Disaggregated Impacts of CAP Reforms

PROCEEDINGS OF AN OECD WORKSHOP

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Please cite this publication as:
OECD (2011), *Disaggregated Impacts of CAP Reforms: Proceedings of an OECD Workshop*
Publishing.
http://dx.doi.org/10.1787/9789264097070-en

ISBN 978-92-64-09653-0 (print)
ISBN 978-92-64-09707-0 (PDF)

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Foreword

The OECD Workshop on the Disaggregated Impacts of CAP Reforms was held in Paris on 10-11 March 2010. It was organised as part of a wider project to evaluate 25 years of reforms of the Common Agricultural Policy of the European Union. The workshop focused on reforms since 2003 and their impact at the national, regional and farm levels.

These proceedings contain the 16 papers presented at the workshop and are organised as follows: agricultural markets and farm performance (Part 1); land markets and farm structure (Part II); the dairy sector (Part III); the agro-food industry (Part IV); the distribution of support and income (Part V); the environment (Part VI) and rural development (Part VII). The workshop agenda is provided in the annex.

These proceedings also contain an overview which explains the context in which the workshop took place, briefly presents the coverage of the different contributions included in these proceedings, and outlines the main approaches, findings, and scope for further work as identified in the closing session of the workshop.

Acknowledgements

Catherine Moreddu organised the workshop and supervised the preparation of the proceedings. Michèle Patterson provided editorial assistance.

The OECD expresses its appreciation to all participants for contributing to the success of the workshop. The Secretariat would like to thank in particular the authors of the papers included in the proceedings for their efforts in writing and re-writing their contributions and Ken Thomson for his excellent editing of this volume.

Table of contents

Abbreviations

ABM	Agent-Based Model
ACP	African, Caribbean and Pacific countries
AGMEMOD	Agricultural Member State Modelling
AgriPoliS	Agricultural Policy Simulator
ANOVA	Analysis of variance
ASC	Agricultural Structural Census
AWU	Annual work unit
CAP	Common Agricultural Policy
CAPRI	Common Agricultural Policy Regionalised Impact Modelling System
CAPSIM	Common Agricultural Policy Simulation
CMO	Common Market Organisations
COP	Cereals, Oilseeds and Protein crops
CPI	Consumer Price Index
DG	Directorate-General
DG-AGRI	Directorate-General for Agriculture and Rural Development
DP	Direct payments
DPSIR	Driving force-Pressure-State-Impact-Response
DSR	Driving force-State-Response
EAA	Economic Accounts of Agriculture
EAFRD	European Agricultural Fund for Rural Development
EBA	Everything but Arms
EDIM	European Dairy Industry Model
EC	European Council
EEC	European Economic Community
EPA	Economic Partnership Agreements
ESIM	European Simulation Model
ESU	European Size Unit
EU	European Union
EU2	Countries which joined the EU in 2007
EU10	Countries which joined the EU in 2004
EU12/EU10+2	Countries which joined the EU in 2004 and 2007
EU15	Countries which were member of the EU in 2003
EU25	Countries which were member of the EU between 2004 and 2006
EU27	Countries which were member of the EU from 2007
EUROSTAT	Statistical Office of the European Communities
FADN	Farm Accountancy Data Network
FAIR Act	Federal Agricultural Improvement and Reform Act
FAO	Food and Agriculture Organization
FAPRI	Food and Agricultural Policy Research Institute
FEOGA	Fonds Européen d'Orientation et de Garantie Agricole (European Agricultural Guidance and Guarantee Fund)

FFI	Family Farm Income
GAEC	Good Agricultural and Environmental Conditions
GDP	Gross Domestic Product
GFP	Good Farming Practices
GVA	Gross Value Added
Ha	Hectares
IACS	Integrated Administration and Control System
IDEMA	The Impact of Decoupling and Modulation in the Enlarged Union: a sectoral and farm level assessment
I-O	Input-Output Analysis
Kg	Kilogramme
LEADER	Liaison Entre Actions de Développement de l'Économie Rurale (Links between the rural economy and development actions)
LFA	Less Favoured Area
LDP	Loan Deficiency Payments
LP	Linear Programming
MFN	Most Favoured Nation
MLA	Marketing Loss Assistance
MTR	Mid-Term Review
NMS	New member states
NUTS	Nomenclature of territorial units for statistics
OECD	Organisation for Economic Cooperation and Development
PASMA	Positive Agricultural Sector Model Austria
PEM	Policy Evaluation Model
PFC	Production Flexibility Contract
PMP	Positive Mathematical Programming
PSR	Pressure-State-Response
RDP	Rural development Programme
RED	Renewable Energy Directive
SAPS	Single Area Payment Scheme
SFP	Single Farm Payment
SMP	Skimmed Milk Powder
SMR	Statutory Management Requirements
SPBM	Special Premium for Bovine Male
SPS	Single Payment Scheme
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TRQ	Tariff Rate Quotas
TVC	Total Variable Cost
UAA	Utilized Agricultural Area
UEP	Utility Efficient Programming
URAA	Uruguay Round Agreement on Agriculture
WTO	World Trade Organisation

