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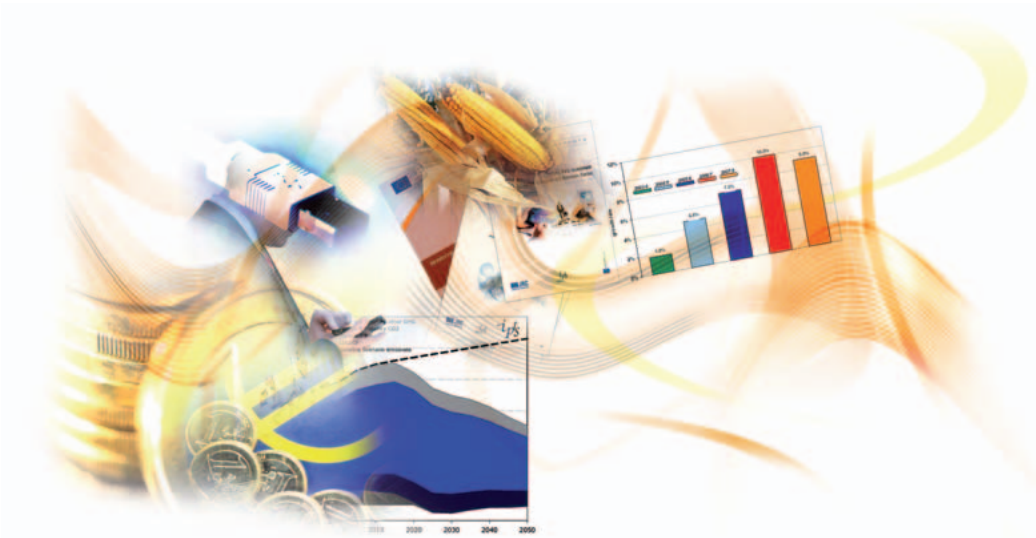

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Executive summary

Background and objectives

The Common Agricultural Policy (CAP) is recognised as being a major driver for agricultural activities in the European Union (EU). Since its inception, and particularly in recent decades, the CAP has undergone a continuous process of reform. Several *ex-ante* studies have highlighted the expected impact of the CAP reform process on land allocation to different crops, with particular emphasis on reallocation towards more efficient ways of farming (EC 2003). Such reallocation should also contribute to the competitiveness of the system. In the medium to long term, however, the results of the reform will be largely determined by changes in farmers' investment behaviour, particularly with respect to more efficient technologies and emerging production processes. Despite the fact that agricultural policy should have a prominent role in determining the propensity to invest, recent studies on the impact of the CAP reform process (both the Health Check and decoupling), as well as on farming structures in new Member States, emphasize the role of non-policy and non-farm variables associated with farm households (e.g. demography, ageing) and the surrounding economic environment (e.g. shadow wages in farm households, return on capital, quality of life in rural areas) in determining farmers' behaviour (EC 2003; Baum et al., 2004). This is particularly true for investment and decommissioning. However, there is limited primary research on the impact of the CAP reform process on farmers' investment behaviour.

Within the above regulatory and economic framework, the present study aims to investigate farmers' investment behaviour, and evaluate the impact of different CAP scenarios on a selected groups of farming systems, hence contributing to the understanding of the relation between policy objectives and farmers' behaviour. It largely replicates a similar study carried out in 2006 (Gallerani et al., 2008), and intentionally surveys the same sample of farms and hence providing primary information about changes in investment behaviour between 2006 and 2009 following a panel approach. The impact of alternative scenarios is simulated using farm-household mathematical programming models.

Main outcomes

The results of the study, based on survey analysis as well as on modelling of farm behaviour, can be summarised in four main outcomes:

With respect to the effects of the CAP decoupling process which began in 2005, the 2009 results mostly confirm those of the first Investment study carried out in 2006 and published in 2008 (Gallerani et al.). In both cases, for about half of the farms decoupling did not result in any change. Among those farms showing some reaction, one of the more prominent effects is the increase in on-farm investment.

Additionally, depending on the system and farm typology, decreases in on-farm, and increases in off-farm investment have also been observed when comparing 2009 results with those from 2006.

The price trends in 2007/2008 and the ongoing economic and financial crisis have partially reshaped access to credit, perceptions of objectives, constraints and expectations. In particular, farms have witnessed a major reduction in access to credit, particularly the share of farms using short term credit, which dropped from more than 40% in 2006 to about 7% in 2009. As far as objectives are concerned, farm-households seem to have increased their overall focus on agricultural activities by increasing the importance of objectives such as limiting debt-asset ratios, and decreasing the importance of objectives such as leisure. In 2009, the share of farmers expecting an increase in production costs, and a decrease in CAP payments, increased. The willingness to invest is still high, although the number of farmers stating an intention to invest in land, buildings or machinery has decreased by about 20% compared to 2006.

The instruments of the CAP, in particular direct payments, are aimed at guaranteeing a minimum level of income through farming. The change in economic conditions has increased this role of the CAP, and the importance of CAP payments in covering current expenditures has become more evident.

Prices confirm their role as the key variable for investment choices. The results of the modelling exercise confirm that farm and farm-household income and investment choices depend more on the price level than on the level of payment received. However, some farming systems, particularly those in eastern EU and livestock systems, show a very high dependency on payments. In addition, the variability of impact across farm types is very high, once again highlighting the relevance of farm-specific components in affecting reactions to markets and policy. This is particularly relevant for investment, which is also determined by path-dependency issues (e.g. asset age).

Altogether, the combined effect of the recent policy reform (decoupling and first pillar payment reductions), as well as price and cost developments tend to reinforce the role of policy for the economic and social sustainability of farming. Notably, policy areas such as income support, investment and credit management, market access, as well as transitory and cross-policy mechanisms, appear to be of particular importance. Uncertainty (and related risk-management instruments) seems to play an increasing role in the investment decision process.

Methodology and further work

The recent literature on farm investment behaviour does not provide any major innovation in terms of the methodologies available, although some refinements are provided with respect to understanding technical determinants, contracting issues and uncertainty.

The literature review and previous experience of the 2006 study, led to the conclusion that the best approach was to further develop the previous IPTS study on investment behaviour (Gallerani et al., 2008). For this purpose, the methodology was organised into two main sequential components: a) the administration and analysis of a survey of 256 farm-households; and b) the simulation of selected scenarios through dynamic farm-household models.

The present study is subject to three main methodological considerations, which must be borne in mind when interpreting the results. First, there is significant variability across systems, which hinders the possibility of providing an average-based generalisation, and suggests the need for a deeper analysis of individual contexts. Second, investment choices are highly dependent on farm and farmer-specific factors, not always detected or poorly formalised by economic research methods. Third, the survey was carried out during a period of important changes in the economic context, strongly affecting farmers' perceptions and expectations; as a consequence it is difficult to distinguish short-term effects and results from those which will be confirmed over the longer term.

The outcome of the study demonstrates the advantages of the panel analysis and the usefulness of repeating the study with the same sample after some years. Future directions for research would benefit from repeating the exercise and the present analysis after the same time interval. In this context, further analytical results would be obtained by focusing on the survey analysis, eventually improved by enlarging the sample size, considering the analysis of policy instruments beyond decoupling and paying closer attention to uncertainty as a key factor influencing the behaviour of economic agents.

This technical report first provides a literature review of key determinants and approaches on farm investment behaviour followed by an illustration of the methodology. The results are then discussed with particular emphasis on their policy implications in the context of the Common Agricultural Policy.

The report includes five annexes: the original questionnaire as used for data collection (Annex A), the model description and specification (Annex B), the detailed survey results (Annex C), the results of the model validation (Annex D) and the detailed modelling results (Annex E).

1. Introduction

Since 2003, the Common Agricultural Policy (CAP) has undergone two reforms: in 2003 farm support was decoupled from production, and the previous direct payments were concentrated in supporting producers' income (Council Regulation (EC) No 1782/2003 of 29 September 2003 establishes the legal framework for the new decoupled scheme). Parallel to the introduction of the Single Payment Scheme (SPS), in order to reinforce the so-called CAP second pillar (i.e. the rural development policy), the modulation mechanism has been introduced. It consists in shifting funding sources from direct payments. Accordingly, direct payments are reduced and recovered funds spent as additional finance for rural development. In January 2009, the Health Check process launched in November 2007 was adopted and a number of reforms were introduced (Council Regulations (EC) No 72/2009; (EC) No 73/2009 and (EC) No 74/2009 of 19 January 2009). The main results of the Health Check are:

- further decoupling of support, with the inclusion of almost all existing coupled direct payments within the SPS;
- more flexibility for assistance to sectors with special problems ('Article 68' measures);
- extending of the simplified Single Area Payment Scheme (SAPS) until 2013 in New Member States instead of being forced into the Single Payment Scheme by 2010;
- shifting of money from direct aid to Rural Development and integration of new challenges (climate change, biodiversity,..);
- investment aid for young farmers under Rural Development increased from €55,000 to €70,000;
- abolition of set-aside;
- simplification of Cross Compliance, by withdrawing standards that are not relevant or linked to farmer responsibility; new requirements will be added to retain the environmental benefits of set-aside and to improve water management;
- abolishment of the energy crop premium;
- phasing out of milk quotas by April 2015.

The objectives of this study are:

- to carry out an analysis of investment behaviour among farming systems clustered by the use of "conventional" and "emerging" (organic) farming systems;
- to assess the impact of the CAP reform process - with special focus on the Single Payment Scheme - on farmers' investment behaviour using a scenario analysis;
- to evaluate the consequences of investment behaviour on the sustainability of farming systems;
- to draw appropriate policy recommendations.

In the following, the literature review is followed by the introduction of the methodology and the presentation of results, which are discussed in a policy context in the concluding section.

The annexes provide the following additional information: the original questionnaire as used for data collection (Annex A), the model description and specification (Annex B) and the detailed survey results (Annex C), the results of the model validation (Annex D) and the detailed modelling results (Annex E).

2. Literature review

2.1 Recent literature related to farm investment behaviour

2.1.1 Overview

A thorough literature review on farm investment behaviour carried out in Gallerani et al. (2008), concludes that there has been a comparatively limited contribution to the analysis of farm investment behaviour in both agricultural economics research and microeconomics. The analysis of investment at the firm level became an important issue in the general economic literature during the 1950s and 1960s, and burgeoned in the agricultural economic literature during the 1990s. Early approaches, based on the neoclassical theory of the firm, were subsequently discussed, improved upon and developed into a number of topics such as: asset fixity and adjustment costs, uncertainty and information, risk and other objectives, household characteristics, on-farm versus off-farm investment, investment and labour allocation, investment and farm structure, investment and technical change, investment and contracts, investment, credit constraints, and inflation.

The main research gaps identified by the authors include the need for: a) more adequate instruments for *ex-ante* analyses; b) model adaptation to incorporate empirical information about farmers' preferences and expectations; c) closer attention to the connection between investment, technical change and learning; and d) a more empirically relevant treatment of the decision maker's (i.e. farm household, firm) objectives.

The most recent literature develops some of the main issues already addressed. Standard budget accounts or Net Present Value (NPV) approaches remain the most common methodologies when investment profitability is the sole or main focus of empirical studies. Both econometric and programming approaches are used, in more research oriented papers, with increasing attention to dynamics. The "Real Options" approach seems to be the most common approach currently being developed, in particular for the evaluation of single investments (rather than whole farm choices) taking into account the option to delay investments, and hence their timing (e.g. Tzouramani, 2008; Zou and Pederson, 2008; McClintock, 2009). This approach follows rather a "Hayekian" view which regards investment as a process of adjusting capital stock, where the optimal amount of investment corresponds to the optimal speed of adjustment to the market equilibrium. A "Keynesian" approach, on the other hand, emphasises the behavioural component of economic agent decisions, focussing rather on the circulation of capital as a result of economic activity and paying less attention to hypothetical optimal capital stock itself.

Uncertainty, contract enforcement, investment characteristics (age structure, reversibility, and asset fixity), credit and financial constraints, and household decision-making are the main theoretical foci of recent literature on farm investment behaviour. The attempt to gain a better understanding of the determinants of farm investment behaviour is common to all studies, and in particular to those adopting an econometric approach to examining agents' behaviour *ex post*. The following sections summarise and discuss the main determinants of investment behaviour in recent literature and microeconomic theory.

2.1.2 Determinants of Farm Investment Behaviour

The main factors determining farm investment behaviour can grouped into: a) technical (investment characteristics, farm characteristics, technical change); b) economic (product markets, factor markets, policy); c) household characteristics and farmers' attitudes (Gallerani et al., 2008). These factors either affect resource availability (labour) or determine the agents' evaluation of the outcomes of investment in terms of expected utility.

Aramyan et al. (2007) adds to the previous studies addressing these determinants, focusing on the adoption of energy-saving technology in Dutch farming. They adopt the perspectives of management and Option Value theories to explain investment decisions, and neoclassical adjustment cost theory to explain levels of investment. Two econometric models (Probit and Cragg's model, also known as the independent Double Hurdle model) are applied to FADN data for the period 1990-1998. Capital stock in energy-saving systems and labour were identified as major determinants in the decision to invest. Price variations, used to test the option value theory, proved to be insignificant. Other determinants were in line with those already well established in the literature, such as the existence of a successor, farm size and farm specialisation.

2.1.3 Uncertainty

Several examples of the inclusion of uncertainty in relation to different evaluation tools can be found in recent literature. For example, Grové et al. (2007) use a stochastic budgeting analysis to evaluate conversion from beef farming to game ranching.

Heikkinen and Pietola (2009) develop an investment model using a Stochastic Dynamic programming approach. Their focus is on the cost of uncertainty as connected to policy change. In the case study provided (a representative Finnish farm) the investment decision is sensitive to risk.

Hüttel et al., (2007) propose a generalised framework taking into account real option concerns (uncertainty, irreversibility and flexibility) and financial constraints, and provide an empirical application through an econometric model applied to panel data from German farms. They find that omitting real option effects may lead to erroneous results with respect to the effects of financial constraints.

Wang and Reardon (2008) explore the effect of social learning on uncertainty when dealing with decisions related to investment in new technologies. Their results are consistent with theoretical expectations, namely that social learning encourages investment, while price volatility has the opposite effect.

Lohano and King (2009) develop a multi-period investment portfolio model including risky farmland, risky and risk-free non-farm assets, and debt financing on farmland with transaction costs and credit constraints. The model represents a stochastic continuous-state dynamic programming problem. The numerical results show that optimal investment decisions in the case of South western Minnesota are dynamic and take into account the future decisions due to uncertainty, partial irreversibility, and the option to wait.

2.1.4 Contract enforcement

Cungu et al. (2008) analyse the effect of contract enforcement on investment, using evidence from Hungary during the transition period. The empirical model used is an augmented liquidity-based model of investment demand. The model is applied to a 1998 survey of Hungarian agricultural enterprises. The study finds that contractual breaches (specifically in the form of delayed payments) have a negative effect on investment, while poor contract enforcement is not perceived as equally important. The study also confirms that the organisational and financial structure of the farms is important for investment; higher levels of liquidity and access to subsidised interest rates have a positive effect on farm investment, while being organised as a cooperative (in opposition to a commercial company) has a negative impact on farm investment.

The opposite causal relationship, i.e. the role of investment in contract enforcement, is further discussed in Guo and Jolly (2008), through an econometric model applied in China. They found that contract enforcement is made easier by the presence of specific investments.

2.1.5 Investment characteristics

Baerenklau and Knapp (2007) use a stochastic-dynamic model of investment and production to account for age structure, reversibility, and uncertainty as determinants of investments by irrigated cotton producers in California, concluding that asset age is more important than both reversibility and uncertainty. Their findings reinforce the need to correctly consider the causes of reversibility/irreversibility, highlighting that the older the assets owned, the more likely new investment will be made, at least for replacement purposes.

Boetel et al. (2007) address the issue of investment/disinvestment asymmetry and the possibility of inaction regarding demand for a quasi-fixed input, adopting an econometric model with a new threshold estimation procedure, applied to the American hog production sector, using quarterly data from 1970 to 2002. A dynamic recursive system is further used in simulations to gain insights into how price changes affect breeding stock, and feed input demand and hog output supply. The paper's findings support the existence of three possibilities (investment, disinvestment and inaction), exploring asset fixity as a key field of research.

Asymmetries in investment decisions are also found by Serra et al. (2008), who assess the impact of decoupled government transfers on the production decisions of a sample of Kansas farms observed from 1996 to 2001, using a threshold regression method. The results suggest that in a dynamic setting, with risk-averse and risk-neutral economic agents, decoupled transfers can have a powerful influence on decisions taken by economic agents, and that the dynamics of the stock of capital causes this influence to grow over time.

2.1.6 Credit and financial constraints

Recent literature corroborates the importance of credit and financial constraints as a determinant of farm investment behaviour. For example, Kirwan (2008) demonstrates their importance through the analysis of the effects of exogenous cash flows on investments in American farms.

Blancard et al. (2006) also investigate the presence of credit constraints using an econometric credit-constrained profit maximization model on a panel of French farmers. The authors find empirical evidence of credit and investment constraints, and characterise unconstrained farms as being larger and better performing. These farmers seem to benefit from a virtuous circle where access to financial markets allows for better productive choices and vice versa.

Jitea (2009) analyses the effects of credit cost on 21 Romanian farms specialised in crop production through a farm-level model optimisation for each year (a mono periodical recursive model), and for the whole period (a multi-periodical recursive model) showing that credit cost affects both the farm performance and its investment behaviour.

2.1.7 Household and farm investment

The connection between household and farm investment is addressed by various papers taking different perspectives. Blank et al. (2009) examine the relationship between agricultural profits and farm household wealth in American agriculture, using a multi-period household model. Results indicate that farmland has out-performed non-farm investments over the past decade and, as a consequence, households have incentives to maintain land ownership to build wealth, even if it requires them to earn off-farm income.

Several interactions between farm and household are identified by Hoveid and Raknerud (2008), using a State-Space model over a panel of farm household accounts in Norway. They find significant effects of farm capital on farm income and wage labour income, of household wealth on farm capital and of household wealth on farm income.

The role of farm succession and household life cycle in connection to investment behaviour is further treated in the literature, e.g. by Taragola et al. (2008). They found that the economic dimension, modernity of durable goods, solvency and investment patterns of the firms in the different stages of the 'family-firm life cycle' show significant differences. Calus and Van Huylenbroeck (2008) demonstrate that the succession effect plays a role from age 45. An early designation of the successor gives an incentive to invest and to improve management.

Miluka et al. (2007) analyses the impact of emigration and related remittances on household farming activities in Albania. The main finding is that emigration contributes to farm de-structuring, with the household having an emigrated member working significantly less and investing less in agriculture.

Olsen and Lund (2009) analyse how socio-economic factors and investment incentives affect farmers' investment behaviour through a survey of Danish pig producers to which logistic regressions are applied. The results indicate that young farmers with high productivity and significant debt are more likely to invest in real agricultural assets, and that socio-economic factors are found to have a significant influence on the investment incentives among farmers.

2.1.8 Inflation

Ariyaratne and Featherstone (2009) determine the effects of government payments, depreciation, and inflation on crop farm machinery and equipment investment behaviour through a Non-linear Generalized Method of Moment (GMM) estimator. The magnitude of the lagged cash flows such as government payments, cash crop income, and grain income were identified as determinants, while no statistical evidence of inflation effects were found.

2.1.9 Methodology (restricted to Operational Research and dynamic microeconomic models)

Martins and Marques (2007) develop a methodology for the economic evaluation of soil tillage technologies in a risky environment, and for capturing the influence of farmer behaviour on technology choice. They present a mathematical programming method whereby the model includes short-term activities that change with the year, and the type of long-term activities, and which includes sets of traction investment activities. The paper is also of direct interest for this research as it provides an example of the use of multi-criteria techniques (MOTAD) with risk aversion and investment choices.

Gardebroek and Oude Lansink (2008) provide a review of micro-econometric dynamic models in agricultural policy analysis, with a focus on different applications, including investment and household modelling. The authors argue that dynamic microeconomic models should be used more in agricultural policy analysis. The reasons for such limited use include the onerous data requirements compared to static models, and the poor explanatory value of dynamic models due to the fact that major inter-temporal decisions (and their results) depend largely on variables that are not dominated by the model (e.g. household objectives), or that are not available to the decision maker at the time of decision making (e.g. future prices).

2.1.10 Dominant typologies of investment and decision issues

Many investment papers remain focused on a specific investment type/issue rather than on methodological issues. The most frequent types of investment in the literature considered are (not in order of relevance): a) tree crops and vineyards (e.g. Jefferson-Moore et al., 2008); b) machinery (e.g. Mooney and Larson, 2009); c) facilities for energy production (e.g. Mallon and Weersink, 2007; Leuer et al., 2008; Zou and Pederson, 2008); d) production rights such as milk quotas (e.g. Hennessy and Shrestha, 2007); and e) dairy farm investments (e.g. Lehtonen, 2008; Rikkonen et al., 2008).

Land markets have also gained renewed attention in recent years, both in connection with economic transition (e.g. Biró, 2007) and CAP reform (Swinnen et al., 2008).

Some emerging issues are to be found in the fields of climate change (e.g. Connor et al., 2007; Kingwell and Farré, 2008) and new technologies, particularly for precision farming (Takács-György, 2008). The latter is strictly connected to innovation adoption and the related literature.

In recent years significant literature has been developed on investment in transition economies. Most frequently, the analysis has been focused on selected investment issues such as credit/financial constraints (e.g. Zinych, 2007; Bojnec and Latruffe, 2007), ownership and farm structure (e.g. Curtiss et al., 2007; Bokusheva et al., 2007).

Bokusheva, Bezlepkina and Lansink (2009) apply an error-correction investment model for analysing investment behaviour of Russian farms during the period of economic stabilisation after 1998, and also an adjustment-cost model to test for differences in the investment behaviour between various farm categories. Additionally to the modelling results, the paper demonstrates that adjustment-cost models are adequate for the evaluation of differences in short-term investment behaviour, but significantly less applicable to differences in the farms' long-term investment behaviour.

A related issue is that of entry-exit decisions by firms which has been addressed by some papers, using concepts similar to those used for investment issues in the strict sense: a recent example is Goncharova and Oskam (2008) who examine the problem of entry-exit for Dutch glasshouse horticulture, using threshold effects and real option concepts.

A relevant issue, which may attract more attention in the future, is the location choice by farms: Richardson et al. (2007) examine the location preference for risk-adverse Dutch dairy farmers immigrating to the United States. They find a high propensity to liquidate farming activities in the Netherlands and to invest in the USA. Willingness to relocate is, in this case, driven by constraints due to milk quotas and environmental regulations.

Hertz (2009) relates non-farm income (primarily earnings and pensions) and agricultural investment in Bulgaria (expenditures on working capital, i.e. variable inputs such as feed, seed, and herbicides) and investment in livestock by estimating the elasticity of the determinants. While the results suggest that increases in the availability of agricultural credit have little effect on farm outcomes, decreases in non-debt-financed sources of liquidity, such as subsidies or transfers, have a stronger effect on the decision to invest.

2.2 Recent literature on the impact of policy and the CAP reforms on investments at the farming system level

In spite of the broad literature dealing with policy evaluation and the CAP reforms, only a few papers deal directly with its effects on investment behaviour. For example, searching "Agecon" (http://ageconsearch.umn.edu/) for "CAP" and "reform" in 2007 and 2008 yields approximately 100 papers presented at international conferences and seminars. Adding the keyword "investment" restricts the results to approximately 10 papers.

Gallerani et al. (2008) constitutes a reference study on this specific issue and, to the knowledge of the authors, is the one which is the most germane to the content of this study. Additional analyses are available in Viaggi et al. (2011a; 2011b). The methodology adopted in this study is based on the integration of primary empirical information collected through a survey of about 250 farm households, with a modelling exercise of the individual farms surveyed. The core model is a multi-criteria dynamic programming model of farm households. Case studies were carried out for France, Germany, Greece, Hungary, Italy, Poland, Spain and the Netherlands.

In the majority of cases, surveyed farmers stated that they were indifferent to decoupling. Where change occurred, the impact of decoupling was highly differentiated. Differences in reaction are better explained by different individual household/farm characteristics, rather than by association with a specific agricultural system. In the more efficient and expansion-oriented farms, decoupling is perceived as an opportunity for investment, while in small, poorer performing farms the introduction of the Single Farm Payment (SFP) is viewed rather as an opportunity for shifting to less input intensive production techniques.

A further analysis of the factors determining an increase in on-farm investment as a reaction to decoupling, based on the same survey, is available in Viaggi et al. (2011b). It shows the relevance of specialisation, the existence of a successor, the farmer's age, labour management, SFP per hectare, location and expectations. In practice such variables are strictly correlated to location.

A scenario analysis demonstrated that the CAP as a whole is very important for the sustainability of farming systems. However, prices (in the range simulated) appeared to be more important than policy, and adaptation of farm activities more important than investment as a reaction to both policy and prices. A critical comparison between survey and modelling results generally confirm the robustness of the exercise, particularly concerning the non-reaction of a majority of farms to decoupling (Viaggi et al., 2011a).

The post-decoupling CAP is evaluated as a policy with few effects on the specific developments of farms, and seems rather to reinforce the strategy already adopted by farm-households, either in terms of expansion or abandonment. This result hints at the fact that a number of broader issues should be addressed in order to better understand aggregate farm household behaviour with respect to policies. In particular, demographic trends, job and land use opportunities and technological options seem to be major drivers of farm household reactions to the CAP.

The remaining literature is grouped into survey-based analyses, econometric analysis on secondary data, and farm and regional level modelling.

Given the scope of the study, large EU-wide models were excluded, focusing on intermediate-farm scale analyses.

Survey based descriptive studies on farm level strategies emphasise the role of investment and technology change, particularly in connection with structural change in some specific sectors, such as in the dairy sector. Rikkonen et al. (2008), run a survey of Finnish dairy farmers in order to identify future challenges for the CAP and conclude that there will be a reduction in the number of dairy farms, but those remaining will be larger in terms of both field area and the number of cows, and will invest heavily in cowhouses and automation of milk production.

Genius et al. (2008) present a survey of farmers' intentions with respect to the 2003 CAP reform in the light of three future price scenarios (-10%, no change, +10%). The survey covers three regions in Greece, the Netherlands and Hungary and applies a sequential discrete choice approach. Future intentions about input use, labour use, business size, investment levels and output diversification are addressed. In Hungary and Greece, about half of the farmers declared that they would use the single farm payment for investment, while this share grows to 75% in the Netherlands. About 60% of Greek farmers state that they would abandon the farming activity if the price were to decrease by 10%. This share is less in Hungary (28%) and in the Netherlands (18%). The choice of abandoning farming is explained by way of an econometric model, using increasing acreage/livestock size or keeping the same mix for the three countries as parameters. In the case of Hungary and Greece, small farms are more likely to abandon, while in the case of the Netherlands the opposite is observed. More specialised farms are more likely to abandon production in Greece and Hungary, while this is less likely to be the case in the Netherlands.

Revoredo-Giha and Leat (2008) present the results of a survey of about 800 Scottish beef and sheep producers undertaken in mid-2006 during which farmers' strategies for production adjustments following the 2003 CAP reform were investigated. The results show that the nature of adjustment was still uncertain at the time of the survey, with a high number (about 50%) of farmers not knowing what strategy to follow, or stating that they will maintain the same production levels despite the reform. However, a significant percentage of farmers indicate their intention to concentrate on the production of high quality output. This strategy is often associated with investment to expand production.

Latruffe et al. (2010) analyse the effects of the introduction of the Single Area Payments (SAP) in Lithuania through the use of an investment model on FADN data and face-to-face interviews with about 220 farmers. The introduction of the SAP had a significant, positive influence on farmers' intentions to expand their farm area compared to a baseline scenario, with this effect being more relevant on farms that were previously credit constrained. This attitude also reveals coupled effects of the decoupled payments.

The use of profit in cooperatives and companies in Slovakia is analysed in Latruffe et al. 2007, through a sample of about 150 farms, showing that, on average, about 50% use profit for investment (59% in private companies and 46% in cooperatives) and about 25% ranked investment as the most probable use of profits.

These results are generally consistent with Gallerani et al. (2008) in evaluating that a large number of farms do not react significantly to decoupling but that decoupled payments can nonetheless play a role in contributing to farm development choices, particularly by way of their interactions with credit constraints. The literature frequently attempts to elicit information about the use of payments, in spite of the variability (and probably some unreliability) of this type of information, due to the fact that payments, as with any other income sources, are not necessarily allocated to a specific item of expenditure.

Among those studies using econometric models applied to secondary data, Sckokai and Moro (2009) apply a dynamic dual model of farm decision-making based on FADN data of Italian arable farms to analyse the impact of the Common Agricultural Policy, and arable crop regimes on farm investment and output, explicitly introducing farmers' risk attitudes. The main finding is that an increase in intervention price would significantly affect farm investment, mainly through reduced price volatility, while an increase of the Single Farm Payment would have much less impact.

Regional scale models, for their part, include different approaches. New examples of Agent-based models (AMB) have been developed following the research stream of Agripolis. For example, Lobianco and Esposti (2008) present the RegMAS (Regional Multi-Agent Simulator) model and use it to evaluate the impact of the Health Check on farm structures, incomes and land use in a hilly area of a Central Italian Region (Marche). The model includes a mixed integer programming approach to allow for the choice of investment goods (including consideration of different dimensional characteristics) by farms. It also includes credit constraints, land exchange and labour allocation. With respect to the impact of the Health Check, their results suggest minor changes in income and a further reduction of farm numbers, with potential land abandonment, particularly in marginal areas.

Lehtonen et al. (2006) use a national model for Finnish agriculture (DREMFIA), including investment, to assess the impact of climate change. The investment rate is connected to the propensity to adopt new technologies, the proportion of each kind of technical capital on the total capital, and the savings rate. The same model is used also by Lehtonen (2008) to assess the impact of phasing out milk quotas in Finland, including structural changes and investment effects.

Bergmann et al. (2008) use the POMMARD model to simulate the impact of policy scenarios with particular attention given to the effects of shifting resources from pillar 1 to pillar 2. The model also includes an "investment" module reflecting the role of investment in regional adaptation to policy changes, and the potential relevance of the model to address the issue of investment on a regional scale. However, the results of this paper are not expressed in terms of investment.

2.3 Conclusion of the literature review

The issue of farm investment behaviour appears to be one of the least developed, and most of the issues addressed by recent literature only provide refinements or confirmation of topics already discussed in previous literature. While the determinants identified tend not to change, the conceptualisation and tools to address some of them, in particular uncertainty, have been refined and further developed. A few recent issues, such as the effects of climate change and energy-related investments, seem to have gained importance.

The literature also shows the difficulty of addressing the issue of investment behaviour explicitly in connection with policy reforms, particularly concerning the Common Agricultural Policy. This may be motivated by the fact that investment choices are long-term issues and the connection between reactions to policy changes are more difficult to evaluate compared with short-term adaptation and due to the fact that the characteristics of investments, such as asset fixity, hold-up, and dependency on capital stock age, may hide other factors guiding the decisions of economic agents.

The reform process under the Health Check umbrella (EC regulations 72, 73 and 74/2009) has resulted in increased demand for studies on investment behaviour. The first investment study (Gallerani et al., 2008), as well as the present study, focus on the effects of decoupling of direct payments, but in addition, several specific reforms introduced from 2005 to 2009 concern sectors likely to have important effects on investment, in particular the dairy sector (phasing out of milk quotas), sugar beet, grapes and wine, and the abolishment of set-aside.

Another important issue in the CAP reform process is the shift of resources to rural development (second pillar). This includes support for investment, which is directly connected to the issues addressed in this study. Second pillar measures also provide payments for Less Favoured Areas, as well as for environmental services and quality of life in rural areas, of which the connection to farm investment is still largely unknown. The trend towards a concentration of resources in the first axis (investment) of the second pillar of the CAP is particularly relevant in Eastern European Member States where the SAPARD measures for 'investment in agricultural holdings' and 'processing' took over 50% of the total resources in every country except the Czech Republic (Ramniceanu and Ackrill, 2007). The importance of investment funding in connection to policy is emphasised in Katona Kovacs (2007), who demonstrates how, this share reaches 55% country-wide in Hungary and is above 65% in the Northern Great Plain (Hungary). The importance of such payments is highlighted by the fact that the average amount of money available for investment measures is above €100.000 per contract. Čechura (2007) analyses the role of the Supporting and Guarantee Agricultural and Forestry Fund (SGAFF) in Czech agriculture through supporting agricultural loans, finding a positive effect and a relevant contribution to investment.

Further issues in this context are connected to the higher dependency on market forces caused by the ongoing liberalisation process and decoupling, and the increasing role of technological change, innovation and entrepreneurship; and finally ongoing structural changes in the farming sector.

The evolution of the differing role of policy and market (or other) drivers deserves particular attention. Future policy scenarios still appear uncertain, but remain largely connected to the issue of the level of (decoupled) payments, at least in the first pillar (European Commission, 2009; 2010), while the future of markets appears more uncertain due to the unknown pace of general economic recovery, the effects of the financial crisis, increasing food and energy demand and the cost of resources. The effects of market and general economy trends on investment behaviour are still little studied in the literature, and are beyond the aim of this study. The importance attached to such issues suggests that policy analysis (scenario and model development) will need to take them into account more prominently than in the past.

3. Methodology

3.1 Motivations, overview and connection with the literature

Based on the literature review, the best approach for this study proved to be the further development of the previous IPTS project on investment behaviour (Gallerani et al., 2008), replicating the study at a three year distance, and maintaining a combined approach based on survey data and modelling.

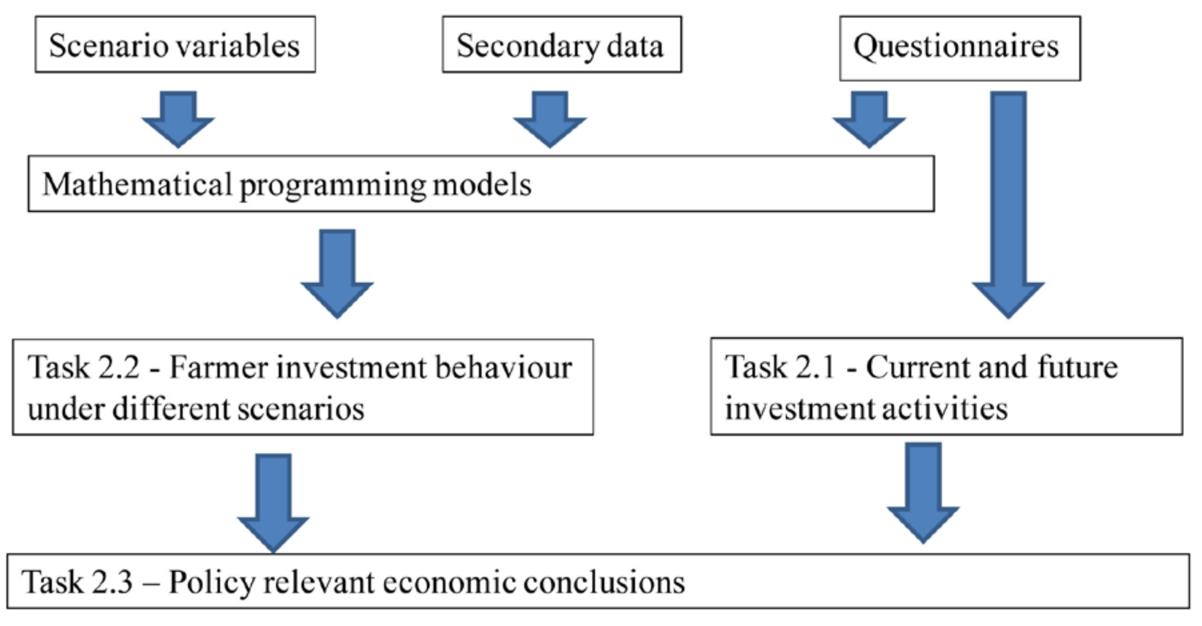
The main motivations are the following: a) the integration of *ex post* and *ex ante* information proved fruitful; b) the methodology used in the 2006 study produced a satisfactory amount of empirical information; c) the previous study was carried out at a time in which the effects of decoupling could not have been fully appreciated due to the recent reforms; d) the changes in market conditions could have significantly affected the actual reactions compared to what was expected in 2006; e) given the lack of attention to the issue in the existing literature, the possibility of repeating such an evaluation after three years proved to be an unique opportunity.

Taking into account this methodological strategy, however, some modifications and improvements have been introduced, compared with Gallerani et al. (2008). These will be illustrated in the following sections and concern: a) the treatment of information concerning stated farm attitudes and investment behaviour; and b) scenarios and model features.

The general features of the methodology are examined in this section, followed by the discussion of the specific tools adopted in the following sections. Following Gallerani et al. (2008), the proposed methodology is based on the integration of an *ex post* empirical analysis of farm investment behaviour and a prospect analysis of reactions to future scenarios.

The methodological flow is described in Figure 1.

Figure 1: General methodology flow



The project relies on detailed empirical information collected through a survey of farm-households intended both to provide direct information on present investment behaviour (task 2.1), and to feed mathematical models used to simulate the effects of different scenarios on farm investment behaviour (task 2.2). The outcome of these two components are then merged to derive policy conclusions.

The details of the methodology are discussed below according to the following main components:

- case study areas and comparability;
- questionnaire;
- statistical analysis of past and stated investment behaviour, based on descriptive statistics comparison and panel data analysis;
- scenario analysis;
- modelling investment behaviour, using a farm-household dynamic model.

The methodology adopted tends to incorporate those components most frequently used in the literature and most likely to contribute to the empirical strength of the work. This includes the use of in-depth interviews about past and stated behaviour, as well as attaching the modelling exercise to the individual characteristics of a selection of the farms interviewed. The combined use of stated intentions and modelling provides a more robust understanding of future behaviour compared to analysing the two components separately as is the case in most of the literature. This is further strengthened by the simultaneous observation of past behaviour, at two points in time, and stated future behaviour. This can only be achieved at the expense of the number of individual farm-households interviewed and model sophistication, as some relevant issues from the literature are excluded, such as uncertainty and risk. For this reason, while the overall design is aimed at providing a robust understanding of the issues addressed in the study, the results of some individual components (e.g. individual model reactions to specific scenarios) should be analysed with care, bearing in mind the above limitations.

3.2 Case study areas, sample selection and comparability

The primary objective of the sample structure of this study is to provide comparability and combined use with the information collected during the previous project study (Gallerani et al., 2008). Accordingly, a new sampling was not required, and the interviews were repeated with the same farm-households as in 2006. In the cases in which this was not possible, i.e. Germany (due to the fact that the original addresses could not be recovered) and Bulgaria (which was not covered in the previous study), new farms were selected using the same method as in 2006 [1].

The case studies are summarised in Table 1 while Table 2 provides a summary of CAP reform implementation in the selected case study areas.

