Labour intensity (Total Labour Force/Utilised Agricultural Area)

This analysis is based on the computation of correlation coefficients between couples of variables. This allows to assess whether the evolution of labour intensity, observed in the farms belonging to each regions, can be correlated with: a) level of direct payments; b) evolution of the share of coupled payments. This provides insights to discuss whether these policy-related aspects have influenced the amount of labour used on the farm.

The correlation has been calculated by means of Pearson's correlation coefficients and statistical tests for their significance[164]. The results of the tests are reported together with the estimated coefficients in order to identify when these can be considered statistically significant (i.e. significantly different from zero) at the standard significance levels: 1% (***), 5% (**) and 10% (*). This means that when the estimated coefficients are reported without the previously described signs (***, ** and *), it is safe to say that the evolution of labour intensity is not correlated with: a) the level of direct payments, or b) the change in the relative importance of coupled payments in the considered groups of farms.

In the cases when correlation coefficients assume values that are significantly different from zero (even if at different levels of significance), it is possible to have positive or negative correlation coefficients that provide insights regarding the direction and magnitude of the relationships between the considered pairs of variables.

The absolute value of the correlation coefficients provides an estimate of the magnitude of the correlation: values closer to the absolute value of 1 mean that a very strong correlation (positive or negative depending on the sign) between the considered variables exists.

It is important to note two main peculiarities of this analysis that make it different from the previous ones:

- The analysis is performed on a constant sample of farms. Thus, results are not influenced by farm exit/entry process.
- Because the analysis is based on the comparison of farms within each region, regional specific economic and environmental factors affect all farms of the sample. Thus, the results are not affected by the differences existing between regions.

[164] The Pearson's correlation coefficient is defined as the ratio between the covariance of two variables and the product of their standard deviations. It can assume values between -1 and +1 and indicates perfect negative correlation at -1, absence of correlation at zero, and perfect positive correlation at +1. Under given assumptions regarding the distribution of the variables at stake, the sampling distribution of Pearson's correlation coefficient follows Student's t-distribution with degrees of freedom n – 2. This allows to test the null hypothesis of whether the estimated coefficients are significantly different from zero (See, for example: Anderson, D.R.; Sweeney, D.J.; Williams, T.A.. (1994) Introduction to Statistics: Concepts and Applications. West Group. ISBN 978-0-314-03309-3).

8.5.1 Description of the case study regions

The constant samples obtained in the 12 case study regions differ in term of number of selected farms but it is never below 180 farms within each whole regional sample (Tab. 45). Indeed the number of farms is close to 200 only in Alentejo (PT) and France Centre, while is very large in the case of Niedersachsen (DE), Makedonia-Traki (GR) and Łódzkie, Mazowsze, Lubelskie and Podlasie (PL). However, when farms are grouped according to size class or type of farming, often the sub-samples become too small to be analysed (i.e. less than 15 farms).

It is important to recall that when the number of farms is small, the analysis can rely only on few observations and this has to be considered when discussing the results. In particular, a small number of observations affect the results of the statistical test performed on the correlation coefficients. Indeed, the correlation coefficients tend to be significant when the estimated coefficient is high. However, a coefficient can be significant even if small when (other factors being held constant) the sample size increases.

Tab. 42 – Number of farms in the 12 case study regions constant samples. Whole sample, by economic size and by type of farming, 2004

					Specialist					Mixed		
	Whole sample	Small farms	Medium farms	Large farms	Field-crops	Horti-culture	Perma-nent crops	Grazing live-stock	Grani-vores	Crop-ping	Live-stock	Crop-live-stock
					TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8
Niedersachsen (DE)	755		451	304	166	22	57	209	62	18	94	127
Brandenburg (DE)	203		60	143	65			49				65
Makedonia Traki (EL)	1081	565	515		778		118	89		61		26
Extremadura (ES)	399	140	254		172			111		23		61
France Centre	245		105	138	138		25	28				37
Del Alfold (HU)	316	103	178	35	179		31	18	23	20		25
Emilia Romagna (IT)	548	118	336	94	117		153	171	16	58		21
LMLP (PL)	2724	1947	766		242	48	148	706	222	227	626	505
Alentejo (PT)	185	56	112	17	38		41	57				33
Slättbygdslän (SE)	407	35	289	83	144			126	42			80
England East (UK)	379		158	221	158	37	30	72	28			44
Slovenia	368	217	149				20	238		21	23	47

Source: FADN constant sample in the 12 case study regions

Regions differ in terms of the considered direct payment and labour dimensions.

The level of direct payments per unit of land (TDP/UAA) differs between regions both in 2004 and in 2009. In particular, in 2004 the lowest levels are found in the two regions applying the SAPS and, to a lesser extent, in Extremadura. On the other hand, Makedonia-Traki and France Centre display the highest levels (Tab. 43).

Tab. 43 – Evolution of direct payments and labour use in the case study regions: Constant FADN sample, 2004-2009

Region	SFP model	Unitary direct payment TDP/UAA Euro/ha	Share of coupled payments CDP/TDP %	Labour intensity TLF/UAA h/ha	Share of family labour FLF/AWU %	Share of part-time farms NPT/NAZ %
				2004		
Niedersachsen (DE)	Hybrid	288.33	100.0	64	72.6	5.3
Brandenburg (DE)	Hybrid	253.96	100.0	36	12.6	3.9
Makedonia Traki (EL)	Histor.	481.66	100.0	201	77.2	14.2
Extremadura (ES)	Histor.	159.51	100.0	30	90.2	1.3
France Centre	Histor.	346.09	100.0	24	68.2	0.8
Del Alfold (HU)	SAPS	136.65	53.1	53	17.2	19.6
Emilia Romagna (IT)	Histor.	194.56	100.0	161	82.0	3.1
LMLP (PL)	SAPS	114.20	59.4	234	86.7	2.1
Alentejo (PT)	Histor.	181.68	100.0	38	60.2	3.8
Slättbygdslän (SE)	Hybrid	235.21	100.0	34	80.6	10.6
England East (UK)	Hybrid	280.34	100.0	69	29.2	6.9
Slovenia	Regional	209.19	100.0	232	91.6	14.7
Average		240.12	92.7	98	64.0	7.2
				2009		
Niedersachsen (DE)	Hybrid	361.25	3.9	62	68.3	4.9
Brandenburg (DE)	Hybrid	295.13	2.7	36	11.6	5.9
Makedonia Traki (EL)	Histor.	702.39	26.1	165	79.0	20.8
Extremadura (ES)	Histor.	140.70	44.4	30	93.3	0.5
France Centre	Histor.	327.58	27.1	24	66.1	0.4
Del Alfold (HU)	SAPS	181.65	9.9	50	18.0	13.9
Emilia Romagna (IT)	Histor.	359.54	9.0	125	68.3	5.1
LMLP (PL)	SAPS	219.10	5.4	193	83.7	3.6
Alentejo (PT)	Histor.	173.54	44.6	30	61.9	4.3
Slättbygdslän (SE)	Hybrid	250.89	7.3	33	75.2	0.5
England East (UK)	Hybrid	252.86	0.8	67	26.2	8.4
Slovenia	Regional	376.16	12.1	163	92.7	10.6
Average		303.40	16.1	82	62.0	6.6
				Rate of change 2004-09 (%)		
Niedersachsen (DE)	Hybrid	25.3	-96.1	-3.5	-5.9	-7.5
Brandenburg (DE)	Hybrid	16.2	-97.3	1.8	-7.7	50.0
Makedonia Traki (EL)	Histor.	45.8	-73.9	-17.9	2.3	46.1
Extremadura (ES)	Histor.	-11.8	-55.6	1.3	3.4	-60.0
France Centre	Histor.	-5.4	-72.9	-0.4	-3.1	-50.0
Del Alfold (HU)	SAPS	32.9	-81.3	-4.2	4.8	-29.0
Emilia Romagna (IT)	Histor.	84.8	-91.0	-22.3	-16.7	64.7
LMLP (PL)	SAPS	91.8	-90.9	-17.4	-3.4	73.7
Alentejo (PT)	Histor.	-4.5	-55.4	-21.7	2.8	14.3
Slättbygdslän (SE)	Hybrid	6.7	-92.7	-2.2	-6.6	-95.3
England East (UK)	Hybrid	-9.8	-99.2	-3.4	-10.1	23.1
Slovenia	Regional	79.8	-87.9	-30.0	1.2	-27.8
Average		26.4	-82.6	-16.8	-3.1	-8.3

Source: Elaboration based on FADN constant sample

On average, direct payments have increased in most of the considered regions. This is due to the phasing-in process in the two regions applying the SAPS (having relatively low levels of direct payment in 2004) but also to the increases experienced in particular by Emilia Romagna (IT), Makedonia-Traki (GR) and Slovenia. Thus, this has not resulted in a reduction of the differences in unitary payment levels between the considered regions.

In 10 out of 12 regions, all direct payments resulted to be coupled in 2004. This is not the case of Del Alfold (HU) and Łódzkie, Mazowsze, Lubelskie and Podlasie (PL) where around 45% of the payments were decoupled from production at least in the considered FADN farms[165]. The relative importance of coupled payments has strongly declined in all regions from 2004 to 2009. However, the reductions have been relatively less intense in the SPS Historical regions and, in particular, in Extremadura (ES) and Alentejo (PT) where in 2009 still over 40% of direct payments resulted to be

[165] It is important to recall that the considered data are not weighted. Thus the sample data are not necessarily fully representative of the farm sector of the considered regions.

coupled in the considered farms. For this reason, differences in the decoupling levels between regions are still important in 2009.

Labour intensity differs in the considered regions. High levels can be found in Łódzkie, Mazowsze, Lubelskie and Podlasie (PL), Slovenia, Makedonia-Traki (GR) and, to a lesser extent, Emilia Romagna (IT). On the contrary, low levels can be found in France Centre, Extremadura (ES) and Slättbygdslän (SE). Differences between regions have reduced over time. While most regions have experienced a decline in labour intensity (with the exception of Brandenburg and Extremadura), the strongest decreases have been experienced by some of the regions with the highest level in 2004 such as Slovenia, Makedonia-Traki and Łódzkie, Mazowsze, Lubelskie and Podlasie.

There are differences between regions also in terms of the relative importance of family labour: high in the regions of Poland, Sweden, Spain and Italy; low levels in Brandenburg and Del Alfold and, to a lesser extent, in England East. In the considered period of time, a reduction in the relative importance of family labour has been experienced by a large share of the considered regions. Such reduction has been particularly relevant in England East and Emilia Romagna. However, Del Alfold, Estremadura and Alentejo show opposite trends, thus, differences between regions have not diminished.

The considered data do not permit to identify differences in behaviour that may be linked to the implementation of different SFP models.

8.5.2 Relationship between direct payments and labour intensity in the farms within each region

This section reports the analysis developed to estimate the correlation existing between:

- Level of direct payments and evolution of labour intensity
- Change in the relative importance of coupled payments and evolution of labour intensity.

The analysis starts by calculating the correlation coefficients within the whole regional samples. However, because sampled farms of each region may strongly differ in terms of structural characteristics and behaviour, the analysis also considers farms classified according to their economic size class and farm type (TF). This further disaggregation produces sub-samples with less than 15 farms. Results for less than 15 farms are not shown.

8.5.2.1 Level of direct payments and evolution of labour intensity

As previously said, for correlation coefficients statistically different from zero, sign and magnitude of the coefficients provide insights into the relationship between the level of direct payments and the evolution of labour intensity observed in the farms of the sample in the years 2004–2009.

Regarding the sign it is possible to say that:

- A significant positive correlation coefficient means that, within the considered group, farms with relatively high levels of direct payments generally experienced stronger increases of labour intensity than other farms (or that farms with relatively low levels of direct payments generally experienced stronger decreases of labour intensity than other farms).
- A significant negative correlation coefficient means that, within the considered group, farms with relatively low levels of direct payments generally experienced stronger increases of labour intensity than other farms (or that farms with relatively high levels of direct payments generally experienced stronger decreases of labour intensity than other farms).

Correlation coefficients obtained in whole regional samples are very small. In only 2 of the 12 regions the coefficients are significantly different from zero and negative (Tab. 44). A similar situation occurs when disaggregation by economic size is considered, except for medium size farms. In this latter group, the coefficients are statistically significant in 4 regions out of 12.

Tab. 44 – Correlation between level of direct payments and evolution of labour intensity in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	-0.04		0.02	-0.05
Brandenburg (DE)	-0.29 ***		-0.35 ***	-0.13
Makedonia Traki (EL)	-0.04	-0.10 **	0.00	
Extremadura (ES)	-0.07	-0.08	-0.18 ***	
France Centre	-0.07		-0.12	-0.01
Del Alfold (HU)	-0.13 **	-0.33 ***	0.04	-0.25
Emilia Romagna (IT)	-0.03	0.04	-0.03	-0.12
LMLP (PL)	0.03	0.05 **	-0.08 **	
Alentejo (PT)	-0.03	-0.05	0.02	-0.21
Slättbygdslän (SE)	0.06	0.08	0.15 ***	-0.26 **
England East (UK)	0.02		0.08	-0.01
Slovenia	-0.03	0.03	-0.05	

Significant at: *** 1%, ** 5%, * 10%.

Source: Elaboration based on constant FADN sample

Similar results are obtained when farms are classified according to farm type (Tab. 45). Indeed, only in one sector (farms specialised in grazing livestock) the coefficients are statistically significant at least at 5% in 3 cases, and at 10% in two other cases. In the other sectors, the estimated coefficients are almost never significantly different from zero.

Tab. 45 – Correlation between level of direct payments and evolution of labour intensity by type of farming

	Specialist					Mixed		
	Field-crops	Horti-culture	Perma-nent crops	Grazing live-stock	Grani-vores	Crop-ping	Live-stock	Crop-live-stock
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8
Niedersachsen (DE)	-0.18 **	0.14	-0.10	0.11 *	0.07	0.42 *	0.07	0.02
Brandenburg (DE)	-0.09			-0.33 **				-0.13
Makedonia Traki (EL)	-0.14 ***		-0.07	0.18		0.19		-0.11
Extremadura (ES)	-0.17 **			-0.13		0.06		0.10
France Centre	-0.03		-0.07	-0.38 **				-0.05
Del Alfold (HU)	0.02		0.48 **	-0.29	-0.13	0.22		-0.20
Emilia Romagna (IT)	0.00		0.04	0.03	0.19	0.15		-0.03
LMLP (PL)	0.06	0.09	-0.15 *	-0.22 ***	-0.04	0.12 *	-0.09 **	0.00
Alentejo (PT)	-0.10		-0.05	0.05				0.21
Slättbygdslän (SE)	0.10			0.05	-0.28 *			0.17
England East (UK)	-0.06	-0.23	0.31 *	0.21 *	0.00			0.26 *
Slovenia			0.13	-0.03		0.09	-0.17	0.01

Significant at: *** 1%, ** 5%, * 10%

Source: elaboration based on constant FADN sample

Thus, it is possible to conclude that the results of the analysis do not support the hypothesis that the level of direct payment influenced the evolution of the intensity of labour use, apart very specific cases. This general result comes from the analysis developed on whole regional samples, but also on farms classified according to economic size and to type of farming.

8.5.2.2 Decoupling of direct payments and evolution of labour intensity

In this case, the correlation analysis is aimed at assessing the sign and magnitude of the relationship between the evolution of the relative importance of coupled payments (i.e. extent of the decoupling process) and the evolution of labour intensity observed in the farms of the sample in the years 2004–2009.

Regarding the sign it is possible to say that:

- A significant positive correlation coefficient means that changes in labour intensity have the same sign that the changes in the relative importance of coupled payments. Because the decoupling process has generally generated a reduction in the relative importance of coupled payments, a positive correlation means that decoupling is associated with a reduction in labour intensity (i.e. farms experiencing stronger reduction of coupled payments generally experienced a stronger reduction in labour intensity).
- A significant negative correlation coefficient means that changes in labour intensity are opposite

to changes in the relative importance of coupled payments. Because the decoupling process has generally generated a decline in the relative importance of coupled payments, a negative correlation means that decoupling is associated with an increase in labour intensity (i.e. farms experiencing stronger reduction of coupled payments generally experienced stronger increases in labour intensity).

Considering the whole sample, the correlation coefficients are statistically significant only in 3 cases out of 12: Makedonia-Thraki (GR), Del Alfold (HU) and the Polish regions of Łódzkie, Mazowsze, Lubelskie and Podlasie (Tab. 46). However, it is important to underline that also in these cases, the coefficients are very small (i.e. always lower than 0.15).

Tab. 46 – Correlation between evolution of degree of decoupling (CDP/TDP) and evolution of labour intensity in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	-0.01		0.01	-0.03
Brandenburg (DE)	-0.03		0.00	-0.07
Makedonia Traki (EL)	0.09 ***	0.10 **	0.05	
Extremadura (ES)	0.07	-0.02	0.16 **	
France Centre	0.00		-0.05	0.08
Del Alfold (HU)	0.12 **	-0.06	0.30 ***	-0.04
Emilia Romagna (IT)	0.06	-0.12	0.04	0.19 *
LMLP (PL)	0.13 ***	0.20 ***	0.01	
Alentejo (PT)	-0.08	-0.20	-0.04	0.11
Slättbygdslän (SE)	0.06	0.26	0.03	0.14
England East (UK)	0.00		-0.01	0.01
Slovenia	0.04	-0.01	-0.01	

Significant at: *** 1%, ** 5%, * 10%

Source: elaboration based on constant FADN sample

The correlation is even less important when looking at farms classified according to their economic size. In each size class, the coefficients are statistically significant in no more than two regions and in any case, correlation is very small reaching a maximum of 0.3 (Del Alfold, medium size farms). However, it seems important to underline that in all cases where the coefficients are significant, these are positive. This means that a decrease of coupled payments is often found in those farms where labour intensity has decreased the most.

The results by sector also show few significant correlation coefficients (Tab. 47). However, in some of those cases, the correlation coefficients assume much higher values than in the previously considered groups. Indeed, these often exceed an absolute value of 0.5. Furthermore, it is important to mention that the significant correlations found within sectors, are sometimes negative in sign. This is the case of farms specialised in horticulture in Makedonia-Thraki (GR), farms specialised in granivores and mixed crops/livestock farms in England East (UK).

Tab. 47 – Correlation between evolution of degree of decoupling (CDP/TDP) and evolution of labour intensity by type of farming

	Specialist					Mixed		
	Field-crops	Horti-culture	Perma-nent crops	Grazing live-stock	Grani-vores	Crop-ping	Live-stock	Crop-live-stock
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8
Niedersachsen (DE)	-0.04			-0.03	0.21	0.50 **	-0.08	0.00
Brandenburg (DE)	-0.09			0.07	0.79	0.01	0.40	-0.08
Makedonia Traki (EL)	0.12 ***	-0.96 **	0.04	-0.04		0.06		-0.03
Extremadura (ES)	0.04		-0.25	-0.06	0.07	-0.13	0.29	0.15
France Centre	-0.06		0.15	-0.28		0.21	0.47	-0.21
Del Alfold (HU)	0.01		0.59 ***	-0.14		0.15	-0.36	-0.03
Emilia Romagna (IT)	-0.12	0.41	-0.03	-0.12	-0.18	0.21	0.97 ***	0.01
LMLP (PL)	0.42 ***			-0.03	0.04	0.06	0.02	0.00
Alentejo (PT)	-0.20		0.28	-0.14		0.12	0.07	-0.28
Slättbygdslän (SE)	0.09			-0.08	0.12	-0.73	-0.10	0.28 **
England East (UK)	0.09			-0.01	-0.58 ***	0.58		-0.27 *
Slovenia	0.68		0.12	0.05	0.70 ***	-0.16	0.02	0.09

Significant at: *** 1%, ** 5%, * 10%

Source: elaboration based on constant FADN sample

The results therefore suggest that there is not a generalised correlation between extent of the decoupling process and evolution of labour use, but in some cases, where correlation exists and it is positive. In those cases, this means that farms that have experienced the most intense decoupling process, have also experienced a reduction in labour use. This seems reasonable given that in some cases, the activities supported by coupled payments are also very labour intensive. This hypothesis is supported by evidence regarding the evolution of production patterns in some of the regions where correlation coefficients are significant and positive in sign. In particular:

- Farms in the Makedonia-Traki (GR) sample have experienced a reduction of field crops other than cereals and an increase of forage crops. It is important to note that within the former group of crops, tobacco and sugar beet have experienced a reduction of the cropped area. In 2004, these two crops have received a strong coupled support that has been decoupled in the following years.
- Farms in the Polish region have experienced a reduction of cereals, a strong increase of forage crops and a limited increase of fallow land and set-aside land.
- Farms in Del Alfold (HU) have also experienced a reduction of the area cropped with cereals and vegetables as well as a decrease in the number of dairy livestock.

However, in some cases the correlation coefficients do not show a positive sign when the farms are grouped by sector. This means that in some cases, the decoupling process has been accompanied by an increase in labour intensity.

8.6 Effects of direct payments on labour intensity: results of the econometric modelling

The evaluation of the contribution of the direct payments to the farm labour force, uses "time worked in hours by total labour input on holding" as the dependent variable of the model (variable SE011 in "Community Committee for the Farm Accountancy Data Network", EC, 2012).

The model is linear in the logarithmic transformation of the variables and is estimated using a fixed effects panel model[166], estimated over a sample of farms , excluding farms without land, observed in the time interval 2005-2009. With this selection, the final sample is composed of 38,697 farms repeated in each of the five years (2005-2009), obtaining a total of 191,325 observations.

More specifically, the structure of the models is represented by:

$$\ln L_{i,t} = \ln \beta_i + \sum_k \gamma_k \ln P_{i,t,k} + \sum_m \delta_m \ln F_{i,t,m} + \sum_n \lambda_n \ln C_{i,t,n} + \varepsilon_{i,t}$$

Where:

$L_{i,t}$ Labour input in hours per hectare of utilised agricultural area (UAA);

$P_{i,t,k}$ Public subsidies per hectare, with k=4: Coupled direct payments, Decoupled direct payments, Rural development aids and Subsidies on investment;

$F_{i,t,m}$ Set of variables at farm level, with m=5: Net worth[167], Cash flow[168], Age of holder, Organisational form (dummy variable) and Type of farming (dummy variable);

$C_{i,t,n}$ Gross domestic product per capita as a variable representing the general macroeconomic context at regional level within the five years interval.

Collinearity[169] (Variance inflation factor test –VIF – whose average values are under a cut-off value of 2) and heteroskedasticity[170] (Breusch-Pagan)tests are conducted on the model, to verify the absence of

[166] A random effects specification has also been estimated but was rejected on the basis of the Hausman test.

[167] Defined as the difference between Total Assets and Liabilities.

[168] Defined as the holding's capacity for saving and self-financing.

[169] Collinearity refers to an exact or approximate linear relationship between explanatory variables.

[170] Heteroskedasticity occurs when the variance of the error terms differ across observations (e.g. if there are sub-populations that have different variabilities from others on a set of variables). The presence of heteroskedasticity is a concern in the application of regression analysis because it can invalidate statistical tests of significance.

collinearity and the presence of heteroskedasticity. The latter uses heteroskedasticity consistent standard errors, after an accurate analysis of the distribution of residuals was carried out.

The model takes the natural logarithm of Labour input in hours per hectare of UAA as the dependent variable and the following 16 explanatory variables:

- *CAP payments*
  - Logarithm of Coupled Payments per hectare
  - Logarithm of Decoupled Payments per hectare
  - Logarithm of Rural development Payments per hectare

The variable Subsidies on investment is excluded by the model due to collinearity problems.

- *Farm variables*
  - Logarithm of Net worth per hectare
  - Logarithm of Cash flow per hectare
  - Logarithm of age of holder
  - Organisational form - dummy variable where: 1=Individual farms (base outcome); 2=Partnership; 3=Other
  - Types of farming - dummy variable where: 1=Field crops (base outcome); 2=Horticulture; 3=Wine; 4=Other permanent crops; 5=Milk; 6=Other grazing livestock; 7=Granivores; 8=Mixed
- *Context variable*
  - Logarithm of Gross domestic product per capita

Tab. 48 shows the results of the panel regression. Only three dummy variables related to the farm's organisation and specialisation are not significant. All the other explanatory variables and the model as a whole are highly statistically significant.

The contribution of CAP payments is positive in the case of coupled payments and rural development aids, but it is negative in the case of decoupled payments. Although statistically significant, the very low absolute values of the estimated parameters indicate the absence of a tangible role of CAP payments in explaining labour intensity per hectare. This is particularly true remembering that, in a logarithmic regression, the parameters represent the constant elasticity of the dependent variable with respect to percentage changes in the explanatory variable (*i.e.* if Decoupled payments per ha increased by 1%, then the decrease in Labour input per ha would be equal to -0.0092%).

As far as farm's characteristics are concerned, the positive and significant parameter estimates for Age of holder and Organisational form (Other), suggests higher labour intensity in farms conducted by aged holders and in farms under "other" organisational forms. With respect to Type of Farming, the results show that field crops farms (the base outcome in the Types of farming dummy variable) have a lower contribution to the level of labour input than the other types of farming.

Tab. 48 – Results of the panel regression model with Labour force per ha as dependent variable

Ln Labour force in hours per ha	Coefficient.	Robust Std. Err	t	P>|t|
Ln Net worth per ha	0.2035	0.0054	37.44	0.000
Ln Coupled direct payments per ha	0.0079	0.0008	9.96	0.000
Ln Decoupled direct payments per ha	-0.0092	0.0008	-12.1	0.000
Ln Rural development payments per ha	0.0013	0.0007	1.84	0.066
Ln Cash flow per ha	0.0479	0.0017	27.42	0.000
Ln age of holder	0.1075	0.0112	9.56	0.000
Organisational form (Partnerships) - Dummy	-0.0026	0.0131	-0.2	0.844
Organisational form (Other) - Dummy	0.0503	0.0130	3.86	0.000
Types of farming (Horticulture) - Dummy	0.0953	0.0163	5.84	0.000
Types of farming (Wine) - Dummy	0.0246	0.0198	1.24	0.215
Types of farming (Other permanent crops) - Dummy	-0.0109	0.0140	-0.78	0.437

Ln Labour force in hours per ha	Coefficient.	Robust Std. Err	t	P>|t|
Types of farming (Milk) - Dummy	0.1233	0.0097	12.76	0.000
Types of farming (Other grazing livestock) - Dummy	0.1180	0.0099	11.96	0.000
Types of farming (Granivores) - Dummy	0.1947	0.0108	17.96	0.000
Types of farming (Mixed) - Dummy	0.0929	0.0062	15.08	0.000
Ln Gross Domestic Product per capita	-0.3976	0.0168	-23.73	0.000
Constant	3.3458	0.0659	50.76	0.000
Number of observations	176416			
Log likelihood	22076			
Degrees of freedom model	16			
Degrees of freedom residuals	139407			
R^2	0.97765			
Adjusted R^2	0.97172			
F	158.75			

8.7 Evaluation judgment

The evaluation question required to assess to what extent direct support schemes as introduced by Regulation 1782/2003 have influenced labour use according to several dimensions, i.e. labour use intensity (expressed in terms of hours per hectare), family labour (expressed as relative importance of family labour on total labour force), age structure, part-time/full-time farm organisation.

The analysis is carried out at macro- and micro-economic level across the EU27 Member States. At the macro level, the analysis is based on Eurostat data (FSS) and carried out at the NUTS II regional level. At the micro level, the analysis is based on FADN farm data (Source: EU FADN - DG AGRI).

The analysis concerning labour use intensity is carried out using two methodological approaches: statistical analysis and econometric models. The first one analyses its development in the observation period corresponding to the years 1995 onwards, and it is instrumental for interpreting the observed phenomena, in particular in the post-reform years. The analysis is completed by further investigation developed on samples of individual farms in the case study regions. Finally, econometric modelling provides a quantitative estimation of the impact of the direct support schemes on labour use in the post-reform years.

The analysis concerning the other labour indicators (i.e. family labour, age structure, part-time/full-time farm organisation) is carried out using a statistical analysis.

Effects of direct payments on the evolution of labour use intensity

In general, the reduction of labour force is one of the main aspects of structural change in the farm sector. However, **the statistical analysis has shown that labour use intensity has declined at a faster pace in the post-reform period than in the previous period**. This trend has been experienced by all considered groups of regions, albeit with some differences in the intensity of this phenomenon among the groups. These results suggest that **the reform may have contributed, together with other factors, to accelerate the decline in labour force in the sector**.

The observed differences between groups of regions are likely to have been generated by the relevant structural differences among Member states belonging to these groups. In particular, the faster decline in labour use observed in the SAPS regions seems related to the reduction of excess labour force in former large cooperatives and state farms, existing in the pre-reform (where labour use was higher than in most of the other EU15 regions, at the beginning of the considered period).

Moreover, the reduction has been particularly strong in some of the regions implementing the SPS Historical model and, in particular, where certain coupled payments strongly supported labour intensive activities prior to the reform (e.g. tobacco and tomatoes for processing). This suggests that, **in some cases, the decoupling process may have contributed to the reduction of labour use**.

In addition, the analysis shows that the observed changes in labour use intensity are also the result of changes in other structural attributes. In particular, labour use is still significantly higher in small farms than in large farms even if differences between size groups have slightly reduced in the post-reform period at least in the SPS Historical and Hybrid regions. Thus, **the decrease in small farms numbers and the increase in the importance of relatively large farms (observed in EQ 1) can be one of the main factors causing the observed reduction of labour use as well as the changes in other labour use attributes**.

The application of econometric models at micro-economic level, using FADN data, allowed to estimate the effects of direct payments on labour use intensity in the years 2005-2010. The econometric approach has been used to identify the statistical relationships between labour use and a number of explanatory variables expected to influence it (i.e. decoupled direct payments, coupled direct payments, rural development aids[171], farm organisation, farm specialisation, economic factors).

The regression parameters estimate the impact of direct payments on labour per hectare. If parameters are statistically different from zero and positive in sign, it can be assumed that direct payments contribute to increasing labour use, and vice versa for statistically significant parameter estimates with negative sign. The magnitude of the parameters provides an estimate of the extent of this contribution.

The results **show that in the years 2005-2010 coupled payments may have played a role in increasing labour use and that decoupled payments could have played a role in decreasing labour use**. However, the very **low values[172] of the estimated parameters for coupled and decoupled direct payments indicate that they played a minor role in influencing labour use**.

Finally, the correlation analysis conducted on constant FADN samples (2004 and 2009) within each one of the 12 case study regions has provided some additional insights at regional level on whether the observed evolution of labour use intensity can be associated to direct payments. The analysis is based on the computation of correlation coefficients between couples of variables.

The results of the correlation analysis are consistent with the other analyses, overall **confirming a minor role of direct payments on labour use**. Only in few cases (region; region/class of economic size; region/farm type) direct payments correlation coefficients are significant but in some cases high levels of direct payments correspond to a stronger increase of labour use and in other cases high levels of direct payments correspond to a stronger decrease of labour use. Therefore it is not possible to assess any systematic correlation even within these few cases.

In a limited number of regions, farms that have experienced the strongest reduction in the relative importance of coupled payments have often also experienced a (generally limited) reduction of labour use. In particular, this has occurred only in the specific circumstances in which farm activities supported by coupled payments are also among the most labour intensive[173]. This hypothesis is supported by the analysis of the evolution of production patterns observed in the few regions where correlation coefficients are significantly different from zero. These findings confirm that, in some specific cases, the **decoupling process may have contributed, together with other non-policy factors, to the reduction of labour use**.

Role of CAP reform in the evolution of other labour attributes

The statistical analysis based on Eurostat data of the years 1995 onwards, shows that in the post-reform years, **the relative importance of farms managed by holders ≤35 years old has increased**

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[171] These include agri-environmental payments?, LFA payments and other rural development payments (see § 5.1.2.2). Computation of FADN variables is [(SE621+ SE622 + SE623) - JC840], where JC840 mainly gathers art. 69 payments (quality) and is, therefore, included in the computation of coupled direct payments.

[172] The estimated parameters of coupled and decoupled direct payments are statistically significant and in a logarithmic regression, the parameters represent the constant elasticity of the dependent variable with respect to percentage changes in the explanatory variable (*i.e.* if Decoupled payments per ha increased by 1%, then the decrease in Labour input per ha would be equal to -0.0092%).

The estimated parameters for other explanatory variables take higher values, e.g. age of holder, net worth (total capital minus total debts), cashflow, GDP per capita.

[173] E.g. Makedonia Traki in TF1 – Field crops; Emilia Romagna in TF7 – Mixed livestock; Slättbygdslän and England East in TF 8 – Crop livestock; Niedersachsen in TF 6 – Cropping.

while that of holders ≥65 years old has declined. This suggest a certain degree of intergenerational transfer in the farm sector following the CAP reform, with growing relative importance of farms managed by young farmers. However, the **observed changes can also be the result of other factors that, as explained in the theoretical analysis, affect structural change**. In particular, this can be the case of the increase in the relative importance of farms managed by young holders given that other policies (i.e. both at national level – see Chapter 4 - and rural development measures) pursue this aim.

The analysis has **not provided strong evidence of discontinuity in the trends observed in the period before and after the implementation of the CAP reform in the other two labour attributes: family labour and part-time/full-time farm organisation**. In particular, the relative importance of part-time farming as well as of the labour provided by family members has increased more or less constantly in both considered period. Therefore, **the reform did not affect farm labour in terms of the relative importance of family labour force and part-time farming**.

9. Theme 3 – Labour force and capital: To what extent have direct payments affected farm capital intensity? (EQ4)

9.1 Comprehension and interpretation of the evaluation question

Structural change is often characterized by a process of substitution of capital for labour. The theoretical analysis has discussed the possible role of agricultural policy and other factors in this process. Here the key terms of this evaluation question are defined.

In agriculture, the term capital refers to all fixed farm assets excluding land given that land represents a special type of capital.

This evaluation question focuses on capital intensity in terms of the relationship between capital and other factors, namely: labour and land. The process of substitution of capital for labour is expected to have increased the capital intensity in terms of the ratio between capital and labour used on farm. As explained in the theoretical analysis, this evolution may have been influenced by direct support policy.

The ratio between capital and land can change because of the substitution of capital (excluding land) for land but also because a process of intensification or extensification of the overall production process. For example, a process of extensification can generate a change in production pattern such to cause a reduction of the amount of both labour and capital used per unit of land. This may have occurred in some areas of the EU after the decoupling of direct payments, especially in the case farmers have decided to leave some of the land uncultivated as production was no longer necessary in order to receive the decoupled payments.

Therefore, it seems interesting to evaluate the trend in capital intensity (in relation to both labour use and land use) over the observed time period and to correlate this trend with the evolution of the intensity and the degree of decoupling of direct payments. Furthermore, in order to assess whether direct payments affected farm capital intensity, it is evaluated whether the rate of change of capital intensity observed over the examined years is positively correlated with the level of direct payments received in the considered farm samples.

The evolution of capital intensity could also be influenced by the use of contract work on-farm. Thus, the analysis should consider the cases in which farmers use external contract work services at some stages of the production process on the farm. Indeed, this strategy reduces the need to rely on own capital only, shifting some fixed cost into variable costs.

9.2 Methodological approach, data sources and limits

The analysis is carried out at farm level (Eurostat does not provide data on capital). The applied methodology comprises statistical analysis and econometric modelling. Below we detail the methodology adopted for the statistical analysis. For the description of the methodology developed for the econometric analysis, please refer to § § 5.1.2.2.

The statistical analysis, conducted across the EU27 Member States, is based on the FADN database from 2004 to 2009. The analysis is completed by a further investigation comparing 2004 (pre-reform) and 2009 (post-reform) data for a constant sample of farms in the 12 case study regions.

The indicators regarding capital intensity are:

- Available Capital per unit of Utilised Agricultural Area (K/ha)
- Available Capital per Annual Work Unit (K/AWU)

Available capital (K) has been calculated starting from total fixed assets (variable SE441 in the FADN database). This sums up land, permanent crops and quotas (SE446), buildings (SE450), machinery (SE455) and breeding livestock (SE460). Available capital (K) is then calculated by subtracting land, permanent crops and quotas (SE446) from total fixed assets (SE441). This permits to compute the two ratios expressing the relationships between non-land capital and, as denominators, land or labour.

It should be noted that EU FADN gives only the balance sheet value of capital. Variations in the value of capital assets may thus be used as a *proxy* for the physical amount of capital, but to the extent that the nominal value is given at constant prices.

EU FADN instructions require from survey respondents: i) an assessment of capital and its depreciation at replacement value; ii) the opening valuation must be equal to the closing valuation of the previous year.

Unfortunately, these instructions are not followed correctly by all MS. The analysis of data at individual farm level has highlighted the implementation of very different bookkeeping methods (sometimes also within the same MS, depending on the farms and/or years). We have also noticed the existence of differences (mostly positive, sometimes negative) between the closing value for a year (n) and the opening value for the following year (n+1). This could be (also) due to a revaluation process (positive or negative) of capital in the balance sheet. With regard to Member States outside the Eurozone, the fluctuation of Euro/national currency exchange rates may have played a role, since EU FADN values are expressed in Euros. This does not however explain the phenomenon within Eurozone Member States.

This too broad variety of cases has prevented us from identifying and applying a unique and sufficiently robust methodology to eliminate the inconsistencies and/or to re-calculate the value of capital in real terms (i.e. through the application of a price deflator). Our attempts at applying methodologies (resting on different hypotheses) to different cases (also at single farm level) have produced overly uneven and thus unreliable results.

We have therefore decided to present the analysis based on the original data, being aware, however, of the limitations.

Because the evolution of capital intensity could be also influenced by the use of contract work on-farm, the evolution of the use of contract work over time has been analysed per unit of land, i.e. by means of the ratio: Total Contract Work/UAA (Euro/ha).

The intensity of the evolution over time of the above listed indicators is measured by average annual growth rates (%, AAGR), computed for the years 2004-2009. Within the group of regions applying the SAPS, Bulgaria and Romania accessed the EU (and thus the FADN sample) in 2007. This requires that Bulgaria and Romania be analysed separately. Thus, we first analyse the data 2004-2009 for all regions including the group implementing the SAPS model, except Bulgaria and Romania. Subsequently, we repeat the analysis for Bulgaria and Romania (considered together) and for all other groups of regions for the years 2007–2009.

Farm data were aggregated according to three key characteristics related to the direct payments schemes that may have created differences in the behaviour of farms:

- Type of farming
- Economic size classes based on ESU classification
- Single Farm Payment (SFP) model of implementation, differentiating between regions and Member States implementing the SAPS and the three different schemes of SPS: Historical, Regional and Hybrid.

Regarding the policy side, three main dimensions have been considered:

1. The changes occurred in the groups of regions having different models of SFP implementation;
2. The unitary level of direct payments, in terms of average level of direct payments per unit of land;
3. The extent of the decoupling process, in terms of reduction of the share of direct payments occupied by coupled payments.

The first policy dimension has been analysed by means of the full FADN sample, while the other two by means of the constant FADN sample in the 12 case study regions (i.e. a sample consisting of the same farms in the two analysed years 2004 and 2009).

The analysis using constant samples is very useful to identifying possible relationships between direct payment policy and capital related structural change. In particular, the analysis is aimed at evaluating whether between 2004 and 2009: i) farms benefitting from high direct payments show relatively high/low rates of change in capital intensity; ii) farms that have experienced the strongest reductions of coupled payments (i.e. decoupling) have also experienced relatively high/low rates of change in capital intensity. Please refer to Chapter 8.5 for the calculation of the correlation coefficients and their interpretation.

9.3 Judgment criteria and indicators

In order to reply to this question, we based our judgement on the following criteria and indicators:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, in the EU regions direct payments have (have not) affected farms' capital intensity**
Capital intensity (K/ha; K/AWU) with respect to SFP implementation model, size class and type of farming (2004-2009)
AAGR of capital intensity with respect to SFP implementation model, size class and type of farming (2004-2009)
Relative importance of costs related to Total Contract Work per unit of land (CW/UAA: Euro/ha) with respect to SFP implementation model, size class and type of farming (2004-2009)
AAGR of CW/UAA (Euro/ha) with respect to SFP implementation model, size class and type of farming (2004-2009)
Correlation between average level of direct payments and relative change of capital intensity and of contract work use at farm level in the case study regions (2004 and 2009)
Correlation between relative change of the share of coupled payments to total direct payments and capital intensity and of contract work use at farm level in the case study regions (2004 and 2009)
Regression parameter estimates for direct payments at the farm level (dependent variables: capital per unit of land; capital per unit of labour)

9.4 Analysis of the evolution of capital intensity in the EU regions

9.4.1 Amount of capital per unit of land

In 2009 the amount of capital per unit of land is around 2 400 Euro/ha. Capital intensity is much higher in the regions applying the SPS regional compared to the EU27 average value (i.e. 3 times as high)[174], while it is way lower in the regions implementing the SAPS and, in particular, in Bulgaria and Romania.

Tab. 49 – Evolution of capital intensity (K/ha) in the groups of EU regions

	Available capital/Utilised Agric. Area (Euro/ha)						Average annual growth rate (%)	
	2004	2005	2006	2007	2008	2009	09/04	09/07
SPS Historical	2375	2401	2406	2474	2581	2604	1.9	2.6
SPS Hybrid	2708	2686	2984	2534	2429	2420	-2.2	-2.3
SPS Regional	6887	7125	6871	6465	7337	7639	2.1	8.7
SAPS:				1918	2155	1895		-0.6
SAPS*^	2043	2045	2103	2175	2345	2074	0.3	-2.3
Bulg. and Rom.				1296	1767	1535		8.8
EU-15	2472	2486	2570	2491	2536	2548	0.6	1.1
EU-12				1973	2214	1959		-0.4
EU 25	2408	2415	2494	2444	2515	2474	0.5	0.6
EU-27				2359	2451	2391		0.7

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

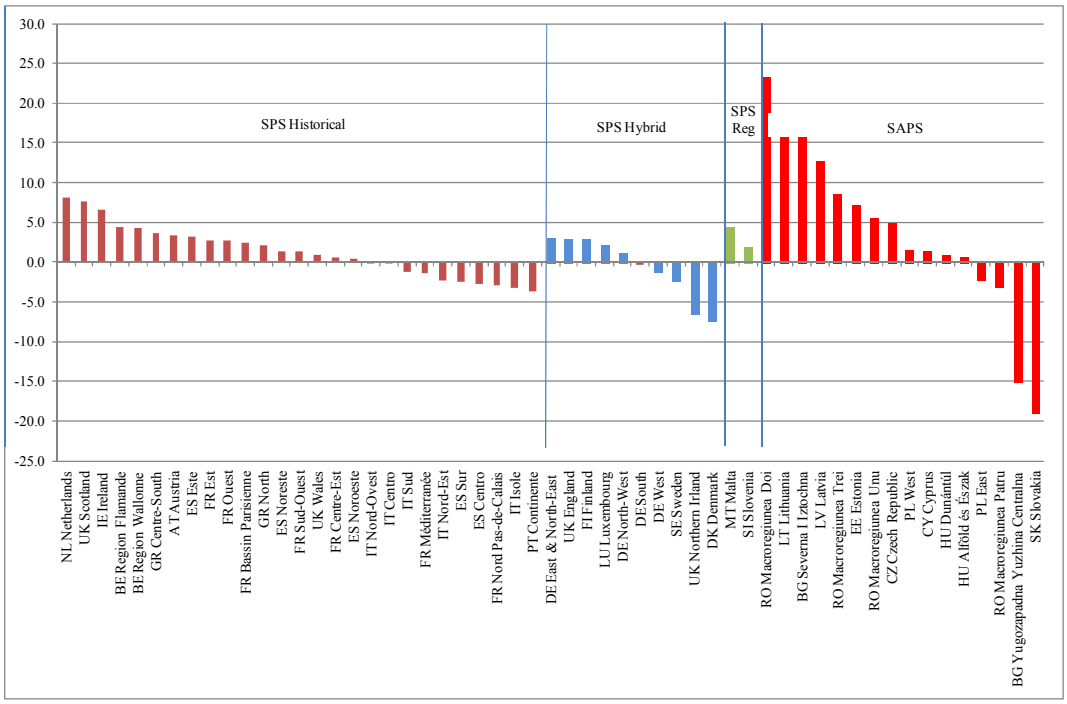
Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

At EU level, the value of capital per hectare has only slightly increased in the considered time period. However, this is the result of very different evolutions observed in the considered groups of regions. Indeed, while the unitary amount of capital has increased in the groups of regions applying the SPS Historical and Regional models, it has declined in the regions applying the SPS Hybrid and the SAPS

[174] SPS Regional (Malta and Slovenia): The value of the ratio K / UAA is very high in Malta, where the agricultural structure is characterized by small size farms probably over-capitalised.

8 (i.e. excluding Bulgaria and Romania)[175]. However, the analysis at regional level reveals a large heterogeneity. The observed changes of capital intensity are not similar across regions within the same SFP model.

Fig. 75 – Evolution of capital intensity (K/ha) across EU regions. Average annual growth 2004-2009 (%), Bulgaria and Romania avegare annual growth rate 2007-2009 (%)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

This suggests that the differences in average values between groups of countries should not be necessarily considered as statistically significant.

At EU level, the ratio K/ha does not strongly differ in the farms of different economic size. However, this is not true in all considered groups of regions. In those applying the SPS Regional model, capital intensity is higher in large size farms and in medium size farms than in small farms (Tab. 50). The opposite is true in the group of regions applying the SAPS. Here the highest values are found in small and medium size farms. This is particularly true in the regions of Bulgaria and Romania.

Tab. 50 – Capital intensity by farm economic size class in the groups of EU regions (K/ha and % average annual growth rate)

	2004				2007				2009				AAGR (%) 2009-04				AAGR (%) 2009-07			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
SPS Historical	2497	2120	2442	2375	2497	2130	2608	2470	2547	2269	2765	2599	0.4	1.4	2.5	1.8	1.0	3.2	3.0	2.6
SPS Hybrid	3600	2683	2677	2708	2506	2192	2612	2534	2391	2065	2498	2420	-7.9	-5.1	-1.4	-2.2	-2.3	-2.9	-2.2	-2.3
SPS Regional	6118	9891	10361	6887	5786	7866	9568	6465	6982	8909	10803	7639	2.7	-2.1	0.8	2.1	9.9	6.4	6.3	8.7
SAPS:					2426	2121	1345	1918	2321	2113	1330	1895					-2.2	-0.2	-0.5	-0.6
SAPS*^	2468	2125	1608	2043	2637	2380	1669	2175	2433	2439	1591	2074	-0.3	2.8	-0.2	0.3	-4.0	1.2	-2.4	-2.3
Bulg. and Rom.					2018	716	543	1296	2162	693	697	1535					3.5	-1.6	13.3	8.8
EU 15	2568	2250	2528	2472	2498	2143	2610	2488	2538	2223	2663	2545	-0.2	-0.2	1.0	0.6	0.8	1.8	1.0	1.1
EU 12					2496	2213	1363	1973	2404	2213	1352	1959					-1.9	0.0	-0.4	-0.4
EU 25	2577	2250	2408	2408	2594	2194	2480	2441	2550	2272	2518	2471	-0.2	0.2	0.9	0.5	-0.9	1.8	0.8	0.6
EU 27					2497	2155	2376	2357	2465	2221	2419	2389					-0.6	1.5	0.9	0.7

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

At EU level, capital intensity per unit of land has not changed very much over the years. However, some differences can be found comparing the evolution of capital intensity in the three considered economic size groups: capital intensity declined in small farms and increased in large farms. The strongest difference between size groups can be found in the regions applying the SPS Hybrid and the SAPS 8 (i.e. excluding Bulgaria and Romania): here small farms experienced a strong reduction of the

[175] Completely different results are obtained for the regions of Bulgaria and Romania where, capital intensity per hectare has increased very much in the years 2007-2009. In any case, we believe that the data for Bulgaria and Romania should be taken with some caution, as they show abnormal values and the remarkable regional differences do not seem justified

amount of capital per hectare. This suggests that in these two groups of regions strong structural change is occurring in small farms. In contrast, capital intensity per unit of land strongly increased in large farms of Bulgaria and Romania in the years 2007-09.

The ratio K/Ha strongly differs in farms classified according to farm type. It is very high in farms specialised in horticulture, high in those specialised in permanent crops, while it is low in farms specialised in field crops. The considered farm types also differ in terms of the evolution of capital intensity over the examined years (Tab. 51). At EU level, the index of capital intensity has declined in farms specialised in field crops and in granivores, whereas it has increased in mixed livestock farms. However, the evolution differs according to the groups of regions too. Indeed, while in the group of regions implementing the SPS Historical capital intensity has declined more or less at the same pace in all types of farming, this is not the case in the other groups of regions.

Tab. 51 – Capital intensity (K/ha) by production sector in the groups of EU regions (% average annual growth rate)

	field crops	horticulture	permanent crops	grazing livestock	granivores	cropping	livestock	crops-livestock	Total
	Specialist TFs:					Mixed TFs:			
	1	2	3	4	5	6	7	8	Total
	Average Annual Growth Rate (%) 2004-2009								
SPS Historical	-4.2	-4.1	-2.1	-1.4	-4.6	-3.6	-3.1	-3.3	-2.2
SPS Hybrid	-0.8	-6.2	-7.0	0.5	9.3	-1.3	12.9	2.4	2.1
SPS Regional	-0.3	-4.2	-4.7	-0.2	-0.6	1.2	2.0	2.6	-1.5
SAPS*^	3.7	-3.2	-2.7	-0.6	-2.1	0.8	1.1	1.3	0.3
EU 15	-0.5	-4.3	-4.8	-1.0	-0.4	0.7	2.2	2.5	-1.7
EU 12									
EU 25	-1.7	0.1	-0.3	0.8	-1.0	0.3	1.8	0.2	-0.2
EU 27									
	Average Annual Growth Rate (%) 2007-2009								
SPS Historical	0.7	6.0	-5.0	-4.1	-3.9	5.4	-1.6	-3.6	-2.3
SPS Hybrid	10.4	10.0	8.4	6.6	-3.1	1.1	34.2	-2.0	8.7
SPS Regional	3.6	2.4	-1.4	-1.6	-4.3	-4.0	0.0	2.6	-0.6
SAPS:	2.8	3.3	1.8	0.1	-0.7	2.3	3.4	-0.6	1.1
SAPS*^	0.6	1.6	-2.7	-4.5	-5.1	-4.1	-2.2	-1.8	-2.3
Bulg. and Rom.	20.0	13.8	4.9	6.6	14.6	-3.9	6.4	27.3	8.8
EU 15	3.6	2.4	-0.9	-1.1	-4.2	-3.7	1.0	2.5	-0.4
EU 12	2.4	3.4	1.5	-0.2	-1.6	0.4	1.6	-1.0	0.6
EU 25	2.6	3.4	1.6	-0.1	-1.4	-0.2	2.1	0.3	0.7
EU 27	0.7	1.7	-2.0	-3.2	-5.0	-3.6	-0.6	-1.8	-1.8

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Differences are very large in the group of regions implementing the SPS Hybrid model. Here capital intensity strongly declines in farms specialised in horticulture and in permanent crops, while remarkably increases in farms specialised in granivores and in mixed livestock farms. Similarly, large differences can be found in the regions of Bulgaria and Romania: here in 2007-09 large increases in capital intensity are found in mixed crop-livestock and in specialised field crops farms.

9.4.2 Amount of capital per unit of labour

Capital is used together with labour, but the relative importance of these two factors can vary. Thus, it seems interesting to investigate capital intensity also in relation to labour input (K/AWU).

The FADN data show that, in the EU27, the available capital is around 40 000 Euro/AWU. The lowest ratio is found in regions applying the SAPS: only 18 000 Euro/AWU. The highest level is found in the regions applying the SPS Hybrid model with almost 88 000 Euro/AWU, due to the very low level of labour intensity that characterizes this group of regions (see § 8.4.1). This is supported by the fact that the amount of capital per unit of land is very much in line with the EU27 figure. The importance of capital/AWU is very low in Bulgaria and Romania: this indicator is at around ¼ of the EU27 average. This is due to a limited amount of capital per ha and to a large amount of labour per unit of land.

There are strong differences in the level of this ratio also within regions applying the same model of SFP implementation.

Tab. 52 – Evolution of capital intensity (K/AWU) in the groups of EU regions

	Available capital/Labour Units (Euro/AWU)						Average annual growth rate (%)	
	2004	2005	2006	2007	2008	2009	09/04	09/07
SPS Historical	39780	41454	43302	44500	49398	51057	5.1	7.1
SPS Hybrid	91141	93381	104915	89625	88494	88553	-0.6	-0.6
SPS Regional	38088	38064	36120	39536	45851	49383	5.3	11.8
SAPS:				15620	19058	18626		9.2
SAPS*^	23172	24312	25280	27059	29888	26909	3.0	-0.3
Bulg. and Rom.				5751	9601	10152		32.9
EU-15	48497	50428	53640	51957	56599	58089	3.7	5.7
EU-12				16006	19482	19146		9.4
EU 25	41391	42806	45298	44792	48730	48861	3.4	4.4
EU-27				35155	38959	40239		7.0

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

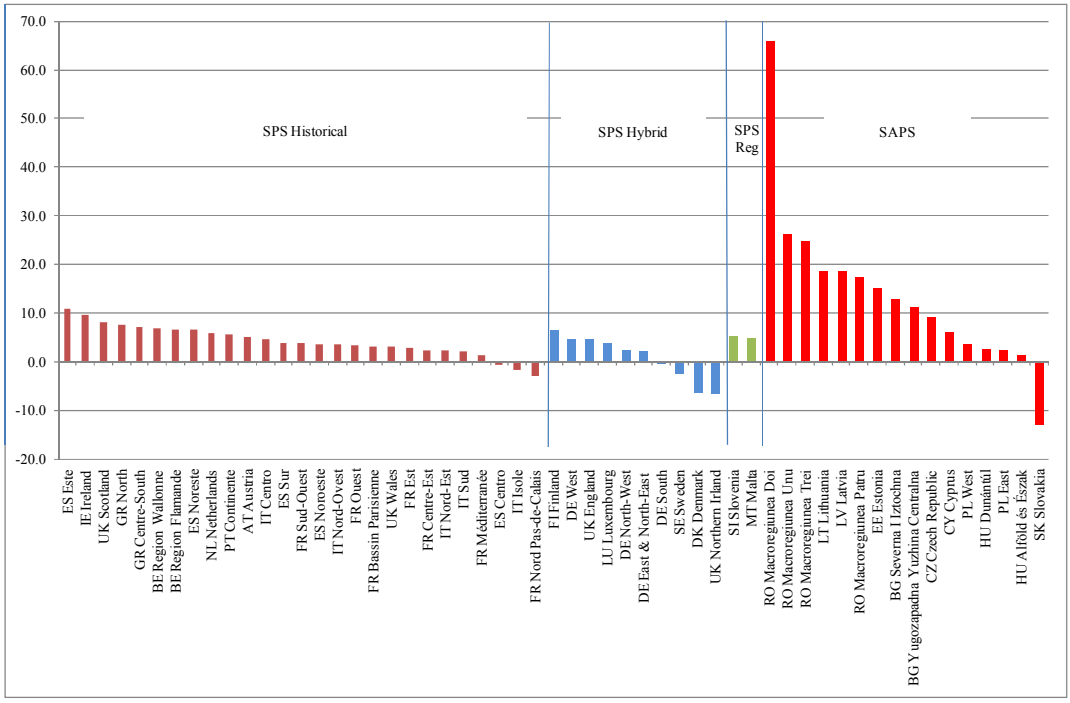
At EU level, because of the strong and generalised reduction of labour use experienced by most of the EU regions in the considered years, the ratio K/AWU is steadily increasing.

Also in this case there are differences in the evolution observed in the regions grouped according to SFP model:

- the groups of regions applying the SPS Historical and Regional models have experienced a strong increase of the ratio K/AWU; this is also true for the groups of regions applying the SAPS (SAPS 8 excluding Bulgaria and Romania) even if the increase is less strong;
- in the groups of regions applying the SPS Hybrid, the relative importance of capital vs. labour remains constant. This seems coherent with the fact that, in these regions, the relative importance of capital per unit of land has declined (Table K.1) and, in the meantime, the amount of labour per unit of land has also declined;
- finally, according to the limited available data, the group of regions of Bulgaria and Romania has experienced an extraordinary increase of capital intensity per unit of labour in the period 2007-09.