Overview

At a time when the post-2013 future of the Common Agricultural Policy (CAP) is being discussed, it is important to review the impact of past reforms and to draw lessons. The CAP has regularly been reviewed and adjusted to improve its performance and adequacy to changing circumstances. Successive reforms have reduced market intervention and border protection, and increased the share of direct payments to producers in total support. Payments have been gradually delinked from current production or production factors to the extent that a large share of payments is now granted with no requirement to produce. Decoupling support from current parameters has contributed to making producers more responsive to market signals. Through a mechanism of transfers of funds from the first to the second pillar of the CAP, called "modulation," reforms have also increased the share of payments targeted to specific objectives, such as improving the environmental performance of agriculture or its competitiveness.

As part of a wider project to evaluate CAP reforms since 1992, the Organisation for Economic Cooperation and Development (OECD) organised a workshop in Paris in March 2010. Researchers were invited to present recent studies on the disaggregated impact of CAP reforms with the objective to review available information at a more disaggregated level than the aggregate European Union (EU) level generally analysed by OECD. These workshop proceedings contain all the papers presented at the workshop and which were subsequently edited by Ken Thomson.

The studies presented cover reforms implemented since 2004, i.e. the reduction in intervention prices, the introduction of single payments to replace all or part of former area and headage payments, modulation as part of the 2003 "Luxembourg" reform, successive reforms of commodity sectors to integrate these into the single payment scheme, and the 2009 Health Check of the CAP, which consolidated the 2003 reform. The studies also include features specific to the sugar and dairy reforms with respect to the quota system and the restructuring of both these industries.

While the studies often take account of national and international market effects, they also go beyond aggregate impacts to consider on farm level or regional/local impacts. They combine a mixture of approaches, including interviews with farmers, micro-level data and regional case studies, as well as various types of modelling framework: from farm household level to regional (AgriPolis) and sectoral models, or both (CAPRI), and market equilibrium models (ESIM). A number of studies were carried out as part of EU Research Directorate-General (DG) projects, or for DG-AGRI or national governments.

The Workshop included seven sessions, which are reflected in the seven parts of the proceedings: agricultural markets and farm performance (Part I); land markets and farm structure (Part II); the dairy sector (Part III); the agro-food industry (Part IV); the distribution of support and income (Part V); the environment (Part VI) and rural development (Part VII). In the concluding session, Frank van Tongeren, Division Head in

the OECD Trade and Agriculture Directorate, outlined the main findings and identified areas where further work would be warranted and where complementary approaches would be useful.

In Part I, Brady *et al.* present the synthesis of the EU IDEMA research project on the impact of decoupling and modulation in a number of regions of the European Union. They examine farmers' adjustment to these policy changes, and impacts on farm structure, farm income, land rental prices, and land use. The analyses combine information from a survey of farmers' attitude and the AgriPoliS, which models farm adjustment in space and time. Using the CAPRI model, Renwick *et al.* assess the impact of allowing partial decoupling on prices, production and farm revenues in the European Union.

Part II focuses on land markets and structural change. Ciaian *et al.* discuss theoretical impacts of support on land values and present empirical evidence on changes in land markets with the introduction of the Single Payment Scheme in EU15 member states and the implementation of the Single Area Payment Scheme in new member states. Arfini and Donati assess the effect of a regionalised single payment system on farmers' behaviour and farm economic performance, using Positive Mathematical Programming (PMP) applied to FADN data in selected regions of the European Union.

The same method is used by Lelyon *et al.* to evaluate the impact of decoupling and market price variations on different types of dairy farms (Part III). In the same part, Jogeneel presents the results of studies on the impact of recent reforms of EU dairy policy on markets for dairy products, and on the size and income of dairy farms in selected EU member states. He then discusses market outlook and challenges for the EU dairy sector.