Germany, Italy and Poland were the main target regions of the study. Germany and Italy were the largest countries implementing the SFP since 2005, the first year in which member states were obliged to implement the new system. Furthermore, Germany and Italy have different decoupling mechanisms in place (respectively hybrid and historical models). Poland provides the example of a country in Eastern Europe with an important agricultural sector and a different policy setting, characterised by increasing area payments through the SAPS scheme. SAPS, however, are area-based payments that can be thought of as comparable to the SFP system to some extent, which allows for a comparison across the case study countries. The case studies in the other countries were selected in order to ensure complementarity:

1 Compared to the tender, the Hungarian case study has been removed and a larger number of interviews have been carried out in the additional Bulgarian case study

Table 1: Case study areas

Country	NUTS 1	NUTS 2	NUTS 3	Area
Bulgaria		South East Planning Region		
France		Centre	Eure-et-Loir	"Beauce Chartraine"
Germany	Schleswig-Holstein, Niedersachsen, Nordrhein-Westfalen, Rheinland-Pfalz, Hessen, Baden-Württemberg, Bayern			
Greece		Central Macedonia	Pieria, Kilkis, Thessaloniki	
Italy		Emilia-Romagna	Bologna, Modena, Ferrara, Ravenna	
Netherlands		Gelderland		Mainly Gelderse Vallei
Poland		Mazowieckie, Swietokrzyskie, Malopolskie, Kujawsko-pomorskie, Pomorskie		
Spain		Andalusia		Cordoba, Seville

- Spain and Greece complement the results from Italy with purely Mediterranean areas;
- Bulgaria complements Poland with case studies from an additional new Member State;
- The Netherlands complements other case studies as a typical *north-western* EU country;
- France represents an important share of agriculture in the EU 15; furthermore it is a benchmark country for the SFP implementation, as it applied partial decoupling.

The Bulgarian case study is located in the south east of the country, and is characterised by a mixed farming system, including grapes, fruit, corn, and cattle breeding.

The French case study is located approximately 100 km south-west of Paris, around Chartres in the northern area of the Beauce region ("Beauce Chartraine"). The Beauce area is known as the "grain loft" of France. The flat geography, good soil and climate conditions make the area ideal for cereals and oil-protein seeds. In general, the farms are large in size (larger than the French average), and employ intensive production methods.

The data survey in Germany was spread over 7 Bundesländer. Crop and livestock farms in plains were predominantly located in Schleswig-Holstein, Niedersachsen and Nordrhein-Westfalen, while those in mountainous areas were located in Bayern, Baden-Württemberg, Hessen and Rheinland-Pfalz. The latter two were also the regions where vineyard farms were surveyed. In the sample selection, specific attention was given, on an equal basis, to conventional and emerging farms in all types of farm specialisations and locations.

As for the Greek case study, Pieria, Kilkis and Thessaloniki prefectures are located in northern Greece in the Region of Central Macedonia. The economy of these prefectures is based primarily on agriculture. The most important crops are: wheat, maize, alfalfa, vegetables and industrial crops. The agricultural holdings are characterised by multi-functionality and small farm size.

The case study area for Italy is in the central-eastern part of Emilia-Romagna, including the provinces of Bologna, Modena, Ferrara and Ravenna. This area includes a mix of hills-mountains and plain areas. The plain areas are characterised by a very strong arable crop cultivation, as well as fruit and vegetable

Table 2: Implementation of the CAP and CAP reform in case study areas

Country	Start SPS	Model	Sectors remaining coupled	Second wave of CAP
Bulgaria		SAPS	F&V: Transitional soft fruit payments 100% The farmers who are eligible for benefits under the scheme for additional payments for domestic animals are those who in unrelated schemes: • for cattle (cows, male cattle (steers and bulls) and calves - (NDZH1): have raised at least 5 cattle in their farms to 28.02.2009g.; • ewe and / or goat (NDZH2): have grown at least 20 ewes and / or 20 on a goat farm to 15.10.2008 • in coupled scheme (NDZH3): have kept in their holding at least 20 ewes and / or 20 goats	
France	2006	SPS historical	- arable crops 25% - sheep and goat premium 50% - suckler cow premium 100% - slaughter premium calves 100% - slaughter premium bovine adults 40% - seeds (some species) 100% - outermost regions 100% Olive oil sector: 10% deduction for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003). Hops payments 25% Annex VII point H and I: - olive oil coefficient for decoupling: 1 - tobacco coefficient for decoupling: 0.4 F&V: Until end 2011: 50% for tomatoes intended for processing Until end 2010: 98% of national envelope for orchards producing prunes, peaches, and pears intended for processing From 2011 until end 2012: 75% of national envelope for orchards producing prunes, peaches, and pears intended for processing	From 2010 onwards: - suckler cow premium: 50€ coupled per unitary premium - slaughter premium: 100% decoupled - sheep and goat premium: 100% decoupled - cereals: 100% decoupled - oilseeds: 100% decoupled from 2012 - within article 68, creation of 8 measures, among which: - new sheep premium (100% coupled) - new goat premium (100% coupled) - maintenance of organic farming

Germany	2005	SPS dynamic hybrid moving to a flat rate model	- hop payments 25% coupled - tobacco coefficient for decoupling: 0.4	- hops payments 25% coupled - tobacco coefficient for decoupling: 0.4
Greece	2006	SPS historical	- seeds - Article 69 application: = 10% of the ceiling for arable crops = 10% of the ceiling for the beef sector = 5% of the ceiling for the sheep and goat sector F&V: Until end 2010: 30% of the envelope for tomatoes intended for processing Until end 2012: 60% of the envelope for citrus fruits intended for processing	- Article 69 application: = 2% of the ceiling for tobacco = 4% of the ceiling for olive oil =10% of the ceiling for sugar - 2% deduction in the olive oil sector for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003) Annex VII point H and I: - tobacco and olive oil coefficient for decoupling: 1
Italy	2005	SPS historical	- seeds 100% - Article 69 for quality production = 8% of the ceiling for the arable sector = 7% of the ceiling for the bovine sector = 5% of the ceiling for the sheep and goat sector F&V: Until end 2010: 50% for tomatoes intended for processing Until end 2010: 100% for pears, peaches and prunes intended for processing. From 2011 until end 2012: 75% of envelope for prunes	- Article 69 application: = 8% of the ceiling for sugar - 5% deduction in the olive oil sector for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003) Annex VII point H and I: - olive oil coefficient for decoupling is increased to 1 - tobacco coefficient for decoupling: 0.4 - for the region Puglia, the decoupling coefficient for tobacco is 100%
Netherlands	2006	SPS historical		- slaughter premium calves 100% - slaughter premium bovine adults 100% - seeds for fibre flax 100%
Poland		SAPS	F&V: Separate F&V payment for tomatoes, peaches and pears 100% Transitional soft fruit payment 100%	- separate sugar payments
Spain	2006	SPS historical	- seeds 100% - arable crops 25% - sheep and goat premiums 50% - suckler cow premium 100% - slaughter premium calves 100% - slaughter premium bovine adults 40% - Article 69 application: = 7% of the ceiling for the bovine sector = 10% of the ceiling for dairy payments - outermost regions 100% F&V: Until end 2010: 50% of the envelope for tomatoes intended for processing Until end 2009: 100% for citrus fruits intended for processing	- tobacco coefficient for decoupling: 0.4 - olive oil coefficient for decoupling: 0.936 - Article 69 application: = 5% of the ceiling for the tobacco sector = 10% of the ceiling for the cotton sector = 10% of the ceiling for sugar

Abbreviations: **SPS** *Single Payment Scheme,* **SAPS** *Single Area Payment Scheme,* **F&V** *Fruit and Vegetables.*

Source: European Commission, 2008.

production and livestock (mainly dairy for milk production). The hill-mountain area includes a variety of extensive livestock, grape, fruit and some cereal production.

The Polish survey includes various areas in the north, centre and southern part of the country. Among the regions considered, Mazowieckie is particularly diversified, but includes a large concentration of apple farms and Malopolskie is dominated by animal production.

The Spanish case study is located in the area of Cordoba and Seville and addresses a very specialised olive growing sector, although the farms surveyed also have some citrus growing.

The Netherlands case study concerns mainly the Gelderse Vallei area and includes a very focused set of farms specialised in dairy production.

The proposed approach is based on the in-depth analysis of a limited number of case study areas and households. Due to this approach, statistical representativeness could not be achieved and the conclusions rely rather on qualitative inference instruments. This is even more pronounced in the case of individual specialisations, for which the sample selected cannot be considered as representative of a whole sector in the country, or even in the region. However, by applying the following criteria, derived from the 2006 study (Gallerani et al., 2008), the study made the effort to achieve a certain degree of representativeness:

- in each case study area attention was focused on those systems that were most relevant in terms of their contribution to the agricultural sector of the selected area, through the following criteria: land allocation, number of farms and the value of production;
- within each case study, farms with the "most frequent" characteristics are selected in order to capture the main issues in the behaviour of the sector. The choice was based on expert judgement given the small number of farms selected. The character of the "representative" farm was attributed through consideration of the following variables: size (land area, herd size), technology, household composition, and age of household head. These variables were chosen based on the literature review, in which they emerge as the most frequently significant determinants of investment behaviour;
- the number and distribution of interviews is intended to cover the main systems targeted by the study. Those with too low share of the farm population were not considered relevant for inclusion in the sample.

Comparability amongst the cases is assured by using the same criteria for farm type definition and for farm selection in each country.

Comparability of scenarios is achieved by the definition of a unique set of scenarios at EU level (identification and storyline) that is common to all case studies. These general scenarios are adapted to each area by modifying only location-specific parameters, while taking into account global trends (e.g. labour costs are different from area to area; but each scenario may affect the cost in the same direction).

Differences in models relate only to the parameterisation, which is to a large extent based on primary data collected in the survey. Similarly, the output can be compared through the definition of a common set of indicators and related calculation procedure (which is incorporated in the model).

Finally, comparability with the previous study on investment behaviour (Gallerani et al., 2008) is possible through the use of the same case study areas and farming systems, the same questionnaire (with small additions) and partially comparable models. Even if the modelling approaches are partially the same, they still differ with respect to:

- their starting conditions (farms are modelled based on their assets and perspectives in 2009, rather than 2006), and their scenarios (even in the baseline);
- the solution algorithm, as some results of the 2006 models come from a recursive approach, which is not used in the present study.

For the above reasons, the model results are not directly comparable between the two studies. Yet, for a selection of individual models, namely those in which the same farms and approach have been used, a comparison of the results could be useful to identify changes in perspective developments given the new conditions and the new (2009) expectations about policies and markets.

3.3 The questionnaire

Face-to-face interviews have been conducted using a common questionnaire. The interviews lasted from 1 to 3 hours and were conducted by experts in the field in order to obtain the highest possible understanding of household reaction to the CAP reforms.

The structure of the questionnaire is the following:

1. location and contact details;
2. farm structure;
3. household structure and labour management;
4. farm activities and production;
5. farm organisation, constraints and connections;
6. policy and decoupling;
7. farm household assets and past investments/disinvestments;
8. vision of the future & expectations;
9. household status and objectives;
10. foreseen farm-household and farm developments.

Section 6 is devoted to collecting information about the household's reaction to decoupling. It includes the collection of the following data:

a) Single Farm Payment received;
b) use of money from the Single Farm Payment;
c) other payments received (e.g. axis 1 Rural Development Programs, RDP);
d) use of money from other payments received;
e) which were, or were expected to be, the changes in the farm/household as a reaction to the introduction of the Single Farm Payment.

The content of the questionnaire is essentially the same as in 2006. Some additions have been made in agreement with the Steering Committee of the study, including questions concerning:

a) the reason for abandonment of agriculture (if any) and the destination of land in such cases;
b) the role of RDP subsidies in investment;
c) the effects of the financial crisis;
d) the demand for policy changes.

The full questionnaire is included in Annex A of this report.

3.4 Statistical analysis of past and stated investment behaviour

The statistical analysis has been applied in two steps:

- first, we provide a descriptive analysis of the outcome of the survey for the most relevant components of the questionnaire;
- second, a panel model was used to understand the determinants of farmer investment behaviour.

In the results section, we use data from all 256 farms for the description of the 2009 results, and data from the 178 farm-households present in both survey years for comparison and analysis of the change in answers (see sample description).

Since the other components of the methodology are commonly accepted procedures, the focus will be on the description of the panel approach.

The panel analysis has been carried out only on the data from the farms interviewed in both periods (178 observations). One of the most prominent features of panel analysis compared to cross-sectional analysis is the possibility to control for individual unobserved heterogeneity improving the accuracy of the estimated effects of the explanatory variables. In the present analysis where t=1,2 and i= 1,2,...178, the following random effect model (RE) (Greene, 2003) is applied:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + ... + v_i + \varepsilon_{it}$$

In a regression with a constant term, the RE model assumes that the intercept is a random outcome variable, the random error v_i (i.e. random effects) is constant over time and the random error ε_{it} is specific to the individual effects. The random effects model has the advantage of allowing for time-invariant variables to be included amongst the regressors, and all the estimators for β are consistent with the assumption that $Cov(x_{it}, v_i) = 0$.

We used a random effect model in order to consider the variability for the two periods. In this model the random component is included in the constant term β_0. It is considered as purely random and unrelated to the covariate.

Additionally, the regressors are obtained as exogenous and consistent estimate for the beta coefficients. To test the importance of the panel level variance, the correlation coefficient rho is calculated and tested: when zero, the panel-level variance component is unimportant; on the contrary when rho is significantly different from zero, it means that the panel level variance is relevant and the use of a random effect model is justified.

We construct four RE models with dependent variables considering different typologies of investment:

- for land: a logit model to investigate the decision to invest (yes/no), and a linear regression model to analyse as dependent variable the land area (hectares) intended to be purchased;
- for buildings: a logit model to investigate the decision to invest (yes/no);
- for machinery a logit model to investigate the decision to invest (yes/no).

3.5 In all cases the dependent variable is limited to the decision to invest, while disinvestment is not considered. Scenario analysis

Scenario analysis is a widespread approach to simulate policies in uncertain futures. Approaches to scenario analysis may vary from qualitative descriptions of consistent futures, to more quantitative analyses, based on mathematical models or logical algorithms. Expert opinions can be used in different stages of the methodology.

In this project, we focus on a limited number of scenarios which are used to analyse impacts on farm behaviour under different macro-economic, agricultural price and agricultural policy settings.

Scenario definition follows the following steps:

1. scenario identification;
2. scenario description through short storylines;
3. scenario characterisation through quantitative variables.

The identification of scenarios was carried out in coordination with DG AGRI, building upon three main sources: a) the scenarios identified in the Scenar 2020 II study; b) the scenarios identified

Table 3: Scenario development

Group	Number	2006 study	2009 study	Link with scenar2020 II
Group 1	1.1 (-30+RSP) **Reference**	-	Health Check CAP until 2013 + 30% decrease in (fully decoupled) payments after 2013 + reference prices (Scenar 2020 II)	Same policy and prices as Reference scenario in Scenar 2020 II
	1.2 (GR+LSP)	-	Health Check CAP until 2013 + gradual reduction of (fully decoupled) payments after 2013 (to zero in 2020) + liberalisation prices (Scenar 2020 II)	Same policy and prices as liberalisation scenario in Scenar 2020 II
Group 2	2.1 (-30+LP)	-	Health Check CAP until 2013 + 30% decrease in (fully decoupled) payments after 2013 + lower prices	Same policy as reference scenario in Scenar 2020 II
	2.2 (GR+LP)	2003 reforms until 2013 + gradual reduction of payments after 2013 (to zero in 2020) + lower prices	Health Check CAP until 2013 + gradual reduction of (fully decoupled) payments after 2013 (to zero in 2020) + lower prices	Same policy as liberalisation scenario in Scenar 2020 II
Group 3	3.1 (-100+CP)	2003 reforms until 2013 + no payment after 2013 + current prices	Health Check CAP until 2013 + no payment after 2013 + current prices	
	3.2 (-15+LP)		Health Check CAP until 2013 + 15% decrease in flat-rate payments at national level after 2013 + lower prices	Same policy as conservative CAP in Scenar 2020 II
Group 4	4.1 (HC+LP)	2003 reforms + lower prices (-20%)	Health Check CAP + lower prices (-20%)	
	4.2 (HC+CP) **Validation**	2003 reforms + current prices	Health Check CAP + current prices	

-15, -30-100 = percent decrease of SFP; RSP= Reference Scenario Prices (i.e. prices from the Reference Scenario in the Scenar2020 II study; GR= Gradual Reduction; LSP=Liberalisation Scenario Prices (i.e. prices from the Liberalisation Scenario in the Scenar2020 II study); LP=Lower prices; CP=Current prices; HC= Health Check.

in the previous investment study (Gallerani et al., 2008), and; c) the further CAP policy perspectives at the time of designing the study.

The Scenar 2020 II study aims to replicate the previous Scenar 2020 study (European Commission, 2006). Among other issues, EU markets and structural trends in rural areas were simulated based on three main scenarios: Reference scenario, Liberalisation Scenario and Conservative CAP scenario. Results from this study are available in Nowicki et al. (2009). The information used from the scenarios developed in this study was provided by the EU Commission.

The scenario framework and connection with the other scenario exercises is described in Table 3

The scenarios are differentiated based on two main variables: product prices and SFP payments. Against these parameters, all others (production costs, salaries, interest rates, etc.) are held constant across scenarios. The specification "current prices" intends to refer to the prices (input and output prices) at the time of the study (beginning 2009).

Based on the scenario variables, four main groups of scenarios are identified:

Scenarios 1.1 and 1.2 are the central scenarios of the study, in which the set of prices follows the ESIM model and is the same used for the Scenar 2020 II study. The two sets of prices used in 1.1 and 1.2 reflect the results of the Reference and of the Liberalisation scenarios in Scenar 2020 II respectively. They can be considered as the most important drivers at the farm-household level emerging from the Scenar 2020 II scenarios. Scenario 1.1 (-30+RSP) provides a combination of reduced payments after 2013 and lower prices for agricultural commodities. Scenario 1.2 (GR+RSP) assumes both lower agricultural commodity prices, and a gradual reduction in payments expected to reach zero in 2020. The conditions of the Scenar 2020 II reference scenario are used as the baseline conditions in our study (scenario 1.1, -30+LSP).

The following scenarios reflect the attempt to carry out a scenario/sensitivity analysis on a more simplified set of variables, in order to interpret the mechanisms of reaction to policy and market change.

Scenarios 2.1 and 2.2 result in the same policy assumptions as scenarios 1.1 and 1.2, respectively, but the price assumptions are substituted by a flat hypothesis of lower prices (minus 20%) compared to 2009 prices. These scenarios can be used to compare the complex price hypothesis simulation through ESIM with a 20% reduction in prices, the other (policy) conditions being the same. Scenario 2.1. (Health Check CAP until 2013 + 30% decrease in (fully decoupled) payments after 2013 + lower output prices) includes the same policy assumptions as the reference scenario in the Scenar 2020 II study, and our 1.1 (-30+RSP) scenario. Scenario 2.2 (Health Check CAP until 2013 + gradual reduction of (fully decoupled) payments after 2013 (to zero in 2020) + lower output prices) corresponds to the Liberalisation scenario in Scenar 2020 II and our 1.2 (GR+RSP) scenario.

Scenarios in group 3 simulate additional combinations of payment reductions and prices. In particular, Scenario 3.1 (Health Check CAP until 2013 + no payment after 2013 + current prices) simulates a radical change in payments (total abolition) after 2013, while maintaining current prices. Scenario 3.2 (Health Check CAP until 2013 + 15% decrease in (fully decoupled) payments after 2013 + lower output prices) tests a (minor) change in payments. It corresponds to the policy hypotheses of Scenario "Conservative CAP" of the Scenar 2020 II study[2]. Scenarios 3.1 and 3.2. test how prices and payments compensate each other, by checking the effect of a small change in prices under a total removal

2 This scenario is not simulated in detail, as the related price sets were not available.

of the CAP payment (3.1) and a small change in payment under lower prices (3.2).

The remaining two scenarios assume the 2009 policy conditions (Health Check), associated with opposite price hypotheses. Scenario 4.2 (Health Check+current prices) describes the policy as implemented in 2009 and projects it up until 2020 (2030 for computation purposes, see next section). The framework assumed in this case corresponds to scenario 2.1 (2003 reforms+current prices) of the 2006 study. It is used as a reference for validation, as it was the closest to the expectation stated by the farmers. Scenario 4.1. (Health Check+lower prices) describes the same conditions as scenario 4.2 but assumes that output prices are lowered by 20% across the whole simulation period, in analogy with some of the previous scenarios. Scenarios 4.1 and 4.2 reveal the difference with the present (2009) policy setting, considered either under 2009 prices and with a price reduction by 20%.

In all of the scenarios, yields have been considered as constant, and no technical progress related to input saving technologies has been assumed.

3.6 Modelling investment behaviour

3.6.1 Motivations and background literature

Following Gallerani et al. (2008), we use a dynamic household model to simulate the reaction of a sample of individual farm households to prices and policy changes in the medium-long term. The choice of this approach in the previous study was based on the following considerations: a) the choice of a normative model is due to the difficulty of collecting *ex post* data related to very recent reforms, the need to represent innovative policy mechanisms and also due to the possibility of more easily simulating alternative scenarios; b) the dynamic approach is a straightforward requirement to deal with investment and is widely adopted in the literature on this issue (a recent comprehensive theoretical framework on investment in agriculture using this approach is provided by Gardebroek and Oude Lansik (2004)); c) finally, the choice of a household model was justified by the need to regard investment choices as embedded in the overall objectives of the "social" decision making unit (the household).

One of the challenges of this approach is to provide a satisfactory representation of households' objective functions, usually characterised by at least a mix of consumption and leisure objectives, most often also taking into account risk aversion. To represent multiple objectives, one solution presented in the literature is multi-criteria analysis. In spite of the broad literature applying multi-criteria models, relatively few papers use multi-criteria analysis in combination with multi-period planning. Two of the existing cases are Wallace and Moss (2002), who develop a multi-criteria model applied to strategic decisions from the perspective of the farm household, and Gallerani et al. (2008), who also use multi-criteria programming as an alternative to pure NPV maximisation. In particular, the latter study uses two modelling options: a) a NPV-maximising, consumption constrained model; and b) a multi-objective recursive model.

Compared to Gallerani et al. (2008), the first option, i.e. a net present value (NPV) maximising model, is preferred in this study. It includes constraints ensuring that a certain minimum household consumption level is reached in any given year, while maximising total income over the planning horizon based on NPV.

The main motivation for the choice to limit the multi-criteria component of the model is to simplify the computational burden of the analysis, by maintaining the main information contents of the model.

One problem with the representation of investment is that real investment behaviour implies discontinuities due to the indivisibility of capital goods. One approach to address this constraint is offered through dynamic integer programming, e.g. as adopted by Asseldonk et al. (1999), who provide a programming approach to farm technology adoption, including technology change. Since this approach can be easily extended to investment behaviour, it is applied to the present study though excluding technological change.

The model used is deterministic, and unsuitable to include uncertainty and risk, which are in fact major components of investment behaviour. This choice was justified by the need to consider longer term scenario descriptors, rather than short-term fluctuations, and due to the lack of empirical evidence concerning price volatility in future scenarios.

3.6.2 The model

Summarising the above considerations, a household-level dynamic programming model is developed, the general formulation of which can be represented as follows:

$$Z = F\left[z_1(x_t), z_2(x_t), \ldots z_q(x_t) \ldots, z_Q(x_t)\right] \qquad (1)$$

s.t.

$$x \in X \qquad (2)$$

$$x \geq 0 \qquad (3)$$

where:

Z = objective function;

z_q = value of attribute/objective q, q=1, 2, …, Q;

X = feasible set;

x_t = vector of decision variables.

The objective function represents household utility. The farm household is expected to take decisions based on an objective function defined as a combination of multiple criteria, each defined as a function of a set of decision variables. Decision variables change their value over time, and the utility function consequently assumes some aggregation over time and related time preference. The maximisation is subject to constraints on decision variables, represented by the feasible set and by non-negativity constraints. The empirical specification of the model follows the NPV maximising version used by Gallerani et. al. (2008).

In this model, equation (1) is substituted by:

$$\text{Max } Z = \sum_t \delta F_t(x_t) \qquad (4)$$

$$\text{s.t. } C_t \leq C^* \qquad (5)$$

where δ is a discounting factor, $F_t(x_t)$ is the net cash flow expressed as a function of the activities carried out in time period *t*, C_t is the annual consumption and C^* is the minimum yearly consumption acceptable by the household. Consumption is constant and expressed in the monetary terms of the initial period (2009). Equation 4 is connected to (5) and both are connected to the investment behaviour through $x_t = f(I_{t'})$ and $I_{t'} = g(C_{t'})$, with *F* and *f* being an increasing function (i.e. increased investments *I* generate the possibility to carry out a larger set/amount of activities, which in turn allows a higher cash flow), and *g* being a decreasing function (i.e. investment is negatively correlated to consumption through the identity of savings). *t'* represents any time $t' < t$.

The model output is given in the form of several output (sustainability) indicators. Selected according to Gallerani et al. (2008); they include the following:

a) Economic:
- farming income;
- total household income;
- net investment.

b) Social:
- farm labour use.

c) Environmental:
- nitrogen use on land;
- water use.

The model and the calculation of the individual indicators is better illustrated in Annex B.

3.6.3 Model parametrisation, calibration and validation

Parametrisation is performed separately for each farm-household (one model per farm-household). The parametrisation process was carried out mainly using data from the survey. Existing secondary data were considered where available and required. In cases in which the models were already available from the 2006 study, this stage was limited to verifying and updating the prices, asset composition and age, and activity set.

The calibration process is performed by including decision rules/constraints in the model which are derived from the questionnaire, particularly with respect to:

- allowable activities (derived from past, present and possible future activities as stated by the farmers);
- land and labour availability (by type/ quality, if required);
- rotations and interconnections between activities (e.g. forage and livestock);
- contracts;
- liquidity and credit.

Some difficulties arose due to the specific economic contingencies of the time frame in which the study was carried out. In particular, due to the high volatility of prices and costs in recent years (2007-2008), the most recent (2008 or beginning 2009) prices proved to be unsuitable as an assumption for a 21-year period. In addition, due to the on-going financial crisis, recent interest rates were considered to be too low to be adopted for the whole period, and very likely to be a strong under-estimation of longer term interest rates. The following assumptions helped overcome these shortcomings:

- prices of agricultural products in 2009 were kept the same as in 2006; for the future, they have been either kept constant, reduced by 20% or determined year by year based on Scenar2020 II simulations, depending on the scenario;
- production costs and labour costs have been updated using the Eurostat index for the cost of agricultural inputs (applying the average annual increase 1998-2006 to the three years 2006-2009) and labour at the country level (based on the most recent labour price indicators);
- interest rates have been set based on the average interest rates from Eurostat for the decade 1999-2008.

These choices are mainly motivated by the need to adopt long-term parameters, as prices, costs and interest rates are assumed to be constant for a period of 21 years. These assumptions tend to narrow profitability compared to the 2006 study, and likely the 2009 reality, as production costs have increased significantly, according to cost trends, while prices are held constant. On the other hand, interest rates for the period 1999-2008 are higher than those of 2009, which have decreased during the ongoing financial crisis.

All prices are intended as real prices (no inflation is accounted for in the prices and discount rates are deflated).

The results of models are given separately for the two periods, 2009-2013 and 2014-2020, as most of the scenarios simulated provide a policy break (change in payments) after 2013. Within each period, results are given as an average of the period. Results from simulations are first reported by individual farms, in order to allow for a better understanding of the underlying specificities affecting the results (annex E) and then aggregated by system (see results chapter).

The validation of the model is performed through:

1. comparing the model's output (activity set and investment) with the real behaviour of the farmers in the base year;

2. comparing the model's output (activity set and investment) with the intentions stated by the farmers for the next 5 years under the actual conditions.

The first comparison reflects the common approach to model validation as proposed in the literature (Howitt, 2005). The second comparison is used given that information about activity, and investment intended behaviour for the coming years was available from the survey. This includes, in particular, verification of:

- the feasibility of the stated investment and activity plan;
- the difference between the stated investment and activity plan on one side, and the planned investment and activity plan generated by the model on the other.

The sensitivity analyses of the models were carried out during the calibration stage in order to verify the stability of the key variables, and in particular those derived from the economic context such as labour costs and interest rates (specific sensitivity analyses are not reported since the large number of scenarios already provides a good understanding of model sensitivity). Details of model validation can be found in Annex D.

4. Sample description

4.1 Surveyed farms

In the 2009 survey the sampling was targeted to collect data from the same farm-households as in 2006, and to obtain a direct comparison of the characteristics and answers. The sample was consequently built by contacting the same farms after 3 years and enquiring into their availability for a new interview. Approximately 71% of the sample was obtained in this way. To complete the sample, new farm-households were chosen in order to maintain the same coverage of farming systems as given by those that could not be interviewed again.

Table 4: Sample structure in 2009

Technology	Area	Specialisation	BG	DE	ES	FR	GR	IT	NL	PL	Total
Conventional	Mountain	Arable	3	7	0	0	1	4	0	0	15
		Livestock	5	5	0	0	0	3	0	11	24
		Permanent	0	6	2	0	0	10	0	6	24
	Plain	Arable	5	5	1	6	6	14	0	5	42
		Livestock	7	5	0	0	0	6	5	17	40
		Permanent	0	3	14	0	0	11	0	8	36
Emerging	Mountain	Arable	0	6	0	0	3	8	0	0	17
		Livestock	0	4	0	0	0	6	0	5	15
		Permanent	0	2	0	0	0	2	0	2	6
	Plain	Arable	0	3	0	0	2	7	0	1	13
		Livestock	0	4	0	0	0	3	7	4	18
		Permanent	0	0	0	0	0	6	0	0	6
Total			**20**	**50**	**17**	**6**	**12**	**80**	**12**	**59**	**256**

Table 5: Farms interviewed in both 2006 and 2009

Technology	Area	Specialisation	BG	DE	ES	FR	GR	IT	NL	PL	Total
Conventional	Mountain	Arable			0	0	1	4	0	0	5
		Livestock			0	0	0	3	0	11	14
		Permanent			2	0	0	10	0	6	18
	Plain	Arable			1	6	6	14	0	5	32
		Livestock			0	0	0	5	5	17	27
		Permanent			14	0	0	11	0	8	33
Emerging	Mountain	Arable			0	0	3	6	0	0	9
		Livestock			0	0	0	6	0	5	11
		Permanent			0	0	0	2	0	2	4
	Plain	Arable			0	0	2	7	0	1	10
		Livestock			0	0	0	3	6	4	13
		Permanent			0	0	0	6	0	0	6
Total			**0**	**0**	**17**	**6**	**12**	**77**	**11**	**59**	**182**

Table 4 reports the sample structure used in 2009, while Table 5 reports the number of farms repeated in 2006 and 2009 by system and country.

As in 2006, the sample was designed to cover different systems defined by the combination of the following variables: a) technology, either conventional or emerging, with emerging identified as organic farming; b) area, either mountain or plain, where mountain covers both proper mountain and hill areas[3]; c) main specialisation classified as Arable, Livestock, and Permanent crops. The 'arable systems' are farms cultivating mostly extensive arable crops (e.g. cereals), however in some countries there is a small number of specialised vegetable producers (as is the case in Greece). 'Livestock' refers to bovine rearing for about two-thirds of the farms, of which a large share are specialised dairy farms. Accordingly, this is a rather heterogeneous group, except for the Netherlands, where all livestock farms are specialised dairy farms. Finally, the 'Permanent crops" category includes mainly fruit farms in Germany and Poland, mixed fruit and vineyard farms in Italy and specialised olive growers in Spain[4]. Of the 256 farms interviewed in 2009, 182 had already been interviewed in 2006 and, out of these, 178 were active in both periods. Altogether the majority of farms accepted to be interviewed again and the difference between the 2006 sample and the 2009 sample is mostly due to the fact that Bulgaria was not included in 2006 (20 farm-households) and that the German farm-households could not be contacted again (due to a change in the sub-contractor in charge of this Country) (50 farms). In addition, 4 of the farm-households interviewed in 2006 could not be interviewed again (3 in Italy and 1 in the Netherlands). Of those that answered both in 2006 and 2009, 4 were excluded from the analysis due to the fact that they had exited the farming activity[5] (3 in Italy and 1 in Spain).

4.2 Descriptive statistics and comparison with 2006

The main descriptive statistics for 2009 are summarised in Table 1, while the deviation with the 2006 sample is shown in Table 7.

About 80% of the farm-households interviewed run the farm as family farms. The median age is 51, which is within the most frequent category (45-54 years of age) in EU agriculture[6]. In terms of labour, the farm-households interviewed are very concentrated on agricultural activities, with a median of one full-time person and two full-time equivalent family members working on the farm, which is almost twice the EU average[7]. Additionally, external labour is hired, with a median of about 300 hours/year, which is about half of the EU average (still, this indicator belongs to those showing the highest variability in the sample, with a peak of up to 28000 hours per year of hired labour). About 44% of the households have a successor willing to engage in farming. Median farm size is 32 hectares, which is rather large compared to an average EU size of 22 hectares per holding. Only about one-third of the total available land is owned by the farm, which is below the EU average (around 54%). Land rented and total land

3 Hill and mountain areas are defined based the definitions available in each country, which mainly refer to the altitude of the municipality where the farm is located. For example, for Italy, the definition of 'hill and mountain' refers to municipalities above 300 meters above the sea level. This does not necessarily relate to 'Less Favoured Areas', though in many cases they do coincide with mountain and hill areas.

4 The nomenclature used in this report does not refer to any official classification, but is simply intended to follow the text of the call behind this study.

5 Information about motivations for exit and purpose of the farm was collected in these cases, but is not reported here due to the very small number of cases.

6 Given the small number of cases selected in each system, an evaluation of regional representativeness is not possible for this sample. For the same reason, and due also to the sample structure, that does not reflect any EU-wide frequency of farm typologies, the sample cannot be expected to be representative of EU agriculture. However, in the comment to the table some reference to the EU averages, taken from Eurostat (2009), are provided.

7 Statistics on off-farm labour by family members could not be elaborated due to some heterogeneity in the format of the data collected.

Table 6: Sample descriptive statistics 2009[8]

	Min	Max	Median	CV	% of farm with positive value
Family farm	-	-			79
Age of farm head (years)	24	87	51	0,22	98
Successor (% of yes)	-	-			44
Household head labour on farm (hours/year)	0	4000	2200	0,36	93
Household head labour off farm (% of yes)	-	-			14
Household labour on farm (hours/year)	0	26200	4200	0,63	93
Total external labour purchased (hours/year)	0	39252	308	2,26	54
Owned land (ha)	0	500	15	1,67	91
Land rented in (ha)	0,2	4500	7	4,91	66
Land rented in (% of total farm area)	0,02	1	0,5	0,56	66
Land rented out (ha)	0,5	19,85	0	0,85	7
Total land (ha)	0	4800	32,67	3,80	97
Share of organic products (%)	0	100	0	0,40	26
SFP amount in 2006 (euro/farm)	0	160000	4841	1,61	68
SFP amount in 2007 (euro/farm)	0	160000	5000	1,55	70
SFP amount in 2008 (euro/farm)	0	180000	5541	1,57	73
SFP amount in 2009 (euro/farm)	0	170000	5605	2	70

Table 7: Main differences in sample descriptive statistics 2009-2006 (only farm-households in both samples)

	Min	Max	diff mediana	diff Cv	% of farm with positive value
Family farm	-	-	-	-	-3%
Age of farm head (years)	3	3	2,50	-0,01	0%
Successor (% of yes)	-	-	-	-	-7%
Household head labour on farm (hours/year)	0	620	0,00	0,01	-6%
Household labour on farm (hours/year)	0	11800	284,00	-0,64	-6%
Total external labour purchased (hours/year)	0	-11040	-160,00	-0,21	-11%
Owned land (ha)	0	0	0,18	-0,10	0%
Land rented in (ha)	0	84	0,00	0,09	1%
Land rented in (% of total farm area)	0	0	0,27	-0,53	1%
Land rented out (ha)	0	0	0,00	-13,49	-0%
Total land (ha)	-1,3	0	-0,10	-	0%
Share of organic products (%)	0	0	0,00	0,04	0%

availability are two additional indicators showing the highest variability, pointing to a high degree of heterogeneity in terms of structural characteristics. About a quarter of the farms are organic and these farms sell, on average, about 84% of their products as organic, which constitutes about 40% of the products sold as organic in the entire sample. This share of organic production is very large compared to the actual share in the countries considered, which means that total averages are biased towards the structural and productive characteristics of organic farming. The amount of SFP received has a median of around 5600 euro per farm.

8 In this table and the following, the column "% of farms reporting a positive value" reports: a) for yes/no answers (e.g. family farm) the share of farms with answer "yes"; b) for quantitative variables (e.g. "Owned land") the share of farms with values higher than zero for that parameter.

Table 8: Number of models and distribution across case studies

Technology	Area	Specialisation	DE	ES	FR	GR	IT	NE	PL	BG	Total
Conventional	Muntain	Arable	1				1			1	3
		Livestock	1				1		1	1	4
		Permanent									0
	Plain	Arable	1		1	1	1		1	1	6
		Livestock	1				1	1	1		4
		Permanent		1							1
Total			**4**	**1**	**1**	**1**	**4**	**1**	**3**	**3**	**18**

The sample denotes a very wide range of conditions, as shown by the statistics regarding distribution.

The comparison between 2006 and 2009 denotes a general decrease in farm-household labour on-farm, with a reduction in hired labour used on-farm. Owned land and rented land show negligible changes.

4.3 Number and characteristics of modelled farms

The number of models was restricted to 18 farm-households (compared to 80 in Gallerani et al. 2008), distributed among the case studies as described in Table 8.

The farms modelled were selected according to representativeness principles, in an attempt to cover all the main systems considered with a small number of representative farms.

Operationally, the following procedure was used: a) it was first verified which of the farm-households modelled in the previous study were covered by the present study; b) of these, the farm-households representing the most frequent ("modal") behaviours in terms of results in the first study were selected (1 per system).

During the selection process, the project's Steering Committee decided to avoid modelling organic farms in order to focus resources on the most widespread systems, namely the conventional systems. This decision was made also due to the fact that the actual (low) weight of organic farming in most cases was almost impossible to reproduce. One of the possible outcomes would have been to have organic farming over-represented in the models (as was the case in Gallerani et al., 2008). In addition, organic farms were in most cases very peculiar, at least in terms of their farming activities, making it very difficult to generalise the outcome of their simulation with a reduced number of models.

The main characteristics of the modelled farm households are shown in Table 3. They reflect the characteristics of the sampled farm for each system, while a representativeness of the aggregated average characteristics was not sought. A great share of the farm households modelled are individually or family-run; only a few farms in Bulgaria and Italy are limited liability companies.