Indeed, also in this case there is strong heterogeneity in the evolutions observed within the groups of regions applying the same SFP model (Fig. 76). For example, within the regions applying the SPS Historical model, some regions experienced an increase by around 10% per year, while others have experienced a small and negative evolution. Similar situations can be found also within the other groups of regions.

Fig. 76 – Evolution of capital intensity (K/AWU) across EU regions. Average annual growth rate2004-2009 (%), Bulgaria and Romania average annual growth rate2007-2009 (%)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The importance of K/AWU strongly differs in farms of different economic size. Indeed, because a relatively high labour intensity can be found in small farms, here the ratio K/AWU is way lower than in medium and in large size farms (Tab. 53). However, this phenomenon is not so strong in all considered groups of regions. Peculiar is the situation of the group of regions implementing the SPS Hybrid model. Here the level of the indicator is similar in small and large farms, and larger than in medium size farms.

Tab. 53 – Capital intensity by farm economic size class in the groups of EU regions (K/AWU and % average annual growth rate)

	2004				2007				2009				AAGR (%) 2009-04				AAGR (%) 2009-07			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
SPS Historical	18255	38874	69286	39780	19871	42128	73167	44016	23727	47701	80238	50449	5.4	4.2	3.0	4.9	9.3	6.4	4.7	7.1
SPS Hybrid	168000	70099	95103	91141	121715	64982	95505	89625	117694	65886	93525	88553	-6.9	-1.2	-0.3	-0.6	-1.7	0.7	-1.0	-0.6
SPS Regional	32991	52978	100337	38088	32544	64269	76756	39536	41706	70202	107737	49383	4.8	5.8	1.4	5.3	13.2	4.5	18.5	11.8
SAPS:					10576	35141	37592	15620	13332	36942	40410	18626					12.3	2.5	3.7	9.2
SAPS*^	16988	32505	38707	23172	19345	39452	46400	27059	18838	41326	46926	26909	2.1	4.9	3.9	3.0	-1.3	2.3	0.6	-0.3
Bulg. and Rom.					4918	11854	15397	5751	9048	14073	22831	10152					35.6	9.0	21.8	32.9
EU 15	19849	44295	77429	48497	21010	45773	79702	51485	24888	50672	84516	57526	4.6	2.7	1.8	3.5	8.8	5.2	3.0	5.7
EU 12					10929	36073	37901	16006	13816	38014	40885	19146					12.4	2.7	3.9	9.4
EU 25	18927	42446	71098	41391	20505	44767	74615	44504	22409	49084	78987	48530	3.4	2.9	2.1	3.2	4.5	4.7	2.9	4.4
EU 27					14309	43708	71234	34984	17442	47884	76068	40027					10.4	4.7	3.3	7.0

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

As already pointed out, the relative importance of capital in comparison with labour has increased in the EU mainly because of the strong reduction in labour use. However, it is important to note that the largest increases can be found in small size farms. This result seems to further corroborate the assumption that a strong structural adjustment is taking place in this class of farms.

In contrast with the previously discussed indicator of capital intensity (i.e. K/ha), the amount of capital per unit of labour (K/AWU) does not differ so much between farms grouped according to type of farming, with the highest values found in specialised livestock farms. The ratio K/AWU has increased more or less in all considered farm types, though slightly more in mixed livestock and in horticultural farms (Tab. 54). Also in this case, the situation is slightly different in the considered groups of regions: while in the regions implementing the SPS Historical model all types of farming experienced similar increases, this is not the case in the other groups.

Tab. 54 – Capital intensity (K/AWU) by production sector in the groups of EU regions (% average annual growth rate)

	field crops	horticulture	permanent crops	grazing livestock	granivores	cropping	livestock	crops-livestock	Total
	Specialist TFs:					Mixed TFs:			
	1	2	3	4	5	6	7	8	Total
	Average Annual Growth Rate (%) 2004-2009								
SPS Historical	5.4	6.5	3.6	5.0	3.9	5.1	6.2	3.4	4.9
SPS Hybrid	-2.1	0.1	-1.2	1.4	-1.0	-0.4	-1.3	-1.0	-0.6
SPS Regional	2.5	7.1	-1.0	3.2	4.5	2.5	15.3	4.2	5.3
SAPS*^	4.0	-2.4	1.3	3.0	1.3	1.0	4.2	4.0	3.0
EU 15	2.7	5.4	3.4	4.0	2.6	5.0	4.5	1.3	3.5
EU 12									
EU 25	2.2	4.0	3.2	3.2	3.4	3.6	5.3	1.9	3.2
EU 27									
	Average Annual Growth Rate (%) 2007-2009								
SPS Historical	7.4	6.0	7.4	5.7	9.3	6.5	6.7	4.2	7.1
SPS Hybrid	2.1	0.0	-0.8	-1.6	2.1	2.6	-0.9	-1.5	-0.6
SPS Regional	13.7	10.5	15.9	8.7	-9.5	1.3	35.3	7.8	11.8
SAPS:	4.9	0.7	0.1	12.2	2.8	15.0	4.6	14.2	9.2
SAPS*^	2.3	-6.1	-2.0	-0.7	-1.1	-3.7	-0.7	1.1	-0.3
Bulg. and Rom.	24.2	34.2	8.3	34.2	6.0	30.5	30.5	57.2	32.9
EU 15	6.4	4.9	7.1	3.7	6.8	8.1	5.3	2.4	5.7
EU 12	4.9	0.9	0.7	12.4	2.8	15.0	5.6	14.1	9.4
EU 25	5.4	2.9	6.4	3.3	4.2	4.2	3.0	1.9	4.4
EU 27	4.1	4.2	6.4	6.9	6.4	14.0	4.4	8.7	7.0

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Large differences can be found in the group of regions implementing the SPS Regional model and, to a lesser extent, in those implementing the SPS Hybrid, the SAPS (excluding Bulgaria and Romania).. In Bulgaria and Romania mixed crop-livestock farms experienced very strong increases between 2007 and 2009, whereas farms specialized in granivores and in permanent crops do not experience important changes.

9.4.3 Relative importance of contract work on farm

This section analyses the evolution of the intensity of contract work on the farm (i.e. amount of contract work per land unit: CW/ha). The production process can be managed either by using only own capital, or by outsourcing some stages of production. This choice affects the allocation of capital and the cost structure (fixed in the first case, variable in the second). Therefore, it is interesting to complement the analysis of the evolution of capital intensity with the evolution of contract work.

The analysis shows that the use of contract work resembles very much the use of capital (Tab. 55). Indeed, while expenditure for contract work is approximately 80 Euro per ha in the EU27, this value is much lower in the regions implementing the SAPS than the SPS. This means that in the regions applying the SAPS there are low levels of both capital goods and contract work. Finally, it is worth to mention that in the group of regions applying the SPS Regional model, contract work is used at approximately the same level as in the regions applying the SAPS.

Tab. 55 – Evolution of contract work use on-farm (CW/ha) in the groups of EU regions

	Costs for Contract Work/Utilised Agricultural Area (Euro/ha)						Average annual growth rate (%)	
	2004	2005	2006	2007	2008	2009	09/04	09/07
SPS Historical	79.2	78.4	78.6	85.3	90.7	90.0	2.6	2.8
SPS Hybrid	91.8	89.7	96.2	103.7	103.8	100.7	1.9	-1.5
SPS Regional	32.6	36.3	36.4	52.6	44.2	47.0	7.6	-5.4
SAPS:				39.9	46.5	40.3		0.6
SAPS*^	34.7	34.8	35.1	36.4	44.8	36.9	1.2	0.8
Bulg. and Rom.				48.3	50.1	47.1		-1.3
EU-15	82.9	81.7	83.6	90.4	94.6	93.3	2.4	1.5
EU-12				40.0	46.5	40.4		0.5
EU 25	73.9	72.5	74.2	79.9	84.9	82.3	2.2	1.4
EU-27				77.6	82.0	79.2		1.0

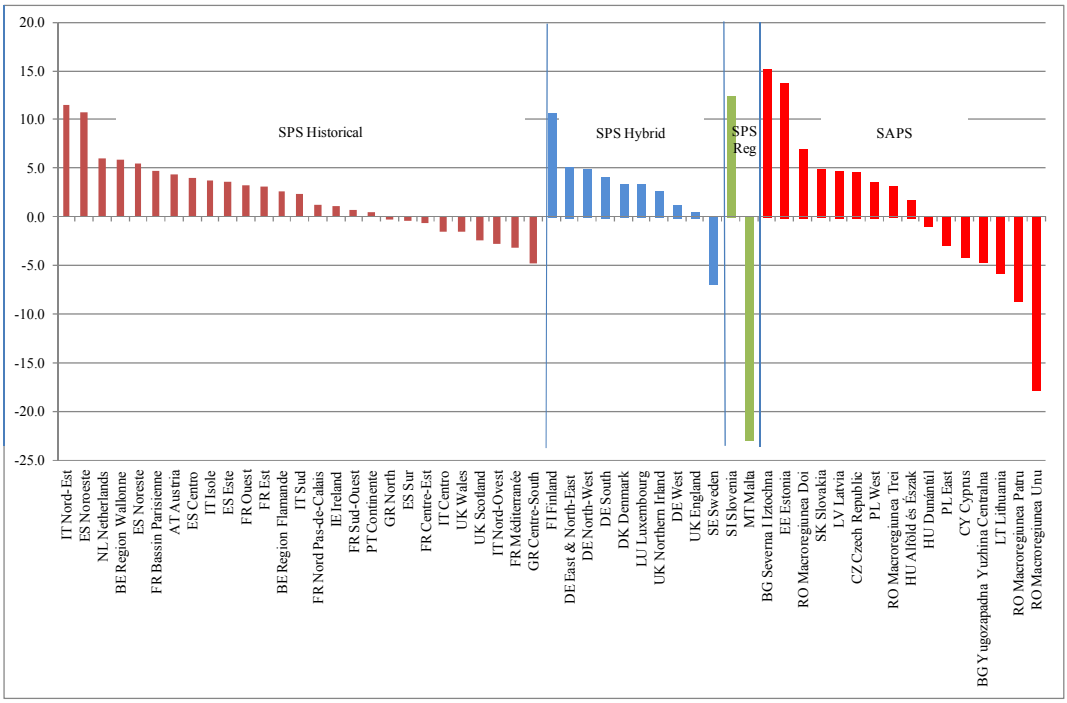
^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

At EU level, contract work has increased over time. This increase has been particularly strong in the regions applying the SPS Regional model, while more limited in those applying the SPS Hybrid and the SAPS excluding Bulgaria and Romania (i.e. SAPS*).

Again in the case of this indicator, there is large heterogeneity in the direction and size of the changes observed in different regions within the same model of SFP implementation (Fig. 77). This is very evident for the two regions applying the SPS Regional model. While Malta shows a strong decline in the intensity of contract work per unit of land, the opposite can be said for Slovenia. Very strong differences can also be found within the regions applying the SAPS.

Fig. 77 – Evolution of contract work use (CW/ha) across EU regions. Average annual growth rate2004-2009 (%), Bulgaria and Romania average annual growth rate 2007-2009 (%)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The evolution of contract work varies in farms of different economic size over the considered time interval. The use of contract work increases with farm size, with the average EU figure for large farms almost twice that of small size farms (Tab. 56). This phenomenon is common to all considered groups of regions but those implementing the SAPS (i.e. SAPS* excluding Bulgaria and Romania). In this

latter group the lowest level of CW/ha can be found in medium size farms[176]. The largest difference between the amount of contract work between large and small size farms can be found in the regions implementing the SPS Historical model.

Tab. 56 – Contract work use by farm economic size class in the groups of EU regions (CW/ha and % average annual growth rate)

	2004				2007				2009				AAGR (%) 2009-04				AAGR (%) 2009-07			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
SPS Historical	59.1	55.6	96.2	79.2	60.8	62.4	102.9	85.1	60.2	63.7	111.7	89.9	0.4	2.7	3.0	2.6	-0.5	1.0	4.2	2.8
SPS Hybrid	78.0	72.7	96.7	91.8	70.0	81.1	110.3	103.7	74.2	80.7	106.0	100.7	-1.0	2.1	1.9	1.9	3.0	-0.3	-1.9	-1.5
SPS Regional	25.6	68.6	44.0	32.6	56.3	35.0	57.7	52.6	45.0	48.6	61.9	47.0	11.9	-6.6	7.1	7.6	-10.7	17.9	3.6	-5.4
SAPS:					44.5	27.4	39.1	39.9	43.7	25.4	41.3	40.3					-0.9	-3.7	2.8	0.6
SAPS*^	36.6	28.7	35.1	34.7	35.5	25.2	41.3	36.4	31.5	24.9	46.7	36.9	-2.9	-2.8	5.9	1.2	-5.8	-0.6	6.3	0.8
Bulg. and Rom.					62.0	39.3	33.6	48.3	61.2	27.8	28.2	47.1					-0.6	-16.0	-8.4	-1.3
EU 15	60.3	59.6	96.4	82.9	61.4	66.5	105.5	90.3	61.1	67.6	109.5	93.1	0.3	2.6	2.6	2.4	-0.3	0.8	1.9	1.5
EU 12					44.8	27.5	39.2	40.0	43.7	25.8	41.3	40.4					-1.2	-3.2	2.8	0.5
EU 25	50.8	55.5	88.2	73.9	51.1	60.4	96.4	79.9	48.9	61.3	100.8	82.2	-0.8	2.0	2.7	2.1	-2.2	0.8	2.2	1.4
EU 27					52.9	59.8	93.0	77.5	51.6	60.2	96.8	79.1					-1.3	0.3	2.0	1.0

^ SAPS* refers to regions implementing the SAPS excluding Bulgaria and Romania.

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

As already pointed out, the importance of contract work has increased over the whole considered period of time in all groups of regions. However, it is important to note that the evolution is not homogeneous in farms of different economic size.

At EU level (EU25, years 2004-09), the relative importance of contract work has increased the most in large farms and also, but to a lesser extent, in medium size farms. On the other hand, it has slightly decreased in the group of small farms. This means that the already existing differences between small and larger size farms in the use of contract work are growing. This trend can be found in the groups of regions implementing the SPS Historical, the SPS Hybrid and the SAPS* (i.e. excluding Bulgaria and Romania) models. In the groups of regions applying the SPS Regional, the importance of contract work is growing both in small and large size farms, while it is declining in medium size farms.

In the aggregate of Bulgaria and Romania, the stronger declines observed in 2007-09 are found in medium and large size farms. This peculiar evolution seems to suggest that here small farms are increasingly relying on contract work in order to obtain the services needed to develop the production process. Clearly, this requires that this kind of farms can rely on a (probably developing) market ensuring the provision of those services.

Finally, the growing use of contract work means that farmers do not have to rely on the services provided by their own capital goods alone. This phenomenon seems very relevant in shaping the restructuring process of small size farms especially in Bulgaria and Romania.

The analysis performed on farms classified by type of farming shows that big differences exist in terms of the importance of contract work. The ratio CW/ha is very high in farms specialised in horticulture, while it is slightly lower than the average figure in field crops farms and in mixed cropping farms.

Differences between types of farming also exist in terms of changes over time (Tab. 57). The increase in the importance of contract work is stronger in farms specialised in granivores and, to a lesser extent, in mixed livestock farms, while very weak in farms specialised in permanent crops.

[176] It is worth mentioning that in the aggregate of regions of Bulgaria and Romania, the highest value can be found in small farms, while medium and large farms have very similar average values.

Tab. 57 – Contract work use (CW/ha) by production sector in the groups of EU regions (% average annual growth rate)

	Specialist TFs:					Mixed TFs:			
	field crops	horticulture	permanent crops	grazing livestock	granivores	cropping	livestock	crops-livestock	Total
	1	2	3	4	5	6	7	8	Total
	Average Annual Growth Rate (%) 2004-2009								
SPS Historical	2.7	1.9	-0.2	2.6	9.9	1.0	5.0	2.4	2.6
SPS Hybrid	1.6	1.8	3.2	2.2	-2.7	2.0	-1.5	1.1	1.9
SPS Regional	22.4	-24.9	22.0	10.2	4.7	18.0	20.0	1.8	7.6
SAPS*^	2.3	3.7	1.7	-0.8	4.2	-1.5	-0.6	2.2	1.2
EU 15	2.3	1.8	0.0	2.5	4.3	1.4	3.2	1.9	2.4
EU 12									
EU 25	2.1	1.9	0.1	2.1	5.5	1.3	3.1	1.7	2.1
EU 27									
	Average Annual Growth Rate (%) 2007-2009								
SPS Historical	2.7	-1.7	1.9	2.5	21.8	-3.6	5.2	2.2	2.8
SPS Hybrid	1.0	-5.4	-2.9	-3.2	-4.2	9.9	-4.2	-1.2	-1.5
SPS Regional	-3.7	32.3	1.8	-20.6	-14.5	11.8	50.5	4.5	-5.4
SAPS:	1.8	4.5	0.7	-3.5	1.4	-6.7	9.3	3.5	0.6
SAPS*^	1.7	7.0	2.7	-2.6	6.4	-7.5	3.3	2.9	0.8
Bulg. and Rom.	2.6	-6.5	-2.3	-6.5	14.4	-6.3	10.6	4.6	-1.3
EU 15	2.2	-1.9	1.9	0.7	10.1	-0.9	2.7	0.9	1.5
EU 12	1.7	4.8	0.7	-4.5	1.2	-6.5	10.0	3.5	0.5
EU 25	2.1	-0.4	2.0	0.4	9.6	-1.5	2.7	1.1	1.4
EU 27	1.4	-0.8	1.9	0.1	9.3	-2.2	3.0	1.2	1.0

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

However, the situation differs between the considered groups of regions. In the regions implementing the SPS Historical model, the stronger increases can be found in farms specialised in granivores and in mixed livestock farms, while in the group implementing the SPS Hybrid the situation is almost the opposite, with remarkable increases occurring in farms specialised in permanent crops). Similarly, in the regions implementing the SAPS* (excluding Bulgaria and Romania), contract work increases the most in specialist granivore and in mixed livestock farms, whereas it decreases in mixed cropping and specialist grazing livestock farms.

9.5 Evolution of capital intensity in the case study regions

The analysis now moves on to the FADN constant samples (2004 and 2009) of farms in the 12 regional case studies. Similarly to the approach in EQ3, the core of the analysis is aimed at identifying whether evolution of capital intensity can be associated to changes in the policy, namely, level of direct payments and the extent of the decoupling process.

In particular, the analysis focuses on the following dimensions:

- unitary direct payments level (Total Direct Payments/Utilised Agricultural Area);
- relative importance of coupled direct payments (Coupled Direct Payments/Total Direct Payments);
- capital intensity per unit of land (K/ha);
- capital intensity per unit of labour (K/AWU);
- relative importance of contract work per unit of land (CW/ha).

As already discussed, two main peculiarities of this analysis that make it different from the previous one are worth recalling:

- The analysis is performed on a constant sample of farms. Thus, results are not influenced by farm exit/entry process.
- Because the analysis is based on the comparison of farms within each region, regional specific economic and environmental factors affect all farms of the sample. Thus, the results are not affected by the differences existing between regions.

9.5.1 Description of the case study regions

The main characteristics of the constant samples in the 12 case study regions, including details regarding direct payment policy, have been already presented (§ 8.5.1) Here the analysis focuses on aspects regarding capital intensity and the use of contract work.

Capital intensity strongly differs in the considered regions (Tab. 58). Capital intensity per hectare is extremely high in Slovenia and high in Łódzkie, Mazowsze, Lubelskie and Podlasie (PL), Emilia Romagna (IT) and Slättbygdslän (SE), while very low in Extremadura (ES), Alentejo (PT) and Del Alfold (HU). Capital intensity per labour unit is extremely high in Slättbygdslän, but also high in France Centre and Niedersachsen (DE), while it is low in Makedonia-Thraki (EL), Del Alfold and Alentejo.

The results allow two main considerations: 1) a large heterogeneity exists between the considered regions in terms of capital intensity, although this heterogeneity has slightly reduced in 2009; 2) only in few regions a high ratio K/ha corresponds to a high ratio K/AWU, because regions also strongly differ in labour use.

Tab. 58 – Evolution of direct payments, capital intensity and contract work in the case study regions: Constant FADN sample, 2004-2009

Region	SFP model	Unitary direct payment TDP/UAA Euro/ha	Share of coupled payments CDP/TDP %	Capital intensity per unit of land K/UAA Euro/ha	Capital intensity per unit of labour K/AWU Euro/AWU	Contract work per unit of land CW/UAA Euro/ha
				2004		
Niedersachsen (DE)	Hybrid	288.33	100.0	2616	73073	120
Brandenburg (DE)	Hybrid	253.96	100.0	1251	63347	54
Makedonia Traki (EL)	Historical	481.66	100.0	1961	17552	132
Extremadura (ES)	Historical	159.51	100.0	421	25672	12
France Centre	Historical	346.09	100.0	1212	89871	50
Del Alfold (HU)	SAPS	136.65	53.1	744	25493	49
Emilia Romagna (IT)	Historical	194.56	100.0	3073	34443	65
Lodzie (PL)	SAPS	114.20	59.4	3416	26317	32
Alentejo (PT)	Historical	181.68	100.0	630	29578	23
Slättbygdslän (SE)	Hybrid	235.21	100.0	2979	156610	123
England East (UK)	Hybrid	280.34	100.0	1355	35311	82
Slovenia	Regional	209.19	100.0	8355	64759	25
Average		240.12	92.7	2334	53502	64
				2009		
Niedersachsen (DE)	Hybrid	361.25	3.9	2702	78222	148
Brandenburg (DE)	Hybrid	295.13	2.7	1364	67820	65
Makedonia Traki (EL)	Historical	702.39	26.1	1926	20999	130
Extremadura (ES)	Historical	140.70	44.4	449	26982	19
France Centre	Historical	327.58	27.1	1254	93375	84
Del Alfold (HU)	SAPS	181.65	9.9	872	31179	49
Emilia Romagna (IT)	Historical	359.54	9.0	4592	66244	78
Lodzie (PL)	SAPS	219.10	5.4	3569	33283	26
Alentejo (PT)	Historical	173.54	44.6	435	26059	11
Slättbygdslän (SE)	Hybrid	250.89	7.3	2671	143620	89
England East (UK)	Hybrid	252.86	0.8	1537	41479	85
Slovenia	Regional	376.16	12.1	8168	90414	46
Average		303.40	16.1	2462	59973	69
				Rate of change 2004-09 (%)		
Niedersachsen (DE)	Hybrid	25.3	-96.1	3.3	7.0	23.2
Brandenburg (DE)	Hybrid	16.2	-97.3	9.0	7.1	20.6
Makedonia Traki (EL)	Historical	45.8	-73.9	-1.8	19.6	-1.9
Extremadura (ES)	Historical	-11.8	-55.6	6.5	5.1	57.5
France Centre	Historical	-5.4	-72.9	3.5	3.9	67.3
Del Alfold (HU)	SAPS	32.9	-81.3	17.2	22.3	0.6
Emilia Romagna (IT)	Historical	84.8	-91.0	49.4	92.3	18.4
Lodzie (PL)	SAPS	91.8	-90.9	4.5	26.5	-20.0
Alentejo (PT)	Historical	-4.5	-55.4	-31.0	-11.9	-51.3
Slättbygdslän (SE)	Hybrid	6.7	-92.7	-10.3	-8.3	-27.7
England East (UK)	Hybrid	-9.8	-99.2	13.5	17.5	3.4
Slovenia	Regional	79.8	-87.9	-2.2	39.6	82.2
Average		26.4	-82.6	5.4	12.1	7.9

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The importance of contract work also differs between regions, albeit less than for capital intensity. The cost of contract work is around 60-70 Euro per ha on average, however ranging between 11 Euro/ha and approximately 130 Euro/ha across the case study regions. Indeed, in some regions it is lower than 40 Euro/ha (e.g. Extremadura, Lodzie, Alentejo), but over 100 Euro/ha in other regions (e.g. Niedersachsen and Makedonia-Thraki).

It is important to note that, in the 12 case study regions, there is no correlation between the levels of capital intensity relative to land (K/ha) and importance of contract work (CW/ha). In other words, it is not possible to say that regions having relatively high capital intensity also have high (or low) amount of contract work (per hectare). However, it appears from the results that some of the regions with high capital intensity (K/AWU) also have a relatively high importance of contract work (CW/ha).

Similarly, there is only a limited and positive correlation between the rates of changes in capital intensity (K/ha and K/AWU) and contract work (CW/ha) observed in the considered period. In other words, it is often the case that regions experiencing an increase in capital intensity also experience an increase in contract work, and vice-versa. These results suggest that in the considered regions there is no clear substitution effect between capital and contract work.

Finally, the data do not show differences in behaviour that may be linked to the implementation of different SFP models. For example, the Polish region, Alentejo and Slättbygdslän (implementing SAPS, SPS Historical and SPS Hybrid, respectively) all experienced a strong reduction of the amount of contract work per hectare.

9.5.2 Relationship between level of direct payments and capital intensity in the farms within each region

This section reports the analysis developed to assess the correlation existing between:

- Level of direct payments and evolution of capital intensity/contract work;
- Change of the relative importance of coupled payments and evolution of capital intensity /contract work.

The analysis starts by considering the correlation within the whole regional samples. However, as it has been done in EQ3, the analysis considers also farms grouped according to economic size class and type of farming[177]. In both cases, the analysis covers the three considered aspects related to the use of capital: capital intensity per unit of land (K/ha), capital intensity per unit of labour (K/AWU) and importance of contract work (CW/ha).

1.5.2.1 Level of direct payments and evolution of capital intensity and contract work

The correlation has been calculated by means of Pearson's correlation coefficients and statistical tests for their significance have been developed. The results of the tests are reported together with the estimated coefficients to highlight when these can be considered statistically significant (i.e. significantly different from zero) at the standard significance levels: 1% (***), 5% (**) and 10% (*).

Thus, when the estimated coefficients are reported without the signs (***, ** and *), it is safe to say that the evolution of capital intensity is not correlated with: a) the level of direct payments, or b) the change in the relative importance of coupled payments in the considered groups of farms.

In the other cases, a positive correlation coefficient between level of direct payments and the three considered variables related to the use of capital suggests that farms within each region receiving high levels of payments also have high level of capital intensity (K/UAA or K/AWU) or contract work (CW/UAA). This being the case, the result suggests that direct payments may have the effect of increasing capital intensity and/or the amount of contract work used on farm. The opposite applies to negative significant correlation coefficients.

The evolution of capital intensity per unit of land (K/ha) is almost never correlated with the level of direct payments observed in the whole sample. Only in Del Alfold the correlation coefficient is statistically significant at 1%, but rather small in magnitude (Tab. 59).

[177] Data for less than 15 farms are not shown.

This is also the case of farms within t small and medium size classes. However, in the large size farms the situation is different. In four regions (the Polish region, Slättbygdslän, England East and Extremadura) the correlation coefficients are statistically significant and positive, albeit high only in two cases (i.e. Extremadura and Lódzkie, Mazowsze, Lubelskie and Podlasie).

Tab. 59 – Correlation between level of direct payments and evolution of capital intensity per unit of land (K/ha) in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	-0.05		-0.02	-0.07
Brandenburg (DE)	-0.05		-0.07	0.02
Makedonia Traki (EL)	-0.02	-0.02	-0.04	
Extremadura (ES)	-0.05	-0.13	-0.05	0.87 *
France Centre	0.02		0.03	0.03
Del Alfold (HU)	-0.11 ***	-0.51 **	-0.06	0.06
Emilia Romagna (IT)	0.01	0.13	-0.02	-0.01
Lodzie (PL)	-0.01	-0.01	-0.04	0.86 ***
Alentejo (PT)	0.02	-0.20	-0.02	-0.03
Slättbygdslän (SE)	0.03	0.01	0.01	0.25 **
England East (UK)	0.05		-0.01	0.12 ***
Slovenia	-0.09 *	-0.10	-0.07	

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Similar results are obtained when farms are classified according to farm type. Indeed, only in very few groups the correlation coefficients are statistically significant. Furthermore, while in most of these (few) cases the significant coefficients are negative, there are also a couple of cases in which the estimated coefficients are positive.

The correlation coefficients computed between level of direct payments and capital intensity per labour unit (K/AWU) are in almost all cases not significantly different from zero (Tab. 60). This occurs in the whole sample but also when farms grouped according to economic size class and type of farming. This suggests that direct payments have not a clear effect on capital intensity per unit of labour.

Tab. 60 – Correlation between level of direct payments and evolution of capital intensity per unit of labour (K/AWU) in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	-0.02		-0.01	-0.03
Brandenburg (DE)	0.09		0.09	0.14
Makedonia Traki (EL)	0.00	0.07	-0.01	
Extremadura (ES)	-0.03	-0.09	-0.03	-0.23
France Centre	0.04		0.06	0.07
Del Alfold (HU)	-0.02	-0.05	-0.01	0.08
Emilia Romagna (IT)	0.02	0.20	-0.01	-0.03
Lodzie (PL)	-0.03	-0.04	0.02	0.62 **
Alentejo (PT)	0.04	-0.13	-0.03	-0.02
Slättbygdslän (SE)	-0.02	-0.07	-0.07	0.31
England East (UK)	0.06		0.00	0.08
Slovenia	-0.09 *	-0.11	-0.09	

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The correlation analysis developed with respect to the evolution of contract work use shows that the correlation coefficients are not statistically different from zero considering the whole sample and farms grouped by size and type of farming (medium size farms of Extremadura represent the only exception) (Tab. 61).

Tab. 61 – Correlation between level of direct payments and evolution of contract work use (CW/ha) in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	-0.13		-0.07	-0.15
Brandenburg (DE)	-0.04		0.02	-0.06
Makedonia Traki (EL)	0.08	-0.04	0.15	
Extremadura (ES)	0.51	-0.04	0.62 **	-0.46
France Centre	-0.02		0.00	-0.08
Del Alfold (HU)	-0.02	-0.03	-0.02	-0.09
Emilia Romagna (IT)	0.04	0.33	0.03	-0.05
Lodzie (PL)	0.00	0.00	0.02	0.53
Alentejo (PT)	-0.03	0.01	-0.10	0.39
Slättbygdslän (SE)	0.11	0.12	0.10	0.20
England East (UK)	0.03		0.02	0.05
Slovenia	-0.11	-0.15	-0.08	

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

9.5.2.1 Decoupling of direct payments and evolution of capital intensity and contract work

In this case, correlation analysis is aimed at assessing the sign and magnitude of the relationship between the evolution of the relative importance of coupled payments (i.e. extent of the decoupling process) and the evolution of capital intensity and contract work observed in the farms of the sample in the years 2004–2009.

Regarding the sign it is possible to say that:

- a significant positive correlation coefficient means that changes in capital intensity/contract work have the same sign that the changes in the relative importance of coupled payments. Because the decoupling process has generated a reduction in the relative importance of coupled payments, a positive correlation means that decoupling is associated with a reduction in capital intensity/contract work;
- a significant negative correlation coefficient means that changes in capital intensity are opposite to changes in the relative importance of coupled payments. Because the decoupling process has generated a reduction in the relative importance of coupled payments, a negative correlation means that decoupling is associated with an increase in capital intensity/contract work.

The results suggest that there is not a generalised correlation between extent of the decoupling process and evolution of capital intensity per labour. Only in very few groups of farms the estimated correlation coefficients are significantly different from zero. The analysis shows significant coefficients only for large size farms (economic size) and in 4 out 12 regions (Del Alfold, Emilia Romagna, Alentejo and Slättbygdslän). In these cases, the coefficients are positive, although their value is low (Tab. 62). The correlation is even less important when looking at farms classified according to farm types: only in a very limited number of cases a significant correlation exists between the considered pairs of variables. Also in these (few) cases, the sign of the coefficients are generally positive, but in one case.

Tab. 62 – Correlation between evolution of degree of decoupling (CDP/TDP) and evolution of capital intensity (K/ha) in total regional samples and by farm size class

	Whole sample	Small farms	Medium farms	Large farms
Niedersachsen (DE)	0.06		0.04	0.08
Brandenburg (DE)	-0.05		-0.01	-0.07
Makedonia Traki (EL)	-0.03	0.02	-0.05	
Extremadura (ES)	-0.03	-0.05	-0.03	-0.38
France Centre	0.03		0.04	0.06
Del Alfold (HU)	-0.04	-0.09	-0.06	0.36 **
Emilia Romagna (IT)	0.11 **	-0.07	0.03	0.27 **
Lodzie (PL)	0.03	0.02	0.03	
Alentejo (PT)	0.03	-0.04	-0.10	0.57 **
Slättbygdslän (SE)	0.03	0.25	0.01	0.33 ***
England East (UK)	-0.02		-0.02	0.00
Slovenia	0.06	0.07	-0.01	

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

These results suggest that the decoupling process has not been responsible, per se, for the changes in capital intensity per unit of land, apart in few cases relating to large farms (economic size). In these cases, the correlation is often positive, indicating that the decoupling of direct payments is correlated with a reduction in the relative importance of capital per land unit.

The correlation coefficients computed between the evolution of the share of coupled payments and capital intensity in terms of labour and evolution of contract work per ha are never statistically different from zero (except for a couple of cases when the analysis distinguishes farms by type of farming).

9.6 Effects of direct payments on capital intensity: results of the econometric modelling

The evaluation of the contribution of direct payments to farms' capital intensity is developed by using two distinct models. The first model adopts as dependent variable defining capital intensity, the Capital per hectare of utilised agricultural area, whereas, in the second model the dependent variable is Capital per labour unit, where labour is expressed in worked hours.

Both models are linear in the logarithmic transformation of the variables.

In both cases, panel regression with fixed effects[178] is adopted,[179] on a FADN sample of farms, excluding farms without land, observed over the time interval 2005-2009. The final sample is composed of 38,697 farms repeated over the interval of five years (2005-2009), corresponding to a total of 191,325 observations.

More in general, the structure of the models is represented by:

$$\ln K_{i,t} = \ln \beta_i + \sum_k \gamma_k \ln P_{i,t,k} + \sum_m \delta_m \ln F_{i,t,m} + \sum_n \lambda_n \ln C_{i,t,n} + \varepsilon_{i,t}$$

Where:

$K_{i,t}$ Capital per hectare of utilised agricultural area (Model 1) or Capital per labour in hours (Model 2), where *Capital = Total fixed assets – Land assets*;

$P_{i,t,k}$ Public subsidies per hectare (or per labour in hours), with k=4: Coupled direct payments, Decoupled direct payments, Rural development aids and Subsidies on investment;

$F_{i,t,m}$ Set of variables at farm level, with m=6: Labour force in hours, Total output, Loans, Age of holder, Organisational form (dummy variable) and Type of farming (dummy variable);

$C_{i,t,n}$ Gross domestic product per capita as a variable representing the general macroeconomic context at regional level within the five years interval.

Collinearity and heteroskedasticity[180] tests were conducted on both regression models, to verify the absence of collinearity (Variance inflation factor test –VIF – whose average values are under a cut-off value of 2) and the presence of heteroskedasticity (Breusch–Pagan test). This is taken into account, after an accurate analysis of the residuals distribution, by using heteroskedasticity consistent standard errors in both regressions.

9.6.1 Results of regression with Capital per hectare as dependent variable

The model assumes the natural logarithm of Capital per hectare of utilised agricultural area as dependent variable and the following 18 explanatory variables:

- *Public subsidy variables*
  - Logarithm of Coupled Payments per hectare

[178] For a description of the methodology refer to § 5.1.2.2.

[179] A random effects specification has also been estimated but was rejected on the basis of the Hausman test results.

[180] Collinearity refers to an exact or approximate linear relationship between explanatory variables.

Heteroskedasticity occurs when the variance of the error terms differ across observations (e.g. if there are sub-populations that have different variabilities from others on a set of variables). The presence of heteroskedasticity is a concern in the application of regression analysis because it can invalidate statistical tests of significance

- Logarithm of Decoupled Payments per hectare
- Logarithm of Rural development Payments per hectare
- Logarithm of Subsidies on investment per hectare

▪ *Farm variables*

- Logarithm of Labour in hours per hectare
- Logarithm of Total output per hectare
- Logarithm of Loans per hectare
- Logarithm of age of holder
- Organisational form - dummy variable where: 1=Individual farms (base outcome); 2=Partnership; 3=Other
- Types of farming - dummy variable where: 1=Field crops (base outcome); 2=Horticulture; 3=Wine; 4=Other permanent crops; 5=Milk; 6=Other grazing livestock; 7=Granivores; 8=Mixed

▪ *Context variable*

- Logarithm of Gross domestic product per capita

Tab. 63 shows the results of the panel regression. The explanatory variables result highly significant, with the exception of one dummy variable representing ”Other” farm organisational forms. The model as a whole is also highly statistically significant.

The contribution of all public subsidies is significant and positive, but it is worth noting the very low level of the parameters’ values that, in a logarithmic regression, represent the constant elasticity of the dependent variable with respect to percentage change of the explanatory variable (*i.e.* if Decoupled payments per ha increased by 1%, then the increase in Capital per ha would be equal to 0.0051%).

Among the four types of payments, only Subsidies on investments per ha present a relatively higher value of the parameter (equal to 0.0287).

On the farm variables side, it is very interesting to observe the negative contribution of the holder's age, providing evidence of the role of young farmers in determining higher capital levels. In the same way, individual farms tend to be more capitalized than farms organized as partnerships. As far as specialisation is concerned, field crops farms (the base outcome in the Type of farming dummy variable) tend to be associated with lower levels of capitalization compared to other types of farming.

Tab. 63 – Results of the panel regression model with Capital per ha as dependent variable

Ln Capital per ha	**Coefficient.**	**Robust Std. Err.**	**t**	**P>|t|**
Ln Labour force in hours per ha	0.3247	0.0070	46.63	0.000
Ln Coupled direct payments per ha	0.0058	0.0010	5.62	0.000
Ln Decoupled direct payments per ha	0.0051	0.0010	5.34	0.000
Ln Rural development payments per ha	0.0068	0.0010	7.1	0.000
Ln Subsidies on investments per ha	0.0287	0.0008	36.99	0.000
Ln Total output per ha	0.1880	0.0046	41.27	0.000
Ln Loans per ha	0.0399	0.0009	45.09	0.000
Ln age of holder	-0.0482	0.0200	-2.41	0.016
Organisational form (Partnerships) - Dummy	-0.0455	0.0186	-2.45	0.014
Organisational form (Other) - Dummy	0.0200	0.0191	1.05	0.295
Types of farming (Horticulture) - Dummy	0.0720	0.0216	3.34	0.001
Types of farming (Wine) - Dummy	0.1284	0.0299	4.3	0.000
Types of farming (Other permanent crops) - Dummy	0.0587	0.0190	3.09	0.002
Types of farming (Milk) - Dummy	0.1384	0.0115	12.07	0.000
Types of farming (Other grazing livestock) - Dummy	0.1113	0.0112	9.97	0.000
Types of farming (Granivores) - Dummy	0.0946	0.0123	7.71	0.000
Types of farming (Mixed) - Dummy	0.0566	0.0078	7.29	0.000

Ln Capital per ha	Coefficient.	Robust Std. Err.	t	P>|t|
Ln Gross Domestic Product per capita	-0.1224	0.0189	-6.49	0.000
Constant	5.0976	0.0991	51.44	0.000
Number of observations	183532			
Log likelihood	-48892			
Degrees of freedom model	18			
Degrees of freedom residuals	146426			
R^2	0.95556			
Adjusted R^2	0.94429			
F	454.78			

9.6.2 Results of regression with Capital per labour force as dependent variable

The model assumes the natural logarithm of Capital per labour force expressed in hours as dependent variable and the following 17 explanatory variables:

- *Public subsidy variables*
  - Logarithm of Coupled Payments per labour force
  - Logarithm of Decoupled Payments per labour force
  - Logarithm of Rural development Payments per labour force
  - Logarithm of Subsidies on investment per labour force
- *Farm variables*
  - Logarithm of Total output per labour force
  - Logarithm of Loans per labour force
  - Logarithm of age of holder
  - Organisational form - dummy variable where: 1=Individual farms (base outcome); 2=Partnership; 3=Other
  - Types of farming - dummy variable where: 1=Field crops (base outcome); 2=Horticulture; 3=Wine; 4=Other permanent crops; 5=Milk; 6=Other grazing livestock; 7=Granivores; 8=Mixed
- *Context variable*
  - Logarithm of Gross domestic product per capita

Tab. 64 shows the results of the panel regression. Also in this model, nearly all explanatory variables result highly statistically significant, as well as the whole model.

Tab. 64 – Results of the panel regression model with Capital per labour force as dependent variable

Ln Capital per labour force in hours	Coefficient.	Robust Std. Err	t	P>|t|
Ln Total output per labour force	0.3076	0.0045	68.65	0.000
Ln Loans per labour force	0.1294	0.0023	56.03	0.000
Ln Coupled direct payments per labour force	0.0347	0.0015	22.42	0.000
Ln Decoupled direct payments per labour force	0.0267	0.0011	25.27	0.000
Ln Rural development payments per labour force	0.0399	0.0019	20.78	0.000
Ln Subsidies on investments per labour force	0.0485	0.0022	21.97	0.000
Ln age of holder	-0.0606	0.0204	-2.97	0.003
Organisational form (Partnerships) - Dummy	-0.0359	0.0193	-1.86	0.062
Organisational form (Other) - Dummy	0.0186	0.0198	0.94	0.348
Types of farming (Horticulture) - Dummy	0.0187	0.0217	0.86	0.389
Types of farming (Wine) - Dummy	0.1064	0.0304	3.51	0.000
Types of farming (Other permanent crops) - Dummy	0.0643	0.0195	3.3	0.001
Types of farming (Milk) - Dummy	0.0450	0.0118	3.81	0.000

Types of farming (Other grazing livestock) - Dummy	0.0311	0.0116	2.69	0.007
Types of farming (Granivores) - Dummy	-0.0455	0.0123	-3.71	0.000
Types of farming (Mixed) - Dummy	-0.0047	0.0080	-0.59	0.557
Ln Gross Domestic Product per capita	-0.1925	0.0194	-9.91	0.000
Constant	2.7383	0.0957	28.61	0.000
Number of observations	183532			
Log likelihood	-55031			
Degrees of freedom model	17			
Degrees of freedom residuals	146427			
R^2	0.93829			
Adjusted R^2	0.92265			
F	679.88			

In this model, the positive contribution of all public subsidies is associated with a higher level of the parameters values than in the previous model (Capital per hectare). Thus, the estimated parameters show a higher elasticity of Capital intensity to changes in public subsidies.

The comparison of the results of the two models on capital intensity suggests that CAP payments may induce some incentive to substitute capital for labour[181]. As in the previous model, Subsidies on investments per ha present a relatively higher value of the parameter compared to the other payments.

Regarding the behaviour of farm variables, the results do not differ from those obtained in the previous model, with the negative contribution of the age of holder and the positive contribution of individual farms. Equally negative (lower than the others) is the contribution of field crops type of farming, although the difference is not significant in comparison with horticulture and granivores type of farming.

9.7 Evaluation judgment

The evaluation question required to assess to what extent direct support schemes, as introduced by the Regulation 1782/2003, have influenced farms' capital intensity.

The analysis is carried out at farm level across the EU27 Member States and is based on FADN farm data. The study uses statistical analysis and econometric modelling. The statistical analysis examines the evolution of capital intensity in regions grouped according to the SFP model they implement, over the years 2004-2009. The application of econometric models at micro-economic level allows to estimate the effects of direct payments on capital intensity from 2005 onwards. Furthermore, the statistical analysis conducted on constant FADN sample (2004 and 2009, 12 case study regions) provides some additional insights at regional level.

The analysis looks at capital intensity per unit of land (K/ha) and per unit of labour (K/AWU). Furthermore, the statistical analysis considers the evolution of contract work on-farm (CW/ha), as capital intensity may be affected by the outsourcing of certain stages of the production process.

The statistical analysis of the evolution of capital intensity highlights a large heterogeneity within each SFP model. Despite certain average trends[182] the observed evolutions of capital indicators are not similar among regions within the same model. These results lead to conclude that the **different ways of SFP implementation, per se, have not had a clearly identifiable effect on capital intensity attributes**. The observed differences are likely to have been generated by the relevant structural differences among Member States belonging to these groups (see Chapter 6, Farm structural changes).

The econometric approach has been used to identify the statistical relationships between capital intensity and a number of explanatory variables expected to influence it (i.e. decoupled direct

[181] It should not be forgotten however, that substitution of capital for labour, may also be an effect of ongoing structural adjustment process in some EU12 regions.

[182] In the SPS Historical and Regional models, K/AWU increases more than the ratio K/ha, in regions implementing the SAPS, excluding Bulgaria and Romania, there has been no increase in capital intensity but decline of workforce, in SPS Hybrid model, capital intensity declines when expressed in terms of both land and labour.

payments, coupled direct payments, rural development aids, subsidies on investments, farm organisation, farm specialisation, macro economic factors). The evaluation of the contribution of direct payments to farms' capital intensity is developed by using two distinct models. The first model adopts as the dependent variable capital intensity, value of capital per hectare, whereas in the second model the dependent variable is capital per labour input (working hours).

The results of the two models show that in the years 2005-2009 both **coupled and decoupled payments may have had an effect in terms of increasing farms' capital**. Nevertheless the very low values[183] of the estimated parameters for coupled and decoupled payments indicate **a practically absent tangible role of direct payments in explaining farm's capital intensity per land and per labour input.**

Moreover, the results show that the values of parameters for coupled and decoupled payments in the model concerning **capital intensity per labour input (second model) are slightly higher than the parameters per land**. Therefore, the comparison of the results of the two models on capital intensity suggests that **direct payments may induce some incentive to substitute capital for labour**[184].

The findings of correlation analysis conducted on constant FADN samples[185] are consistent with the results of the econometric estimations, providing at the same time further insight. In particular, the analysis shows that:

- **The level of direct payments has not influenced capital intensity to a great extent, except for large farms (in terms of economic size) in some of the case study regions**. This result suggests that in large size farms the financial resources deriving from direct payments may increase farms' capital intensity (and thus supporting farm investments, see also Chapter 11).
- In some cases, **large farms having experienced the strongest reduction in the relative importance of coupled payments, have often also experienced a (generally small) reduction in the amount of capital per hectare**. This suggests that coupled payments, being more directly linked to farm production activities, might have been more related with on-farm investments.

[183] In a logarithmic regression, the parameters represent the constant elasticity of the dependent variable with respect to percentage changes of the explanatory variable (consequently, according to the models, if coupled payments per hectare increased by 1%, then the increase in capital per hectare would be equal to 0.0058%; if decoupled payments per hectare increased by 1%, then the increase in capital per ha would be equal to 0.0051%).

[184] It should not be forgotten however, that substitution of capital for labour, may also be an effect of ongoing structural adjustment process in some EU12 regions.

[185] The correlation analysis allows to examine at farm level whether the observed evolution of capital intensity can be associated to direct payments and to the decoupling process. The analysis is based on the computation of correlation coefficients between pairs of variables (Pearson's correlation coefficients and statistical tests for their significance were used).

10. Theme 4 – Farm business strategies: To what extent have direct payments affected farm specialisation? (EQ5)

10.1 Comprehension and interpretation of the evaluation question

The evaluation question requires an assessment of whether and to what extent direct support schemes as introduced by the Regulation 1782/2003 have influenced farm business strategies in terms of specialisation, i.e. of type of farming (a farm is said to be specialised when a particular activity provides a standard gross margin (SGM) of at least two thirds of the total SGM of the holding).

Decoupled payments do not provide an incentive for specific production and thus for specialisation. Thus, in theory, after 2005 in a context of decoupled aid[186], and taking into account farms' technical and organisational constraints, it is reasonable to expect changes to production choices, in relation to the coupled aid situation of the previous period.

Thus, the aim of the analysis is to investigate the extent to which the changes in direct aid policy have influenced farmers' choices and their effects in terms of the composition of land use. Furthermore, it is important to bear in mind the existing implications between farm specialisation, organisation of work and the use of capital. Therefore, the analysis aims to assess whether the (possible) changes in farmers' production decisions are related to labour/capital-saving strategies.

10.2 Methodological approach, data sources and limits

The methodology encompasses three tools: statistical analysis and econometric analysis complemented with the information collected through a CATI survey, implemented in the twelve case study regions. The different methodologies are described separately. Below we detail the methodology adopted for the statistical analysis. For the description of the methodology developed for the econometric analysis, please refer to § 5.1.2.2 and for the CATI survey refer to § 5.1.4.

The **statistical analysis** is based on farm data available from the FADN and compares 2004 and 2009 data[187] for a constant sample of farms in the EU25 regions[188], i.e. a sample consisting of the same farms in the two analysed years. The advantage of this methodology is that it gives the possibility to analyse the structural adjustments in the same farms over time, avoiding the influence of change in the FADN sample over time.

The constant sample represents, by definition, <u>those agricultural holdings that have decided to continue farming</u> between 2004 and 2009. Accordingly, the results of the analysis concerning strategy changes only apply to the sample and not to the whole agricultural sector. Therefore, the results of the EQ5 do not necessarily coincide with those of answers to EQ 1, EQ3 and EQ4, where the analysis focuses on the structure of agriculture as a whole.

Individual farm data were classified according to two key characteristics related to the direct payments schemes that may have created differences in the behaviour of farms:

- Type of farming (TF). Farm data were aggregated into 8 groups, representing the main production orientations: Specialist field crops; Specialist horticulture; Specialist permanent crops; Specialist grazing livestock; Specialist granivores; Mixed cropping; Mixed livestock; Mixed crops-livestock.
- Regional data were aggregated into groups of regions according to the Single Farm Payment (SFP) model of implementation, differentiating between regions and Member States implementing SAPS and three different schemes of SPS: Historical, Regional and Hybrid.

The analysis of the EU-FADN-DG AGRI-L3 constant sample 2004-2009, for a total of 42,160 farms, highlighted the presence of 498 farms that do not have any utilised agricultural area. Of these 498 farms:

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[186] The new single payment began to be applied in some MSs and to some products as from 1 January 2005, and was gradually extended to the other 17 member States (EU15, Malta and Slovenia) and to other products. The other 10 MSs apply the Single Area Payment Scheme (SAPS - decoupled).

[187] 2004: last year of pre-reform period for EU15, first months of introduction of EU direct payments for EU10

[188] In 2004 Romania and Bulgaria were not yet EU members.

- 21 are included in the TF Specialist Horticulture, 24 farms in the TF Mixed crops and do not perform any farming activity. In order to belong to these TF, the availability of land is of course a necessary condition. In both cases therefore these farms were removed from the 2004-2009 constant sample. The sample considered for the analysis thus consists of 42,114 farms.
- the majority of farms without UAA are included in the TF Specialist grazing livestock (183) and Specialist granivore (269)[189]. In these cases it is technically possible to have no UAA, as these farms operate in the beef, pig and poultry fattening phase, for which animal feed is totally purchased outside the farm (animal feed industry). For these two TFs, therefore, farms were divided into two sub-groups: farms with land and those without land (for the latter, of course, differences between 2004 and 2009 concern only livestock consistency). This is with a view to detecting any differences in the effects of the change of policy on different farming/breeding models.

The size of the FADN constant sample used for the analysis is given in the table below.

Tab. 65 - Size of EU FADN constant sample 2004-2009 used in the analyses: No of farms by TF in 2004[190]

	SPS Historical	SPS Hybrid	SPS Regional	SAPS	Total
TF1 Specialist field crops	5 240	1 655	**10**	2 465	9 370
TF2 Specialist horticulture	1 482	551	62	247	2 342
TF3 Specialist permanent Crops	4 613	452	40	461	5 566
TF4 Specialist grazing livestock	6 892	3 053	278	1 776	11 999
- with UAA	6 717	3 052	274	1 773	11 816
- without UAA	175	**1**	**4**	**3**	183
TF5 Specialist granivore	848	431	60	1 080	2 419
- with UAA	693	415	35	1 007	2 150
- without UAA	155	16	25	73	269
TF6 Mixed cropping	1 403	222	79	706	2 410
TF7 Mixed livestock	494	362	26	1 666	2 548
TF8 Mixed crops-livestock	1 695	1 510	52	2 203	5 460
Total	22 667	8 236	607	10 604	42 114
- with UAA	22 337	8 219	578	10 528	41 662
- without UAA	330	17	29	76	452

Source: EU-FADN-DG AGRI L-3
In red the number of farms below the minimum allowed for specific analyses

It is important to recall that a general limit of the analysis concerns the fact that the results of the SAPS model include only eight of the actual ten Member States (EU10 instead of EU12). Indeed the analysis is based on the comparison of FADN data related to years 2004 and 2009 (constant sample) and Romanian and Bulgarian data are not available for 2004.

Moreover, other limits are related to the methodology applied to the analysis. In particular:

- the estimate of the theoretical labour intensity required for each crop and its comparison with labour intensity actually employed in the farms of the constant sample.
- The use of FADN data concerning capital intensity (machinery) and its variations.

As these limits are strictly linked to the methodological approach used, the details are presented in the respective chapters (§ 10.6.1 and § 10.6.2).

Other methodological aspects and limits concerning the statistical analysis are described in the relative chapters.

[189] For these two TF, the distribution of farms without UUA is uneven: Spain had 77% of all landless farms of the TF "Specialist grazing livestock" (19% in Greece), and 44% of the TF "Specialist granivore" (14% in Hungary, 10% in Poland, 9% in Malta and Netherlands, the rest in other MSs). Landless farms moreover represent11.5% of the total sample for the TF "Specialist grazing livestock" of Spain and 8.7% of Greece. For the TF "Specialist granivore", landless farms account for 57% of the FADN sample in CZ, 52% in HU, 50% in GR and 44% in ES.

[190] As it will be explained later, the number of farms is the same in 2004 and 2009, but for each TF the number of farms changes between the two years according to the change of specialization.

10.3 Judgment criteria and indicators

In order to reply to this question, we based our judgement on the following criteria and indicators:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, farms belonging to different sectors have maintained/change their type of specialisation. Direct payments have (have not) contributed farm specialisation**
Percentage of farms that shifted from one sector to another (2004-2009), with respect to model of policy implementation
Panel Multinomial Logistic regression parameter estimated for direct payments
Judgment criterion no. 2 **Over the examined time period, farms belonging to different sectors have re-oriented their strategies concerning land availability and land use choices**
Percentage variations of total UAA, by type of farming, with respect to SFP model of implementation (2004 and 2009)
Difference in the land allocation (% UAA) by type of farming, with respect to SFP model of implementation (2004 and 2009)
Development and rate of change % LU/UAA of farms with LU, with respect to SFP model of implementation (2004 and 2009)
Comparison of % rate of Grazing Livestock Units with % rate of UAA for livestock feeding production
Difference in land allocation by groups of farms that have increased, decreased or maintained unchanged their UAA between 2004 and 2009, by type of farming, with respect to SFP model of implementation
Indicator resulting from the CATI survey
Judgment criterion no. 3 **Changes in production choices have (have not) had an impact on the intensity of labour and of capital**
Percentage variations in estimated man hours, in total and by hectare, by type of farming and by SFP model of implementation
Comparison of percentage variations of estimated man hours by hectare and percentage variation of actual man hours
Machinery/hectare in 2004 and percentage variation 2009/2004 by type of farming and SFP model of implementation
Comparison of variations (absolute and by hectare) 2004/2009 for man hours and machinery by groups of farms that have increased, decreased or kept unchanged UAA, by type of farming and SFP model of implementation

10.4 Policy context

For each type of farming and region groups, classified according to the Single Farm Payment implementation model (SPS Historical, SPS Hybrid, SPS Regional and SAPS), the average value of direct payments (CNDP included) per hectare was computed (2004 and 2009). This information can help to better interpret the results of analyses.