In Part IV, Gudoshnikov summarises the impact of the EU sugar reform on the sugar processing sector. Nowicki and Van Meijl then present an overview of Scenar2020 scenarios using a suite of models and statistical methods at the global, European Union, national and regional levels to decompose the individual effects of various policy components on agri-food trade, agri-food production and land use. This decomposition analysis helps identify the elements that drive the effects of policy reform.

Part V considers the impact of CAP reform on the distribution of support and income between farms. Using FADN data, Kleinhanss compares the distribution of single payment entitlements in France, where payments are based on historical entitlement (historical model), and in Germany, which applies a dynamic, hybrid model in which the share of payments based on historical entitlements gradually decreases as the share of regional flat rate payment entitlements increases. Kleinhanss also compares changes in entitlements in German regions and discusses developments in the distribution of payment entitlements by farm size, farm type and regions between 2000 and 2009, as well as income developments. Finally, he simulates the effect of moving to a regional model in other EU member states. Chatellier and Guyomard also use FADN data to simulate how the implementation of the Heath Check will affect the distribution of support among French farms. They demonstrate how modulation and Article 63 and 68 of the Health Check regulation are used to redistribute payments to areas with natural handicaps. Boulanger adopts a long term perspective of reforms and a more institutional approach to analyse the distribution of support in France in relation to national choices.

The impact of CAP reform on the environment is discussed in Part VI. Brady reports the findings of the IDEMA project on the environmental impact the introduction of single payments has had in selected EU regions via its impact on land use, biodiversity, nitrogen surplus and soil losses. Using the PMP method, Sinabell *et al.* reports *ex ante* estimates of

the environmental consequences of decoupling payments in Austria. The analysis simulates the impact of three options for implementing the single payment scheme — Austrian implementation, full decoupling with requirement to maintain land in Good Agricultural and Environmental Condition (GAEC) and full decoupling without GAEC — on a series of farm management and environmental indicators. He then compares observed outcomes of agri-environmental indicators. The findings show that the CAP reform of 2003 actually brought about environmental improvements which the previous reform (Agenda 2000) promised but did not deliver.

In Part VII, three papers consider the impact of CAP reform on different aspects of rural development. Mattas *et al.* use a multi-modelling cross-country approach (Positive Mathematical Programming applied to FADN data) to identify and measure the impact of decoupling on land use, gross margin and rural employment in five regions which present a diversity of geographic and economic characteristics. Using the LEITAP model, Nowicki *et al.* (2010) investigate the impact of the Health Check, in particular modulation, on land use, production, income and consequences for the environment and disadvantaged regions of higher fund availabilities. Ben Arfa *et al.* analyse the regional dynamic and spatial distribution of agricultural production in France from 1990 to 2006 and draw some conclusions on the role of the CAP in shaping the spatial structure of agricultural production.

The studies focus on the implementation of the single payment scheme, depending on implementation options and the transfer of funds from Pillar 1 to Pillar 2 (modulation). The main findings are as follows.

- Disaggregated impacts are larger than aggregate ones.
- Regions are diverse and the impacts of reforms depend on the structural characteristics of the farms and regional economies.
- The largest impacts on land use are in marginal regions, and not so profitable farms and farm types.
- As the movement towards decoupling has been gradual, the impact of more recent reforms on production is relatively modest in most regions, but the effect on income distribution is significant.
- As applied in the European Union, decoupling slows structural adjustment as it allows inefficient farmers to stay in business, and it increases the extensification of production.
- One crucial factor is the capitalisation of payments into land rent and prices, which reduces the income transfer efficiency of support.

The studies did not cover all aspects of policy reform and some areas for further work were identified. For example, the primary focus is at the farm level and there is still much to discover concerning the impact of CAP reforms on the structure and competitiveness of the agro-food sector, including the extent to which upstream and downstream industries have reacted to the reduction of market price support measures. Land markets are a crucial factor that influences the agricultural sector and it would be useful to maintain systems to monitor the functioning of these markets in order to understand the impact of agricultural policies on them. In order to better evaluate the impact of decoupling, risk and wealth effects of policies should also be taken into account more

systematically. Finally, it would be useful to know more on the effects of the CAP reform on innovation, competitiveness and employment.