The farmers tend to be younger compared to the averages in the case study areas. Farm households with legal owners older than 60 years of age have only been simulated in Italy and Spain. However, age plays no role in the model.

Generally, the available household labour is in line with the average of the sample and sufficient to cover the labour required by the farm (only 5 farm-households modelled use external labour). Furthermore, more than half of the farm households simulated allocated at least one household member to off-farm work.

Twelve farm-households use credit and, for seven of these, the debt/asset ratio is higher than 50%. In Italy and Poland this ratio is particularly low compared to the other countries.

All farm households modelled are owners of some part of the land they cultivate; in addition, 15 out of 18 farms also rent land in. The amount of Usable Agricultural Area (UAA) operated is heterogeneous among the farms modelled (ranging from 15 ha to 295 ha). In most cases, the UAA of modelled farms is higher than the average UAA for each case study area, with relevant exceptions, such as the Italian mountain livestock farms and most of the German models.

The amount of SFP, and the weight of this payment on farm income[9] are exceptionally varied, with some cases having payments which are very relevant both in absolute terms and in relation to land and total income. The payment received by the farmers through the SFP is between 1,000 € and 91,410 € per farm. Generally, for those farm households for which the data on farm income was made available, the weight of SFP is over 10% of total farm income. Only farm household IT80MCA has a ratio of SFP/farm income lower than 10%; this is a consequence of the high amount of land invested in forest and timber production. On the contrary, the maximum weight of EU payments on the total income is achieved by PO04PCL with about 96% of the total.

The number of SFP entitlements (number of rights) varies from 0 to 164[10].

9 Defined as total farm revenue (including CAP payments) minus variable costs, including the renting-in of land and external services costs.

10 For Poland this number refers to the area generating payments, while proper entitlements as in Western EU are not in place.

Table 9: Main characteristics of the farm households modelled

Code	Legal status	House hold compo-nents (#)	Age farmer	Use of external labour	Members working off farm	Household debt/ assets ratio	Land owned (ha)	Land rent-in (ha)	Land rent-out (ha)	SFP (€) (average 2006-2009)	SFP/ income ratio	Rights (#) (average 2006-2009)
BG 07 PCA	limited company	5	57	yes	no	0,5	15	280	-		-	
BG 09 MCL	individual/family run	4	59	yes	no	-	7	80	-		-	
BG 14 MCA	individual/family run	3	56	no	no	-	4	196	-		-	
DE 12 PCA	individual/family run	2	55	no	no	0,94	35	57	1	33500	0,36	89
DE 19 PCL	individual/family run	2	56	yes	no	1	36	-	-	12438	0,05	33
DE 28 MCA	individual/family run	2	28	no	yes	1	19	20	5	14000	1	61
DE 40 MCL	other	3	51	no	no	0,7	38	22	-	22000	0,13	60
ES 03 PCP	individual/family run	3	68	yes	no	-	150	-	-	40000	0	120
FR 06 PCA	individual/family run	3	40	no	yes	0,99	11	142	-	50000	0	140
GR 09 PCA	individual/family run	2	57	yes	no	0,41	2	26	-	14160	0	34
IT 21 MCL	individual/family run	7	37	no	yes	-	8	7	-	7500	0	14
IT 37 PCA	individual/family run	7	48	no	yes	0,06	105	5	-	34500	0,29	107
IT 75 PCL	limited company	3	58	no	yes	0,02	45	15	-	25657	0	34
IT 80 MCA	limited company	4	79	no	yes	-	34	32	-	1000	0,16	na
NL 08 PCL	individual/family run	4	52	no	yes	0,6	28	31	-	20757	0	na
PL 03 PCA	individual/family run	6	59	no	no	0,15	61	80	-	26915	0,24	164
PL 04 PCL	individual/family run	5	52	no	yes	0,13	34	20	-	9832	0,96	59
PL 18 MCL	individual/family run	3	60	no	no	-	25	-	-	3239	0,26	17

11 Here, and in the following tables: 1) Country: BG=Bulgaria, DE= Germany, ES=Spain, FR= France, GR=Greece, IT=Italy, NL=Netherlands, PO=Poland; 2) Area: P=Plain, M=Hilly/mountain; C=Conventional; 3) Specialisation: A=Arable crops, L=Livestock, P=Permanent.

5. Statistical analysis: descriptive analysis and comparison with 2006

5.1 Farm-household objectives and constraints

The ranking in the first three most important farm-household objectives for the 2009 survey is listed in Table 10. Based on the number of cases in which the objective ranks first, the income certainty and farm-household worth (intended as total value of assets owned by the farm-households) are the most important, followed by household consumption, debt asset ratio and diversification.

This ranking would be different if other criteria had been considered, e.g. the sum of the number of cases in which the objective occurs in the first three places would be higher for household consumption compared to debt-asset ratio. This order should be interpreted with some caution, in particular due to the fact that the concepts of income level, income certainty and consumption can have been difficult for respondents to distinguish. As a result, the high importance attributed to income certainty should to some extent be interpreted as the respondents' intention to give a high importance to income level, rather than properly to its degree of certainty.

The changes comparing 2006 and 2009, identified by a move to or out of the three most important objectives, show an increased importance in diversification, farm-household

Table 10: Ranking of different farm-household objectives in 2009 (first three columns) and change in ranking of different objectives 2009-2006 (other three columns) (number of answers)

	Ranking of different farm-household objectives in 2009			Change in ranking of different objectives 2009-2006		
	1	2	3	1	2	3
Income certainty	148	51	15	3	2	-2
Household worth	63	77	55	-4	0	5
Household debt/asset ratio	56	23	30	-1	1	14
Household consumption	48	45	52	-3	1	11
Diversification in household activities	37	43	30	5	10	-1
Leisure time	22	31	35	-1	-9	-11
Others	3	0	1	0	-1	0

Table 11: Role of farming with respect to household income in 2009 (%) and variation with respect to 2006 (%)

	Percentage in 2009	Difference between 2009 and 2006
It is the main economic activity	74	3
It is a significant contribution to overall income	12	-2
It is a secondary contribution to overall income	12	-1
It is a net loss	0	-1
Others	1	1
Missing	2	0

Table 12: Role of the farm in household asset management in 2009 (%) and variation with respect to 2006 (%)

	Percentage in 2009	Difference between 2009 and 2006
Does not have any particular role	3	1
Serves as a low-risk asset for investment differentiation	19	11
Has strong sentimental value and we will never leave it	53	2
Others	23	-14
Missing	2	1

debt/asset ratio and consumption, while all other objectives decrease in importance, particularly leisure time. This is consistent with an economic context in which profit-making is more difficult, requiring a (slightly) increased focus on "hard" issues, such as income, diversification, consumption and debt/asset ratio.

The stated role of the farm in contributing to household income is summarised in Table 11.

Farming is the main economic activity for 74% of the sample and in about half of the remaining cases it contributes significantly to household income. The negligible differences between 2009 and 2006 mainly hint at no clear change in importance among the different roles considered.

The role of the farm in household asset management reveals two main attitudes: an important stated affection component, for about half of the sample, and an orientation towards use of the farm as a low risk asset, for about one fifth of the sample Table 12.

These answers are a stated attitude, which does not necessarily reveal an actual pattern of behaviour. They rather convey the message that the respondent seeks to attach to their activity when answering to the questionnaire, while, in most cases, the ownership of farm assets can play a mixed role. Accordingly, the answer should not necessarily be seen as representing the real attitude of the farm-households. If the strong emotional value attached to the farming activity reveals a real behaviour pattern, it can be seen as a limitation of the willingness to trade resources, labour in particular, between on-farm and off-farm uses, and puts into question the use of a household model to represent farm-household behaviour. However, evidence from respondents seems also to suggest that the reported emotional value is attached to the property and the operation of the farm by some household members, but does not imply unwillingness to work off-farm. On the contrary, this answer is often delivered by farm-households that show some inclination towards moving labour off-farm.

The number of respondents reporting a strong emotional connection to the farm does not basically change from 2006 to 2009. During this period, the main change in such perceptions concerns an increase in those stating that they maintain the farming activity to differentiate investments, which increased by 11% of the total (which means that this group has more than doubled compared to 2006), and is balanced by a reduction of those stating to have other reasons for keeping the farm. Two main ownership profiles emerge from the assessment of these results: those farm-households characterised by a prevailing attitude of affection for the farm, and which do not change their view as a result of the changing economic context, and the second group, namely those farm-households for which farming is mainly an economic pursuit, and which tend to react more markedly to the changes in the economic context; in particular, higher attention is paid to asset risk management in the increasingly uncertain context.

Table 13: *Ranking of different farm household constraints in 2009 (first three columns) and change in ranking of different constraints 2009-2006 (other three columns) (number of answers)*

	Ranking of different farm-household constraints in 2009			Change in ranking of different constraints 2009-2006		
	1	**2**	**3**	**1**	**2**	**3**
Market share/contract of key products	110	33	13	-3	4	0
Liquidity availability	79	37	16	11	1	0
Land availability from neighbouring	48	32	22	-1	-8	-1
Total household labour availability	42	26	13	2	0	-1
External labour availability in key periods	33	29	34	-1	3	5
Household labour availability in key periods	33	23	19	-3	-5	-6
Short term credit availability	28	16	27	11	-1	-5
Total external labour availability	22	32	18	6	4	3
Long term credit availability	18	21	17	-2	-2	2
Others	18	17	6	-6	5	1

Table 13 ranks different farm constraints in 2009 compared with 2006, limited to the number of cases where each objective was ranked in the first three positions.

The market share of key products, i.e. the amount of products that a farm can expect to place on the market, is the main constraint, followed by liquidity availability, and land and labour availability.

Compared to 2006, the main changes are the increased importance of liquidity availability, short-term credit availability and total external labour availability. Land availability and farm-household labour availability in key periods are the constraints showing the highest decrease in importance. As far as credit is concerned, the increased importance of short-term credit is noteworthy, in opposition to longer term credit. These changes appear consistent with the context represented by the economic crisis during the 2009 survey, which has affected both liquidity availability and access to credit.

5.2 Credit and contracts

About 30% of the farms interviewed in 2009 do not use credit, with relevant differences between systems. The type of credit most often required is long-term, for about 40% of the farms. Medium and short-term credit is less frequently used (respectively 28% and 13%).

The share of farms using credit is higher among emerging farms, for all types of credit (Figure 2). The same applies for farms located in the plains, for which the use of credit is more frequent than for mountain farms (Figure 3). This is likely due to the lower expectation of profits in mountain areas, but could also be reinforced by the lower accessibility of credit due to the lower collateral, as farms in the plains are larger (in terms of UAA) than farms in mountain areas. Credit is more frequently used among crop and livestock farms, while it is less used by orchards and vineyards (Figure 4). Long-term credit is always more frequent than medium-term which, in turn, is more frequent than short-term credit. Short-term credit is almost totally absent in some systems (notably orchards and vineyards).

Access to credit depends on a number of other variables besides technology, location and specialisation. In particular, the age of the farmer, the legal status of the farm and farm size can play a role in determining access to credit. Of these variables, the only one showing clear differentiation of credit access across all systems

Figure 2: Type of credit used by technology (% of farms, 2009)

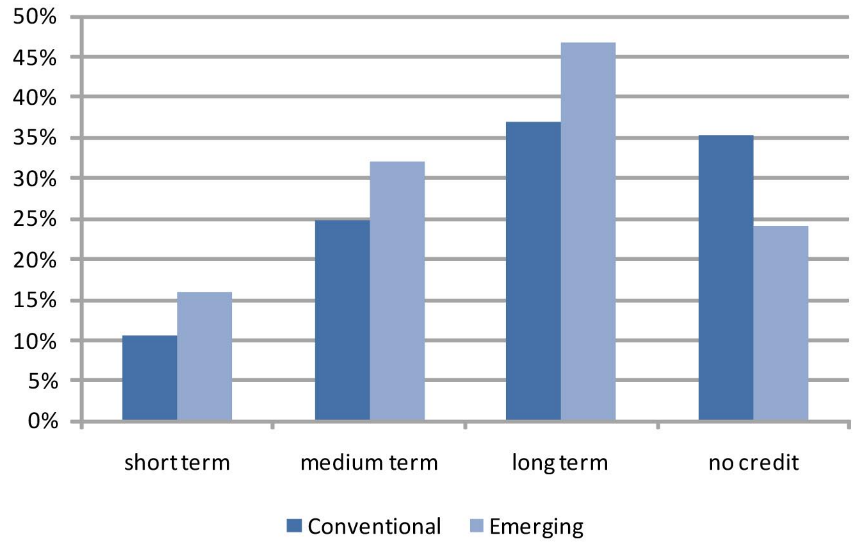
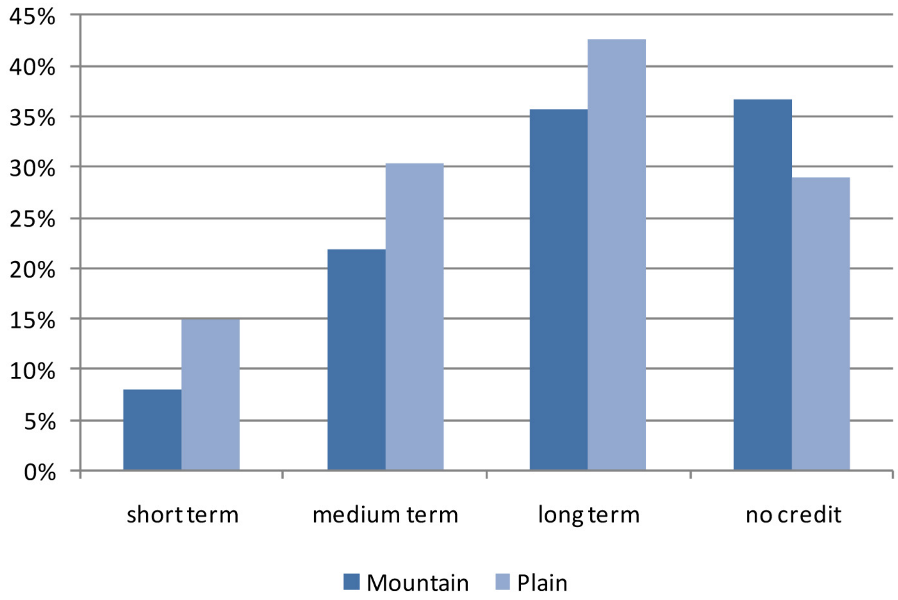


Figure 3: Type of credit used by location (% of farms, 2009)



is farm size, expressed in terms of farm usable agricultural land. Larger farms (those above the median) have greater access to credit in all systems, with the differences being particularly evident for short-term credit (which large farms are able to access about twice as frequently as small farms).

Figure 5, Figure 6 and Figure 7 report the changes in access to credit between 2009 and 2006 by technology, location and specialisation. The main changes concern the strong increase in farms that do not use credit, and the marked decrease in the use of short-term credit. This trend is also evident for medium and long-term credit for which, however, the situation is more mixed, with some cases showing increases. The main changes concern mountain areas and orchard/vineyard systems, which have seen a stall in short-term credit availability.

Figure 4: Type of credit used by specialisation (% of farms, 2009)

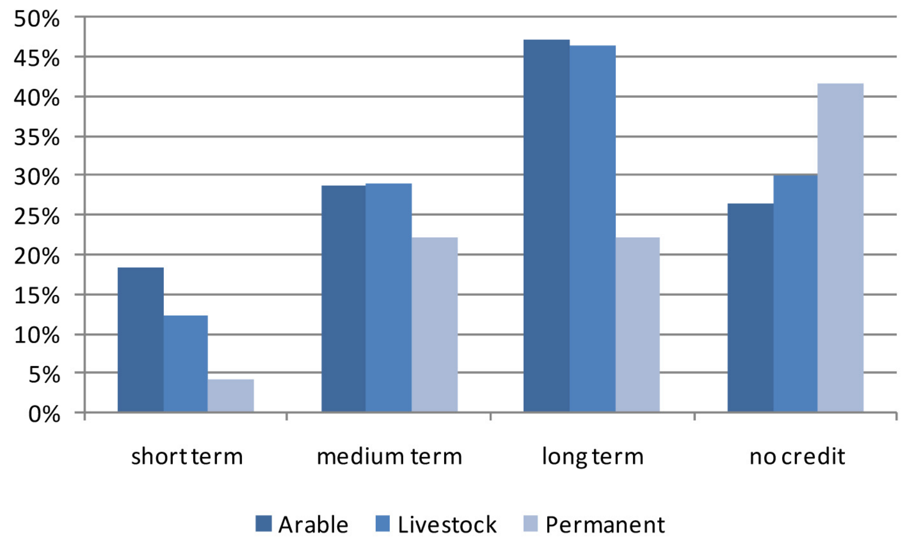
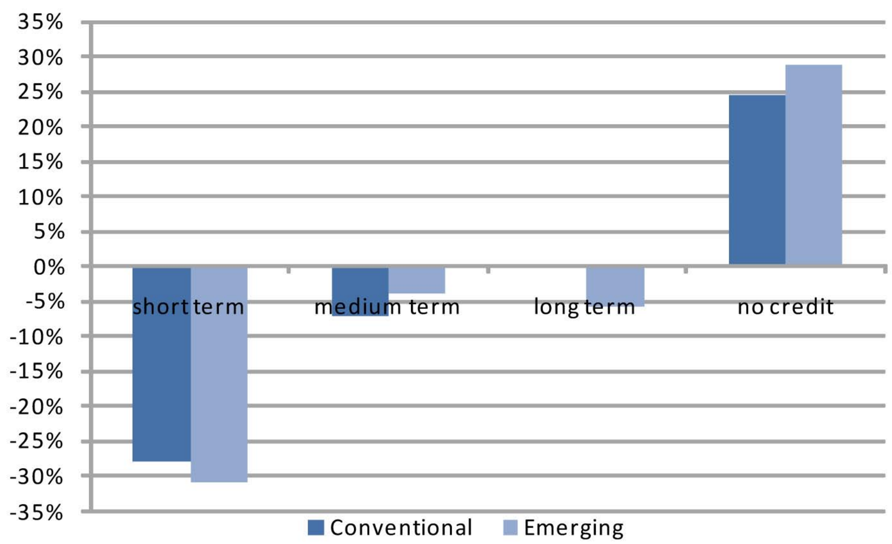


Figure 5: Variation in type of credit used between 2006 and 2009 by technology (% of the number of farms)



Though several variables may have contributed to this significant change, the most plausible cause appears to be the financial crisis of 2007-2008.

Figure 5: Variation in type of credit used between 2006 and 2009 by technology (% of the number of farms)

Figure 6: Variation in type of credit used between 2006 and 2009 by location (% of the number of farms)

Figure 7: Variation in type of credit used between 2006 and 2009 by specialisation (% of the number of farms)

Figure 8, Figure 9 and Figure 10 summarise the percentage of farms with contracts in place, divided by typology, location and specialisation. The main contract typology used is a private production contract with a downstream wholesaler

Figure 6: Variation in type of credit used between 2006 and 2009 by location (% of the number of farms)

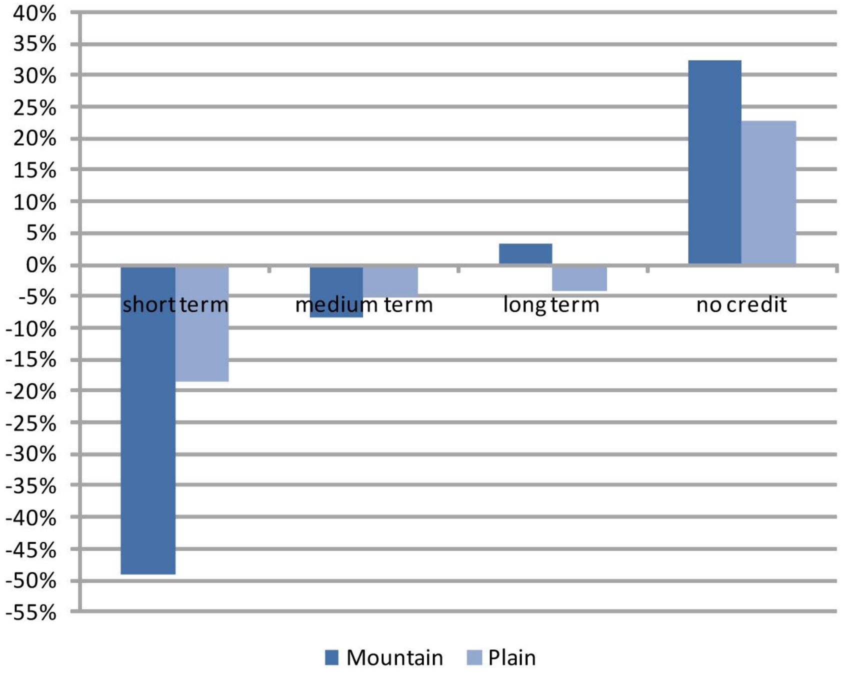


Figure 7: Variation in type of credit used between 2006 and 2009 by specialisation (% of the number of farms)

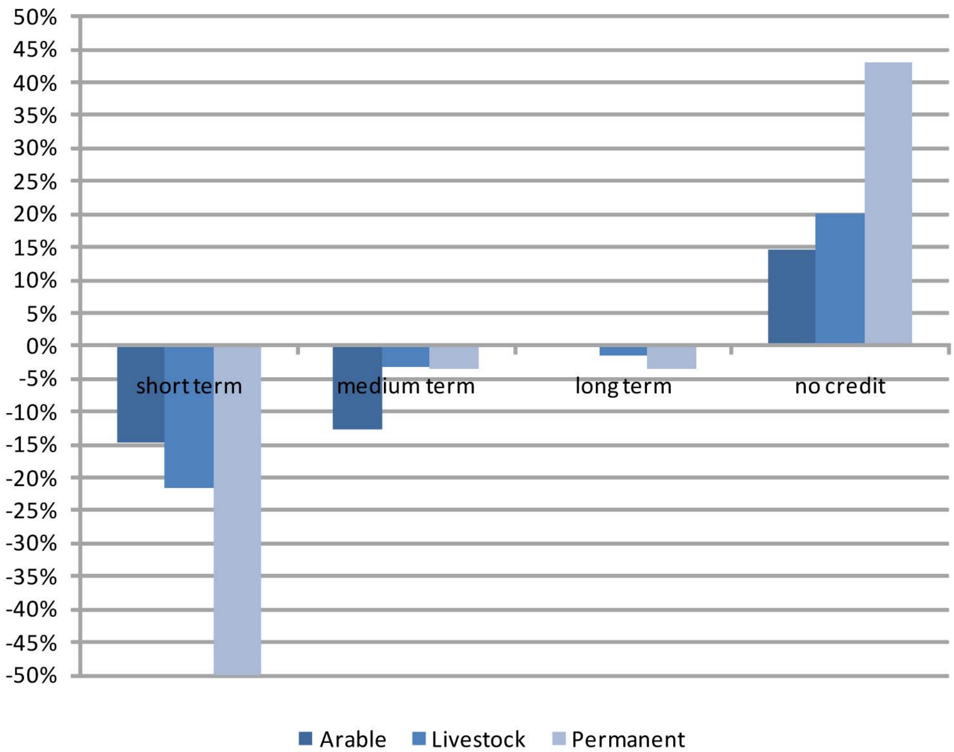


Figure 8: Contracts in place by technology (% of the number of farms, 2009)

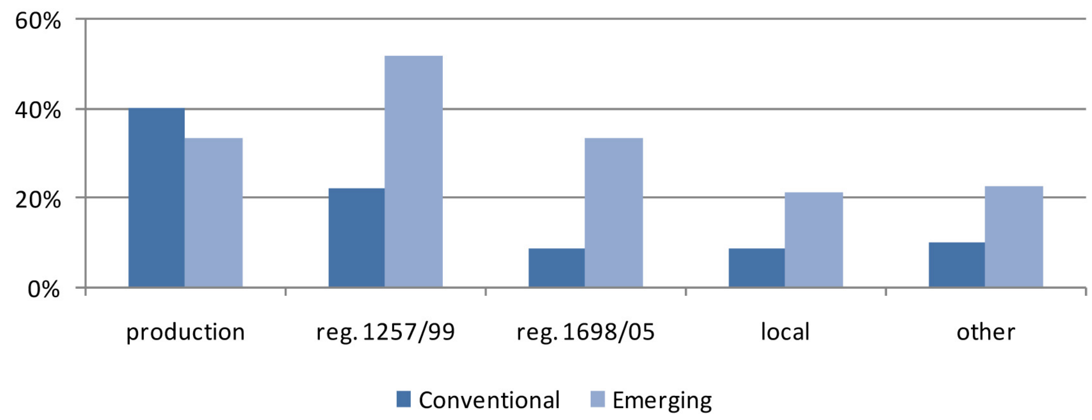


Figure 9: Contracts in place by location (% of the number of farms, 2009)

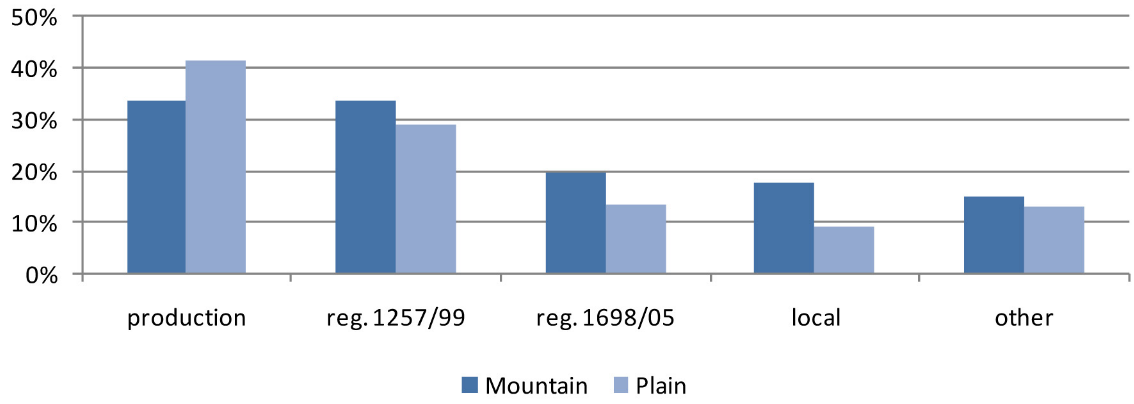
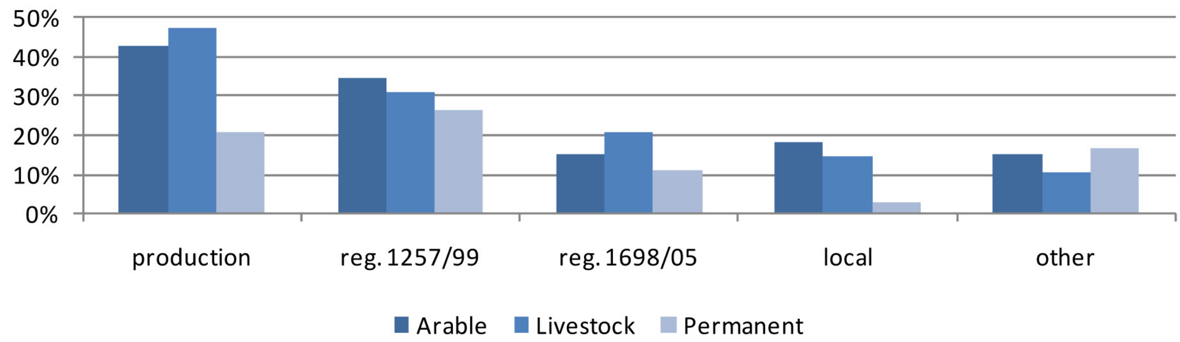


Figure 10: Contracts in place by specialisation (% of the number of farms, 2009)



or processor for conventional farms, while agri-environmental contracts (Reg. EC 1257/99 and 1698/2005) are mainly used by emerging farms. Farms in mountain areas also show a higher share of agri-environmental contracts compared to production contracts. Arable and livestock specialisations have a higher share of contracts compared to permanent crops. This is more obvious for production contracts, but also applies to some extent to agri-environmental contracts.

Local measures are here defined as agri-environmental measures offered by local bodies in addition to those provided by the EU, e.g.

Table 14: Difference in the number of contracts between 2006 and 2009 (% of the number of farms that have contracts)

Technology	Area	Specialisation	production	reg. 1257/99	local	other
CONVENTIONAL	Mountain	Arable	-40	10	0	0
		Livestock	-64	43	4	-14
		Permanent	-41	21	0	88
	Plain	Arable	-34	12	1	10
		Livestock	-4	34	-26	-11
		Permanent	-55	-6	0	100
EMERGING	Mountain	Arable	-100	-21	15	-5
		Livestock	-82	-10	-36	100
		Permanent	-75	50	0	0
	Plain	Arable	-50	-23	13	33
		Livestock	-77	20	-23	21
		Permanent	-50	17	0	20

small pond maintenance paid by the Provinces in Emilia-Romagna. "Others" relate to any other contract types (mostly unspecified).

Table 14 shows the main changes in the number of contracts between 2006 and 2009.

The number of contracts decreases sharply over the three year time period. This is particularly the case for production contracts which decrease by up to 100%, and which decrease rather consistently across systems. Though this may be connected to the price instability witnessed in recent years, evidence of possible causes is not available from the study. The other typologies of contracts have changed in different directions, likely depending on the individual contexts of farm-households.

5.3 CAP payments and the effects of decoupling

Figure 11, Figure 12 and Figure 13 compare the amount of payments received in 2009, in relation to total farm income.

The situation in 2009 shows very different payment patterns between the farming systems: farm-households belonging to the conventional farming systems receive higher payments than those received by farms in the emerging

Figure 11: Payments received in 2009 in relation to total farm income, separated by technology

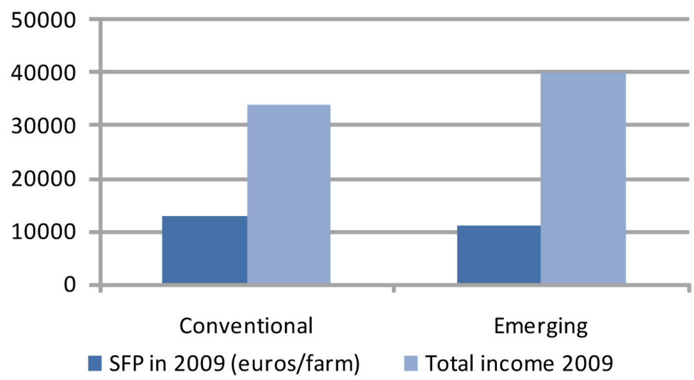


Figure 12: Payments received in 2009 in relation to total farm income, separated by location

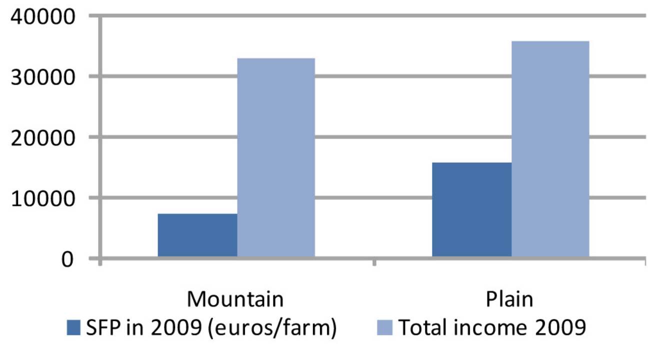
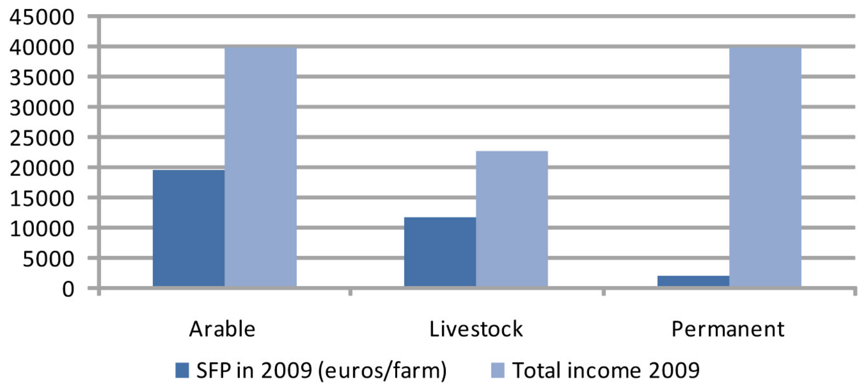


Figure 13: Payments received in 2009 in relation to total farm income, separated by specialisation



systems, and which are also higher than the total farm-household income (which is lower in conventional farming systems). The same applies for plain systems compared to mountain systems. Crop system farms receive the highest amount of subsidies per farm, compared to livestock farms, whilst for orchards/vineyards the amount of payments is practically insignificant. However, as livestock farms also have a lower average total income, the relative weight of the SFP between crop and livestock is comparable, and is around half of the total income. The negligible role of payments for orchard/vineyard farms is further highlighted by the small value compared to total income. This distribution is not surprising as payments are historically connected to crop and livestock specialisations; crop and livestock farms are generally larger and in the past plain areas benefitted from higher payments per hectare.

Figure 14, Figure 15 and Figure 16 illustrate the changes between 2006 and 2009, showing an increased concentration of payments towards the systems already benefiting from higher payments per farm.

In particular, the changes from 2006 to 2009 seem to point out a further concentration of payments in conventional, plain and crop specialisations. The most significant decreases occur for orchard specialisations. Increases are generally prevailing in all systems, particularly in Poland and Germany. This is consistent with the SAPS and the hybrid systems adopted in these countries and also with the high share of expanding farms included in the sample.

Figure 14: Change in payments received between 2009-2006 separated by technology

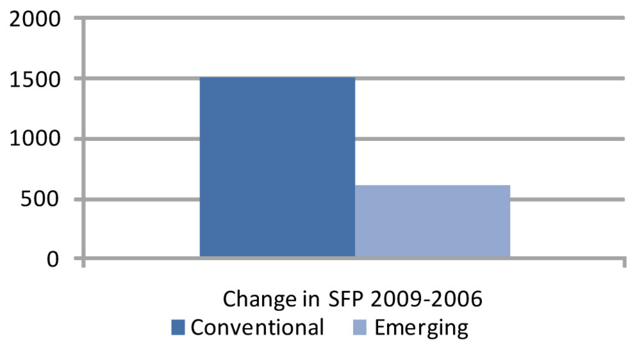


Figure 15: Change in payments received between 2009-2006 separated by location

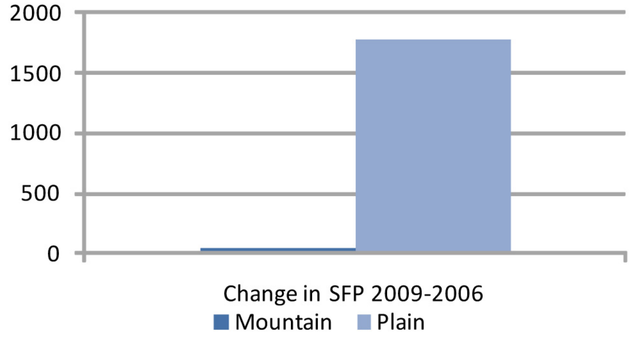
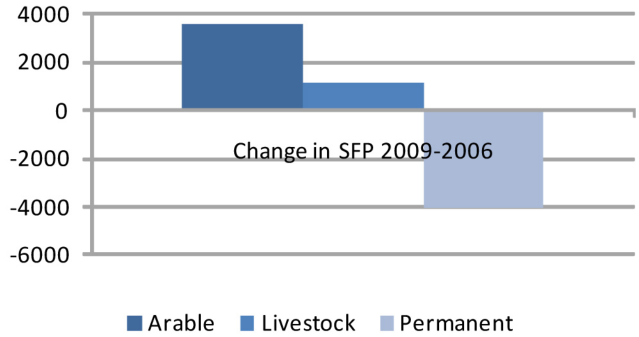


Figure 16: Change in payments received between 2009-2006 separated by specialisation



The vast majority of the SFP is reported to be used[12] to cover on-farm current expenditures (82% on average), followed by on-farm investments (14% on average). The need to cover current expenditures is higher for emerging systems (Figure 17) and crop cultivation (Figure 19), while the difference among locations is negligible (Figure 18). Investment is higher in conventional and livestock farms.

The changes between 2009 and 2006 show a clear movement from all other uses to on-farm

12 We stress once again that a rigorous connection between SFP revenues and expenditure is not possible. However, farmers were generally able to answer these questions with relative ease, which leads us to think that it is at least a good proxy of farmers' perceptions and likely to reveal relevant financial constraints.

Figure 17: Stated use of SFP based on 2009 survey by technology

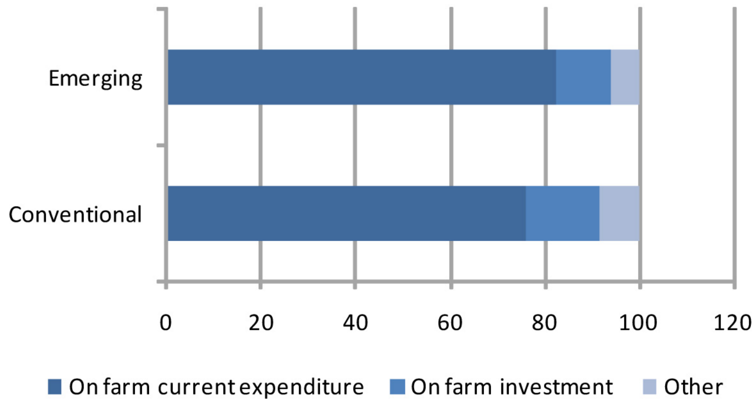


Figure 18: Stated use of SFP based on 2009 survey by location

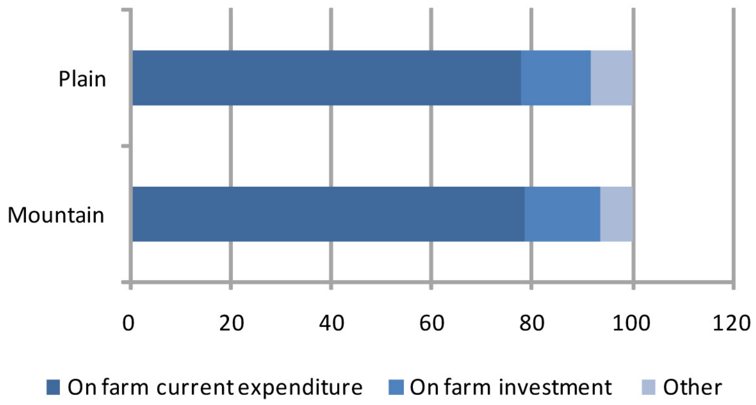
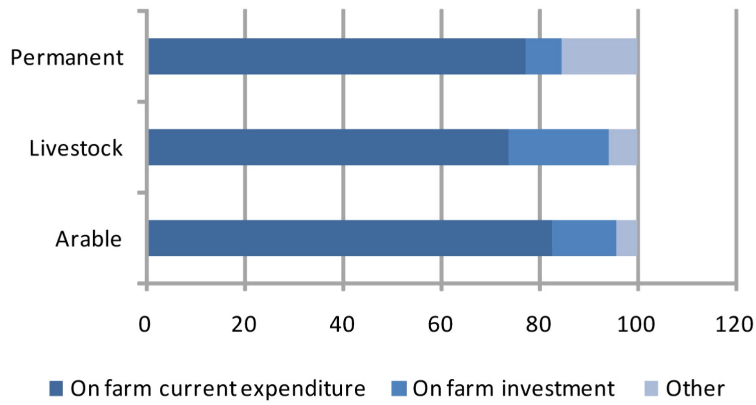


Figure 19: Stated use of SFP based on 2009 survey by specialisation



current expenditures , with particular decreases in on-farm investment (Figure 20, Figure 21 and

Figure 22). This follows the economic context between 2006 and 2009, with an increase in production costs and a decrease in profit margins. Shifts from investment to on-farm current expenditure are particularly visible for livestock specialisations, mountain areas and emerging systems.