Tab. 66 - Direct payments received by the farms of the constant sample (average amount per ha, 2004)

	SPS Historical	SPS Hybrid	SPS Regional	SAPS	Total
Specialist field crops	340.19	298.18	-	99.64	226.98
Specialist horticulture	120.84	414.82	318.71	116.22	205.59
Specialist permanent crops	181.87	47.17	95.76	105.14	163.54
Specialist grazing livestock (with UAA)	228.6	291.6	234.7	86.8	220.0
Specialist granivore (with UAA)	15.2	57.6	178.1	34.9	32.6
Mixed cropping	232.8	307.2	276.6	114.7	190.4
Mixed livestock	268.7	349.4	693.9	112.1	203.1
Mixed crops-livestock	290.3	316.1	302.4	96.6	201.1

Tab. 67 - Direct payments received by the farms of the constant sample (average amount per ha, 2009)

	SPS Historical	SPS Hybrid	SPS Regional	SAPS	Total
Specialist field crops	368.2	302.7	-	175.4	266.8
Specialist horticulture	185.0	553.7	766.7	135.5	300.9
Specialist permanent crops	218.8	113.8	236.2	171.4	205.6
Specialist grazing livestock (with UAA)	268.6	348.7	500.1	200.8	282.3
Specialist granivore (with UAA)	16.4	54.3	74.0	58.5	36.3
Mixed cropping	248.7	328.0	523.7	235.8	263.3
Mixed livestock	306.7	360.6	527.5	213.1	269.7
Mixed crops-livestock	308.5	323.9	433.7	210.5	265.6

Source: EU-FADN-DG AGRI L-3

In 2009 the progressive implementation of the new direct support schemes was almost completed and direct payments represent the majority of the payments (also CNDP).

The specialist granivores benefit from quite limited average aid in both years[191], while the other sectors report values not too different from each other (total). Regions applying the SAPS model show in general the lowest average values (2004 and 2009).

In 2009, compared to 2004, the average aid per hectare increased, with the exception of Specialist granivore and Mixed livestock farms in the Regional SPS; however the sample of farms for this model is quite small and results should be treated with caution.

This augmentation is due to changes in the policy framework (increase of the phasing-in level: SPS regional and SAPS, reform of the sugar sector, MS choices concerning reform implementation). Moreover, given the general increase in the UAA of the farms of the constant sample (see following paragraphs), the increase in the average value per hectare could also be due to the acquisition of UAA with high value entitlements.

The highest increase of the average aid per hectare between 2004 and 2009 (in absolute terms and in %) are recorded by the groups of farms located in EU10 regions: regions implementing the SAPS model (all sectors except for horticulture), Malta and Slovenia, implementing the SPS regional model (Specialist horticulture, Specialist permanent crops, Specialist grazing livestock, Mixed cropping). Farms specialised in permanent crops in the Hybrid model also recorded a high augmentation.

10.5 Changes in farm specialisation

In this section we analyse the changes occurred between 2004 and 2009 concerning farms' economic and production specialisation choices. The analysis is carried out for 8 types of farming and distinguishes EU regions according to the SFP model.

Economic and production changes in response to policy changes can be evaluated by measuring the number of farms which, in the period considered and following the introduction of the single payment, have altered their organisation so as to move from their original TF_i to another TF_j. To this end, for each TF we have measured in the EU FADN constant sample flows of farms (number and percentage) that between 2004 and 2009: i) remained in the same TF_i; ii) migrated from TF_i to another TF_j; iii) arrived in the TF_i from another TF_j.

The following tables show the results of the analysis.

[191] We recall that in the past, not all the products/sectors have been able to receive direct payments (e.g. granivores, most permanent crops, horticulture). However, farms can receive direct payments for other crops for which direct payments were granted. After the reform, in EU15 regions applying the historical model the rules have remained unaltered, while where the hybrid model is applied and in EU12 countries (SAPS or regional model), farms benefit, like all others, from direct payments.

Interpreting the tables

The tables consist of two parts: the first gives absolute values (total number of farms of constant FADN sample). The second part gives the percentage composition.

Column **n. 2004** shows the number of farms belonging to each TF in 2004. In the same way, column **n. 2009** shows the number of farms of the same TF in 2009. The difference between TF*i* 2004 and TF*i* 2009 is the result of the following flows:

- incoming: in TF*i* from other TF*j* (yellow cells)
- outgoing: from TF*i* to other TF*j* (light blue cells)

The squares in bold type (along the diagonals of the tables) represent the number (or percentage) of farms that belonged to TF*i* in 2004 and remained in the same TF*i* in 2009.

In the TF Specialist field crops in the Historical model for example, there were 5,240 farms in 2004, dropping to 5,209 in 2009. This result is due to the following dynamics:

- 4,620 farms remained in the same TF Specialist field crops
- 620 farms migrated to other TF (67 in TF Specialist horticulture, 76 in TF Specialist permanent crops, etc.).
- In the same period 589 farms that were previously in other TF (36 from TF Specialist horticulture, 47 from TF Specialist permanent crops, etc.) migrated to the TF Specialist field crops.

The global variation was thus -31 farms, or -0.6%.

Finally the right side of the table (percentages) gives (in red) flow percentages greater than 5%.

Tab. 68 - Number and percentage of farms that shifted from one Type of Farming (TF) to another (2004-2009): by model of implementation and total EU

TOTAL EU	n. 2004		To/From between 2004 and 2009: number								n. 2009
			TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	
TF1 Specialist field crops	9 370	To	**8 323**	96	88	61	20	389	19	374	9 888
		From	**8 323**	53	53	141	99	379	44	796	
TF2 Specialist horticulture	2 342	To	53	**2 168**	26	1	1	86	2	5	2 442
		From	96	**2 168**	26	2	1	124	6	19	
TF3 Specialist permanent crops	5 566	To	53	26	**5 272**	10	1	181	4	19	5 907
		From	88	26	**5 272**	17	8	423	6	67	
TF4 Specialist grazing livestock	11 999	To	141	2	17	**11 216**	13	26	140	444	12 647
		From	61	1	10	**11 216**	14	24	626	695	
TF5 Specialist granivore	2 419	To	99	1	8	14	**1 832**	21	147	297	2 318
		From	20	1	1	13	**1 832**	5	166	280	
TF6 Mixed cropping	2 410	To	379	124	423	24	5	**1 163**	38	254	2 299
		From	389	86	181	26	21	**1 163**	108	325	
TF7 Mixed livestock	2 548	To	44	6	6	626	166	108	**1 103**	489	1 687
		From	19	2	4	140	147	38	**1 103**	234	
TF8 Mixed crops-livestock	5 460	To	796	19	67	695	280	325	234	**3 044**	4 926
		From	374	5	19	444	297	254	489	**3 044**	

	To/From between 2004 and 2009: %								Δ %
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	2009-04
To	**88.8**	1.0	0.9	0.7	0.2	4.2	0.2	4.0	5.5
From	**84.2**	0.5	0.5	1.4	1.0	3.8	0.4	8.1	
To	2.3	**92.6**	1.1	0.0	0.0	3.7	0.1	0.2	4.3
From	3.9	**88.8**	1.1	0.1	0.0	5.1	0.2	0.8	
To	1.0	0.5	**94.7**	0.2	0.0	3.3	0.1	0.3	6.1
From	1.5	0.4	**89.3**	0.3	0.1	7.2	0.1	1.1	
To	1.2	0.0	0.1	93.5	0.1	0.2	1.2	3.7	5.4
From	0.5	0.0	0.1	88.7	0.1	0.2	4.9	5.5	
To	4.1	0.0	0.3	0.6	**75.7**	0.9	6.1	12.3	-4.2
From	0.9	0.0	0.0	0.6	**79.0**	0.2	7.2	12.1	
To	15.7	5.1	17.6	1.0	0.2	**48.3**	1.6	10.5	-4.6
From	16.9	3.7	7.9	1.1	0.9	**50.6**	4.7	14.1	
To	1.7	0.2	0.2	24.6	6.5	4.2	**43.3**	19.2	-33.8
From	1.1	0.1	0.2	8.3	8.7	2.3	**65.4**	13.9	
To	14.6	0.3	1.2	12.7	5.1	6.0	4.3	**55.8**	-9.8
From	7.6	0.1	0.4	9.0	6.0	5.2	9.9	**61.8**	

Historical	n. 2004		To/From between 2004 and 2009: number								n. 2009
			TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	
TF1 Specialist field crops	5 240	To	**4 620**	67	76	47	11	283	11	125	5 209
		From	**4 620**	36	47	83	32	163	13	215	
TF2 Specialist horticulture	1 482	To	36	**1 363**	23	1	1	54	1	3	1 519
		From	67	**1 363**	18	2	0	65	1	3	
TF3 Specialist permanent crops	4 613	To	47	18	**4 373**	10	1	142	4	18	4 900
		From	76	23	**4 373**	15	8	343	4	58	
TF4 Specialist grazing livestock	6 892	To	83	2	15	**6 470**	9	19	64	230	6 996
		From	47	1	10	**6 470**	6	16	124	322	
TF5 Specialist granivore	848	To	32	0	8	6	**724**	9	24	45	812
		From	11	1	1	9	**724**	2	31	33	
TF6 Mixed cropping	1 403	To	163	65	343	16	2	**725**	17	72	1 334
		From	283	54	142	19	9	**725**	25	77	
TF7 Mixed livestock	494	To	13	1	4	124	31	25	**239**	57	418
		From	11	1	4	64	24	17	**239**	58	
TF8 Mixed crops-livestock	1 695	To	215	3	58	322	33	77	58	**929**	1 479
		From	125	3	18	230	45	72	57	**929**	

	To/From between 2004 and 2009: %								Δ %
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	2009-04
To	**88.2**	1.3	1.5	0.9	0.2	5.4	0.2	2.4	-0.6
From	**88.7**	0.7	0.9	1.6	0.6	3.1	0.2	4.1	
To	2.4	**92.0**	1.6	0.1	0.1	3.6	0.1	0.2	2.5
From	4.4	**89.7**	1.2	0.1	0.0	4.3	0.1	0.2	
To	1.0	0.4	**94.8**	0.2	0.0	3.1	0.1	0.4	6.2
From	1.6	0.5	**89.2**	0.3	0.2	7.0	0.1	1.2	
To	1.2	0.0	0.2	93.9	0.1	0.3	0.9	3.3	1.5
From	0.7	0.0	0.1	92.5	0.1	0.2	1.8	4.6	
To	3.8	0.0	0.9	0.7	**85.4**	1.1	2.8	5.3	-4.2
From	1.4	0.1	0.1	1.1	**89.2**	0.2	3.8	4.1	
To	11.6	4.6	24.4	1.1	0.1	**51.7**	1.2	5.1	-4.9
From	21.2	4.0	10.6	1.4	0.7	**54.3**	1.9	5.8	
To	2.6	0.2	0.8	25.1	6.3	5.1	**48.4**	11.5	-15.4
From	2.6	0.2	1.0	15.3	5.7	4.1	**57.2**	13.9	
To	12.7	0.2	3.4	19.0	1.9	4.5	3.4	**54.8**	-12.7
From	8.5	0.2	1.2	15.6	3.0	4.9	3.9	**62.8**	

Hybrid	n. 2004		To/From between 2004 and 2009: number								n. 2009
			TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	
TF1 Specialist field crops	1 655	To	1 488	1	0	2	3	33	3	125	1 773
		From	1 488	5	1	36	15	26	3	199	
TF2 Specialist horticulture	551	To	5	538	1	0	0	7	0	0	550
		From	1	538	2	0	0	8	0	1	
TF3 Specialist permanent crops	452	To	1	2	441	0	0	8	0	0	465
		From	0	1	441	0	0	20	0	3	
TF4 Specialist grazing livestock	3 053	To	36	0	0	2 878	4	3	28	104	3 072
		From	2	0	0	2 878	2	1	57	132	
TF5 Specialist granivore	431	To	15	0	0	2	345	0	20	49	569
		From	3	0	0	4	345	1	55	161	
TF6 Mixed cropping	222	To	26	8	20	1	1	131	5	30	218
		From	33	7	8	3	0	131	5	31	
TF7 Mixed livestock	362	To	3	0	0	57	55	5	199	43	299
		From	3	0	0	28	20	5	199	44	
TF8 Mixed crops-livestock	1 510	To	199	1	3	132	161	31	44	939	1 290
		From	125	0	0	104	49	30	43	939	

	To/From between 2004 and 2009: %								Δ %
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	2009-04
To	89.9	0.1	0.0	0.1	0.2	2.0	0.2	7.6	7.1
From	83.9	0.3	0.1	2.0	0.8	1.5	0.2	11.2	
To	0.9	97.6	0.2	0.0	0.0	1.3	0.0	0.0	-0.2
From	0.2	97.8	0.4	0.0	0.0	1.5	0.0	0.2	
To	0.2	0.4	97.6	0.0	0.0	1.8	0.0	0.0	2.9
From	0.0	0.2	94.8	0.0	0.0	4.3	0.0	0.6	
To	1.2	0.0	0.0	94.3	0.1	0.1	0.9	3.4	0.6
From	0.1	0.0	0.0	93.7	0.1	0.0	1.9	4.3	
To	3.5	0.0	0.0	0.5	80.0	0.0	4.6	11.4	32.0
From	0.5	0.0	0.0	0.7	60.6	0.2	9.7	28.3	
To	11.7	3.6	9.0	0.5	0.5	59.0	2.3	13.5	-1.8
From	15.1	3.2	3.7	1.4	0.0	60.1	2.3	14.2	
To	0.8	0.0	0.0	15.7	15.2	1.4	55.0	11.9	-17.4
From	1.0	0.0	0.0	9.4	6.7	1.7	66.6	14.7	
To	13.2	0.1	0.2	8.7	10.7	2.1	2.9	62.2	-14.6
From	9.7	0.0	0.0	8.1	3.8	2.3	3.3	72.8	

Regional	n. 2004		To/From between 2004 and 2009: number								n. 2009
			TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	
TF1 Specialist field crops		To									
		From									
TF2 Specialist horticulture	62	To	0	53	0	0	0	7	0	2	75
		From	1	53	0	0	0	21	0	0	
TF3 Specialist permanent crops	40	To	1	0	31	0	0	8	0	0	39
		From	0	0	31	1	0	7	0	0	
TF4 Specialist grazing livestock	278	To	1	0	1	267	0	0	3	6	294
		From	0	0	0	267	1	0	8	18	
TF5 Specialist granivore	60	To	0	0	0	1	55	0	1	3	57
		From	0	0	0	0	55	0	2	0	
TF6 Mixed cropping	79	To	2	21	7	0	0	44	2	3	67
		From	3	7	8	0	0	44	1	4	
TF7 Mixed livestock	26	To	0	0	0	8	2	1	8	7	18
		From	0	0	0	3	1	2	8	4	
TF8 Mixed crops-livestock	52	To	4	0	0	18	0	4	4	22	45
		From	2	2	0	6	3	3	7	22	

	To/From between 2004 and 2009: %								Δ %
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	2009-04
To									
From									
To	0.0	85.5	0.0	0.0	0.0	11.3	0.0	3.2	21.0
From	1.3	70.7	0.0	0.0	0.0	28.0	0.0	0.0	
To	2.5	0.0	77.5	0.0	0.0	20.0	0.0	0.0	-2.5
From	0.0	0.0	79.5	2.6	0.0	17.9	0.0	0.0	
To	0.4	0.0	0.4	96.0	0.0	0.0	1.1	2.2	5.8
From	0.0	0.0	0.0	90.8	0.3	0.0	2.7	6.1	
To	0.0	0.0	0.0	1.7	91.7	0.0	1.7	5.0	-5.0
From	0.0	0.0	0.0	0.0	96.5	0.0	3.5	0.0	
To	2.5	26.6	8.9	0.0	0.0	55.7	2.5	3.8	-15.2
From	4.5	10.4	11.9	0.0	0.0	65.7	1.5	6.0	
To	0.0	0.0	0.0	30.8	7.7	3.8	30.8	26.9	-30.8
From	0.0	0.0	0.0	16.7	5.6	11.1	44.4	22.2	
To	7.7	0.0	0.0	34.6	0.0	7.7	7.7	42.3	-13.5
From	4.4	4.4	0.0	13.3	6.7	6.7	15.6	48.9	

SAPS	n. 2004		To/From between 2004 and 2009: number								n. 2009
			TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	
TF1 Specialist field crops	2 465	To	2 211	27	12	12	6	70	5	122	2 894
		From	2 211	12	4	21	52	188	28	378	
TF2 Specialist horticulture	247	To	12	214	2	0	0	18	1	0	298
		From	27	214	6	0	1	30	5	15	
TF3 Specialist permanent crops	461	To	4	6	427	0	0	23	0	1	503
		From	12	2	427	1	0	53	2	6	
TF4 Specialist grazing livestock	1 776	To	21	0	1	1 601	0	4	45	104	2 285
		From	12	0	0	1 601	5	7	437	223	
TF5 Specialist granivore	1 080	To	52	1	0	5	708	12	102	200	880
		From	6	0	0	0	708	2	78	86	
TF6 Mixed cropping	706	To	188	30	53	7	2	263	14	149	680
		From	70	18	23	4	12	263	77	213	
TF7 Mixed livestock	1 666	To	28	5	2	437	78	77	657	382	952
		From	5	1	0	45	102	14	657	128	
TF8 Mixed crops-livestock	2 203	To	378	15	6	223	86	213	128	1 154	2 112
		From	122	0	1	104	200	149	382	1 154	

	To/From between 2004 and 2009: %								Δ %
	TF1	TF2	TF3	TF4	TF5	TF6	TF7	TF8	2009-04
To	89.7	1.1	0.5	0.5	0.2	2.8	0.2	4.9	17.4
From	76.4	0.4	0.1	0.7	1.8	6.5	1.0	13.1	
To	4.9	86.6	0.8	0.0	0.0	7.3	0.4	0.0	20.6
From	9.1	71.8	2.0	0.0	0.3	10.1	1.7	5.0	
To	0.9	1.3	92.6	0.0	0.0	5.0	0.0	0.2	9.1
From	2.4	0.4	84.9	0.2	0.0	10.5	0.4	1.2	
To	1.2	0.0	0.1	90.1	0.0	0.2	2.5	5.9	28.7
From	0.5	0.0	0.0	70.1	0.2	0.3	19.1	9.8	
To	4.8	0.1	0.0	0.5	65.6	1.1	9.4	18.5	-18.5
From	0.7	0.0	0.0	0.0	80.5	0.2	8.9	9.8	
To	26.6	4.2	7.5	1.0	0.3	37.3	2.0	21.1	-3.7
From	10.3	2.6	3.4	0.6	1.8	38.7	11.3	31.3	
To	1.7	0.3	0.1	26.2	4.7	4.6	39.4	22.9	-42.9
From	0.5	0.1	0.0	4.7	10.7	1.5	69.0	13.4	
To	17.2	0.7	0.3	10.1	3.9	9.7	5.8	52.4	-4.1
From	5.8	0.0	0.0	4.9	9.5	7.1	18.1	54.6	

Cells marked in red: values > 5%

Elaborations based on sample data EU-FADN-DG AGRI L-3

The analysis highlights that very strong dynamics have affected the farms in the observed period, with significant flows of farms moving from one sector to another between 2004 and 2009.

In particular, three distinct groups can be identified.

The first group is made up of four sectors: Specialist field crops; Specialist horticulture; Specialist permanent crops and Specialist grazing livestock. For these types of farming, there was an increase in farms between 2004 and 2009 (around +5% total EU25). They are all sectors with the highest degree

of farm specialisation (i.e. where most income is generated by a single class of products). This phenomenon is basically common to the various models of implementation, despite one or two differences (basic stability in TF Specialist field crops Historical model, in TF Specialist horticulture Hybrid model and in TF Specialist permanent crops Regional model). In all of these sectors there was however a larger percentage growth for farms in the SAPS model compared with other models.

The second group consists of three sectors: Mixed cropping, Mixed livestock and Mixed crops-livestock, for which the number of farms was significantly reduced (-34% Mixed livestock¸ -4.6% Mixed cropping). These are all sectors with the lowest degree of farm specialisation (i.e. pluribusiness farms without a dominant sector for income generation). This phenomenon is common to all models, albeit with small differences: TF Mixed livestock showing the largest falls (in all models), with the smallest reduction for the Historical model (-15.4%) and the largest for the SAPS model (43%).

Finally, and differently from the other specialist sectors, the TF Specialist granivore shows a decrease (albeit moderate: -4.2%) in the number of farms. This phenomenon is seen in all models with the (significant) exception of the Hybrid model (+32%).

In all sectors the changes are (also) the result of two-way trends: there are no cases of single-way flows (incoming only or outgoing only). This would point to the existence of more complex situations where production choices are impacted not only by policy changes.

In particular, concerning the first group (Specialist field crops; Specialist horticulture; Specialist permanent crops and Specialist grazing livestock) flows, both incoming and outgoing, are quite modest[192]. Moreover, the percentage of farms remaining in these sectors in 2009 is very high (around 90% of farms present in 2004). This phenomenon is basically reflected in all models (with minor differences) with the exception of the regional model (Malta and Slovenia), for which farms remaining in the same sector are lower in number, and shifts to other sectors are higher (in particular from TF Specialist horticulture and TF Specialist permanent crops to TF Mixed cropping).

In the second group (Mixed cropping, Mixed livestock and Mixed crops-livestock), flows - both incoming and outgoing - are considerable, accompanied by a low percentage of farms remaining in the same sector in 2009 (less than 50% in Mixed cropping and Mixed livestock, a little more than 50% in Mixed crops-livestock). For all three sectors, moreover, the situation appears to be very complex, since both the destination of farms leaving and the origin of farms coming in concerns, with significant percentages (above 5%), practically all sectors, with the (partial) exception of the TF Specialist horticulture. In this rather unclear picture, some aspects can however be highlighted. In greater detail, farms that have changed sector have moved in the following ways:

- Mixed cropping: about 39% of farms in TF Mixed cropping in 2004 migrated to more specialised sectors (crop farming), whereas about 12% opted to introduce (or expand) livestock breeding activities in non-specialist sectors. This general trend is basically common to all SFP implementation models (with one or two differences). Worthy of note is the larger shift to TF Specialist permanent crops for the Historical model (24% of farms) and to TF Specialist horticulture for the Regional model (about 27% of farms).
- Mixed livestock: about 33% of farms in TF Mixed livestock in 2004 migrated to more specialised sectors (in particular specialist livestock), whilst about 23% opted to introduce (or expand) crop-growing activities in non-specialist sectors. In this case too, the general trend is basically mirrored in all models of implementation.
- Mixed crops-livestock: about 34% of farms in TF Mixed crops-livestock in 2004 migrated to higher-specialised sectors, expanding cropping or breeding activities. On the other hand, about 10% migrated to other less specialised sectors, although here too they expanded cropping or breeding activities. In this case too, the general trend is basically mirrored in all implementation models. Worthy of note is the bigger shift to TF Specialist granivore in the Hybrid model (about 11% of farms) and to TF Specialist grazing livestock in the regional model (about 35% of farms).

In the TF Specialist granivore flows (both incoming and outgoing) were significant, but less so than for the second group. The destination for outgoing farms was chiefly the TF Mixed crops-livestock

[192] Incoming flows exceed 5% of farms only for TF1 “Specialist field crops” (8.1% from TF8 “Mixed crops-livestock”), TF2 “Specialist horticulture” (5.1% from TF “Mixed cropping”) and TF3 “Specialist permanent crops” (7.2% again from TF6 “Mixed cropping”).

and, to a lesser extent, the TF Mixed livestock. Thus about 19% of farms present in 2004 chose to evolve towards less specialised farming, retaining however their breeding activities. This phenomenon is repeated to a greater extent in the SAPS and Hybrid model, and to a lesser extent in the Historical model.

In all of these cases the main sectors of destination are also those from which the migration mainly originates; this confirms the complexity of situations already mentioned.

10.5.1 Effects of direct payments on farm specialisation: results of the econometric modelling

This part of the analysis aims at assessing whether and to what extent direct payments have affected changes in farm specialisation in the years following the implementation of the 2003 CAP reform. The analysis is based on a FADN constant sample of farms observed over the years 2005-2009, with farms classified according to the 8 groups of TF-General. The model is estimated over a sample overall comprising 38 697 observations.

As described in the methodology (see § 5.1.2.2.2), a Multinomial Logit approach on the observed transitions 2005–2009 is adopted to describe the expected effects of direct payments on changes in farm specialisation. The estimation model adopts as dependent variable the farms' specialisation structure observed in 2009 (i.e.TF classification).

Three sets of explanatory variables are included in the model:

- *Variables expressing public support*
  - Sum of Coupled Payments per hectare in the period 2005-2009
  - Sum of Decoupled Payments in the period 2005-2009
  - Sum of Rural development Payments in the period 2005-2009
  - Sum of Subsidies on investment in the period 2005-2009
- *Farm variables at the initial year 2005*
  - Capital per hectare of utilised agricultural area, where *Capital = Total fixed assets – Land assets*
  - Age of holder
  - Organisational form - dummy variable where: 1=Individual farms (base outcome); 2=Partnership; 3=Other
  - Type of farming - dummy variable where: 1=Specialist Field crops; 2=Specialist Horticulture; 3=Specialist Permanent crops; 4=Specialist Grazing livestock (reference category); 5=Specialist Granivores; 6=Mixed cropping; 7=Mixed livestock; 8=Mixed crops-livestock
- *Context variable at the initial year 2005*
  - Gross domestic product per capita

The model estimated coefficients are not directly interpretable. However, it is possible to provide an interpretation based on the odds ratios between categories (i.e. types of farming).

The odds ratio between categories *i* and *j* (when both *i* and *j* are different from the reference alternative *J*) for individual *n* is:

$$\log(\omega_{i|j}) = \log\left(\frac{P(y_n = i|X)}{P(y_n = j|X)}\right) = x_n'(\beta_i - \beta_j).$$

When the comparison is operated with respect to the reference alternative *J* the above expression simplifies into

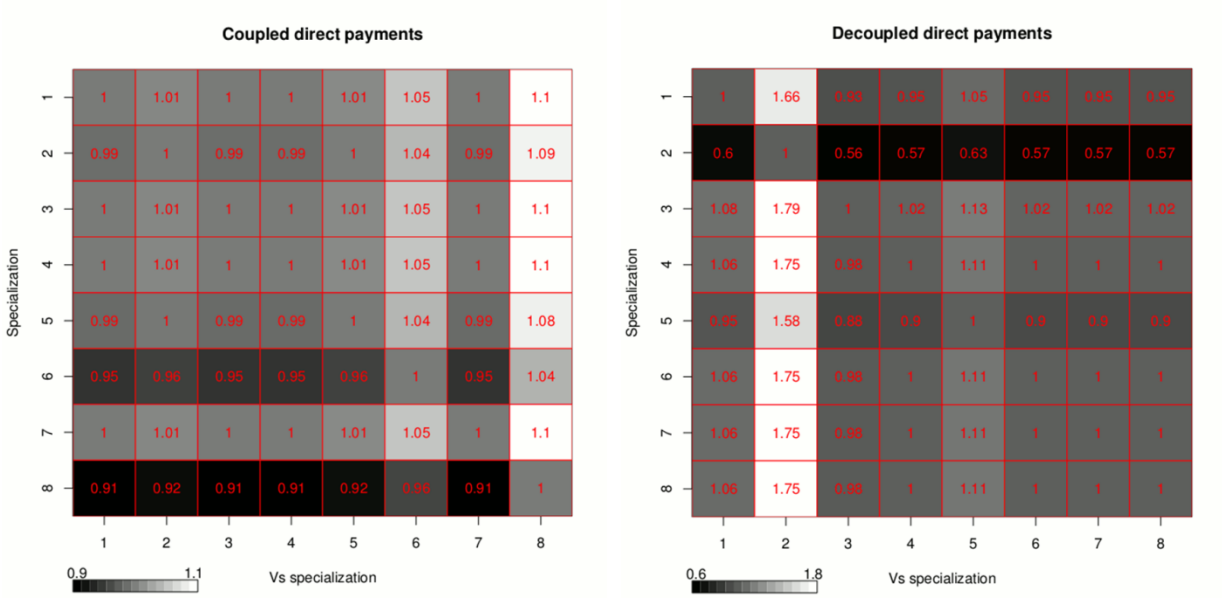
$$\log(\omega_{i|J}) = \log\left(\frac{P(y_n = i|X)}{P(y_n = J|X)}\right) = x_n'\beta_i.$$

Since we are especially interested in the effects of direct payments on farm specialisation decisions, the analysis specifically focuses on the odds ratios related to the parameters of coupled direct payments and decoupled direct payments.

Results of the analysis

In order to give account of all the relevant odds ratios related to coupled and decoupled payments, we summarize the results in Fig. 78. The Figure reports the increase of each odds ratio associated with a unit change in the payment variable of interest, all the other explanatory variables remaining constant. For example, a value equal to 1.15 in correspondence with categories *i* and *j* indicates that a 15% increase of the odds ratio should be expected on average as the response to a unit increase of the explanatory variable. In other words, following a unit increase in the explanatory variable, the probability that category *i* is preferred to category *j* is estimated to increase by 15% on average. Therefore, large values in correspondence with an alternative (with respect to all others) do not necessarily indicate that alternative as being the preferred choice. Rather, such a result would indicate that alternative as the one whose probability of being chosen increases most in response to a unit change in the payment variable.

Fig. 78 – Relevant odds ratios to coupled and decoupled direct payments



The results highlights few clear patterns:

- Overall the probabilities of types of farming being chosen are quite low in association with coupled payments (i.e. most values are quite close to 1), except in the case of TF8 (Mixed crops-livestock). In this case, a unit increase in coupled payments produces a smaller relative probability of choosing this sector as compared to the other sectors. A similar situation is observed in TF6 (Mixed cropping) with the exception of farms in TF8, for which the probability of choosing TF6 is estimated to increase by 4% following a unit increase in coupled payments.
- The probabilities of changing TF appear to be overall higher in association with decoupled payments than with coupled payments. Specifically, decoupled direct payments are associated with a positive effect on specialisation in Permanent crops (TF3) where a unit increase in decoupled payments produces the largest increase of the odds ratios compared to the other specialisations. On the contrary, Horticulture (TF2) appears to be the least influenced by a unit increase in decoupled payments. This means that with increasing decoupled payments, farms in other sectors are not likely to move to this TF.

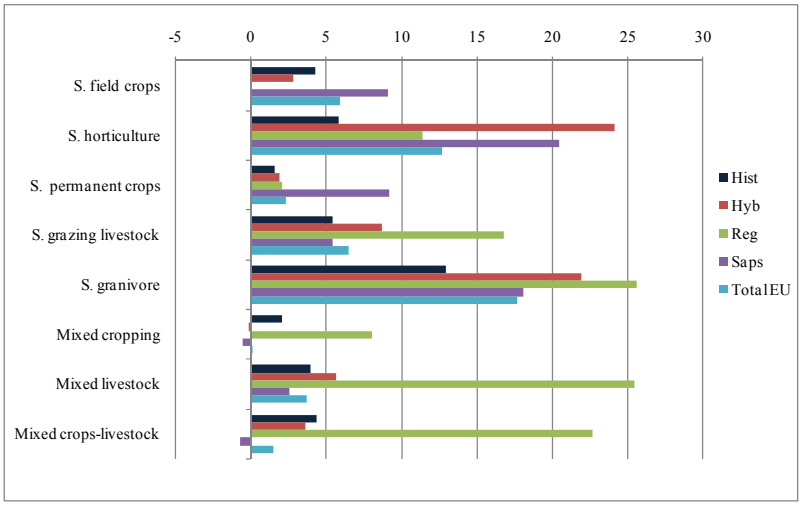
10.6 Changes in strategies concerning land availability and land use choices

In this section we analyse the changes occurred between 2004 and 2009 in farms' choices in terms of size of farms and of land allocation. We also analyse the changes occurred between 2004 and 2009 in livestock farms' strategic decisions in terms of intensification or extensification of production. Since in this part the analysis focuses on farms' strategic behaviour, sample farms have been grouped together according to the TF they were in in 2004, regardless of the TF they belonged to in 2009.

10.6.1 Strategies concerning farm size

A key aspect of structural adaptation strategies in response to policy changes relates to farming land. The analysis shows a general rise in UAA for all TFs and for all models of implementation (farms with UAA, average data for the constant sample). The only exception is a very small decrease (less than 1%) for the TF Mixed cropping and the TF Mixed crops-livestock in the SAPS model.

Fig. 79 - % variation of UAA between 2004 and 2009 in farms of the EU FADN constant sample, by TF and by model of implementation



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Between 2004 and 2009 the total UAA of farms in TF Specialist horticulture and TF5 Specialist granivore grew more than in other types of farming. In TF2 Specialist horticulture the Hybrid (24.1%) and SAPS (20.5%) models expanded most, whereas for TF5 Specialist granivore the Regional (25.6%) and Hybrid models (21.9%) grew most. On the other hand, the growth of total UAA was more modest for TF3 Specialist permanent crops, with about 2% growth in each model, with the exception of SAPS (9.2%).

In the Regional model (Malta and Slovenia) UAA growth was among the highest in almost all sectors. One should however consider the fact that the sample of farms for this model is quite small, and variability is very high. Results for the Regional model should therefore be treated with due caution.

10.6.2 Strategies concerning land allocation

10.6.2.1 Methodological aspects

In this section we analyse the changes between 2004 and 2009 in land allocation (constant sample). To facilitate the interpretation of results, the various crops / land uses were grouped into classes based on uniform criteria:

CLASSES	CROPS
Cereals	Common wheat Durum wheat Rye Barley Oats Summer cereals mix. Grain maize Rice Other cereals
Oilseeds & Protein crops	Dry pulses Oilseeds
Industrial crops	Sugar beet Hops Tobacco Other industrial crops (cotton, etc.)
Vegetables & potatoes	Potatoes Fresh vegetables open field Fresh vegetables market garden
Permanent crops	Fruit + berry orchards Citrus orchards Olive groves Vines Other permanent crops
UAA for livestock feeding	Fodder roots + brassicas Others forage plants Temporary grass Meadows + permanent pastures Rough grazing
Leased to others	
Fallow land and set aside	
Other UAA	

In order to allow a uniform comparison of data, total UAA for 2004 (for each sector and each SFP model) was set at 100, with the shares of different crop classes contributing to the formation of total UAA indicated as a percentage. The land occupied by different crop groups in 2009 has also been compared with total UAA in 2004. As a consequence, the total sum of values of the different classes of crops, representing total UAA for 2009, will be greater than or less than 100 depending on whether total UAA has risen or fallen between 2004 and 2009.

10.6.2.2 Overall results by Single Farm Payment implementation models

In the first instance, we analysed the changes in land allocation for the whole sample (i.e. all TF together). This allows us to observe the changes of each crop class, and thus to gauge any differences that might be ascribable to the different direct payments models.

Tab. 69 - Farm land use trends for farms in all TFs, by model of implementation and total EU: Total UAA 2004=100

	SPS Historical			SPS Hybrid			SPS Regional			SAPS			Total EU		
	2004	2009	Δ%	2004	2009	Δ%	2004	2009	Δ%	2004	2009	Δ%	2004	2009	Δ%
Total UAA	100.0	104.6	4.6	100.0	105.1	5.1	100.0	116.9	16.9	100.0	104.2	4.2	100.0	104.6	4.6
Cereals	30.8	32.4	5.0	41.5	44.8	7.9	14.8	22.7	53.8	49.8	51.1	2.7	41.4	43.4	4.9
Oilseeds & Protein crops	4.9	5.8	17.9	11.1	11.8	5.6	0.6	1.4	150.0	11.4	15.8	39.3	9.3	11.5	23.8
Industrial crops	2.5	2.0	-23.0	2.2	2.1	-5.2	2.0	0.7	-65.5	2.8	1.6	-43.8	2.5	1.8	-27.4
Vegetables & potatoes	2.1	2.3	7.6	1.9	1.8	-6.1	4.9	4.7	-4.9	1.8	1.4	-21.8	2.0	1.8	-7.2
Permanent crops	6.4	6.4	0.7	0.6	0.6	-3.7	2.7	2.9	5.8	0.7	0.8	18.3	2.4	2.5	2.3
UAA for livestock feeding	45.4	48.7	7.2	35.7	40.1	12.1	72.2	81.5	12.9	29.2	31.2	6.6	36.2	39.3	8.5
Fallow land and set aside	6.3	5.2	-16.6	5.5	2.2	-60.8	0.8	0.4	-51.6	3.6	1.2	-66.7	5.0	2.7	-45.4
Other UAA	1.3	1.7	28.8	1.1	1.5	31.8	2.1	2.6	24.8	0.7	0.9	24.5	1.0	1.3	28.6

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3
In red the % variations of UAA of crops greater than % variation of total UAA

Bearing in mind the average rise in UAA of 4.6%, it can be seen that a growing use is being made of land for COP crops and for livestock grazing. The stronger growth relates to Oilseeds & Protein crops (31% Oilseeds, -27% protein crops). This is happening (as for the majority of TF/models analysed thus far) to the detriment of industrial crops[193] (mainly due to the partial or full decoupling of aid for tobacco and cotton and to the reform of the sugar sector), and because of the utilisation of almost 50% of fallow lands and set-aside existing in 2004. Vegetables & potatoes too have lost shares, especially in the potato sector and fresh vegetables open fields.

Therefore, it appears that the change in policy has favoured a shift in land use towards "easier", less "demanding" crop classes (in terms of production factors, technical characteristics and business effort).

This overall conclusion is also valid when distinguishing by model of implementation of direct payments, despite some size differences[194]. It would appear that the change in policy and the consequent rise in alertness to market signals has affected in similar ways the different MS groups. It may thus be stated that models adopted to implement the SFP have played a secondary role in shaping farms' behaviours[195].

10.6.2.3 Results by sector

Changes in land allocation between 2004 and 2009 in each sector are shown below.

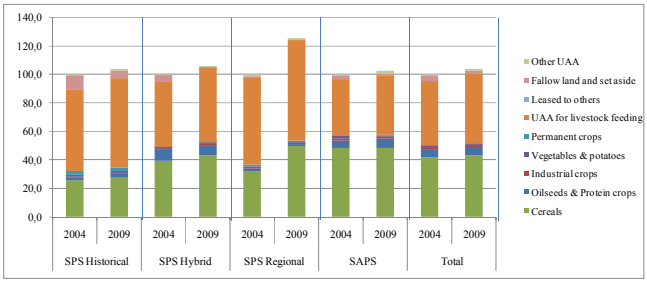
Fig. 80 - Farm land use evolution by TF and by model of implementation: Total UAA 2004=100

[193] To this purpose cf results of the "Evaluation of market effects of partial decoupling", Agrosynergie 2010.

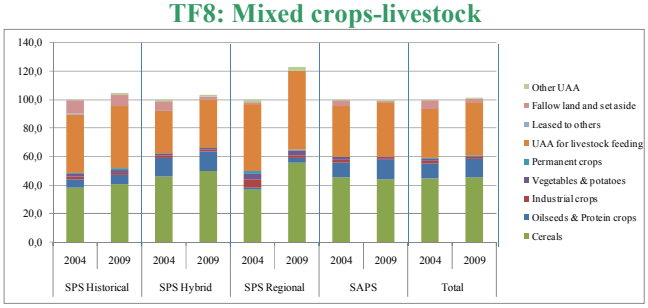
[194] We report for example the case of industrial crops, which have collapsed dramatically everywhere except in the Hybrid model: This is due to the stability of the sugar beet sector in the MSs of this model (in particular Germany) following the 2006 reform of the sugar CMO.

[195] In this respect, it should be noted here that the UAA in Vegetables & potatoes decreased in the Hybrid and Regional models, which contradicts expectations (unlike the Historical model, in the Hybrid and Regional models land destined for horticulture should be eligible for direct aid).

TF7: Mixed livestock



TF8: Mixed crops-livestock



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The UAA expansion process (see § 10.5.3.2) is generally confirmed when looking at the 8 sectors in all four analysed implementation models. Further observations can be made as a result of the analysis:

- For each sector, the land allocation structure is quite similar across all models of implementation. The sole exceptions are the Regional model (probably due to the small size of the sample and high variability, as already mentioned) and the group of Specialist horticulture farms, for which the crop composition is varied and differs from model to model.
- In the types of farming where the presence of livestock is dominant/relevant (Specialist grazing livestock; Specialist granivore; Mixed livestock and Mixed crops-livestock) the land allocation structure is almost all based on two classes: cereals and fodder crops. Other land uses make a minor contribution to total UAA.
- Cereals (present in all sectors to varying extents) account for 70% of the UAA of TF Specialist granivore (on average), and for about 60% of Specialist field crops.
- Besides the TF Specialist permanent crops where they account for about 68% of total UAA), permanent crops have a significant presence only in TF Mixed cropping of the regions applying the Historical model, with about 19% of total UAA. In all other cases their presence is negligible.
- In the same way, Vegetables & potatoes have a significant presence (obviously in TF Specialist horticulture with about 40% of total UAA) only in the TF Mixed cropping of the Regional model. In all other cases their presence is marginal.
- Land for industrial crops is present with at least 4% of total UAA (in 2004) only in Specialist field crops and Mixed cropping farms, down in 2009 due to the decoupling of aid. It is also down in types of farming where in 2004 too it had a marginal presence. This is applicable to all models, even though for the Hybrid model the decrease is more modest.
- In all TF and in all models the UAA for the class Fallow land and set-aside is down, with the exception of TF Specialist horticulture and TF Specialist permanent crops in some implementation models. This is clearly to be attributed to the removal of the set-aside obligation for COP crops. Thus in all TF having a presence of cereals, oilseeds and protein crops, a portion of unproductive UAA in 2004 was used for crop growing in 2009.

Below, we present in more detail the observed changes in each sector.

Specialist field crops

At EU level (considering all regions together), the analysis highlights an increase of land used for Oilseeds & Protein crops (+25%, as an effect of the algebraic sum of a large increase for oilseeds - +33% - and a decrease for protein crops) and of UAA for livestock feeding (+28.4). UAA used for cereals also rose (+4.6%)[196], but by less than the total increase in UAA (+5.9%).

Although varied, these changes are common to all implementation models, but the growth in Oilseeds & Protein crops is more marked in the SAPS model (+41%), whereas the rise in UAA for livestock feeding is higher in Historical (+37%) and Hybrid models (+34%). For cereals, growth was higher (in percentage terms) than for total UAA in the Hybrid model.

At EU level, there was a drop in the amount of land used for Industrial crops (-24%) and in Fallow land and set-aside (-37.5%). In this case too the trend was common to all models, although the drop in

[196] But with a large fall in UAA for durum wheat.

land use for Industrial crops was more marked in the SAPS model, and that for Fallow land and set-aside less marked in the Historical model.

Finally, land use for other crop classes decreased slightly (Vegetables & potatoes, -3%) or rose slightly (permanent crops, +11%), but for marginal areas.

Overall then, despite minor differences among implementation models, in Specialist field crops farms there was additional focus on COP-fodder crops through the abandonment of industrial crops and recovery of previously unfarmed land.

Specialist Horticulture

At EU level, the UAA of all crop classes grew in this TF, with the exception of Industrial crops (-4.6%). This is attributable to the strong growth of total UAA across the whole constant sample (+13% circa)[197]. Within this general rise in average farm size, the classes that have really grown in size (percentage growth greater than total increase of average UAA) were cereals (+24.5%) and livestock feeding crops (+31%). Oilseeds saw a three-fold increase in land use, but the initial level was very small. Other product classes were in expansion, but growth rates were lower than the increase in total UAA (thus they declined in relative share). These included the Vegetables & potatoes class, which determines farms being assigned to the TF "Specialist horticulture". Finally, we observe an important presence (basically only in this TF) of the class "Other UAA" (over 23% of total UAA in 2004), which was also in expansion but with loss of its relative share.

This evolution is partially confirmed when looking at implementation models. Land used for cereals fell in the Regional model (-42%, due to the almost complete disappearance of soft wheat), but grew by 60% for the Hybrid model[198]. UAA for livestock feeding, in expansion for all models, grew most for the SAPS model (+143%). For land used to grow Vegetables & potatoes, in all the models there was either a fall in absolute terms (Regional and SAPS) or in relative terms (Hybrid). Only in the Historical model was the percentage rise in area greater than that for total UAA.

With regard to Fallow land and set-aside, in all models except for SAPS there was growth, large for the Hybrid model (+32%) and very large for the Regional model (+394%). With regard to the SAPS model, the fall (-34%) should be seen in the light of a particular initial situation: in 2004 Fallow land and set-aside occupied almost 16% of total UAA.

In general, therefore, in almost all models there was a change towards greater diversification of farming activity, with growth in the share of cereals and fodder crops as a result of the expanding average size of farms. Not all the additional land was used for crop growing though. This resulted in an increase (except for the SAPS model) in unused area.

Specialist permanent crops

In this TF, at EU level permanent crops occupy the majority of UAA (about 68% of the total). This percentage remained steady between 2004 and 2009, accompanied by a (slight) increase in average farm size (+2.3%). An exception to this general trend is found in the SAPS model, for which UAA for Permanent crops increased (7%) vis-à-vis a larger increase in total UAA (9.2%), while for the Regional model there was a larger rise in UAA for Permanent crops (3.5%) compared with a more moderate increase in total UAA (2.1%).

At EU level, land used for cereals accounted for 12-13% of total UAA, down by 3% over the period in question due to the combined effect of a decrease in the Historical model (-4.3%), growth in the Regional and Hybrid models and a basic stability in the SAPS model. On the other hand, area used for livestock feeding, accounting for 5-6% of total UAA, was up on the whole (+17.3%); this positive change applied to all models except the Regional model.

At EU level, land used for Other crops (+12% circa) and for Fallow land and set-aside (+8.4%) gained in relative importance. With regard to the former, the increase applied to all models, exceeding the growth of total UAA (with the exception of the Hybrid model, for which Other UAA remained

[197] Strong growth for all models except for Historical, for which growth was more moderate (+5.8%).

[198] In the Hybrid model total UAA increased by 24%.

constant). With regard to the latter, the result is the effect of different trends in different models: more than proportional growth in the Historical and Hybrid models and a relevant decline in the other two models.

The areas of other crop classes were marginal in 2004, and remained so in 2009. The only exception was the area used for Vegetables & potatoes, the share of which has grown only in the Regional model.

In conclusion, for farms in the TF Specialist permanent crops, permanent crops have undergone only small variations, and rises in average farm size have tended to increase, albeit to a limited overall extent, not only some crop classes (varying in each model) but also previously unfarmed land (similar to what seen in TF Specialist horticulture). The general trend is for a slight increase in various land uses, with less focus on permanent crops alone.

Specialist grazing livestock

In this sector, UAA for livestock feeding crops represented about 82% of total UAA (in 2004 for total EU), with land for cereals accounting for 13-14% of the total. Therefore, the two crop classes occupy about 95% of available UAA. The other crops were (and remained) practically non-existent. Crop areas grew by 6.5% on average between 2004 and 2009. This increase, combined with a drop in Fallow land and set-aside, was used to further strengthen the two crop classes (+15% for UAA used for cereals and +7% UAA for livestock feeding). This trend applies to all four implementation models (to varying extents, depending on the initial relative shares of UAA for cereals and UAA for livestock feeding).

Thus, in all models, between 2004 and 2009, the polarisation of the two (almost) exclusive crops has become more accentuated.

Specialist granivore

This sector is the one for which the average increase in UAA was generally the highest (+17.7%, with peaks of +26% for the Regional model and +22% for the Hybrid model). At the EU level, over 70% of UAA is occupied by cereals, about 12% by fodder crops and about 6% by Oilseeds & Protein crops.

Again at EU level, this rise in UAA was accompanied by larger areas being used to grow oilseeds (+66.5%) and fodder crops (+25.2%). These increases are mainly attributable to the overall UAA increase and the fall in Fallow land and set-aside (-38%). The growth in the amount of land used for cereals is in line with total UAA growth (+17.9%, compared with +17.7% for total UAA).

These general trends are basically repeated (albeit with small differences) in the Historical and Hybrid models. On the other hand, in the Regional model UAA for Oilseeds & Protein crops (already small in 2004) disappeared completely in 2009, and UAA for livestock feeding fell by 16%. This favoured an even larger rise for cereals (+70%) relative to total EU. In the SAPS model the area dedicated to cereals and livestock feeding crops rose, but less than the global UAA increase. UAA for Oilseeds & Protein crops increased 2.4 times (+136%).

In conclusion, for TF Specialist granivore farms there was a general evolution (more or less shared by all models) of growth in land destined to livestock feed crops (different crops depending on the various use functions); which seems justified by increase in market prices of these products (replacing off-farm purchases with own production).

Mixed cropping

For the whole of the EU, unlike other sectors, total UAA did not present significant changes. This is the effect of a slight increase in the Historical model (+2.1%) and a small decrease in the SAPS model (-0.6%)[199].

For Mixed cropping farm types the initial composition of land uses (2004) in the different models was rather varied with cereals as the dominant crop class (around 50% of UAA). Permanent crops were

[199] Unchanged situation in the Hybrid model, 8% growth in the Regional model. UAA for the TF "Mixed cropping" in this model was however limited (a little over 600 ha).

important in the Historical model (19.1%, constant over time), whereas they were practically absent in the Hybrid (0.9%) and SAPS (1.9%) models. Farmland used for Vegetables & potatoes represented about 25% of the total in the Regional model (with a small increase between 2004 and 2009), but a negligible percentage in the SAPS model. Oilseeds & Protein crops were very important in the Hybrid model (16.4%), much less so in the Historical model (6-7%) and almost absent in the Regional model. Fallow land and set-aside exceeded 10% in the Historical model, but only a little over 1% in the SAPS model.

Bearing in mind the diversity of the initial context, in general land used for cereals grew in size (+1.6%), due to growth in the Hybrid and SAPS models (+2.5 and 2.4% respectively) despite a reduction in the Historical model (-2.0%)[200]. UAA for Oilseeds & Protein crops rose significantly (+21% in general) in all models except for the Hybrid model, which underwent a slight decrease. UAA for livestock feeding was generally stable, due to a significant drop in the SAPS model (-14%) and growth in the Historical and Hybrid models (+20% and +18% respectively). Fallow land and set-aside generally fell by 33%, with a plunge by over 60% in the Hybrid, Regional and SAPS models and basic stability in the Historical model. Industrial crops area (not very widespread across all models with the exception of SAPS) fell by 33% overall (totally absent in the Regional model but remained constant in the Hybrid model).

In conclusion, the largest shifts were registered towards COP and livestock feeding crops, generally in favour of Oilseeds. This led to a reduction in industrial crops and recovery of part of unfarmed land.

Mixed livestock and Mixed crops-livestock

These two sectors are very similar in terms of crop composition, and in turn quite similar to the TF Specialist grazing livestock. In 2004 indeed about 86% of UAA for TF Mixed livestock and about 80% for TF Mixed crops-livestock was used for cereals and livestock feeding. If one also includes land used for Oilseeds, the these crop classes represented (in 2004) 91% of UAA for TF Mixed livestock and 90% for TF Mixed crops-livestock. Considering also that Fallow land and set-aside accounted for a further 4-5% of UAA, other crops were practically non-existent.

Between 2004 and 2009, agricultural area increased on average by 3.7% and 1.5% respectively for TF Mixed livestock and TF Mixed crops-livestock. This increase, in conjunction with a drop in Fallow land and set-aside (-53% for the former TF and -57% for the latter) was used to further expand all three crop classes. In TF Mixed livestock: +3.4% UAA for cereals, +18.4% UAA for Oilseeds and +8.2% UAA for livestock feeding. In TF Mixed crops-livestock: +2.1% UAA for cereals, +18.8% UAA for Oilseeds and +6.8% UAA for livestock feeding.

These trends basically applied (to varying extents, depending on the initial UAA composition of the three crops) to all four implementation models. The only exceptions were a slight reduction of cereals area in the SAPS model (in both TF) and Oilseeds & Protein crops in the Hybrid model of the TF Mixed livestock, whereas expansion was greater in the remaining two classes.

Thus, for all models, between 2004 and 2009, the polarisation of the three (almost) exclusive crops has become more accentuated.

10.6.3 Analysis of production choices adopted by livestock farms

This part of the analysis was carried out for two groups of farms:

- livestock farms with availability of land (UAA >0). We have considered only the sectors for which livestock is significant, thus excluding from the analysis farms specialised in horticulture and permanent crops.
- livestock farms without land (UAA=0), thus purchasing 100% of animal feed from outside or that use common land for grazing[201]. In this case we have limited the analysis to farms specialised in grazing livestock and granivores (in which livestock farms without UAA are concentrated). With regard to specialist grazing livestock farms, the analysis was conducted at EU level (considering

[200] In the Regional model there was a growth of 37%, but the initial situation was very modest.

[201] In some regions, it is likely that farms without land use common land for livestock, especially sheep and goats, but also for pigs (cf 6.4.6.3).

all regions together) and for the group Historical model, since for other models the number of farms without UAA was very small (failing to reach the minimum threshold).

10.6.3.1 Changes in Livestock Units[202] in farms with UAA

The graphs below show the evolution of Livestock unit (LU) coefficients (total and by animal species) for each type of farming between 2004 and 2009.

Fig. 81 - LSU evolution by animal species in farms with UAA, by TF and by implementation model (2004 and 2009; total LU 2004=100)

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Between 2004 and 2009, farms specialised in grazing livestock (TF4) and granivores (TF5) have decided to expand their activity, supported (as already observed) by the augmentation of the UAA for animal feeding (TF4) and for cereals (TF5). This expansion is observed in all four groups of regions aggregated according to the SFP model they implement. For farms specialised in grazing livestock, LU units increased as much as 7.6% for the Hybrid model and by 5.4% for the Historical model. This applied in particular to dairy herds and other cattle (changes in sheep and goat units were less clear-cut). For farms specialised in granivores, the growth was between 15.3% for the Hybrid model and 2% for the Regional model.

In other sectors the strategies adopted vary according to the model of implementation of single payments. In greater detail:

- Specialist field crops, mixed livestock and mixed crops-livestock farms, located in EU regions implementing the Historical or the Hybrid model, adopted an expansion strategy (in this case too, supported by an increase of land for cereals and for livestock feeding). In particular, farms specialist in field crops and located in Historical model regions show the highest increase in LSU (41%), mostly due to expansion of Pigs & Poultry (+116%). In mixed livestock and mixed crops-

[202] The Livestock unit (LU) is a coefficient used to standardise units of animals of different species or categories. LUs are related to the feed requirements of each individual animal category

livestock farms located in regions implementing the Regional model LSU also grew to some extent. On the contrary, farms located in regions implementing the SAPS show a reduction of the coefficient (all the four analysed types of farming), thus a totally different strategy was adopted.

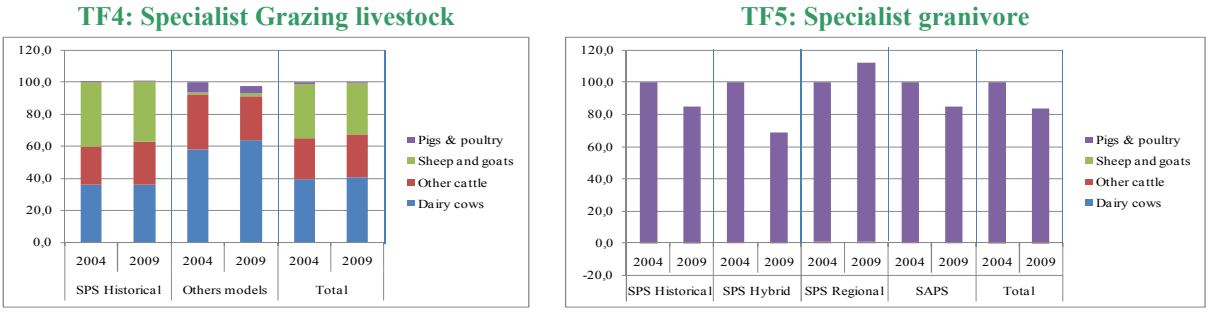
- There was a drop in LSU in mixed cropping farms, affecting all livestock species, in all groups of regions except for the regional model (where growth was high: +31% due to the expansion of Pigs & poultry).

10.6.3.2 Changes in Livestock Units in livestock farms without UAA

The situation of farms without UAA specialised in grazing livestock ("landless" holdings of some Member States use common land for grazing) remained practically unchanged between 2004 and 2009.