Different approaches were used, including survey data, case studies, and various models, often in combination. In some studies, macro, regional and farm level models were used sequentially to simulate alternative reform options. In many cases, disaggregated impacts are captured at the administrative regional level, which is the level at which general data are available. In some areas such as environment or rural development, it would be interesting to have the flexibility to analyse more relevant areas, such as a water catchment area or an employment basin. Most analyses are carried out to evaluate *ex ante* impacts of future reforms. They would be usefully complemented by an empirical *ex post* assessment that examines what has really happened and identifies the contribution of policy reforms to changes at farm, regional and sectoral levels. Taking a longer term approach would also help take stock of the cumulative achievements of successive CAP reforms. This is what the OECD project, to which the workshop contributed, attempts to do.

Part I

The Impact of Decoupling on Agricultural Markets and Farm Performance

Chapter 1

The impact of decoupling and modulation in the European Union: a sectoral and farm level assessment

Mark Brady, Sone Ekman
and Ewa Rabinowicz[1]

This chapter presents the main findings from the IDEMA project on the impact of the single payment scheme on production, prices, trade flows, farm income and structural change at the European Union and regional levels. Three complementary evaluation approaches were used: surveys of farmers' intentions, sector modelling and agent-based models of regional structural change. The findings provide no strong evidence that farmers intend to change their strategic decision to exit agriculture. Instead, structural change is shown to slow down when payments are more decoupled because minimal land management becomes an additional source of income. The reform has increased the market orientation of EU farmers and has reduced trade distortions. The single payment scheme is shown to increase farm incomes, but also land rental prices in most regions. Capitalization of payments into land values over time will, however, erode the ability of the reform to support incomes in the long run as incumbent farmers retire or otherwise leave the sector. The impact of the reform would have been very different if there had been no link between the decoupled payment and land.

Since the early 1990s, the Common Agricultural Policy (CAP) has been gradually reformed towards increasing market orientation. Price-related support dominated agricultural policies in the EU other OECD countries in the 1970s and 1980s. Two reform packages in the 1990s replaced a large share of the price support in the European Union (EU) by direct payments per hectare of land and per head of livestock. These direct payments were only paid to certain crops and certain types of livestock. The latest substantial reform of the CAP, the 2003 reform, constitutes a further radical change of European policies for supporting farmers. The central element of the reform is decoupling of direct payments from production via a Single Payment Scheme (SPS). The SPS is paid per hectare of agricultural land, but is independent of the individual farmer's output. It is paid regardless of whether the farmer produces or not, as long as the land is kept in Good Agricultural and Environmental Condition (GAEC). However, there are exceptions to the general principle of decoupling, since individual member states are currently allowed to keep limited coupled payments for some products (partial decoupling).

The reform was intended to make European agriculture more competitive and market-oriented, and at the same time to provide support to farmers with less distortion of production and trade. However, in the public debate preceding the 2003 CAP reform, it was argued that a decoupled SPS would lead to substantial abandonment of production in various regions and sectors, and an exodus from the most disadvantaged rural areas. Some farmers' organisations argued that production would shrink and that considerable job losses would ensue. It was also claimed that farmers in less favoured regions might risk being squeezed out as economic land rents were often below the arable area payment. In this case, landowners might reclaim their land from leaseholders and cash the decoupled payment themselves. Another concern voiced was that decoupling would distort the market for previously unsupported products.

Assessing the potential impacts of decoupling was not a simple task because there are several potential links between support to agriculture and farm output. The impacts of support schemes that affect output prices are well known. These impacts can be removed by decoupling support from production, as is the case with the SPS. However, indirect effects may remain after decoupling, as agricultural support can induce production effects by its mere existence. These include the income effect, where the support potentially affects farmers' choice of on-farm labour supply, a risk-related effect as risk-averse producers may increase output as a consequence of the support providing greater income security, and finally dynamic effects which may affect output through farmers' investment decisions and their expectations about future policy. Studies of indirect effects of agricultural support to date have been few and with little consensus (Andersson, 2004).

The IDEMA[2] project

Uncertainty regarding the impacts of the 2003 reform due to its radical nature – as well as the concerns voiced in the public debate – highlighted the need to provide comprehensive assessment of the impacts of decoupling on the EU farm sector. Accordingly, the European Community's Sixth Framework Programme included, under the heading of CAP reform, a call entitled: "Decoupling – Development of various tools and methods for the impact assessment of decoupling." The assignment was to assess the impact of combining existing direct payments into a decoupled income support scheme and in particular to quantify the impact on:

- supply, demand, trade and prices for major commodities;
- localisation of production;

- land market and prices;
- farm income and structural adjustment of holdings;
- entries and exists from the agricultural sector; and
- land use and environmental impacts.