Figure 20: Change (2009-2006) in stated use of SFP by technology (%)

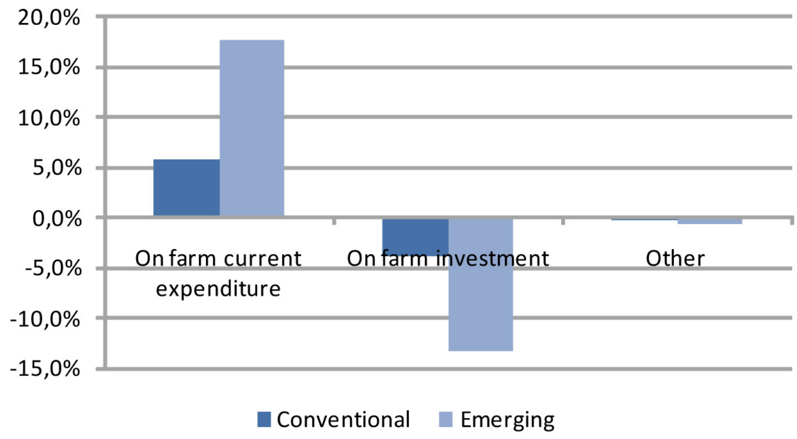


Figure 21: Change (2009-2006) in stated use of SFP by location (%)

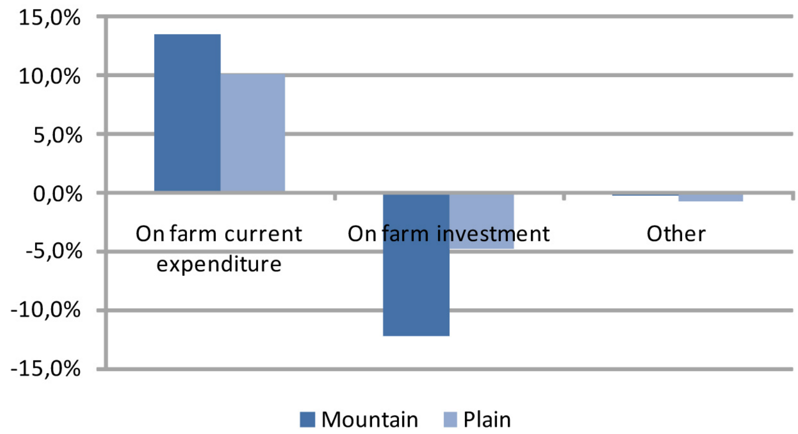
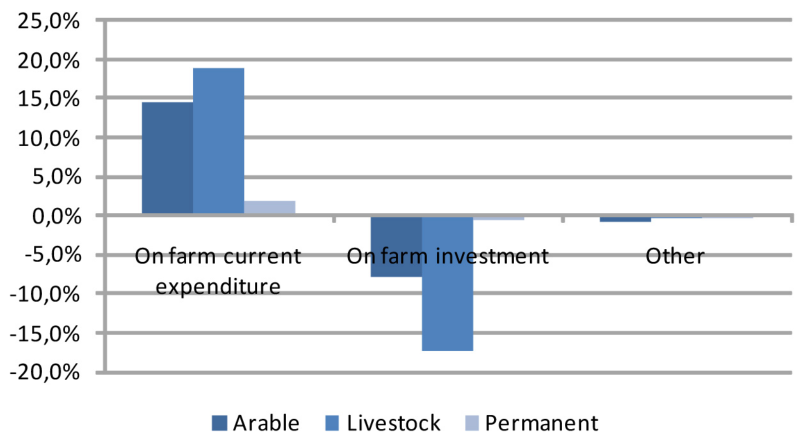


Figure 22: Change (2009-2006) in stated use of SFP by specialisation (%)



The stated effects of decoupling and the introduction of the SFP are described in Figure 23, Figure 24 and Figure 25. The majority of farm-households (59%) state no reaction to decoupling. This share prevails for all systems and appears to be more significant for emerging

Figure 23: *Stated effect of decoupling by technology (2009*

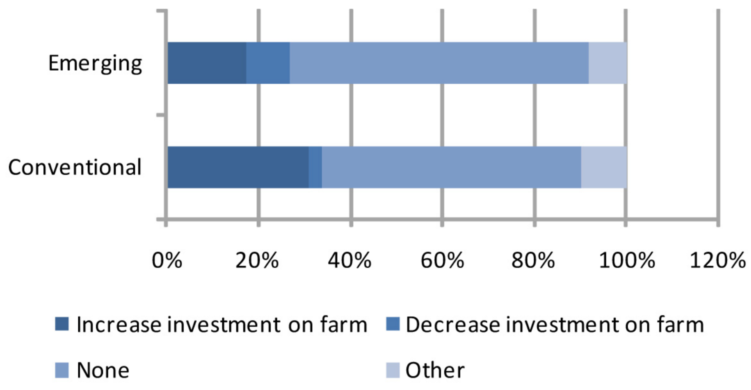


Figure 24: *Stated effect of decoupling by location (2009)*

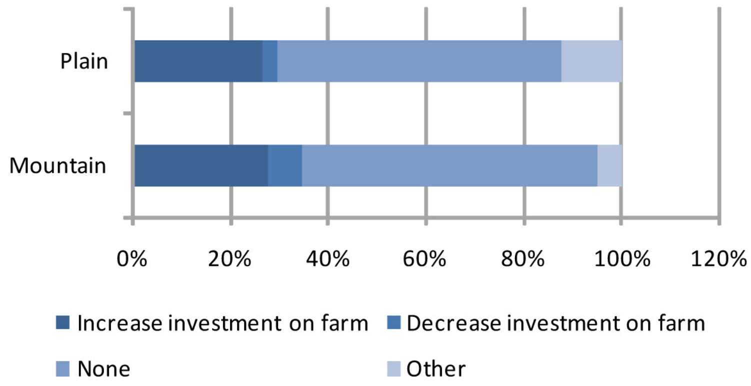
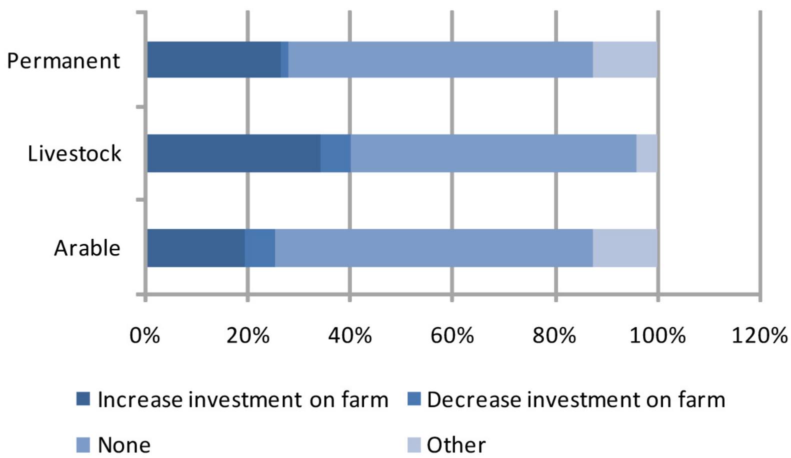


Figure 25: *Stated effect of decoupling by specialisation (2009)*



systems compared with conventional farms. The remaining 41% state some effect, which is potentially very relevant. Among these remaining farm-households, the most frequent statement concerns on-farm investment, though also the opposite (decreased investment) is relevant. Increases in investment are most frequently reported by conventional farms, farms located in mountain areas and livestock farms, followed by orchards/vineyards. Decreases in investment

Figure 26: *Change in stated effect of decoupling by technology between 2006 and 2009*

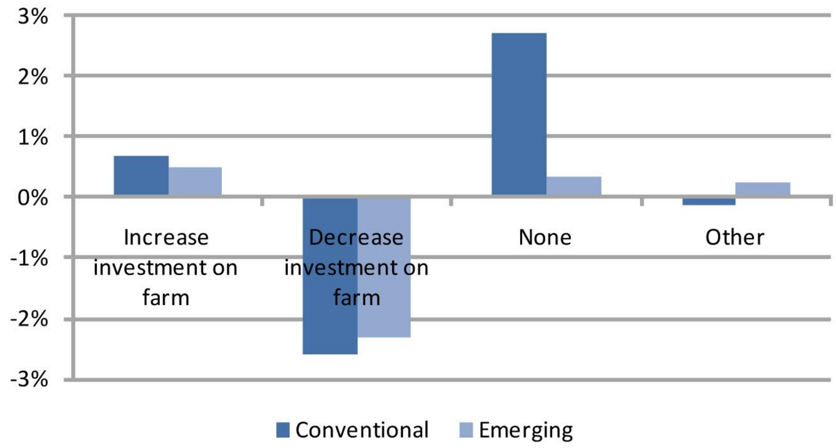


Figure 27: *Change in stated effect of decoupling by location between 2006 and 2009*

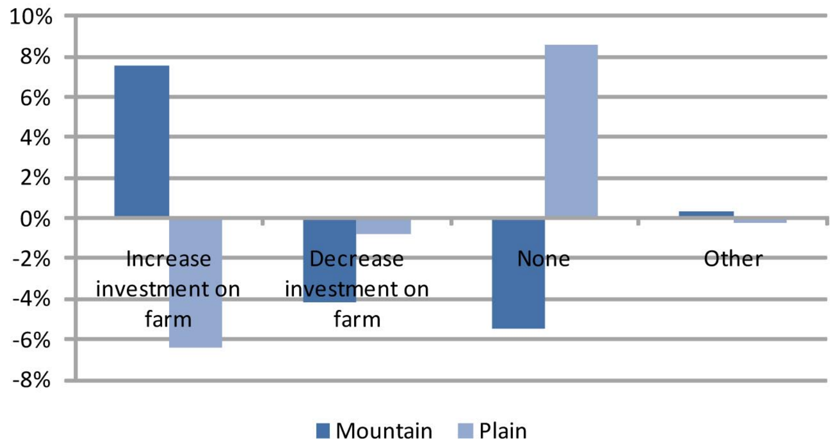
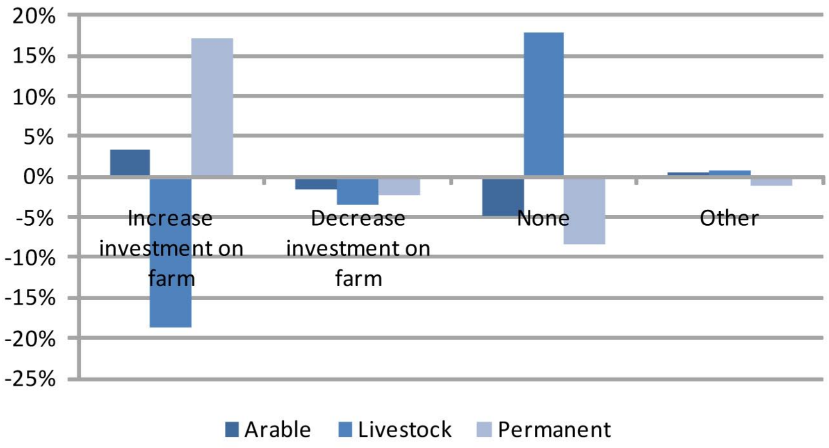


Figure 28: *Change in stated effect of decoupling by specialisation between 2006 and 2009*



are most noteworthy in emerging systems, farms located in mountain areas and in farms specialised in livestock (each characteristic taken separately).

Several relevant changes were noted in the comparison 2006-2009 (Figure 26, Figure 27 and Figure 28).

The changes from 2006 to 2009 are mainly an increase in "no change" answers, and the reduced increase in on-farm investments. However, this is rather differentiated across the different farming systems. The differences in changes between conventional and emerging systems are not particularly relevant except for the answer "none". They are more important for mountain areas compared to plains, with an increasing share of "increased investment on-farm" answers in mountain areas.

Increased attention to farm investment is observed in combination with SFP for orchard and vineyard specialisations, while strong decreases are reported by livestock farms. The reason for these changes is not evident from the data. The most likely explanation seems to be that coupled payments were a direct driver of profitability for livestock farms, while being a driver of competitive land uses for fruit and vineyard farms (that did not receive area payments, except in the case of olive production). At the same time, the share of farms that report a decrease in on-farm investment as a result of decoupling is also reduced showing altogether an increased degree of instability and diversification of reactions. This is confirmed for livestock farms only, by the changes in the answer "none", which increased sharply for this specialisation. The opposite is the case for orchards and, to some extent, for arable crops. The most homogenously increasing category is the increase in off-farm productive and off-farm non-productive investments, though their overall share remains rather low.

Considering that the 2006 survey was carried out only one year after decoupling had been implemented (or in the same year for France), the 2009 responses should be regarded as a more aware and realistic *ex-post* description of the effects of the CAP decoupling. On the other hand, changes between the two periods are also affected by the price and cost volatility in 2007-2008, and by the recent financial crisis. Altogether, this may have moderated the 2006 emphasis on modifying farm production plans in response to the market as an effect of the substitution of area-based payments with the SFP and the results confirm and strengthen the idea that the effect of decoupling itself was very low or negligible in the majority of cases.

5.4 The effects of the financial crisis and expectations

Information on the effects of the most recent market trends was included in the survey through two separate questions about the effects of 2007-2008 crisis on the farm-household and the farm itself. Half of the farm-households (51%) claim to not have been affected by the crisis (Figure 29).

With respect to the farms, less than one-third have not been affected as can be seen in Figure 30.

Among the specific answers, "cost increase" is the most frequent, followed by different perceptions of price reduction. In this case, a very high share of answers is included in "others" and "missing".

Concerning expectations about the future, farmers were asked about key variables of their economic environment in five years time as presented in Table 15.

The strongest expectations regarding the future relate mainly to price increases for agricultural products, agricultural labour costs and the production factors. The expectation seems to be that decoupled payments will either remain stable, or decrease, and that they will be associated with stable coupled payments. Otherwise, increases are expected for rural and organic production payments. This follows the recent and on-going trend of the CAP reforms, i.e. the reallocation of funds from coupled to decoupled and from the first pillar to the second pillar.

Figure 29: Effects of 2007-2008 crisis on farm-households

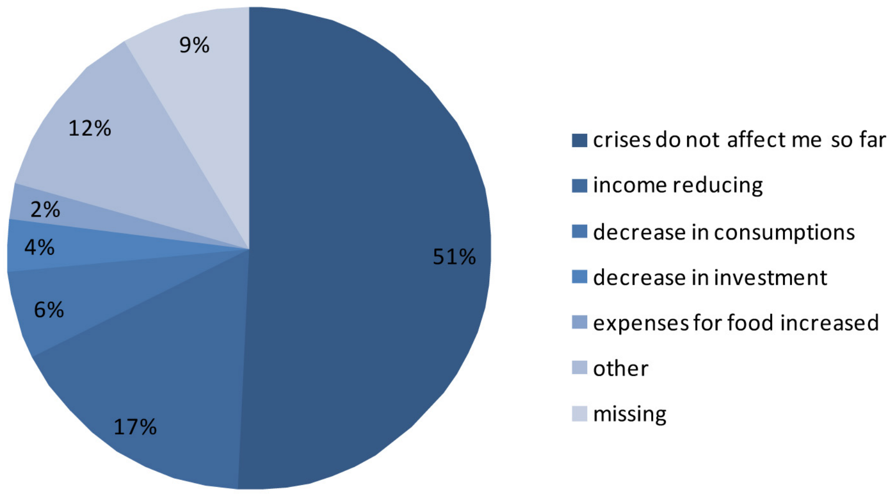


Figure 30: Effects of 2007-2008 crisis on farms

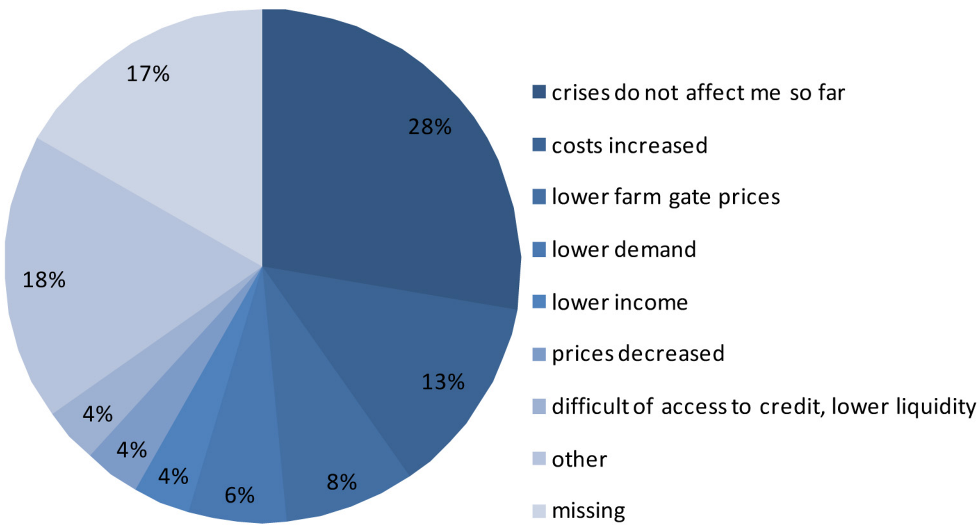


Table 15: Expectations for prices and payments – direction of change- in 2009 (%)

	Direction of expected change			
	Decrease	**Increase**	**Stable**	**No reply**
Product prices	16%	53%	25%	7%
Agricultural labour cost	3%	68%	18%	12%
Cost of agricultural capital goods	10%	65%	18%	7%
Cost of other production means	9%	72%	10%	9%
Decoupled payments	43%	16%	25%	16%
Rural development payments	25%	32%	25%	19%
Payments for organic production	20%	38%	24%	18%
Coupled payments	25%	9%	36%	30%

Table 16: Change in expectations between 2006 and 2009 for prices and payments – direction of change (%)

	Direction of expected change			
	Decrease	**Increase**	**Stable**	**No reply**
Product prices	27%	-19%	-7%	-1%
Agricultural labour cost	31%	-43%	11%	2%
Cost of agricultural capital goods	28%	-23%	6%	-10%
Cost of other production means	1%	-13%	1%	11%
Decoupled payments	2%	0%	0%	-2%
Rural development payments	6%	-6%	-4%	4%
Payments for organic production	17%	12%	2%	-31%
Coupled payments	20%	-22%	-12%	14%

Table 17: Percentage of farms that have invested and percentage of investments by category in the last five years (2009)

			% of farm households	% of investments
off-farm			18%	
	house			58%
	new car			14%
on-farm	land		20%	
	farm buildings		32%	
		cow house		36%
		machinery buildings		35%
		barns and shed		30%
	machinery		37%	
		tractors		47%
		forage harvesting		15%
		soil cultivation		13%

A comparison with 2006 underscores a strong reduction in those farms expecting increases in product prices and production costs, and an increase in those expecting a decrease (Table 16).

This may also be due to the fact that prices in the period considered (2006-2009) were high (at least for part of the period), increasing the likelihood of a decrease in the future. Expectations with respect to decoupled and rural development payments are rather stable, and more respondents believe that coupled payments will be reduced. In the case of organic farming, the number of 'no replies' decreases sharply and respondents are distributed in both directions, increasing or decreasing, highlighting the uncertainty about the future of these payments.

5.5 Past and future investments

Only about one-fifth of the farm-households have undertaken some off-farm investment in the last 5 years, while a higher share have carried out some on-farm investment, most often in the form of investments in machinery Table 17).

Table 18: Deviation between stated investment intentions in 2006 and actual investment in the period 2006-2009

Technology	Area	Specialisation	Deviation *no*	*yes*	*missing*
CONVENTIONAL	Mountain	Arable	1	0	4
		Livestock	2	5	7
		Permanent	3	5	9
	Plain	Arable	3	7	22
		Livestock	1	8	18
		Permanent	6	4	21
EMERGING	Mountain	Arable	2	0	6
		Livestock	1	6	4
		Permanent	0	1	3
	Plain	Arable	2	1	7
		Livestock	0	4	9
		Permanent	2	0	4

Table 19: Linkage between investments and RDP support in 2009

Technology	Area	Specialisation	Farms with at least one investment	% of farm by system	Total number of investments supported by RD	% of those who would not have invested without RD
CONVENTIONAL	Mountain	Arable	10	67%	18	61%
		Livestock	10	42%	17	65%
		Permanent	11	46%	21	57%
	Plain	Arable	22	52%	37	68%
		Livestock	26	65%	47	74%
		Permanent	12	33%	18	44%
EMERGING	Mountain	Arable	8	47%	12	83%
		Livestock	9	60%	12	92%
		Permanent	2	33%	4	75%
	Plain	Arable	7	54%	10	80%
		Livestock	14	78%	30	87%
		Permanent	2	33%	2	100%
Total			**133**	**52%**	**228**	**74%**

The high number of buildings is due to the inclusion of restructuring, together with new construction, in this category.

Altogether, 23% of the farm-households interviewed stated having experienced major deviations from planned investments in the period 2006-2009, while only 13% declared no deviation (Table 18).

This suggests that the sudden changes in prices and costs between 2006 and 2009 may have affected the planned investment schedule, at least in terms of provoking a delay in investments. However, since this question collected a very high share (64%) of non-responses, interpretation becomes difficult, even if considering the share of those having no investment intention in 2006.

Table 20: *On-farm Investment intention for the next 5 years in 2009 (% of farm-households per farming system)*

Technology	Area	Specialisation	Investment typology *land*	*machinery*	*buildings*
CONVENTIONAL	Mountain	Arable	20%	33%	67%
		Livestock	17%	33%	21%
		Permanent	17%	46%	25%
	Plain	Arable	26%	33%	29%
		Livestock	30%	40%	48%
		Permanent	6%	25%	19%
EMERGING	Mountain	Arable	12%	29%	29%
		Livestock	20%	40%	20%
		Permanent	0%	33%	33%
	Plain	Arable	8%	46%	23%
		Livestock	50%	56%	61%
		Permanent	0%	33%	0%

Concerning rural development, a comparatively high share of farms used RDP support or identify the RDP as the resources for investments[13] (Table 19).

About half of the farms used RDP support, with at least a third in permanent crop systems. About 74% of the farms using RDP support also state that they would not have invested in the same way without the RDP payment. In most cases, this does not mean that the investment would not have been carried out without the RDP payments, but rather that RDP payments have influenced size, typology or timing of investment. However, these percentages must be analysed with care due to the low number of observations, particularly in the systems where the farm-households interviewed were less numerous. For the same reasons, differences between EU-15 and New Member States, or between single countries do not appear to be reliable enough to allow conclusions.

Investment intentions for the next 5 years, based on the 2009 interviews, are shown in Table 20.

The share of households intending to invest is rather high, likely due to the relatively high share of very active farms in the sample. Investment intentions are more frequent in machinery and buildings. Differences among systems are more evident across farm specialisations. Major differences between conventional and emerging systems, as well as between different altitudes do not appear. Livestock farms are those stating the strongest intentions to invest in land and this is associated with high investment also in machinery and buildings. Tree specialisations show the lowest intention to invest in land and buildings while investments are higher for machinery.

Changes in investment intentions between 2006 and 2009 are on average about minus 20% (Table 21).

In line with the economic and financial crisis, and its effects on expectations discussed in the previous sections, changes are always negative

13 Although the question was intended to collect information about the specific support received, and the formal use made from this support, in many cases the farmer likely interpreted the question in a wider sense and answered from the perspective of the investments actually undertake as a result of having received some Axis 1 payments. This helps to explain the number of cases in which land is reported to have been purchased thanks to the RDP payments, while such purchases should generally be avoided under the RDP.

Table 21: Difference in investment intention between 2006 and 2009

			Investment typology		
Technology	**Area**	**Specialisation**	*land*	*machinery*	*buildings*
CONVENTIONAL	Mountain	Arable	-20%	-60%	0%
		Livestock	14%	-21%	-50%
		Permanent	-12%	-29%	-24%
	Plain	Arable	6%	-28%	-22%
		Livestock	-19%	-33%	-15%
		Permanent	-3%	3%	-3%
EMERGING	Mountain	Arable	-25%	-13%	0%
		Livestock	-18%	-9%	-27%
		Permanent	0%	-25%	-25%
	Plain	Arable	-20%	0%	-10%
		Livestock	31%	-15%	0%
		Permanent	-17%	0%	-17%

for machinery and buildings, with a few cases of stability for emerging systems. The strongest reductions concern conventional mountain areas, particularly arable crops for machinery investments and livestock for buildings.

Land investment intentions seem to be less consistent, with some major increases as well as major reductions. Increases in land investments are concentrated in livestock farms. It appears that investment in land tends to follow investment criteria that are different from agricultural returns only. Typical for land markets, land purchase strategies may be more connected to the wealth management strategies of individual households.

5.6 Panel model analysis: explaining investment

Table 22 describes the variables used for the panel analysis carried out on the farm households interviewed in both surveys.

Table 23 shows the output of the logit model with the intention to invest in land (yes/no) as dependent variables.

The coefficients are significant for the following explanatory variables: year, the non-use of credit (cred_no), country dummies for Poland, Italy, Greece, France, Spain and the constant. The Netherlands is omitted due to collinearity, and is to be interpreted as the base. The negative effect of the year means that there is a decrease between the two periods of the intentions to invest in land. The farms that do not use any credit have a negative effect on the probability to invest, which reflects the positive correlation between credit use and investment. From this outcome it is not possible to affirm whether the willingness to invest encourages the use of credit, or whether the availability of credit encourages the willingness to invest, but only that the two variables are linked to each other. All of the coefficients of countries are negative, meaning that the probability to invest in these case studies is less compared to that of the Netherlands.

The correlation coefficient rho is interpreted as the proportion of the total variance contributed by the panel-level (i.e. subject level). The fact that the null hypothesis is rejected in our data, i.e. rho is significantly different from zero, means that the panel level variance is relevant and justifies the use of a random effect model.

Table 22: *Description of variables used in the panel analysis*

Variable name	Description
year	Year of the interview
invest_land	1 if the farmer intend to invest in land, 0 otherwise
invest_land_ha	hectares to be invested in
invest:mach	1 if the farmer intend to invest in machinery, 0 otherwise
invest_build	1 if the farmer intend to invest in buildings, 0 otherwise
land_tot	Total surface of the farms
head_age	Age of the farm head
head_lab_~01	1 if there are labour on farm by farm head, 0 otherwise
cred_no	1 if the farm don't use credit, 0 otherwise
Poland	1 if the farm is in Poland, 0 otherwise
italy	1 if the farm is in Italy, 0 otherwise
greece	1 if the farm is in Greece, 0 otherwise
france	1 if the farm is in France, 0 otherwise
espan	1 if the farm is in Spain, 0 otherwise
exp_pricep~d	-1 if the expectation is a decrease of price production, 1 if it is an increase, 0 otherwise
livest	1 if the farm specialisation is livestock, 0 otherwise
tree	1 if the farm specialisation is permanent crops, 0 otherwise
arable	1 if the farm specialisation is arable crop, 0 otherwise
_cons	constant

Table 23: *Output of the logit model where the dependent variable is the land investment decision (0-1)*

invest_land	Coef.	Std. Err.	z	P>lzl
year	-0.420***	0,138	-3,050	0,002
land_tot	0,0029	0,003	0,970	0,334
head_age	-0,018	0,018	-0,960	0,337
head_lab_~01	0,298	0,691	0,430	0,666
cred_no	-2.245***	0,794	-2,830	0,005
poland	-3.048***	1,008	-3,020	0,002
italy	-4.963***	1,150	-4,320	0,000
greece	-5.678***	1,469	-3,870	0,000
france	-4.092**	1,790	-2,290	0,022
espan	-4.709***	1,311	-3,590	0,000
exp_pricep~d	0,041	0,271	0,150	0,880
_cons	846.738***	276,974	3,060	0,002
sigma_u	1,286	0,464		
rho	0,334	0,161		
Likelihood-ratio test of rho=0 chibar2=3.31 Prob>= chibar2=0.035				
wald chi2	29,93			
Prob>chi2	0,001			

**** significant at 1%*

*** significant at 5%*

Table 24: Output of regression model with dependent variable land in hectares

invest_land_ha	Coef.	Std. Err.	z	P>lzl
year	0,991	1,149	0,860	0,389
land_tot	0.125***	0,033	3,800	0,000
head_age	-0,061	0,147	-0,420	0,677
head_lab_~01	2,630	5,106	0,520	0,606
cred_no	-1,857	5,629	-0,330	0,741
livest	-3,058	3,888	-0,790	0,432
tree	-4,528	4,695	-0,960	0,335
poland	26.764**	10,758	2,490	0,013
netherl	19,469	11,384	1,710	0,087
italy	24.794**	10,852	2,280	0,022
greece	15,218	12,732	1,200	0,232
espan	24,951	11,659	2,140	0,032
exp_pricep~d	2,275	2,067	1,100	0,271
_cons	-2004,580	2305,796	-0,870	0,385
sigma_u	2,514			
sigma_e	7,353			
rho	0,105			
wald chi2	45,09			
Prob>chi2	0,000			

**** significant at 1%*

*** significant at 5%*

Table 24. provides the estimated coefficients in a linear regression model, where the dependent variable is the number of hectares of land that the farm has stated to be willing to buy.

The significant coefficients are related to total farm land (land_tot), and the dummies for Poland, Italy, and Spain. France and the arable typology are omitted due to collinearity and could be considered as the base. The positive effect of 'total land' means that the amount of land intended to be purchase (in hectares) increases when the farm is larger. The positive coefficients of Poland, Italy, and Spain could be interpreted as a comparison with the France case study. Altogether, besides the country variables, it seems that the main determinant (positively) affecting the size of the investment is the size of the purchasing farm.

Table 25 summarises the output of a logit model where the dependent variable is the decision to invest in buildings (yes/no).

The coefficients are significant for the year, total farm land (land_tot), Italy, Greece, France and the constant. The Netherlands is omitted due to collinearity, and could be considered as the base. The negative coefficient of the year confirms the major trend represented by the decreased intentions to invest in the time period considered. Furthermore, in this model the farm size has a positive effect on the tendency to invest in buildings. All the country coefficients are negative, indicating their negative effect on the tendency to invest compared to the Netherlands case study.

Table 26 shows the output of a logit model where the dependent variable is the decision to invest in machinery (yes/no).

The coefficients are significant for the covariate year, Poland, Italy, Greece, Spain and the constant. The Netherlands is omitted due to collinearity, and could be considered as the base.

Table 25: Output of logit model where the dependent variable is the building investment decision

invest_build	Coef.	Std. Err.	z	P>lzl
year*	-0.495***	0,140	-3,550	0,000
land_tot	0.007**	0,003	2,460	0,014
head_age	-0,019	0,018	-1,030	0,305
head_lab_~01	0,522	0,811	0,640	0,520
cred_no	-0,118	0,507	-0,230	0,816
poland	-1,559	0,908	-1,720	0,086
italy	-3.233***	0,988	-3,270	0,001
greece	-4.025***	1,311	-3,070	0,002
france	-4.474**	1,944	-2,300	0,021
espan	-25,410	14295,740	0,000	0,999
exp_pricep~d	0,171	0,286	0,600	0,549
_cons	995.988***	280,190	3,550	0,000
sigma_u	1,534	0,416		
rho	0,417	0,132		
Likelihood-ratio test of rho=0 chibar2=7.85 Prob>= chibar2=0.003				
wald chi2	25,500			
Prob>chi2	0,007			

**** significant at 1%*

*** significant at 5%*

Table 26: Output of logit model where the dependent variable is the machinery investment decision

invest_mach	Coef.	Std. Err.	z	P>lzl
year	-0.487***	0,132	-3,700	0,000
land_tot	-0,000	0,003	-0,030	0,977
head_age	-0,026	0,018	-1,460	0,144
head_lab_~01	-0,854	0,748	-1,140	0,254
cred_no	-0,060	0,486	-0,120	0,902
poland	-2.503**	1,159	-2,160	0,031
italy	-4.535***	1,262	-3,590	0,000
greece	-5.141***	1,466	-3,510	0,000
france	-1,025	2,044	-0,500	0,616
espan	-4.976***	1,478	-3,370	0,001
exp_pricep~d	0,213	0,252	0,840	0,399
_cons	983.44***	264,604	3,720	0,000
sigma_u	1,625	0,446		
rho	0,445	0,136		
Likelihood-ratio test of rho=0 chibar2=9.42 Prob>= chibar2=0.001				
wald chi2	30,000			
Prob>chi2	0,001			

**** significant at 1%*

*** significant at 5%*

The reduction, due to the change in conditions between 2006 and 2009, is also confirmed in this typology of investment by the negativity of the year coefficient. However, the link to land size is not relevant for machinery, compared to buildings. The negative coefficients of the country covariates make clear the decrease in probability compared to the Netherlands case study.

In conclusion, some covariates and their effects are significant in all of the three different investment typologies. The covariate 'year' captures the negative trend of the investment decision in the period 2006-2009, and is negative for all of the investments. The country covariates, when significant, summarise a mix of variables and typical aspects of the different case studies considered. For land size and building investments the size of the farm shows a positive correlation which could be interpreted as a higher propensity on the part of large farms to invest.

6. Modelling: impact of scenarios

6.1 Baseline results

Farm income is highly different across the farm households modelled (from 67 € per ha in IT 80 MCA to 7,003 € per ha in DE 19 PCL) (Table 27).

The above heterogeneity is the result of country differences, farming specialisations and the differentiation in farm structure. Generally, livestock and tree specialisations have the highest values of farm income per ha. In addition, high values of farm income are obtained by those farms that differentiate sources of farm income, for example, by including rural tourism activities (e.g. DE 19 PCL).

Generally, the farm households modelled obtain the largest portion of household income from farming. The weight of farm income on household income is generally higher than 70%, with the exception of BG 14 MCA, IT 80 MCA, PO 04 PCL. In these farm-households, the result is due to relatively high income obtained by members employed off-farm.

The net investment indicator is rather heterogeneous among farming systems, and over the two time periods. Farms have either positive or negative values. Negative values mean that the disinvestments are greater than investments on the farm. Ten farms have a negative value of net investment in the first period, with values comprising between -9 €

Table 27: Results of baseline scenarios (social and economic indicators)

2009 model	Farm income (€/ha)		Household income (€/ha)		Net investment (€/ha)		On farm labour (hours/ha)	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	176	151	186	197	-9	5	31	31
BG 09 MCL	685	721	607	732	648	286	47	51
BG 14 MCA	184	178	230	268	17	7	18	20
DE 12 PCA	2.297	2.196	2.473	2.620	-839	478	18	20
DE 19 PCL	7.003	5.355	7.428	6.958	-98	199	160	160
DE 28 MCA	527	467	606	637	29	-654	9	9
DE 40 MCL	3.492	3.184	3.688	3.935	-519	450	94	117
ES 03 PCP	2.140	2.079	2.247	2.618	254	-173	90	91
FR 06 PCA	1.318	1.141	1.393	1.316	-39	166	7	7
GR 09 PCA	1.122	980	1.091	1.096	- 0	- 0	94	94
IT 21 MCL	3.741	2.812	5.549	4.932	1.247	837	184	183
IT 37 PCA	1.201	1.146	1.562	1.611	-38	16	11	11
IT 75 PCL	3.290	2.651	4.027	3.855	-3.482	1.193	133	141
IT 80 MCA	109	67	628	655	28	301	7	7
NL 08 PCL	2.383	- 0	3.447	- 0	-13.105	- 0	79	- 0
PL 03 PCA	719	633	769	936	65	-14	44	46
PL 04 PCL	268	206	723	6.072	-368	-1.131	64	64
PL 18 MCL	400	465	440	958	-147	-974	109	117

Table 28: Results of baseline scenarios (environmental indicators)

2009 model	Nitrogen (kg/ha)		Water (m³/ha)	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	25	25	- 0	- 0
BG 09 MCL	3	1	- 0	- 0
BG 14 MCA	14	15	- 0	- 0
DE 12 PCA	300	307	1.500	1.500
DE 19 PCL	211	211	- 0	- 0
DE 28 MCA	138	137	- 0	- 0
DE 40 MCL	73	46	- 0	- 0
ES 03 PCP	49	50	650	660
FR 06 PCA	175	175	537	537
GR 09 PCA	129	130	2.496	2.502
IT 21 MCL	1	- 0	- 0	- 0
IT 37 PCA	198	198	1.900	1.900
IT 75 PCL	19	19	214	222
IT 80 MCA	23	23	- 0	- 0
NL 08 PCL	176	- 0	- 0	- 0
PL 03 PCA	205	204	849	913
PL 04 PCL	83	82	190	190
PL 18 MCL	51	55	67	207

per ha in BG 07 PCA and -3,475 € per ha in IT 75 PCL. There are six farms which have negative values for net investment in the second period. The reduction of the number of negative values compared to the previous period is due to the price assumptions of the reference scenario, which assumes a price increase in the period from 2014 to 2020. With the exception of the two farms in Poland, the farms with negative values of net investment in the second period had positive values of the indicator in the first period, which hints at the potential allocation of investment needs on the two periods, depending on assets' age.

The amount of on-farm labour is generally constant among periods. However, in some farms the amount of labour used in the second period increased significantly per unit of land, due to the decrease of agricultural area (DE 40 MCL; IT 75 PCL and PO 18 MCL).

The baseline environmental indicators are also very different among case studies, mainly due to the different land uses among countries and systems (Table 28).

Nitrogen use is between 1 kg per ha in model BG 09 MCL and 205 kg per ha in PO 03 PCA. Water usage varies, and generally depends on the climatic conditions in the case study areas. The highest farm water use is 2502 m³ per ha in GR 09 PCA as a consequence of the significant water requirements for cotton and maize crops in the area (for "continental" systems this indicator is not included).

The marginal value of selected resource constraints in the baseline scenario is shown in Table 29.