The behaviour of farms without UAA specialised in granivores was completely different: the number of LSU shrunk considerably in all models, with the sole exception of the Regional model[203]. The drop in LSU was between 15.1% for the Historical model and 3.1% for the Hybrid model[204]. It thus appears that those livestock farms could, among others, have suffered the effects of the rise in cereal prices. This problem has been addressed by farms with UAA by expanding their own production of cereals for feeding purposes.

Fig. 82 - LSU evolution by animal species in farms without UAA, by TF and by implementation model (2004 and 2009; total LU 2004=100)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

10.6.3.3 Choice of extensification or intensification

In order to gauge changing behaviours of livestock farms following the introduction of the single payment system, we have compared the percentage variations of Grazing Livestock Units with changes in areas used for the production of animal feed. This analysis comprises livestock farms with availability of land (UAA >0). We have considered only the types of farming for which livestock is significant, thus excluding from the analysis farms specialised in horticulture and permanent crops.:

The results of the analysis are shown in the graph below[205]. All cases placed above the bisecting line show a variation in LSU that is greater that the variation in land for fodder crops, and vice versa for cases placed below the line.

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[203] In EQ 1 (§ 6.5.3 and 6.4.6.3) we have seen that total LSU in farms without land has increased. This is also due to the fact that, overall, the number of farms without land has also increased. The LSU decrease observed in the FADN constant sample farms without land is only aparently contradictory because the number of farms does not change.

[204] This evolution is not consistent with the evolution of LSU highlighted by census data (cf. § 6.4.6.2). However, as already mentioned, the results of this analysis solely concern the farms of the FADN constant sample. Moreover, the two analysed time periods differ: 2004-2009for FADN, 2003-2010 for FSS (census data show that the increase/recovery of LSU respectively in the SPS Historical + Hybrid model and in the SAPS model occurred in 2010).

[205] In the diagram the various TF relating to the various models of implementation have been identified as follows:

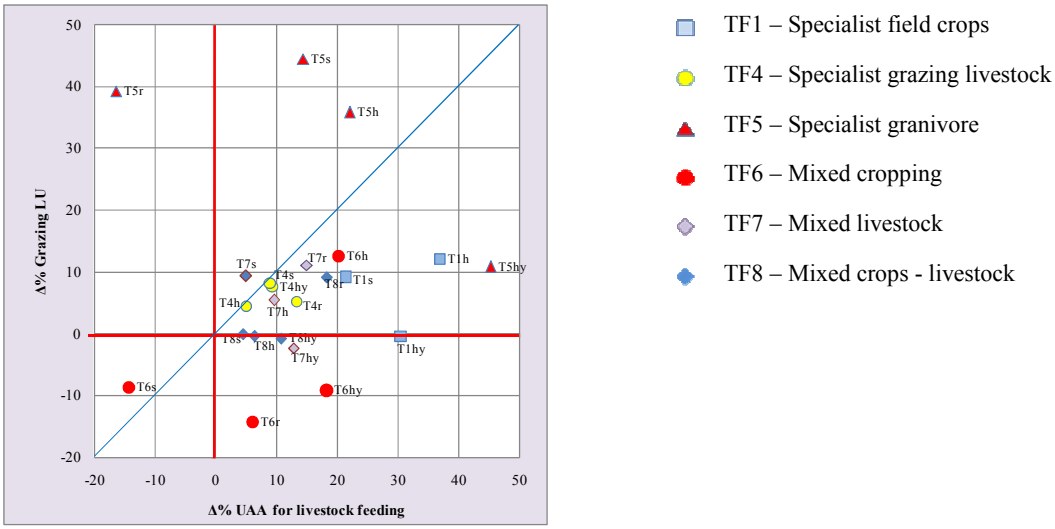
T(1…8)h = TF from 1 to 8 of the historical model

T(1…8)hy = TF from 1 to 8 of the hybrid model

T(1…8)r = TF from 1 to 8 of the regional model

T(1…8)s = TF from 1 to 8 of the SAPS model

Fig. 83 - % variation between 2004 and 2009 of Grazing LU and UAA for livestock feeding in farms with land belonging to TF with livestock, by model of implementation



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The graph shows an apparent extensification (lower stocking rate per hectare) of livestock activity, covering almost all types of farms and almost all models (except for farms specialised in granivore belonging to the Historical, regional and SAPS models and, to a lesser extent, mixed livestock farms located in regions adopting the Historical model). In TF6 Mixed cropping of SAPS model regions, intensification is due to a reduction in UAA for fodder crops larger than the fall in LSU.

However, the extensification may only be apparent, since the greater increase in UAA for fodder crops (compared with the variation in LSU) may conceal the substitution of animal feed purchased outside the farm for animal feed produced on the farm (choice determined by the change in relative prices).

It is also noted that this (apparent) extensification has occurred in different ways. Of the 19 combinations of TF/SFP model showing apparent extensification, this has occurred:

- In 11 TFs/models, through a percentage increase in UAA for fodder crops larger than the percentage increase in LSU. This is particularly relevant in TF5 Specialist granivore for the hybrid model and in TF1 Specialist field crops for the Historical model. In general, this pattern appears to be more common in the Historical model (four of the six types of farms considered for this model).
- In 8 TFs/models, through an increase in UAA for fodder crops accompanied by a drop in LSU. This is particularly relevant in TF6 "Mixed cropping" for the Regional and Hybrid models. In general, this pattern appears to be more common in the hybrid model (four of the six types of farms considered in this SFP model).

10.6.4 Farms' land allocation choices in relation to farm size

In the previous sections we have analysed farms' reactions in terms of farm size and land allocation to the intervened changes in direct support policy. The present part is dedicated to evaluate whether farms' strategic behaviour in terms of land allocation has been different depending on whether farms have increased, decreased or maintained unaltered their size. The analysis is carried out by type of farming and groups of regions aggregated according to the SFP implementation model in order to seize any differentiated effects.

10.6.4.1 Different farm size strategies adopted in the post-reform period

In the above chapters we observed a general rise in agricultural area concerning (almost) all sectors in all SFP implementation models. This increase is however the result of different behaviours within each type of farming, namely:

- farms adopting size expansion strategies;
- farms adopting size reduction strategies;
- farms that have kept their agricultural area unchanged.

The following table highlights for each sector and SFP implementation model, the percentage of farms of the EU25 constant sample that have increased, decreased or kept unchanged their UAA between 2004 and 2009 (farms with UAA>0)[206].

Tab. 70 - Farms with UAA that have increased/decreased UAA from 2004 to 2009, by TF and by model of implementation

		SPS Historical				SPS Hybrid				SPS Regional				SAPS			
		Incr	Decr	Unch	Total	Incr	Decr	Unch	Total	Incr	Decr	Unch	Total	Incr	Decr	Unch	Total
TF1	S. field crops	47.9	36.3	15.8	100.0	54.3	41.1	4.6	100.0					60.6	28.8	10.6	100.0
TF2	S. horticulture	29.6	25.5	44.9	100.0	29.9	24.0	46.1	100.0	32.3	24.2	43.5	100.0	47.4	25.9	26.7	100.0
TF3	S. permanent crops	33.9	29.4	36.6	100.0	46.9	31.6	21.5	100.0	32.5	35.0	32.5	100.0	52.1	26.2	21.7	100.0
TF4	S. grazing livestock	49.5	29.0	21.5	100.0	62.5	30.0	7.5	100.0	63.1	30.3	6.6	100.0	74.4	17.1	8.5	100.0
TF5	S. granivore	43.1	36.4	20.5	100.0	59.8	33.7	6.5	100.0	28.6	45.7	25.7	100.0	59.0	18.6	22.4	100.0
TF6	Mixed cropping	38.6	34.4	27.0	100.0	50.5	46.8	2.7	100.0	35.4	20.3	44.3	100.0	54.2	32.6	13.2	100.0
TF7	Mixed livestock	52.8	31.0	16.2	100.0	61.6	35.9	2.5	100.0	65.4	26.9	7.7	100.0	69.1	16.9	14.0	100.0
TF8	Mixed crops-livestock	49.6	35.6	14.8	100.0	59.2	37.8	3.0	100.0	67.3	26.9	5.8	100.0	57.8	29.8	12.3	100.0

% Decreased > % Increased

> 50%

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

It is noted that the percentage of farms increasing their area is always greater than the percentage of farms that have reduced it (with the exception of farms located in regions adopting the model SPS regional specialised in permanent crops and in granivores, however keeping in mind that results for the Regional model should be treated with caution).

In the group of regions applying the SAPS model, over 50% of total farms have increased their UAA across all farm types (except for farms specialised in horticulture), with a peak over 70% for specialists grazing livestock. A similar situation is found in the regions implementing the Hybrid model (only exceptions are specialist horticulture and permanent crops farms). On the other hand, in the group of regions applying the Historical model, the percentage of farms that have increased their UAA was over 50% only for the group of mixed livestock farms.

In no case did farms keeping UAA unaltered exceed 50% of the total. The percentage of these farms is in general higher for those specialised in horticulture and (to a lesser extent) in permanent crops. In the group of regions applying the Hybrid model, the percentage of these farms is very low compared to other models in nearly all farm types.

The analysis of individual farm data of the FADN constant sample have also made it possible to calculate the percentage variation in average farm size for groups of farms that have increased or decreased UAA from 2004 to 2009.

Tab. 71 - Average UAA of farms with land that have increased/decreased UAA, and % variation from 2004 to 2009, by TF and by model of implementation (Ha)

			SPS Historical				SPS Hybrid				SPS Regional				SAPS			
			Incr	Decr	Unch	Total	Incr	Decr	Unch	Total	Incr	Decr	Unch	Total	Incr	Decr	Unch	Total
TF1	S. field crops	UAA 2004	75.4	74.5	58.8	72.4	183.2	258.2	119.7	211.1					185.9	334.4	67.1	216.1
		UAA 2009	88.8	65.4	58.8	75.5	210.9	235.9	119.7	217.0					238.1	292.6	67.1	235.7
		Δ %	17.8	-12.2	0.0	4.3	15.2	-8.6	0.0	2.8					28.1	-12.5	0.0	9.1
TF2	S. horticulture	UAA 2004	9.4	10.5	4.5	7.5	17.1	15.3	1.8	9.6	4.4	5.6	3.7	4.4	8.3	16.1	3.3	9.0
		UAA 2009	12.8	8.3	4.5	7.9	27.3	12.2	1.8	11.9	6.6	4.7	3.7	4.9	14.3	12.2	3.3	10.8
		Δ %	35.7	-20.9	0.0	5.8	59.9	-20.1	0.0	24.1	50.8	-16.2	0.0	11.4	72.0	-24.0	0.0	20.5
TF3	S. permanent crops	UAA 2004	19.6	22.7	13.9	18.4	16.5	24.5	15.3	18.8	6.5	6.9	6.2	6.5	17.5	32.1	13.2	20.4
		UAA 2009	24.5	18.0	13.9	18.7	19.8	20.8	15.3	19.1	7.8	6.1	6.2	6.7	24.2	25.9	13.2	22.3
		Δ %	25.2	-20.6	0.0	1.6	20.1	-15.4	0.0	1.9	18.6	-10.8	0.0	2.1	38.4	-19.3	0.0	9.2
TF4	S. grazing livestock	UAA 2004	61.2	72.1	91.9	71.0	99.3	114.5	93.8	103.5	23.6	18.1	4.0	20.7	61.5	372.7	49.4	113.6
		UAA 2009	76.8	58.7	91.9	74.8	118.4	104.7	93.8	112.5	30.3	15.6	4.0	24.2	81.1	323.1	49.4	119.7
		Δ %	25.4	-18.5	0.0	5.4	19.3	-8.6	0.0	8.7	28.3	-13.8	0.0	16.8	31.9	-13.3	0.0	5.4
TF5	S. granivore	UAA 2004	27.7	26.0	17.2	24.9	71.2	54.8	21.2	62.4	15.3	4.4	2.0	6.9	33.6	41.4	25.7	33.3
		UAA 2009	39.2	21.2	17.2	28.1	98.6	46.8	21.2	76.1	22.9	3.5	2.0	8.7	45.8	35.2	25.7	39.3
		Δ %	41.7	-18.5	0.0	12.9	38.4	-14.5	0.0	21.9	50.0	-20.7	0.0	25.6	36.2	-15.1	0.0	18.1
TF6	Mixed cropping	UAA 2004	41.0	44.6	35.2	40.7	302.4	341.8	21.8	313.3	11.8	6.4	5.7	8.0	102.1	427.4	28.6	198.4
		UAA 2009	51.6	35.1	35.2	41.5	319.5	322.5	21.8	312.9	13.9	5.9	5.7	8.7	119.9	394.2	28.6	197.2
		Δ %	25.8	-21.2	0.0	2.1	5.7	-5.6	0.0	-0.1	18.1	-8.5	0.0	8.1	17.5	-7.8	0.0	-0.6
TF7	Mixed livestock	UAA 2004	55.7	65.0	64.9	60.1	113.3	112.6	36.7	111.1	23.2	12.2	3.7	18.7	29.0	181.1	19.5	53.3
		UAA 2009	69.1	49.9	64.9	62.5	128.1	104.5	36.7	117.4	31.3	10.2	3.7	23.5	35.8	161.1	19.5	54.7
		Δ %	24.0	-23.3	0.0	4.0	13.1	-7.2	0.0	5.6	35.0	-16.2	0.0	25.5	23.7	-11.1	0.0	2.6
TF8	Mixed crops-livestock	UAA 2004	90.0	86.4	91.8	89.0	200.9	309.4	114.6	239.4	24.7	19.6	11.1	22.5	134.9	528.6	29.8	239.4
		UAA 2009	106.8	73.8	91.8	92.8	230.2	286.3	114.6	248.0	33.3	17.1	11.1	27.6	157.7	478.6	29.8	237.6
		Δ %	18.7	-14.6	0.0	4.3	14.6	-7.5	0.0	3.6	34.9	-12.9	0.0	22.7	16.9	-9.5	0.0	-0.7

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

[206] This analysis does not include farms without land, whose values would have altered the results.

First of all, the data analysis confirms the existence of different structural farm characteristics according to specialisation (TF) and/or location:

- in all groups of regions aggregated according to the SFP implementation model, farms specialising in horticulture and in permanent crops are much smaller in size (on average) than those belonging to other TF
- in the regions adopting the Hybrid model and the SAPS, the average size of farms is considerably higher than that of farms located in regions implementing the Regional and Historical models (except for farms specialised in horticulture). This is ascribable to the presence of large-sized farms in the eastern areas of Germany (hybrid model) and, in general, in eastern Europe (SAPS model).

Having said that, analysis of the table shows some other interesting aspects.

In general, the average UAA for all farms (i.e. column Total) has risen[207]. Accordingly, the increase in the UAA of farms that have expanded in size is greater than the fall in farms downsizing (as borne out by % variations). It is thus possible to assume that the former have also acquired land from farms that ceased operations in the period from 2004 to 2009.

Farms specialised in horticulture have increased their size to a greater extent (on average), with an increase of over 50% in all models except for the Historical model. Nevertheless, this is also the type of farming for which the biggest area decreases were recorded (about -20% for all models). Horticulture farms thus appear to be among those most affected (on average) by structural change in terms of size. Farms specialised in granivores also recorded a high augmentation of farms' size. On the contrary, farms specialised in permanent crops show an important diminution of farms' size.

Farms that decided not to change their size are those of smaller size (in some cases much smaller) compared with farms that have increased or decreased their size[208]. It is therefore likely that for these farms size represents a strategic constraint. In other terms, these are farms whose size does not allow a further reduction without this implying a growth in unit costs (with a consequent rise in inefficiency), but for which a (modest) increase in farming area does not significantly change the farm's profitability (i. e. does not allow economies of scale).

Farms that decided to decrease their size have in most cases a larger size compared with farms that have increased or kept their size unaltered. This phenomenon concerns the groups of farms located in regions implementing the SAPS (all types of farming) and to specialists granivores and mixed crops-livestock farms located in the regions adopting the Historical and the Hybrid models. On the other hand, most groups of farms that have enlarged have a size (on average) between that of farms that have downsized and that of farms that have not altered their size. In short (with a few exceptions), a general rule appears to be applicable here: UAA farms decreased > UAA farms increased. There thus appears to be a process of structural adjustment which leads (on average) to convergence towards an "intermediate" farm size. This size does not however appear to be uniform, as it will be influenced by the context in which farms operate.

10.6.4.2 Changes in land allocation of farms adopting different size strategies

To complete our analysis of land use by farms in the EU FADN constant sample 2004-2009, we studied for each type of farming whether and to what extent there are significant differences in behaviour between three groups of farms: farms that have chosen a size expansion strategy (*Increased group*), farms that have decided to downsize (*Decreased group*) and farms that have kept their size unaltered (*Unchanged group*).

First, we analysed land use variation for each group of farms by sector (all farms belonging to each TF in 2004). Changes in land use were measured applying the same method used in § 10.5.3: the areas of different crop classes in 2004 and 2009 are compared, with total UAA for 2004 =100.

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[207] Except for: farms specialised in mixed cropping and located in the group of regions adopting the CAP hybrid model; farms specialised in mixed cropping and in mixed crops-livestock located in SAPS area.

[208] With the exception of farms specialized in grazing livestock, mixed livestock and mixed crops-livestock located in the regions adopting the historical model.

Then, we analysed land use variation in percentage (i.e. the difference between the percentage share of each crop class in 2009 and in 2004). This percentage value is calculated by setting total UAA in 2004 and in 2009 =100. This indicator thus shows land use choices irrespective of UAA variations, i. e. variations regarding the share of crops classes, and not absolute variations[209].

The analysis highlights some relevant general aspects.

- In the initial situation (2004), the composition of land use is quite similar for the three groups of farms in each sector, even though there are some exceptions (see below the results by TF). Thus, in 2004 crop structure was (on average) quite uniform and defined by farm specialisation, having nothing to do with the size of the farm.
- In the initial situation (2004), in TF Specialist field crops, Mixed cropping, Mixed livestock and Mixed crops-livestock, the percentage of Fallow land and set-aside is significantly greater in the group of farms that have not changed their UAA (from 9.5% to 13% of total UAA, more than double that of the other two groups). This would imply that farms belonging to this group are, in addition to being relatively smaller, (see § 10.5.5.1), also those less involved in productive activities. In short, less dynamic and less market-oriented farms.
- UAA in industrial crops is the only category that has always decreased, in all TF and all groups of farms in which it had been present in 2004. The effect of the introduction of SPS/SAPS has thus been uniform for this class of crops, something that does not happen in other classes.
- UAA for livestock grazing and UAA for Oilseeds & protein crops has grown slightly in almost all TF and almost all groups of farms, while changes for cereals are more varied.
- UAA for Vegetables & Potatoes has grown slightly in almost all TF and almost all groups of farms (except for the *Unchanged group* of TF Specialist field crops and TF Specialist horticulture, and for the *Increased group* and *Decreased group* of TF Specialist permanent crops. On the other hand, UAA trends for Permanent crops have been more varied.
- UAA for Fallow land & set-aside has diminished slightly everywhere, with the exception of the *Increased group* in TF Specialist horticulture and TF Specialist permanent crops, and in the *Unchanged group* in TF Specialist permanent crops and TF Mixed crops-livestock. It is noted that, in general, this decrease has contributed to the relative growth of UAA for livestock grazing and UAA for cereals and for Oilseeds & protein crops.

Looking at each TF, the following may be noted:

- TF Specialist field crops: in 2004 no significant difference was noted between the Increased group and Decreased group. In the Unchanged group there was a higher percentage of UAA for set-aside and a lower percentage for Oilseeds compared with the other two groups. In 2009 there was a significant (relative) growth in areas dedicated to oilseeds and livestock feeding, with a significant fall for industrial crops and set-aside in all groups. UAA for cereals rose only for the Unchanged group, and fell for the other groups. In short, regardless of farm size strategies, the decoupling of aid and abolition of compulsory set-aside have generated very similar behaviours for all three groups.
- TF2 Specialist horticulture: in 2004 UAA in Vegetables & potatoes was significantly higher in the Increased group (45%) compared with the other two groups, in particular Unchanged (30%). On the other hand, in the latter group the portion dedicated to "Other UAA" (31%) was considerably higher in permanent crops (10%). In 2009 UAA in Vegetables & potatoes had lost some of its share in the Increased group (-6 percentage points) in favour of the relative growth of cereals and oilseeds. In this group, therefore, the increase in farm size was accompanied by a diversification strategy towards less intensive arable crops. A similar but less drastic strategy was adopted in the Decreased group. On the other hand, in the Unchanged group there was a slight increase in UAA for Vegetables & potatoes, chiefly fuelled by a weakening of Other UAA.
- TF3 Specialist permanent crops: in this case too, in 2004 there was no appreciable difference between the Increased and Decreased groups: UAA in permanent crops was around 64-66% and around 14% in cereals. In the Unchanged group there was a higher proportion of UAA in

[209] In other words, positive percentage variations show an increase in UAA of crop *i* that is more than proportional to the increase in total UAA for the **Increased** group, and a less than proportional increase in relation to the reduction in total UAA for the **Decreased** group. Vice versa, with regard to negative variations. In the case of the **Unchanged** group percentage variations are absolute.

permanent crops (over 75%) and a lower proportion in cereals (8.3%). In 2009 UAA in permanent crops had lost some of its share in the Increased group (-4.2 points) in favour of the relative growth of livestock feeding and fallow land. In this group, therefore, the increase in farm size was accompanied by farm extensification. In the other two groups changes were rather limited. The relative decrease in cereals in the Decreased group points to a strategy towards a greater focus on activities that determine farms' belonging to this TF.

- TF4 Specialist grazing livestock (group of farms with UAA): in 2004 UAA for livestock feeding was dominant in all three groups, more so in the Unchanged group (92%) and less in the Increased group, in favour of a greater presence of cereals. The Decreased group lay in the middle. In 2009 land use changes were extremely modest in all three groups, and practically absent in the Unchanged group. Some relative increases (cereals and/or livestock feeding) were brought about through the drop in UAA for Set-aside. In short, area variations (in the first two groups) helped to maintain the same composition of land use.
- TF5 Specialist granivore (group of farms with UAA): in 2004 UAA for cereals was dominant in all three groups (> 65%), more so in the Increased group (73%). At the same time, the amount of land set aside for livestock feeding was greater in the Unchanged group. In 2009 there was a significant drop, in all three groups, for UAA in Set-aside, but also for Vegetables & potatoes and Industrial crops. This was accompanied by a relative increase in UAA for livestock feeding and oilseeds. Cereals raised their relative share in the Decreased group, whilst it fell in the other two groups. In short, very similar strategies were implemented in all three groups, leading to further specialization in livestock breeding activities.
- TF6 Mixed cropping: in 2004 there were small differences between the Increased and Decreased groups: in both cases over 80% of UAA was used for cereals, oilseeds and livestock feeding. Land use distribution was very different for the Unchanged group. The three mentioned crop classes occupied only 58% of UAA, while there were large shares for permanent crops (23%), Vegetables & potatoes (6%) and Fallow land & set-aside (9.5%). This group thus appears to be (on average) more diversified than the other two, although there are some contradictions (greater presence of intensive farming, greater presence of Set-aside). In 2009 the first two groups tended to reinforce their specialisations, with a further relative increase of UAA for the three crop classes. On the other hand, the Unchanged group showed only small increases of UAA for livestock feeding and for permanent crops, and a slight decrease for other classes.
- TF7 Mixed livestock: The specific economic orientation of farms in this group leaves little room for diversification: available UAA in 2004 was used almost exclusively for the production of fodder crops for granivores (cereals) and for grazing livestock (livestock feeding) and of Oilseeds & Protein crops. Worthy of note is the large presence of Fallow land & set-aside in the Unchanged group (11.2%). Results for 2009 show a further relative increase (in all three groups) of land used for fodder crops and oilseeds, due to the use of previously Set-aside land and the quasi disappearance of other crop classes (vegetables & potatoes, etc.). In this context however, there was a relative increase in UAA for livestock feeding, accompanied by a fall in UAA for cereals in the Increased and Unchanged groups, and vice versa in the Decreased group. This appears to be justified by different livestock trends: a relative increase for granivores in the Decreased group and grazing livestock in the Increased and Unchanged groups.
- TF8 Mixed crops-livestock: Similarly to TF7, in this case too available UAA in 2004 was used almost exclusively for the production of fodder crops and cereals in all three groups. UAA for oilseeds acquired a relevant share in the first two groups, while it was less relevant in the Unchanged group. On the other hand, in the latter group the portion of Fallow land & set-aside over total UAA was particularly high (13%). Other crop classes were negligible. In 2009 there was a further relative increase in UAA for livestock feeding and for oilseeds, while areas for cereals increased only in the Decreased group. In this case too, the small amount of UAA for vegetables and industrial crops reduced further in 2009. It is noted that in the first two groups most of the areas that had increased in size was fuelled by the large reductions in UAA for Fallow land & set-aside. On the other hand, the share of UAA for Fallow land & Set-aside remained constant at 13% in the Unchanged group.

10.6.4.3 Indicator resulting from the CATI survey

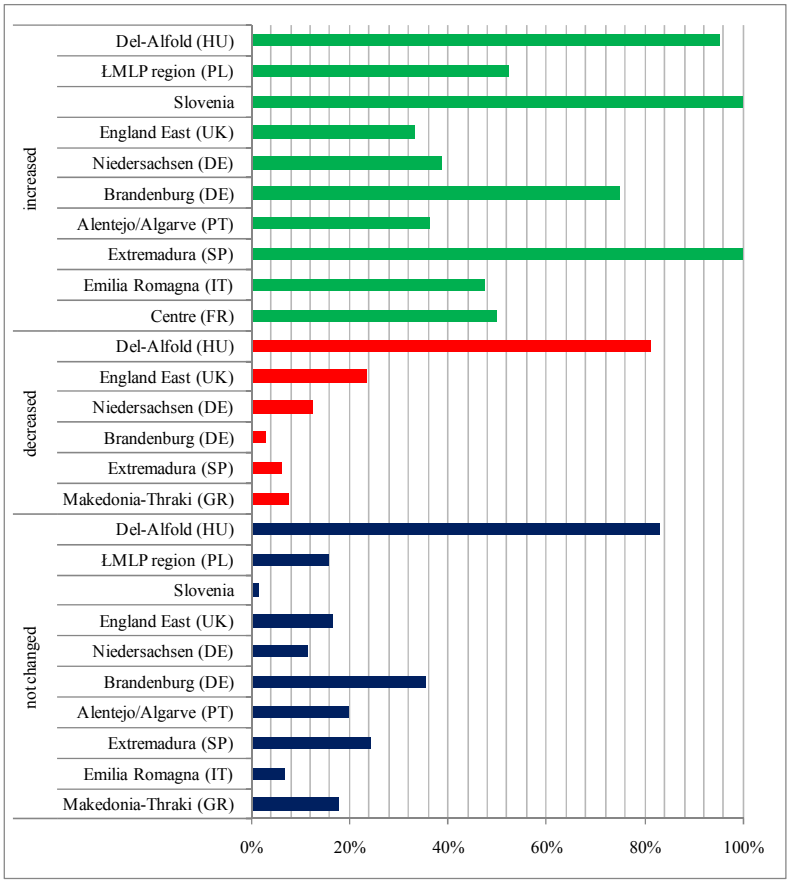
The statistical analysis developed in the previous sections has compared farm data in 2004 and 2009 and has studied changes to production strategies (before and after the implementation of the CAP reform in the EU15 regions, before and after the application of CAP in the EU10 regions). The time horizon of the CATI survey is limited to recent years, when the new system of direct payments was fully implemented.

About a third of the interviewees affirmed that in the recent years direct payments have influenced their decisions concerning farm size (in terms of agricultural area or animals) and/or production choices. Hungary (Del-Alfold region) differs from all other regions with a much higher percentage (86.7% of respondents), followed by the Portuguese region of Alentejo/Algarve with 43.8%. At the other extreme, the region Centre of France (13.8%).

In the vast majority of cases (81,9%) farmers stated that their production choices were indifferent to direct payments. This result is confirmed when looking at SFP implementation models, despite some dissimilar results at regional level. The group of regions implementing the SAPS shows a strong dichotomy: 100% of respondents in the Polish region exclude that direct payments have influenced their production choice in the last years, 63.3% of respondents in the Hungarian region affirms the contrary). Concerning the Historical model, in Alentejo/Algarve and in Emilia Romagna the influence of direct support on production choices is relatively stronger.

With regard to the decisions concerning farm size, the importance attached to direct payments is greater in the group of farms that have adopted expansion strategies (56%)[210]. Also, a part of farms that have kept unchanged or have decreased their size represents an effect of direct payments on that decision. The following figure shows the distribution at regional level.

Fig. 84 - Farmers stating that their decision on farm size were influenced by direct payments (% of the total number of respondents, by region and size strategy)



Source: CATI survey

[210] The percentage is high in all regions (except for Makedonia-Thraki, Greece, where, however, only 3 out 90 farms have increased their size in recent years; both farms regardless direct payments).

Many farmers have also pointed out that direct aid provide support of a financial nature, "direct aid has improved our financial situation" (27% of farms stating that their decision about farm size were influenced by direct support) "has improved our credit" (10% of farms stating that their decision about farm size were influenced by direct support and 21% of respondents having increased farm size stating that their decision about farm size were influenced by direct support). Others declare that direct payments have represented a safety net in the face of conjunctural difficulties, or more specifically, they helped maintain the farm's business or to limit the contraction of farm activities.

Actually, according to the CATI survey results, direct aid seem today to play a minor role on farms' production decisions. On the other hand, they appear to be an opportunity for farm investments and a safety net for farmers. These results seem consistent with the nature of the current system of direct payments (mainly decoupled), aimed at providing basic income support for farmers not linked to production (type of product, animal species, quantity).

10.7 Analysis of the effects of changes in farms' production choices on labour and capital intensity

To complete the answer to the evaluation question, we studied whether the observed changes in farms' specialisation, subsequent to the implementation of the new direct payments system, were also related to labour/capital-saving strategies.

10.7.1 Changes in labour intensity

10.7.1.1 Methodological aspects and limits

In order to analyse whether the observed changes in the amount of labour absorbed by farms are justified by changes in land allocation or whether they (also) respond to labour-saving strategies, we have compared the real situation (variations in total hours[211] of labour empirically observed from FADN data, in absolute terms and per hectare), with a theoretical situation (variations in labour calculated applying technical parameters, in absolute terms and per hectare).

The various crop and/or livestock activities require different levels of labour hours per hectare. Technical literature has allowed us to define parameters for the main crops (hours/ha) and for the main types of livestock (hours/head). Clearly, labour needs for each crop/livestock type vary considerably depending on the context (environmental, structural and organisational) in which activities are performed. Thus, the graphs below show minimum and maximum values of labour requirements rather than average values.

Fig. 85 – Labour hours/ha levels by crop types

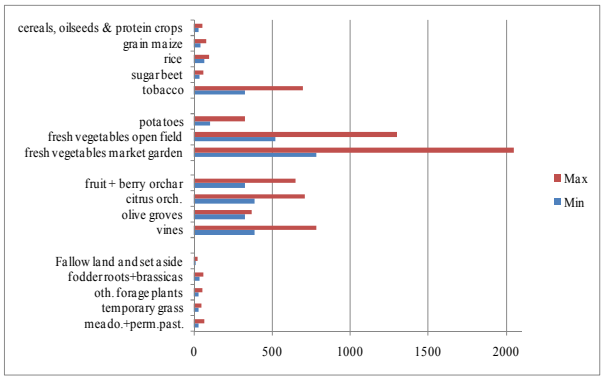
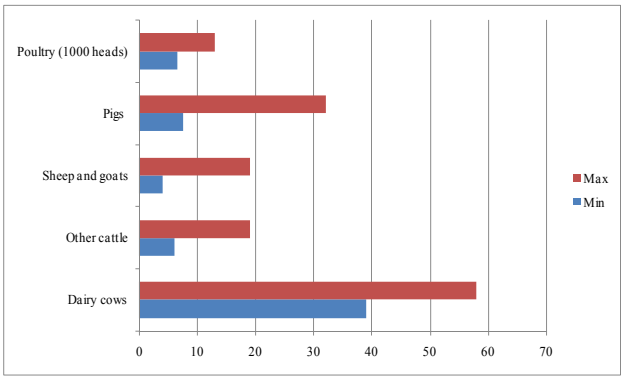


Fig. 86 - Labour hours/head by type of livestock



Source: Various technical literature[212]

[211] FADN variable SE011: Labour input (time worked in hours by total labour input on holding).

[212] Tables annexed to Rural Development Plans of some regions/Member States.

For instance, the amount of labour required per hectare for fresh vegetables open field is 50 times the minimum required for cereals, oilseeds & protein crops[213]. Another example, the amount of labour required per hectare of tobacco is 27 times the minimum required for cereals, oilseeds & protein crops.

In order to evaluate the effects of land use changes on "theoretical" labour needs, we have applied the theoretical minimum and maximum labour requirements (hours/ha) to the total UAA of each crop (and calculated for each crop class). The same calculation was carried out for livestock types (and therefore for total livestock). The total sum of theoretical labour requirements (crops and livestock) was used to obtain the theoretical number of hours (minimum and maximum) for the years 2004 and 2009. The percentage variations of these sums (minimums and maximums), and the average of these variations were then calculated.

The calculations were done only for farms with UAA >0. They have also been applied to each TF and to each model of implementation, and to total TF and total EU. Finally, for each TF and each implementation model, the calculation was also applied to groups of farms that have increased, decreased or kept unaltered UAA from 2004 to 2009.

In order to take into account structural changes in terms of farm size, we have also calculated, for each of the above groups, the average number of hours per hectare (total hours[214]/total UAA) and percentage variations between 2009 and 2004.

However, bearing in mind:

- the great variability of the geographical, structural and organisational contexts in which farms belonging to each TF and to each model of implementation operate;
- the measurement of labour in agriculture is rarely of good quality (in particular when comparing to theoretical values),

the results of the analysis must be treated with due caution.

10.7.1.2 Results of the analysis

As already seen, the utilised agricultural area of each sector (and thus the total UAA of the whole sample) rose from 2004 to 2009. Moreover, the decrease in "theoretical" labour demand caused by the fall in industrial crops was offset by the farming of a portion of previously set-aside land (except for farms specialised in permanent crops) and/or by the increase of total livestock (with the exception of mixed cropping farms).

The effect of these factors was a growth in "theoretical" (i.e. estimated) demand, in absolute terms (total no. of hours), by almost 5% in total. This increase can be seen in all types of farming with the exception of Mixed cropping.

Concerning "theoretical" unit demand (hours/ha), no significant variations were observed at EU level (+0.1%) but at TF level, situations were more varied, with increase in TF Specialist grazing livestock, Mixed livestock and Mixed crops-livestock, and decrease in other TF. However, variations (both positive and negative) appear to be modest, with the exception of horticulture farms (-8%).

The situation is much more diverse when looking at the SFP models of implementation. EU10 Member States present negative variations, both for the total and for most TF: for the group of regions applying the SAPS model, there is a drop in labour per hectare in all types of farming except for TF Specialist grazing livestock; for the Regional model in five types of farming (out of seven). On the other hand, in the EU15 regions (both groups of regions: Hybrid and Historical models) theoretical demand variations are positive as a whole and in six types of farming (except for farms specialised in horticulture and in permanent crops). In general, these variations are more significant in the group of regions applying the Hybrid model.

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[213] It is noted that in some cases (e.g. TF2 Specialist horticulture) a portion of the agricultural area relates to "other crops". These also include flower and nursery activities, occupying from 1,600 (nursery) to 5,600 (production of potted plants) hours/year per hectare.

[214] Including work for livestock activities.

Tab. 72 - % variations in observed and in estimated work hours, total and per hectare, by TF and by model of implementation

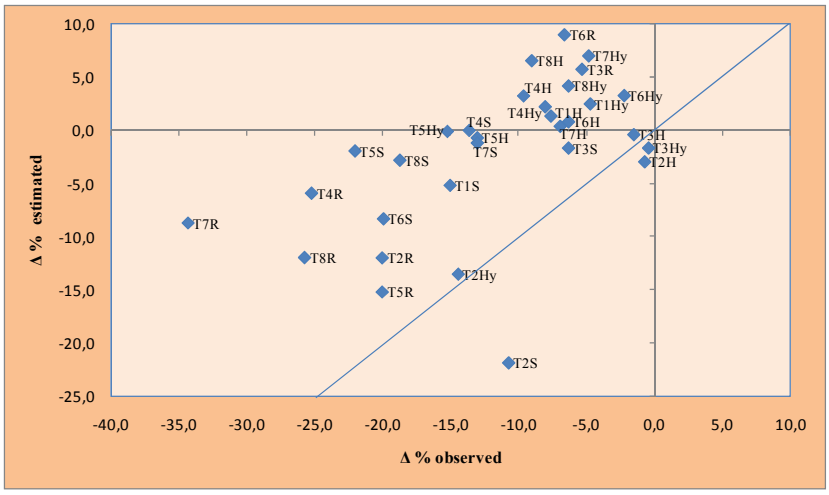
		Total hours					Hours/ha				
		Historical	Hybrid	Regional	SAPS	Total	Historical	Hybrid	Regional	SAPS	Total
TF1	Δ % observed	-3.6	-2.1		-7.3	-5.1	-7.6	-4.7		-15.0	-10.3
	Δ % estimated	5.7	5.3		3.4	4.7	1.3	2.5		5.2	1.1
TF2	Δ % observed	5.0	6.2	-10.9	-7.6	5.4	-0.7	-14.4	-20.0	-10.7	-6.5
	Δ % estimated	2.7	7.3	2.0	5.9	3.6	2.9	13.5	12.0	21.9	8.1
TF3	Δ % observed	0.1	1.5	-3.3	2.3	0.5	-1.5	-0.4	-5.3	-6.3	-1.8
	Δ % estimated	1.2	0.2	8.0	7.3	1.6	-0.4	-1.6	5.8	-1.7	-0.7
TF4	Δ % observed	-4.7	-0.1	-12.6	-9.0	-4.9	-9.6	-8.0	-23.2	-13.6	-10.7
	Δ % estimated	8.8	11.1	9.9	5.4	9.0	3.2	2.2	-5.9	0.0	2.3
TF5	Δ % observed	-1.7	3.4	0.4	-8.8	-4.6	-13.0	-13.2	-20.0	-22.0	-19.0
	Δ % estimated	12.2	21.8	6.4	14.6	15.4	-0.7	-0.1	-15.2	-1.9	-2.0
TF6	Δ % observed	-4.4	-2.3	0.9	-20.3	-13.0	-6.3	-2.2	-6.6	-19.9	-13.2
	Δ % estimated	2.9	3.1	17.8	-8.9	-1.8	0.8	3.3	9.0	-8.3	-1.9
TF7	Δ % observed	-3.2	0.5	-17.5	-10.8	-8.0	-6.9	-4.8	-34.3	-13.0	-11.3
	Δ % estimated	4.4	13.0	14.6	1.4	5.3	0.4	7.0	-8.7	-1.2	1.6
TF8	Δ % observed	-5.0	-2.9	-8.9	-19.3	-13.9	-9.0	-6.3	-25.7	-18.7	-15.2
	Δ % estimated	11.2	7.9	8.0	-3.5	3.0	6.6	4.2	-12.0	-2.8	1.4
TOTAL	Δ % observed	-2.1	-0.2	-9.1	-13.0	-6.4	-6.3	-5.0	-22.2	-16.5	-10.5
	Δ % estimated	5.6	8.3	9.5	0.4	4.7	1.0	3.1	-6.4	-3.6	0.1

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3 and technical literature

The comparison of "theoretical" and actual variations reveals a number of surprises. Focusing comments to variations of hours per hectare, and bearing in mind the limitations mentioned in the previous paragraph, it is noted that:

- In the real situation, variations are always negative, in all sectors and in all implementation models. In general, for the EU10 regions - Regional and SAPS models the fall in hours/ha is larger compared with those observed for the EU15 regions - Historical and Hybrid models.
- Where theoretical demand is higher, actual demand is in decline. In these cases, therefore, there is inconsistency between theoretical evolutions and reality.
- In almost all cases where theoretical demand decreases, real demand reduces even more[215]. In some of these cases, the difference between the two variations reaches particularly relevant magnitude[216].

Fig. 87 - % variations in estimated and observed man hours per hectare, by TF and by model of implementation



H=Historical; Hy= Hybrid; R= Regional; S= SAPS

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3 and technical literature

[215] With the exception of TF Specialist horticulture of the Regional and Historical models, and TF3 Specialist permanent crops of the Hybrid model.

[216] TF5 Specialist granivore. On the other hand, differences between real and estimated variations are more limited in TF2 Specialist horticulture and TF3 Specialist permanent crops.

In conclusion, the analysis highlighted (for the whole sample, each sector and each model of implementation) a drop in labour that does not appear to be justified only by a change in land use and in the size of livestock. Therefore other circumstances (other strategies) must have had an influence on this phenomenon, hypothetically:

- A process towards replacement of farm labour with capital (machinery) and/or outsourcing of some phases of the production process (e.g. greater use of external contractors).
- A process towards extensification of production processes (with reduction of farm labour and of capital), possibly following a change in the intended use of crops (e.g. cereals/oilseeds for human/animal consumption towards use for energy production).
- The existence of forms of hidden unemployment and / or under-utilisation of machinery capacity in 2004, which were progressively eliminated in the following years[217] and / or absorbed through an increase of farm size[218].

10.7.2 Changes in capital intensity (machinery)

10.7.2.1 Methodological aspects and limits

With regard to machinery, it has not been possible to identify technical parameters in the literature (hours of use/hectare per crop type) that are as accurate as those relating to labour. Therefore, it has not been possible to estimate theoretical variations depending on land use changes.

Furthermore, for each farm EU FADN gives only the balance sheet value of machinery assets (variable SE455)[219], and not physical quantities. Variations in the value of capital assets may thus be used as a *proxy* for the physical amount of capital, but to the extent that the nominal value is given in real terms.

It is recalled here that, with regard to machinery, FADN instructions require: i) an assessment of capital and its depreciation at replacement value; ii) the opening valuation must be equal to the closing valuation of the previous year.

Concerning machinery, for the reasons and with limitations already mentioned in EQ4, we have decided to present the analysis based on the original FADN data.

10.7.2.2 Results of the analysis

The diagrams below provide two types of information: i) capital intensity per hectare in 2004 for each TF of each implementation model; ii) percentage variations of these intensities from 2004 to 2009.

To facilitate interpretation of results we have produced two diagrams comprising two TF groups: the first consisting of TF1 Specialist field crops, TF 4 Specialist grazing livestock, TF6 Mixed cropping, TF7 Mixed livestock, TF8 Mixed crops-livestock; the second of TF2 Specialist horticulture, TF3 Specialist permanent crops, TF5 Specialist granivore.

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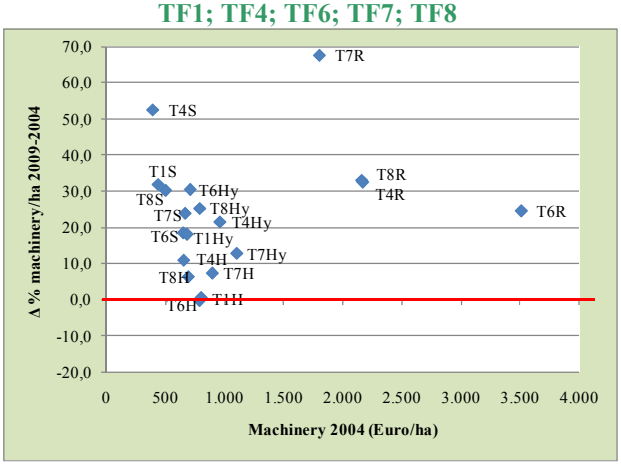
[217] At least in the past in former big cooperatives and state farms in eastern EU countries. The existence of excess labour in some MS of the EU12 was also highlighted in the "Evaluation of income effects of direct support" – Agrosynergie, May 2011. Such excess labour was the effect of social policy implemented through maximization of employment.

[218] In these cases the "extensification" of production processes is only apparent.

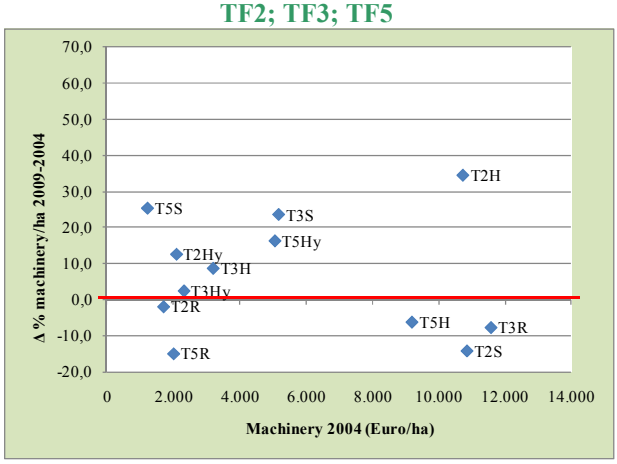
[219] Variable SE455 represents the Closing valuation for machinery. It is the result of the following algebraic sum: CV= Opening valuation + Investment + Subsidies for machinery – Sales – Depreciation.

Fig. 88 - Machinery[220] levels/ha in 2004 and % variation 2009/2004, by TF and by model of implementation

TF1; TF4; TF6; TF7; TF8



TF2; TF3; TF5



H=Historical; Hy= Hybrid; R= Regional; S= SAPS

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3 and technical literature

In the first five sectors (Specialist field crops, Specialist grazing livestock, Mixed cropping, Mixed livestock, Mixed crops-livestock), capital intensity (i.e. the intensity of machinery use per hectare) was between 400 and 1,500 Euros/ha in 2004. Exceptions are farms located in the Regional model (in all five sectors), whose average values are more than double relative to farm types of other SFP models; this suggests that there is surplus capitalisation in farms within this model which, as highlighted previously, are on average of a smaller size[221]. Farms located in regions applying the SAPS have lower average values (thus there would be under-capitalisation in these farms that have large average size). With regard to EU15, farms located in the regions applying the SPS Hybrid model show, on average, a slightly higher level of capitalisation than those located in the regions applying the Historical model.

In the second group (Specialist horticulture, Specialist permanent crops, Specialist granivores) there is a clear difference between horticulture farms, with values over 10,000 Euro/ha (with the exception of the SAPS model) and other farm types, where machinery is valued between 2,000 and 5,000 Euro/ha. In this case too, however, farms located in regions implementing the SPS Regional model have higher values than other models, and farms located in regions implementing the SAPS have the lowest levels (on average).

With regard to the evolution of capital intensity between 2004 and 2009, the analysis showed that:

- Specialist field crops, Specialist grazing livestock, Mixed cropping, Mixed livestock, Mixed crops-livestock: In all cases (TF/region) the intensity of capital increased between 2004 and 2009, with only one exception. Farms located in EU10 regions (both SAPS and Regional model) display the highest increase, with peaks of 68% for mixed livestock farms in the Regional model regions and 53% for farms specialised in grazing livestock in SAPS[222]. On the other hand, farms located in the regions implementing the Historical model displayed the least increase, no more than 11%; this model also had the only case of a slightly negative variation (Specialist field crops).
- Concerning Specialist horticulture, Specialist permanent crops, Specialist granivores, the picture is more varied: the Historical and SAPS models show quite a large increase in capital intensity for farms specialised in horticulture and in granivores (in any case below 35%), and a decrease for farms specialised in permanent crops (with a lowest point of -15% for the SAPS model). On the other hand, the Hybrid and Regional models showed a large increase for farms specialised in permanent crops (with a highest point of 23% for the Regional model), and a decrease (or only a very slight increase) for farms specialised in horticulture and in granivores.

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220 Variable SE455: Machinery (value of the machinery assets in the closing valuation).

221 Nevertheless, we remind that the size of the sample of farms for the regional model is small, and internal variability very large. The results for this model should thus be treated with due caution

222 We note that the high positive variation in TF of the SAPS model regions is in keeping with the low level of intensity of machinery assets per hectare in 2004. A capitalisation process appears to be under way to reduce the gap with EU15 Member States (Historical and Hybrid models). The large increase in TF of the Regional model, which already appear to have surplus capitalisation, is difficult to understand.

10.8 Global analysis of farm strategies regarding the three factors of production

In previous sections we have seen that between 2004 and 2009 farms in the EU FADN constant sample made choices bearing effects on their land, labour and capital (machinery) intensity. In this section we analyse the variations of these three production factors considered as a whole, in order to identify strategic behaviour in some way related to the effects of CAP changes (i.e. the decoupling of direct support for EU15/ introduction of direct support for EU10).

10.8.1 Method adopted

All holdings with UAA of the FADN 2004-2009 constant sample were classified and grouped together based on variations (between 2004 and 2009) of the following parameters:

- UAA: holdings with increased (↑), decreased (↓) or unchanged (=) UAA
- Machinery (M): holdings with increased (↑) or decreased (↓) machinery, in absolute terms
- Hours (H): holdings with increased (↑) or decreased (↓) work hours, in absolute terms
- Machinery/ha (m): holdings with increased (↑) or decreased (↓) machinery, by area unit
- Hours/ha (h): holdings with increased (↑) or decreased (↓) work hours, by area unit

In theory, for each group of holdings with increased or decreased UAA there are 16 possible combinations, defined by the increase/decrease in **M** and **H**, and by the increase/decrease in **m** and **h**. There are also 4 possible combinations for the group of holdings with UAA unchanged.

There are in all, therefore, 36 possible combinations.

In practice some of these combinations have not been adopted by any of the sample holdings. Accordingly, the number of combinations that were actually adopted was 22 (9 of which for the group of holdings with UAA Increased; 9 for the group with UAA Decreased; 4 for the group with UAA Unchanged[223]).

For ease of interpretation, each possible combination (**M** and **H)** & (**m** and **h)** was assigned identifying initials (from **Aa** to **Dd**).

The figure below shows the combinations actually analysed (blank combinations are dimmed). In particular:

Group A (from Aa to Ad in the grid) shows the combinations adopted by farms that have increased, decreased or kept unchanged UAA and at the same time increased Machinery and Hours in absolute terms. Group A includes those combinations of holdings that have undergone variations in machinery/ha and hours/ha: from combination Aa (increase in both) to combination Ad (decrease in both).

Group B as a whole (from Ba to Bd in the grid) shows the combinations adopted by holdings that have increased, decreased or kept unchanged UAA and at the same time increased Machinery, but decreased Hours in absolute terms. This group B includes combinations of holdings that have undergone changes in machinery/ha and Hours/ha: from combination Ba (increase in both) to combination Bd (decrease in both).

Group C as a whole (from Ca to Cd in the grid) shows the combinations adopted by holdings that have decreased, decreased or kept unchanged UAA and at the same time increased Machinery, but increased Hours in absolute terms. This group C includes combinations of holdings that have undergone changes in machinery/ha and Hours/ha: from combination Ca (increase in both) to combination Cd (decrease in both).

Finally, group D as a whole (from Da to Dd in the grid) shows the percentages of holdings that have increased, decreased or kept unchanged UAA and at the same time decreased both Machinery and Hours in absolute terms. This group D includes combinations of holdings that have undergone changes in machinery/ha and Hours/ha: from combination Da (increase in both) to combination Dd (decrease in both).

[223] In the group of holdings UAA Unchanged there are only four possible strategies (Aa; Bb; Cc; Dd), since the sign (↑ ; ↓) for absolute Machinery and Hours values must be the same as that for variations per hectare.

Tab. 73 - Machinery UAA grid of combinations; machinery and hours in absolute terms, machinery/ha and hours/ha

UAA ↑			
Aa (M↑ H↑) & (m↑ h↑)	Ba (M↑ H↓) & (m↑ h↑)	Ca (M↓ H↑) & (m↑ h↑)	Da (M↓ H↓) & (m↑ h↑)
Ab (M↑ H↑) & (m↑ h↓)	Bb (M↑ H↓) & (m↑ h↓)	Cb (M↓ H↑) & (m↑ h↓)	Db (M↓ H↓) & (m↑ h↓)
Ac (M↑ H↑) & (m↓ h↑)	Bc (M↑ H↓) & (m↓ h↑)	Cc (M↓ H↑) & (m↓ h↑)	Dc (M↓ H↓) & (m↓ h↑)
Ad (M↑ H↑) & (m↓ h↓)	Bd (M↑ H↓) & (m↓ h↓)	Cd (M↓ H↑) & (m↓ h↓)	Dd (M↓ H↓) & (m↓ h↓)

UAA ↓			
Aa (M↑ H↑) & (m↑ h↑)	Ba (M↑ H↓) & (m↑ h↑)	Ca (M↓ H↑) & (m↑ h↑)	Da (M↓ H↓) & (m↑ h↑)
Ab (M↑ H↑) & (m↑ h↓)	Bb (M↑ H↓) & (m↑ h↓)	Cb (M↓ H↑) & (m↑ h↓)	Db (M↓ H↓) & (m↑ h↓)
Ac (M↑ H↑) & (m↓ h↑)	Bc (M↑ H↓) & (m↓ h↑)	Cc (M↓ H↑) & (m↓ h↑)	Dc (M↓ H↓) & (m↓ h↑)
Ad (M↑ H↑) & (m↓ h↓)	Bd (M↑ H↓) & (m↓ h↓)	Cd (M↓ H↑) & (m↓ h↓)	Dd (M↓ H↓) & (m↓ h↓)

UAA =			
Aa (M↑ H↑) & (m↑ h↑)	Bb (M↑ H↓) & (m↑ h↓)	Cc (M↓ H↑) & (m↓ h↑)	Dd (M↓ H↓) & (m↓ h↓)

This method has been applied:

- to EU25 and to each of the Single Farm Payment implementation models (SPS Historical, SPS Hybrid, SPS Regional and SAPS)
- for EU25 and each model, to the 8 Types of Farming (TF) taken into consideration in previous chapters

Finally, in order to simplify the interpretation of results, we have grouped together the various combinations by similarity criteria. This exercise has allowed us to single out five basic strategies, naturally with variations according to the various combinations.

10.8.2 Results of analyses of combinations: variation in UAA; absolute variations in machinery and hours, variations in machinery/ha and hours/ha

10.8.2.1 Interpretation of behaviour corresponding to different combinations and frequency of holdings by EU25 and by SFP implementation model

A well-reasoned analysis of the 22 combinations has enabled us to interpret the underlying behaviour of farm holdings. Nevertheless, some combinations may hide one or two ambiguities and/or be the result of different basic motivations. So, as always in such cases, the interpretations put forward (inevitably subjective) should be treated with due caution.

The following grids (one for each choice concerning UAA: UAA increased; UAA decreased; UAA unchanged) show the behaviour of holdings for each combination adopted. Furthermore, the percentages of holdings that adopted the various combinations are given (100% = total number of holdings that have increased, decreased or kept unchanged UAA for EU25 and for each SFP implementation model).