The IDEMA project was organised to respond to the above objectives. The research was performed by nine partners in eight countries, with the AgriFood Economics Centre in Sweden as coordinator. The choice of approach for IDEMA was influenced by two main factors: the radical nature of the reform, and the complexity and immensity of the issues to be addressed. The radical nature of the reform implies limited possibilities to generalize from past experiences. Further, the reform was implemented after the project started; hence there was no historical data that could be used in econometric analyses. As the implications of decoupling are multifaceted, no single methodological approach was considered sufficient; rather, a multiplicity of complementary approaches was applied. Accordingly, the project was organised around the following three approaches:

- survey-based analysis of farmers' strategic decisions,
- dynamic agent-based regional modelling with AgriPoliS, and
- sector-level and general-equilibrium modelling with the European Simulation Model, ESIM (Balkhausen and Banse, 2005).

The different approaches complement each other as they can answer different questions on the possible impacts of decoupling agricultural support. The need to analyse the expected reaction of agriculture at different scales (European Union, national and regional) made necessary the use of different models. Agent-based regional modelling is appropriate to analyse impacts on for example structural change (development towards fewer and larger farms), while sector-level modelling is suited for analysing impacts on, e.g. product markets. These modelling approaches can be contrasted with results from surveys that investigate how farmers intend to react to decoupling. The methodological approaches are also complements with respect to their weaknesses. Surveys of farmers' intentions are biased by farmers' expectations about policy evolution. On the other hand, models are limited by the behavioural assumptions on which they are based. By combining and extending the three main approaches and applying them simultaneously to a sample of member states, the project was able to cover the most important potential impacts of decoupling CAP support from production. In this chapter, we focus on the results of the survey and agent-based regional modelling. Aggregate effects of decoupling are covered by a range of other studies (see Balkhausen *et al.,* 2008 for an overview). Environmental impacts are presented in the paper by Brady (2010) in the proceedings from this workshop.

Survey-based analysis of farmers' intentions

Predicting the impacts of radical policy change when no historical data are available is naturally a challenging task. One solution is to ask those who will be affected by the reform, the farmers, how they intend to respond. Accordingly, a survey instrument was considered a valuable tool to study the reform. Detailed results from this study are presented in Douarin *et al.* (2007). The objectives of the survey were not only to establish what farmers intended to do but also to understand their reaction patterns and underlying motives. Do farms react differently depending, for example, on farm structure, region, farm financial performance, human capital, age?

Surveys have both advantages and disadvantages. They provide information without *a priori* assumptions and provide insights into farmers' business confidence (Thomson and Tansey, 1982). However, opinions about whether surveys are good predictors of actual farmer behaviour are mixed. Some authors provide evidence that, in the short run, farmers actually implement their intentions (Harvey, 2000; Tranter *et al.*, 2004), whereas others show that a survey response constitutes a weak predictor of actual behaviour (Vare *et al.*, 2005). Furthermore, answers may be biased by respondents' expectations about policy evolution and by respondents' attempts to influence the outcome of the analysis (Thomson and Tansey, 1982).

A unique dataset was collected regarding farmers' planned activities in the post-2003 era in five member states [France, Lithuania, Slovakia, Sweden and England (United Kingdom)]. The choice of countries incorporates a mix of old (EU15) and new member states (NMS). To understand the specific effects of the switch in policy, farmers were asked to state their intentions under two main policy frameworks. This would in particular allow the comparison of farmers' intentions holding everything else but the policy framework constant. The two policy frameworks considered were as follows.

- Continuation of policies under Agenda 2000 in the EU15 and continuation of pre-accession policies in the NMS; this provided a benchmark as to what farmers would have done if the previous policy framework with coupled support had been continued.
- Intentions under the 2003 CAP reform as it was to be implemented in each member state.

Data was collected through face-to-face interviews, except in Sweden where a postal survey was conducted. To avoid collecting large amounts of data on economic performance and structural characteristics of farms, IDEMA survey data was matched to records of the Farm Accountancy Data Network[3] (FADN). The rationale was to use the wealth of information included in the FADN system to be able to analyse farmers' responses in conjunction with historic records of farm performance and structure. It was however necessary to collect additional, particularly demographic, information, which is usually missing in FADN databases. Primary data were collected on intentions to exit from or stay in agriculture, as well as intentions to change the area of land farmed or the production mix. Data were also collected in relation to farmers' objectives, values and attitudes concerning policy support.