As in the model each resource was assigned a price for buying or selling (in a limited amount), these marginal values are marginal contributions to income by each resource above the local price included in the model. The marginal value of land above the local rent reported is generally positive,

Table 29: *Marginal value of selected resources in the baseline scenario*[14]

2009 model	max rent-in (€/ha)		max land buy (€/ha)		max labour purchase (€/ha)		saving (€/ha)	
	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020
BG 07 PCA	- 0	- 0	- 0	- 0	5,76	4,41	0,70	0,40
BG 09 MCL	1,17	114,14	- 0	- 0	- 0	- 0	1,53	0,43
BG 14 MCA	53,15	31,05	- 0	- 0	3,49	3,24	0,70	0,40
DE 12 PCA	111,23	- 0	- 0	- 0	- 0	- 0	0,55	0,31
DE 19 PCL	209,07	316,16	- 0	- 0	36,22	16,37	0,54	0,31
DE 28 MCA	647,26	366,80	598,67	- 0	240,37	128,68	0,54	0,31
DE 40 MCL	270,07	258,97	- 0	- 0	- 0	- 0	0,54	0,31
ES 03 PCP	517,76	752,05	- 0	- 0	3,02	2,35	0,65	0,39
FR 06 PCA	1.472,00	1.007,71	10.853,55	7.682,48	- 0	- 0	0,25	0,15
GR 09 PCA	1.066,26	1.054,17	2.426,90	1.068,91	- 0	- 0	0,79	0,45
IT 21 MCL	430,51	476,29	- 0	- 0	- 0	- 0	0,30	0,19
IT 37 PCA	457,03	338,77	- 0	- 0	- 0	- 0	0,30	0,19
IT 75 PCL	337,83	374,94	- 0	- 0	- 0	- 0	0,30	0,19
IT 80 MCA	364,28	256,11	- 0	- 0	- 0	- 0	0,59	0,43
NL 08 PCL	134,16	30,62	- 0	- 0	- 0	- 0	0,20	0,22
PL 03 PCA	- 0	- 0	- 0	- 0	55,17	45,68	1,12	0,61
PL 04 PCL	121,30	- 0	- 0	- 0	- 0	- 0	1,12	0,61
PL 18 MCL	219,94	74,34	- 0	- 0	- 0	- 0	1,12	0,61

with a few exceptions for Bulgaria and Poland[15]. The highest marginal values are for France and Greece due to the large amount of value added crops cultivated in this case study areas. In the period 2014-2020, marginal values drop in most cases, as expected, with the general exception of livestock farms, in which the positive trend in prices overcompensates for the shortest time period for the exploitation of the dynamic effects. The marginal value of land purchases is less relevant as only 3 farms in the period 2009-2013, and 2 in the period 2014-2020 have a positive value. Maximum labour purchase is positive and very high only in a few cases related to arable farming with little amount of labour use.

14 Marginal values in constrained optimization reflect the change in the objective function due to a unit change in resource availability. Zero values mean that the resource is not constraining.

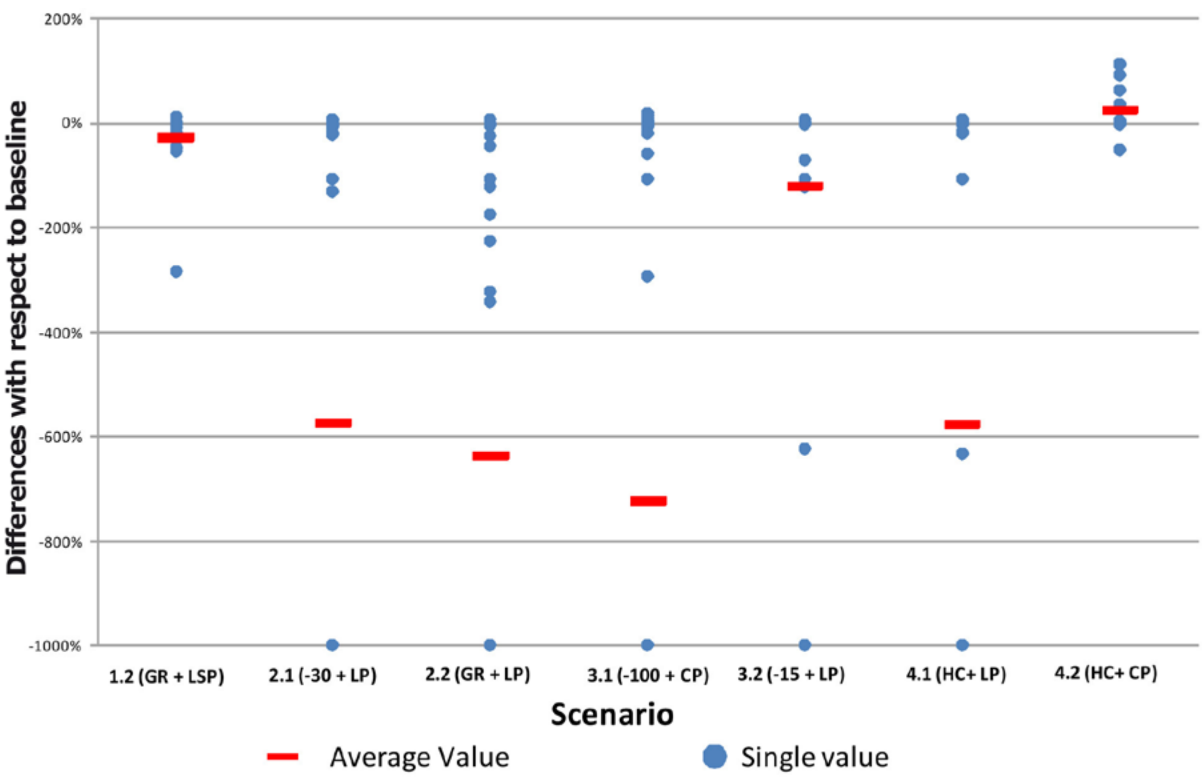
15 These results reflect average dynamic effects of annual constraints, and are not directly comparable with current market prices of, for example, land rent. See annex B for further details.

The scenario analysis is presented in two parts: first, the effects of different scenario hypotheses on investment behaviour, and second, the effects of these hypotheses on farm sustainability.

6.2 Scenario effects on investment behaviour

The impact on investment behaviour is presented by calculating differences with respect to the baseline (Scenario 1.1) as well as for different aggregations: average of all models; average between farms belonging to the same geographical area; average between farms belonging the same altitude; average between the farms with the same farm specialisations.. The average result of all 18 models in each scenario and the graphical distribution of individual models is shown in Figure 31.

Figure 31: Scenario effect on net investment (all models)[16]



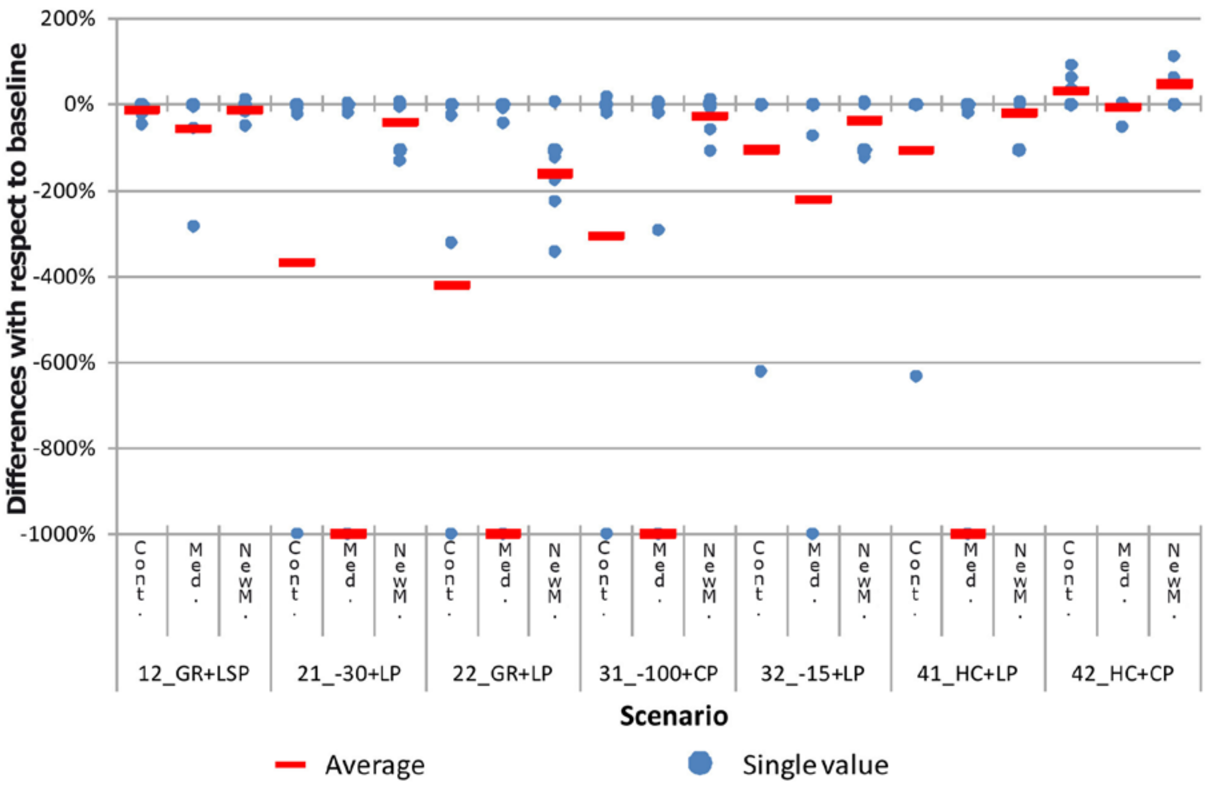
Farmers react heterogeneously over the entirety of the scenarios. Six scenarios result in negative impacts on net investment values, reducing the amount of investment with respect to the baseline. Only under the hypotheses of scenario 4.2 (HC + CP) does an average increase of the net investment indicator occur. The average net investment indicators with respect to the baseline for Scenarios 2.1 (-30% +LP), 2.2 (GR+LP), 3.1 (-100+CP) and 4.1 (HC+LP) decreased by more than 500% (five times). Such a negative performance is mainly due to several farms exiting from agricultural activity (farms which fall in the category with values lower than -1000% in the figure), the choice of which has a strong effect on the average change in investment. For this reason the worst scenario (on average) seems to be scenario 3.1 (-100% +CP). This scenario, along with the 'best' scenario 4.2 (HC+CP), presents some single value of positive net investment with respect to the baseline, emphasising the variability of reactions by individual farms to the different scenario conditions. Such results can be explained by the strong influence of prices on farm investment; in particular the current level of prices can result in an increase in farm investment with respect to the Scenar2020 II reference hypotheses. Furthermore, the conservation of the SFP in scenario 4.2 strongly impacts on both farm growth and farm survival, as it can be detected comparing the two scenarios with current prices (3.1 and 4.2).

Changes in net investment with respect to the baseline disaggregated by geographic area are presented in Figure 32.

Farms from different geographic regions react heterogeneously in all scenarios, though their average change remains negative in almost all cases, even after disaggregation. Only in scenario 4.2 (HC+CP) is the value of net investment with

16 Values less than 10 times with respect to baseline (-1000%) have been truncated in the graph. However, the average has been calculated with all values.

Figure 32: Scenario effect on net investment (aggregation by geographic area)[17]



respect to the baseline positive for Continental Areas (Dutch, French and German Farms) and New Member States (Bulgarian and Polish Farms), while at the same time being negative for Mediterranean Areas (Greek, Italian and Spanish Farms). The farms in Mediterranean Areas experience a greater decrease in the net investment indicator with respect to the baseline. For these areas, the average decrease is higher than -1000% (10 times) in four scenarios out of seven, as a consequence of either the complete removal of the SFP in scenario 3.1 (-100%+CP) or the low level of prices as in scenarios 2.1 (-30+LP); 2.2 (GR+LP) and 4.1 (HC+LP). These results are mostly generated by the very low value of investment in the baseline, and the size of the relative amount should be taken carefully. Net investment values with respect to the baseline in Continental Area farms have the same trends as in Mediterranean Areas, but at a lower level. The net investment value with respect to the baseline does not change significantly in the farms from New Member States among the different scenarios.

Changes in net investment with respect to the baseline disaggregated by altitude are presented in Figure 33.

The net investment indicator changes significantly between farms in different altitudes across the scenarios. In all of these scenarios assuming low price levels (2.1 (-30+LP), 2.2 (GR+LP) and 4.1 (HC+LP)) the reduction with respect to the baseline is lower than 700% in plains, and from 150% to 300% in mountain areas. The other scenarios do not have relevant changes in net investment indicators among different altitude conditions.

17 Values less than 10 times with respect to the baseline (-1000%) have been truncated in the graph. T he average has been calculated with the real value.

Figure 33: Scenario effect on net investment (aggregation by altitude)[18]

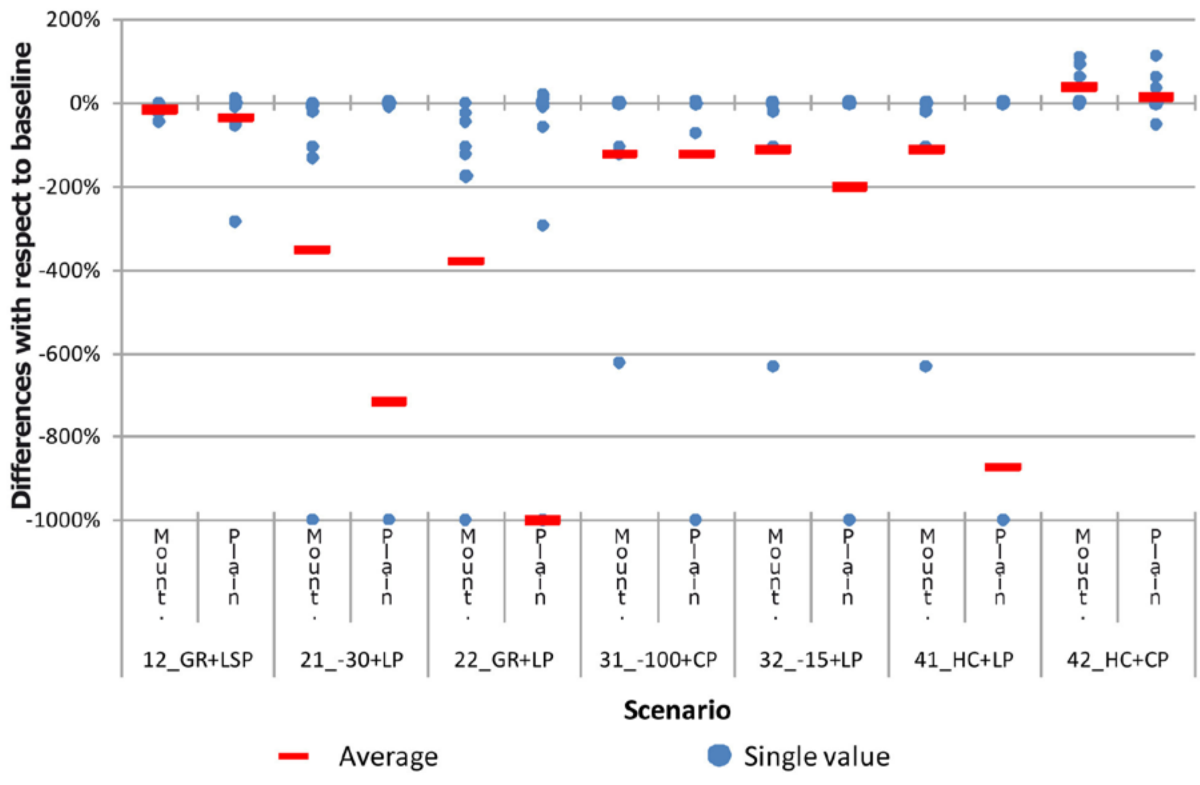
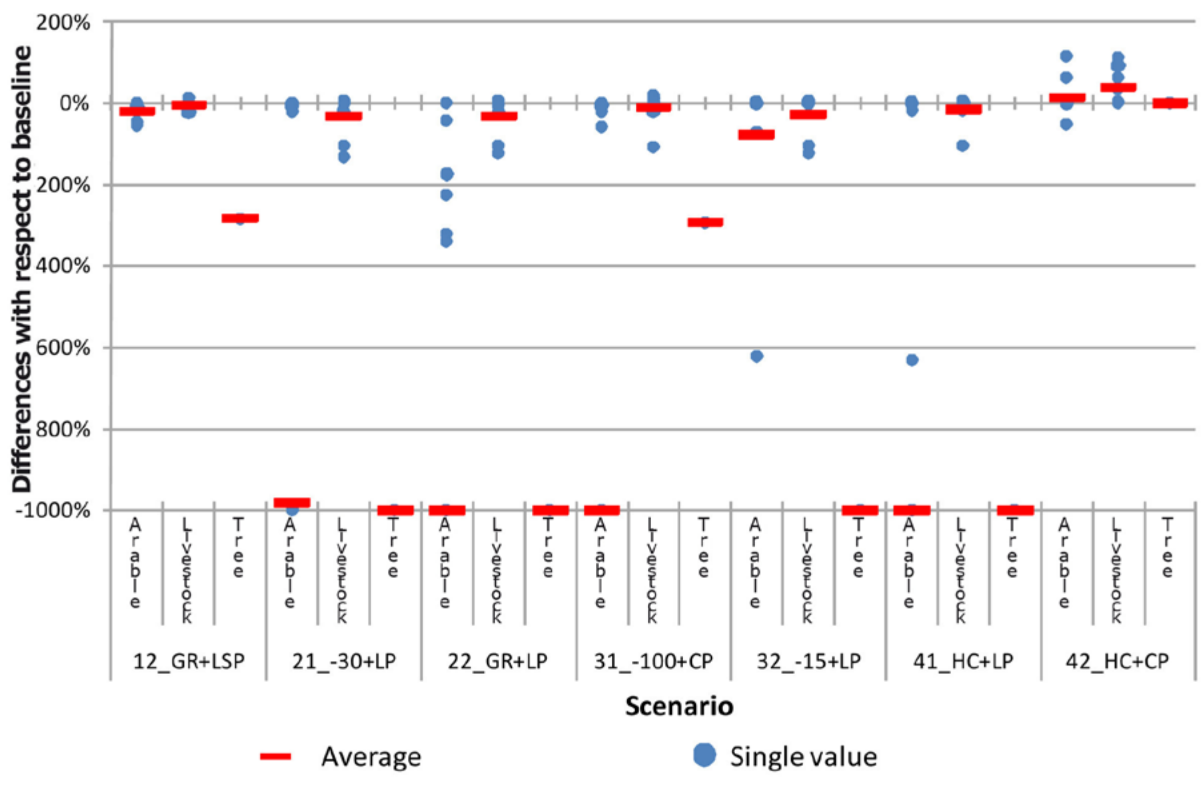


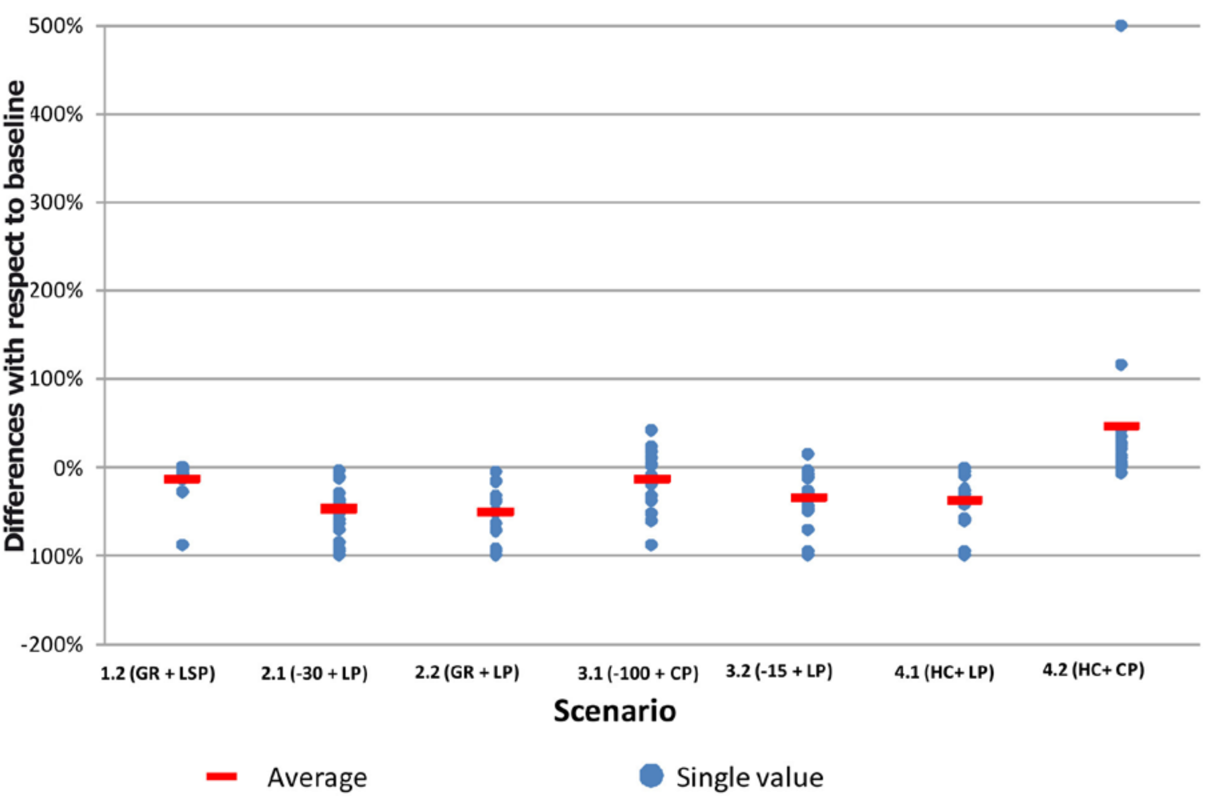
Figure 34: Scenario effect on net investment (aggregation by farm specialisation)[19]



18 Values less than 10 times with respect to the baseline (-1000%) have been truncated in the graph. However, the average has been calculated with the real value.

19 Value less than 10 time with respect to baseline (-1000%) has been truncated in the graph. However the average has been calculated with the real value.

Figure 35: Scenario effect on farm income (all models)[20]



Differences in net investment indicators among farm specialisations are shown in Figure 34.

Scenario hypotheses impact heterogeneously on net investment indicators among different farm specialisations: arable and tree farm specialisations are negatively affected by scenario hypotheses, while livestock farming is relatively more stable. In fact, the hypothesis of a 20% price reduction (scenarios 2.1, 2.2, 3.2 and 4.1) induces high disinvestments in both arable and tree specialisations, while livestock farms do not show relevant changes with respect to the baseline.

6.3 Scenario Impacts on sustainability

The impacts of the different scenario hypotheses on sustainability are presented through a comparison for each indicator with respect to the baseline.

The averages of the farm income indicator under different scenario hypotheses change from -50% in scenario 2.2 (GR +LP) to +47% in scenario 4.2 (HC+CP) (Figure 35).

Only scenario 4.2 (HC+LP) experiences an increase in farm income. This increase is strongly influenced by an outlier farm, with an increase higher than 5 times with respect to the baseline, but is also consistent with the prevailing direction of change in the income of the other farms. Scenarios with lower price hypotheses have the worst performances. However, even with current prices the scenario with no CAP payments (3.1) sees a decrease in farm profit with respect to the baseline.

Changes in household income indicators under different scenario hypotheses are more limited compared to farm income due to the fact that farm-related drivers are "diluted"

20 Values higher than 5 times with respect to the baseline (+500%) have been truncated in the graph. The average has been calculated with all values.

Figure 36: Scenario effect on household income (all models)

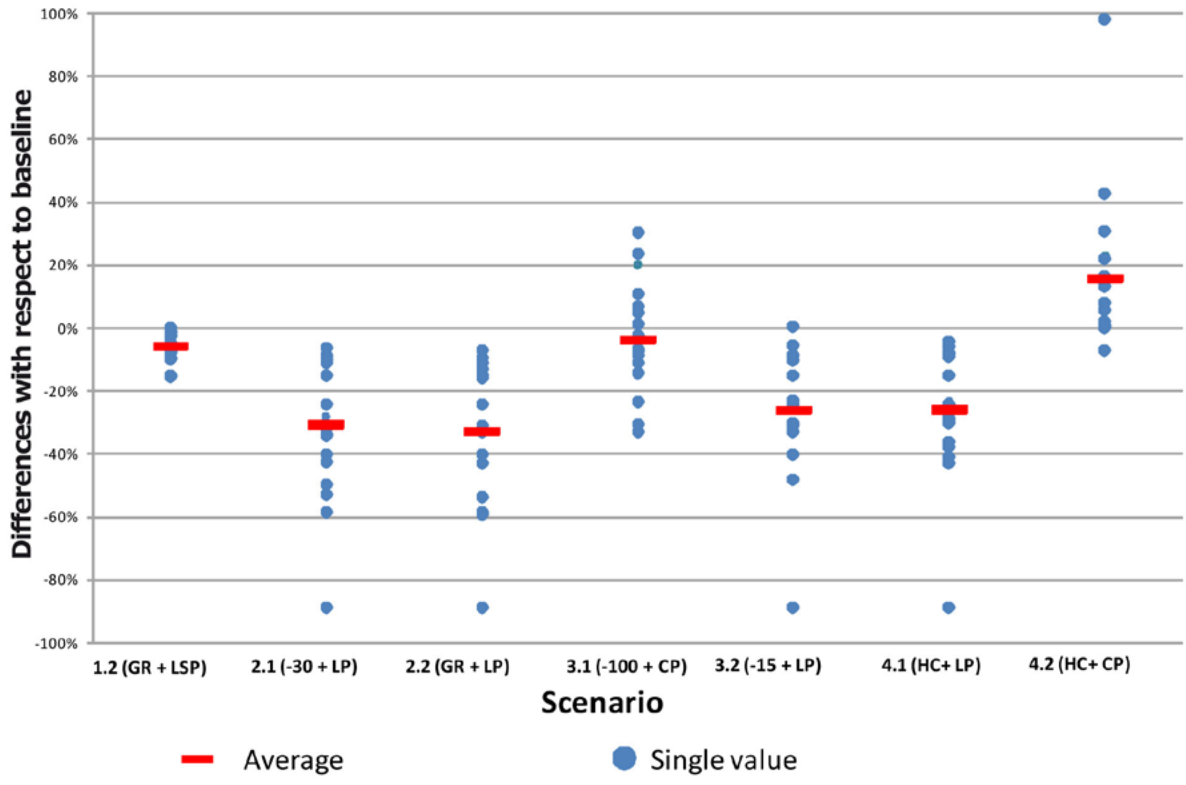


Figure 37: Scenario effect on on-farm labour (all models)

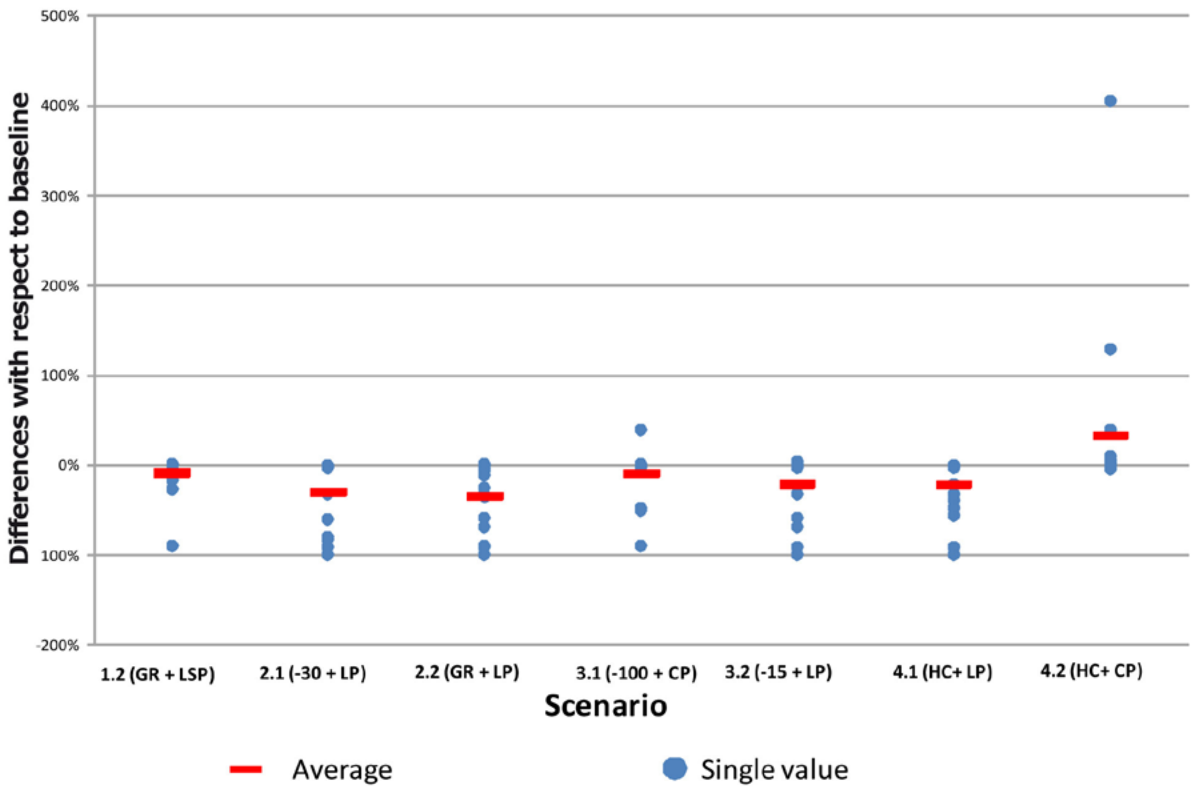
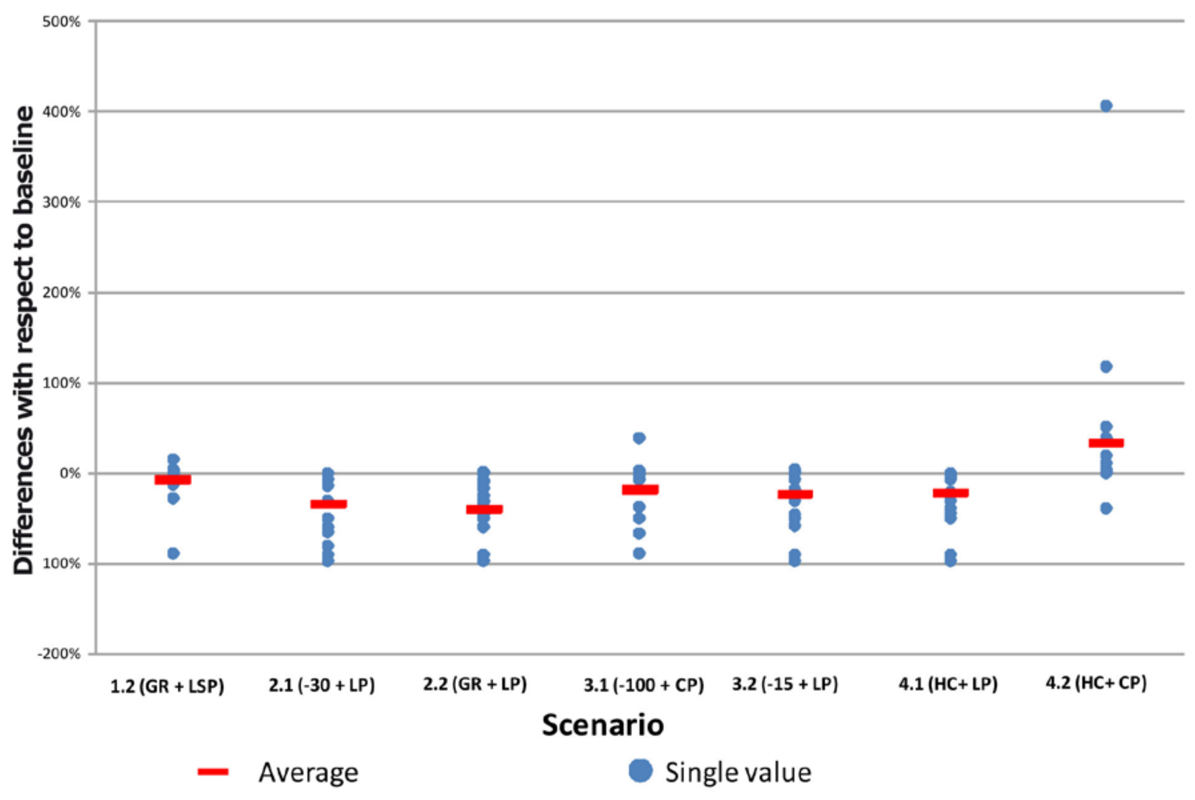


Figure 38: Scenario effect on nitrogen use (all models)



over the whole farm-household income (Figure 36).

In six scenarios the average changes with respect to the baseline are negative, with values form -3% to -30%, and the changes among scenarios are in line with those concerning farm income. Only in scenario 4.2, does the average value of the household income indicator increase by 17%.

The average on-farm labour indicator under different scenario hypotheses changes from -32% in scenario 2.2 (GR +LP) to +34% in scenario 4.2 (HC+CP) (Figure 37).

The scenario hypotheses impact on on-farm labour similarly to the economic indicators, showing that the differences in income are not just an effect of payments and prices, but also drive changes in farm organisation and the employment potential of farming.

Environmental impacts are shown in Figure 38 and Figure 39 with respect to impacts on nitrogen and water use.

Changes with respect to the baseline are lower for both nitrogen and water use compared to the other indicators previously illustrated. Differences range from – 40% to +33% for nitrogen and from –16% to +24% for water.

A summary of the effects of the different scenarios on sustainability measured through the different indicators illustrated above is provided in Table 30, using a qualitative scale (+,0, -).

In this context, the reduction of nitrogen and water use are coded as "+", as they reflect a positive effect in terms of sustainability.

Under this representation, three main groups of scenarios can be identified: the first group, represented by scenarios 1.2 (GR+LSP) and

Figure 39: Scenario effect on water use (all models)

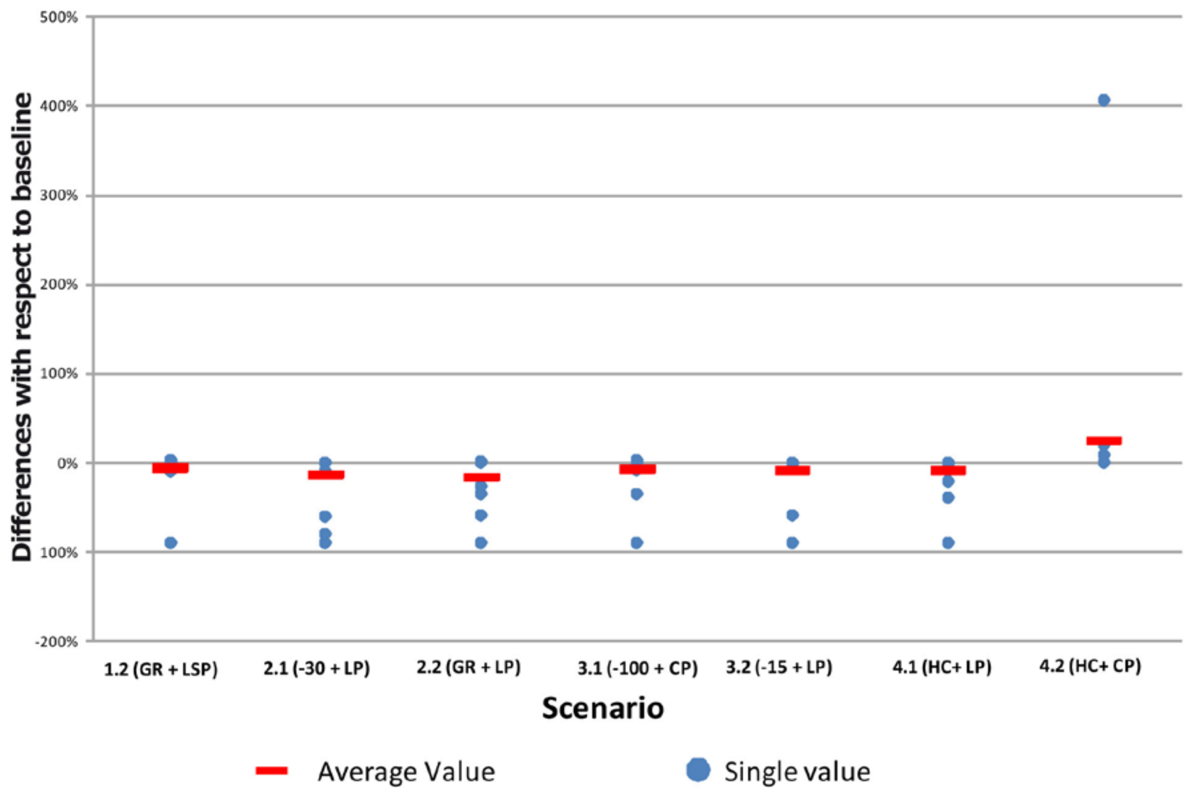


Table 30: Scenario effect on sustainability

Scenarios	1.2 (GR+LSP)	2.1 (-30+LP)	2.2 (GR+LP)	3.1 (-100+CP)	3.2 (-15+LP)	4.1 (HC+LP)	4.2 (HC+CP)
Farm income	0	-	-	0	-	-	+
Household income	0	-	-	0	-	-	0
On-farm labour	0	0	-	0	0	0	0
Nitrogen use	0	+	+	0	0	0	0
Water use	+	+	+	+	+	+	0

3.1 (-100+CP), reflects substantial stability in economic and social indicators, while showing some positive change in terms of environmental impact. The main driver in this direction seems to be represented by the change in payments. The second group of scenarios includes 2.1 (-30+LP), 2.2 (GR+LP), 3.2 (-15+LP) and 4.1 (HC+LP). The main feature of this group of scenarios is the strong trade-off between economic effects (always negative in these scenarios) and environmental effects (always positive for water, and in two cases also for nitrogen). The strongest trade-off appears in scenario 2.2, in which the negative impact on labour adds to the negative results of the economic indicators, while nitrogen use reduction adds to water use reduction in providing environmental benefits. The main driver in these cases is the flat price reduction by 20% compared to initial (2009) conditions that, while affecting income negatively, would also reduce the intensity of production.

Finally, scenario 4.2 (HC+CP) forms the third group, and is characterised by minor differences in all indicators, except for better performance in farm income, due to the associated higher prices and payments.

7. Discussion and policy implications

7.1 Evaluation of project outcomes and limitations

Before conclusions can be drawn from these results, and policy implications derived, two significant limitations emerging from this study must be highlighted:

- First, there is significant variability across systems, with each system showing very different results; this prevents providing average-based generalisations, and points to the need for a deeper analysis of individual contexts.
- Second, investment also depends on farm/farmer specific factors which were not always detected or manageable in this study, due to both study design and sample size. In particular, the outcome of the survey reveals an important trade-off between the in-depth contents of individual interviews and the numerical ability to provide statistically reliable results.
- The period in which the 2009 survey was carried out, and the interval between 2006 and 2009, were characterised by rapid changes in the economic context (agricultural product and factor prices, economic and financial crisis), that likely led to quick changes in perceptions and expectations, as well as high uncertainty about future directions in farming.