Tab. 74 - Machinery UAA Grid of combinations concerning absolute changes to Machinery (M) and Hours (H), and variations by hectare of machinery/hectare (m) and hours/ha (h): their strategic meaning and frequency by implementation model.

a- holdings with increased UAA

UAA INCREASED (51% of total holdings with UAA)

Aa: (M↑ H↑) & (m↑ h ↑)		Ba: (M↑ H↓) & (m↑ h ↑)		Ca: (M↓ H↑) & (m↑ h ↑)		Da: (M↓ H↓) & (m↑ h ↑)	
Development of holding with intensification of all production factors (thus with intensification of production methods)	11% EU 11% Hi 14% Hy 9% Rg 11% S	NOT ADOPTED		NOT ADOPTED		NOT ADOPTED	
Ab: (M↑ H↑) & (m↑ h ↓)		**Bb: (M↑ H↓) & (m↑ h ↓)**		**Cb: (M↓ H↑) & (m↑ h ↓)**		**Db: (M↓ H↓) & (m↑ h ↓)**	
Development of holding oriented towards more capital-intensive and labour-saving production methods and/or farming	14% EU 13% Hi 17% Hy 11% Rg 14% S	Development of holding oriented towards more capital-intensive production methods and/or farming, with labour by machinery. Likely presence of hidden unemployment in 2004	18% EU 17% Hi 17% Hy 36% Rg 20% S	NOT ADOPTED		NOT ADOPTED	
Ac: (M↑ H↑) & (m↓ h ↑)		**Bc: (M↑ H↓) & (m↓ h ↑)**		**Cc: (M↓ H↑) & (m↓ h ↑)**		**Dc: (M↓ H↓) & (m↓ h ↑)**	
Development of holding oriented towards more labour-intensive production methods and/or farming	2.0% EU 2,2% Hi 1,9% Hy 1,3% Rg 1,6% S	NOT ADOPTED		Development of holding oriented towards labour-intensive techniques and/or farming, machinery replaced by labour and/or greater focus on labour-intensive farming. Likely presence of unused capacity in 2004	10% EU 11% Hi 9% Hy 7% Rg 9% S	NOT ADOPTED	
Ad: (M↑ H↑) & (m↓ h ↓)		**Bd: (M↑ H↓) & (m↓ h ↓)**		**Cd: (M↓ H↑) & (m↓ h ↓)**		**Dd: (M↓ H↓) & (m↓ h ↓)**	
Development of holding oriented towards more extensive production methods and/or towards less capital- and labour-intensive farming	6% EU 5% Hi 6% Hy 5% Rg 7% S	Development of holding size oriented towards more extensive production methods (with machinery/labour replacement) and/or towards less capital- and labour-intensive farming. Likely presence of hidden unemployment in 2004	4.7% EU 4.6% Hi 3.7% Hy 6.5% Rg 5.6% S	Development of holding size oriented towards more extensive production methods, and/or expansion of less capital- and labour-intensive farming. Likely presence of unused capacity in 2004	14% EU 15% Hi 16% Hy 9% Rg 12% S	Development of holding size with extensification of production methods and/or shift towards less capital- and labour-intensive farming. Possible outsourcing of some phases of production processes to contractors	20% EU 22% Hi 16% Hy 15% Rg 21% S

b- holdings with decreased UAA

UAA DECREASED (30% of total holdings with UAA)

Aa: (M↑ H↑) & (m↑ h ↑)		Ba: (M↑ H↓) & (m↑ h ↑)		Ca: (M↓ H↑) & (m↑ h ↑)		Da: (M↓ H↓) & (m↑ h ↑)	
Downsizing of holding, but oriented towards rise in productivity of remaining land, through more intensive production methods and/or focus on more capital- and labour-intensive farming	22% EU 21% Hi 25% Hy 21% Rg 19% S	Downsizing of holding, but oriented towards rise in productivity of remaining land and of labour, through more intensive production methods and/or focus on more capital- and labour-intensive farming. Likely presence of hidden unemployment in 2004	8% EU 8% Hi 6% Hy 3% Rg 9% S	Downsizing of holding, but oriented towards rise in productivity of remaining land and of capital, through more intensive production methods and/or focus on more capital- and labour-intensive farming. Likely presence of unused capacity in 2004	3.8% EU 4.2% Hi 2.8% Hy 4.8% Rg 3.7% S	Disinvestment of all factors, but accompanied by more intensive production methods for remaining land and/or by greater focus on more capital- and labour-intensive farming	4.1% EU 4.4% Hi 2.6% Hy 3.0% Rg 5.0% S
Ab: (M↑ H↑) & (m↑ h ↓)		**Bb: (M↑ H↓) & (m↑ h ↓)**		**Cb: (M↓ H↑) & (m↑ h ↓)**		**Db: (M↓ H↓) & (m↑ h ↓)**	
NOT ADOPTED		Downsizing of holding, but oriented towards rise in productivity of remaining land and of labour, through more capital-intensive production methods and farming, and with labour replaced by machinery. Likely presence of hidden unemployment in 2004	18% EU 17% Hi 16% Hy 22% Rg 21% S	NOT ADOPTED		Disinvestment of all factors, but accompanied by greater focus on farming suited to mechanisation	2.2% EU 2.2% Hi 1.7% Hy 3.0% Rg 2.7% S
Ac: (M↑ H↑) & (m↓ h ↑)		**Bc: (M↑ H↓) & (m↓ h ↑)**		**Cc: (M↓ H↑) & (m↓ h ↑)**		**Dc: (M↓ H↓) & (m↓ h ↑)**	
NOT ADOPTED		NOT ADOPTED		Downsizing of holding, but oriented towards rise in productivity of remaining land and of capital, with greater focus on labour-intensive farming. Likely presence of unused capacity in 2004	19% EU 19% Hi 24% Hy 15% Rg 15% S	Disinvestment of all factors, but accompanied by greater focus on more labour-intensive farming	6% EU 6% Hi 5% Hy 8% Rg 6% S
Ad: (M↑ H↑) & (m↓ h ↓)		**Bd: (M↑ H↓) & (m↓ h ↓)**		**Cd: (M↓ H↑) & (m↓ h ↓)**		**Dd: (M↓ H↓) & (m↓ h ↓)**	
NOT ADOPTED		NOT ADOPTED		NOT ADOPTED		Disinvestment of all factors, with more extensive production methods and/or shift towards less capital- and labour-intensive farming	28% EU 28% Hi8) 30% Hy 28% Rg 30% S

c- holdings with unchanged UAA

UAA UNCHANGED (19% of total holdings with UAA)							
Aa: (M↑ H↑) & (m↑ h ↑)		**Bc: (M↑ H↓) & (m↓ h ↑)**		**Cc: (M↓ H↑) & (m↓ h ↑)**		**Dd: (M↓ H↓) & (m↓ h ↓)**	
Oriented towards rise in productivity of land already available, through more intensive production methods and/or focus on more capital- and labour-intensive farming	24% EU 25% Hi 25% Hy 25% Rg 20% S	Oriented towards rise in productivity of land already available and of labour, through more intensive production methods and/or more capital-intensive farming, and with labour replaced by machinery. Likely presence of hidden unemployment in 2004	20% EU 22% Hi 19% Hy 15% Rg 17% S	Oriented towards rise in productivity of land already available and of capital, through greater focus on labour-intensive farming. Likely presence of unused capacity in 2004	27% EU 25% Hi 26% Hy 32% Rg 34% S	Disinvestment of Capital and Labour factors, with more extensive production methods and/or shift towards less capital- and labour-intensive farming	28% EU 28% Hi8) 30% Hy 28% Rg 30% S

As already mentioned, the analysis of the percentage distribution of holdings for each combination was conducted for EU25 for each Single Farm Payment implementation model and by Type of Farming (TF).

By way of example, the table below summarises results by model and for EU25 as a whole), including all TFs.

Tab. 75 - Percentage distribution of holdings by combination of UAA, machinery and hours in absolute terms; machinery/ha and hours/ha. Total EU25, and by Implementation model

Combinations		SPS Historical				SPS Hybrid				SPS Regional				SAPS				TOTAL EU			
		UAA var.			Tot	UAA var.			Tot	UAA var.			Tot	UAA var.			Tot	UAA var.			Tot
		Incr	Decr	Unch		Incr	Decr	Unch		Incr	Decr	Unch		Incr	Decr	Unch		Incr	Decr	Unch	
Aa	**(M↑ H↑) & (m↑ h ↑)**	10.8	21.3	25.4	17.7	13.7	25.1	24.8	18.6	9.5	20.6	25.2	15.6	10.6	19.0	19.6	13.8	11.4	21.7	24.3	16.9
Ab	**(M↑ H↑) & (m↑ h ↓)**	12.9			5.7	17.0			9.6	11.4			6.1	13.8			8.6	14.0			7.2
Ac	**(M↑ H↑) & (m↓ h ↑)**	2.2			1.0	1.9			1.1	1.3			0.7	1.6			1.0	2.0			1.0
Ad	**(M↑ H↑) & (m↓ h ↓)**	4.9			2.2	5.9			3.4	4.9			2.6	6.8			4.2	5.7			2.9
Tot A	**(M↑ H↑)**	**30.9**	**21.3**	**25.4**	**26.5**	**38.5**	**25.1**	**24.8**	**32.7**	**27.1**	**20.6**	**25.2**	**24.9**	**32.8**	**19.0**	**19.6**	**27.7**	**33.1**	**21.7**	**24.3**	**28.0**
Ba	**(M↑ H↓) & (m↑ h ↑)**		8.2		2.6		6.1		2.1		3.0		0.9		8.9		2.2		7.8		2.4
Bb	**(M↑ H↓) & (m↑ h ↓)**	17.1	16.7	21.6	18.1	17.0	16.4	19.1	17.0	35.6	22.4	15.0	28.0	19.8	21.3	16.7	19.8	18.2	17.6	20.4	18.4
Bc	**(M↑ H↓) & (m↓ h ↑)**																				
Bd	**(M↑ H↓) & (m↓ h ↓)**	4.6			2.0	3.7			2.1	6.5			3.5	5.6			3.5	4.7			2.4
Tot B	**(M↑ H↓)**	**21.7**	**24.9**	**21.6**	**22.7**	**20.7**	**22.5**	**19.1**	**21.2**	**42.2**	**25.5**	**15.0**	**32.4**	**25.5**	**30.2**	**16.7**	**25.4**	**22.9**	**25.4**	**20.4**	**23.2**
Ca	**(M↓ H↑) & (m↑ h ↑)**		4.2		1.3		2.8		1.0		4.8		1.4		3.7		0.9		3.8		1.2
Cb	**(M↓ H↑) & (m↑ h ↓)**																				
Cc	**(M↓ H↑) & (m↓ h ↑)**	10.6	18.8	25.2	16.8	8.6	23.5	26.0	15.3	7.2	15.2	31.8	14.0	8.8	15.3	34.2	13.8	9.6	19.1	27.0	15.7
Cd	**(M↓ H↑) & (m↓ h ↓)**	14.9			6.5	15.7			8.9	8.8			4.7	12.0			7.5	14.1			7.2
Tot C	**(M↓ H↑)**	**25.5**	**23.1**	**25.2**	**24.7**	**24.4**	**26.3**	**26.0**	**25.2**	**16.0**	**20.0**	**31.8**	**20.1**	**20.8**	**19.0**	**34.2**	**22.2**	**23.7**	**22.9**	**27.0**	**24.1**
Da	**(M↓ H↓) & (m↑ h ↑)**		4.4		1.4		2.6		0.9		3.0		0.9		5.0		1.2		4.1		1.2
Db	**(M↓ H↓) & (m↑ h ↓)**		2.2		0.7		1.7		0.6		3.0		0.9		2.7		0.7		2.2		0.7
Dc	**(M↓ H↓) & (m↓ h ↑)**		6.3		2.0		5.1		1.8		7.9		2.2		6.1		1.5		6.0		1.8
Dd	**(M↓ H↓) & (m↓ h ↓)**	21.9	17.9	27.8	22.1	16.4	16.8	30.1	17.7	14.7	20.0	28.0	18.7	21.0	18.1	29.5	21.4	20.3	17.7	28.3	21.0
Tot D	**(M↓ H↓)**	**21.9**	**30.8**	**27.8**	**26.2**	**16.4**	**26.1**	**30.1**	**21.0**	**14.7**	**33.9**	**28.0**	**22.7**	**21.0**	**31.9**	**29.5**	**24.7**	**20.3**	**30.0**	**28.3**	**24.7**
Tot farms (%)		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The following comments may be made in light of the results of these analyses:

- The frequencies calculated for all groups A, B, C and D (positive and/or negative variations of Machinery and Hours in absolute terms) are distributed quite evenly at EU25 level: each group contains around 25% of holdings in the constant sample. There is thus no concentration in a specific group.

  This global result does however conceal one or two significant differences within the groups of holdings that have increased, decreased or kept unchanged UAA and by SFP implementation model and Type of Farming. In greater detail:

  - In EU25, there was a slight prevalence of group A for holdings that increased UAA (about 33%). This prevalence is common to most TFs (in particular TF1-Specialist field crops and TF4-Specialist grazing livestock, with about 35% each); and of group D for holdings that decreased UAA (approximately 30%). This prevalence was higher in TF2- Specialist Horticulture (41%), and above average for TF1- Specialist field crops (32%), TF3- Specialist permanent crops (34%) and TF6-Mixed cropping (32%).
  - In the SPS Hybrid model there is a slight prevalence of group A (around 33%), ascribable to the group of holdings that increased UAA (about 39%, with all TFs generally close to the average),

- In the SPS Regional model there is a slight prevalence of group B (around 32%), due to the group of holdings with increased UAA (about 42%).
- For the other two models, although distribution is quite even, in both the SPS Historical and SAPS models there was a slight prevalence (again 31-33%) of group A for the group of holdings with increased UAA (with TF7- mixed livestock well above average for the SPS Historical model; and TF1-specialist field crops and TF4-specialist grazing livestock well above average for SAPS) and of group D for the set of holdings with decreased UAA (with TF3- Specialist permanent crops, TF6- Mixed cropping and above all TF2- Specialist horticulture, well above average for SPS Historical; with Specialist permanent crops, TF6- Mixed cropping and TF7- Mixed livestock above average for SAPS).

- In all models (and thus in EU25), the most frequent combinations are Aa; Bb; Cc; Dd (i.e. all combinations along the diagonal of the grid). Generally speaking, the same happens for all groups of holdings with increased, decreased or unchanged UAA, with the sole exceptions:
  - of the set of holdings in group A with increased UAA, where the most common combination is Ab (increase in Machinery and Hours in absolute terms, increase in machinery/ha and decrease in hours/ha). This exception is common to all models and almost all TFs (except for TF2- specialist in horticulture, TF3- Specialist in permanent crops and TF6- Mixed cropping)
  - of the set of holdings in group C with increased UAA, where the most common combination is Cd (decrease in Machinery, increase in Hours in absolute terms, and decrease in both machinery/ha and hours/ha). This exception is common to all models and almost all TFs (except for TF3- Specialist in permanent crops and TF6- Mixed cropping)
- In all models (and thus in EU25) and within groups of holdings with increased, decreased or unchanged UAA there are combinations recorded by a very small percentage of holdings (below 3%). This is so for the combinations Ac and Db in all cases (models and groups for UAA variations). For some combinations moreover the frequencies are above 3% only in some cases, while generally speaking this limit is not reached (for example, but not only, in the combinations Ad, Ba, Ca, Da and Dc for EU25)

10.8.2.2 Basic strategies

As already mentioned in the paragraph concerning methodology, we have grouped the above combinations using similarity criteria. This exercise has allowed us to single out five basic strategies, naturally with variations according to the various combinations.

In addition, for all combinations in which Machinery has increased in absolute terms (i.e. all combinations of groups A and B), we calculated the balance between the number of farms that have started Contract work activities and the number of farms that have abandoned this activity between 2004 and 2009. This balance was analysed in relation to the total number of farms that have increased Machinery between 2004 and 2009 within each strategy.

This is based on the hypothesis that, irrespective of the changes in UAA, at least for part of the farms that have increased Machinery, this growth is not only linked to the change of "agricultural" strategy, but (probably) also related to the implementation of a diversification strategy (i.e. Contract work).

STRATEGY 1: DEVELOPMENT AND INTENSIFICATION OF THE USE OF FACTORS

This strategy pertains solely to the combination **Aa** of holdings with **increased UAA**. This development strategy is based on the intensification of all production factors, also leading to an intensification per hectare of Machinery and Hours. This strategy thus also implies the intensification of production methods for the growth of total Output, through a rise in productivity. These holdings therefore appear to be the most dynamic and most reactive to change.

This strategy was adopted by 11.4% of all holdings with increased UAA. The percentage is a little higher for holdings from the Hybrid model (13.7%) and lower for the Regional model (9.5%).

In total, moreover, the percentage is higher for holdings which in 2004 belonged to TF1 (13.7%) and TF6 (12.8%), and lower for those from TF5 (9.6%) and TF7 (7.6%).

However, a quite substantial portion of farms have also started, between 2004 to 2009, an activity of Contract work, at the same time a small part of farms have ceased such activity. The positive balance represents 9.7% of the total farms that implemented this strategy (12.5% in the SPS Historical model; 6.4% in the Hybrid model). For these farms the real increase in Machinery/ha is (or may be) only apparent or it can occur to a more limited extent than it appears, therefore the intensification of production methods may also be a more limited phenomenon.

STRATEGY 2: DEVELOPMENT WITH OPTIMISATION OF FACTORS USE EFFICIENCY

This strategy describes the combinations **Ab, Ac** and **Bb** of holdings with increased UAA. With a greater availability of UAA, an increase in either or both machinery and labour in absolute terms (higher and/or lower compared with the increased of the UAA) results in an increase in machinery/ha and a drop in labour/ha (or, vice versa, in a decrease in machinery/ha and in a increase in labour/ha). This is therefore a development strategy based on the optimisation of Capital and Labour efficiency (maximising labour productivity through the replacement of labour with machinery and/or adjustment of K/L standard ratio). The strategy has some variants:

- move towards production methods and/or farming systems that are more capital intensive and labour saving (combination Ab),
- move towards production methods and/or farming systems that are more labour intensive (combination Ac)
- move towards production methods and/or farming systems that are more capital intensive (combination Bb).

In the latter case there are likely to be elements of hidden unemployment in 2004, partially absorbed through the expansion of UAA.

The strategy (for the set of different combinations) was adopted by 34.2% of all holdings with increased UAA (in particular, 14% of holdings chose combination Ab, 18.2% combination Bb. The combination Ac was adopted by only 2% of holdings with increased UAA.

Compared with the average, percentages were higher for holdings in the SPS Regional model (48% of holdings belonging to this model that raised their UAA) and lower in SPS Historical (32.3%). The other models are in line with the general average.

Generally speaking, moreover, the percentage of holdings that applied this strategy is higher for those which in 2004 belonged to TF4 (39%) and lower for those in TF2 (25%). The percentages of farms belonging to other TFs are within this range.

However, an overall small pro portion of farms have also started (or abandoned) a Contract work activity. The positive balance represents about 6% of the total farms that implemented this strategy (the percentage is highest in the SAPS model (8.7%) and lowest in the SPS Hybrid model (2%). In these farms, therefore, the increase in Machinery/ha is (or may be) apparent, thus the total percentage of farms that have implemented this strategy could be slightly overestimated.

STRATEGY 3: DEVELOPMENT WITH EXTENSIFICATION

This strategy pertains to the combinations **Ad**, **Bd**, **Cd** and **Dd** with increased UAA. As the availability of land grows, there is a drop in intensity (per hectare) of hours and machinery, even though Machinery and Hours may both rise in absolute terms (combination Ad), or one of the two factors rise (combinations Bd and Cd). This is therefore a development strategy enacted through the extensification of production methods and/or a greater shift towards less capital and less labour-intensive farming (presumably for the newly acquired land). This is probably with the aim of reducing unit costs while maintaining production volumes over a large agricultural area.

It is not however possible to rule out the possibility (in particular for the combination Dd) that:

- in 2004 there were elements of hidden unemployment and/or surplus machinery capacity. In this case, therefore, it would be a choice of optimising the efficient use of the factors Machinery and Hours (see strategy 2).
- the decrease (in absolute and relative terms) in machinery and hours is the effect of outsourcing

one or more phases of production processes to contractors. In this case, therefore, the strategy would be similar to strategy 1, but with the use of external factors, for which the cost of use is transferred from the fixed costs to the variable costs structure.

The strategy (for the set of different combinations) was adopted overall by 45% of holdings with increased UAA (in particular, 14.1% of holdings opting for the combination Cd and 20.3% the combination Dd. The combinations Ad and Bd were adopted by a very small number of farms (5.7% and 4.7% respectively of those with increased UAA).

Compared with the average, percentages were higher for holdings in SPS Historical (46.4% of holdings belonging to this model raised their UAA) and lower in SPS Regional (35%). In the other models they were slightly below the general average.

In general, the percentage of holdings applying this strategy is higher for those which in 2004 belonged to TF2 (56%), TF5 (51%) and TF 7 (52%), and lower for those that belonged to TF1 (40%). The percentages of farms belonging to other TFs were close to the general average.

In this case too, an overall small portion of farms have also started (or abandoned) a Contract work activity. The positive balance is approximately 5% of the total number of farms that implemented this strategy (this share is highest in the SAPS model (7.4%) and lowest in the SPS Hybrid (1.6%). In these farms, therefore, the real decrease in Machinery/ha is (or may be) even stronger, which further strengthens the choice of extensification of production.

STRATEGY 4: CONSOLIDATION, WITH OR WITHOUT DOWNSIZING

This strategy pertains to the combinations **Aa**, **Ba**, **Bb**, but also to **Ca** and **Cc** with decreased (or unchanged) UAA. In the event of downsizing (or no change in holding size), the intensity (per hectare) of hours and machinery (or hours only) rises. These holdings therefore apply a consolidation strategy by maximising the productivity of land and/or the factors machinery or hours (probably in surplus in 2004 in some cases). This also implies a policy of replacing labour with capital. This strategy also (presumably) implies the adoption of more intensive production methods and/or a shift towards Capital-intensive and/or Labour-intensive farming in some cases.

A similar strategy is also adopted by holdings with increased UAA that chose the combination **Cc** (development strategy oriented towards more labour-intensive techniques and/or farming, with machinery replaced by labour).

The strategy (for the set of different combinations) was adopted by 70% of holdings with decreased UAA and by 72% of holdings with unchanged UAA. It was also adopted by 9.6% of farms with increased UAA.

In greater detail:

- with regard to holdings with less land, 21.7% chose the combination Aa, 17.6% the combination Bb and 19.1% the combination Cc. The combinations Ba and Ca were adopted by a smaller number of farms (7.8 % and 3.8% respectively).

  Compared with the average, the percentages are higher for SPS Hybrid (74% of holdings belonging to this model with decreased UAA) and lower in SPS Regional (66%). In the other models the percentages are slightly below the general average (69% and 68% respectively for SPS Historical and SAPS).

  In general moreover, the percentage is higher for holdings which in 2004 belonged to TF4 (75%), and lower for those from TF2 (59%). The percentages of farms belonging to other TFs are closer to the general average.
- with regard to holdings with unchanged UAA, 24.3% chose the combination Aa, 20.4% the combination Bb and 27% the combination Cc.

Looking at implementation models, the percentages deviate little from the average. At TF level (in general) the situation is similar to that of holdings with decreased UAA: the percentage is higher for farms which in 2004 belonged to TF4 and TF6 (76% and 77% respectively), and lower for those from TF2 (63%).

Again, we find that a small portion of farms have also started (or abandoned) an activity of Contract Work. The positive balance is 4.7% of the total number of farms that implemented this strategy in 2009 (the percentage is significantly higher in the SAPS model (about 10%) and lower in the SPS Hybrid (2.5%). In these farms, therefore, the real increase in Machinery/ha is (perhaps) only apparent or it may be more limited than it seems. In these cases thus, the (assumed) adoption of more intensive modes of production may also be a more limited phenomenon than it appears.

STRATEGY 5: DIVESTMENT AND/OR DISENGAGEMENT FROM FARMING

This strategy pertains to the combinations **Dd** with decreased or unchanged UAA: for both these types, the intensity of hours and machinery goes down in both absolute terms and per hectare. The strategy is thus one of a gradual disinvestment of two (Machinery and Hours) or all three production factors (Land, Machinery and Hours). This implies the will to disengage from farming activities (especially for holdings with decreased UAA) and the adoption of more extensive production methods. Accordingly, these holdings appear to be the least dynamic and the most resistant to change.

This strategy may also be applied to the combinations **Da**, **Db** and **Dc** with decreased UAA: the partial divestment of all production factors is accompanied, in different cases, by the implementation of more intensive production methods and/or a shift towards:

- farming requiring a greater intensity of machinery and of hours (combination Da);
- farming requiring more machinery (combination Db);
- more labour-intensive farming (combination Dc)

The strategy (for the set of different combinations) was adopted by 30% of all holdings with decreased UAA and by 28% of holdings with unchanged UAA (in the latter case, only the combination Dd).

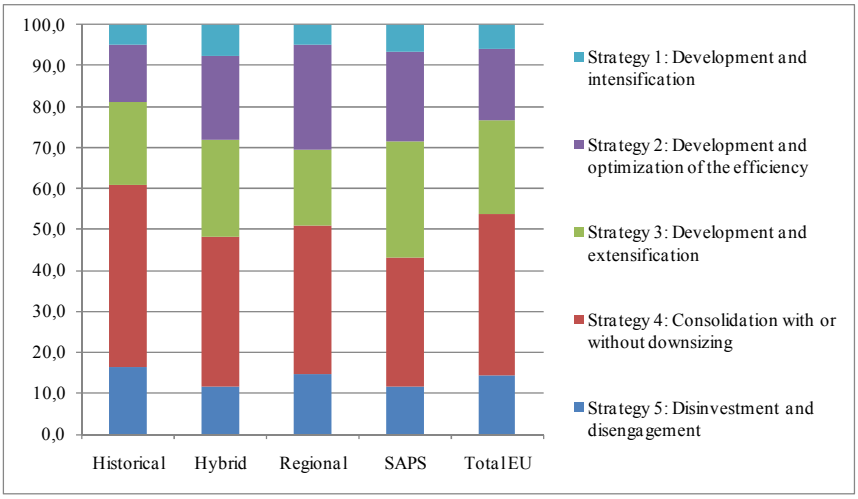
In greater detail:

- With regard to holdings with less farmland, 21.7% implemented the combination Dd. Other combinations were chosen by smaller numbers of holdings (4.1% the combination Da; 2.2% the combination Db and 6% the combination Dc). Furthermore, compared with the average, the percentages are higher for SPS Regional (34% of holdings belonging to this model with less UAA) and lower for SPS Hybrid (26%). In the other models percentages are slightly above the general average (31% and 32% respectively for SPS Historical and SAPS).

  Furthermore, the percentage is higher in general for holdings which in 2004 belonged to TF2 (41%), TF3 (34.4%) and TF6 (34%), and lower for those from TF4 (25%).
- With regard to holdings with unchanged UAA, the percentages are basically similar for all implementation models (percentages close to the general average). Looking at TFs (in general), the percentage is higher for holdings which in 2004 belonged to TF2 (37%), TF7 (32%) and TF8 (34%), and loser for those from TF4 and TF6 (24% and 23%).

To complete the analysis, we believe it is interesting to have an overview of the strategic choices made by holdings in the FADN 2004-2008 constant sample. To this end, for every implementation model and for Total EU25, we have calculated the percentage of holdings that have implemented each of the five strategies out of all holdings with UAA. This makes it possible (bearing in mind the limitations of the method of grouping together the different combinations) to summarily assess which adaptation strategies have been adopted most or least in relation to policy changes.

Fig. 89 - Distribution of holdings of the FADN constant sample pursuing different strategies, by implementation model and total EU (as % of total holdings of each model)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

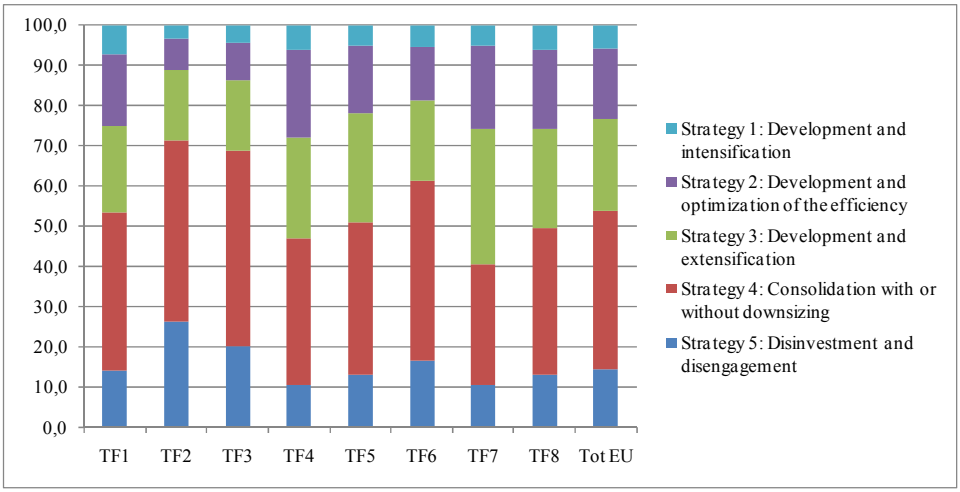
The results highlight some interesting points:

- holdings defined as *"the most dynamic and most reactive to change"* (applying strategy 1) are below 6% in EU25. This percentage rises to 7.8% for Hybrid regions, and 6.6% for the SAPS model, but falls to 4.7% in SPS Historical regions.
- On the other hand, again in EU25, holdings defined as *"the least dynamic and most resistant to change"* (applying strategy 5) are above 14% of the total. This percentage drops to 11.7% for SAPS regions and SPS Hybrid regions, and rises to 16.6% for holdings in SPS Historical regions.
- Strategy 4 (consolidation with or without downsizing) is that most commonly adopted in EU25 (39.4% of holdings) and in all models. It is however adopted more in the SPS Historical model (44.3%) and relatively less in the SAPS model (31.4%).
- The other two development strategies (Strategy 2 and Strategy 3) refer to quite significant percentages of farms: at EU25 level 17.5% adopted the former and 23% the latter. In this case too however a significantly higher percentage was seen for the SAPS model (22% and 28.3% respectively for Strategies 2 and 3), and significantly lower for SPS Historical (14.1% and 20.3% respectively for Strategy 2 and Strategy 3).
- For all strategies, the percentages observed for the SPS Hybrid and SPS Regional models were within the range represented by SAPS and SPS Historical.

Generally speaking, therefore, strategies contemplating the development of the holding have been pursued chiefly by farms located in SAPS model (59%) and Hybrid model (52%) regions, while consolidation and disinvestment strategies have been chosen more by holdings located in Historical model (61%) and Regional model (51%) regions.

Finally, we conducted the same analysis for each Type of Farming (and reproduced the EU total for comparison purposes), the results of which are given in the graph below.

Fig. 90 - Distribution of FADN constant sample holdings enacting different strategies, by Type of Farming (as % of total holdings of each TF)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Compared with the EU25 average, there are some notable differences:

- holdings applying strategy 1 (the most dynamic) are most common in TF1- Specialist field crops (7.2%), with higher levels also in TF4- specialist in grazing livestock and TF8-Mixed crops livestock. On the other hand, strategy 1 is least common in TF2-Specialist in horticulture (3.2%) and in TF3- specialist in permanent crops.
- Almost symmetrically, holdings applying strategy 5 (the least dynamic) are more common in TF2-Specialist in horticulture (26.3%) and in TF3+specialist in permanent crops (20.2%), and least common in TF4- specialist in grazing livestock (10.6%) and TF7- Mixed livestock.
- Strategy 4 (consolidation with or without downsizing) is also the most commonly adopted by holdings in all TFs, with the exception of TF7-mixed livestock, for which strategy 3, Development and extensification, was the most common (33.5%). It was also comfortably above the European average in TF3-specialist in permanent crops (49%), TF2-specialist in horticulture (45%) and TF6-mixed cropping (45%), while it was rightly least common in TF7 (30%).
- Strategy 2 (Development and optimization of efficiency) and strategy 3 (Development and extensification) are both most commonly adopted in TF7 (21% and 33.5% respectively), and least common in TF2 (8% and 17.7% respectively) and in TF3 (9.6% and 17.4% respectively).
- Finally, it is noted that for TF5-specialist granivore, TF8-Mixed crops livestock and TF1-specialist field crops (except for Strategy 1), the distribution of frequencies for the five strategies is quite similar to that of the EU25 average.

Generally speaking, therefore, the strategies contemplating the development of the holding appear to have been pursued most by holdings which in 2004 belonged to TF7 (59.4%), TF4 (53%) and TF8 (50.6%). In all three cases they are holdings for which livestock farming is prevalent (TF4 and TF7) or in any case has a significant presence (TF8)[224].

On the other hand, consolidation and/or disinvestment strategies appear to have been implemented mostly by holdings producing predominantly fruits & vegetables (specialist in horticulture, 71.2% and specialist in permanent crops, 68.7%), or by holdings where this activity is important (mixed cropping, 61%). In the first two cases, these are holdings for which fruit and vegetable production is prevalent, and in the third case holdings for which fruit and vegetable production has a significant presence[225]. It is stressed that holdings belonging to these three TFs have a high incidence in the set of regions of the SPS Historical and SPS Regional models (33.1% and 29.8% respectively of all holdings), where consolidation and disinvestment strategies have most been pursued. On the other hand, they have a

[224] In the constant sample for the whole of the EU UAA for livestock feeding made up about 36% of total UAA, with a peak of 45% in SPS Regional and a low of 32% in SPS Hybrid.

[225] In some models in particular: In SPS Historical, UAA in Vegetables & potatoes and in Permanent crops for holdings belonging (in 2004) to TF6 made up about 23% of total UAA. In SPS Regional it was about 32% (see Chapter 10.6.2).

much lower incidence in the set of regions of the SAPS model (13.3%) and SPS Hybrid model (15%), for which development strategies are pursued to a greater extent.

In conclusion, and considering the fact that:

- holdings with herbivore livestock (cattle, sheep and goats) are particularly affected by direct aid;
- holdings specialising in fruit and vegetable production receive the fewest benefits from direct aid (and in general are the least affected by policy changes),

it is fair to state that adaptation strategies oriented towards development (according to the methods analysed) have been implemented more by holdings more exposed to the change in policy (in particular to changes in rules governing direct aid).
In such cases, therefore, this change has served to stimulate the reorganisation of holding structures.
On the other hand, where policy changes have produced the fewest effects and where the need to adapt has been less urgent, the strategies of holdings have been oriented more towards the consolidation and/or downsizing of the existing situation.

10.9 Evaluation judgement

The evaluation question required to assess to what extent direct support schemes as introduced by the Regulation 1782/2003 have influenced farm business strategies in terms of specialisation (a farm is said to be specialised when a particular activity provides a standard gross margin of at least two thirds of the total SGM of the holding).

The analysis was carried out at micro level, based on farm data from the Farm Accountancy Data Network (FADN) database (Source: EU FADN - DG AGRI). It uses statistical methods and econometric analysis, complemented with the information collected through a CATI survey (1,000 farms beneficiaries of direct payments in the 12 case study regions).

The statistical analysis compared 2004 and 2009 FADN data for a constant sample of farms in the EU25 regions within a framework of eight production sectors[226]. Farm data were aggregated according to the Single Farm Payment models (SPS historic, SPS hybrid, SPS regional and SAPS) implemented across EU regions from 2005 onwards.

The constant sample (42 114 farms) represents, by definition, those agricultural holdings that have decided to continue farming between 2004 and 2009. Accordingly, the results of the analysis concerning changes in farm strategy only apply to the sample and not to the whole agricultural sector.

Effects of direct payments on farms specialisation and on farms strategies concerning land availability and land use choices

Economic and production changes in response to policy changes have been evaluated by measuring the number of farms which have altered their organisation so as to move from their original type of farming (TF) to another one. To this end, for each TF we have measured in the EU FADN constant sample flows of farms that between 2004 and 2009: i) remained in the same TF; ii) migrated from a TF to another; iii) arrived in a TF from another TF.

The findings of the statistical analysis show that in the analysed period **a major number of farms belonging to different sectors have altered their organisation in terms of production choices, farms size and land allocation**.

In general, in the sectors with a lowest degree of specialisation (i.e. mixed farms without a dominant sector for income generation), the number of farms decreased significantly in all models of SFP implementation; flows, both incoming and outgoing, are considerable, accompanied by a low percentage of farms remaining in the same sector in 2009. On the other hand, the sectors with a highest degree of farm specialisation (specialist field crops, horticulture, permanent crops and specialist grazing livestocks) presented an increase in the number of farms in all models of SFP implementation and flows are quite modest.

[226] TF1 – Specialist field crops; TF 2 – Specialist horticulture; TF 3 – Specialist permanent crops; TF4 – Specialist grazing livestock; TF5 – Specialist granivore; TF6 – Mixed cropping; TF7 – Mixed livestock; TF8 – Mixed crops – livestock.

These results, which confirm those already highlighted in EQ1, lead to conclude that the reform has played a role in directing an important part of holdings towards greater specialisation: the **greater freedom of decision related to decoupling of direct support has stimulated part of the holdings to focus more on the production activities (crops and / or livestock) for which market conditions allow higher profitability** (and, therefore, greater specialisation). However, in all sectors, changes are (also) the result of two-way flows (there are no cases of one-way flow, i.e. incoming only or outgoing only). **This would point to the existence of more complex situations where production choices are not impacted by policy changes alone.**

The results of econometric analysis aimed at assessing the effect of coupled and decoupled direct payments on **specialisation "preferences" show that the probabilities of changing TF appear to be overall higher in association with decoupled payments than with coupled payments**. Horticulture (TF2) appears to be the sector least influenced by a unit increase in decoupled payments. This means that in correspondence with an increase in decoupled payments, farms in other sectors would not be interested to move to this TF (Specialised horticulture). Quite the opposite, TF3 (Specialist permanent crops) appears to be the sector most likely to attract farms (from all other sectors) wishing to change specialisation.

A key aspect of structural adaptation strategies in response to policy changes relates to farm size and to land allocation. Between 2004 and 2009, we observed an **overall expansion of the utilized agricultural area (UAA), in all analysed sectors and SFP implementation models (constant sample)**.

This expansion was accompanied by a **growing use of land for COP crops and for livestock feeding. This occurred to the detriment of industrial crops**[227] **(mainly due to the partial or full decoupling of aid for tobacco and cotton and to the reform of the sugar sector), and because of the utilisation of almost 50% of fallow land and set-aside land existing in 2004** (this is clearly to be attributed to the removal of the set-aside obligation for COP crops).

Thus, it appears that the implementation of **direct support following the 2003 reform has favoured a shift in land use towards easier, less "demanding" crops in terms of production factors**, technical characteristics and business effort.

The effect of the change in policy (in particular that regarding direct payments) and the consequent rise in responsiveness to market signals has affected in similar ways the different groups of regions. It may thus be stated that models adopted to implement the policy have played a secondary role in shaping farms' behaviour. This overall conclusion is valid despite some magnitude differences[228].

These findings were confirmed by the results of the CATI survey (about 1 000 farmers beneficiaries of direct payments in 12 case study regions). According to the vast majority of farmers, direct aids seem today to play a minor role on farms' production decisions. Otherwise they appear to be an opportunity for farm investments and a safety net for farmers.

With specific regard to **strategic decisions of livestock farms, the analysis leads us to conclude that the change in direct aids policy, i.e. aids decoupling, seems to have allowed a strategic response to market conditions (i.e. the rise of cereal prices), namely of livestock farms with availability of land**.

In the EU15 regions, **in FADN constant sample livestock farms with UAA** (both specialised and mixed farms) **have generally increased the number of livestock units, supported by the augmentation of land for animal feeding and/or for cereals** (in the EU10 regions the results are less clear-cut: in some types of farms the number of livestock units has increased and in others it has decreased).

The analysis shows a lower stocking rate of livestock per hectare, covering almost all sectors and almost all models. Extensification may however only be apparent, since the greater increase in agricultural area for fodder crops (compared with the variation in livestock units) may conceal the

[227] To this purpose cf results of the "Evaluation of market effects of partial decoupling", Agrosynergie 2010.

[228] We report for example the case of industrial crops, which have collapsed dramatically everywhere except in the Hybrid model: This is due to the stability of the sugar beet sector in the MSs of this model (in particular Germany) following the 2006 reform of the sugar CMO.

substitution of animal feed purchased outside the farm with animal feed crops produced on the farm (choice determined by the change in relative prices).

The behaviour of **livestock farms without land of the FADN constant sample** (and in particular of farms specialised in granivores) confirms these conclusions: the number of LSU in the these farms has shrunk considerably in almost all models[229] probably, among others, due to farms not being able to address the increase in cereals price by expanding their own production for feeding purposes.

Farms' land allocation choices in relation to farm size

The already mentioned UAA overall increase between 2004 and 2009 hides different farm choices: the majority of farms in the sample has consistently increased their UAA, but part of them (more or less substantial, depending on the groups) has decreased UAA or maintained it unchanged.

Farms that decided not to change their size are those of smaller size (in some cases much smaller) compared with farms that have increased UAA or decreased it. It is therefore likely that for these farms size represents a strategic constraint. In other words, these are the farms whose size does not allow a further reduction without this implying a growth in unit costs (with a consequent rise in inefficiency), but for which a (modest) increase in farming area does not significantly change the farm's profitability (i. e. does not allow economies of scale).

Farms that decided to decrease their size have in most cases a larger size compared with farms that have increased or kept their size unaltered. On the other hand, most groups of farms that have enlarged have a size (on average) between that of farms that have downsized and that of farms that have not altered their size. This suggests the existence of a process of structural adjustment leading (on average) to convergence towards an "intermediate" farm size. This size does not however appear to be uniform, as it will be influenced by the context in which farms operate.

With regard to land use choices (and therefore production choices), the results of the analysis show that these were, in general, scarcely influenced by decisions concerning farm size: changes in the composition of the different crop types are basically consistent (on average) among the three farm groups.

In nearly all cases, in the three groups of farms we observe (in most TF) a greater focus on their specific core business (thus greater specialisation). In some cases, however (TF2-TF3), we noticed a move towards greater diversification to activities with lower labour and capital intensity in the group of farms that have increased the UAA (cereals and oilseeds in TF2 ; Livestock feeding, and Fallow land in TF3).

Strategic changes concerning production factors stimulated/favoured by the policy change

The statistical analysis shows that between 2004 and 2009 farms have made choices bearing effects on their land, labour and capital (machinery).

The analysis of the different combinations concerning variations in absolute terms of UAA, labour and machinery, together with unit variations of surfaces, labour and machinery points to **five farm basic strategies related to the effects of intervened changes in the policy**.

[229] In EQ 1 (§ 6.5.3 and 6.4.6.3) we have seen that total LSU in farms without land has increased. This is also due to the fact that, overall, the number of farms without land has also increased. The LSU decrease observed in the FADN constant sample farms without land is only apparently contradictory because in this case the number of farms does not change.

STRATEGIES AND CHARACTERISTICS	GEOGRAPHICAL DISTRIBUTION	SECTOR DISTRIBUTION
Strategy 1 - Development and intensification of the use of factors Based on the intensification of all production factors (UAA, machinery and labour), also leading to intensification of machinery and hours per hectare. This strategy thus also implies the intensification of production methods aimed at growth of farm total output. These holdings therefore appear to be the most dynamic and most reactive to change.	▪ adopted by 6% of all farms of the EU25 sample; ▪ most commonly adopted in the SPS Hybrid (7.8%), and least common in SPS Historical regions (4.7%); ▪ adopted by 11.4% of all holdings with increased UAA.	▪ highest percentage in TF1-Specialist field crops (7.2%), ▪ least common in TF2-Specialist in horticulture (3.2%) and in TF3-Specialist in permanent crops.
Strategy 2 - Development with optimisation of production factors use efficiency With a greater availability of UAA, an increase in either machinery or labour or in both of them in absolute terms (higher and/or lower compared with the increase of UAA) results in an increase in machinery/ha and a drop in labour/ha (or, vice versa, in a decrease in machinery/ha and in a increase in labour/ha). This is therefore a development strategy based on the optimisation of capital and labour efficiency (maximising labour productivity through the replacement of labour with machinery and/or adjustment of capital/labour standard ratio). The strategy has some variants: a) move towards production methods and/or farming systems that are more capital intensive and labour saving. Farms having adopted this variant represent 14% of farms having increased the UAA; b) move towards production methods and/or farming systems that are more labour intensive (2% of farms having increased the UAA); c) move towards production methods and/or farming systems that are more capital intensive[230] (18% of farms having increased the UAA).	▪ adopted by 17.5% of all holdings of the EU25 sample; ▪ most commonly adopted in the SAPS model (22% of farms), and significantly least common in SPS Historical (14.1%); ▪ adopted by 34% of all holdings with increased UAA.	▪ most commonly adopted in TF7-Mixed livestock (21%); ▪ least common in TF2-Specialist in horticulture (8%) and in TF3-Specialist in permanent crops (9.6%).
Strategy 3 - Development with extensification As the availability of land grows, there is a drop in intensity of hours and machinery (per hectare), even though both machinery and hours or one of them may rise in absolute terms. This is therefore a development strategy enacted through the extensification of production methods and/or a greater shift towards less capital and less labour-intensive farming (presumably for the newly acquired land). This is probably with the aim of reducing unit costs while maintaining production volumes over a large agricultural area. It is however not possible to rule out the possibility (at least in certain farms) that: i) in 2004 there were elements of hidden unemployment and/or surplus machinery capacity. In this case, therefore, this would correspond to the adoption of strategy 2; ii) the decrease in	▪ adopted by 23% of all holdings of the EU25 sample; ▪ most commonly adopted in the SAPS model (28.3% of farms), and least common in SPS Historical (20.3%); ▪ adopted by 45% of all holdings with increased UAA.	▪ most commonly adopted in TF7-Mixed livestock (33.5%), ▪ least common in TF2-Specialist in horticulture (17.7%) and in TF3-Specialist in permanent crops (17.4%).

[230] In this latter case, we can assume the existence of a hidden unemployment phenomenon in 2004, absorbed (at least a part of it) through the UAA increase.

STRATEGIES AND CHARACTERISTICS	GEOGRAPHICAL DISTRIBUTION	SECTOR DISTRIBUTION
machinery and labour is the effect of outsourcing one or more phases of production processes to contractors. In this case, therefore, the strategy would be similar to strategy 1, but with the use of external factors.		
Strategy 4 - Consolidation, with or without downsizing In the event of downsizing (or no change in holding size), the intensity (per hectare) of labour and machinery (or labour only) rises. These holdings therefore apply a consolidation strategy by maximising the productivity of land and/or (alternatively) machinery or labour (probably in surplus in 2004 in some cases). This strategy also (presumably) implies the adoption of more intensive production methods and/or a shift towards capital-intensive and/or labour-intensive farming in some cases.	▪ this strategy is the most commonly adopted in EU25 (39.4% of holdings); ▪ it is adopted more in the SPS Historical model (44.3%) and relatively less in the SAPS model (31.4%); ▪ adopted by 70% of holdings with decreased UAA and by 72% of holdings with unchanged UAA. It was also adopted by 9.6% of farms with increased UAA[231].	▪ mostly adopted in TF3-Specialist in permanent crops (49%); ▪ rightly least common TF7- Mixed livestock (30%).
Strategy 5 - Disinvestment and/or disengagement from farming In the event of downsizing (or no change in holding size), intensity of hours and machinery goes down in both absolute terms and per hectare. The strategy is thus one of a gradual disinvestment of two (machinery and hours) or all three production factors (land, machinery and hours). This implies the will to disengage from farming activities (especially for holdings with decreased UAA) and the adoption of more extensive production methods. Accordingly, these holdings appear to be the least dynamic and the most resistant to change. This strategy may also be applied to farms for which the partial divestment of all production factors is accompanied, in different cases, by the implementation of more intensive production methods and/or a shift towards: ▪ farming requiring a greater intensity of machinery and of labour (4.1% of farms decreasing UAA); ▪ farming requiring more machinery (2.2%); ▪ more labour-intensive farming (6%).	▪ adopted by 14% of the total farms at EU25 level; ▪ mostly adopted by holdings in SPS Historical regions (16.6%) and less adopted in SAPS regions and SPS Hybrid regions (11.7%); ▪ 30% of all holdings with decreased UAA and 28% of holdings with unchanged UAA.	▪ mostly adopted in TF2-Specialist in horticulture (26.3%), ▪ rightly least common TF4-Specialist in grazing livestock (10.6%).

[231] For these farms, in particular, it is a development strategy towards production methods and or farming activities more labour intensive, with a substitution of capital with labour.

However, in the strategies 1, 2, 3 and 4, a share of the farms that have increased machinery (in absolute terms) have started a new contract work activity. Therefore, it is conceivable that in these cases the increase in machinery not only is related to the change of "agricultural" strategy, but (probably) also to the implementation of a diversification strategy (i.e. contract work for others).

Generally speaking, strategies contemplating the development of the holding (strategies 1, 2 and 3) have been pursued chiefly by farms located in SAPS model (59%) and Hybrid model (52%) regions, while consolidation and disinvestment strategies have been chosen more by holdings located in Historical model (61%) and Regional model (51%) regions.

Furthermore, the strategies contemplating the development of the holding appear to have been pursued most by holdings belonged (in 2004) to TF7- Mixed livestock (59.4%), TF4- specialist in grazing livestock (53%) and TF8-Mixed crops livestock (50.6%). In all three cases they are holdings for which livestock farming is prevalent or in any case has a significant presence.

On the other hand, consolidation and/or disinvestment strategies appear to have been implemented mostly by holdings producing predominantly fruits & vegetables (specialist in horticulture, 71.2% and specialist in permanent crops, 68.7%), or by holdings where this activity is important (mixed cropping, 61%). It is stressed that holdings belonging to these three TFs have a high incidence in the set of regions implementing the SPS Historical and SPS Regional models (where consolidation and disinvestment strategies have most been pursued), and have a much lower incidence in the set of regions of the SAPS model (13.3%) and SPS Hybrid model (for which development strategies are pursued to a greater extent).

In conclusion, it is fair to state that adaptation strategies oriented towards development have been implemented to a greater extent by holdings more exposed to the change in policy (i.e grazing livestock). In such cases, the change has served to stimulate the reorganisation of holding structures. On the other hand, where policy changes have produced the least effects (i.e. fruits & vegetables) and where the need to adapt has thus been less urgent, the strategies of holdings have been oriented more towards the consolidation and/or downsizing of the existing production systems.

11. Theme 4 – Farm business strategies: To what extent have direct payments influenced farm competitiveness? (EQ6)

11.1 Comprehension and interpretation of the evaluation question

For the purpose of this evaluation question we define farm competitiveness as the capability of a farm to maintain the necessary conditions for staying in business whilst carrying out its activities. The conditions for staying in business are determined by cost and revenue balances from farming activities, also taking into account subsidies and other sources of income from activities on and off-farm.

The scope of analysis includes situations in which:

- the farm provides a sufficient remuneration of labour force and capital and a surplus for accumulation and investment (on and off-farm) In this case farmers could pursue (new) business strategies (marketing or diversification) to develop farm activities.
- the farm provides neither an investment opportunity nor acceptable remuneration for the farmer. In this case, farmers need to act to develop farm activities to achieve economic viability: alternative farm strategies (marketing or diversification) need to be pursued.

In the "Evaluation of income effects of direct support" (Agrosynergie, 2011)[232] we assessed the extent to which direct payments have contributed to supporting the economic viability of EU farms, on the basis that a farm can be considered viable when it is able to guarantee a sufficient remuneration of family labour and farm capital. Two aspects have been taken into account: the ability to guarantee remuneration of family labour at least equal to its opportunity cost, and a positive remuneration of farm capital (economic viability) expressed as the ability to guarantee remuneration of farm capital at least equal to the average interest rate applied to medium-term loans (economic and financial viability). Therefore, in the framework of this evaluation we do not analyse the contribution of direct payments to the remuneration of labour and capital.

The analysis here focuses on farmers' strategies aimed at maintaining farm competitiveness, and in particular on the evaluation of the impact of the 2003 CAP reform on farm investment decisions and on decisions concerning diversification and marketing strategies.

11.2 Methodological approach

The analysis of farm investment decisions, marketing and diversification strategies has been conducted at different levels (farm and macro-regional level) based on data available from different sources (FSS - Eurostat and FADN). The lack of systematic data on some evaluation issues required to supplement the existing data with primary data collected ad hoc. Therefore, the results of a structured survey using CATI in the twelve case study regions, involving about 1,000 farms beneficiaries of direct payments (details of the survey methodology, number and composition of interviews by region are presented in § 5.1.4) complement the results of analysis based on FADN and Eurostat data.

The paragraphs that follow detail the methodology applied for each of the three areas of investigation.

Farm investment decisions

The analysis, conducted at farm level, is based on the FADN database and combines standard statistical methods with econometric modelling. For the description of the methodology of the econometric modelling, please refer to § 5.1.2.2.

[232] http://ec.europa.eu/agriculture/eval/reports/income/index_en.htm

The statistical analysis relative to farm investment decisions compares 2004 and 2009 data for a constant sample of farms in the EU25 regions[233], i.e. a sample consisting of the same farms in the two analysed years[234]. The analysis comprises three parts:

1. First of all, we examine the extent to which the share of farms investing on fixed assets (i.e. gross investment per hectare[235] > 0) has changed within the FADN constant sample between 2004 and 2009 (pre- and post-reform), operating a distinction between farm types (TF) and models of SFP implementation. The analysis focuses on gross investment on fixed assets per hectare (FADN variables SE516/SE025) and on gross investment on specific single farm assets (per ha) computed as the difference between asset purchase and sale: land (G95IG – G95SA), land improvement (G97IG – G97SA), farm buildings (G98IG – G98SA) and machinery & equipment (G101IG – G101SA);
2. In parallel, we examine the share of farms with positive net investments on fixed assets (i.e. net investment per hectare > 0) which allows to better detail the previous step of analysis by identifying the proportion of farms that are able to compensate the loss of existing capital due to depreciation with new investments. Changes between 2004 and 2009 are analysed within the constant sample of farms, again distinguishing between farm types (TF) and models of SFP implementation. The FADN variables used are SE521/SE025 for total investments and computed net investment values for land improvement, farm buildings, machinery & equipment (difference between asset purchase and sale, net of depreciation value);
3. The third step of the analysis consists in observing farms' propensity to invest measured as the share of gross investment over the value of existing farm capital (i.e. fixed assets). This share is calculated as the percentage ratio between variables SE516/SE441 (gross investment on fixed assets / value of total fixed assets). The changes intervened in farm propensity to invest between 2004 and 2009 are analysed distinguishing by farm type and model of SFP implementation.

The analysis is complemented by the results of the CATI survey.

Marketing strategies

Because of lack of systematic data on this topic, the analysis of marketing strategies is based on data collected through direct interviews with farmers (i.e. CATI survey).

In the interviews, farm holders were asked whether they were members of a co-op or producers' organisation, whether they had a direct relationship with the processing industry and with food retailers before the introduction of the single payment and if they still have such marketing channels today. Farmers were also asked whether they have started direct sales of their farm's products (on the farm or in farmers' markets, through mail order, internet sales, etc.) and whether the single payment had any impact on their decisions.

Diversification strategies

For the purpose of this evaluation, we adopt the concept of diversification as defined by the European Commission[236], where a family farm manager is considered "… as *pluriactive* if he carries out any activity other than farm work for remuneration, be it on the holding itself (farm diversification), on another holding, or as employee in a non-agricultural enterprise. Farm *diversification* is understood as the creation of any gainful activities that do not comprise any farm work but are directly related to the holding, i.e. use its resources or products, and have an economic impact on the holding."

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[233] Such temporal comparison is not possible for Bulgaria and Romania that accessed the EU (and thus the FADN sample) in 2007.

[234] Please refer to § 10.2 (methodology of EQ5) for details on the composition of the constant sample by region and type of farming.

[235] This means that livestock farms without land are not interested by this part of the analysis.

[236] European Commission, Directorate General for Agriculture and Rural development – Unit G2. Economic analysis of EU agriculture, "Other gainful activities: pluriactivity and farm diversification in EU-27". Note to the file, 17 June 2008.

A strong limit for the analysis of pluriactive farmers is the lack of information concerning off-farm income[237]. Only for the year 2010, the Farm Structure Survey (Eurostat) has collected data concerning other gainful activities of the farm holder (and family members working on the farm), distinguishing between activities related or not related to the holding. However, the data do not include information about income generated by on-farm or off-farm diversified activities.

The analysis of farm diversification strategies, i.e. the presence of other gainful activities on the farm comprises three parts differentiated according to the level of analysis and data source (regional data from Eurostat FSS, farm data from FADN and from the CATI survey). A fourth piece of analysis focuses specifically on other gainful activities of the farm holder-manager, as it will be explained afterwards in this section.

Other gainful activities on the farm

The first part of the analysis uses FSS - Eurostat regional data with the aim of providing an overview of the evolution in the number of holdings with on-farm diversified activities from 2005 to 2010 across the regions of the EU27[238]. The analysis distinguishes among the various other gainful activities examining the changes intervened for each type. The results of the analysis are presented for regions grouped according to the SFP model implemented, and at the level of individual EU regions only to highlight specific trends. Due to a change introduced in the 2010 FSS regarding the definition of "processing of farm products" and in the recording of the relative data (see § 5.1.1.1), holdings (with OGA) with olive groves and vineyards are excluded from the 2005 dataset in order to improve comparability of 2005 data with 2010 data.

The second part of analysis is carried out at farm level. First of all, farm diversification strategies are examined based on FADN data, specifically on the constant sample of farms across the EU25 in 2004 and 2009 grouped according to the SFP implementation model of the region where they are located (SPS Historical, SPS Hybrid, SPS Regional and SAPS) looking at:

- overall % share of farms with diversified activities (organic farming, farm product processing, farm tourism, contract work for others and land leased to others) and change between 2004 and 2009.
- net change in the number of farms with diversified activities (organic farming, farm product processing, farm tourism, contract work for others and land leased to others) taking into account the number of farms that had diversified activities in 2004 but no longer in 2009, those that in 2009 maintained the activities already present on the farm in 2004 and those that did not have diversified activities in 2004 but introduced them in 2009 (for each type of diversification).
- average number of diversified activities per farm and overall farm distribution according to the number of diversified activities present on the farm (i.e. distinguishing farms with one such activity and farms with two. three or more diversified activities) and changes between 2004 and 2009;

Statistical analysis is based on the following FADN variables grouped as appropriate into the various types of on-farm diversified activities. Organic farming includes both farms that exclusively apply organic methods and those that partly apply such techniques or are in the process of converting to organic production.

[237] It should be stressed that at EU level and for individual member States there is limited availability of data on farm household total income. Specifically with respect to off-farm income, we carried out an in-depth analysis in the above mentioned Evaluation of income effects of direct support. The analysis had led to the conclusion that data on total income of farm households (i.e. level and composition of farm household income: farm business income and off-farm income) are not collected in a systematic and harmonised way throughout the EU. To overcome this lack of homogeneous data, a critical analysis of the existing literature was carried out. Unfortunately, the analysis of studies and statistics revealed the existence of heterogeneous definitions of agricultural households and, thus, of a variety of measurement criteria and data collection instruments (where they exist). In essence, therefore, the high heterogeneity of definitions and methods makes a reading of the existing information on off-farm income impossible.

[238] With the exclusion of Romania due to unreliable comparison between 2005 and 2010 data. According to the available data, the number of holdings with other gainful activities falls by 95% (from about 930 000 to 43 000 holdings) vis-à-vis a 9.3% decrease in the total number of holdings. A similar sharp change does not appear in the data regarding other gainful activities of farm holder-managers.

	VARIABLE	DESCRIPTION
Organic farming	A32	organic farming
Farm product processing	K160TP	processed other crops
	K163TP	cows' (incl. buffalos') milk products
	K167TP	sheep's milk products
	K168TP	goats' milk products
	K283TP	olive oil
	K288TP	miscellaneous wine products
	K289TP	quality wine
	K290TP	table wine & other wine
	K294TP	quality wine PGI
	K295TP	other wines
Farm tourism	K179TP	receipts from tourism
Contract work	K177TP	contract work for others
Land leased to others	K149TP	leased land ready for sowing
	K172TP	receipts from occasional letting of fodder areas

Source: EU-FADN-DG AGRI L-3

The analysis of the 2004-2009 constant sample of FADN farms is integrated by the results of the CATI survey conducted on a total of approximately 1 000 farms in the 12 case study regions. In the interviews farmers where asked whether they have started some new form of farm diversification after 2005, which types of activity were chosen and to explain the role played by the single payment in making the decision to diversify activities on the farm.

As illustrated in the theoretical analysis, the approach proposed by Van der Ploeg and Roep (2003) for the analysis of farm diversification strategies broadly classifies the various non-conventional activities conducted on-farm into two types of strategies, depending on their relationship with the core activity (i.e. agricultural production in the strict sense):

- the activities aimed at developing and enhancing farm production are defined as "deepening" strategies;
- the activities aimed at expanding the range of activities of interest to agricultural holdings (besides the core farming activity) are defined "broadening" strategies.

Such classification is adopted here in the analysis of diversification strategies implemented by farms of the FADN constant sample 2004-2009. Based on the given definitions, we apply the following classification:

- organic farming, product processing on the farm (including crafts and wood processing) are classified as “deepening” the scope of farm activities;
- accommodation and/or catering services (farm tourism), aquaculture, contract work for others, land leased to others, production of renewable energy and learning/educational activities[239] are defined as “broadening” the scope of farm activities.

Other gainful activities of the farm holder-manager

The last part of the analysis concerning diversification strategies focuses on other gainful activities of the farm holder based on FSS - Eurostat data for the EU27, examining the changes intervened between 2000 and 2010 for the EU15 and between 2005 and 2010 for the EU12 and the evolution of number of holder-managers with Main or Subsidiary other gainful activities relative to the evolution of the total number of agricultural holdings.

[239] Educational farms, also known as teaching farms, are working agricultural holdings that host school trips, families and adults' groups. Visitors are actively involved in several activities and fields focused around farming (conventional activities, recreational, environmental education, therapeutic, etc.). Farmers are those who welcome and train visitors on products’ season and cycle of life, animal’s care, local environment. Norway, Sweden and Denmark were the first to launch educational farms in Europe, followed by Germany and The Netherlands. Today educational farms are experiencing a great development in most EU regions. A large network of educational farms and national federations, the European Federation of City Farms (EFCF), was founded in 1990.

Eurostat data about farm holders with other gainful activities do not cover all farms but only those where the sole holder is also manager of the holding (i.e. managers of legal entities and group holdings are not included). Information is collected as to whether farm holder-managers have or not another gainful activity, and whether they spend more time on this activity than on farm work (i.e. Main or Subsidiary other gainful activities). Only in 2010 further detail was collected by Eurostat on whether the other gainful activities of the holder-manager are related or not related to the holding.

Again, holdings (with OGA) with olive groves and vineyards are excluded from the 2005 dataset in order to improve comparability of 2005 with 2010 data.

Concerning the data relative to the other gainful activities of farm sole holder-managers (and of the family members engaged in work on the farm), in the 2010 agricultural census the Member States were let free to decide whether to collect this information for the whole population or only for a sample of farms. We do not know whether this may cause any concern for 2010 data comparability with previous years.

11.3 Judgment criteria and indicators

The answer to the evaluation question is based on the following criteria and indicators:

Criteria and indicators
Judgment criterion no. 1 **Over the examined time period, in the EU regions direct payments have (have not) affected farm investment decisions**
Percentage share of farms with Gross and Net investment on total fixed assets/ha >0, with respect to SFP implementation model, macro-region and TF (2004 and 2009)
Percentage share of farms with investment on Agricultural land (per ha) >0, with respect to SFP implementation model and TF (2004 and 2009)
Percentage share of farms with Gross and Net investment on Land improvements (per ha) >0, with respect to SFP implementation model and TF (2004 and 2009)
Percentage share of farms with Gross and Net investment on Farm buildings (per ha) >0, with respect to SFP implementation model and TF (2004 and 2009)
Percentage share of farms with Gross and Net investment on Machinery & equipment (per ha) >0, with respect to SFP implementation model and TF (2004 and 2009)
Farm propensity to invest on fixed assets with respect to SFP implementation model and TF (2004 and 2009)
CATI survey: effect of the switch from coupled to decoupled support (introduction of direct payments in the EU12 regions) in facilitating investments, distinguishing between investments on the farm and outside the farm
CATI survey: effect of the switch from coupled to decoupled support (introduction of direct payments in the EU12 regions) in facilitating farm access to credit
Regression parameter estimates for Direct Payments (coupled and decoupled); Dependent variable: Gross Investment per ha of UAA
Judgment criterion no. 2 **Over the examined time period, in the analysed regions farms have (have not) re-oriented their marketing strategies**
CATI survey: distribution of farms with different marketing strategies (members of co-operative or producers' organisations; direct relationship with processing industry; direct relationship with retailers) and evolution after the 2003 CAP reform
CATI survey: effect of the switch from coupled to decoupled support (introduction of direct payments in the EU12 regions) in starting up direct sale of farm produce (on the farm, in farmers' markets, mail order by catalogue, internet sales, etc)
Judgment criterion no. 3 **Over the examined time period, in the analysed regions farms have (have not) re-oriented their strategies towards farm diversification**
Percentage share of farms with diversified activities and variation between 2005 and 2010 by SFP model (FSS

– Eurostat)
Percentage shares of farms in the FADN constant sample with "deepening" diversification strategies (organic farming and farm product processing) by SFP model, 2004 and 2009
Number of farms in the FADN constant sample that maintained/ changed their "deepening" diversification strategies between 2004 and 2009 by SFP model
Percentage shares of farms in the FADN constant sample with "broadening" diversification strategies (farm tourism, contract work for others, land leased to others) by SFP model, 2004 and 2009
Number of farms in the FADN constant sample that maintained/ changed their "broadening" diversification strategies between 2004 and 2009 by SFP model
Percentage share of farms in the FADN constant sample with one or more diversified activities and average number of activities per farm by SFP model in 2004 and 2009
CATI survey: impact of the switch from coupled to decoupled support (introduction of direct payments in the EU12 regions) on decisions to diversify farm activities
Evolution of number of sole holder-managers with Main or Subsidiary other gainful activities by SFP model, 2000 - 2005 – 2010 (FSS – Eurostat))
Distribution of holdings where holder-manager has other gainful activities related or not related to the holding, 2010 (FSS – Eurostat)

11.4 Effects of direct payments on farm investment decisions

As previously described, the analysis is carried out on the 2004-2009 constant sample of FADN farms across the EU25, distinguishing between farm types (TF) and models of SFP implementation (with some details at the regional level).

The analysis focuses on changes in the strategic behaviour of EU farmers concerning investments (shares of farms with positive gross and net investments on fixed assets and investment propensity) in the period before and after the introduction of the SFP. The analysis considers first total investments and, subsequently, investments on the main assets: land, land improvement, farm buildings, machinery & equipment.

The analysis on FADN data is subsequently integrated by the results of analysis on investment decisions based on the CATI survey in the twelve case study regions.

11.4.1 Farm investments on fixed assets

The analysis starts by examining the share of farms with positive gross investment balance (i.e. gross investment on fixed assets per hectare greater than zero) and by observing the changes intervened between 2004 and 2009. At the same time, we look at the proportion of farms that, through such investments, are able to compensate the loss of existing capital due to depreciation, i.e. farms for which net investment on fixed assets per hectare is greater than zero, again comparing 2004 and 2009. The table below reports such percentage shares of farms for regions grouped according to the SFP model they implement and distinguishing between the different farm types.

Tab. 76 - Percentage share of farms with total Gross investment/ha >0 and Net investment/ha >0 by TF and SFP model, 2004 and 2009 (%)

	SPS Historical				SPS Hybrid				SPS Regional				SAPS			
	2004		2009		2004		2009		2004		2009		2004		2009	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Spec. field crops	37.1	16.3	36.9	16.9	84.1	36.6	79.5	36.0					62.1	36.3	65.2	35.4
Spec. horticulture	45.1	16.5	41.3	15.1	74.4	24.9	72.8	21.6			51.6		47.0	27.1	49.6	20.3
Spec. permanent crops	41.9	17.6	37.9	13.8	86.7	34.7	82.5	29.2	42.5		55.0		62.0	33.6	62.7	25.2
Spec. grazing livestock	72.6	37.0	68.4	33.0	84.5	37.6	81.0	37.5	78.1	48.5	87.3	44.0	75.7	42.8	70.2	31.0
Spec. granivores	65.0	22.3	62.7	25.2	84.3	33.5	80.3	35.0			75.0		64.9	26.4	70.5	27.7
Mixed cropping	36.7	15.5	33.7	13.8	85.6	32.0	83.3	38.3	32.9		44.3		56.8	22.8	65.7	24.2
Mixed livestock	72.2	28.0	69.0	26.7	82.6	29.8	79.8	34.0	88.5		96.0		59.3	19.0	65.9	23.1
Mixed crops-livestock	67.7	27.3	63.1	25.4	83.2	33.0	81.0	36.4	78.8	44.2	86.5	44.2	65.5	26.5	66.5	25.6

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The frequencies reported in the table above concerning the proportion of farms with positive gross investments on fixed assets (per hectare) lead to the following general observations:

- The share of farms with positive gross investment balance per hectare is variable across farm types and groups of EU regions, ranging from a minimum of 32.9% of mixed crop farms making new investments in regions implementing the SPS Historical (2004) model to a maximum of 96% of mixed livestock farms in regions of the SPS Regional model (2009);
- The share of holdings investing on fixed assets appears to be relatively higher in farm types with livestock rather than in crop specialist farms;
- With respect to model of SFP implementation, regions of the SPS Hybrid group show generally higher share of holdings investing on fixed assets across all farm types (in all cases above 70% of all holdings in the constant sample in 2004 and 2009) compared to the regions implementing other SFP models.

The comparison of gross investments (per ha) in 2004 and in 2009 across sectors and SFP models shows a clear opposite pattern of change between 2004 and 2009 for EU15 on the one hand (SPS Historical and Hybrid) and EU10 on the other (SPS Regional and SAPS). In the former group of MSs, the share of holdings investing on fixed assets (i.e. gross investment per ha) decreases in 2009 compared to 2004 in all considered farm types. The opposite is true for the EU10 Member States, with the only exception of specialist grazing livestock farms in regions implementing SAPS.

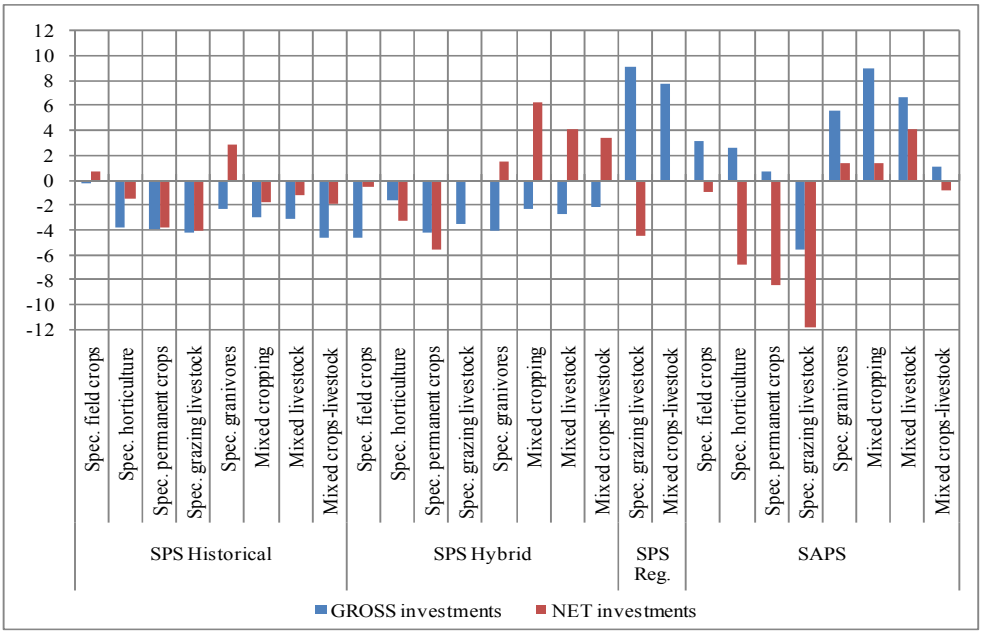
The comparison of the shares of farms with positive gross and net investment balance (investment/ha>0) (see Tab. 76 above) shows that, out of all farms making new investments in a given year (2004, 2009), only a fraction of them are able to maintain or increase the value of own capital through such investments. Compared to the proportion of farms with positive gross investment balance, the share of those with net investments on fixed assets/ha >0 usually is significantly lower. The following observations can be made:

- The share of farms with positive net investment balance per hectare is variable across sectors and groups of EU regions within the considered constant sample, ranging from a minimum of 13.8% found for Specialist permanent crop and Mixed crop farms in regions implementing the SPS Historical model (2009) to 42.8-48.5% for Specialist grazing livestock and Mixed crops-livestock farms in regions implementing the SPS Regional (both 2004 and 2009) and Specialist grazing livestock farms in regions applying SAPS (2004);
- Similarly to what observed in the case of gross farm investments, when compared to regions applying the other SFP models, the regions implementing the SPS Hybrid model[240] show a generally higher percentage of farms that are able to preserve the value of own capital through new investments. Conversely, the lowest shares of farms with positive net investment balance can be found in the regions of the SPS Historical model, and specifically in all farm types with crops (Specialist field crops, horticulture and permanent crop farms, and Mixed crop farms) and in Specialist granivore farms;
- Differently from what seen in the case of gross farm investments, farm net investment patterns appear to be less clearly differentiated according to farm type (i.e. crops *versus* livestock). Specialist grazing livestock counts the largest overall share of farms able to compensate the loss of value of own capital with new investments across all SFP models. On the other hand, Specialist horticulture farms are those generally less able to compensate the depreciation of capital through new investments.

We conclude the analysis of farm total investments on fixed assets by examining the changes occurred after the 2003 CAP reform in the FADN constant sample of farms, comparing the 2009/2004 variations of Gross and Net investments (per ha). The graph below summarises the 2009/2004 changes in the shares of farms with positive investment balances distinguishing by sector and SFP implementation model.

[240] And also in the regions implementing the SPS Regional model, albeit here we can observe net investments in two farm types only. In general, the constant sample in these regions is very small in size, therefore the results have to be considered with caution.

Fig. 91 - Variation 2004-2009 in % share of farms with total Gross investment/ha >0 and Net investment/ha >0 by TF and SFP model (% point difference)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

As previously seen, the share of farms investing on fixed assets (gross investment /ha >0) decreases in all farm types within the regions of the EU15 (SPS Historical and Hybrid models). In both groups of regions, the portion of farms able to compensate the loss of value of own capital with new investments also tends to reduce or not change significantly in most sectors, however, with some clear exceptions: Specialist granivore farms (SPS Historical and Hybrid) and all three Mixed farm types in the regions of the SPS Hybrid model.

In the regions of the EU10 where the proportion of farms making new investments generally increases between 2004 and 2009, the position of farms with respect to maintaining the value of farm capital appears to worsen. Indeed, in 2009 a smaller number of farms is able to compensate with new investments the loss of capital due to depreciation compared to 2004 in most sectors, but especially in Specialist grazing livestock farms (both SPS Regional and SAPS) and in the Specialist permanent crop, horticulture and field crop farms, and in the Mixed crops-livestock farms (SAPS). Specialist granivore farms, Mixed cropping and Mixed livestock farms (SAPS) show an increasing number of farms making effective new investments in 2009.

11.4.1.1 Farm investments on fixed assets across EU macro-regions

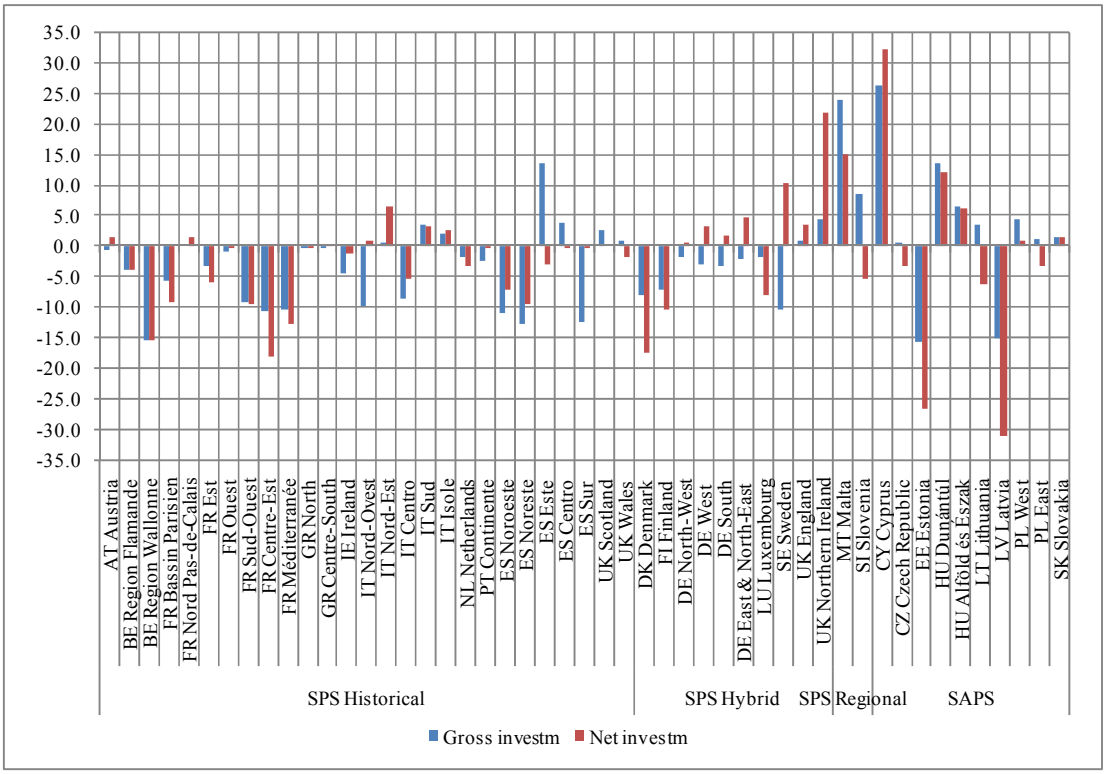
A further analysis of the 55 macro-regions considering all farm types together highlights the following patterns with respect to shares of farms with gross investment/ha >0:

- What was observed at the level of SFP implementation model is confirmed when examining the 55 individual macro-regions, with only few exceptions. Thus, in all regions applying the SPS Historical and Hybrid models (i.e. EU15) the proportion of holdings investing on fixed assets decreases everywhere but in IT Sud and Isole where it grows slightly (+3.6% and +1.9% respectively), throughout all UK regions (from +0.8% of England and Wales to +4.3% of Northern Ireland) and in ES Centro (+3.7%). Only ES Este records a larger increase (+13.5%). Conversely, in all regions applying the SPS Regional and SAPS models (i.e. the 10 MSs that joined the EU in 2004) the share of holdings investing in fixed assets increases or remains constant with two exceptions only: Estonia and Latvia, where this share decreases by 15.8% and 15.1% respectively.
- Southern Mediterranean and northern European regions show opposite patterns, with the share of holdings investing in fixed assets being significantly higher in the latter group and generally over 75% except only for Hungary (64.9% in Dunantul and 53.2% in Alfold és Eszak), Poland (60.8% in the West region and 64.8% in the East region), Czech Republic (67.2%) and Ireland (69%). In southern EU regions the percentage of holdings with positive gross investments is generally ranging between 20 to 40%, with a low point in IT Sud (13.2%) and a high point in ES Noroeste

and Noreste (respectively 69.4% and 59.7%).

The graph below shows the changes intervened between 2004 and 2009 in the share of farms with gross and net investment on fixed assets/ha across EU macro-regions (again within the FADN constant sample of farms).

Fig. 92 - Variation 2004-2009 in % share of farms with total Gross investment/ha >0 and Net investment/ha >0 in EU macro-regions (% point difference)



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The comparison of changes between 2004 and 2009 in the share of farms with gross and net farm investments/ha >0 highlights two main groups of regions:

- Regions where the reduction in the share of holdings able to compensate with new investments the depreciation of existing farm capital is larger than the reduction in the number of farms making investments at all, or such share of farms has decreased *vis-à-vis* an increase of the portion of farms investing on fixed assets. In the regions of the SPS Historical and Hybrid models this occurs in nearly all regions of France, in the Netherlands, in ES Este, in UK Wales, in Luxemburg, Denmark and Finland. In the regions of the EU10 implementing the SPS Regional model and SAPS this pattern is common to Slovenia, the Czech Republic, Estonia, Latvia, Lithuania and PL East.
- Regions where the share of holdings able to compensate with new investments the depreciation of existing farm capital has increased more relative to the increase in the number of farms making investments at all, or it has increased *vis-à-vis* a reduction of the portion of farms investing on fixed assets. We find such regions mostly among those implementing the SPS Historical and Hybrid models: Austria, FR Nord Pas-de-Calais, IT Nord-Ovest, IT Nord-Est, IT Isole, all three German regions, Sweden, UK England and Northern Ireland. Out of all regions of the SPS regional and SAPS models, only Cyprus shows the same pattern.

11.4.2 Farm investments on specific assets: agricultural land, land improvement, farm buildings, machinery & equipment

The analysis is taken to further detail by considering farm investments on specific assets: agricultural land, land improvement, farm buildings, machinery & equipment. Again the analysis is carried out on the 2004 and 2009 constant sample of FADN farms distinguishing between the different SFP models and farm types.

The table below shows the percentage shares of holdings with gross investment on individual assets per hectare > 0 in 2004 and 2009. For land improvement, farm buildings and machinery & equipment we also compare this share (gross investment/ha>0) with the proportion of farms able to compensate with these investments the loss of asset value due to depreciation (net investment/ha>0) in the two considered years.

Tab. 77 - Percentage share of farms with Gross and Net investment in specific fixed assets/ha >0 by TF and SFP model, 2004 and 2009 (%)

	AGRICULTURAL LAND															
	SPS Historical				SPS Hybrid				SPS Regional				SAPS			
	2004		2009		2004		2009		2004		2009		2004		2009	
Spec. field crops	3.2		3.8		15.6		13.7						17.5		16.1	
Spec. horticulture	2.6		2.1		5.4											
Spec. permanent crops	3.2		3.4		12.2		10.8						7.4		5.2	
Spec. grazing livestock	4.0		4.8		12.7		10.9		5.1		5.5		12.1		9.7	
Spec. granivores	4.1		5.7		10.1		7.5						10.3		8.4	
Mixed cropping	3.2		4.8		27.0		23.9						12.9		12.0	
Mixed livestock	5.1		5.9		13.5		12.2						6.4		5.3	
Mixed crops-livestock	5.1		4.6		18.3		17.7						13.3		13.0	
	LAND IMPROVEMENT															
	SPS Historical				SPS Hybrid				SPS Regional				SAPS			
	2004		2009		2004		2009		2004		2009		2004		2009	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Spec. field crops	2.7	2.2	3.0	2.4	5.4	4.0	5.4	4.6					0.7	0.6		
Spec. horticulture	8.2	6.8	7.2	5.5												
Spec. permanent crops	2.6	2.2	1.8	1.4	4.2	3.8	3.5	3.5								
Spec. grazing livestock	7.2	6.1	8.2	7.3	4.8	4.2	5.3	4.6			6.2	6.2				
Spec. granivores	6.1	5.1	7.6	6.2	5.1	4.6	5.6	4.9								
Mixed cropping	2.8	2.2	2.4	2.2												
Mixed livestock	5.1	4.3	6.9	5.7												
Mixed crops-livestock	6.0	4.9	5.7	4.7	3.8	3.4	4.2	3.8								
	FARM BUILDINGS															
	SPS Historical				SPS Hybrid				SPS Regional				SAPS			
	2004		2009		2004		2009		2004		2009		2004		2009	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Spec. field crops	10.2	6.1	8.8	5.4	28.9	16.3	29.6	18.5					13.3	11.0	22.8	16.5
Spec. horticulture	20.3	9.2	18.4	7.7	24.1	13.1	20.1	12.2					21.5	17.8	20.3	12.2
Spec. permanent crops	11.0	6.4	8.2	4.1	33.6	23.0	32.1	22.1					14.3	11.7	17.6	11.5
Spec. grazing livestock	26.4	14.3	23.1	12.8	37.4	18.6	39.1	21.9	24.8	10.2	38.5	20.7	14.9	11.8	15.2	9.7
Spec. granivores	36.0	15.2	33.2	14.3	48.2	22.7	39.4	19.2					14.0	11.0	16.4	11.0
Mixed cropping	8.6	5.5	7.1	4.3	39.6	20.3	39.2	23.4					11.8	7.5	20.5	14.4
Mixed livestock	31.2	13.4	29.4	11.7	32.3	16.0	34.8	21.3					9.2	7.2	12.7	8.6
Mixed crops-livestock	24.2	11.3	22.0	11.5	38.3	17.3	38.0	20.7					13.9	9.6	19.3	12.1
	MACHINERY & EQUIPMENT															
	SPS Historical				SPS Hybrid				SPS Regional				SAPS			
	2004		2009		2004		2009		2004		2009		2004		2009	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Spec. field crops	31.9	13.9	31.1	14.5	80.7	31.2	73.4	28.9					49.9	30.1	53.5	28.8
Spec. horticulture	37.6	15.9	33.8	13.1	71.0	23.8	67.7	23.2					35.6	20.6	37.4	22.0
Spec. permanent crops	29.2	13.2	25.3	11.4	79.0	24.8	74.6	24.8					43.8	29.1	39.7	19.5
Spec. grazing livestock	54.3	26.0	48.1	21.6	82.7	32.9	76.9	28.6	61.7	46.4	68.0	36.0	48.1	27.6	47.9	24.1
Spec. granivores	50.1	18.8	49.7	23.5	85.3	29.2	75.2	28.7					39.1	18.7	42.5	23.3
Mixed cropping	24.2	12.4	21.4	9.7	80.6	24.8	79.7	27.0					35.6	18.3	41.4	19.8
Mixed livestock	55.6	23.3	53.0	20.0	80.7	21.3	77.9	23.8	57.7		84.0		31.0	12.1	39.0	19.9
Mixed crops-livestock	50.6	22.0	47.3	18.6	82.8	27.4	77.3	27.7	57.7	46.2	73.1	48.1	44.4	20.7	46.2	21.3

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Concerning the proportion of farms with gross investment/ha >0 (single assets), the frequencies reported in the table above suggest the following observations:

- Across all sectors and SFP models, the number of holdings investing in machinery & equipment is much higher compared to holdings investing in land, land improvements and farm buildings in both considered years. This is not surprising given the different scale of investment required, generally smaller for machinery & equipment than for land and buildings;
- More specifically, land investment and improvements only concern a very small proportion of farms in the examined constant sample, to the extent that in many cases analysis is not possible as the number of farms with this types of investments (subdivided by sector and SFP model) falls under the threshold for which analysis of FADN data is allowed (i.e. 15 farms). This occurs mostly in regions of the SPS Regional and SAPS models.
- Consistently with what observed at the aggregate level for all gross investments, the group of

regions implementing the SPS Hybrid model comprises higher number of holdings with investments in all individual fixed assets compared to the regions implementing the other SFP models. Such pattern is common to all farm types. In the case of agricultural land, regions of both the SPS Hybrid and SAPS models comprise a significantly larger share of farms with land investments compared to the regions of the SPS Historical model.

The comparison of gross investments on single fixed assets (per ha) in 2004 and in 2009 across farm types and SFP models leads to the following considerations:

- Agricultural land: in 2004 the share of farms investing on agricultural land in the regions of the SPS Historical model is much lower compared to both SPS Hybrid and SAPS models, but it increases (albeit the change is relatively small) in 2009 across most sectors, with the only exception of Specialist horticulture and Mixed crops-livestock farms. The opposite is observed in the regions implementing the SPS Hybrid and SAPS models, where the share of farms expanding through land acquisition shrinks between 2004 and 2009 across all farm types.
- Land improvements: the comparison is possible only between regions of the SPS Historical and Hybrid models. Similarly to what observed in the case of land investments, changes in the share of farms investing on land improvements between 2004 and 2009 are of small magnitude. In both SPS models, the portion of farms investing on land improvements tends to increase in specialist livestock farms (Grazing livestock and granivores) and to decrease in crop farms (Specialist horticulture and permanent crops farms, Mixed cropping farms).
- With regard to investments on farm buildings and machinery & equipment, the regions implementing the SPS Historical and Hybrid models on the one hand and the SPS Regional and SAPS models on the other, show opposite investment patterns. The percentage share of holdings investing in these two types of assets decreases in the former groups (only exceptions are Specialist grazing livestock and Mixed livestock farms of the SPS Hybrid model, where small increases are recorded in the percentage share of farms investing in buildings), whereas it increases in the latter, again with only a couple of exceptions for Specialist horticulture (farm building investments) and Specialist permanent crops holdings (machinery investments) of regions applying the SAPS.
- The largest positive changes from 2004 to 2009 are recorded in particular for mixed farm types such as Mixed cropping (SAPS – increasing share of farms investing in buildings), Mixed livestock (SPS Regional and SAPS – machinery & equipment) and Mixed crops-livestock (SPS Regional- machinery & equipment), but also for Specialist grazing livestock farms of the SPS Regional model (farm buildings).
- The largest reduction in the share of farms investing in both farm buildings and machinery & equipment occurs in Specialist granivore farms of regions implementing the SPS Hybrid model.

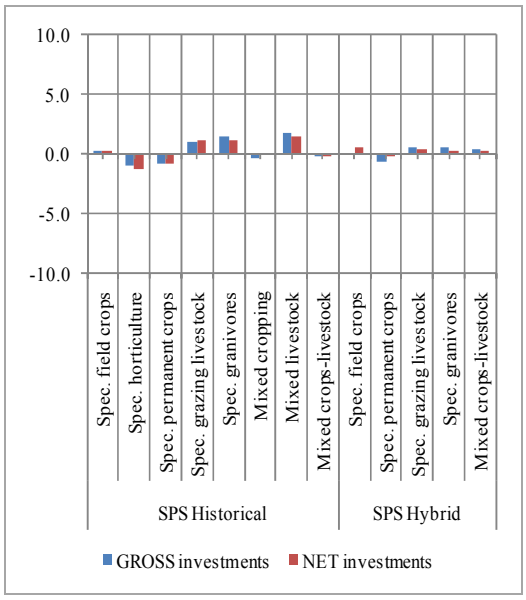
In the case of farm buildings and machinery & equipment, the comparison of the shares of farms with positive gross and net investment balance (investment/ha>0) (see Tab.2 above) confirms what already observed for total investments: out of the total number of farms making new investments in a given year (2004, 2009), only a fraction of them are able to compensate the loss of value of the different assets due to depreciation. There are, however, some differences among regions implementing different SFP models. In particular, the share of farms with net investments /ha >0 in such assets, but more so for machinery & equipment, tends to be higher in regions implementing the SAPS compared to regions applying the SPS Historical and Hybrid models.

In contrast, the analysis shows that the near totality of farms investing in land improvements (generally over 75% in 2004 and 2009) are able to preserve the value of farm land through such investments. This applies to all examined sectors and groups of regions (i.e. those of the SPS Historical and Hybrid models).

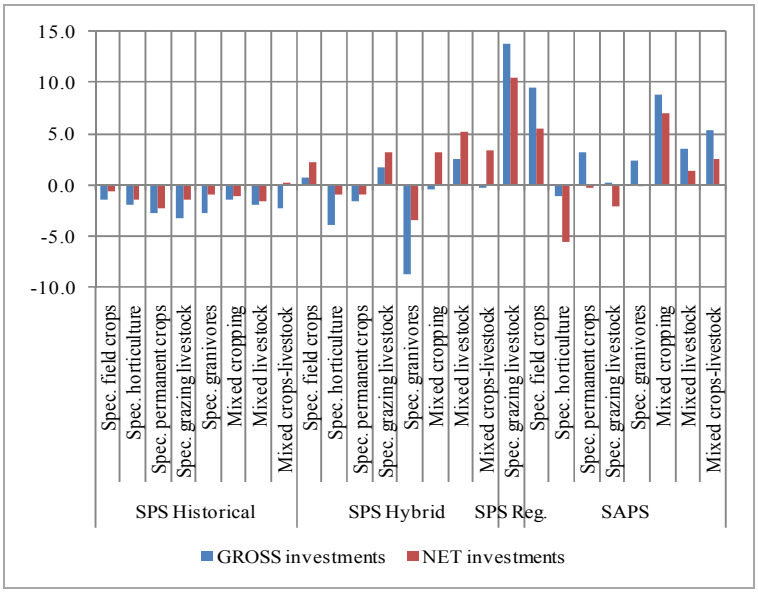
The graphs below summarise the 2009/2004 changes in the shares of farms with positive gross and net investment balances for the individual fixed assets considered in the analysis, distinguishing by sector and SFP implementation model.

Fig. 93 - Variation 2004-2009 in % share of farms with total Gross investment/ha >0 and Net investment/ha >0 in EU macro-regions (% point difference)

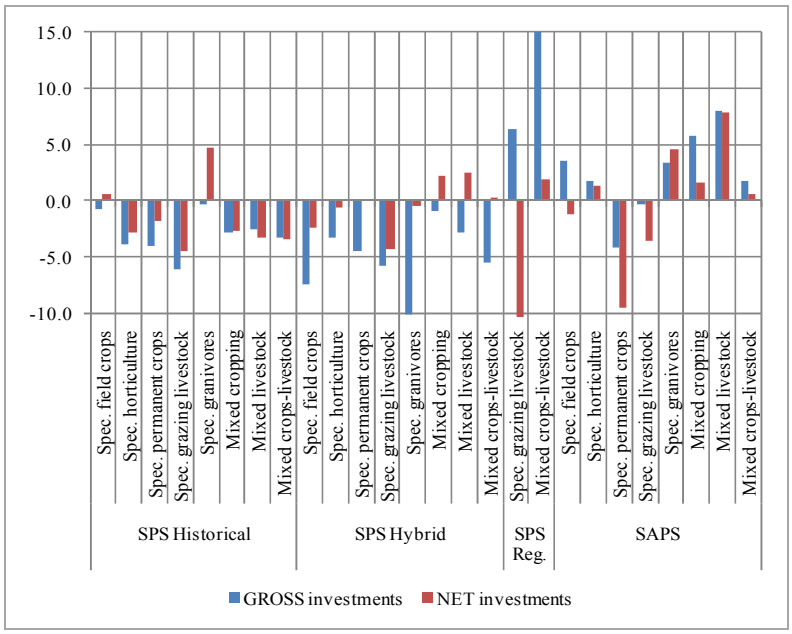
Land improvement



Farm buildings



Machinery & equipment



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

With regard to land improvements, the very small changes in the shares of farms with gross and net investment /ha >0 between 2004 and 2009 are almost identical both in terms of direction and magnitude.

The pattern of 2009/2004 changes in the percentage shares of farms with gross and net investment/ha >0 in farm buildings and machinery & equipment broadly reflects what observed in the case of total investments on fixed assets, with only few differences:

- In the regions implementing the SPS Historical model the fraction of farms able to compensate the loss of value of buildings and machinery with new investments tends to reduce (but less compared to the reduction in the share of farms making new investments) or not change significantly in all sectors, with the only exception of machinery & equipment investments in Specialist granivore farms where the portion of farms able to compensate the loss of capital with new investments increases.
- In the regions of the SPS Hybrid model, the proportion of farms able to make up for the loss of

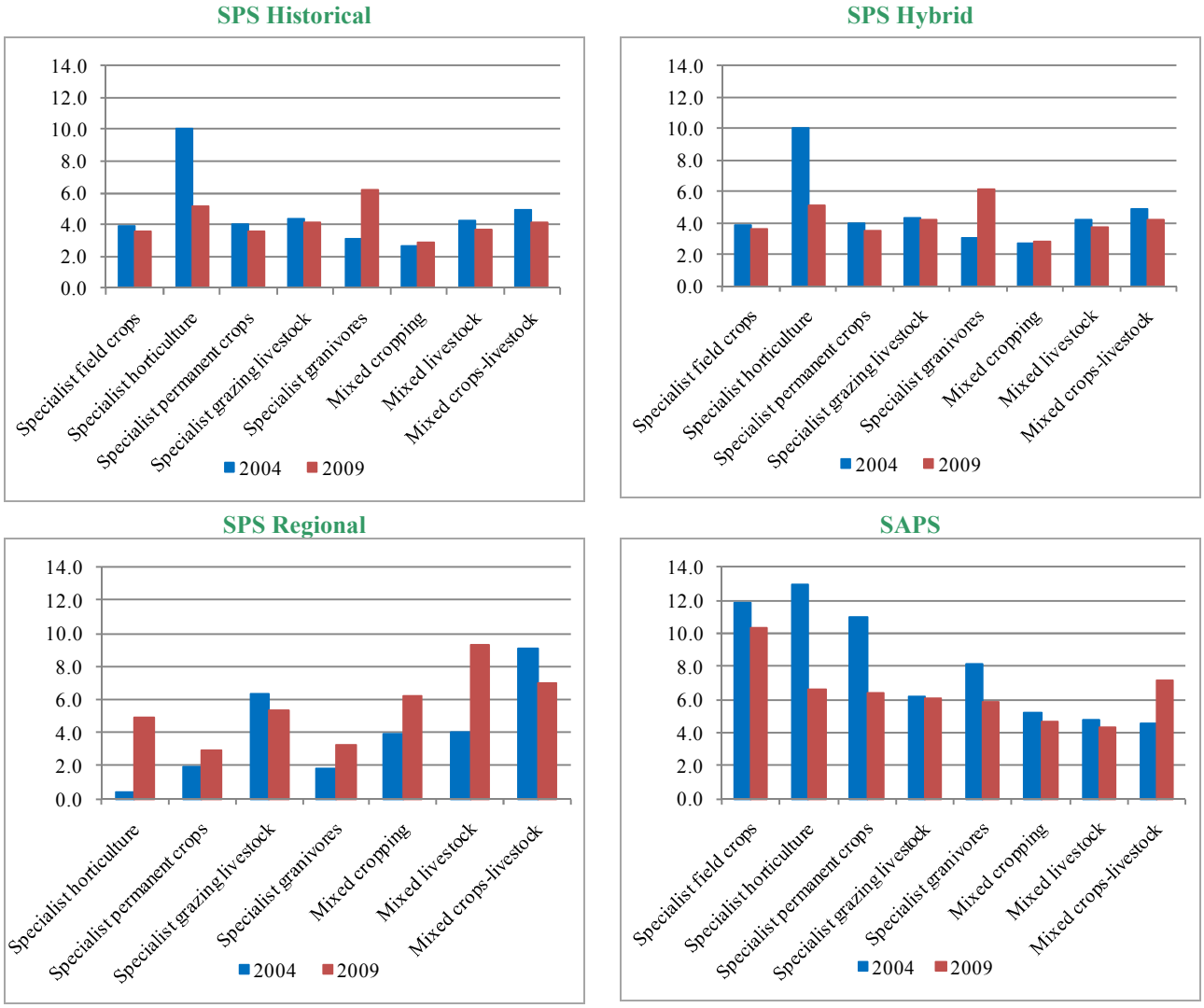
value of existing capital with new investments grows between 2004 and 2009 in a number of farm groups: Specialist field crop, Specialist grazing livestock and Mixed crops-livestock farms (investments in farm buildings); Mixed cropping and Mixed livestock farms (both investments in buildings and machinery & equipment).

- In the regions of the EU10 (SAPS and SPS Regional model) where the proportion of farms making new investments in buildings and machinery generally increases between 2004 and 2009, the position of farms with respect to maintaining the value of farm capital appears to worsen in some sectors: with respect to machinery & equipment, in Specialist grazing livestock farms (both SPS Regional and SAPS) and in the Specialist permanent crop and field crop farms (SAPS); with respect to farm building investments, in Specialist horticulture, permanent crops and grazing livestock farms (SAPS).

11.4.3 Farm propensity to invest on fixed assets

The last part of the analysis examines farms' propensity to invest measured as the share of gross investment over the value of farm capital (i.e. fixed assets) in a given year. The changes intervened in farm propensity to invest between 2004 and 2009 are analysed for regions grouped according to model of SFP implementation distinguishing between farm types.

Fig. 94 - Farm propensity to invest on fixed assets by TF and SFP, 2004 and 2009



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The analysis of the results reported in the graphs above allow the following considerations:

- Propensity to invest on fixed assets is generally contained, with gross investments representing in most cases no more than 8% of the value of total farm capital in most farm types across the examined groups of EU regions (slightly higher only in 2004 in SAPS regions for Specialist field

crops, horticulture and permanent crops holdings; in SPS historical regions for Specialist horticulture holdings).

- Overall, the regions implementing the SPS Historical model show lower propensity to invest compared to regions applying the other SFP models.
- Within the EU15, propensity to invest appears to be slightly higher in the regions implementing the SPS Hybrid model than in the regions of the SPS Historical model. Propensity to invest generally decreases across nearly all sectors in these two groups of regions, with fairly similar patterns of change between 2004 and 2009. Only Specialist granivore farms show opposite variations in investment propensity (growth in the SPS Historical and drop in the SPS Hybrid). The largest decreases in propensity to invest are recorded for Specialist Horticulture farms (both SPS Historical and Hybrid models) and for Specialist granivore farms of regions applying the SPS Hybrid model.
- In the regions applying the SAPS propensity to invest reduces across nearly all sectors as well, and more so in the farm types where propensity was higher than elsewhere in 2004 (Specialist field crop, horticulture, permanent crop and granivore farms).
- Differently from the other three SFP models, in the regions of the SPS Regional model propensity to invest appears to increase between 2004 and 2009 in five out of seven analysed sectors. However, results should be interpreted with caution, as previously said, due to the small size and large internal variability of the FADN constant sample for these regions.
- Specialist horticulture farms show the largest reductions in propensity to invest on fixed assets across all policy models, with the only exception of the SPS Regional model.

Finally, we have examined the overall propensity to invest on fixed assets across EU macro regions, again focusing on the changes intervened between 2004 and 2009. Consistently with what observed at the more aggregate level of SFP models, propensity to invest decreases in nearly all regions implementing the SPS Historical and Hybrid models, and more specifically:

- Reduction in investment propensity appears to be more marked across all French regions, BE Région Wallonne, Portugal, the two northern regions of Spain, UK Scotland, Denmark (where the largest decrease is observed), Finland and Luxembourg. Very few regions increase their propensity to invest in 2009 compared to 2004: BE Règion Flamande, DE East & North-East, UK Northern Ireland and ES Este. In all other regions, propensity does not appear to change in any significant way.
- Changes within the regions implementing the SPS Regional and SAPS models are more mixed. Decrease in the propensity to invest is recorded in 2009 in Slovenia, the two Polish regions, Estonia, Latvia and Lithuania (with reduction being significantly more marked in the three Baltic republics). In the remaining regions propensity to invest increases, with Slovakia seeing the largest growth.

11.4.4 Indicator resulting from the CATI survey

The statistical analysis developed in the previous section has compared FADN farm data in 2004 and 2009. Here, we integrate the analysis with farmers' opinions about whether the switch from coupled to decoupled support has facilitated their investment decisions and their access to credit.

We asked farmers if, in the period following the introduction of the SFP, they made investments (distinguishing between on-farm or off-farm investments) and, in this case, if their decision was facilitated by the SFP. The graph below shows the results aggregated by SFP implementation models and other sample characteristics.

Fig. 95 - CATI survey: SFP and farm investments

Source: CATI survey

The following observations can be made:

- With respect to SFP implementation model, in line with the results of the previous analysis, the highest percentage of farmers who have made investments in the period following the introduction of the SFP is recorded in the regions applying the SPS Regional (Slovenia) and the SAPS. The lowest proportion is found in the regions applying the SPS Historical model (25.8%). In this group a clear opposite pattern is observed: Makedonia-Thraki (Greece) and Estremadura (Spain) record a very low proportion of farms having invested (respectively 1.1% and 7.8%), on the other hand Algarve (Portugal) and Emilia Romagna (Italy) record respectively 48.9% and 51.1%. The region England East differs from other regions applying the SPS Hybrid model, with a much lower proportion of farms having invested.
- The strategic behaviour of farmers is mainly oriented towards investment on the farm (only 2.7% of the total number of farmers who have made investments, invested almost exclusively outside the farm, e.g. real estate, purchase of bonds).
- Small farms (up to 19.9 ha) and farms managed by holders over 65 years-old record the lowest proportion of holdings having made investments.
- In the opinion of the majority of farms having invested, farm investments have been facilitated by the introduction of the SFP. The proportion is much higher in the two regions of Poland and Hungary (SAPS), the lowest proportion is recorded in England East. Also, the effect of SFP on farm investments seems to be less important in Slovenia and in the Medium size farms.
- With respect to level of direct support, the effect of SFP on farm investments seems to be relatively higher in the groups of respondents receiving direct payments in the range of 4,000-8,000 Euro per year (2009).
- With respect to size farm, the importance of SFP on farm investments seems to be relatively lower in Medium farms (from 20 to 49.9 ha) relative to Small and Large farms (50 ha or over).

We also asked farmers how these investments were financed and if CAP entitlements had somehow facilitated their access to credit (for investments but also for operating costs, e.g. seeds purchase) in terms of reliance and/or conditions. With regard to the source of financing, in most cases farmers used a mix of sources: farm proceeds and own capital (25.2%), farm proceeds, own capital and bank loans (22.2.%).

Regarding access to credit, opinions vary among regions. In 6 regions (of Portugal, France, Italy, Spain, two German regions), 20-30% of farmers stated that CAP entitlements have enhanced their situation. This proportion is much higher in the Polish region (88.9%) and in the Greek region (71.1%). At the other extreme we find the results of Slovenia, East England and the Hungarian region.

With respect to the other sample characteristics, CAP entitlements seem to have facilitated access to credit, particularly for young farmers.

11.4.5 Effects of direct payments on farm investments: results of the econometric model

The evaluation of the influence of direct payments on investment decisions, is carried out by testing a model with gross investment on fixed assets per hectare of utilised agricultural area as the dependent variable (FADN variable SE516).

More precisely, the adopted dependent variable is defined as:

Gross investment on fixed assets = Purchases – Sales of fixed assets + breeding livestock change of valuation

When the Sales of fixed assets is higher than the sum of the other components, the value of the dependent variable becomes negative, therefore preventing the use of the logarithmic parameterization of the model. The proposed model is a linear fixed effects panel model[241].

The definition of the data sample in this case is critical. The extremely high variability of the dependent variable, the presence of numerous outliers and of heteroskedasticity, a structurally different investment behaviour among farms across European regions, suggested to select the sample in such a way as to allow a substantial improvement of the explanatory performance of the model. As a consequence, after an accurate analysis of the data distribution as well as of the distribution of model residuals estimated on the full data sample, farms under 5 hectares and outliers present in some regions were excluded from the final sample[242]. After sample selection, the sample size is reduced from the original 191,325 to 159,815 observations.

The model still presents signs of the presence of heteroskedasticity, but its quality is certainly improved.

The structure of the model is represented by:

$$I_{i,t} = \beta_0 + \sum_k \gamma_k P_{i,t,k} + \theta\, K_{i,t-1} + \sum_m \delta_m F_{i,t,m} + \sum_n \lambda_n C_{i,t,n} + \varepsilon_{i,t}$$

Where:

$I_{i,t}$ Gross investments per hectare of agricultural utilised area;

$P_{i,t,k}$ Public payments per hectare, with k=4: Coupled direct payments, Decoupled direct payments, Rural development aids and Subsidies on investment;

$K_{i,t-1}$ Capital per hectare of agricultural utilised area at time t-1, and where *Capital = Total fixed assets – Land assets*

$F_{i,t,m}$ Set of variables at farm level, with m=5: Total output, Loans, Age of holder, Organisational form (dummy variable) and Type of farming (dummy variable);

$C_{i,t,n}$ Gross domestic product per capita as a variable representing the general macroeconomic context at regional level within the five years interval.

Collinearity (Variance inflation factor test –VIF – whose average values are under a cut-off value of 2) and heteroskedasticity[243] (Breusch–Pagan) tests are carried out on the estimated model. The tests highlight the absence of collinearity and the presence of heteroskedasticity. The latter uses heteroskedasticity consistent standard errors, after an accurate analysis of the distribution of residuals.

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[241] A random effects specification has also been estimated but was rejected on the basis of the Hausman test.

[242] In particular, observations from the Netherlands, Denmark, the Mazowieckie Region in Poland (PL12) were excluded as well as five observations (1 in Italy, 1 in Ireland, 1 in Spain and 2 in Latvia) were excluded.

[243] Collinearity refers to an exact or approximate linear relationship between explanatory variables.

Heteroskedasticity occurs when the variance of the error terms differ across observations (e.g. if there are sub-populations that have different variabilities from others on a set of variables). The presence of heteroskedasticity is a concern in the application of regression analysis because it can invalidate statistical tests of significance.

The dependent variable is Gross investment on fixed assets per hectare of utilised agricultural area. The model tests the effects of 16 explanatory variables summarized as follows:

- *Public subsidy variables*
  - Coupled Payments per hectare
  - Decoupled Payments per hectare
  - Rural development Payments per hectare
  - Subsidies on investment per hectare
- *Farm variables*
  - Capital per hectare at time t-1
  - Total output per hectare
  - Loans per hectare
  - Age of holder
  - Organisational form - dummy variable where: 1=Individual farms (base outcome); 2=Partnership; 3=Other
  - Types of farming - dummy variable where: 1=Field crops (base outcome); 2=Horticulture; 3=Whie; 4=Other permanent crops; 5=Milk; 6=Other grazing livestock; 7=Granivores; 8=Mixed
- *Context variable*
  - Gross domestic product per capita

Tab. 78 shows the panel estimation results. When using heteroskedasticity consistent standard errors, only few of the estimated parameters are statistically significant.

The contribution of public support is positive and significant only in the case of subsidies on investment and coupled direct payments. As expected, the parameter estimate associated to subsidies on investment has a large positive and significant value (1.024). The parameters associated with decoupled payments and rural development aids are not significant. In synthesis, while coupled payments appear to have an effect on farm investments (per ha) in the years following the implementation of the 2003 CAP reform, decoupled payments do not.

With respect to the variables describing farm's characteristics, it should be noted that their estimated parameters are mostly not significantly different from zero. The statistically significant negative effect of farm capital on investments (per hectare) suggests that for higher levels of farm capital, the scope for investments is reduced.

Tab. 78 - Results of the panel regression model with Investments per ha as dependent variable

Gross Investment per ha	Coefficient.	Robust Std. Err	t	P>|t|
Capital per ha (t-1)	-0.0409	0.0149	-2.75	0.006
Coupled direct payments per ha	0.1256	0.0602	2.08	0.037
Decoupled direct payments per ha	0.0095	0.0934	0.1	0.919
Rural development payments per ha	0.3591	0.3183	1.13	0.259
Subsidies on investments per ha	1.0240	0.2472	4.14	0.000
Total output per ha	0.0257	0.0117	2.2	0.028
Loans per ha	0.3335	0.0641	5.2	0.000
Age of holder	0.3662	1.1094	0.33	0.741
Organisational form (Partnerships) - Dummy	-107.13	85.79	-1.25	0.212
Organisational form (Other) - Dummy	49.93	64.28	0.78	0.437
Types of farming (Horticulture) - Dummy	-257.49	157.40	-1.64	0.102
Types of farming (Wine) - Dummy	21.41	65.43	0.33	0.744
Types of farming (Other permanent crops) - Dummy	-67.47	52.93	-1.27	0.202
Types of farming (Milk) - Dummy	36.78	36.58	1.01	0.315
Types of farming (Other grazing livestock) - Dummy	-49.95	27.74	-1.8	0.072
Types of farming (Granivores) - Dummy	-49.93	40.15	-1.24	0.214
Types of farming (Mixed) - Dummy	-6.14	15.81	-0.39	0.698
Gross Domestic Product per capita	21.00	5.15	4.08	0.000
Constant	-324.15	138.89	-2.33	0.020
Number of observations	159751			
Log likelihood	-1.40E+06			
Degrees of freedom model	18			
Degrees of freedom residuals	127344			
R^2	0.52386			
Adjusted R^2	0.40269			
F	6.9086			

11.5 Farm marketing strategies

The analysis of farm marketing strategies is entirely based on the data collected through the ad hoc CATI survey in the twelve case study regions (994 interviews). The interviewed farm holders were asked whether they were members of a co-op or producers' organisations and whether they had direct relationships with the processing industry and with food retailers before the introduction of the single payment, and if they still use today such marketing strategies.

Farmers were also asked whether they have started direct sales of their products (on the farm or in farmers' markets, through mail order, internet sales, etc.) and whether the single payment had any impact on their decisions.

The results of the survey data analysis are presented in the following sections.