These limitations lead to major difficulties in generalising investment behaviour and reactions to policy intervention which are consistent with the complexity of the themes addressed by the literature on farm investment behaviour.

The modelling framework adopted underscores the above-mentioned complexity. While focusing on detailed representation of specific technical features and farm-household decision drivers (e.g. asset age), high variability is added by the high number of factors in play. Consequently, policy effects are also extremely varied across the sample and cannot be easily reconnected to general behavioural conclusions for the purposes of policy evaluation.

Taking into account these limitations, the following main messages and implications for policy can still be derived from the present analysis.

7.2 Main messages

The periods observed (2006 and 2009), were characterised by both high prices and cost volatility, and by the final stages of the introduction and consolidation of the decoupling of payments. This led to growing attention on agricultural product markets and on production factors markets as determinants of farm choices, including investment. The results of this study concerning the *ex-post* analysis of farm household reactions to the changes in the economic context highlight this relationship, in particular through the reduction of credit available and the reduction of the share of farms that intend to carry out investments in the near future.

In spite of the average trend, it appears clear, in the comparison between 2009 and 2006, that farm behaviour remains particularly heterogeneous and that a thorough interpretation of the determinants of single farm reactions remains difficult due to the limited size of the sample, and its relevant sampling biases (driven by initial coverage requirements). In addition, it remains very difficult to evaluate which effects are short- and which are long-term.

A better understanding of what may be the longer term incentive conditions could be derived from the combination of these results with the results of scenario modelling. Since the scenarios are mostly based on prices and/or payment reductions, all of them would yield worse economic results compared with the present situation. Given the narrow profit margins, price decreases in the range of 20% would have a very detrimental effect on economic sustainability and investment. The same happens, albeit with less extreme results, when the SFP is removed. This is confirmed, though partly attenuated, in the baseline hypothesis of the Scenar 2020 II reference scenario (Scenario 1.1 -30+ RSP). This happens because in the Scenar 2020 II hypotheses, exogenous price dynamics are explicitly taken into account, allowing for some recovery in the 2014-2020 period, which would compensate for decreased payments. The outcomes of modelling in turn require a careful examination, as they are based on "ceteris paribus" assumptions about the economic context and a simplified representation of decision mechanisms. An example is the relevant role of exits from farming predicted by the model. This indicates a direction of change, but cannot be expected to be observed in reality, at least in the short-term, due to the time needed for the decision and the implementation of the exit process, not considered in the model, or due to actual employment difficulties in other sectors, which is also not completely considered in the model. As a further example, reduction of first pillar payments are not supposed to be compensated by increases in pillar II funding.

As a result of the difficult and uncertain economic context, and the mostly negative market scenarios, the role of policy seems to be reinforced compared to the previous study carried out in 2006. The SFP appears to have a more direct role in supporting farm profitability and contributing to household income. Since this is occurring partly due to the SFP contribution to cover production costs, this also indicates that the SFP is not fully decoupled from farming activity. In addition, second pillar support to investment is reported as a major determinant of investment choices of many farms.

This reduces the stated effect of decoupling witnessed in the 2006 study. In particular, the mostly negative market trends have negatively influenced the on-farm investment effects of decoupling and payments are used in a more conservative way to cover current expenditures. On the other hand, productive off-farm investment seems to have increased.

The evidence of a number of different determinants reveals that a key role in specific investment decisions is played by past investments and the overall existing farm and farm-household strategy, also taking into account household cycles, and expectations regarding prices and policy (with a different relevance depending on the specific sector). Decoupling also emphasises the role of other policies (e.g. environmental, energy, land planning) in determining the farm's strategic orientation.

The perception of the economic context is increasingly dominated by uncertainty. The territorial and chain dimensions are not in the scope of this study, but are relevant in times of high market volatility, and add to other variables in explaining individual differences.

7.3 Policy implications

Based on the results discussed above, the key to derive policy implications remains the differentiation of policy addressees. In this respect, the broad division of four farm-household typologies with respect to policy proposed in the previous investment study (Gallerani et al., 2008) remains relevant:

a) CAP-indifferent, referring to farm-households for which the Common Agricultural Policy has no major economic impact, and does not affect farm decisions;

b) Income-CAP-dependent, referring to farm-households for which the CAP contributes to income, but does not affect agricultural activities;

c) Farming-CAP-dependent retiring, referring to farm-households for which the CAP is a major determinant of farming choices, but which do not expect to continue their farming activities;

d) Farming-CAP-dependent expanding, referring to farm-households for which the CAP is a major determinant of farming choices, and the farm follows a strategy focused mostly on expansion.

The above types are related mainly to individual characteristics and cannot be associated with any particular farming system. Yet, type a) can be observed more frequently in EU-15 farms, operating in a context with greater economic opportunities.

The findings of the present study confirm the need for policy to pay particular attention to types b) and d), for the respective objectives of income protection and supporting investment and competitiveness.

Further, policy implications are to be seen in the framework of the consolidation of the findings of the recent literature on the 2003 decoupling, and the emerging debate on the future of the Common Agricultural Policy after 2013. This calls for moving attention away from assessing the effects of decoupling and focusing on: a) a more direct understanding of the suitability of present policy instruments for emerging needs, and; b) consideration of potentially relevant alternative policy instruments for the future.

This is addressed under the following main policy areas:

a) income support;
b) investment support;
c) access to credit;
d) risk and uncertainty;
e) market access;
f) cross-policy mechanisms;
g) transition mechanisms.

The differences in use of the SFP and the propensity to exit from farming, particularly in the worst scenarios, allows for the identification of a basic need for funds from CAP payments as income support (point a). This is either related to the individual household characteristics (e.g. low income), or to the location of farming activities (e.g. disadvantaged areas). This supports the concept of a first level of policy interventions focussed on basic income support, some of which could be linked to location (and farming), and others to household characteristics. This tends, however, to shift to the debate between agricultural and social policy domains, and needs to be connected to the actual social relevance of maintaining agriculture/land management activities (and not just supporting income *per se*).

The economic and financial crisis and the uncertainty about the future strongly influence investment behaviour. The results underscore the relevance of present policy interventions to support investment, and likely the need to maintain and strengthen the measures in place (point b).

This is particularly relevant in cases where the credit market is subject to important failures or shortages, as occurred in the current crisis, or where the farm structure and the national loan regulations set constraints on access to credit. However, the negative results of most scenarios hint at the fact that most investment would be unprofitable if the price-cost margin were to drop significantly in the future. As a result, “blind” support for investment would likely cause over-investment. Investment support should be rather pursued with attention to the adequacy of different capital endowments, technology change strategies and a careful selection of the most promising beneficiaries.

Credit appears to be a major issue in the short-term, due to the financial crisis (point c), but also in the longer term, due to the increasing trend of farm dependency on external capital, and the significant number of farm-households stating an intention to invest. In addition, high quality of life expectations and increased structuring of internal household relationship seem to provide increasing limitations on the use of household savings for investment. Increased dependency from credit by farms requires more policies dedicated to this field.

The results further stress the perceived need for uncertainty-management instruments (point d). Farmers have a very weak position in markets compared to other actors, and the market context is increasingly volatile. In addition, the farmers that have been encouraged to invest more (through investment support) are consequently more exposed to difficulties, particularly in the worst market scenarios. Innovative instruments to reduce risk over the lifecycle of the funded investment would allow for compensation for the increased difficulties encountered.

On the other hand, these issues need to be directly addressed on the side of market connections, even if not directly addressed in this study (point e). This includes market information, chain structuring measures, support for market access and an appropriate marketing strategy.

Many of the considerations above draw attention to cross-policy mechanisms (point f). Particularly in a context of reduced direct income support, the consistency between investment subsidies and credit and risk-management tools will be key factors for effective incentives for investment. For example, counter-cyclical income support, or insurance systems, could be an appropriate complement to investment funding, in order to offset higher risks taken by farmers through co-funding of investments by RDP measures. Furthermore, an increased connection between credit instruments and direct incentives for investment discussed in point b) could be explored.

Finally, if relevant policy changes are to be adopted, transitory mechanisms (point g) should be considered as an opportunity for increased targeting and stimulating self-selection by farmers, in order to concentrate policy attention on those who respond better. The difficulty in finding consistency between the use of the SFP, farm strategies and the social objectives attached to agriculture points to the need to support more self-tailoring solutions. For example, assuming a move of the CAP budget towards pillar II measures, a mechanism that could be further explored is the possibility to use the present SFP as an “option” right, in which the farmer owning the right can choose between using such a right as a payment for the provision of public goods, or as an investment subsidy (or credit mechanism).

Altogether the results of this study strengthen the need to pay greater attention to the targeting of the various policy components to the policy objectives attached to the different farm types discussed above.

8. Conclusions

The main outcomes of the study, arising from the analysis of the results of the 2009 survey, and the comparison between the 2009 and 2006 surveys, can be summarised as follows:

- Distribution of payments: a tendency towards the concentration of payments was observed, with payments moving out of mountain and emerging livestock systems towards plain areas, arable crops and conventional systems, due to land and entitlement transfers.
- Impact on individual farms: the impact of the CAP decoupling introduced in 2005/2006 is confirmed to be low or negligible for more than half of farm-households; compared to 2006, the share of farms stating an increase in on-farm investment as a reaction to the introduction of the SFP has decreased, while more farms state a decrease in on-farm investments. The use of SFP to cover current expenditures prevails in 2009, and a strong shift is observed from its use to pay for investments to coverage of current expenditures between 2006 and 2009 (as a consequence of the income reduction many farmers were facing during the financial and economic crisis).
- Impacts on farm behaviour and objectives: the ranking of farm-household objectives is almost the same in the two surveys. However, in 2009 greater attention is paid to agricultural activities and diversification, than to leisure (and, more generally speaking, "quality of life"-related indicators), focusing more on the effective involvement of the household in farming.
- Trends in investment: intentions to invest are high in both surveys, but the share of farms willing to invest is significantly lower in 2009 compared to 2006, the difference being more pronounced for buildings and machinery, while land seems to follow different drivers. The panel analysis shows that the year of the survey (2006 and 2009) as well as specific case study conditions are the main significant determinants of investment choices. Actual investment, based on *ex-post* information, showed a relevant deviation from investments planned in 2006 (but mainly concerning investment timing and typology), as well as a high dependency on RDP payments under axis 1.
- Transitory shifts: in 2009, compared to 2006, greater attention is paid to short-term constraints, particularly credit limitations, which is corroborated by the results concerning the availability of short-term credit (which has decreased significantly).

These trends are highly variable across systems. In particular, mountain areas seem to show the greatest difficulties, and clearly evaluating different specialisations and technologies has proven more challenging.

The differences between the 2006 and 2009 results are likely to be caused by a mix of additional constraints arising from the financial crisis, short-term perceptions of uncertainty, and longer term revision of expectations, which are difficult to evaluate regarding their relevance for longer term considerations.

The modelling results confirm the differing reactions of the farming systems considered to policy and price scenarios:

- compared to the 2006, the simulation confirms that price levels (in the range considered) are more important than income support by (de)coupled payments as a driver of both income and investment; this relationship is more articulated for some systems (in particular arable crops) as far as investments are concerned;

- Scenar 2020 II and other scenarios simulating a reduction of payments and/or prices reflect a context that is more pessimistic than the real 2009 economic conditions; this results in lower investment, lower income, reductions in labour use, reduced nitrogen and water use; the negative economic results of these scenarios also seem to cause a number of households to find it more profitable to exit agriculture;
- the variability of policy effects among farming systems is very high and Mediterranean systems appear to be in comparison the most vulnerable;
- variability within systems is very high, due to the number of individual farm-household specificities that contribute to the determination of the results; this concerns, in particular, the share of farm-household income derived from agriculture, individual consumption expectations, and asset specificities, such as age, as far as investments are concerned.

Based on these results, the above policy considerations emphasise in particular: a) the need for appropriate income support in more disadvantaged/fragile areas; b) the need for an appropriate mix of policy instruments to provide incentives to invest while at the same time managing risks.

The outcome of this study, considered in light of the present market and policy context, leads to several considerations about future research needs. The panel approach has proven to be very effective in revealing important phenomena, even with a small sample of farms. This was magnified by the strong changes in the economy which occurred during the period of observation (2006-2009). At the same time, the replication of the scenario simulation through farm-household models has proven to be useful in considering adaptations to ever-changing policy conditions.

This justifies the potential of further replicate the study on the same sample in parallel to future policy reforms. In this case, however, the following improvements should be considered:

- The econometric part which analyses the primary data should be expanded in terms of sample size and strengthened in terms of the focus of the survey.
- The simulations by way of models should be expanded in the scope of the decision mechanisms, to cover risk and household preferences regarding labour use and leisure. Equally, a more elaborated calibration exercise, e.g. based on Positive Mathematical Programming (PMP) in conjunction with exogenous elasticities, could be adopted, with the aim of obtaining more robust models. This would also imply methodological innovation since, to the best knowledge of the authors, PMP applications in relation to investment decisions have yet to be attempted.

In addition, the following issues should be considered to shape further research:

- decoupling, though with some delay, has now been widely addressed in the literature and it seems that the understanding of its main effects has already been achieved; it is hence suggested to move toward considering further policy questions related to investment, either connected to pillar II or the post-2013 CAP reform proposals;
- there seems to be demand for studying innovative policy options, not explicitly addressed in existing studies, which are mostly focused on the evaluation

of existing tools or their applications; a stronger focus on *ex ante* assessments of alternative policy mechanisms could be of interest in this period in light of the upcoming negotiations for the post 2013 CAP;

- there is a need for considering additional issues complementary to those already addressed in this project, such as entrepreneurship, outsourcing, contracting and chain/network connections, all of which are increasingly connected to investment;
- the relevance of pillar two (axis 1) measures encourages greater attention to detailed analyses of the impact of such policy instruments on investment behaviour at the farm/household level, with a focus on understanding the actual and potential additional effects of the second pillar policies by investigating participation mechanisms and effects of alternative policy designs.

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■ 10. Annex A - The questionnaire

CALL FOR TENDERS J05/25/2008

CONTRACT N. 151247-2008 A08-IT

FARM INVESTMENT BEHAVIOUR UNDER THE CAP REFORM PROCESS

Task 2

Questionnaire

Authors: Raggi M., Viaggi D.

Diffusion: All subcontractors / IPTS

Bologna, February 2009

Presentation and treatment of personal data

The purpose of this questionnaire is to collect information within the project "FARM INVESTMENT BEHAVIOUR UNDER THE CAP REFORM PROCESS CALL FOR TENDERS J05/25/2008, CONTRACT N. 151247-2008 A08-IT, funded by the European Commission through the JOINT RESEARCH CENTRE, Institute for Prospective Technological Studies (Seville).

The questionnaire focuses on the future of rural households and their investment behaviour. Various information is requested related to farm and non-farm activities, including personal objectives and expectations. The data collected will be treated in a completely anonymous manner.

Add here a sentence about treatment of personal data according to national law.

Questionnaire code 2009[21]:_______

Questionnaire code 2006:___ ___

1.Location and contact details

1) Country____
2) Region/area _______________________ 3) Post code __________________________
4) Address ____
4b) Less Favoured Area (Yes/No)____
5) Name of interviewee ____
6) Name of Interviewer____
7) Date_____________________________
8) 8) Time taken to filling-in _________________

1b To be filled in in case the household has ceased the farming activity

1b.1 What was the main motivation for ceasing to farm?

____
____
____
____
____

1b.2 What changes did this bring in your labour activities?

____
____
____

21 Country code+number+type code

1b.3 What happen to your farm?

1. I sold the farm and the house, and moved elsewhere
2. I kept the house and sold the land and buildings
3. I retained ownership and rented out land and buildings
4. Others_______________________________

1b.4 Who took up the farm?

1. A family member
2. A neighbouring farmer
3. A new farmer
4. A non-agricultural company
5. Others_____________________

(if possible ask for the contact of the person/company taking up the farm)

2. Farm type, structure and specialisation

2.1 Legal status of the farm

1) Individual/family farm
2) Limited company
3) Cooperative farm
4) Other, namely____

2.2 Land ownership (ha)[22]

Type	Area
Owned	
Rent in	
Rent out	
Other (specify_____________)	

2.2b Number of plots (comment if required)

____

2.3 Location

1) Plain
2) Hill/mountain

2.4 Farm specialisation

1. Crops
2. Livestock
3. Orchard/vineyard/forest

22 All types of land, please comment on type if some is not UAA.

Comments

____

____

____

____

2.5 Type of production

3) Mostly conventional
4) Mostly organic

2.6 If organic, what share of the products (in value) are marketed as organic products?

____%

3. Household structure and labour management

3.1 Household structure

Member (role relative to farm head)	Male/ Female	Age (years)	Education level (see 11)	Education type (agricultural vs. non-agricultural)	On farm labour (hours/year)	Off farm employment (description)	Off farm income (€/ year)
Farm head							

3.2 Does the farmer have a successor?

1) Yes
2) No
3) Do not know

3.3 Other people working on the farm

Worker (description)	Labour time (hours/year)

4. Farm organisation, constraints and connections

4.1 Constraints determining current farm activities (rank 1= most important, 2= second most important, put a bar "-" for those not important at all)

Constraint	Rank	Specify
Market share/contract of key products		
Total household labour availability		
Total external labour availability		
Household labour availability in key periods		
External labour availability in key periods		
Land availability from neighbour farmers		
Liquidity availability		
Short term credit availability		
Long term credit availability		
Others		

4.2 Crop rotations/sequence (describe)

____

____

4.3 Production contracts in place

Product	Year established	Length (years)	Amount of product (t/year)

4.4 Public contracts in place

Policy	Tick	Specify
Rural development contracts (reg. 1257/99)		
Rural development contracts (reg. 1698/2005)		
Local/national conservation contracts		
Others		

4.5 What organisations or persons provide advice to the farm? (please tick only those considered most important)

Organisation	Tick	Specify
Public extension services		
Private advice		
Farmer association or union advice service		
Agri-input provider enterprise		
Downstream food processing enterprise and cooperative association advice service		
Bank		
Other farmers		
Family		
Machinery services		

4.6 Type of credit used (in 2009)

Credits	Tick	Interest rate paid (%)	Specify use of money
None			
Short term (<1 year)			
Medium term (1-5 years)			
Long term (>5 years)			

4.7 Debt/asset ratio

1) ____________________%

4.8 Limits to accessing credit (please rank: 1=most important, etc.)

1) High interest rate
2) Insufficient collateral
3) Other guarantees requested
4) Others____
5) No limit

5. Policy and decoupling

5.1 Single Farm Payment received

Year	Euro	Number of rights (ha)
2006		
2007		
2008		
2009 (expected)		

5.2 Money from Single Farm Payment is used for (describe):

a) Off-farm ____

____

____

b) On-farm____

____

____

5.3 Summarise the destination of money coming from Single Farm Payments (express % of the Single Farm Payment)

	Current expenditure	Investment
On-farm		
Off-farm productive		
	Immediate consumption	**Durable goods**
Off-farm non-productive		

5.4 Other payments received (e.g. axis 1 RDP, etc.)

Type	Surface (ha) or heads (n.)	Total amount

5.5 Money from other payments received is used for (describe):

a) Off-farm ______________________________

b) On-farm______________________________

5.6 Summarise the destination of money coming from other payments (express % of the other payments)

	Current expenditure	Investment
On-farm		
Off-farm productive		
	Immediate consumption	**Durable goods**
Off-farm non-productive		

5.7 What changes have been made, or are expected to be made, in your farm/household as a reaction to the introduction of the Single Farm Payment?

Sectors	Tick	Specify
None		
Increased investment		
• On-farm		
• Off-farm productive		
• Off-farm non-productive		
Decreased investment		
• On-farm		
• Off-farm productive		
• Off-farm non-productive		
Changes in crop mix		
Changes in other activities		

6. Perspectives & expectations

6.1 What are the expected changes in the social/economic environment influencing the farm-household (e.g. new roads, infrastructures)?

____

6.2 What conditions do you expect for household related activities in 5 year time (2009=100%)

	%	Level of confidence in response (High, Medium, Low)
Price of consumption goods		
Price of housing		
Level of off farm salaries		
Interest rates		

Comments____

6.3 What conditions do you expect for farm-related markets in 5 year time with respect to the activities /crops that you are carrying out (2009=100%)

	%	Confidence in response (High, Medium, Low)
Product prices		
Agricultural labour cost (price)		
Cost of agricultural capital goods (price)		
Cost of other production means (price)		

Comments____

6.4 What will the conditions of agricultural policy be after 2013 (2009=100%)

	%	Confidence in response (High, Medium, Low)
Decoupled payments		
Rural development payments		
Payments for organic production		
Coupled payments (specify)		
Others payments (specify)		

Comments____

7. Household status and objectives

7.1Household wealth and asset management

	UNIT	Amount
Total household revenue	000 €/year	
Household consumption	000 €/year	
Household debt/asset ratio	%	
Household net worth	000 €	

7.2 Objectives, targets and importance

Objective	Importance (rank)	Minimum acceptable (% of 2009)	Target by 2013 (% of 2009)
Household worth			
Household consumption			
Household debt/asset ratio			
Diversification in household activities			
Income certainty			
Leisure time			
Others…			

Rank 1=most important, 2=second most important, etc.

Comments

____

____

____

____

____

7.3 How important is the role of the farm in the overall household income?

1) It is the main economic activity
2) It is a significant contribution to overall income
3) It is a secondary contribution to overall income
4) It is a net loss
5) Others (specify)____

7.4 How important is the role of the farm in overall household asset management?

1) Does not have any particular role
2) Serves as a low-risk asset for investment differentiation
3) Has strong sentimental value and we will never leave it
4) Others____

8. Present and future farm/household activities

8.1 Crops[23]

Crop (description)	Area in 2009 (ha)	Cultivated in the last 5 years[24]		Considered/planned for the next 5 years	
		Year	Area (ha)	Year	Area (ha)

8.2 Animals on farm

Animals on the farm (description)	Number of animals (2009)	Number expected in 5 years	Grazing (yes/no)

8.3 Other activities carried out on the farm

Description	Measurement Unit	Size/amount	Starting date (year)	Continued in the future (Yes/ No)

8.4 Off-farm activities (only activities different from employment in question 3.1)

Description	Measurement Unit	Size/amount	Starting date (year)	Continued in the future (Yes/ No)

23 Including pastures and other land uses.
24 Or last 2 for the farms surveyed in 2006.

8.5 In case of any major deviation between expected activities based on the 2006 survey and actual activities in the period 2007-2009, please explain the main reasons for such deviation

____

____

____

____

9. Past and future farm/household assets and investments/disinvestments

9.1 Main non-farm assets (stocks)

Presently owned

Description	Purchase year	Unit	Amount	Purchase value	Expected end of life/ disinvestment (year)	To be replaced (Yes/No)	Support by Rural Development measures? (Yes/No)

Expected investment (excluding replacements) in the next 5 years (flows)

Description	Purchase year	Unit	Amount	Approximate value	Support by Rural Development measures? (Yes/No)

Disinvestments (excluding replacements) in the last 5 years (flows)

Description	Purchase year	Unit	Amount

9.2 Agricultural assets presently on the farm (stocks)

Existing land and disinvestment

Description	Purchase year	Ha	Purchase value	Expected disinvestment (year)	Support by Rural Development measures? (Yes/No)

Land investment

Description	Purchase year	Decided (Y/N)	Area (ha)	Approximate value	Support by Rural Development measures? (Yes/No)

Existing buildings and disinvestment

Description	Purchase year	Size		Purchase value	Expected end of life/ disinvestment (year)	To be replaced (Yes/No)	Used for crops/ activities	Support by Rural Development measures? (Yes/No)
		Unit	amount					

Building investments

Description	Purchase year	Decided (Y/N)	Size		Approximate value	Support by Rural Development measures? (Yes/No)
			Unit	amount		

Existing machinery and disinvestment

Description	Purchase year	Size		Purchase value	Expected end of life/ disinvestment (year)	To be replaced (Yes/No)	Used for crops/ activities	Support by Rural Development measures? (Yes/No)
		Unit	amount					

Machinery Investments

Description	Purchase year	Decided (Y/N)	Size		Approximate value	Support by Rural Development measures? (Yes/No)
			Unit	amount		

Other existing equipment (e.g. PC) and disinvestment

Description	Purchase year	Size		Purchase value	Expected end of life/ disinvestment (year)	To be replaced (Yes/No)	Used for crops/ activities	Support by Rural Development measures? (Yes/No)
		Unit	amount					

Other equipment (e.g. PC) investment

Description	Purchase year	Decided (Y/N)	Size		Approximate value	Support by Rural Development measures? (Yes/No)
			Unit	amount		

Quota and production rights

Description	Purchase year	Size		Purchase value	Used %	Expected disinvestment (year)
		Unit	amount			

Investment in Quotas and production rights

Description	Purchase year	Decided (Y/N)	Size		Approximate value
			Unit	amount	

9.3 Main farm assets sold in the last 5 years[25] (e.g. machinery, livestock, land, etc.) (flows)

Category (as above)	Description	Year	Unit	Amount

25 Or last 2 for the farms surveyed in 2006

9.4 Others (including training) investment/disinvestment

Description	Year	Decided (Y/N)	Investment /disinvestment(I/D)	Size		Approximate value
				Unit	amount	

9.5 Use of external services (e.g. mechanical operations)

Description	Quantity/year		Crops involved
	Unit	Amount	

9.6 In case of any major deviation between expected investment/disinvestment based on the 2006 survey and actual investment/disinvestment in the period 2007-2009, please explain the main reasons for such deviation

____

____

____

____

9.7 In case you used money from the measure "support for investment" of RDP, axis 1, to carry out investments, would you have done the same investment even without the CAP funding?

____

____

10. Concluding opinions

10.1 Considering now the measure support to investment of axis 1 of the RDP, what would your suggestions be to make the measures more useful for your farm?

____

____

____

10.2 How is your household being affected by the ongoing economic and financial crisis?

____

____

____

10.3 How is your farming activity being affected by the ongoing economic and financial crisis?

____

____

____

Contacts and information

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11. Annex B - Model description

The empirical model – objective function

The model proposed is a dynamic integer programming model simulating household behaviour, derived from version 1 (NPV maximising) of the models used in Gallerani et al. (2008).

The objective function is expressed by the NPV of total household cash flows over the time horizon. In case 1 the objective function takes the following form:

$$\text{Max } Y = \sum_t \rho_t Y_t \quad \text{(B1)}$$

where:

$$Y_t = y_t^a + y_t^l + y_t^c + y_t^I - y_t^{tc} + y_t^p \quad \text{(B2)}$$

$$y_t^a = \sum_i x_{i,t} gm_i - v_m^p \upsilon_m^p \quad \text{(B3)}$$

$$y_t^l = \sum_h l_{h,t}^{out} w_h^{out} - \sum_j l_{j,t}^{in} w_j^{in} \quad \text{(B4)}$$

$$y_t^c = c_t^- r^- - c_t^+ r^+ \quad \text{(B5)}$$

$$y_t^I = \sum_m \sum_\tau I_{m,t,\tau}^- k_{m,\tau} - \sum_m \sum_\tau I_{m,t,\tau}^+ k_{m,\tau} \quad \text{(B6)}$$

$$y_t^{tc} = TC^- \sum_m \sum_\tau I_{m,t,\tau}^- k_{m,\tau} + TC^+ \sum_m \sum_\tau I_{m,t,\tau}^+ k_{m,\tau} \quad \text{(B7)}$$

$$y_t^p = \sum_i x_{i,t} \psi_{i,t} + \Psi_t^d \quad \text{(B8)}$$

Yearly household income includes farm gross margin from farm activities (B3), net household labour income (B4), capital costs (B5), net costs for investment/disinvestment (B6), transaction costs (B7) and CAP payments (B8).

Transaction costs have been included to represent the realistic evidence that buying, selling or keeping items results in additional costs related to the operation of the transaction. Since transaction costs are very complex, the needed amount of information could not be collected through the survey. Accordingly, during the testing, a reasonable time for the conclusion of transactions was estimated, including the associated administrative costs. Since this value may vary considerably amongst farms, it has been approximated as a uniform percentage of asset value (20%).

In order to maintain the household perspective, a minimum requirement has been assumed on consumption (C_t), based on the interviews. This minimum consumption has been added as constraint to the model, forcing the annual consumption to be higher than the minimum acceptable declared by the household:

$$C_t \leq C^* \tag{B9}$$

The empirical model – constraints and feasibility set

The constraints defining the feasibility set are organised into sub groups:

- Investment and capital;
- Activities;
- Liquidity, credit and external investment;
- Labour;
- Payments;
- Non-negativity constraints.

Investment and capital

$$I_{m,t,\tau} = I_{m,t-1,\tau-1} + I^{+}_{m,t,\tau} - I^{-}_{m,t,\tau} \tag{B10}$$

$$k_{m,\tau} = \gamma_{m,\tau} k_{m,0} \tag{B11}$$

$$K_t = \sum_{m} \sum_{\tau} I_{m,t,\tau} k_{m,\tau} + \chi_t \tag{B12}$$

$$I_{m,1,\tau} = I^{i}_{m,\tau} \tag{B13}$$

$$I^{-}_{m,T,\tau} = I_{m,T,\tau} \tag{B14}$$

This group of equations describes capital and investment relations. In equation (B10) capital at time t is related to capital at time t-1, plus investments, minus disinvestments. The variables $I^{i}_{m,\tau}$ represent the number of individual assets, defined by their type (m) and age (τ) and are defined as integer variables. Equation (B10) is verified for each year (t). The value of each capital good is calculated in equation (B11), based on the initial value $k_{m,0}$ and the depreciation coefficient $\gamma_{m,\tau}$. Depreciation is assumed to be linear with age. Land is not depreciated.

The value of the total household capital is calculated in equation (B12) as a sum of the depreciated value of all capital assets, plus the value of liquidity χ_t. Equations (B13) and (B14) are included to control for the beginning and the end of the actual time horizon considered. B13 assigns the initial capital endowment and B14 forces the model to sell all capital at time T. This allows the model to take into account the salvage value of all capital when taking decisions close to the end of the time horizon.

As the model refers to individual farms, it is not adapted to structural change and land exchanges. To keep the model 'conservative' (i.e. avoiding an unrealistic growth of the farm through land purchases), the possibility of farm expansion is allowed only when land purchases are already planned. In other cases, land availability is considered as fixed and propensity to expansion will be judged on the basis of the marginal value of land.

Activities

$$\sum_i x_{i,t} a_{i,s} \leq rhs_s \quad \text{(B15)}$$

$$\sum_i x_{i,t} a_{i,z} \leq \sum_m I_{m,t,\tau} v_{m,z} + v_m^p \quad \text{(B16)}$$

$$gm_{i,t} = \mu_i p_{i,t} - e_{i,t} \quad \text{(B17)}$$

Equation (B15) is the standard set of constraints of a mathematical programming model ensuring that the solution is compatible with the availability of resources defined by rhs_s for each resource *s*. Furthermore rhs_s also includes the non-productive households assets (i.e. house, holiday house, leisure flat), and with equation (B15) the maintenance for the whole time horizon of such assets. Land, machinery, quotas and production rights are generally treated elsewhere in the model, in the category of investments. Equation (B15) covers relevant technical and economic constraints in addition to the standard issue of resource availability. These are very different from case to case and have been designed as the most appropriate. In general, the most common issues have been:

- management of intermediate products, such as feeding with own-produced fodder, use/handling of organic waste from animals;
- crop rotation;
- market constraints.

Equation (B16) connects crops, capital goods and service rental through the use of "investment services" *z* (e.g., hours of work of specific machinery). Each capital good can produce some amount of service *z* ($v_{m,z}$) per year, which is used by farm activities. The availability of capital goods can be substituted by the purchase of the service v_m^p. Equation (B16) ensures that the amount of capital services required by farm activities is available from capital goods plus rented services. Equation (B17) is a simple computation of gross margin subtracting the variable costs of each activity from the gross revenue from the sale of products.

Liquidity, credit and external investment

$$S_t = Y_t - C_t \quad \text{(B18)}$$

$$\chi_t = \chi_{t-1} + S_{t-1} + c_t^+ \quad \text{(B19)}$$

$$\sum_m \sum_q I_{m,t,\tau}^+ k_{m,\tau}^+ + \sum_j l_{j,t}^{in} w_{j,t}^{in} + \sum_m v_m^p \upsilon_m^p + \sum_i x_i e_i + y_t^{tc} + c_t^- \leq \chi_t \quad \text{(B20)}$$

$$c_t^+ \leq \delta K_t \quad \text{(B21)}$$

This group of equations defines the relationships between capital, liquidity and investment. Savings S_t are defined as the difference between income Y_t and consumption C_t (equation B18), quantified at the household level. Liquidity at year *t* χ_t is defined as the sum of liquidity of year *t*-1, the savings of year *t*-1 and the amount of external capital purchased (credit) c_t^+ (equation B19). In equation B20, liquidity requirements due to investment, payment of external labour, variable activity costs, machinery service rental costs, costs of credit and off-farm investments c_t^- are constrained to liquidity availability. The access to credit c_t^+ is constrained to the share δ of total capital owned (equation B21). The model constrains credit to some share of capital availability. Credit and external investment are treated as yearly variables (e.g. no mortgage structure).

Labour

$$\sum_i x_{i,t} a_i^l + l_{h,t}^{out} \leq L_{h,t}^t + l_{j,t}^{in} \quad \text{(B22)}$$

$$l_{j,t}^{in} \leq l_{j,t}^{in*} \quad \text{(B23)}$$

Equation B22 constrains labour use to labour availability at the farm-household level. Labour use includes both on-farm and off-farm activities of the farm-household. Labour availability includes both own household labour and purchased labour.

Payments

$$\Psi_t^d = SFP \frac{\sum_i x_{i,t} n_i^u}{n} \quad \text{(B24)}$$

Payments are calculated based on owned entitlements, after adjustment based on eligible land uses. Payments are not traded.

Non-negativity constraints

$$x_{i,t},\ l_j^{in},\ l_h^{out},\ I_{m,t,\pi},\ I_{m,t,\pi}^+,\ I_{m,t,\pi}^-,\ c_t^+,\ c_t^-,\ S_t,\ \chi_t \geq 0 \quad \text{(B25)}$$

Equation B25 includes all variables that can take only zero or positive values in the model.

Further issues clarified below are uncertainty, risk aversion, non-linearity and technical change.

As far as uncertainty and risk aversion are concerned, the model described above is deterministic. Uncertainty is a major component of investment decisions and is the main focus of much of the literature on investment. Many of the parameters of the model could be treated as uncertain from the agent's perspective. By addressing the issues with the above model a good deal of uncertainty or risk consideration may have already been captured, in either the decision rules or the objectives. For example, multi-criteria analysis may already incorporate many aspects of uncertainty; crop combinations or rotations may solve risk concerns. For these reasons, the main approach is to capture the above issues through the constraints and objective function of the basic model. Whether this is satisfactory is verified through the calibration and validation process; i.e. by verifying whether the values generated by the model are reasonably close to those planned (in this case those that the farmer has stated as his intentions for next 5 years).

Concerning non-linearity, the model is designed as a linear problem primarily for simplicity of computation. Since the model requires mixed integer solutions for investment decisions, adding non-linearity to integer variables could make the solution more difficult. Non-linear components have been treated through piecewise or discontinuous linear functions, for all aspects for which the model reaches a sufficient degree of detail. For example, household labour has been attributed a different opportunity cost depending on the stated off-farming salary of each component. This is a widely used solution in linear programming models (Hazell and Norton, 1986; Hillier and Lieberman, 2005).

The analysis of technical change, though relevant, is not an explicit objective of this study. In the model, technical change is considered only as incorporated in possible investments and not as a separate variable. This means that there will not be differences (e.g. for yields) across scenarios, or regular changes in yields over time. This choice is driven by the attempt to limit the number of variables determining the results of the model and make them more interpretable. Investment in a different (e.g. technically improved) piece of machinery is allowed and can affect labour and land productivity.

Output indicators

The output indicators, selected according to Gallerani et al. (2008) include the following:

a) Economic:
   - farming income;
   - total household income;
   - net investment.

b) Social:
   - farm labour use.

c) Environmental:
   - nitrogen use on land;
   - water use.

All indicators are expressed as an average over the time period considered (*T*).

The farming income indicator is derived from an average over time of the annual income obtained from equation B3,:

$$E_{fi} = \frac{1}{T}\sum_t y_t^a \ . \qquad \text{(B26)}$$

Total household income is derived from equation B1 by averaging the net cash flow rather than calculating the NPV, as in the objective function,

$$E_{hi} = \frac{1}{T}\sum_t \rho_t Y_t \ . \qquad \text{(B27)}$$

Net investment is calculated as a similar average over the investment cash flow derived from equation B6:

$$E_{ni} = \frac{1}{T}\sum_t y_t^I \qquad \text{(B28)}$$

Farm labour use is calculated as the average over time of the farm-related part of labour computation in equation B22:

$$E_l = \frac{1}{T}\sum_t \sum_i x_{i,t} a_i^l \ . \qquad \text{(B29)}$$

Nitrogen and water use indicators are directly derived from the combination of activities through appropriate environmental coefficients, i.e. respectively:

$$E_N = \frac{1}{T}\sum_t \sum_i x_{i,t} a_{i,N} \qquad \text{(B30)}$$

$$E_W = \frac{1}{T}\sum_t \sum_i x_{i,t} a_{i,W} \qquad \text{(B31)}$$

'Nitrogen use' concerns the nitrogen content of fertilisers, while 'water use' is the amount of water distributed on crops, without accounting for upstream losses. Water is calculated only for the systems in which irrigation has a significant role in farming (Spain, Italy, and Greece).

All indicators are expressed in hectares of land, in order to allow comparability across farms, while comparison across scenarios is made by calculating the percent deviation of each indicator in each scenario with respect to the baseline scenario.

In addition to the previous indicators, three indicators related to the marginal value of key resources in different scenarios were added. Among the several options available, the following three were chosen:

- marginal value of land availability (equation B15 for land rented-in and land owned);
- marginal value of labour availability (equation B23);
- marginal value of monetary capital availability (equation B18).

Marginal values are obtained as averages over each time period. Marginal values of each yearly constraint in dynamic models incorporate the effects on the following years and, other things being equal, they decrease as they move towards the end of the period, to reach a minimum in the final year. For this reason, they are also not comparable with annual marginal values in static models and are hence higher than the current market prices of resources.

Time horizon

Results focus on farm investment and its impact over an 8–12-year period from the time that the survey was carried out. As investments are decided within a reasonable time horizon over which their effects are evaluated by the decision maker, a longer time period is considered in the model, to justify investment choices during the last years of the period considered.

Taking into account these requirements, models are solved on a 22 year time horizon, setting the final year at 2030. This period appears to be long enough to assess the profitability of most investments and is consistent with the timescale used in Gallerani et al, 2008, and similar scenarios available at present.

In order to avoid conflicts with choices related to the final period of the planning horizon (e.g. lack of investment, forced selling of capital good in the final year), results are given as average of two shorter periods: 2009-2013 and 2014-2020.

The first period corresponds with the remainder of the present programming period of the CAP, and the final year is consistent with the expected end of such period. For the initial year, the decisions on the farm are assumed to have already been taken when the information is collected. Thus, the actual planning horizon is 4 years (2010-2013), while 2009 represents the initial conditions (e.g. existing capital).

BOX 1 – Symbols used

Parameters and variables (v in parentheses=variable)

Z = objective function;

z_q = value of attribute/objective q;

$z_q^{\min}$ = minimum achievement required for each objective;

X = feasible set;

x = vector of decision variables;

ρ_t = discounting factor;

Y_t = total farm household income (v);

y_t^a = household cash flow from production activities, including farming (v);

y_t^l = household cash flow from labour: external household labour minus hired labour (v);

y_t^c = household cash flow from liquid capital management: rents from investment in non-durable goods minus cost of credit (v);

y_t^I = cash flow from investment and disinvestment activities (v);

y_t^{tc} = transaction costs connected to investment/disinvestment (v);

y_t^p = cash flow from agricultural policy payments (v);

$x_{i,t}$ = degree of activation of productive activity i (v);

gm_i = gross margin from productive activity i;

$l_{j,t}^{in}$ = labour purchase of type j (v);

$l_{j,t}^{in*}$ = maximum labour purchase of type j (v);

w_j^{in} = cost of labour purchase of type j;

$l_{h,t}^{out}$ = labour selling (v);

w_h^{out} = wages from labour selling of type h;

c_t^+, c_t^- = purchase of liquidity (access to credit), investment of liquidity in non-durable goods outside the farm (v);

r^+, r^- = interest rate paid on credit, interest rate gained on liquidity and related uses (e.g. bonds);

$I_{m,t,\tau}, I_{m,t,\tau}^+, I_{m,t,\tau}^-$ = number of capital goods, investment and disinvestment activities of type m and age τ at time t (v);

$k_{m,\tau}$ = value of capital goods m, depending on age;

TC^+, TC^- = transaction costs on, respectively, investment and disinvestment as a percentage of the value of investment/disinvestment;

$\psi_{i,t}, \Psi_t^d$ = area based and decoupled payment (v), respectively;

C_t = consumption;

C^* = minimum acceptable yearly consumption accepted by the household;

a_{iq} = coefficient of the objective q for the activity i; a_{iq} quantifies the change in the value of objective q as a result of a unit increase in activity i;

ω_q = weight of attribute q;

χ_t = liquidity;

$\gamma_{m,\tau}$ = depreciation coefficient for capital goods;

$I_{m,\tau}^i$ = stock of capital good m on the farm in the initial year (2006);

rhs_s = right hand side: availability of resource s;

$a_{i,s}, a_{i,z}, a_i^l, a_{i,o}$ = technical coefficients with respect to farm resource s, investment, labour use and environmental impact;

$v_{m,z}$ = amount of investment service z produced by investment m;
v^{p}_{m} = purchased amount of investment service z;
υ^{p}_{m} = price of purchased investment service z;
S_{t} = savings (v);
$p_{i,t}$ = product price of activity i;
μ_{i} = yield of activity i;
$e_{i,t}$ = variable costs of activity i;
K_{t} = value of household's capital stock (v);
δ = maximum debt/asset ratio allowed;
$L^{t}_{h,t}$ = labour availability of type h in the household;
SFP = single farm payment;
n, n^{u}_{t} = total and used payment entitlements (v) in each year, where the latter depends on the crops cultivated;
E_{o} = value of output indicator o.

Sets
q = objectives;
t=1, 2…,T = time/years in the planning period, with T = time horizon;
i = activities (e.g. crops);
j = labour type for purchase (non household);
h = labour type for selling (household);
m = types of capital goods;
τ = age of capital goods;
s = farm resources and constraints (different from land, labour or capital);
z = investment services;
o = output indicator.

12. Annex C - Detailed survey results

Table 31: Household characteristics - Median and percentages

Technology	Area	Specialisation	% of family farm	Age of farm head (years)	Successor (% of yes)	Household head labour on farm (hours/year)	Household head labour off farm (% of yes)	Household labour on farm (hours/year)	Total external labour purchased (hours/year)
CONVENTIONAL	Mountain	Arable	4,4	47	2,54	2000	1,56	3800	0
		Livestock	8,4	50,5	6,36	2400	0,00	5409	0
		Permanent	7,2	50	5,08	2200	1,17	4700	900
	Plain	Arable	13,5	51	7,63	2200	3,13	2288	300
		Livestock	13,1	50,5	11,86	2200	1,56	4176	0
		Permanent	11,2	55	2,54	2200	1,95	4400	2000
EMERGING	Mountain	Arable	4,8	50,5	2,54	2200	1,56	4400	50
		Livestock	3,2	50	2,54	2200	0,78	5200	0
		Permanent	1,6	49,5	1,69	2690	0,00	5980	2290
	Plain	Arable	4,4	53	2,12	2200	1,17	4400	2700
		Livestock	6,4	50	2,54	2200	1,17	4165	0
		Permanent	2,4	53,5	0,00	2200	0,00	3200	0

26 Data refers to the 2009 survey except where otherwise indicated.

Table 32: Farm characteristics - Median and percentages

Technology	Area	Specialisation	Owned land (ha)	Land rented in (ha)	Land rented in (% of total farm area)	Land rented out (ha)	Total land (ha)	Share of organic products (%)	SFP amount in 2006 (euro/farm)	SFP amount in 2007 (euro/farm)	SFP amount in 2008 (euro/farm)	SFP amount in 2009 (euro/farm)
CONVENTIONAL	Mountain	Arable	13,0	20	0,69	0	51	0	12313	13500	13500	11500
		Livestock	10,5	9	0,47	0	22	0	2548	3023	3245	3392
		Permanent	10,0	0	0,55	0	12	0	327,5	351,5	371,5	60
	Plain	Arable	20,5	25	0,67	0	66	0	13024	14082	16000	16000
		Livestock	22,0	14	0,44	0	34	0	6242	5038	6200,5	7642,5
		Permanent	13,0	0	0,40	0	17	0	1019	1259	1583	524,5
EMERGING	Mountain	Arable	40,5	7	0,60	0	57	100	9500	10500	10500	10500
		Livestock	12,0	17	0,49	0	45	100	7500	8750	8750	8750
		Permanent	8,5	0	0,61	0	11	77,5	204	214	224	251
	Plain	Arable	13,0	13	0,61	0	30	100	13500	13500	11250	10650
		Livestock	27,9	8	0,35	0	38	100	7000	7000	5541	9135,5
		Permanent	4,8	0	0,43	0	5	100	0	190	200	0

Table 33: *Legal status of the farms in the sample (% of individual/family)*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	67	100	-	-	100	25	-	-
		Livestock	100	60	-	-	-	67	-	100
		Permanent	-	83	100	-	-	50	-	100
	Plain	Arable	80	100	100	67	100	64	-	100
		Livestock	71	100	-	-	-	33	100	94
		Permanent	-	100	71	-	-	64	-	100
EMERGING	Mountain	Arable	-	100	-	-	100	38	-	-
		Livestock	-	75	-	-	-	0	-	100
		Permanent	-	50	-	-	-	50	-	100
	Plain	Arable	-	67	-	-	100	86	-	100
		Livestock	-	100	-	-	-	33	100	100
		Permanent	-	-	-	-	-	100	-	-

Table 34: *Average age of the farm head in the sample*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	52	40	-	-	49	65	-	-
		Livestock	52	53	-	-	.	49	-	46
		Permanent	-	47	59	-	.	50	-	51
	Plain	Arable	55	52	51	47	36	56	-	53
		Livestock	55	46	-	-	-	57	56	44
		Permanent	-	55	59	-	-	55	-	51
EMERGING	Mountain	Arable	-	52	-	-	43	48	-	-
		Livestock	-	53	-	-	-	48	-	52
		Permanent	-	46	-	-	-	56	-	50
	Plain	Arable	-	61	-	-	37	53	-	55
		Livestock	-	53	-	-	-	53	49	47
		Permanent	-	-	-	-	-	54	-	.

Table 35: Successor (percentage of yes)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	100	14	-	-	-	50	-	-
		Livestock	60	60	-	-	-	67	-	64
		Permanent	-	50	-	-	-	33	-	100
	Plain	Arable	80	60	-	33	-	43	-	60
		Livestock	71	60	-	-	-	100	60	65
		Permanent	-	33	-	-	-	30	-	25
EMERGING	Mountain	Arable	-	50	-	-	-	43	-	-
		Livestock	-	50	-	-	-	33	-	40
		Permanent	-	50	-	-	-	50	-	100
	Plain	Arable	-	67	-	-	50	14	0	100
		Livestock	-	25	-	-	-	33	33	50
		Permanent	-	-	-	-	-	-	-	-

Table 36: Household head labour on farm (hours/year)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	1856	2060	-	-	2100	2000	-	-
		Livestock	1856	3450	-	-	-	2427	-	2465
		Permanent	-	2583	500	-	-	2078	-	2011
	Plain	Arable	1485	2350	-	1887	1808	2061	-	1688
		Livestock	1856	1840	-	-	-	2648	2200	2043
		Permanent	-	1900	1167	-	-	1980	-	2350
EMERGING	Mountain	Arable	-	1742	-	-	2100	2394	-	-
		Livestock	-	2875	-	-	-	2313	-	2000
		Permanent	-	3100	-	-	-	2540	-	2500
	Plain	Arable	-	3250	-	-	2100	1656	-	2900
		Livestock	-	1750	-	-	-	2200	2090	2925
		Permanent	-	-	-	-	-	2167	-	-

Table 37: *Percentage of yes of household head labour off farm)*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	57	-	-	-	-	-	-
		Livestock	-	-	-	-	-	-	-	-
		Permanent	-	17	-	-	-	10	-	17
	Plain	Arable	60	20	-	33	-	-	-	40
		Livestock	14	60	-	-	-	-	-	-
		Permanent	-	33	7	-	-	9	-	25
EMERGING	Mountain	Arable	-	67	-	-	-	-	-	-
		Livestock	-	25	-	-	-	-	-	20
		Permanent	-	-	-	-	-	-	-	-
	Plain	Arable	-	67	-	-	-	14	-	-
		Livestock	-	25	-	-	-	-	14	25
		Permanent	-	-	-	-	-	-	-	-

Table 38: *Average labour availability in the sample (hours per year per household)*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	3867	4489	-	-	2100	4500	-	-
		Livestock	3650	8500	-	-	-	3160	-	5252
		Permanent	-	6358	900	-	-	4278	-	5113
	Plain	Arable	2784	2675	-	2015	2413	3829	-	3998
		Livestock	3778	3016	-	-	-	6481	2860	5261
		Permanent	-	2683	1892	-	-	4135	-	6650
EMERGING	Mountain	Arable	-	4558	-	-	2800	4803	-	-
		Livestock	-	4575	-	-	-	6207	-	9200
		Permanent	-	7050	-	-	-	3980	-	5300
	Plain	Arable	-	4167	-	-	3150	3227	-	6725
		Livestock	-	3310	-	-	-	6133	3049	4405
		Permanent	-	-	-	-	-	3267	-	-

Table 39: Average of total external labour purchased (hours per year per household)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	1443	691	-	-	3300	1781	-	-
		Livestock	1856	492	-	-	-	400	-	63
		Permanent	-	1897	3400	-	-	2213	-	1383
	Plain	Arable	8627	1736	6800	465	1032	1228	-	905
		Livestock	7750	756	-	-	-	550	-	650
		Permanent	-	9667	3973	-	-	158	-	2500
EMERGING	Mountain	Arable	-	517	-	-	1267	1537	-	-
		Livestock	-	3125	-	-	-	988	-	280
		Permanent	-	5430	-	-	-	2200	-	1700
	Plain	Arable	-	11020	-	-	2550	2368	-	4400
		Livestock	-	5016	-	-	-	-	-	3840
		Permanent	-	-	-	-	-	413	-	-

Table 40: Average size of the farms in the sample (ha per farm owned land)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	6	21	-	-	6	26	-	-
		Livestock	3	31	-	-	-	55	-	14
		Permanent	-	7	35	-	-	21	-	9
	Plain	Arable	27	43	20	52	3	60	-	70
		Livestock	51	51	-	-	-	19	15	35
		Permanent	-	32	44	-	-	9	-	16
EMERGING	Mountain	Arable	-	66	-	-	3	82	-	-
		Livestock	-	18	-	-	-	115	-	7
		Permanent	-	13	-	-	-	12	-	5
	Plain	Arable	-	34	-	-	7	29	-	12
		Livestock	-	28	-	-	-	122	20	16
		Permanent	-	.	-	-	-	7	-	-

Table 41: Average of the land rent in (ha per farm)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	191	23	-	-	70	9	-	-
		Livestock	26	26	-	-	-	6	-	5
		Permanent	.	0	0	-	-	9	-	0
	Plain	Arable	131	19	80	90	12	54	-	30
		Livestock	757	52	-	-	-	39	13	27
		Permanent	.	15	7	-	-	2	-	0
EMERGING	Mountain	Arable	-	47	-	-	7	5	-	-
		Livestock	-	48	-	-	-	36	-	5
		Permanent	-	22	-	-	-	0	-	0
	Plain	Arable	-	154	-	-	11	38	-	4
		Livestock	-	9	-	-	-	57	38	3
		Permanent	-	.	-	-	-	1	-	-

Table 42: Percentage of land rented on an average sized farm

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	0,97	0,53	-	-	0,92	0,34	-	-
		Livestock	0,83	0,49	-	-	-	0,33	-	0,35
		Permanent	-	0,24	-	-	-	0,73	-	0,06
	Plain	Arable	0,85	0,27	0,80	0,64	0,79	0,52	-	0,31
		Livestock	0,64	0,39	-	-	-	0,60	0,46	0,42
		Permanent	.	0,39	0,41	-	-	1,00	-	-
EMERGING	Mountain	Arable	-	0,56	-	-	0,64	0,27	-	-
		Livestock	-	0,70	-	-	-	0,55	-	0,29
		Permanent	-	0,61	-	-	-	-	-	-
	Plain	Arable	-	0,80	-	-	0,72	0,45	-	0,25
		Livestock	-	0,18	-	-	-	0,37	0,70	0,18
		Permanent	-	.	-	-	-	0,43	-	-

Table 43:- Average of land rented out (ha per farm)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	0,00	5,14	-	-	-	-	-	-
		Livestock	0,40	0,00	-	-	-	-	-	-
		Permanent	.	2,50	-	-	-	-	-	-
	Plain	Arable	0,00	3,20	-	-	-	-	-	-
		Livestock	1,14	3,00	-	-	-	-	-	-
		Permanent	.	7,62	-	-	-	-	-	-
EMERGING	Mountain	Arable	-	0,08	-	-	-	-	-	-
		Livestock	-	0,00	-	-	-	-	-	-
		Permanent	-	0,00	-	-	-	-	-	-
	Plain	Arable	-	0,00	-	-	-	-	-	-
		Livestock	-	1,25	-	-	-	-	0,21	-
		Permanent	-	-	-	-	-	-	-	-

Table 44: Average size of the farm in the sample (total land) (ha)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	197	49	-	-	76	35	-	-
		Livestock	32	57	-	-	-	61	-	19
		Permanent	-	10	35	-	-	27	-	8
	Plain	Arable	158	64	100	143	15	117	-	100
		Livestock	812	108		-	-	60	28	62
		Permanent	-	55	52	-	-	11	-	16
EMERGING	Mountain	Arable	-	113	-	-	10	91	-	-
		Livestock	-	66	-	-	-	154	-	30
		Permanent	-	34	-	-	-	12	-	5
	Plain	Arable	-	189	-	-	18	66	-	16
		Livestock	-	38	-	-	-	179	59	18
		Permanent	-	-	-	-	-	9	-	-

Table 45: *Percentage of organic production*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	-	-	-	-	-	-	-
		Livestock	-	-	-	-	-	-	-	-
		Permanent	-	-	-	-	-	-	-	-
	Plain	Arable	-	-	-	-	-	-	-	-
		Livestock	-	-	-	-	-	-	-	-
		Permanent	-	-	-	-	-	-	-	-
EMERGING	Mountain	Arable	-	93	-	-	100	44	-	-
		Livestock	-	100	-	-	-	55	-	76
		Permanent	-	98	-	-	-	50	-	55
	Plain	Arable	-	98	-	-	100	84	-	100
		Livestock	-	94	-	-	-	100	86	100
		Permanent	-	-	-	-	-	100	-	-

Table 46: *Average of SFP payments received in 2006 (EUR per farm)*

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	13429	-	-	11626	4250	-	-
		Livestock	-	23800	-	-	-	7600	-	1978
		Permanent	-	-	12500	-	-	2053	-	620
	Plain	Arable	-	19000	22000	-	8595	27329	-	9753
		Livestock	-	20060	-	-	-	31073	-	5931
		Permanent	-	17000	27111	-	-	143	-	1029
EMERGING	Mountain	Arable	-	18500	-	-	1343	7371	-	-
		Livestock	-	17250	-	-	-	12375	-	851
		Permanent	-	3500	-	-	-	-	-	332
	Plain	Arable	-	51333	-	-	9750	12700	-	1146
		Livestock	-	14375	-	-	-	13333	-	3427
		Permanent	-	-	-	-	-	238	-	-

Table 47: Average of SFP payments received in 2007 (EUR per farm)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	16643	-	-	11000	4250	-	-
		Livestock	-	23360	-	-	-	8267	-	2302
		Permanent	-	-	12500	-	-	1987	-	550
	Plain	Arable	-	19800	22000	-	8500	29354	-	11695
		Livestock	-	20060	-	-	-	17371	-	5632
		Permanent	-	17000	27111	-	-	143	-	3340
EMERGING	Mountain	Arable	-	18450	-	-	1240	8086	-	-
		Livestock	-	17500	-	-	-	13700	-	957
		Permanent	-	3500	-	-	-	-	-	340
	Plain	Arable	-	52000	-	-	9360	12617	-	1134
		Livestock	-	14375	-	-	-	12667	-	3571
		Permanent	-	-	-	-	-	1238	-	-

Table 48: Average of SFP payments received in 2008 (EUR per farm)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	16857	-	-	10500	4500	-	-
		Livestock	-	22360	-	-	-	7600	-	2499
		Permanent	-	-	12500	-	-	1903	-	589
	Plain	Arable	-	20400	28000	49090	8227	31936	-	12711
		Livestock	-	21060	-	-	-	30449	-	6547
		Permanent	-	18667	27111	-	-	66	-	1372
EMERGING	Mountain	Arable	-	18400	-	-	1200	8371	-	-
		Livestock	-	17750	-	-	-	12100	-	1006
		Permanent	-	3500	-	-	-	-	-	363
	Plain	Arable	-	53333	-	-	8900	12917	-	1187
		Livestock	-	14375	-	-	-	9333	-	2764
		Permanent	-	-	-	-	-	600	-	-

Table 49: Average of SFP payments received in 2009 (EUR per farm)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	16857	-	-	10000	750	-	-
		Livestock	-	22360	-	-	-	7600	-	2279
		Permanent	-	-	-	-	-	1819	-	570
	Plain	Arable	-	21400	-	50172	7482	31221	.	14028
		Livestock	-	23810	-	.	.	31537	12008	7517
		Permanent	-	18667	-	.	.	66	.	1756
EMERGING	Mountain	Arable	-	18333	-	-	1190	8086	-	-
		Livestock	-	18000	-	-	-	12100	-	1122
		Permanent	-	3500	-	-	-	0	-	406
	Plain	Arable	-	54667	-	-	8600	12667	.	1622
		Livestock	-	14375	-	-	-	9333	14856	3179
		Permanent	-	-	-	-	-	50	.	-

Table 50: Type of credit used by system (percentage of farms per farming system)

			Credit tipology			
Technology	**Area**	**Specialisation**	*short term*	*medium term*	*long term*	*no credit*
CONVENTIONAL	Mountain	Arable	20%	13%	47%	40%
		Livestock	0%	13%	33%	38%
		Permanent	0%	21%	21%	58%
	Plain	Arable	17%	29%	43%	29%
		Livestock	15%	38%	55%	30%
		Permanent	8%	22%	19%	31%
EMERGING	Mountain	Arable	18%	29%	53%	12%
		Livestock	13%	27%	33%	33%
		Permanent	0%	50%	33%	17%
	Plain	Arable	23%	46%	54%	23%
		Livestock	22%	33%	56%	17%
		Permanent	0%	0%	33%	67%

Table 51: Differences in type of credit used by system 2009-2006 (percentage of farms per farming system)

			Credit tipology			
Technology	**Area**	**Specialisation**	*short term*	*medium term*	*long term*	*no credit*
CONVENTIONAL	Mountain	Arable	-60%	0%	-20%	40%
		Livestock	-64%	-14%	21%	14%
		Permanent	-65%	-6%	12%	59%
	Plain	Arable	0%	-16%	-3%	9%
		Livestock	0%	4%	0%	15%
		Permanent	-39%	-6%	-10%	32%
EMERGING	Mountain	Arable	-13%	-25%	13%	0%
		Livestock	-27%	-18%	-9%	36%
		Permanent	-50%	50%	-50%	25%
	Plain	Arable	-40%	0%	10%	30%
		Livestock	-15%	8%	-23%	23%
		Permanent	-67%	-17%	17%	67%

Table 52: *Contracts in place in 2009 (percentage of farm-households per farming system with contracts)*

			Percentage of farms with contracts				
Technology	**Area**	**Specialisation**	*production*	*reg. 1257/99*	*reg. 1698/05*	*local*	*other*
CONVENTIONAL	Mountain	Arable	27%	20%	7%	20%	7%
		Livestock	42%	25%	17%	21%	0%
		Permanent	29%	25%	4%	0%	29%
	Plain	Arable	50%	36%	7%	7%	10%
		Livestock	68%	15%	13%	10%	8%
		Permanent	11%	11%	8%	3%	8%
EMERGING	Mountain	Arable	35%	35%	38%	35%	24%
		Livestock	33%	60%	53%	20%	13%
		Permanent	33%	67%	17%	17%	17%
	Plain	Arable	46%	46%	23%	31%	31%
		Livestock	22%	50%	22%	11%	28%
		Permanent	33%	83%	50%	0%	17%

Table 53: *SFP & SAPS payments received in 2009 (EUR per farm)*

Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	-	16643	-	-	11000	4250	-	-
		Livestock	-	23360	.	-	.	8267	.	2690
		Permanent	-	0	12500	-	.	1987	.	642
	Plain	Arable	-	19800	22000	-	8500	29354	.	13668
		Livestock	-	20060	.	-	.	17371	.	6582
		Permanent	-	17000	27111	-	.	143	.	3904
EMERGING	Mountain	Arable	-	18450	.	-	1240	8086	.	.
		Livestock	-	17500	.	-	.	13700	.	1118
		Permanent	-	3500	.	-	.	0	.	397
	Plain	Arable	-	52000	.	-	9360	12617	.	1325
		Livestock	-	14375	.	-	.	12667	.	4173
		Permanent	-	.	.	-	.	1238	.	.

Table 54: Change in SFP & SAPS payments received 2009-2006 (EUR per farm)[27]

Technology	Area	Specialisation	BG	DE	ES	FR	GR	IT	NL	PL
CONVENTIONAL	Mountain	Arable	.	3429	.	.	-1626	-3500	.	.
		Livestock	.	-1440	.	.	.	0	.	266
		Permanent	.	0	.	.	.	-234	.	-33
	Plain	Arable	.	2400	.	.	-1114	3893	.	2730
		Livestock	.	3750	.	.	.	464	.	649
		Permanent	.	1667	.	.	.	-78	.	393
EMERGING	Mountain	Arable	.	-167	.	.	-153	714	.	.
		Livestock	.	750	.	.	.	-275	.	137
		Permanent	.	0	.	.	.	0	.	22
	Plain	Arable	.	3333	.	.	-1150	-33	.	294
		Livestock	.	0	.	.	.	-4000	.	-788
		Permanent	.	.	.	.	.	-188	.	.

27 In this table the comparison is between 2009 and 2006 values both of which were collected using the 2009 survey, and concerns the entire sample of 256 farm-households. Contrary to the previous 2009-2006 comparisons, this is not a comparison between the two surveys. For Bulgaria, the 2006 data was not available. For France, Spain and the Netherlands, either the 2006 or the 2009 data were not available.

Table 55: Stated use of SFP based on 2009 survey

Technology	Area	Specialisation	Stated use of SFP					
			On farm current expenditure	On farm investment	Off farm productive current expenditure	Off farm productive investment	Off farm non-productive intermediate consumption	Off farm non-productive durable goods
CONVENTIONAL	Mountain	Arable	73%	24%	0%	0%	0%	4%
		Livestock	74%	19%	0%	3%	2%	3%
		Permanent	96%	3%	0%	0%	1%	1%
	Plain	Arable	79%	14%	2%	0%	3%	1%
		Livestock	69%	25%	0%	0%	3%	3%
		Permanent	79%	9%	4%	0%	8%	0%
EMERGING	Mountain	Arable	84%	12%	2%	0%	3%	0%
		Livestock	76%	16%	0%	0%	4%	4%
		Permanent	67%	33%	0%	0%	0%	0%
	Plain	Arable	98%	2%	0%	0%	0%	0%
		Livestock	85%	15%	0%	0%	0%	0%
		Permanent	100%	0%	0%	0%	0%	0%

Table 56: Change in stated use of SFP between 2006 and 2009

			Stated use of SFP						
Technology	**Area**	**Specialisation**	**On farm current expenditure**	**On farm investment**	**Off farm productive current expenditure**	**Off farm productive investment**	**Off farm non-productive intermediate consumption**	**Off farm non-productive durable goods**
CONVENTIONAL	Mountain	Arable	3%	-3%	0%	0%	0%	0%
		Livestock	13%	-15%	-4%	4%	-2%	4%
		Permanent	2%	0%	-2%	0%	-0%	0%
	Plain	Arable	8%	-5%	2%	0%	-2%	-0%
		Livestock	4%	2%	0%	-1%	-7%	2%
		Permanent	5%	-2%	-1%	0%	-0%	-1%
EMERGING	Mountain	Arable	15%	-10%	0%	0%	-5%	0%
		Livestock	48%	-45%	0%	-10%	6%	2%
		Permanent	0%	0%	0%	0%	0%	0%
	Plain	Arable	32%	-13%	0%	0%	-6%	-3%
		Livestock	11%	-11%	0%	0%	0%	0%
		Permanent	0%	0%	0%	0%	0%	0%

Table 57: Stated effects of decoupling (2009)

Technology	Area	Specialisation	Stated effects of SFP								
			Increase investment			Decrease investment			Changes in crop mix	Changes in other activities	None
			On farm	*Off farm productive*	*Off farm non-productive*	*On farm*	*Off farm productive*	*Off farm non-productive*			
CONVENTIONAL	Mountain	Arable	17%	6%	0%	6%	0%	6%	0%	6%	61%
		Livestock	36%	0%	4%	4%	0%	0%	0%	0%	56%
		Permanent	30%	0%	0%	0%	0%	0%	0%	0%	70%
	Plain	Arable	22%	4%	0%	4%	2%	0%	9%	11%	48%
		Livestock	37%	0%	11%	2%	0%	0%	4%	0%	46%
		Permanent	30%	9%	0%	0%	0%	0%	3%	3%	55%
EMERGING	Mountain	Arable	11%	0%	0%	11%	0%	0%	11%	11%	58%
		Livestock	28%	11%	11%	17%	0%	0%	6%	0%	28%
		Permanent	33%	0%	0%	0%	0%	0%	0%	0%	67%
	Plain	Arable	13%	13%	0%	0%	0%	6%	0%	6%	63%
		Livestock	11%	6%	0%	6%	0%	0%	0%	0%	78%
		Permanent	0%	0%	0%	17%	0%	0%	0%	0%	83%

Table 58: Changes in stated effects of decoupling (2009-2006)

			Stated effects of SFP								
Technology	Area	Specialisation	Increase investment			Decrease investment			Changes in crop mix	Changes in other activities	None
			On farm	*Off farm productive*	*Off farm non-productive*	*On farm*	*Off farm productive*	*Off farm non-productive*			
CONVENTIONAL	Mountain	Arable	-2%	-2%	0%	0%	0%	-2%	0%	-2%	7%
		Livestock	-9%	0%	7%	-7%	0%	0%	-7%	0%	17%
		Permanent	35%	0%	0%	-6%	-6%	-6%	0%	-6%	-12%
	Plain	Arable	6%	3%	0%	-5%	3%	0%	-5%	9%	-10%
		Livestock	-35%	0%	12%	3%	0%	0%	6%	0%	14%
		Permanent	8%	1%	-3%	0%	0%	0%	-3%	-3%	0%
EMERGING	Mountain	Arable	9%	0%	0%	-1%	0%	0%	18%	-2%	-25%
		Livestock	-13%	6%	14%	-11%	0%	0%	-1%	0%	5%
		Permanent	25%	0%	0%	0%	0%	0%	0%	0%	-25%
	Plain	Arable	0%	8%	0%	0%	0%	0%	-15%	0%	8%
		Livestock	-18%	8%	-7%	1%	0%	0%	-20%	0%	36%
		Permanent	0%	0%	0%	-3%	0%	0%	0%	0%	3%

Table 59: Ranking of objectives per country (percentage of cases in which the objective ranks first)

Country	Income certainty	Household worth	Household debt/asset ratio	Household consumption	Diversification in household activities	Leisure time	Others
BG	3,52	1,56	0,39	2,34	0,00	0,39	0,00
DE	15,23	10,94	17,58	10,94	7,81	4,69	0,00
ES	2,73	1,95	0,00	1,17	0,78	0,78	0,00
FR	0,00	0,00	0,78	0,39	1,17	0,00	0,00
GR	1,17	2,34	0,00	0,39	0,78	0,00	0,00
IT	12,89	6,25	2,73	1,17	3,52	2,34	0,39
NL	2,73	0,00	0,00	1,56	0,00	0,00	0,39
PL	19,53	1,56	0,39	0,78	0,39	0,39	0,39

Table 60: Role of farming with respect to household income in 2009 in the countries (percentage)

Country	It is the main economic activity	It is a significant contribution to overall income	It is a secondary contribution to overall income	It is a net loss	Others	Missing
BG	60,0	15,0	25,0	0,0	0,0	0,0
DE	72,0	10,0	16,0	0,0	2,0	0,0
ES	58,8	17,6	17,6	0,0	0,0	5,9
FR	16,7	33,3	33,3	0,0	16,7	0,0
GR	58,3	16,7	25,0	0,0	0,0	0,0
IT	76,3	8,8	11,3	0,0	0,0	3,8
NL	91,7	8,3	0,0	0,0	0,0	0,0
PL	88,1	11,9	0,0	0,0	0,0	0,0

Table 61: Difference in the role of farming with respect to household income (2009-2006) (percentage)

Country	It is the main economic activity	It is a significant contribution to overall income	It is a secondary contribution to overall income	It is a net loss	Others
ES	0,03	-0,01	-0,02	0,00	0,00
FR	0,00	0,00	0,01	-0,01	0,01
GR	0,00	0,00	0,00	0,00	0,00
IT	0,01	-0,02	0,01	0,00	0,00
NL	-0,01	0,01	0,00	0,00	0,00
PL	0,00	0,00	0,00	0,00	0,00

Table 62: Role of the farm in household asset management in 2009 in countries (percentage)

Country	Does not have any particular role	Serves as a low-risk asset for investment differentiation	Has strong sentimental value and we will never leave it	Others	Missing
BG	10,0	20,0	65,0	5,0	0,0
DE	6,0	10,0	52,0	32,0	0,0
ES	0,0	64,7	29,4	0,0	5,9
FR	0,0	0,0	83,3	16,7	0,0
GR	0,0	25,0	75,0	0,0	0,0
IT	3,8	27,8	21,5	43,0	3,8
NL	0,0	8,3	50,0	41,7	0,0
PL	0,0	5,1	91,5	3,4	0,0

Table 63: Difference in the role of farming with respect to household asset management in 2009-2006 (per country) (percentage)

Country	Does not have any particular role	Serves as a low-risk asset for investment differentiation	Has strong sentimental value and we will never leave it	Others
ES	0,000	0,004	0,004	-0,007
FR	0,000	0,000	-0,004	0,004
GR	0,000	0,000	0,000	0,000
IT	0,004	0,065	0,032	-0,104
NL	0,000	0,004	-0,022	0,018
PL	0,000	0,000	0,000	0,000

Table 64: Percentage of the first rank of constraints for countries

Country	Market share/ contract of key products	Liquidity availa-bility	Land availa-bility from neigh-bouring	Total household labour availa-bility	External labour availability in key periods	Household labour availability in key periods	Short term credit availa-bility	Total external labour availa-bility	Long term credit availa-bility	Others
BG	65,0	5,0	0,0	0,0	10,0	0,0	5,0	5,0	5,0	5,0
DE	68,0	82,0	36,0	50,0	44,0	56,0	26,0	22,0	28,0	4,0
ES	35,3	5,9	5,9	23,5	5,9	5,9	0,0	11,8	0,0	0,0
FR	16,7	0,0	66,7	0,0	0,0	0,0	0,0	0,0	0,0	16,7
GR	91,7	0,0	8,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0
IT	36,3	20,0	5,0	12,5	2,5	3,8	5,0	2,5	2,5	11,3
NL	0,0	16,7	41,7	8,3	0,0	8,3	0,0	8,3	0,0	22,2
PL	27,1	30,5	25,4	3,4	10,2	0,0	16,9	8,5	1,7	5,1

Table 65: *Effects of 2008-2009 financial/economic crisis on farm-households by country (number of farms)*

	COUNTRY							
	BG	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
crises do not affect me so far	7	45	3	4	11	33	1	26
income reducing	8	0	3	0	0	7	1	24
decrease in consumptions	1	0	0	0	0	13	1	0
decrease in investment	1	2	0	0	0	0	6	0
expenses for food increased	0	0	0	0	0	0	0	6
other	3	2	1	2	1	16	3	3
missing	0	1	10	0	0	11	0	0
total	**20**	**50**	**17**	**6**	**12**	**80**	**12**	**59**

Table 66: *Effects of 2008-2009 financial/economic crisis on farms by country (number of farms)*

	COUNTRY							
	BG	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
crises do not affect me so far	0	30	0	3	11	14	0	13
costs increased	0	0	1	0	0	1	0	30
lower farm gate prices	9	5	0	3	0	4	0	0
lower demand	1	2	0	0	0	2	0	11
lower income	1	2	0	0	0	6	0	0
prices decreased	0	0	9	0	0	0	0	0
difficult of access to credit, lower liquidity	5	1	0	0	0	3	0	0
other	3	10	2	0	1	27	0	3
missing	1	0	5	0	0	23	12	2
total	20	50	17	6	12	80	12	59

Table 67: *Expected change in product prices (percentage per country)*

Country	**Decrease**	**Increase**	**Stable**	**No reply**	**Tot**
BG	0	20	80	0	100
DE	10	20	68	2	100
ES	0	24	71	6	100
FR	0	0	33	67	100
GR	0	8	92	0	100
IT	8	18	60	15	100
NL	0	8	92	0	100
PL	80	2	19	0	100

Table 68: *Expected change in agricultural labour costs (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	0	10	90	0	100
DE	4	10	86	0	100
ES	0	24	71	6	100
FR	0	33	0	67	100
GR	33	8	58	0	100
IT	1	36	48	15	100
NL	0	0	0	100	100
PL	92	0	5	3	100

Table 69: *Expected change in cost of agricultural capital goods (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	15	20	65	0	100
DE	6	24	70	0	100
ES	29	35	29	6	100
FR	0	33	17	50	100
GR	25	17	58	0	100
IT	3	16	64	18	100
NL	8	8	83	0	100
PL	80	3	17	0	100

Table 70: *Expected change in cost of other production means (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	10	10	80	0	100
DE	8	18	74	0	100
ES	6	18	47	29	100
FR	0	17	0	83	100
GR	8	0	92	0	100
IT	1	6	75	18	100
NL	17	25	58	0	100
PL	75	2	24	0	100

Table 71: *Expected change in decoupled payments (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	0	20	80	0	100
DE	64	24	4	8	100
ES	82	6	6	6	100
FR	17	33	0	50	100
GR	100	0	0	0	100
IT	30	29	5	36	100
NL	67	25	0	8	100
PL	63	3	29	5	100

Table 72: *Expected change in rural development payments (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	0	30	70	0	100
DE	34	28	32	6	100
ES	59	12	24	6	100
FR	17	17	0	67	100
GR	58	25	17	0	100
IT	18	23	21	39	100
NL	17	25	0	58	100
PL	68	3	24	5	100

Table 73: *Expected change in payments for organic production (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	0	40	60	0	100
DE	14	44	38	4	100
ES	71	12	12	6	100
FR	17	17	0	67	100
GR	58	17	25	0	100
IT	16	24	23	38	100
NL	17	25	0	58	100
PL	73	2	22	3	100

Table 74: *Expected change in coupled payments (percentage per country)*

Country	Decrease	Increase	Stable	No reply	Tot
BG	0	40	60	0	100
DE	42	42	12	4	100
ES	82	0	0	18	100
FR	17	33	0	50	100
GR	100	0	0	0	100
IT	19	10	6	65	100
NL	17	25	0	58	100
PL	83	0	0	17	100

Table 75: *Intention to invest in land in the next five years (% per farming system and country)*

			COUNTRY							
Technology	Area	Specialisation	BG	DE	ES	FR	GR	IT	NL	PL
CONVENTIONAL	Mountain	Arable	67	0	0	0	0	25	0	0
		Livestock	20	0	0	0	0	0	0	27
		Permanent	0	67	0	0	0	0	0	0
	Plain	Arable	40	0	100	67	0	7	0	60
		Livestock	43	40	0	0	0	0	100	12
		Permanent	0	0	14	0	0	0	0	0
EMERGING	Mountain	Arable	0	17	0	0	0	13	0	0
		Livestock	0	25	0	0	0	0	0	40
		Permanent	0	0	0	0	0	0	0	0
	Plain	Arable	0	33	0	0	0	0	0	0
		Livestock	0	50	0	0	0	0	100	0
		Permanent	0	0	0	0	0	0	0	0

Table 76: Intention to invest in machinery in the next five years (% per farming system and country)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	67	43	0	0	0	0	0	0
		Livestock	20	40	0	0	0	33	0	36
		Permanent	0	83	0	0	0	20	0	67
	Plain	Arable	40	60	0	67	0	29	0	20
		Livestock	43	20	0	0	0	17	100	35
		Permanent	0	33	14	0	0	9	0	63
EMERGING	Mountain	Arable	0	17	0	0	0	50	0	0
		Livestock	0	50	0	0	0	0	0	80
		Permanent	0	50	0	0	0	0	0	50
	Plain	Arable	0	67	0	0	0	43	0	100
		Livestock	0	50	0	0	0	0	100	25
		Permanent	0	0	0	0	0	33	0	0

Table 77: Intention to invest in building in the next five years (% per farming system and country)

			COUNTRY							
Technology	**Area**	**Specialisation**	**BG**	**DE**	**ES**	**FR**	**GR**	**IT**	**NL**	**PL**
CONVENTIONAL	Mountain	Arable	100	71	0	0	0	50	0	0
		Livestock	40	40	0	0	0	0	0	9
		Permanent	0	83	0	0	0	10	0	0
	Plain	Arable	40	40	0	0	0	29	0	80
		Livestock	86	40	0	0	0	50	60	29
		Permanent	0	67	0	0	0	0	0	63
EMERGING	Mountain	Arable	0	50	0	0	0	25	0	0
		Livestock	0	50	0	0	0	17	0	0
		Permanent	0	50	0	0	0	0	0	50
	Plain	Arable	0	67	0	0	0	14	0	0
		Livestock	0	75	0	0	0	67	86	0
		Permanent	0	0	0	0	0	0	0	0

13. Annex D - Model validation

The model was validated by comparing model output with stated farm choice intentions in the five years following the survey. The comparison was made using the price and payment conditions assumed in scenario 4.2 which is the *status quo* condition in 2009 with the current (2009) price levels and the Health Check situation concerning CAP payments. This was also the scenario which was closest to farmers' expectations. The option to validate the model using farmers' expectations as scenario variables was not used due to the impossibility of deriving consistent quantitative scenario variables from the farmers' answers about their expectations, which were reasonably precise only with respect to the direction of expected change. With respect to the simulation, scenario 1.1 was used as the baseline, as it uses prices and policy hypotheses validated and used for policy analysis purposes by EU Policy Makers.