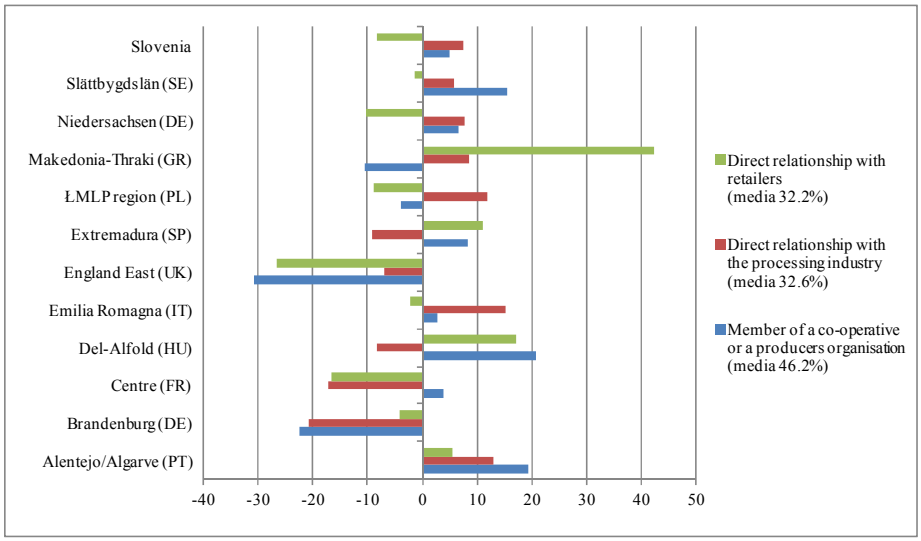
11.5.1 Marketing strategies currently implemented by farms in the 12 case study regions

The CATI survey results show that, currently (at the time of interviews during winter 2012-2013) 46.2% of farms (out of 994 interviews) are members of a co-operative or Producers Organisation (PO); 32.6% of farms have a direct relationship with the processing industry and 32.2% have a direct relationship with food retailers[244].

[244] There is some overlapping with farms implementing more than one marketing strategy: overall, 37% of farms are both Member of a co-operative or PO and have Direct relationship with the processing industry. The frequency is much higher in England East (57%) , Makedonia-Thraki (53%) e Alentejo/Algarve (51%) , whereas it is close to zero in Centre FR.

Individual regions present different shares compared to the overall average, as illustrated by the graph below.

Fig. 96 - CATI survey: Differences between percentage shares of farms implementing marketing strategies across regions and the average sample share



Source: CATI survey

The comparison between the sample average and each region's percentage shares of farms implementing the three different marketing strategies leads to the following observations:

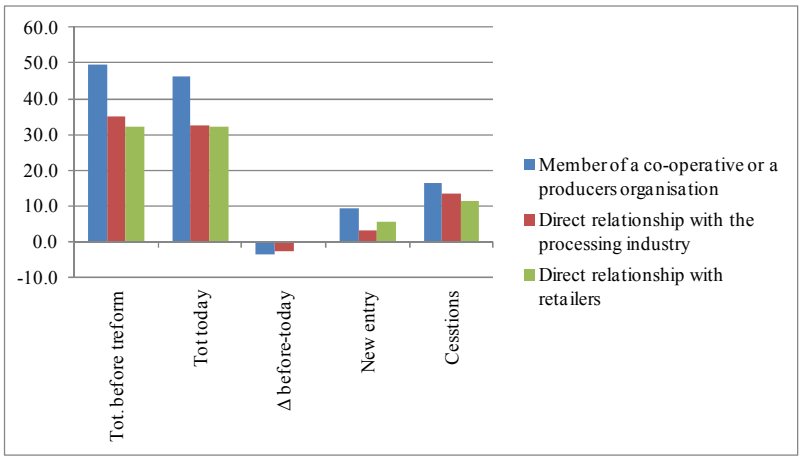
- Only Alentejo/Algarve presents percentage shares above the sample average for all three types of marketing strategies;
- In Emilia-Romagna (IT), Niedersachsen (DE), Slättbygdslän (SE) and Slovenia percentages are higher than average for both "Member of a co-operative or a producers organisation" and "Direct relationship with the processing industry", but lower than average for "Direct relationship with retailers." In Emilia Romagna, direct relationship with the processing industry shows the highest frequency (+15.2 points compared to the average);
- Del-Alfold (HU) and Extremadura (SP) show above average percentages for both "Member of a co-operative or a producers organisation" and "Direct relationship with retailers", but below average for "Direct relationship with the processing industry ". In Del Alfold, farms that are "Member of a co-operative or a producers organisation" are the most frequent (+21 points compared to the average);
- Makedonia-Thraki (GR) has higher percentage than average for both "Direct relationship with the processing industry" and "Direct relationship with retailers", but lower than average for "Member of a co-operative or a producers organisation". In particular, Direct relationship with retailers located is the most frequent marketing strategy in this region (+42 points compared to the average). Moreover, thanks to the large number of farms having direct relationship with retailers, Makedonia-Thraki is also the region with the largest overall percentage of holdings having developed the examined marketing strategies;
- By contrast, Brandenburg (DE) and East England (UK) have lower than average percentages in all the three types of commercial relationship. In these two regions, therefore, we find the farms that least developed these marketing strategies. In addition, in East England "Member of a co-operative or a producers organisation" and "Direct relationship with retailers" show the absolute lowest percentage shares (respectively, -30.6 and -26.6 points compared to the average), whereas a similar situation is found in Brandenburg with respect to "Direct relationship with the processing industry" (-20.8 points compared to the average).

11.5.2 Evolution of farms' implementation of marketing strategies

The current situation described in the previous section, is the result of diverging changes involving farms across the examined regions, in particular, of farms that have started marketing strategies after the 2003 CAP reform ("new entry") and of farms that implemented these strategies before the reform, but who have subsequently abandoned them. The following graph shows:

- the % of farms implementing marketing strategies before the 2003 CAP reform, the % of farms implementing the strategies today, the difference between before the reform and today (% points);
- the % of farms that did not implement marketing strategies before the reform but have started them afterwards ("New entry");
- the % of farms implementing marketing strategies before the reform that subsequently abandoned it ("Cessation").

Fig. 97 - CATI survey: Evolution in the percentage shares of farms developing/maintaining/abandoning marketing strategies



Source: CATI survey

The analysis shows that the resulting balance between farms starting up and abandoning specific marketing strategies is negative in the case of "Member of a PO / Cooperative" (-3.4 percentage points after the reform) and "Direct relationship with processing industry" (-2.6 percentage points), while it is zero for "Direct relationship with retailers" (i.e. the number of farms developing and abandoning this strategy is identical).

Overall, therefore, the results would not seem to suggest any role played by the 2003 reform (and in particular of direct payments) in the marketing decisions of agricultural holdings.

Again, the overall results mask some significant differences among the examined regions. In particular:

- with regard to "Member of a co-operative or a producers' organisation", we observe a fall in Makedonia-Thraki (GR) (-27 % points between pre- and post-reform), and a strong decrease in Emilia-Romagna (IT) (9 % points)[245]. By contrast, in Alentejo / Algarve (PT) and Centre (FR) the interest in this marketing strategy has grown (+5.6 points and +6.7 points, respectively)[246];
- with regard to having a "Direct relationship with the processing industry" there has been a collapse in East England (-16.7 % points between pre- and post-reform), and a strong decrease in Makedonia-Thraki (9 points)[247]. By contrast, in Extremadura and in Slovenia has been a modest growth of companies that implement the strategy (4.4 points and 2.5 points, respectively).
- with reference to "Direct relationship with retailers," an important decrease is recorded in Extremadura (-12.2 % points after the reform)[248]. By contrast, in Emilia-Romagna there has been a

[245] In Makedonia-Thraki 45% of farms that implemented this strategy before the reform claimed that they subsequently abandoned it, while only 3% of farms represent a "new entry". In Emilia Romagna, these percentages are respectively 19% and 5.2%. Also worthy of note is the case of England East where vis-à-vis a balance of -5.6 % points (between pre- and post-reform), 26% of farms have abandoned this strategy, while no farm has started the strategy as new.

[246] In Alentejo/Algarve farms representing a "new entry" reach 22%, against 5.6% of farms that have abandoned this strategy. In Centre FR these percentages are 19.6% and 10.3% respectively.

[247] In England East 45% of farms implementing this strategy before the reform, have subsequently abandoned it, whereas only 4% have started it as new. In Makedonia-Thraki such percentages are 18% e 0%, respectively.

[248] In Extremadura 40% of farms implementing this strategy before the reform, have subsequently abandoned it, whereas 22.5% have started it as new. It is worth mentioning that in England East vis-à-vis a balance of -3.3 % points (between pre- and post-reform), 37.5% of farms have abandoned this strategy, while no farm has started the strategy as new.

significant growth in the number of farms implementing this strategy (appx +9 % points)[249] and a smaller increase in Makedonia-Traki and Del-Halfold (both +3.3 % points). Finally, for three regions (Centre FR, Slättbygdslän and Slovenia) no change occurs after the reform.

It is also interesting to test whether and to what extent is there a correlation between the Direct relationship with retailers and product processing on the farm (i.e. farm diversification), based on the hypothesis that farm product processing activity may have stimulated the development of direct relationships with retailers. For this purpose, we calculated the percentage of farms that have started selling directly to food retailers after the reform, out of the total number of farms that have, at the same time, product processing activities on the farm. The results show that this only occurs in 4 regions (out of the 12), and in particular: 27-28% of farms in Alentejo / Algarve and in Brandenburg, 15% and 9% respectively in Extremadura and in Emilia Romagna.

11.5.3 Direct sale of farm products

Finally, respondents were asked to indicate if, after the introduction of the single payment, they have started direct sale of farm products[250]. Over 21% of the total answered affirmatively. Such percentage is remarkably higher in East England (70%), in Del-Alfold (37.4%) and Emilia-Romagna (34.4%). By contrast, in ŁMLP region, Makedonia-Thraki, Niedersachsen and Slättbygdslän, the number of farms that developed this marketing channel is very limited (between zero and 6%).

Nonetheless, when asked about the extent to which the introduction of the single payment has influenced the decision to start up direct sale channels, only 18% of those who developed this marketing strategy answered affirmatively (including both given answers “yes, a little”, “yes, a lot”).

In this case too it is interesting to investigate whether and to what extent is there a relationship between opening up direct sale channels and farm product processing activity (diversification strategy). Thus, we calculated the percentage share of farms that have started direct sale of their produce after the reform out of the total number of farms that have product processing activities on the farm. The results show that such a relation exists in eight regions (of the 12 analysed)[251], with a higher frequency in Alentejo/Algarve (91%), East England (78%) and Brandenburg (71%).

11.6 Farm diversification strategies

This section presents the analysis of farm diversification strategies carried out, firstly, at the macro-level on regional Eurostat data (FSS) focussing on the changes occurred between 2005 and 2010 and, subsequently, at the micro level through examination of the 2004-2009 constant sample of FADN farms and farms in the twelve case study regions (CATI survey).

In all parts of the analysis, results are discussed through comparison of the groups of regions implementing the different SFP models and, where appropriate, through more detailed analysis at the regional level within SFP models to highlight specific phenomena and changes.

11.6.1 Farm diversification in the EU27, 2005 – 2010

This first part of the analysis is based on Eurostat regional data to provide an overview of the changes intervened between 2005 and 2010 in the number of holdings with on-farm diversified activities across the regions of the EU27 (except Romania, as explained in § 11.2).

The magnitude of the “other gainful activities” phenomenon is described through the percentage shares of farms with such diversified activities over the total number of farms in 2005 and 2010 (overall and for each type of OGA). In addition, the percentage variation in the number of holdings between the two examined years is computed to summarise the changes occurred in absolute terms.

The table below reports the results of the analysis distinguishing between groups of regions implementing the different SFP models and the different other gainful activities.

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[249] In Emilia Romagna farms representing a “new entry” reach 12.7%, against 5.3% abandoning the strategy.

[250] Including product sale on farmers’ markets, through mail order, Internet sale, etc.

[251] The four regions where the percentage equals zero are the ŁMLP region (PL), Makedonia-Thraki, Niedersachsen and Slattbygldslandan.

Tab. 79 - Evolution of holdings with other gainful activities by SFP model, 2005 – 2010

		No. holdings		% holdings with OGA/tot holdings		% variation no. holdings 2010/05
		2005	2010	2005	2010	
SPS Historical	Total	4 968 620	4 503 910			-9.4
	Holdings with Other Gainful Activities	304 940	264 660	6.1	5.9	-13.2
	Tourism	52 470	53 270	1.1	1.2	1.5
	Renewable energy production	5 560	13 310	0.1	0.3	139.4
	Aquaculture	970	1 540	0.0	0.0	58.8
	Contractual work	53 150	62 510	1.1	1.4	17.6
	Processing of farm products	134 720	56 870	2.7	1.3	-57.8
	Handicraft	3 830	2 680	0.1	0.1	-30.0
	Wood processing	7 960	6 180	0.2	0.1	-22.4
	Organic farming	96 710	107 740	1.9	2.4	11.4
	Other gainful activities n.a.e.	103 260	52 810	2.1	1.2	-48.9
SPS Hybrid	Total	813 410	607 370			-25.3
	Holdings with Other Gainful Activities	174 090	182 660	21.4	30.1	4.9
	Tourism	44 570	24 550	5.5	4.0	-44.9
	Renewable energy production	19 800	42 450	2.4	7.0	114.4
	Aquaculture	1 990	1 270	0.2	0.2	-36.2
	Contractual work	58 680	65 550	7.2	10.8	11.7
	Processing of farm products	29 600	18 000	3.6	3.0	-39.2
	Handicraft	3 340	2 910	0.4	0.5	-12.9
	Wood processing	5 880	8 090	0.7	1.3	37.6
	Organic farming	24 750	26 930	3.0	4.4	8.8
	Other gainful activities n.a.e.	54 420	44 870	6.7	7.4	-17.5
SPS Regional	Total	88 240	87 180			-1.2
	Holdings with Other Gainful Activities	3 470	12 790	3.9	14.7	268.6
	Tourism	550	640	0.6	0.7	16.4
	Aquaculture	10	30	0.0	0.0	200.0
	Contractual work	850	780	1.0	0.9	-8.2
	Processing of farm products	1 220	2 610	1.4	3.0	113.9
	Handicraft	150	170	0.2	0.2	13.3
	Wood processing	450	510	0.5	0.6	13.3
	Organic farming	1 220	1 860	1.4	2.1	52.5
	Other gainful activities n.a.e.	640	410	0.7	0.5	-35.9
SAPS	Total	4 291 160	2 843 040			-33.7
	Holdings with Other Gainful Activities	201 540	114 720	4.7	4.0	-43.1
	Tourism	12 640	11 620	0.3	0.4	-8.1
	Renewable energy production	620	540	0.0	0.0	-12.9
	Aquaculture	14 820	5 290	0.3	0.2	-64.3
	Contractual work	43 060	28 320	1.0	1.0	-34.2
	Processing of farm products	30 520	31 290	0.7	1.1	2.5
	Handicraft	3 540	1 950	0.1	0.1	-44.9
	Wood processing	12 440	3 180	0.3	0.1	-74.4
	Organic farming	6 870	21 310	0.2	0.7	210.2
	Other gainful activities n.a.e.	96 190	37 500	2.2	1.3	-61.0

Source: Elaborations based on Eurostat data

The analysis of the data presented in the table above leads to the following considerations:

- Across the four examined groups of regions, in 2005 the number of holdings with other gainful activities represents a variable share of the total number of holdings, more similar in size among the regions implementing the SAPS, SPS Historical and Regional models (ranging between 4% and 6%), but reaching as much as 21.4% in the regions of the SPS Hybrid model;
- In the Hybrid model, the overall high frequency of holdings with OGA is due to the important presence of most diversified activities and, in particular farm tourism, contract work and other activities not recorded in one of the other categories (these may include educational activities on the farm), but also processing of farm products;
- In the regions of the other three SFP models the share of holdings that diversify is always

considerably lower for each type of other gainful activity compared to the Hybrid model. In the SPS Historical and Regional models, the most frequent diversified activities appear to be Processing of farm products, Organic farming and Contract work (in the SPS Historical model regions also Tourism and other gainful activities not recorded elsewhere). The regions of SAPS have the least number of holdings with diversified activities.

The comparison between 2005 and 2010 highlights some interesting changes with respect to individual diversified activities across the four examined SFP models:

- First of all, the number of holdings with diversified activities decreases in the regions of the SPS Historical and SAPS models, whereas it increases in the regions implementing the SPS Hybrid and Regional models. This results in the number of farms with diversified activities noticeably increasing in the latter groups of regions, but only slightly decreasing in the former two;
- In spite of representing only a small share of holdings overall, the number of farms developing Renewable energy production increases considerably between 2005 and 2010 in the regions of the SPS Historical and Hybrid models (i.e. it more than doubles), whereas this diversified activity does not even appear in the regions of the SPS Regional model and is very limited and decreasing in the regions implementing the SAPS;
- Similarly, the number of holdings with Contract work also increases in both SPS Historical and Hybrid models, whereas the opposite trend occurs in the regions of the SPS Regional and SAPS models;
- Conversely, Processing of farm products is abandoned by a considerable number of holdings in the regions of the EU15 (SPS Historical and Hybrid), whereas it is taken up by more holdings in the EU12 regions, especially in the SPS Regional model;
- It is also worth mentioning that the number of holdings adopting Organic farming methods grows everywhere, albeit to differing extents: more in the EU12 member States where it probably was less developed in the past, compared to the EU15;
- Farm tourism does not undergo striking changes except in the regions of the SPS Hybrid model, where the number of holdings with such activities nearly halves. This is related to the drop in the number of holdings with such activities in England (-69%), which, in turn, is a likely effect of the change of UAA threshold in the 2010 Eurostat data, as farm tourism activities may be more likely present on small size holdings;
- As for the remaining other gainful activities (Aquaculture, Handicraft and Wood processing), in absolute terms some variations in the number of holdings appear significant (e.g. the drop in the number of holdings with Wood processing activities in SAPS or the rise in holdings with Aquaculture in SPS Historical), but in relative terms (i.e. the weight of holdings with such activities on the total number of holdings) there is no real substantial change between 2005 and 2010 as these activities only interest a very small number of holdings.

Two main conclusions can be drawn from the analysis of changes in holdings' diversification strategies and, in particular, from the analysis of individual diversified activities.

Firstly, the number of holdings developing other gainful activities on the farm increases in the regions of the SPS Hybrid and Regional models (relatively similar in terms of applied SFP policy), whereas it decreases in the regions of the other two SFP models, but more noticeably in SAPS.

On the other hand, the analysis of the individual other gainful activities highlights a separation between the regions of the EU15 on the one hand and the regions of the EU12 on the other, with respect to the 2005-2010 evolution for a number of diversified activities: Renewable energy production, Contract work, Processing of farm products and Organic farming.

11.6.2 Diversification strategies in the constant sample of FADN farms, 2004 and 2009

This part focuses on farm diversification strategies based on analysis of the 2004-2009 constant sample of FADN farms according to SFP implementation model. As previously explained in the methodology section, we distinguish between farms' "deepening" and "broadening" diversification strategies.

The analysis starts with examining overall % shares of farms with diversified activities and change between 2004 and 2009. Subsequently, the real change in the number of farms with diversified

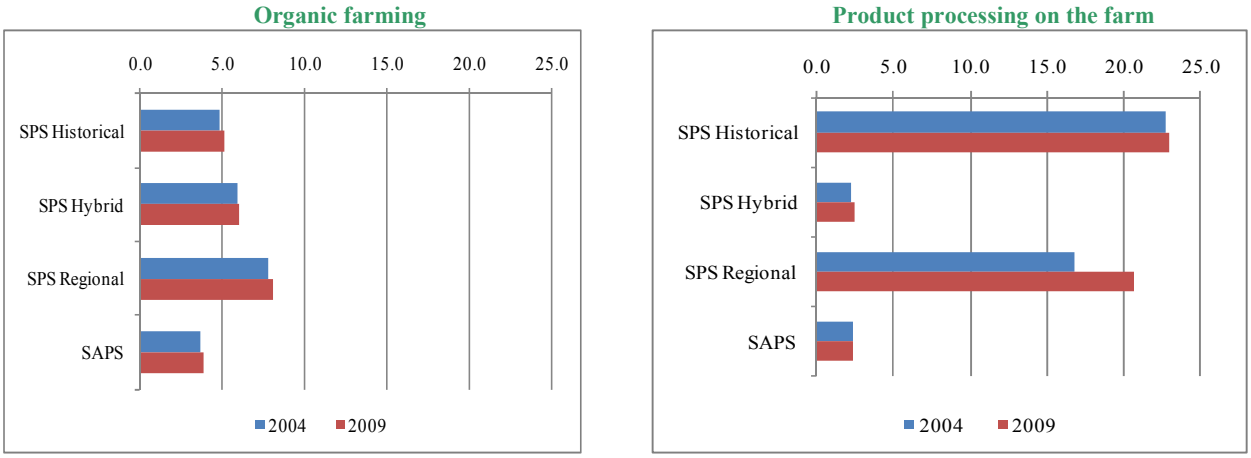
activities is analysed taking into account the number of farms that had diversified activities in 2004 but no longer in 2009, those that in 2009 maintained the activities already present on the farm in 2004 and those that did not have diversified activities in 2004 but introduced them in 2009 (for each type of activity). The analysis concludes by looking at the average number of diversified activities per farm and overall farm distributions according to the number of diversified activities present and changes between 2004 and 2009;

11.6.2.1 "Deepening" strategies: Organic farming and farm product processing

Organic farming interests a small number of farms within the constant FADN sample, ranging in 2004 from 3.6% in the regions implementing the SAPS to 7.7% in the regions of the SPS Regional model (entirely concentrated in Slovenia). The sub-set of farms in conversion or adopting both conventional and organic production methods ranges between 0.7% in the regions of the SPS Regional model to 2.2% of farms in the regions implementing SAPS (again in 2004).

In the case of product processing on the farm, the data show that this activity is far more developed in the regions implementing SPS Historical and Regional models compared to the regions of the other two SFP models.

Fig. 98 - Percentage shares of farms with organic farming / in conversion and with product processing by SFP model, 2004 and 2009



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The graphs above show that from 2004 to 2009 the share of farms adopting organic farming methods overall increases in all four groups of regions applying the different SFP models. The increases are, however, rather modest. At the same time, the proportion of farms in conversion reduces everywhere but proportionally less than the increase in the number of fully organic farms. This suggests that at least some of the farms in conversion in 2004 have completed the transition to fully organic in 2009, other farms probably remain partially organic and partially conventional.

Similarly, the number of farms with farm product processing activities does not change much between 2004 and 2009 in the regions of the SPS Historical, Hybrid and SAPS models, whereas it substantially increases in Slovenia and Malta (SPS Regional model).

At the level of individual macro-regions, the analysis is not always possible as some regions present a number of farms with diversified activities lower than the FADN threshold (15 farms). However, for the regions where the analysis could be carried out, we present the most relevant results, i.e. the main changes occurred between 2004 and 2009 in farm diversification activities.

With respect to organic farming, in 2004 significantly larger proportions of organic farms were found in Austria (17.7%) and ES Sur (18.5) for the SPS Historical model, Sweden (21.7%) and Finland (9.5%) within the regions implementing the SPS Hybrid model, and Slovenia (12.8%) for the SPS Regional model. Within the group of regions applying SAPS, Estonia and Latvia show the largest shares of organic farms (respectively, 11.7% and 12.1% out of the total number of farms). The number of organic farms increased further in 2009 in all these regions with the only exception of Sweden and Slovenia where a small reduction was recorded.

The overall increase in the number of farms implementing organic farming seen at the level of SFP models between 2004 and 2009 is clearly reflected at the more disaggregated level of macro-regions. Increases are generally modest, but slightly more noticeable in the two Greek regions (around 4 percentage points), IT Sud and UK Wales (3.5 percentage points in both regions) of the SPS Historical model, and Lithuania (4.2 percentage points) for the regions implementing the SAPS. In very few regions there is a small reduction in the number of farms implementing organic production techniques: IT Centro and the Netherlands (SPS Historical), Denmark and Sweden (SPS Hybrid).

Again, at the level of individual macro-regions the analysis concerning farm product processing activities is possible in only few cases. The main trends can be summarised as follows:

- The overall stability in number of farms with product processing activities in the regions of the SPS Historical model is the result of decrease in some regions (Austria, BE Région Wallonne, Portugal, ES Noreste) balanced out by increase in other regions (4 out 5 Italian regions and both Greek regions), jointly to substantial stability across all French regions;
- A similar situation is found in the regions implementing the SAPS, with a substantial increase in the Czech Republic barely balanced out by decreases in Slovakia and Cyprus, whereas the number of farms with product processing remains nearly unchanged in the two Hungarian and the two Polish regions;
- Both regions of the SPS Regional model see a substantial increase in the number of holdings developing product processing on the farm.

The table below contains additional detail about farms with "deepening" diversification strategies (organic farming and farm product processing). The analysis focuses on strategic changes operated by farms between 2004 and 2009 in terms of adopting, maintaining or abandoning "deepening" activities.

Tab. 80 - Number of farms that maintained/ changed their "deepening" diversification strategies between 2004 and 2009 by SFP model

			ORGANIC FARMING					PRODUCT PROCESSING ON THE FARM		
			2009					2009		
			No	Yes	*Total*			No	Yes	*Total*
SPS Historical	**2004**	No	20 910	427	*21 337*	**2004**	No	16 524	791	*17 315*
		Yes	341	729	*1 070*		Yes	753	4 339	*5 092*
		Total	*21 251*	*1 156*	*22 407*		*Total*	*17 277*	*5 130*	*22 407*
SPS Hybrid		No	7 657	97	*7 754*		No	8 015	33	*8 048*
		Yes	82	400	*482*		Yes	17	171	*188*
		Total	*7 739*	*497*	*8 236*		*Total*	*8 032*	*204*	*8 236*
SPS Regional		No	552		*552*		No	465	40	*505*
		Yes		41	*41*		Yes	17	85	*102*
		Total	*552*	*41*	*593*		*Total*	*482*	*125*	*607*
SAPS		No	10 045	176	*10 221*		No	10 221	130	*10 351*
		Yes	156	227	*383*		Yes	134	119	*253*
		Total	*10 201*	*403*	*10 604*		*Total*	*10 355*	*249*	*10 604*

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The analysis highlights the following changes occurred between 2004 and 2009:

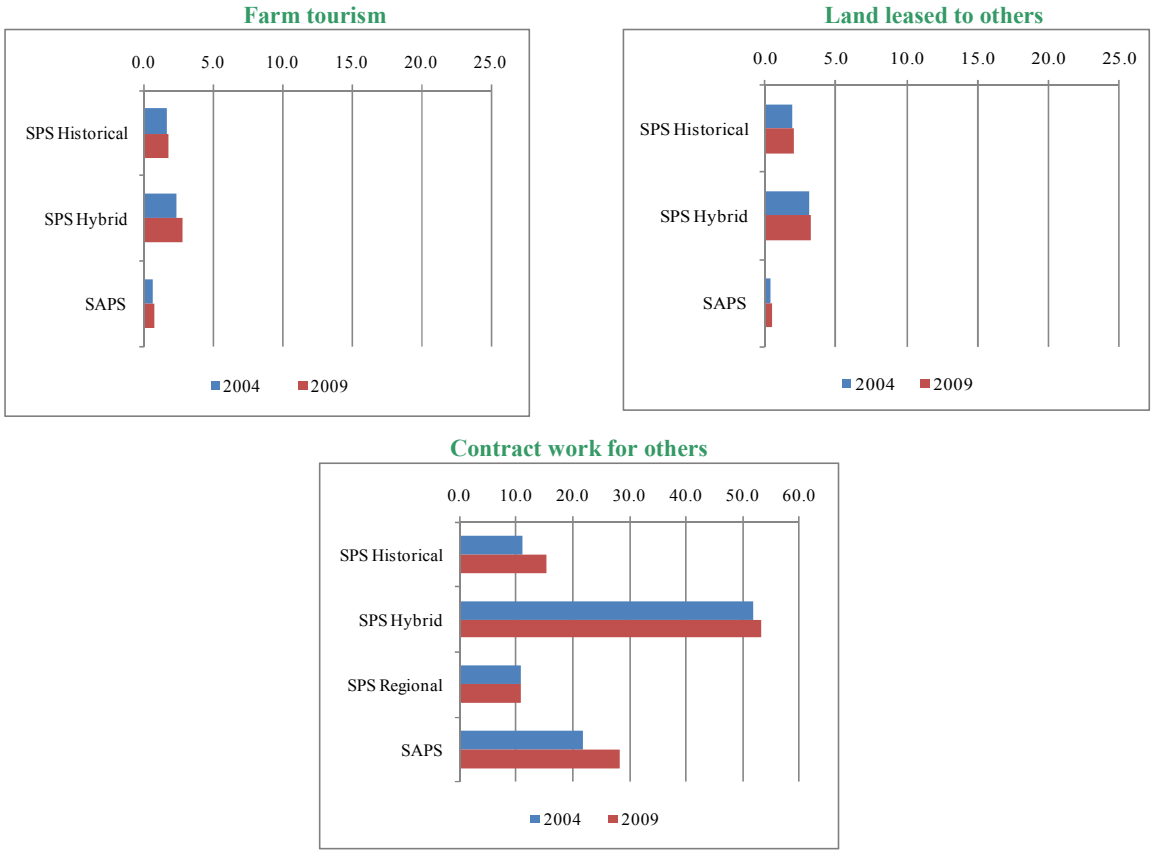
- The majority of farms with Organic farming and Product processing activities in 2004 maintained them in 2009 across all three SPS models: with respect to organic farming, 68.1% of farms in the regions of the SPS Historical, 83% in the regions of SPS Hybrid and 87.2% of those of SPS Regional model. With respect to Farm product processing, such shares range between 83.3% for the SPS regional and 91% in the regions implementing the SPS Hybrid model. The share of farms maintaining such activities appears to be lower in the regions implementing the SAPS: 59.3% of organic farms in 2004 still implemented organic farming in 2009, only 47% of farms with farm processing activities in 2004 maintained them in 2009.
- Out of the total of farms that did not use Organic farming methods in 2004, only a small percentage (ranging between 1.3% in the SPS Hybrid to 2% in the SPS Historical model) had taken them up by 2009. Out of the total number of farms that did not have Product processing activities in 2004, 7.9% and 4.6% of farms respectively in the regions of the SPS Regional and SPS Historical model had started them in 2009. In the regions implementing the SPS Hybrid model and the SAPS, we find smaller shares of farms undertaking such activity (0.4% and 1.3%, respectively).

- The number of farms abandoning either Organic farming or Product processing in 2009 is more than offset by the number of new farms taking up these activities (only exception is found in the farms with Product processing in the regions implementing SAPS), with the result that, on the whole, the share of farms with these diversified activities increases in 2009 compared to 2004 (as previously seen). Again, the regions implementing the SAPS represent the only exception.

11.6.2.2 "Broadening" strategies: Farm tourism, contract work for others and land leased to others

"Broadening" diversification activities that can be analysed with FADN farm data include farm tourism, land leased to others (land ready for sowing and letting of forage areas) and contract work for others. The graphs below illustrate the percentage of farms adopting such activities out of the total number of farms in the FADN constant sample in 2004 and 2009 across SFP models.

Fig. 99 - Percentage share of farms with tourism, contract work for others and land leased to others by SFP model, 2004 and 2009



Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Farm tourism and Land leased to others interest a very small proportion of farms within the examined constant sample across regions of all SFP models (except the SPS regional model that does not present a sufficient number of farms to be analysed) both in 2004 and in 2009, ranging from less than 1% of farms in the regions implementing the SAPS to about 3% in the regions of the SPS Hybrid model. Conversely, contract work for others is by far the most developed diversified activity undertaken by farmers across EU regions, especially in the regions implementing the SPS Hybrid model (just over 50% of all farms), but also in the regions implementing the SAPS (well over 20% of all farms).

The graphs above show that the proportion of farms with farm tourism and letting out land to others either remains stable between 2004 and 2009 or only slightly increases. On the other hand, the number of farms offering services under contract to others grows more substantially, namely in the regions of the SPS Hybrid model and even more substantially in those implementing the SAPS and the SPS Historical model.

The analysis according to individual macro-regions is generally not possible in the case of Farm tourism and Land leased to others (i.e. less than 15 farms in most regions). On the contrary, most regions have a substantial number of farms providing work under contract to others:

- Within the SPS Historical model, the proportion of farms with Contract work for others increases in 2009 in most regions (UK Scotland and Wales, the Netherlands, BE Région Flamande, ES Noreste, Este and Centro) and in a rather pronounced manner in nearly all French regions (between 10-15 percentage points in the southern and Centre-East regions; between 20-33 percentage points in western and northern regions) or, at the least, it remains constant (GR Centre-South, IT Nord-Ovest and Nord-Est, Portugal). Only Austria, BE Région Wallonne, IT Centro and Sud show a slight decrease;
- In the regions implementing the SPS Hybrid model, the increase in the number of farms offering Contract work to others in Denmark, UK England and Northern Ireland only just offsets a decrease in three out of the four German regions and in Luxembourg;
- All regions implementing the SAPS show substantial increases in the number of farms doing Contract work for others with the only exception of the two Hungarian regions.

The table below illustrates the number of farms with the three "broadening" activities in 2004 that have either maintained or abandoned them in 2009 and, conversely, the number of farms that did not have these activities in 2004, but had developed them by 2009.

Tab. 81 - Number of farms that maintained / changed their "broadening" diversification activities between 2004 and 2009 by SFP model

			CONTRACT WORK FOR OTHERS			FARM TOURISM			LAND LEASED TO OTHERS		
			2009			2009			2009		
			No	Yes	*Total*	No	Yes	*Total*	No	Yes	*Total*
SPS Historical	2004	No	18 214	1 699	*19 913*	21 909	127	*22 036*	21 710	255	*21 965*
		Yes	747	1 747	*2 494*	91	280	*371*	245	197	*442*
		Total	*18 961*	*3 446*	*22 407*	*22 000*	*407*	*22 407*	*21 955*	*452*	*22 407*
SPS Hybrid		No	2 973	989	*3 962*	7 943	101	*8 044*	7 837	142	*7 979*
		Yes	875	3 399	*4 274*	65	127	*192*	135	120	*255*
		Total	*3 848*	*4 388*	*8 236*	*8 008*	*228*	*8 236*	*7 972*	*262*	*8 234*
SPS Regional		No	511	31	*542*	607		*607*	607		*607*
		Yes	31	34	*65*						
		Total	*542*	*65*	*607*	*607*		*607*	*607*		*607*
SAPS		No	6 671	1 626	*8 297*	10 505	36	*10 541*	10 526	33	*10 559*
		Yes	933	1 374	*2 307*	20	43	*63*	31		*31*
		Total	*7 604*	*3 000*	*10 604*	*10 525*	*79*	*10 604*	*10 557*	*33*	*10 590*

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

The results shown in the table above can be summarized as follows:

- In the case of Farm tourism and Contract work for others, we find a similar situation to that seen for Organic farming and Product processing with the majority of farms maintaining such activities in 2009 across all SFP models (for Contract work ranging between 52.3% of farms in the regions of the SPS Regional model to 79.5% in the regions implementing the SPS Hybrid model; between 66.1% of farms for the SPS Hybrid model and 75.5% for the SPS Historical model in the case of Farm tourism);
- Similarly to what seen before for Organic farming and Product processing, only a small percentage of farms out of the total that did not have Farm tourism activities or Land leasing to others in 2004, had started them in 2009 (at most, 1.3% for Farm Tourism and 1.8% for Land leased to others in the regions implementing the SPS Hybrid model). With respect to Contract work, the situation appears different, with a higher proportion of new farms taking up this activity in 2009: 25% of farms in the regions of the SPS Hybrid model, 19.6% for the regions of SAPS, 8.5% in the regions of the SPS Historical and 5.7% in the regions of the SPS Regional model
- With respect to Farm tourism and Land leased to others, the number of farms abandoning such activities in 2009 is only just compensated by new farms taking these activities up. On the contrary, the number of farms abandoning Contract work for others in 2009 is largely offset by the number of new farms taking this activity up, with the only exception of the regions implementing the SPS regional model.

It is worth recalling here the results of the analysis carried out in EQ5 that allowed to identify farm strategies strictly related to agricultural activity (i.e. strategic decisions regarding the use of production factors). Specifically, the results show that non-negligible fractions of farms implementing Strategies

1, 2, 3 and 4, between 2004 and 2009 also decided to change their diversification strategy with respect to carrying out contractual work for others. Such results appear to confirm that strategic decisions concerning core farm activities and those concerning diversification are probably not made independently from each other, as it would seem logical to assume.

In particular, out of the total number of farms adopting Strategy 1 (Development and intensification), 12.5%, 8.7% and 6.4% of holdings respectively in the regions of the SPS Historical, SAPS and SPS Hybrid models have also decided to change their contract work activities. Overall, the relationship between strategic decisions concerning production factors and the decision to change contractual work activities appears somewhat more important in the regions implementing the SAPS, where appreciable shares of farms (between 7.4% and 9.9%) are found within four of the five farm main strategies identified (i.e. strategies 1, 2, 3 and 4).

11.6.2.3 Presence of more than one diversified activity on the farm

The previous analysis focuses on individual diversification strategies, however it is not uncommon for a farm holder to have more than one other gainful activity. The analysis of farm diversification strategies based on the 2004-2009 constant FADN sample is therefore completed by comparing the distribution of farms with one, two, three or more diversified activities and the average number of activities per farm in 2004 and 2009 (table below) across regions implementing the different SFP models.

Tab. 82 - Percentage share of farms with one or more diversified activities252 and average no. of activities per farm by SFP model, 2004 and 2009

	SPS Historical		SPS Hybrid		SPS Regional		SAPS	
	2004	**2009**	**2004**	**2009**	**2004**	**2009**	**2004**	**2009**
Average no. of activities per farm	1.22	1.23	1.14	1.16	1.20	1.15	1.07	1.10
No. farms with at least 1 diversified activity	7 743	8 615	4 740	4 828	179	208	2 840	3 424
	% farms with							
no diversified activity	65.4	61.6	42.4	41.4	70.5	65.7	73.2	67.7
1 diversified activity	28.0	30.7	50.2	50.3	23.9	29.2	24.9	29.3
2 diversified activities	5.6	6.7	6.8	7.6	5.4	5.1	1.7	2.8
3 or 4 diversified activities	1.0	1.0	0.5	0.7				0.3

Source: Elaborations based on sample data EU-FADN-DG AGRI L-3

Overall, the number of farms with at least one diversified activity has increased everywhere, regardless of the SFP model implemented. The average number of diversified activities per farm has also increased, except for the SPS Regional model. On average, farms have just one diversified activity (or a little over one) with a slightly higher average recorded for the regions implementing the SPS Historical model.

In terms of number of farms with one, two, three or more diversified activities, the comparison between 2004 and 2009 shows that:

- the percentage of farms with one activity increases across all models, but only very slightly in the regions implementing the SPS Hybrid model and in a more pronounced manner in the regions of the EU10 (SPS Regional and SAPS models);
- the percentage of farms with two activities increases everywhere except for the SPS Regional model, whereas the number of farms with three or more is rather small and does not appear to change between 2004 and 2009.

11.6.2.4 Synthesis of results of the analysis of diversification strategies in the FADN 2004-2009 constant sample of farms

Overall, the analysis based on the farms of the FADN 2004-2009 constant sample shows a growing interest for the development of farm diversified activities. However, the increase in the number of farms with other gainful activities in 2009 compared to 2004 is generally limited except in the case of Contract work and Processing of farm products in some of the considered groups of regions. The results suggest a more marked increase in the regions of the EU10 (SPS Regional and SAPS)

[252] Considering all diversification activities: organic farming, product processing on farm, farm tourism, contract work for others, and land leased to others.

compared to the EU15, however, this seems to be due to some extent to the remarkable increase in 2009 of the number of farms providing Contract work to others in the regions of SAPS and of the number of farms with product processing activities in the SPS Regional model.

Compared to the results of the analysis of regional Eurostat data, the results obtained for the FADN constant farm sample do not highlight as clear differences between SFP models and between EU15 and EU12 (or EU10) for all individual other gainful activities. At the level of SFP models and with respect to individual other gainful activities only some results based on macro data are consistent with results obtained at the farm level. Indeed, only with respect to trends in Organic farming, the results based on analysis of the FADN 2004-2009 constant sample are in line with the results produced by analysis of Eurostat data. This should not surprise, however, given the different types of data used.

11.6.3 Indicator resulting from the CATI survey

The statistical analysis developed in the previous section has studied changes in diversification strategies before and after the introduction of the single payment using FADN farm data in 2004 and 2009. In this section we complement the analysis with the results of the CATI survey. We asked farmers to indicate whether they have began some new form of farm diversification after 2005 and to explain the role played by the single payment in the decision.

Overall, over 37.6% of the interviewees (374 out of 994) declare to have began at least one diversified activity after 2005. The regions with the highest proportion of farms that have introduced a form of diversification are Brandenburg, Niedersachsen, Slovenia, Alentejo/Algarve. On the opposite side, the lowest proportion are found in Makedonia-Thraki, Del Alfold, England East.

The table below illustrates the results at regional level (number of diversified activity newly introduced by typology), as well as well as the perceived importance of the introduction of the single payment in farms' decisions.

Tab. 83 - CATI survey: the perceived importance of SFP in the diversification choices

	Accomodation and/or catering services		Educational activities on the farm		Contract work services		Renewable energy		Processing of agricultural products/crafts		Organic production methods		
	n°	*share*	*n°*	*share*	*n°*	*share*	*n°*	*share*	*n°*	*share*	*n°*	*share*	
Alentejo/Algarve (PT)	2	3.4%	27	46.6%	13	22.4%	2	3.4%	-	-	14	24.1%	100%
Centre (FR)	-	-	5	14.3%	14	40.0%	1	2.9%	8	22.9%	7	20.0%	100%
Emilia Romagna (IT)	8	19.5%	11	26.8%	7	17.1%	10	24.4%	3	7.3%	2	4.9%	100%
Extremadura (SP)	8	16.3%	15	30.6%	1	2.0%	11	22.4%	1	2.0%	13	26.5%	100%
Makedonia-Thraki (GR)	-	-	3	17.6%	-		1	5.9%	1	5.9%	12	70.6%	100%
Brandenburg (DE)	4	6.0%	16	23.9%	8	11.9%	31	46.3%	4	6.0%	4	6.0%	100%
England East (UK)	3	8.6%	22	62.9%	9	25.7%	-	-	-	-	1	2.9%	100%
Niedersachsen (DE)	3	5.9%	18	35.3%	2	3.9%	28	54.9%	-	-	-	-	100%
Slättbygdslän (SE)	-	-	4	40.0%	2	20.0%	4	40.0%	-	-	-	-	100%
Slovenia (SI)	10	18.2%	16	29.1%	3	5.5%	15	27.3%	2	3.6%	9	16.4%	100%
Del-Alfold (HU)	2	6.1%	7	21.2%	11	33.3%	8	24.2%	1	3.0%	4	12.1%	100%
ŁMLP region (PL)	2	5.1%	27	69.2%	1	2.6%	7	17.9%	1	2.6%	1	2.6%	100%
Total per diversification activity	**42**		**171**		**71**		**118**		**21**		**67**		
Share on total sample	**4.2%**		**17.2%**		**7.1%**		**11.9%**		**2.1%**		**6.7%**		
Importance of SPF in the diversification choices (*)	**21.4%**		**34.5%**		**14.1%**		**26.3%**		**9.5%**		**23.9%**		

(share of respondents stating that their choice was influenced in some way by the SFP on total respondents having started the activity)

Source: CATI survey

Farms' behaviour seems to be rather different across regions, regardless of the model of SFP implementation. In 6 out of 12 regions, the preferred form of new diversification is the start-up of educational activities; in Germany, Sweden and Hungary the production of renewable energy[253], in the French region of Centre contract work services. In Greece, where the lowest number of new diversification activities is found, in the majority of cases farmers have introduced organic methods of production. In some regions, farmers have focused on few activities (Niedersachsen, England East and

[253] In particular in Germany and in Sweden the Review of national legal and institutional frameworks (see § 4) highlights the existence of national policies strongly encouraging renewably energy sources.

the Polish region), in other regions (Emilia Romagna and Extremadura) choices are more wide-ranging.

Overall, it appears that larger farms and farms managed by young farmers are more likely to pursue diversification. This result is consistent with the results of the previous analysis on farm investments. In this sense, it is worth noting that a two third of diversified farms have made farm investments after 2005 and a large proportion declared that they were facilitated by the SFP.

Also important is that a quarter of farms having started a diversified activity after 2005 benefitted from funding provided through the Rural Development Programme, even if not always directly aimed to the setting up of the new activities. As would be expected, this proportion is higher (52.2%) in the case of farms having started (also) organic production methods.

The focal point of the survey was to appreciate the role played by the SFP in the diversification choices:

- The perceived importance of the single payment in the diversification choices varies across activities, and is much lower for processing of agricultural products/crafts and for contract work services.
- Overall, 25.9% of responses indicate that the SFP have had some effect on this choice (20.0% a little, 5.9% a lot), while 57.1% does not clearly recognize any effect.
- With respect to SFP implementation models, the proportion of farmers stating that their diversification choice was influenced by the support is higher in Slovenia (22 out of 55, i.e. 40% of cases) and lower in the regions applying the SAPS model (13 out of 72, 18%). In the regions implementing the SPS historical model and the SPS hybrid model, the proportion is respectively 26% and 25%.

Finally, the analysis of farm diversification strategies adopted by the sample (table below) shows that the vast majority of farms opted for only one form of diversified activity. It should be remembered that the table refers only to activities started after 2005, and not to the total number of diversified activities carried out on the farm.

Tab. 84 - CATI survey: farms diversification strategies

Diversification activities introduced after 2005	No of farms and share		
Educational activities	120	32.1%	78,1%
Renewable energy	74	19.8%	
Contract work services	45	12.0%	
Organic production methods	30	8.0%	
Tourism services (accomodation and/or catering)	17	4.5%	
Processing of agricultural products/crafts	6	1.6%	
Educational activities, renewable energy	13	3.5%	18,2%
Organic methods, renewable energy	12	3.2%	
Contract work, educational activities	10	2.7%	
Contract work, processing	9	2.4%	
Educational activities, organic methods	8	2.1%	
Educational activities, tourism services	6	1.6%	
Renewable energy, tourism services	6	1.6%	
Contract work, renewable energy	2	0.5%	
Organic methods, processing	1	0.3%	
Processing of agricultural products/crafts, renewable energy	1	0.3%	
Educational activities, renewable energy, tourism services	5	1.3%	3,2%
Contract work, educational activities, processing	2	0.5%	
Contract work, renewable energy, tourism services	2	0.5%	
Contract work, educational activities, organic methods	1	0.3%	
Organic processing, tourism services	1	0.3%	
Processing, renewable energy, tourism services	1	0.3%	
Educational activities, organic, renewable energy, tourism services	1	0.3%	0,6%
Contract work, educational activities, processing, tourism services	1	0.3%	
Total	**374**	**100%**	**100%**

Source: CATI survey

In short, the analysis of the sample highlights quite a large propensity to diversify. Indeed, over one third of farms have adopted some form of diversified activity after 2005, mainly developing educational activities on the farm (17.2% of total sample) and the production of renewable energies (11.9% of total sample). The propensity to diversify is more or less marked with respect to the regional context and other farms characteristics (size, age of the holder).

The introduction of the single payment seems to have played a role on farms' diversification decisions, in some cases also facilitating the related investments. However, the overall results of the analysis suggest that other factors may have supported diversification choices, in particular rural development aids and other national policies (renewable energies).

11.7 Pluriactive farm holders

Pluriactivity specifically refers to other gainful activities of the farm holder (i.e. holder-manager) carried out for remuneration besides farming. These would include both activities carried out on the holding (i.e. farm diversification), on another agricultural holding, or as employee in a non-agricultural enterprise.

As previously mentioned, Eurostat (FSS) collects information as to whether a farm holder-manager has other gainful activities and whether he/she spends more time on these activities than on farm work itself (i.e. whether the OGA is to be considered as the main activity of the holder or as a subsidiary activity).

The table below reports the evolution from 2000 to 2010 (2005-2010 for SPS Regional and SAPS) in the number of sole holder-managers with other gainful activities as a whole and distinguishing those with Main or Secondary activities, as well as the evolution in the total number of agricultural holdings for the groups of regions implementing the different SFP models.

Tab. 85 - Evolution of number of sole holder-managers with Main or Subsidiary OGA relative to the evolution of the number of holdings with sole holder-managers, 2000 - 2005 - 2010

	SPS Historical			SPS Hybrid			SPS Regional		SAPS	
	2000	2005	2010	2000	2005	2010	2005	2010	2005	2010
Sole holder-manager with Main OGA	906 530	681 390	533 670	268 930	284 770	166 830	52 790	44 220	2 874 300	1 801 500
Sole holder-manager with Subsidiary OGA	156 440	183 220	262 110	74 380	63 630	119 460	6 680	14 490	361 690	431 690
Sole holder-manager No OGA	3 038 210	2 461 980	2 011 230	419 220	385 440	265 560	24 300	19 570	5 017 990	4 159 100
Tot holdings with sole holder-manager	4 101 180	3 326 590	2 807 010	762 530	733 840	551 850	83 770	78 280	8 253 980	6 392 290
Holder-manager with OGA/Tot holdings	0.26	0.26	0.28	0.45	0.47	0.52	0.71	0.75	0.39	0.35
Holder-manager with Main OGA/Tot holdings	0.22	0.20	0.19	0.35	0.39	0.30	0.63	0.56	0.35	0.28
Holder-manager with Subsidiary OGA/Tot holdings	0.04	0.06	0.09	0.10	0.09	0.22	0.08	0.19	0.04	0.07

Source: Elaborations based on Eurostat data

A first consideration to be made is that, overall, the proportion of pluriactive holder-managers (over the total number of farms) appears to be much higher in the regions implementing the SPS Regional model, followed by the regions of the SPS Hybrid and SAPS models. The smallest share of pluriactive farm holder-managers is found in the regions of the SPS Historical model. Furthermore, out of the total number of pluriactive sole holder-managers, those engaged in activities that occupy the majority of their time (i.e. with Main OGA) are more frequent than those engaged in Subsidiary other gainful activities.

In line with the progressive decrease in the number of agricultural holdings across all groups of regions[254], the number of pluriactive sole holder-managers with Main other gainful activities also decreases but to a lesser extent (only in the regions of the SPS Regional model this decrease is larger than the reduction in the total number of farms). On the other hand, the number of pluriactive holder-managers with Secondary activities increases everywhere between 2005 and 2010, and in a more substantial manner in the regions implementing the SPS Hybrid and Regional models.

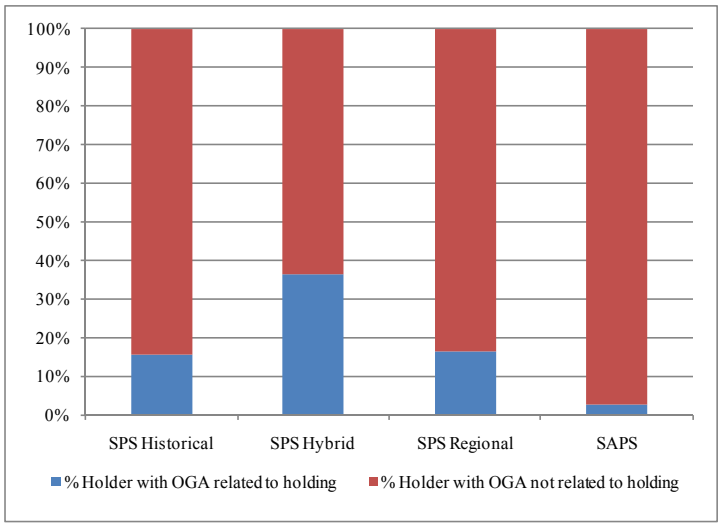
[254] The comparatively larger drop of the total number of holdings in the regions of the SPS Hybrid model between 2005 and 2010 surely is at least partly due to the increase of the UAA threshold to 5ha in the 2010 Census adopted by Germany (4 regions) and the UK (England and Northern Ireland). Similarly, the adoption of the 5ha threshold by the Czech Republic may also have some impact on the marked decrease in the total number of holdings in the regions implementing the SAPS.

The computed ratios between number of holder-managers with other gainful activities and the total number of farms in 2005 and 2010 (table above) add some detail to what already discussed, leading to the following further considerations:

- The overall share of pluriactive holder-managers within the total number of farms with sole holder-manager increases between 2005 and 2010 for all SPS models, and in a more accentuated manner for the regions implementing the SPS Hybrid model (from 47% to 52%). The group of regions applying the SAPS, on the other hand, display an opposite trend – i.e. overall, the share of pluriactive farmers decreases from 39% to 35%;
- The share of holder-managers with Main OGA decreases in relative terms in all groups of regions, whereas the share of holder-managers with Subsidiary activities increases. This occurs in all groups of regions regardless of the SFP model implemented.
- The relative increase in the number of holder-managers with Subsidiary activities is clearly more marked in the regions of the SPS Hybrid and Regional models (respectively 13 and 11 percentage points between 2005 and 2010). The somewhat larger increase in the regions of the SPS Hybrid may not be unrelated to the consistent drop in the number of small size farms in Germany and the UK (i.e. England and Northern Ireland) due to the increase of the UAA threshold to 5 ha in 2010. Indeed, in 2010 only 3.3% of holders with Subsidiary OGA are found in the smallest size farm class (less than 5 ha), whereas the Historical, Regional and SAPS models concentrate in the same size class respectively 30%, 39.6% and 77.8% of holders with Subsidiary OGA;
- Furthermore with respect to farm size, in 2010 holders with Main OGA are mostly concentrated in farms with less than 5 ha (57.8% in the SPS Historical, 73.6% in the SPS Regional and 81.6% in the SAPS model) except for the regions of the SPS Hybrid model where 57.2% of holders with main OGA manage farms sized 5-20 ha. On the other hand, Subsidiary OGA are more commonly found in farms of bigger size (5-20 ha in SPS Historical and Regional, 20-50 ha in SPS Hybrid).

In 2010 additional data were collected in the Eurostat FSS concerning whether the farm holder's other gainful activities are related to the holding or not. The graph below summarises the relative percentage shares of holder-managers engaged in other gainful activities, related and not related to the holding.

Fig. 100 - Distribution of holdings where holder-manager has other gainful activities related or not related to the holding, 2010



Source: Elaborations based on Eurostat data

The data show that in 2010 the vast majority of pluriactive farm holders carry out other gainful activities outside the holding. However, the extent of this phenomenon varies across the examined groups of regions. As many as 97% of all pluriactive farm holders in the regions implementing the SAPS are engaged in other gainful activities not related to the holding; such proportion decreases to about 84% of farm holders in the regions of the SPS Historical and Regional model, whereas "only" 63.7% of pluriactive farmers carry out other gainful activities outside the holding in the regions of the SPS Hybrid model.

11.8 Evaluation judgment

The analysis focuses on farmers' strategies aimed at maintaining farm competitiveness and, in particular, on the evaluation of the impact of the 2003 CAP reform on farm investment decisions and on diversification and marketing strategies.

The analysis applied to each of the three areas of investigation has been conducted at farm level and macro-regional level on the basis of data availability from different sources (Eurostat and FADN). The lack of systematic data on farm marketing strategies required to supplement the existing data with primary data collected ad hoc through the CATI survey in the twelve case study regions.

Farm investment decisions

The analysis of farm investment decisions is entirely based on data from the 2004-2009 constant sample of FADN farms across the EU25 and data collected through the CATI survey, in which farmers were asked to state their opinion on whether the switch from coupled to decoupled support has facilitated their investment decisions and access to credit. The results are presented distinguishing between groups of regions implementing the different SFP models. The FADN constant sample is also examined distinguishing farms according to type of farming (TF). The analysis is completed by the econometric modelling exercise to test the effects of direct support (coupled and decoupled payments) on farm investments in the years following the CAP 2003 reform (2005 to 2009), again based on FADN data.