Comparing simulations with *ex-ante* intentions is a widely applied method in policy analysis and has been used to validate simulation results (see Breen et al., 2005 and Vere et al., 2005).

In addition, the high correspondence between intentions regarding investment resulting from the previous project (years 2006-2011), and those observed in this project (year 2009), in the framework of very heterogeneous price and cost levels, and in the context of the ongoing financial crisis, confirms the suitability of comparisons between stated intentions and model results as validation parameters.

During the calibration process, comparison was made taking into account model results and stated intentions concerning individual activities and assets; using, among others, the following two main validation parameters

- the average deviation between the activity mix in the next five years, and stated intentions about farm activities, normalising the total size of stated activities (hectares, or animals number) to one[28]; this validation parameter is calculated separately with respect to the crop mix, and the animals reared, and as a general index of all activities;
- the deviation between simulated and stated investment intentions is expressed as a share of the total capital stock available on the farm[29].

Table 78 reports the results of the validation parameters of the models.

The validation results allow for an appreciation of the level of accuracy of the models in representing the stated behaviour over the next 5 years. Five models differ strongly from the observed stated intentions concerning the future crop mix (BG 09 MCL; DE 19 PCL; IT 21 MCL; IT 75 PCL and PO 04 PCL), and two models differ strongly compared to the stated intentions with respect to the number of animals reared (BG

28 The validation parameter represents a ratio with a numerator represented by the sum of the absolute value of the difference between the simulation results and the stated size of each activity over the time period 2009-2014, and a denominator expressed as the sum of the size of all activities stated for the time period 2009-2014.

29 The reason for using this parameter derives from the strong heterogeneity in the measurement of investments. The parameter related to investment and the one related to farm activities are connected through an intermediate set that represents the services provided by each specific investment to each crop and livestock. The use of technical coefficients such as 'crop-service' and 'service-investment' can allow for the consideration of the activities and livestock as a proxy of the investments in the validation procedure.

Table 78: Validation parameters in the baseline scenarios (% of absolute deviation from stated activity mix)

Code	VALIDATION		
	Crops	Animals	All Activities
BG 07 PCA	0,10	-	0,10
BG 09 MCL	0,35	0,34	0,35
BG 14 MCA	0,07	-	0,07
DE 12 PCA	0,24	-	0,24
DE 19 PCL	0,47	0,17	0,25
DE 28 MCA	0,06	-	0,06
DE 40 MCL	0,03	0,15	0,09
ES 03 PCP	0,02	-	0,02
FR 06 PCA	0,20	-	0,20
GR 09 PCA	0,19	-	0,19
IT 21 MCL	0,38	0,09	0,29
IT 37 PCA	0,12	-	0,12
IT 75 PCL	0,34	0,24	0,27
IT 80 MCA	0,12	-	0,12
NL 08 PCL	0,14	0,22	0,20
PL 03 PCA	0,20	-	0,20
PL 04 PCL	0,34	0,31	0,33
PL 18 MCL	0,05	0,21	0,12

09 MCL and PO 04 PCL). Altogether, two models in particular (BG 09 MCL and PO 04 PCL) yield results that are significantly different from the stated intentions.

In the majority of models, the validation parameter is also below 30%. However, some of them reveal major differences. These high deviations from stated intentions appear to be due to:

- the very low level of capitalisation, which overemphasises differences in investment (e.g. in GR 09 PCA);
- imprecision during the interview resulting in investment intentions not being stated explicitly, and which, proved necessary based on the initial farm endowment and the intended activity mix (e.g. additional purchase of cows in BG 09 MCL);
- very ambitious stated investment intentions, partly attached to the optimistic expectations related to future prices reported by some farms, which are not consistent with the conditions of scenario 4.2.

In addition, the option to obtain incentives from the RDP was not included in the model. This can cause some of the farms to reduce their actual investments compared to those previously planned.

Based on this, the models were evaluated to be sufficiently accurate for simulating the effect of different scenarios, in spite of the large apparent deviation from stated investment intentions.

14. Annex E - Modelling results

In most of the farms modelled, the scenario hypotheses have a negative impact on farm income. In four scenarios some farms have an increase in farm income with respect to the baseline condition (Table 79).

Under Scenario 1.2 (GR+LSP), the hypothesis of a reduction in CAP payments and the liberalisation scenario produces a small reduction in farm income in the first period. Only farm PO 04 PCL has a significant reduction during the first period as a consequence of the abandonment during the period. Farm income is reducing more consistently in the second period when the reduction is between – 3% in DE 19 PCL to -100% in PO 04 PCL. The latter is also the only farm to exit agricultural activity in the period (which explains the reduction of 100% in farm income). For the others, the reduction of farm income is between -3% and -55%.

The hypothesis of scenario 2.1 (-30%+LP) determines a further reduction in farm incomes compared to the previous scenario. Generally, the reduction is concentrated during the second period, and ranges between -13 and -89% compared to the baseline, with the exception of BG 09 MCL which exits farming in the period (-100%). In the longer term (2014-2020), the hypothesis of a 30% reduction of SFP, and a reduction in prices of 20%, determines three additional exits from agriculture with respect to the previous scenario (BG 09 MCL; DE 28 CA; IT 37 PCA). However, the two livestock farms in Germany under scenario 2.1 (-30%+LP) have a positive increase in farm profit compared to the baseline of 8% and 9%. This becomes more evident in the only specialised dairy farm (NL 08 PCL) which experiences an increase in income by over 100% in the second period of scenario 2.1. These positive changes in farm income are a consequence of the significant reduction in milk prices that occurs during the second period in the baseline scenario.

Under scenario 2.2 (GR+LP) the reductions in farm income in the first period are very similar to scenario 2.1. Further reductions in farm income, with respect to scenario 2.1, appear in the second period . Such differences highlight the relevance of the CAP payments on farm income support. In fact, the SFP progressive reduction results in a further reduction of farm income between 10 and 49% in six farms (BG 07 PCA, BG 14 MCA, DE 12 PCA, FR 06 PCA, IT 75 PCL, and IT 80 MCA).

Scenario 3.1 (-100+CP) implies a complete abolition of the SFP with a constant current price level. The changes in farm income with respect to the baseline condition are extremely variable between farms, and can be positive or negative in one or both periods. During the first period, eight farms (mainly belonging to livestock systems) experience a positive change with a maximum of increase of 15% (DE 19 PCL; DE 40 MCL; FR 06 PCA; IT 21 MCL; IT 75 PCL; NL 08 PCL; PO 03 PCA; PO 18 MCL). The increase in farm profit in the second period is still maintained by six farms, with a major increase for NL 08 PCL explained by the fact that we compare the highest prices across all scenarios (current 2009 prices) with the low prices of the ESIM simulation assumed in the baseline. Farms FR06PCA and PO 18 MCL have a negative change in farm profit compared to the baseline: – 6% and -39% respectively.

All of the other farms have a reduction of farm profit with respect to the baseline condition. The scenario hypothesis determines that an additional farm exits the agricultural sector with respect to the baseline condition (DE 28 MCA).

Table 79: Results of different scenarios – Farm income (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020
BG 07 PCA	-0%	-24%	-45%	-60%	-45%	-81%	-5%	-71%	-45%	-49%	-45%	-37%	-5%	9%
BG 09 MCL	-0%	-3%	-100%	-100%	-100%	-100%	-7%	-11%	-100%	-100%	-100%	-100%	-10%	-3%
BG 14 MCA	-0%	-23%	-36%	-47%	-36%	-66%	-4%	-60%	-36%	-37%	-36%	-26%	-4%	10%
DE 12 PCA	-0%	-13%	-26%	-30%	-26%	-79%	-2%	-30%	-26%	-24%	-26%	-19%	-2%	5%
DE 19 PCL	0%	-3%	-16%	8%	-16%	6%	9%	36%	-16%	9%	-16%	10%	9%	42%
DE 28 MCA	-1%	-55%	-86%	-100%	-86%	-100%	-5%	-100%	-41%	-46%	-42%	-80%	-4%	31%
DE 40 MCL	0%	-5%	-17%	9%	-17%	7%	10%	38%	-17%	11%	-17%	15%	10%	60%
ES 03 PCP	-6%	-21%	-55%	-88%	-55%	-88%	-7%	-23%	-55%	-87%	-51%	-66%	-1%	3%
FR 06 PCA	-0%	-14%	-13%	-10%	-13%	-20%	14%	-6%	-13%	-4%	-13%	1%	14%	32%
GR 09 PCA	-1%	-15%	-36%	-39%	-36%	-42%	-1%	-17%	-36%	-35%	-36%	-27%	-1%	13%
IT 21 MCL	0%	-8%	-23%	-2%	-23%	-7%	8%	27%	-23%	0%	-23%	3%	8%	45%
IT 37 PCA	-16%	-9%	-71%	-100%	-85%	-100%	-2%	-27%	-28%	-30%	-28%	-55%	-2%	2%
IT 75 PCL	-2%	-10%	-22%	-0%	-20%	-12%	7%	14%	-21%	-2%	-21%	1%	1%	39%
IT 80 MCA	-0%	-24%	-54%	-72%	-54%	-91%	-54%	-68%	-1%	30%	-54%	-64%	-1%	56%
NL 08 PCL	0%	0%	-74%	0%	-74%	0%	84%	0%	-74%	0%	-74%	0%	84%	0%
PL 03 PCA	-0%	-7%	-33%	-25%	-33%	-31%	0%	3%	-33%	-21%	-33%	-19%	0%	22%
PL 04 PCL	-77%	-100%	-89%	-100%	-89%	-100%	-77%	-100%	-89%	-100%	-89%	-100%	-1%	1008%
PL 18 MCL	-5%	-22%	-65%	-53%	-44%	-53%	1%	-39%	-44%	-53%	-37%	-36%	2%	230%

Table 80: Results of different scenarios – Household income (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020
BG 07 PCA	-0%	-19%	-46%	-61%	-46%	-73%	-5%	-61%	-46%	-51%	-46%	-40%	-5%	7%
BG 09 MCL	-0%	-3%	-86%	-92%	-86%	-92%	-8%	-15%	-86%	-92%	-86%	-92%	-9%	-5%
BG 14 MCA	-0%	-16%	-29%	-39%	-29%	-51%	-3%	-44%	-29%	-31%	-29%	-24%	-3%	7%
DE 12 PCA	-0%	-11%	-25%	-31%	-25%	-59%	-2%	-28%	-25%	-27%	-25%	-22%	-2%	5%
DE 19 PCL	0%	-2%	-16%	4%	-16%	2%	9%	32%	-16%	4%	-16%	5%	9%	37%
DE 28 MCA	-1%	-30%	-56%	-60%	-56%	-60%	-5%	-56%	-32%	-34%	-32%	-50%	-3%	19%
DE 40 MCL	0%	-4%	-18%	5%	-18%	4%	9%	38%	-18%	7%	-18%	9%	10%	52%
ES 03 PCP	-2%	-11%	-37%	-43%	-37%	-44%	-3%	-12%	-37%	-43%	-35%	-37%	-1%	2%
FR 06 PCA	-0%	-12%	-12%	-10%	-12%	-19%	14%	-4%	-12%	-5%	-12%	-0%	14%	30%
GR 09 PCA	-1%	-14%	-40%	-45%	-40%	-46%	-2%	-12%	-40%	-41%	-40%	-36%	-1%	13%
IT 21 MCL	0%	-5%	-16%	-3%	-16%	-6%	5%	16%	-16%	-2%	-16%	-0%	5%	27%
IT 37 PCA	-12%	-8%	-44%	-56%	-51%	-56%	-2%	-21%	-22%	-24%	-22%	-36%	-2%	2%
IT 75 PCL	-1%	-8%	-18%	-3%	-16%	-10%	4%	9%	-17%	-4%	-17%	-1%	2%	28%
IT 80 MCA	-0%	-2%	-10%	-8%	-10%	-9%	-10%	-8%	-0%	1%	-10%	-7%	-0%	4%
NL 08 PCL	0%	0%	-42%	-6%	-42%	-6%	44%	17%	-42%	-6%	-42%	-6%	44%	152%
PL 03 PCA	-0%	-6%	-34%	-30%	-34%	-32%	0%	2%	-34%	-27%	-34%	-25%	0%	16%
PL 04 PCL	-23%	-8%	-26%	-5%	-26%	-5%	-22%	-6%	-26%	-5%	-26%	-5%	-1%	27%
PL 18 MCL	-5%	-8%	-42%	-26%	-36%	-27%	0%	-5%	-36%	-27%	-33%	-28%	2%	83%

Under scenario 3.2 (-15+LP) the hypothesis determines a strong reduction in farm income compared with the baseline, and compared with the previous scenario (3.1). This is more evident in the first period during which two farms exit the agricultural sector (BG 09 MCL and PO 04 PCL). With respect to the previous scenario (3.1), the reduction of the SFP by 15% instead of its elimination, results in farm DE 28 MCA remaining in the agricultural sector, even in low price conditions.

The hypothesis in Scenario 4.1 (HC + LP) does not differ from scenario 3.2 in the first period, but provides for a higher value of SFP (+15%) after 2013. Results with respect to farm income are quite homogeneous between the two scenarios, in particular in the first period. However, the difference in SFP levels among the two scenarios determines a lower reduction in farm income, and a greater number of farms with positive changes with respect to the baseline (DE 19 PCL; DE 40 MCL; FR 06 PCA; IT 21 MCL; IT 75 PCL; NL 08 PCL). In both scenario 3.2 and 4.1, two farms exit the agricultural sector (BG 09 MCL and PO 04 PCL).

Under scenario 4.2 (HC+CP) the hypothesis of 2009 prices determines changes in both directions with respect to the baseline. During the first period, eight farms increase the farm income with values less than + 14%, and all other farms decrease farm income less than -10%. During the second period, with the exception of BG 09 MCL, all farms have an increase in farm income indicators, with increments ranging from 3% to above 1000%. The latter is the case for two farms (NL 08 PCL and PO 04 PCL) for which economic results are very dependent on milk prices. Under the assumption of this scenario, no farms exit the agricultural sector.

The negative effects on farm income, when they occur, are mainly determined by the hypothesis of lower prices. This can be observed in particular by looking at scenario 3.1 (-100+CP) (with no payments after 2014, but lower prices) in comparison with scenario 4.1 (HC+LP) (with current payments, but lower prices by 20%). However, even with current prices as in scenario 3.1 (-100+CP), the complete removal of SFP results in a very significant reduction in farm incomes.

The prices used in scenario 1.1 vary greatly between the different crops and products. This has a strong impact on the reduction in farm income, in particular for the farms belonging to livestock systems, for which comparatively higher prices are delivered by the Scenar 2020 II simulations (milk).

The impact on household income differs from the farm income as it accounts for off-farm income (due to off-farm use of labour and capital). However, in most cases, it is quite similar to the impact on farm income, due to the high concentration of labour, capital or both in farming activities by the farm-households modelled (with a consequent high share of income from agriculture) (Table 80).

Differences across scenarios, in this case, depend not only on the different initial weights of off-farm income, but also on the possibility of re-allocation of labour and capital between on and off-farm uses[30]. Similar to the case of farm income, farms have changes in both directions in all scenarios with the exception of scenario 1.2.

30 The model allows for the selection of different allocations of household labour between on and off-farm only for those household members who were already involved in off-farm activities at the time of the survey. This assumption has excluded the possibility of allowing the model to allocate off-farm a part or all of the labour of household members who work full-time on-farm. The reason for this constraint is to avoid adding arbitrary assumptions regarding the opportunity costs of on-farm labour to the model.

Table 81: Results of different scenarios – Net investment (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	0%	-96%	0%	0%	0%	-451%	-44%	-72%	0%	0%	0%	0%	0%	0%
BG 09 MCL	0%	0%	-112%	-100%	-112%	-100%	0%	7%	-112%	-100%	-112%	-100%	-10%	9%
BG 14 MCA	0%	-22%	-11%	0%	0%	-351%	-11%	0%	0%	0%	0%	0%	0%	0%
DE 12 PCA	0%	0%	-0%	0%	0%	-644%	0%	0%	0%	-1%	0%	0%	0%	0%
DE 19 PCL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DE 28 MCA	-75%	-17%	-4449%	100%	-4449%	100%	-3772%	100%	-1279%	35%	-1279%	15%	0%	124%
DE 40 MCL	0%	-46%	-136%	93%	0%	-48%	-181%	139%	-136%	139%	0%	0%	0%	185%
ES 03 PCP	-211%	-356%	-2239%	-259%	-2097%	-412%	-210%	-375%	-2103%	-408%	-1250%	-873%	0%	0%
FR 06 PCA	-4%	0%	-17%	0%	-1%	0%	-3%	-0%	-3%	0%	-3%	0%	-4%	0%
GR 09 PCA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
IT 21 MCL	0%	-0%	0%	0%	0%	0%	8%	-5%	0%	0%	0%	0%	7%	-2%
IT 37 PCA	-6%	-103%	-13161%	-62%	-13187%	-152%	-6%	-21405%	-39%	-103%	-39%	-17033%	0%	-103%
IT 75 PCL	9%	-6%	7%	3%	7%	-20%	6%	11%	4%	-1%	2%	-0%	3%	5%
IT 80 MCA	0%	-7%	0%	-41%	0%	-88%	0%	-40%	0%	3%	0%	-39%	0%	11%
NL 08 PCL	0%	0%	-6%	0%	-6%	0%	40%	0%	-6%	0%	-6%	0%	70%	0%
PL 03 PCA	0%	-15%	-0%	-11%	-1%	-681%	0%	-15%	0%	1%	-1%	1%	0%	228%
PL 04 PCL	-60%	85%	-88%	100%	-88%	100%	-68%	96%	-88%	100%	-88%	100%	8%	119%
PL 18 MCL	-46%	12%	-388%	125%	-364%	120%	-337%	122%	-364%	120%	-29%	-6%	76%	146%

Table 82: Results of different scenarios – Labour on-farm (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020	2009-2013	2014-2020
BG 07 PCA	0%	-1%	0%	0%	0%	-50%	0%	0%	0%	-16%	0%	0%	0%	0%
BG 09 MCL	0%	0%	-99%	-100%	-99%	-100%	-99%	-100%	-4%	-3%	-99%	-100%	-7%	-3%
BG 14 MCA	0%	-1%	-3%	-4%	-3%	-18%	-3%	-4%	0%	-4%	-3%	-4%	0%	0%
DE 12 PCA	0%	0%	0%	-11%	0%	-74%	0%	-11%	0%	-11%	0%	-11%	0%	-11%
DE 19 PCL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DE 28 MCA	-1%	-54%	-81%	-100%	-81%	-100%	-22%	-26%	-1%	-100%	-21%	-75%	0%	20%
DE 40 MCL	0%	-0%	0%	-2%	0%	-0%	0%	-2%	0%	-1%	0%	0%	0%	5%
ES 03 PCP	-5%	-11%	-32%	-88%	-32%	-87%	-32%	-85%	-5%	-11%	-26%	-54%	0%	0%
FR 06 PCA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GR 09 PCA	0%	-1%	0%	1%	0%	1%	0%	1%	0%	1%	0%	1%	0%	1%
IT 21 MCL	0%	0%	-2%	0%	-2%	0%	-2%	0%	1%	1%	-2%	0%	1%	1%
IT 37 PCA	-20%	0%	-61%	-100%	-80%	-100%	0%	0%	0%	0%	0%	-43%	0%	0%
IT 75 PCL	-1%	3%	-4%	1%	-2%	3%	-3%	0%	2%	2%	-3%	0%	-5%	2%
IT 80 MCA	0%	-17%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	20%
NL 08 PCL	0%	0%	-64%	0%	-64%	0%	-64%	0%	78%	0%	-64%	0%	78%	0%
PL 03 PCA	0%	3%	0%	-1%	-3%	-11%	0%	3%	0%	-1%	-2%	1%	0%	3%
PL 04 PCL	-79%	-100%	-82%	-100%	-82%	-100%	-82%	-100%	-79%	-100%	-82%	-100%	0%	811%
PL 18 MCL	-1%	-32%	-71%	-95%	-43%	-95%	-43%	-95%	-1%	-95%	-37%	-76%	0%	259%

The strongest decrease of household income is in BG 09 MCL, in which the 4 scenarios, 2.1 (-30+LP), 2.2 (GR+LP), 3.2 (-15+LP) and 4.1 (HC+LP), have reductions of around – 80% and – 90% for the first and second periods in all scenarios compared with the baseline.

In line with the farm income indicator, the "least bad" scenario is 4.2 (-100+CP) with change between -9 % and + 44% in the first period, and between -5% and +152% in the second.

The scenarios proposed, consistently with income reduction, bring about a general reduction in net investments with respect to baseline conditions[31] (Table 81).

Two farm households (DE 12 PCA, and GR 09 PCA) do not see a change in net investments in different scenarios. Some of the other farm households have a reduction in investment, such as in FR 06 PCA; IT 21 MCL; IT 80 MCA, whilst other farm households have increased disinvestments in existing assets with the exception of farm IT 75 PCL, which has a substantial increase in investment[32].

Investment behaviour is very different between farm households, and is quite consistent for all time periods in the scenarios (with the exception of farms household DE 28 MCA; PO 04 PCL and PO 18 MCL which disinvest in the first period, and invest in the second period with respect to the baseline). This is generally a consequence of farm specialisation, farm endowment and the age of assets. In fact, the scenario assumptions (mainly payment and price reductions) generally only justify a replacement of the existing investment, or the execution of already planned investments, if any.

Along with farm income and household income, the worst values of the indicators are under scenarios 2.1 (-30+LP) and 2.2 (GR+LP).

Scenario 4.2 (HC+CP) presents the highest net investment value, due to the assumption of higher (2009) prices and payments. During the second period, only farm IT37PCA has a negative value of net investment with respect to the baseline. The investment activity with respect to the baseline is strongest in the Polish farms, followed by the Dutch farm. A positive attitude towards investment is also very evident in three of the German farms. However, one of them has a higher investment in the first period and a lower investment in the second, contrary to the main trend.

The most consistent positive investment attitude is that of NL 08 PCL (the only farm specialised in dairy) which, due to the very low level of milk prices assumed in the baseline scenario, would increase investment in all cases, reflecting an expansion-oriented strategy in the more favourable conditions.

As is the case for other indicators, on-farm labour is mainly reduced compared to scenario 1.1 under the other scenario conditions hypothesised (Table 82).

With the exception of scenario 4.2 the amount of on-farm labour is reduced or is constant among scenarios and over time. In scenario 4.2, only two farms see the amount of on-farm labour reduced with

31 The percentage has been calculated as the ratio between the difference of net investment under the scenario and the baseline, and the absolute value of net investment under baseline conditions. This is the case due to the impossibility of calculating percentages starting from a negative value in the baseline.

32 Values of net investment of -100% mean that under the scenario conditions the farmers do not undertake the investment realised in the baseline. Further reductions of net investment indicators, under scenario conditions (e.g. less than -100%) imply that in addition to no investment realised in baseline, the farmer disinvests the existing assets.

Table 83: Results of different scenarios – Nitrogen Used (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	0%	-2%	0%	0%	0%	-50%	0%	-16%	0%	0%	0%	0%	0%	0%
BG 09 MCL	0%	0%	-97%	-100%	-97%	-100%	-33%	-100%	-97%	-100%	-97%	-100%	-32%	-47%
BG 14 MCA	0%	-1%	0%	-2%	0%	-17%	0%	-4%	0%	0%	0%	0%	0%	0%
DE 12 PCA	0%	0%	0%	-2%	0%	-72%	0%	-2%	0%	-2%	0%	-2%	0%	-2%
DE 19 PCL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DE 28 MCA	-1%	-54%	-80%	-100%	-80%	-100%	-1%	-100%	-17%	-21%	-16%	-74%	0%	20%
DE 40 MCL	0%	-8%	-2%	-63%	-2%	-63%	-2%	-100%	-2%	-49%	-2%	-5%	-2%	104%
ES 03 PCP	-5%	-11%	-32%	-88%	-32%	-87%	-5%	-11%	-32%	-85%	-26%	-54%	0%	0%
FR 06 PCA	0%	0%	0%	0%	0%	0%	0%	-2%	0%	0%	0%	0%	0%	0%
GR 09 PCA	0%	1%	0%	-29%	0%	-76%	0%	-100%	0%	-16%	0%	-1%	0%	-1%
IT 21 MCL	0%	0%	-100%	0%	-100%	0%	0%	0%	-100%	0%	-100%	0%	0%	0%
IT 37 PCA	-20%	0%	-61%	-100%	-80%	-100%	0%	0%	0%	0%	0%	-43%	0%	0%
IT 75 PCL	-1%	6%	-4%	4%	-2%	5%	1%	3%	-3%	2%	-3%	2%	36%	3%
IT 80 MCA	0%	30%	0%	-15%	0%	-21%	0%	-14%	0%	2%	0%	-14%	0%	3%
NL 08 PCL	0%	0%	-62%	0%	-62%	0%	76%	0%	-62%	0%	-62%	0%	76%	0%
PL 03 PCA	0%	6%	0%	-2%	-7%	-26%	0%	-2%	0%	8%	-5%	2%	0%	7%
PL 04 PCL	-79%	-100%	-80%	-100%	-80%	-100%	-79%	-100%	-80%	-100%	-80%	-100%	0%	811%
PL 18 MCL	0%	-26%	-56%	-75%	-19%	-75%	0%	-75%	-19%	-75%	0%	-11%	0%	235%

Table 84: Results of different scenarios – Water Used (% difference with respect to baseline)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
DE 12 PCA	0%	0%	0%	0%	0%	-14%	0%	0%	0%	0%	0%	0%	0%	0%
ES 03 PCP	-5%	-11%	-32%	-88%	-32%	-87%	-5%	-11%	-32%	-85%	-26%	-54%	0%	0%
GR 09 PCA	0%	1%	0%	-21%	0%	-54%	0%	-71%	0%	-11%	0%	0%	0%	0%
IT 37 PCA	-20%	0%	-61%	-100%	-80%	-100%	0%	0%	0%	0%	0%	-43%	0%	0%
IT 75 PCL	-1%	6%	-4%	4%	-2%	5%	1%	3%	-3%	2%	-3%	2%	36%	3%
IT 80 MCA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PL 03 PCA	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PL 04 PCL	-79%	-100%	-80%	-100%	-80%	-100%	-79%	-100%	-80%	-100%	-80%	-100%	0%	811%
PL 18 MCL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%

Table 85: Marginal value of land rented in (difference with baseline in euro/ha)

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG 09 MCL	-0,35	-33,23	-1,17	-114,14	-1,17	-114,14	-1,17	-113,26	-1,17	-114,14	-1,17	-114,14	-1,17	-66,62
BG 14 MCA	-45,86	5,26	-25,88	-13,34	-29,37	-21,19	-25,88	-31,05	-35,47	1,63	-35,47	5,97	-32,24	0
DE 12 PCA	-62,33	24,63	354,03	493,3	139,6	304,89	354,03	493,3	-111,23	-	-111,23	-	-35,14	11,04
DE 19 PCL	-	-	-209,07	234,05	-	-	-	-	-209,07	234,05	-209,07	234,05	-	-
DE 28 MCA	-0,64	-214,94	-549,24	-366,8	-549,24	-366,8	-26,78	-366,8	-416,05	-352,38	-533,56	-323,41	-26,78	95,4
DE 40 MCL	20,28	-14,48	20,28	-14,48	13,03	-9,31	20,28	-14,48	20,28	-20,2	20,28	-14,48	20,28	-34,75
ES 03 PCP	-270,89	-59,87	-31,11	-289,56	-31,11	-289,56	-89,9	-183,63	-31,11	-361,64	-52,09	-206,55	33,76	-32,21
FR 06 PCA	-2,28	-134,45	-151,04	-73,74	-151,04	-173,31	257,28	-28,27	-151,04	-13,81	-151,04	46,12	257,28	371,25
GR 09 PCA	-6,07	-86,76	-569,62	-1.054,17	-569,62	-1.011,83	-135,26	-1.054,17	-569,62	-807,38	-569,62	-688,66	-135,26	-368,98
IT 21 MCL	1.417,20	-38,03	8,56	-19,08	-73,25	19,39	2.318,30	2.240,69	-73,25	19,39	-73,25	19,39	2.318,30	2.240,69
IT 37 PCA	-90,87	-108,59	-379,49	-338,77	-419,53	-338,77	-30,23	-295,84	-300,07	-274,38	-300,07	-270,86	-30,23	27,87
IT 75 PCL	-	37,54	-73,78	90,23	-77,21	73,91	5,1	37,54	-77,21	92,69	-	37,54	5,1	18,76
IT 80 MCA	-8,91	-34,55	-212,4	-131,2	-226,38	-171,31	22,15	67,43	-212,4	-131,2	-212,4	-131,2	22,15	67,43
NL 08 PCL	-	-	1,04	30,44	1,04	30,44	-77,64	211,43	-134,16	279,15	-134,16	-3,46	-124,33	458,58
PL 03 PCA	-	0	-	-	-	-	-	0	-	0,23	-	-	-	-
PL 04 PCL	-121,3	-	-121,3	-	-121,3	-	-121,3	-	-121,3	-	-121,3	-	-27,97	120,05
PL 18 MCL	-37,29	20,15	-113,02	29,41	-69,69	-20,98	-2,56	21,69	-69,69	-20,98	-37,35	53,32	-2,56	72,92

respect to the baseline. The other farms have an increase of the indicator in an interval between 1% and over 800%, such as in PO 04 PCL. In many cases (already detected through the income indicator) the scenario hypotheses determine abandonment of the farm activity with respect to the baseline. In scenario 1.2, only farm PO 04 PCL abandons the farm activity. Under scenario 2.1 and 2.2, four farms abandon the farm activity (BG 09 MCL; DE 28 MCA; IT 37 PCA and PO 04 PCL). Under scenario 3.1, 3.2 and 4.1 only two farms exit the farm activity (respectively BG 09 MCL, and PO 04 PCL for both scenarios 3.1 and 4.1, and IT 37 PCA and PO 04 PCL for scenario 3.2).

In addition, different scenario hypotheses impact strongly on the amount of on-farm labour for the farm households that do not exit the agricultural activity. The value of on-farm labour indicators for these farm households is very differentiated among scenarios, with higher reductions observed in scenarios 2.1 (-30+LP) and 2.2 (GR+LP).

The peculiar trend of NL 08 PCL, the only farm specialised in dairy and consequently depending totally on milk price, is due to the very low level of milk prices assumed in the baseline scenario. This results in major increases in labour use in all other scenarios, reflecting the shift from a conservative strategy in the baseline to an expansion-oriented strategy in the more favourable conditions.

The different scenarios determine a lower change in the use of nitrogen and water, compared to the other indicators (Table 83 and Table 84).

The cases with the highest reduction in both water and nitrogen use (100%) can be explained by either the abandonment of a farm activity, or the substitution of crops that use significant water or nitrogen for those that do not use any water or nitrogen. Similarly to the other indicators, only in scenario 4.2 do farms intensify production with a higher use of both water and nitrogen per hectare.

The marginal value of land rented-in in different scenarios is reported in Table 85.[33].

In the large majority of cases the prevailing signs are negative, meaning that renting additional units of land is less profitable with respect to the baseline and this reduces the demand for land. Positive values are instead more frequent in scenario 4.2 (HC+CP), due to the higher prices and payment conditions, which is also reflected in a willingness to pay for additional land. The variety of differences across periods, scenarios and farms, however, shows that marginal results in these models are highly dependent on the specific combination of constraints related to the different assets of the farm, and rarely show smooth trends. This is particularly important for livestock farms in which the marginal value of land shows higher variability, depending on the extent to which the values generated by livestock production are actually transmitted to the marginal value of land.

The marginal value of the labour constraint is reported in Table 86.

In almost all cases there is no difference across scenarios, meaning that the constraints related to external labour are not binding, and that the marginal value is simply related to the (linear) local salary. In the cases in which the scenarios make some difference, the difference is mostly negative compared to the baseline, with the exception of scenario 4.2. Cases of very high marginal values, such as DE 28 MCA in

33 The table related to the marginal value of land purchased is omitted here due to the small number of non-zero values.

Table 86: *Marginal value of labour constraints (difference with baseline in euro/hour)*

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	-0,01	-1,36	-3,34	-3,53	-3,34	-3,99	-0,44	-4,41	-3,34	-2,84	-3,34	-2,16	-0,44	0,54
BG 09 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG 14 MCA	-	-0,02	-0,11	-0,1	-0,11	-1,31	-	-0,61	-0,11	-0,1	-0,11	-0,1	-	-
DE 12 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE 19 PCL	0,15	-0,44	-10,5	2,78	-10,5	2,78	5,27	14,53	-10,5	2,78	-10,5	2,78	5,27	14,53
DE 28 MCA	-0,39	-58,56	-200,27	-128,68	-200,27	-128,68	20,34	-128,68	179,35	173,96	-59,54	-85,2	20,34	65,52
DE 40 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES 03 PCP	-	-0,6	-2,37	-2,35	-2,37	-2,35	-	-0,6	-2,37	-2,35	-2,34	-2,35	-	-
FR 06 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GR 09 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 21 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 37 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 75 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 80 MCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NL 08 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PL 03 PCA	0,38	-13,81	18,66	5,2	24,5	3,08	9,13	27,22	18,66	3,41	23,54	8,54	9,13	1,45
PL 04 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PL 18 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 87: *Marginal value of saving constraints (difference with baseline in euro/euro)*

Code	12_GR+LSP		21_-30+LP		22_GR+LP		31_-100+CP		32_-15+LP		41_HC+LP		42_HC+CP	
	2009-2013	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*	*2009-2013*	*2014-2020*
BG 07 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BG 09 MCL	0	-	-0,82	-0,03	-0,82	-0,03	0,36	0,15	-0,82	-0,03	-0,82	-0,03	-0,28	0,05
BG 14 MCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DE 12 PCA	-0,01	-	-0,01	-	-0,01	-	-0,01	-	-0,01	-	-0,01	-	-0,01	-
DE 19 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-0,04	-0,03
DE 28 MCA	-	-	0,03	0,02	0,03	0,02	-	-	1,96	1,63	0,01	0,01	-	-
DE 40 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES 03 PCP	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FR 06 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GR 09 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 21 MCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 37 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 75 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT 80 MCA	-0,04	-0,03	-0,16	-0,14	-0,29	-0,25	0,1	0,09	-0,16	-0,14	-0,16	-0,14	0,1	0,09
NL 08 PCL	-	-	-0,01	-0,03	-0,01	-0,03	-0,04	-0,11	0,19	0,16	-0,04	-0,1	0,09	-0,03
PL 03 PCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PL 04 PCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PL 18 MCL	-	-	0,01	0,01	0,01	0,01	-	-	0,01	0,01	0,16	0,12	-	-

scenario 3.2, reflect more a peculiarity of the specific farm, in which the strict labour constraints translates into high marginal values for labour, rather than leading to any general conclusions about the scenarios.

The difference in marginal value of (monetary) capital availability through the saving constraint is reported in Table 87.

With respect to the saving constraint, in most cases (11 out of 18 farms) there is no change across scenarios, meaning that the marginal value of money available is in fact equal to the (linear) positive interest rate produced by savings. Higher marginal values reflect the existence of a liquidity constraint to investment and cause a differentiation across scenarios. In this case, the effect of scenarios is not straightforward, as the differences with respect to the baseline are always negative for two farms, always positive for another two farms, and mixed (positive and negative) signs for the further three farms showing some change across scenarios. Higher increases in marginal values are mostly associated with scenarios that include lower prices (e.g. scenario 3.2)

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Abstract

The results of the study, based on survey-based statistical analysis as well as on modelling of farm behaviour, can be summarised in four main outcomes.

Similar to the results of the first Investment study carried out in 2006 and published in 2008 (Gallerani et. al.), in the context of the present study (carried out in 2009) for about half of the farms decoupling did not result in any change. Among those farms showing some reaction, one of the more prominent effects is the increase in on farm investment.

The price trends in 2007/2008 and the ongoing economic and financial crisis have partially reshaped access to credit and households' perception concerning their objectives, constraints and expectations. In particular, farms have witnessed a major reduction in access to credit, particularly evident in the share of farms using short term credit, which dropped from more than 40% in 2006 to about 7% in 2009.

The change in economic conditions has increased the role of the CAP, and the importance of CAP payments in covering current expenditures has become more evident.

Prices confirm their role as the key variable for investment choices. The results of the modelling exercise confirm that farm and farm-household income and investment choices depend more on the price level than on the level of payment received.

Altogether, the combined effect of the recent policy reform (decoupling and first pillar payment reductions), as well as price and cost developments tend to reinforce the role of policy for the economic and social sustainability of farming. Notably, policy areas such as income support, investment and credit management, market access, as well as transitory and cross-policy mechanisms, appear to be of particular importance. Uncertainty (and related risk-management instruments) seems to play an increasing role in the investment decision process.

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