With regard to both total farm investments and investments on machinery & equipment and on farm buildings, the share of farms investing on fixed assets (gross investment /ha >0) decreases between 2004 and 2009 in the regions of the EU15(SPS Historical and Hybrid), whereas it generally increases in the EU10 (SPS Regional and SAPS). However, in both EU15 and EU10, the portion of farms able to compensate the loss of value of own capital with new investments (net investment/ha >0) tends to reduce or not change significantly in some cases.

The results also show that, whilst in the SPS Historical model the reduction in the share of farms with positive investment balance (both gross and net investment/ha>0) is common to all examined sectors, in the regions of the SPS Hybrid and SAPS models changes between 2004 and 2009 differ depending on specialisation. Overall, the share of farms with positive investment balance tends to increase in the three Mixed farm types and in Specialist granivore and grazing livestock farms, *vice versa*, it decreases or does not change in the other farm types (Specialist field crops, horticulture and permanent crops farms).

Furthermore, farm investment decisions are likely to depend on the initial level of farm capital (higher value of fixed assets per hectare in 2004 in the regions of the SPS Historical and Hybrid models and lower, on average, in the regions implementing the SAPS). In line with the results presented in EQ5 (§ 10), the increase in the share of farms investing on fixed assets (and especially machinery & equipment, but also farm buildings) between 2004 and 2009 in the regions of SAPS seems to confirm a trend towards higher farm capitalisation that would reduce the existing gap with EU15 regions.

The results of the econometric analysis show that in the years 2005-2009 coupled direct payments may have had an effect in terms of increasing farm investments, whereas decoupled payments do not appear to have had an effect.

The results of the regression analysis also show that an increase of farm capital would produce a decrease in farm investments, suggesting that for higher levels of farm capital the scope for investments is reduced. This result confirms the findings of statistical analysis on FADN farm data.

In the opinion of the majority of farmers investing on farm assets after 2005 (CATI survey), farm investments have been facilitated by the introduction of the SFP. The proportion is much higher in the two regions of Poland and Hungary (applying SAPS) though, suggesting that investment decisions could be facilitated to some extent by the availability of additional financial resources, and more so in the regions where direct support was introduced following EU accession. Furthermore, CAP entitlements seem to have facilitated access to credit, particularly for young farmers.

Overall, the results suggest that policy change has had a differentiated effect on farm investments in the regions implementing the SPS Historical and Hybrid models (EU15) and in

those implementing the SPS Regional and SAPS models (EU10): decreasing farm investments in the former and increasing farm investments in the latter. These opposite trends are also likely to be influenced by pre-existent structural differences with respect to levels of farm capitalisation (generally higher in the former group of regions and lower in the latter). The increase in the share of farms investing on fixed assets between 2004 and 2009 in the EU10, confirms a progressive rise in farm capitalisation that would decrease the gap with the EU15.

Marketing strategies

Interviewed farm holders (CATI survey in the twelve case study regions) were asked whether they were members of a co-op or producers' organisation (PO) and whether they had direct relationships with the processing industry and food retailers before the introduction of the single payment and if they maintain such marketing strategies today. Farm holders were also asked whether they have started direct sale of their products (on the farm or in farmers' markets, through mail order, internet sales, etc.) and whether the single payment has had any impact on this decision.

The analysis shows that the balance between farms starting up and abandoning these marketing strategies is negative in the case of "Member of a PO / Cooperative" and "Direct relationship with processing industry", while it is zero for "Direct relationship with retailers" (i.e. the number of farms developing and abandoning this strategy is identical). A fair share of farmers appear to have started direct sale of farm products after the 2003 reform (21% of the total sample), largely concentrated in East England (SPS Hybrid), Del-Alfold (SAPS) and Emilia Romagna (SPS Historical). However, only 18% of those who developed this marketing strategy declared that the introduction of the single payment has had some influence on this decision.

With regard to marketing strategies, the results do not suggest any role played by the 2003 reform (and in particular by direct payments) in farmers' marketing decisions.

Diversification strategies

The analysis of farm diversification strategies, i.e. the presence of other gainful activities on the farm comprises three parts, differentiated according to the level of analysis and data source (regional data from Eurostat FSS, FADN farm data and CATI survey). A fourth piece of analysis, solely based on Eurostat data, focuses on other gainful activities of the farm holder-manager.

The analysis of farms of the FADN 2004-2009 constant sample shows that diversification on the farm generally concerns a limited number of holdings, except for Processing of farm products in the regions of the SPS Historical and Regional models and Contract work for others in the regions of the SPS Hybrid model and SAPS.

Overall, the number of farms with diversified activities increases in 2009 compared to 2004 across all groups of regions. However, the increase is generally small except in the case of "Contract work for others" in the regions of the SPS Historical and SAPS models and "Processing of farm products" in the regions of the SPS Regional model. Similarly to the findings of the analysis of farm investments, the results generally show a more marked expansion of farm diversification in the regions of the EU10 compared to the EU15. This is due at least to some extent to the remarkable increase in 2009 of the number of farms providing Contract work to others in the regions of SAPS and farms with Product processing activities in the SPS Regional model.

The analysis of farm diversification also highlights a fast growing interest of farms in the regions of the SPS Historical and Hybrid models (EU15) for the production of renewable energy on the farm.

Overall, the results suggest that the policy change has had some differentiated effects on farm diversification decisions in the regions of the EU15 and in those of the EU10: yet other factors may have supported diversification choices, in particular rural development aids and other national policies (especially in the case of renewable energy production).

With regard to organic farming, the analysis based on farms of the FADN 2004-2009 constant sample shows that the number of organic farms very slightly increases in all SFP models. The analysis based on Eurostat data, shows that between 2005 and 2010 the number of holdings adopting Organic farming

methods grows everywhere, albeit more in the EU12[255] where it was less developed in the past, compared to the EU15. The more pronounced growth in the EU12 thus appears to be influenced by a pre-existent structural difference compared with the EU15. **These results do not suggest an impact of the 2003 reform (and in particular of direct payments) on farms' adoption of organic farming.**

Although the majority of farms with other gainful activities in 2004 maintain them in 2009, there are also farms changing their diversification strategies in terms of starting up or abandoning such activities. The most significant changes are found in the case of Contract work, which is taken up as a new other gainful activity in a large share of farms (larger compared to the shares of farms starting up one of the other activities) across all four groups of regions, but especially in the regions of the SPS Hybrid and SAPS models.

In part of the examined farms (FADN 2004-2009 constant sample), the decision to diversify activities through undertaking contract work for others appears to be directly related to the increase in machinery investments and to the adoption of specific farm development or consolidation strategies (Strategies 1, 2, 3 and 4)[256] after the 2003 reform. This is true, in particular, for the regions implementing the SAPS.

The analysis of pluriactive sole holder-managers (Eurostat regional data) shows that pluriactivity is overall more frequent in the regions of the SPS Hybrid, SPS Regional and SAPS models than in the regions of the SPS Historical model. Pluriactive farm holders (on the farm and/or outside) engaged in activities that occupy the majority of their time (i.e. Main other gainful activities) are more frequent than those engaged in Subsidiary other activities across all SFP models.

Between 2005 and 2010, the overall share of pluriactive farm holders within the total number of farms with sole holder-managers increases for all SPS models, less in the regions of the Historical model and in a more accentuated manner in the regions implementing the Hybrid model. On the other hand, the incidence of pluriactive farmers decreases in the regions applying the SAPS.

In all groups of regions, the share of holder-managers with Main OGA decreases (albeit only slightly in the regions of the SPS Historical), whereas the incidence of holder-managers with Subsidiary activities increases. Since Main other gainful activities are more frequently encountered in small size farms, this result appears to be entirely consistent with the long-term process towards increasing farm concentration (progressive decrease in the number of agricultural holdings in the smaller size classes[257]).

Therefore, it is possible to conclude that the decrease in the share of farm holder-managers with Main other gainful activities (consistent with the overall decrease in the number of holdings in the small size classes) may be an indirect effect of the 2003 reform's contribution to speeding up the process of farm concentration across all groups of regions, except those implementing the SPS Historical model.

The analysis also shows that in 2010 the other gainful activities of pluriactive holder-managers were mostly carried out outside the farm (Eurostat). However, it is not possible to make a comparison with previous years because this information was not collected prior to 2010.

[255] EU10 for FADN data.

[256] See EQ5 (§ 10.8.2.2).

[257] See EQ1 (§ 6.4.3.1).

12. CONCLUSIONS

The scope of this evaluation is to examine the effects of the direct support schemes laid down in Council Regulation (EC) No 1782/2003 of 29 September 2003 entered into force on 1 January 2005 (later Council Regulation (EC) No 73/09) on farm structural changes.

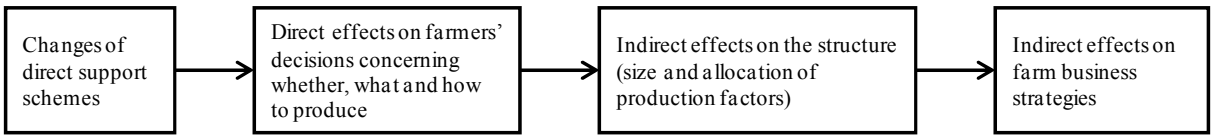
The provisions of Council Regulation (EC) No 1782/2003 define the 2003 CAP reform. This reform constituted a fundamental change in the instruments applied in the CAP, with a switch from coupled income supports to a single decoupled support. This new system of direct support, under which aid is no longer linked to production (decoupling), is known as the Single Payment Scheme (SPS). Nevertheless, at the time of the introduction of decoupling, some aids were maintained totally/partially coupled.

The present evaluation covers all direct support schemes governed by Council Regulation (EC) No 1782/2003: decoupled and coupled payments (including Complementary National Direct Payments), and all implementation models: Single Payment Scheme (Historical, Hybrid and Regional) and Single Area Payment Scheme. Indeed, the models of implementation of the 2003 reform represent a key factor to be taken into account when analysing the relationship between direct support and structural changes.

The evaluation examines the effects of direct payments on evolution of farm structures and on the maintenance of farming in marginal areas, as well as the effects of direct payments on labour force, capital and on farm business strategies.

It is important to take into account that the 2003 CAP reform does not have objectives (either global or specific) directly related to the structure of the agricultural sector.

As mentioned, the main change of the reform is the introduction of the single farm payment, which has the (main) objective of making farmers' production decisions more responsive to market signals. It is therefore the free operation of the market that determines level and quality of agricultural production, and decisions regarding the allocation of production factors (land, capital and labour) are an induced effect. In other words, any observed structural changes are only an indirect effect of the direct support policy. In synthesis:



For this reason (lack of direct policy objectives concerning farm structures) the evaluation study does not present recommendations.

Moreover, the Theoretical analysis shows that there is not a unique and definitive answer to the question of the way agricultural policies, and specifically direct payments, influence farm structure. However, it is widely recognised in the literature that there are three characteristics of structural change adding complexity to the topic. First, structural change is a long term phenomenon that occurs over a relatively long period of time. Second, it affects several structural attributes of the sector at the same time. Third, the evolution of farm structure is part of a more complex evolution of the agricultural sector and its role in the economy [258]. Therefore, a large part of indirect effects of policy on farm structures can be assessed in terms of deviations from the long term trends.

The evaluation themes invited thus to carry out the analysis at two levels:

- at macro level: analysis of sector structure (in terms of evolution in the number of holdings, average size, concentration, etc).
- at farm level: analysis of farms' conduct following structural change and changes on the regulatory framework of the sector (choices on composition/allocation of production factors and strategic choices concerning investments, marketing and farm diversification, etc).

[258] Chavas J.-P (2001).Structural change in agricultural production: economics, technology and policy. In Gardner B. and Rausser G. (Eds.), Handbook of Agricultural Economics, Volume 1. Elsevier Science, B.V. Pages: 263 – 285

If farms' conduct is influenced by sector structural changes, it is also true that farms' conduct has in turn effects on the sector structure. Therefore, sector structure and farms' conduct are interlinked.

The analysis is carried out using two methodological approaches: a) statistical analysis; b) econometric modelling. The first one analyses the development of the main structural indicators and it is instrumental for interpreting the observed phenomena over the years 2005-2010. The second approach provides a quantitative estimation of the impact of the direct support schemes on the observed structural attributes. The methodology is complemented by:

- a review of national legal frameworks, mapping for the 27 Member State the most important legislative instruments at national level that, during the period of analysis, may have played a role in structural changes in the agricultural sector/s.
- a CATI survey, collecting information on the effects of direct support on farm business strategies, not otherwise available in the EU or national statistics. The survey was conducted in twelve case study regions[259] and involved about 1 000 farmers beneficiaries of direct payments.

The following paragraphs illustrate the main findings of our evaluation for each examined theme.

Concerning the theme "Maintenance of farming in marginal areas" it is not possible to draw a conclusion on the role of direct payments after 2005 in the LFAs. The time interval of available data represents a strong limitation for the analysis of structural changes both for the EU15 and EU12. For this reason, this evaluation theme is not reported in the conclusions.

12.1 Effects of direct support on farm structural change

12.1.1 Effects on holdings concentration process

<u>In a context of long term decrease in the number of holdings (occurring also before the 2003 reform) the implementation of Council Regulation (EC) No 1782/2003 has contributed either to speeding up the exit of smaller-sized farms from the sector or to the growth in size of part of smaller-sized farms. This structural development led to a greater homogeneity in farm distribution among size classes in all models, and therefore for the EU27 as a whole.</u>

In the EU27, between 2003 and 2010 the overall number of farms has decreased by 19.8% and the number of holdings >5 ha by 8.9%. Within this general downward trend, the change in policy (in particular that regarding direct payments) appears to have played a role that differs for each SFP implementation model. For the SPS Historical model, in most regions the decline occurring already in the pre-reform period in farm numbers continues after the reform at a slower pace .. This applies to agricultural holdings taken as a whole and to holdings > 5 ha. On the other hand, in the other three SFP models, in most regions there was an acceleration in the decline, or a trend reversal (from rise to decline). In this case too, such trends apply to all agricultural holdings and to holdings > 5 ha. Furthermore, for some regions applying the SAPS model the variation is particularly important[260].

In all models a significant fall in the share of holdings up to 5 ha resulted in an increase in the share of other classes. This is explained by the exit from the sector of smaller farms and/or their shift to a larger size class. The exception to this "rule" is the Regional model, for which the percentage of holdings < 5 ha grew whilst there was a fall in the percentage of holdings in the class from 5 to 19.9 ha.

Since variations in UAA in the EU regions were modest in the time interval under review (and negative in most regions), trends concerning the number of holdings also resulted in a rise in average UAA per holding, both for all holdings (+22.4% in EU27 between 2003 and 2010), and for holdings > 5 Ha (+9.7%). In this case, for the SPS Historical model the growth in average UAA slowed down after the SFP was introduced (both all holdings and holdings > 5 ha), while in the other models growth

[259] The case study regions are: France: Centre; Germany: Niedersachsen; Germany: Brandenburg; Greece: Makedonia-Thraki; Hungary: Del-Alfold; Italy: Emilia Romagna; Poland: Łódzkie, Mazowsze, Lubelskie and Podlasie; Portugal: Alentejo and Algarve; Slovenia; Spain: Extremadura; Sweden: Slattbygldslandan; United Kingdom: England East.

[260] The two Polish regions, Slovakia, Czech Republic and Latvia for all holdings; the four Romanian regions and Lithuania for holdings > 5ha.

accelerated or a trend reversal occurred (from decline to rise), with the sole exception of SPS Regional for holdings > 5 ha[261].

Similarly, the exit from the agricultural sector has concerned almost exclusively farms of small economic size: for all SFP models the average economic size of holdings has increased. After the reform, this process appears however to be faster for the EU15 regions than the EU12 regions.

The results of the analysis of trends in farm numbers (2005-2010) distinguishing farms by Standard Output (SO) classes (economic size), show that the exit of farms from the agricultural sector applied almost exclusively to Small farms (< 25,000€ of SO)[262] in all SFP models. This should come as no surprise, since there is a clear relationship between small physical size and small economic size. On the other hand, a (varying) percentage of holdings belonging to the Medium size class (25,000 to 250,000 €) in 2005 had (presumably) moved up to the Large class (> 250,000€) in 2010.

The downward trend in the number of farms with livestock units (LSU) has been stronger than in agricultural holdings overall.

Results show that in most regions the reduction in the number of holdings with livestock was greater than in agricultural holdings in general, also prior to the reform. After the introduction of the reform the larger decrease in the number of holdings with livestock in relation to the total number of holdings intensified in most regions applying the SPS Historical model, and to a greater extent in Mediterranean regions. On the contrary, after 2005 in the SAPS and Regional models the reduction in the number of holdings with livestock slowed down in most regions. In this case too, exit from the sector mainly concerned farms in the smaller size classes. Nevertheless, the class of landless holdings with livestock[263] (representing a large share of all holdings with livestock in some regions) saw a growth in the Historical and Hybrid models, decreased in the Regional model and remained quite stable in the SAPS.

However, the concentration (n° holdings and UAA; n° holdings and LSU) slightly increased in the EU15 Member States (applying the SPS Historical and Hybrid models) between 2003 and 2010 and it increased in a more important way in the EU12 Member States. However, in particular in Member States applying the SAPS model, structural changes leading to a greater concentration may also have been the effect of other factors (i.e. end of central planning, land reforms, etc). Moreover, in Member States applying the SAPS model, a structural dualism, which was already existing before the reform, is observed. This dualism is confirmed (and increasing) in farms with livestock.

The process of structural concentration regarding i) holdings and UAA and ii) holdings and LSU, was analysed using two analytical tools: the Lorenz curve[264] and Gini coefficient[265]. Variations in concentration may be seen from the comparison between 2003 and 2010.

- The process of structural concentration of holdings and UAA show a wide variety: on the one extreme, a very balanced situation for the SPS Regional model (low concentration), on the other, a structural dualism is observed for the SAPS model (on the one hand, a very high percentage of very small farms which, taken together, concentrate a small percentage of UAA; on the other, a very low percentage of large holdings, concentrating a very high percentage of UAA). In both these SFP models, concentration rose between 2003 and 2010, but in opposite ways[266].

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[261] The analysis did however highlight the fact that these trends result from significantly diverse structural situations at regional level, for which average holding size lies within a range of 0.9 ha (Malta) to 230 ha (DE East & North-East)

[262] Bearing in mind the change in arable UAA threshold criteria for inclusion in the 2010 FSS adopted in some regions (in particular in the SPS Hybrid model).

[263] These are predominantly "industrial" holdings, with a large presence of granivores (Pigs & Poultry), but also (in some regions) other animals probably reared on common land.

[264] Constructed from the combination of cumulative % of the number of holdings by size class and cumulative % of UAA expressed by the same size classes.

[265] The Gini coefficient is a measure of statistical dispersion. Based on the Lorenz curve, the Gini coefficient is a number between 0 and 1. Low values indicate a quite even distribution, with 0 corresponding to pure equidistribution; high values of the coefficient indicate a more uneven distribution, with the value 1 corresponding to the maximum concentration (in this case, the situation in which a single holding concentrates 100% of available UAA.

[266] For the Regional model the 2010 Lorenz curve appears to be lower on the right-hand side (representing larger-sized holdings); For the SAPS model it was lower on the left-hand side (representing smaller-sized farms).

Concentration is more balanced in the SPS Historical model, and a little more pronounced in the SPS Hybrid model.

- At the regional level, the comparison of Gini coefficients shows that most regions saw a rise in concentration between 2003 and 2010[267]. Nevertheless, the size of the increase again varied considerably from region to region.
- The process of structural concentration regarding holdings and LSU shows minimal changes in all SFP models, with the exception of SAPS, where concentration increases to an appreciable extent. This is largely due to the strong growth (> 30%) in nine out of the sixteen examined regions. Moreover, the regions implementing SAPS also in this case show a structural dualism, which existed already before the reform becomes more accentuated in 2010 compared to 2003.

After the reform, the rate of reduction in the number of farms differs across sectors. In general, it is faster in mixed sectors and slower in specialised sectors. Therefore, the change in policy has driven the agricultural production structure towards increased specialisation.

With the aim of verifying the existence of different structural trends in terms of farm specialisation, an analysis is conducted on farm number trends (as well as by size class) based on the Type of Farming (TF; period 2005-2010). Bearing in mind the different percentage distribution of holdings by sector in the four SFP implementation models, the results show negative trends in farm numbers for almost all sectors in all SFP models, with the significant exception of TF5 (Specialist granivores).

Nevertheless, in all other sectors the speed of decline in farm numbers is not the same: in general, in the three "mixed" types of farming (Mixed cropping, Mixed livestock and Mixed crop-livestock) there was a large drop in farm numbers compared with the overall average, whereas the reduction in the number of holdings in more "specialised" types of farming (Specialist field crops, Specialist horticulture, Specialist permanent crops and Specialist grazing livestock) is less pronounced.

Therefore, after the 2003 CAP reform an ongoing farm specialisation process is observed in all SFP models (on average): to a lesser extent in the SPS models applied in the EU15 regions (for which already in 2005 about 85% of holdings were concentrated in the more specialised types of farming) and to a greater extent in the models applied in the EU12 regions, for which more than 50% of holdings belonged to the mixed types of farming in 2005.

12.1.2 Effects on changes in agricultural land use

With regard to land use, the analysis is based on 5 classes: i) Arable land, except for Set-aside areas under incentive schemes and Fallow land; ii) Permanent crops; iii) Kitchen gardens; iv) Permanent grassland and meadow; v) Set-aside areas under incentive schemes and Fallow land.

With the exception of most EU15 Southern regions, direct payments did not have an effect on land use changes after 2005. In the EU15, the withdrawal of compulsory set-aside in 2009 appears to have played the most important role in land use changes. In these regions, set-aside land has mostly been returned to its original purpose, and only a small share has been used as fallow land. Therefore, in the EU15 the extensification index[268] has decreased. In regions implementing SAPS model, where the set-aside requirement has never been applied, there was a rise in the share of fallow land over total UAA, and a rise of the extensification index.

Changes between 2003 and 2010 in the distribution of the five crop classes in the four SFP implementation models appear to be rather modest (except for SPS Hybrid). Variations are negligible in Permanent crops and Kitchen gardens and more perceptible in Arable crops (positive), and Set-aside + Fallow land (negative).

Finally, the analysis shows that some regions have moved against the general trend. In particular, in most southern regions of the SPS Historical model, the relative share of Set-aside + Fallow land and of Permanent grassland and meadows rose, while the share of Arable crops decreased. In these regions,

[267] In particular, 21 regions out of the 27 examined regions of the Historical, 8/10 SPS Hybrid, 2/2 Regional and 12/16 SAPS models.

[268] The extensification index measures the percentage of UAA set aside for non-farming activities (Permanent grassland and meadow) and/or unfarmed due to regulations (set-aside areas under incentive schemes) or so decided by farmers (fallow land) over total UAA.

some arable crops lost their appeal between 2003 and 2010, probably also as a result of the introduction of the reform, and a part of agricultural area previously used for this type of farming was transformed into Permanent grassland and meadows and/or no longer farmed, resulting in a rise in the extensification index.

12.1.3 Effects on holdings' management structure

Legal status[269] of holdings has not been influenced by policy change. Conversely, holdings' organisational form[270] has been indirectly affected by the 2003 CAP reform. Indeed, the observed decrease on land under "farming by owner" seems linked to the farm concentration trends.

The modest growth of the Legal entity or group holding form (and consequently slight decline of the Single holder holding form) in some regions does not appear to be correlated with farm concentration trends, not even in regions where growth is largest. Accordingly, other factors are likely to be cause of this evolution.

Results regarding the evolution of agricultural area by holdings' organisational form show a growing incidence of land under Shared farming or other modes and Farming by tenant, balanced by a decreasing share of land under Farming by owner. This holds true in all SFP models except for the SPS Hybrid[271].

Considering that "Farming by owner" is the most common organisational form among small holdings, the effects of the policy change on the large fall in the number of small farms and on the parallel rise in the number of larger farms, together with the modest decrease of the UAA, leads us to conclude that, in general, the land made vacant by the exit of small farms from the agricultural sector has been taken up by larger farms through land lease agreements (and not through purchase).

12.1.4 Effects of direct payments on changes of EU regions structural profiles

The application of econometric models, using Eurostat data and CATS data for CAP expenditure at regional level (215 regions in 25 EU Member States), allow to estimate whether regions have changed their farm structural profile between 2005 and 2010 and, subsequently, whether direct payments have had an effect on such changes.

The analysis comprises three subsequent stages: i) Factor analysis, aimed at identifying a finite number of farm structural profiles; ii) Classification of EU regions into homogenous groups according to their farm structural profile, in 2005 and 2010; iii) Construction of transition matrices and econometric modelling to estimate whether direct payments have had an effect on changes observed in the structural profiles at the regional level.

The results of the econometric estimation lead to conclude that decoupled direct payments may have played a role in structural changes occurred between 2005 and 2010, in particular towards a regional agricultural structure characterised by larger sized and more professional farms.

Indeed, a larger share of decoupled direct payments on total CAP expenditure is associated to higher probability of regions' transition towards regional profiles characterised by larger sized and more professional farms. At the same time, a larger share of decoupled direct payments on total CAP expenditure appears to reduce the probability of regions moving towards an agricultural structure characterized by smaller and less professional farms.

Furthermore, the higher the importance of decoupled direct payments relative to the value of agricultural output (SO) at regional level, the less competitive regional agriculture is, because heavily dependent on support, thus leading to higher probability of shift towards a structure characterised by smaller and less professional farms.

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[269] FSS data makes it possible to group together holdings into two legal status categories: single holder holding and legal entity or group holding.

[270] The types of organisational forms are: farming by owner; farming by tenant and shared farming or other modes.

[271] Drop in the share of land under Farming by tenant and increase for Farming by owner. This trend is almost exclusively caused by changes in the DE East & North-East region (former DDR), where the land restitution/privatisation process started in 1992 and continued even in recent years (cf Review of National and Institutional Frameworks).

12.2 Effects of direct support on labour use and capital

12.2.1 Effects on labour force

The aim of the analysis is to assess whether and to what extent direct support schemes laid down in Regulation (EC) n.1782/2003 have influenced labour use according to five dimensions: labour use intensity (expressed in hours per hectare), family labour (expressed as relative importance of family labour on total labour force), age structure, part-time/full-time farm organisation.

Effects of direct payments on the evolution of labour use intensity

The CAP reform and in particular, decoupling of support, may have contributed to accelerate the reduction of labour use intensity in the farm sector occurring already before the 2003 reform. The acceleration of the exit from the agricultural sector of small farms with hidden unemployment has influenced this evolution. However, in the Member States applying SAPS model the decrease in labour use seems related to the reduction of excess labour force in former large cooperatives and state farms[272], existing in the pre-reform years.

The statistical analysis shows that labour use intensity (hours/hectare) has declined steadily in all EU regions over the considered period. This evolution is consistent with the long term decline of work force in the agricultural sector shown by most developed countries. However, the analysis shows that labour use has declined to a faster pace in the post-reform years than in the previous years.

This trend has been experienced by all considered groups of regions aggregated according to the SFP model they implement, albeit with some differences. This evidence suggests that the reform may have contributed, together with other factors, to accelerate the decrease of labour force.

The reduction has been particularly marked in some of the regions implementing the SPS Historical model and, in particular, where certain coupled payments strongly supported labour intensive activities (e.g. tobacco and tomatoes for processing). This suggests that, in some cases, the decoupling process may have contributed to the reduction of labour use.

In any case, the reduction in labour use intensity is also the result of changes in other structural attributes. In particular, labour use is still significantly higher in small farms than in large farms, even if differences between size groups have slightly reduced in the post-reform years at least in the SPS Historical and Hybrid regions. Thus, the decrease in small farms numbers and the increase in the importance of relatively larger farms can be one of the main factors causing the reduction of labour use as well as the changes in other labour use attributes.

The application of econometric models at farm level, using FADN data for the years 2005 to 2009, allow to estimate the effects of direct payments on labour use intensity[273]. Furthermore, the statistical analysis (correlation analysis) within 12 case study regions[274] provides some additional insight at regional level.

The econometric analysis, that confirms the findings of the statistical analysis, shows that in the years 2005-2010 coupled payments may have played a role in increasing labour use and that decoupled

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[272] The faster decline in labour intensity observed in regions applying the SAPS seems coherent with the fact that EU12 Member States used to have a higher level of labour intensity than most of the other Member States, at the beginning of the considered time interval.

[273] The econometric approach has been used to identify the statistical relationships between labour intensity and a number of explanatory variables (i.e. decoupled direct payments, coupled direct payments, rural development aids, farm organisation, farm specialisation, economic factors) expected to influence it. The regression parameters estimate the impact of direct payments on the labour per ha. If parameters are statistically different from zero and positive in sign, it can be assumed that direct payments contribute to increasing labour intensity. The magnitude of the parameters provides an estimate measure of this contribution.

[274] The correlation analysis conducted on constant FADN samples (2004 and 2009) allows to examine at farm level whether the observed evolution of labour intensity can be associated to direct payments. The analysis is based on the computation of correlation coefficients between couple of variables. The correlation has been calculated by means of Pearson's correlation coefficients. The case study regions are: France: Centre; Germany: Niedersachsen; Germany: Brandenburg; Greece: Makedonia-Thraki; Hungary: Del-Alfold; Italy: Emilia Romagna; Poland: Łódzkie, Mazowsze, Lubelskie and Podlasie; Portugal: Alentejo and Algarve; Slovenia; Spain: Extremadura; Sweden: Slattbygldslandan; United Kingdom: England East.

payments could have had an effect in terms of decreasing labour use. However, the very low values[275] of the estimated parameters for coupled and decoupled direct payments indicate that they played a minor role in labour use.

Finally, the correlation analysis conducted on the 12 case study regions provides further insight, showing that in a limited number of regions the observed evolution of labour use could be associated to the decoupling process.

In those regions, farms that have experienced the strongest reduction in the relative importance of coupled payments have often also experienced a (generally limited) reduction of labour use. In particular, this has occurred only in the specific circumstances in which the farm activities supported by coupled payments are also among the most labour intensive. This hypothesis is supported by the analysis of the evolution of production patterns observed in the few regions where correlation coefficients are significantly different from zero.

Role of the CAP reform on the evolution of other labour attributes

The CAP reform seems to have favoured an intergenerational transfer with growing relative importance of farms managed by young farmers. Conversely, the reform did not have any impact on the relative importance of family labour and on part-time farming. Furthermore, the model of SFP implementation, per se, has not had a clearly identifiable and homogeneous effect on the considered labour attributes.

In the post-reform period, the relative importance of farms managed by holders ≤35 year old has increased, while that of the holders ≥65 years old has declined. This has determined a certain degree of intergenerational transfer in the farm sector following the CAP reform. However, the observed changes can also be the results of many other factors that, as explained in the theoretical analysis, affect structural change. In particular, this can be the case of the increase of the relative importance of farms managed by young holders given that other policies (i.e. both at national level and rural development measures) pursue this aim.

The analysis does not provide strong evidence of discontinuity in the trends observed in the years before and after the implementation of the CAP reform concerning family labour and part-time/full time organisation: the relative importance of part-time farming as well as of the labour provided by family members has increased more or less constantly in both considered periods.

12.2.2 Effects on capital intensity

The evaluation question required to assess to what extent direct support schemes have influenced farms' capital intensity.

The analysis looks at capital intensity per unit of land (K/ha) and per unit of labour (K/AWU). Furthermore, the statistical analysis considers the evolution of contract work on-farm (CW/ha), as capital intensity may be affected by the outsourcing of certain stages of the production process.

The models of SFP implementation, per se, have not had a clearly identifiable effect capital intensity attributes.

The statistical analysis, based on EU FADN farm data for the years 2004 to 2009, highlights that:

The results of the statistical analysis of the evolution of capital intensity highlights a large heterogeneity within the regions implementing each SFP model. Despite certain average trends the observed changes in the capital indicators are not similar among regions within the same model. The observed differences are likely to have been generated by the relevant structural differences among the Member States belonging to these groups.

The econometric analysis shows that in the years 2005-2009 both coupled and decoupled payments

[275] The estimated parameters of coupled and decoupled direct payments are statistically significant and in a logarithmic regression, the parameters represent the constant elasticity of the dependent variable with respect to percentage changes in the explanatory variable (*i.e.* if Decoupled payments per ha increased by 1%, then the decrease in Labour input per ha would be equal to -0.0092%).

The estimated parameters for other explanatory variables take higher values, e.g. age of holder, net worth (total capital minus total debts), cashflow, GDP per capita.

may have had a rather limited effect in terms of increasing farms' capital. Moreover, direct payments may have induced some incentive to substitute capital for labour.

The application of econometric models at farm level, using FADN data, allows to estimate the effects of direct payments on capital intensity from 2005 onwards[276]. Two distinct models have been used: i) the first model adopts as the dependent variable defining capital intensity, value of capital per hectare; ii) in the second model the dependent variable is capital per labour input (in working hours).

The very low values[277] of the estimated parameters for coupled and decoupled payments indicate a practically absent tangible role of direct payments in explaining farm's capital intensity per land and per labour input.

Moreover, the results show that the values of parameters for coupled and decoupled payments in the model concerning capital intensity per labour input are slightly higher than the parameters per land. Therefore, the comparison of the results of the two models on capital intensity suggests that direct payments may induce some incentive to substitute capital for labour[278].

Moreover, the correlation analysis conducted on the 12 case study regions highlights that large economic size[279] farms that have experienced the strongest reduction in the relative importance of coupled payments, have often experienced a reduction (albeit generally small) in the amount of capital per hectare.

The findings of correlation analysis[280] conducted on constant FADN samples (2004-2009, 12 case study regions) are consistent with the results of the econometric analysis and provide further insight. In particular:

- The level of direct payments has not influenced capital intensity to a great extent, except for large farms (in terms of economic size) in some of the case study regions. This result suggests that in large size farms the financial resources deriving from direct payments may increase farms' capital intensity (i.e. supporting farm investments).
- In some cases, large the farms that have experienced the strongest reduction in the relative importance of coupled payments, have often also experienced a (generally small) reduction in the amount of capital per hectare. This suggests that coupled payments, being more directly linked to farm production activities, have been more related with on-farm investments.

12.3 Effects of direct support on farm specialisation

12.3.1 Effects on farm specialisation[281]

Economic and production changes in response to policy changes have been evaluated by observing the number of farms which have altered their specialisation so as to move from their original type of farming to another one. To this end, for each type of farming (TF)[282] we have measured in the EU

[276] The econometric approach has been used to identify the statistical relationships between capital intensity and a number of explanatory variables expected to influence it (i.e. decoupled direct payments, coupled direct payments, rural development aids, subsidies on investments, farm organisation, farm specialisation, macro economic factors).

[277] In a logarithmic regression, the parameters represent the constant elasticity of the dependent variable with respect to percentage changes of the explanatory variable (consequently, according to the models, if coupled payments per hectare increased by 1%, then the increase in capital per hectare would be equal to 0.0058%; if decoupled payments per hectare increased by 1%, then the increase in capital per ha would be equal to 0.0051%).

[278] It should not be forgotten however, that substitution of capital for labour, may also be an effect of ongoing structural adjustment process in some EU12 regions.

[279] Large farms are above 40 ESU (1 ESU corresponds to a farm's Standard Gross Margin of 1.200 Euro/year).

[280] See footnote 262.

[281] A farm is said to be specialised when a particular activity provides a standard gross margin of at least two thirds of the total SGM of the holding.

[282] TF1 – Specialist field crops; TF 2 – Specialist horticulture; TF 3 – Specialist permanent crops; TF4 – Specialist grazing livestock; TF5 – Specialist granivore; TF6 – Mixed cropping; TF7 – Mixed livestock; TF8 – Mixed crops – livestock.

FADN constant sample[283] flows of farms that between 2004 and 2009: i) remained in the same TF; ii) migrated from a TF to another; iii) arrived in a TF from another TF

The constant sample represents, by definition, those agricultural holdings that have decided to continue farming between 2004 and 2009. Accordingly, the results of the analysis concerning strategy changes only apply to the sample and not to the whole agricultural sector.

The change in policy has contributed to the migration of farms from the less to the more specialised types of farming between 2004 and 2009: the greater freedom of decision related to decoupling of direct support has stimulated part of the holdings to focus more on the production activities (crops and/or livestock) for which market conditions allow higher profitability (and, therefore, greater specialisation).

The findings of the statistical analysis show that over the examined years a large number of farms belonging to different sectors have altered their organisation in terms of production choices, farm size and land allocation.

In general, in the sectors characterised by the lowest degree of specialisation (i.e. mixed farms without a dominant sector for income generation), the number of farms decreased significantly in all models of SFP implementation; flows, both incoming and outgoing, were considerable, accompanied by a low percentage of farms remaining in the same sector in 2009. Altogether, between 33% (Mixed livestock) and 39% (Mixed cropping) of farms migrated to more specialised types of farming. On the other hand, the sectors with a higher degree of farm specialisation (specialist field crops, horticulture, permanent crops and specialist grazing livestock) presented an increase in the number of farms in all models of SFP implementation, however flows between TF were quite modest.

However, in all sectors the changes are (also) the result of two-way trends among TFs (there are no cases of single way flows: incoming only or outcoming only). This would point to the existence of more complex situations where production choices are impacted not only by policy changes.

12.3.2 Effects on farm strategies concerning land availability and land use choices

Overall, farms that decided to decrease their size have in most cases a larger size and farms that decided to increase their size have in most cases a smaller size. Therefore, a process of structural adjustment was observed, leading to convergence towards an "intermediate" farm size.

The statistical analysis regarding the total sample shows an overall expansion of the utilized agricultural area (UAA) between 2004 and 2009, in all analysed sectors and SFP implementation models. This expansion hides three different behaviours:

- 51.2% has consistently increased their UAA;
- 30.3% has decreased their UAA;
- 18.6% maintained their UAA unchanged.

Farms that have increased UAA have, on average, increased their farm size from 84 ha in 2004 to 102 ha in 2009. Farms that have decreased UAA have, on average, decreased their farm size from 142 ha to 126 ha. There is, therefore, a convergence towards the average farm size of 113 ha.

Farms that decided not to change their size are those of smaller size (44 ha on average). For these farms it is likely that the small relative size of farms with unaltered UAA represents (for economic reasons) a constraint hindering the adoption of either expansion or contraction strategies[284]: these are farms whose size does not allow a further reduction without this implying a growth in unit costs (with a consequent rise in inefficiency), but for which a (modest) increase in farming area does not significantly change the farm's profitability (i. e. does not allow economies of scale).

The results suggest that the implementation of the 2003 CAP reform has favoured a shift in land use towards easier, less "demanding" crops in terms of production factors, technical characteristics and business effort.

[283] i.e. a sample consisting of the same farms in the analysed years.

[284] Moreover, this group of farms shows the highest share (in 2004) of Fallow land &Set-aside. Therefore, less dynamic and less market-oriented farms would belong to this group.

On average, the UAA expansion was accompanied by a growing use of land for COP crops and for livestock feeding. This occurred to the detriment of industrial crops (mainly due to the partial or full decoupling of aid for tobacco and cotton and to the reform of the sugar sector), and because of the utilisation of almost 50% of fallow land and set-aside land existing in 2004 (in the EU15 this is clearly to be attributed to the removal of the set-aside obligation for COP crops).

The effect of the policy change (in particular that regarding direct payments) and the consequent rise in responsiveness to market signals has affected in similar ways the different groups of regions. It may thus be stated that SFP models adopted to implement the 2003 reform have played a secondary role in shaping farms' behaviour. This conclusion is valid overall despite some specific exceptions[285].

These findings were confirmed by the results of the CATI survey (about 1 000 farmers beneficiaries of direct payments in 12 case study regions). According to the vast majority of farmers, direct aids seem today to play a minor role on farms' production decisions. Otherwise, they appear to be an opportunity for farm investments and a safety net for farmers.

Concerning strategic decisions of livestock farms, the analysis leads to conclude that the change in direct support policy, i.e. aids decoupling, seems to have allowed a strategic response to market conditions (i.e. the rise of cereal prices), namely of livestock farms with availability of land. In the EU15 regions , FADN constant sample livestock farms with UAA (both specialised and mixed farms) have generally increased the number of livestock units, supported by the augmentation of land for animal feeding and/or for cereals (in the EU10 regions the results are less clear-cut: in some types of farms the number of livestock units has increased and in others it has decreased).

The analysis shows a lower stocking rate of livestock per hectare, across nearly all sectors and all models. Extensification may however only be apparent, since the greater increase in agricultural area for fodder crops (compared with the variation in livestock units) may conceal the substitution of animal feed purchased outside the farm with animal feed crops produced on the farm (choice determined by the change in relative prices).

The behaviour of FADN constant sample livestock farms without land (and in particular of farms specialised in granivores) confirms these conclusions: the number of LSU in these farms has shrunk considerably in almost all models[286], probably due (at least partly) to farms not being able to address the increase in cereals price by expanding their own production of livestock feed crops.

12.3.3 Strategic changes concerning production factors stimulated/favoured by the changes in direct support policy

For all farms of the sample having increased, decreased or maintained unchanged UAA, we have examined the variations of labour and capital (machinery) in absolute terms and per hectare, in order to identify strategic behaviours in some way related to the effects of CAP changes (i.e. the decoupling of direct support for EU15 /the introduction of direct support for EU10).

All farms with UAA of the FADN 2004-2009 constant sample have been classified and grouped on the basis of the observed changes in land, labour and capital between 2004 and 2009.

The analysis of different strategic choices made by farms bearing effects on their land labour and capital leads to the identification of five farm strategies that can be related to the effects of intervened policy changes.

The first one is a strategy of development and intensification of the use of production factors. This development strategy is based on the intensification of all production factors (UAA, Machinery and Labour), also leading to intensification of machinery and labour per hectare. This strategy thus also implies the intensification of production methods aimed at increasing farm total Output. These

[285] We report for example the case of industrial crops that have collapsed dramatically everywhere except in the Hybrid model: This is due to the stability of the sugar beet sector in the MSs of this model (in particular Germany) following the 2006 reform of the sugar CMO.

[286] In the conclusions concerning the "effects on holdings concentration process" (§ 12.1.1) we have seen that total LSU in farms without land has increased. This is also due to the fact that, overall, the number of farms without land has also increased. The LSU decrease observed in the FADN constant sample farms without land is only aparently contradictory because in this case the number of farms does not change.

holdings therefore appear to be the most dynamic and most reactive to change. This strategy was adopted by 11.4% of all holdings with increased UAA and 6% of all farms of the EU25 sample[287].

The second is a strategy of development with optimisation of production factors use efficiency. With a greater availability of UAA, an increase in either machinery or labour or in both of them in absolute terms (higher and/or lower compared with the increase of UAA) results in an increase in machinery/ha and a drop in labour/ha (or, vice versa, in a decrease in machinery/ha and in a increase in labour/ha). This is therefore a development strategy based on the optimisation of capital and labour efficiency (maximising labour productivity through the replacement of labour with machinery and/or adjustment of capital/labour standard ratio). The strategy was adopted by 34% of all holdings with increased UAA, corresponding to 17.5% of all holdings of the EU25 sample[288].

The third is a strategy of development with extensification. As the availability of land grows, there is a drop in intensity of hours and machinery (per hectare), even though both machinery and hours or one of them may rise in absolute terms. This is therefore a development strategy enacted through the extensification of production methods and/or a greater shift towards less capital- and less labour-intensive farming (presumably, for the newly acquired land). This is probably with the aim of reducing unit costs while maintaining production volumes over a large agricultural area. The strategy was adopted by 45% of all holdings with increased UAA, corresponding to 23% of all holdings of the EU25 sample[289]. It is not however possible to rule out the possibility (at least in certain farms) that i) there were elements of hidden unemployment and/or surplus machinery capacity in 2004 (therefore would be strategy 2) and that ii) the decrease in machinery and labour is the effect of outsourcing one or more phases of production processes to contractors. In this case, therefore, the strategy would be similar to strategy 1, but with the use of external factors.

The fourth strategy is a strategy of consolidation, with or without downsizing. In the event of downsizing (or no change in holding size), the intensity of labour and machinery per hectare (or labour only) rises. These holdings therefore apply a consolidation strategy by maximising the productivity of land and/or (alternatively) the use of machinery or labour (probably in surplus in 2004 in some cases). This strategy also (presumably) implies the adoption of more intensive production methods and/or a shift towards capital-intensive and/or labour-intensive farming in some cases. The strategy was adopted by 70% of holdings with decreased UAA and by 72% of holdings with unchanged UAA. It was also adopted by 9.6% of farms with increased UAA[290]. Overall, this strategy is the most commonly adopted in EU25 (39.4% of holdings)[291].

Within the strategies described above, however, a share of the farms that have increased machinery (in absolute terms) have started a new contract work activity. Therefore, it is conceivable that in these cases the increase in machinery is not only related to the change of "agricultural" strategy, but (probably) also to the implementation of a diversification strategy (i.e. contract work for others).

The fifth strategy is a strategy of disinvestment and/or disengagement from farming. In the event of downsizing (or no change in holding size), intensity of labour and machinery decreases both in absolute terms and per hectare. The strategy is thus one of a gradual disinvestment of two (machinery and labour) or all three production factors (land, machinery and labour). This implies the will to disengage from farming activities (especially for holdings with decreased UAA) and the adoption of more extensive production methods. Accordingly, these holdings appear to be the least dynamic and

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[287] Concerning the latter, the highest % is observed in the SPS Hybrid (7.8%), down to 4.7% in SPS Historical regions. Moreover, the highest percentage is observed in TF1- Specialist field crops (7.2%), and is least common in TF2-Specialist horticulture (3.2%) and in TF3- specialist permanent crops.

[288] A significantly higher percentage was observed for the SAPS model (22% of farms), and significantly lower for SPS Historical (14.1%). Furthermore, this strategy has been most commonly adopted in TF7- Mixed livestock (21%), and least common in TF2-Specialist horticulture (8%) and in TF3- Specialist permanent crops (9.6%).

[289] A significantly higher percentage was found for the SAPS model (28.3% of farms), and significantly lower for SPS Historical (20.3%). Furthermore, this strategy has been most commonly adopted in TF7-mixed livestock (33.5%), and least common in TF2-Specialist in horticulture (17.7%) and in TF3- specialist in permanent crops (17.4%).

[290] For these farms, in particular, it is a development strategy towards production methods and/or farming activities more labour intensive, with substitution of capital for labour.

[291] It is however adopted more in the SPS Historical model (44.3%) and relatively less in the SAPS model (31.4%). Furthermore it was mostly adopted in TF3- Specialist permanent crops (49%), while it was less common in TF7- Mixed livestock farms (30%).

the most resistant to change. The strategy was adopted by 30% of all holdings with decreased UAA and by 28% of holdings with unchanged UAA. At EU25 level, this strategy has been adopted by 14% of the total number of farms[292].

Farm adaptation strategies oriented towards development have been implemented to a greater extent by holdings more exposed to the policy change (i.e grazing livestock). In such cases, therefore, the change has served to stimulate the reorganisation of holding structures. On the other hand, where policy changes have produced the least effects (i.e. fruits & vegetables) and where the need to adapt has thus been less urgent, the strategies of holdings have been oriented more towards consolidation and/or downsizing of the existing production systems.

The results of the analysis by farm type show that strategies geared towards the development of the holding appear to have been pursued mostly by holdings belonging (in 2004) to TF7- Mixed livestock, TF4- Specialist grazing livestock and TF8- Mixed crops livestock farms. In all three cases, these are holdings for which livestock farming is prevalent or in any case has a significant presence.

On the other hand, consolidation and/or disinvestment strategies appear to have been implemented mostly by holdings producing predominantly fruits & vegetables (TF2- Specialist horticulture, 71.2% and TF3- Specialist permanent crops farms 68.7%), or by holdings where this activity is important (TF6- Mixed cropping farms, 61%). It is stressed that holdings belonging to these three sectors have importance in the regions implementing the SPS Historical and SPS Regional models (where consolidation and disinvestment strategies have mostly been pursued), and a much lower importance in the regions of the SAPS model (13.3%) and SPS Hybrid model (where development strategies are pursued to a greater extent).

12.4 Effects of direct support on farm competitiveness

The aim of the analysis is to assess farmers' strategies aimed at maintaining farm competitiveness and, in particular, the impact of the 2003 CAP reform on farm investment decisions and on diversification and marketing strategies.

12.4.1 Effects on farm investment decisions

The analysis of farm investment decisions is entirely based on data from the 2004-2009 constant sample of FADN farms across the EU25 and data collected through the CATI survey. The analysis is completed by the econometric modelling exercise to test the effects of direct support (coupled and decoupled payments) on farm investments in the years following the CAP 2003 reform (2005 to 2009), again based on FADN data.

Overall, the results suggest that the policy change has had a differentiated effect on farm investments in the regions implementing the SPS Historical and Hybrid models (EU15) and in those implementing the SPS Regional and SAPS models (EU10): decreasing farm investments in the former and increasing farm investments in the latter. These opposite trends are likely to be influenced by pre-existent structural differences with respect to level of farm capitalisation which was generally higher in the EU15 regions and lower in the EU10 and by the (new) support for agricultural investments through the RDPs. The increase in the share of farms investing on fixed assets between 2004 and 2009 in the EU10, confirms a progressive rise in farm capitalisation that would decrease the gap with the EU15.

With regard to both total farm investments and investments on machinery & equipment and on farm buildings, the share of farms investing on fixed assets (gross investment /ha >0) decreases between 2004 and 2009 in the regions of the EU15(SPS Historical and Hybrid), whereas it generally increases in the EU10 (SPS Regional and SAPS). However, in both EU15 and EU10, the portion of farms able to compensate the loss of value of own capital with new investments (net investment/ha >0) tends to reduce or not change significantly in some cases.

The results of the econometric analysis show that in the years 2005-2009 coupled direct payments may have had an effect in terms of increasing farm investments, whereas decoupled payments do not

[292] This percentage drops to 11.7% in SAPS regions and SPS Hybrid regions, and rises to 16.6% for holdings in SPS Historical regions. Moreover, it was mostly adopted in TF2-Specialist horticulture (26.3%), while it was the least common in TF4- Specialist grazing livestock farms (10.6%)

appear to have had an effect. Moreover, the regression analysis provides evidence that investment subsidies have a significant effect in terms of increasing farm investments.

The results of the regression analysis also show that an increase of farm capital would produce a decrease in farm investments, suggesting that for higher levels of farm capital the scope for investments is reduced. This result confirms the findings of statistical analysis on FADN farm data.

In the opinion of the majority of farmers investing on farm assets after 2005 (CATI survey), farm investments have been facilitated by the introduction of the SFP. The proportion is much higher in the two regions of Poland and Hungary (applying SAPS) though, suggesting that investment decisions could be facilitated to some extent by the availability of additional financial resources, and more so in the regions where direct support was introduced following EU accession. Furthermore, CAP entitlements seem to have facilitated access to credit, particularly for young farmers.

12.4.2 Effects on marketing strategies

The analysis of farm marketing strategies is entirely based on the data collected through the CATI survey.

The results do not seem to suggest any role played by the 2003 reform (and in particular by direct payments) in the marketing decisions of agricultural holdings.

The analysis shows that the balance between farms starting up and abandoning specific marketing strategies is negative in the case of "Member of a Producers organisation / Cooperative" and "Direct relationship with processing industry", while it is zero for “Direct relationship with retailers” (i.e. the number of farms developing and abandoning this strategy is identical). A fair share of farmers appear to have started direct sale of farm products after the 2003 reform (21% of the total sample). However, only 18% of those who developed this marketing strategy declared that the introduction of the single payment has had some influence on the decision to start up direct sale.

12.4.3 Effects on diversification strategies

The analysis of farm diversification strategies, i.e. the presence of other gainful activities on the farm comprises three parts differentiated according to the level of analysis and data source (regional data from Eurostat FSS, farm data from FADN and from the CATI survey). A fourth piece of analysis, solely based on Eurostat data, focuses on other gainful activities of the farm holder-manager.

The policy change has had some differentiated effects on farm diversification decisions in the regions of the EU15 and in those of the EU10 (overall more marked expansion in the latter regions compared to the former, due in particular to increase of “Contract work to others” in the SAPS and “Product processing activities” in the SPS Regional model): yet other factors may have supported diversification choices, in particular rural development aids and other national policies (especially in the case of renewable energy production).

The analysis based on farms of the FADN 2004-2009 constant sample shows that diversification of activities on the farm generally concerns a limited number of holdings and that the increase in the number of farms with diversified activities in 2009 compared to 2004 across all groups of regions is generally small. The only exception concerns Contract work for others in the regions of the SPS Historical and SAPS models and Processing of farm products in the regions of the SPS Regional model. Similarly to the findings of the analysis of farm investment decisions, results suggest a more marked expansion of farm diversification in the regions of the EU10 (SPS Regional and SAPS) compared to the EU15, due, at least to some extent, to the remarkable increase in 2009 of the number of farms providing Contract work to others in the regions of SAPS and of the number of farms with Product processing activities in the SPS Regional model.

The analysis also highlights a fast growing interest of farms in the regions of the SPS Historical and Hybrid models (EU15) for the production of renewable energy as a diversified activity on the farm.

A relatively high proportion of farms (FADN 2004-2009 constant sample) diversifies activities through undertaking contract work for others, which seems to be directly related to the increase in machinery investments and to the adoption of specific farm development or consolidation strategies

(Strategies 1, 2, 3 and 4)[293] after the 2003 reform. This is true, in particular, for the regions implementing the SAPS.

Although the majority of farms with other gainful activities in 2004 maintain them in 2009, there are also farms changing their diversification strategies in terms of starting up or abandoning such activities. The most significant changes are found in the case of Contract work for others, which is taken up as a new other gainful activity in a large share of farms across all four groups of regions, but especially in the regions implementing the Hybrid and SAPS models.

The results do not suggest an impact of the 2003 reform (and in particular of direct payments) on farms' adoption of organic farming.

The analysis based on farms of the FADN 2004-2009 constant sample shows that the number of organic farms very slightly increases in all SFP models.

The analysis based on Eurostat data, shows that between 2005 and 2010 the number of holdings adopting Organic farming methods grows everywhere, albeit more in the EU12[294] where it was less developed in the past, compared to the EU15. The more pronounced growth in the EU12 thus appears to be influenced by a pre-existent structural difference compared with the EU15.

With respect to pluriactivity of farm holders it is possible to conclude that the decrease in the share of farm holder-managers with Main other gainful activities[295] (consistent with the overall decrease in the number of holdings in the small size classes) may be an indirect effect of the 2003 reform's contribution to speeding up the process of farm concentration across all groups of regions.

The analysis of pluriactive farm sole holder-managers shows that pluriactivity is overall more frequent in the regions of the SPS Hybrid, SPS Regional and SAPS models than in the regions of the SPS Historical model. Pluriactive farm holders (on the farm and/or outside) engaged in activities that occupy the majority of their time (i.e. with Main other gainful activities) are more frequent than those engaged in Subsidiary other activities across all SFP models.

Between 2005 and 2010, the overall share of pluriactive farm holders within the total number of farms with sole holder-managers increases for all SPS models, less in the regions of the Historical model and in a more accentuated manner for the regions implementing the SPS Hybrid model[296]. On the other hand, the incidence of pluriactive farmers decreases in the regions applying the SAPS.

In all groups of regions, the share of holder-managers with Main OGA decreases (albeit only slightly in the regions of the SPS Historical), whereas the incidence of holder-managers with Subsidiary activities increases. Since Main other gainful activities are more frequently encountered in small size farms, this result appears to be entirely consistent with the long-term process towards increasing farm concentration[297].

The analysis also shows that in 2010 the other gainful activities of pluriactive holder-managers were mostly carried out outside the farm (Eurostat). However, it is not possible to make a comparison with previous years because this information was not collected prior to 2010.

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[293] See § 5.3.

[294] EU10 for FADN data.

[295] Other gainful activities of farm sole holder-managers are qualified as "Main" if the farm holder spends more time on these activities than on the farm work and as "Subisidiary" in the other case.

[296] However, this larger increase appears to be related to the consistent drop in the number of small size farms in Germany and the UK (i.e. England and Northern Ireland) due to the increase of the UAA threshold to 5 ha in 2010.

[297] See EQ1 (§ 6.4.3.1).