The questionnaire was pre-tested and discussed with focus groups. Data collection took place February to November 2005 in all five countries. Table 1.1 provides general information about the survey and the matching FADN.

Table 1.1. Data available from the IDEMA survey and from FADN

Country	Type of survey	Sample size	Matching FADN
England	Face to face	153	1998-2002
France	Face to face	281	2002, 2003 or 2004 (one year only)
Sweden	Postal	344	1999-2002
Lithuania	Face to face	220	2000-2002
Slovakia	Face to face	154	2001-2002

Source: Douarin *et al.* (2007).

Farm survival and growth

Understanding the determinants of farm survival or exit/closure is critical for capturing the forces of structural change in agriculture. The determinants of strategic decisions under the different policy scenarios were investigated to assess the main factors behind an intention to exit from farming, and to understand which factors were recurrent and which varied with the policy framework. This was done using a probit model with the dependent 0 or 1 response variable being the decision to stay in or exit from the farming sector within the coming five years. Farmers operating larger farms were shown to be more likely to stay in farming in all scenarios.

Growth is another important component of structural change. In the case of our study, the distribution of farmers' plans to grow was strongly biased towards "no change" as many respondents stated they were not planning to alter the size of their farm in the coming five years, and towards "no downscaling" as very few respondents reported a plan to reduce the size of their farm. Under these circumstances, econometric analyses are only possible using a discrete variable based on the farmer's plan to grow with two categories: intending to grow, or not intending to grow. Therefore, the determinants of growth were also analysed using a probit model that contrasted the farmers intending to grow with the rest of the respondents.

Results showed that younger farmers are more likely to grow, but that farm size seems to have no impact on growth intentions. Better performing farms were also more likely to grow under the decoupled policy. Regarding the determinants for both exit and growth, there is no clear difference between the EU15 and the NMS.

Farmers' adjustment to decoupling in the EU15

According to farmers' intentions, the introduction of decoupled payments will have little direct effect on structural change in England. Few farmers plan to modify their exit or growth decisions under SPS arrangements compared to what they would have done if they faced a continuation of Agenda 2000. Under both scenarios, the key characteristics of farmers intending to exit in the short term (defined as the next five years) were the same: elderly farmers specialised in COP production (cereals, oilseeds and protein crops) and with high value added without net current subsidies per hectare.

The more pronounced adjustment concerns production choices (even though the majority of the respondents were not planning to change their output mix, some intended to reduce their cattle herds) and to a certain extent off-farm activities. Therefore, this

early empirical research suggests that in England the adjustments to the 2003 reform are likely to be subtle and to affect mainly production choices and diversification.

The French results are similar to the findings from England in that few farmers said that they intended to alter their plans to exit or grow as a result of the introduction of the SPS. Intentions are hardly affected by the switch to the SPS in France, which might be expected given the conservative manner in which France has chosen to implement the SPS. However, relatively greater adjustment is likely to be witnessed in the output mix of farms and the allocation of time devoted to off-farm work.

In Sweden, in contrast to England and France, the implementation of SPS is more likely to stimulate structural change as some farmers are planning to exit earlier than they would have done under Agenda 2000. However, very little land is likely to be abandoned, as the demand for land for farm growth persists after the change in policy. The predicted changes in production mix are also relatively strong in the Swedish case and are likely to be characterised by 1) a movement away from COP and 2) the extensification of livestock production. The Swedish farmers also intended to keep some land in GAEC without producing on it. These plans are consistent with prior expectations concerning the impact of decoupling, i.e. the use of less intensive farming practices, and reduced incentives to produce.

It became evident that farmers intended to apply a minimal adjustment strategy in response to changes in agricultural policy, at least in France and England. There is no strong evidence that farmers intended to drastically change their strategic decisions to exit agriculture. Few farmers were interested in merely keeping land in good agricultural and environmental condition (GAEC) and not producing. From this point of view, the results of our study are in line with previous studies which investigate farmers' intentions in response to policy change (Harvey, 2000; Tranter *et al.*, 2004; Chatellier and Delattre, 2005; Breen *et al.*, 2005). However, results for Sweden are in contrast with this, as some farmers there intend to change their exit and growth plans, depending on the details of the policy implementation.

Impacts in the EU10

In the IDEMA study NMS (Lithuania and Slovakia), the implementation of the 2003 CAP reform has a different meaning. The implementation of SAPS (a somewhat simplified version of the SPS) in the NMS provides a significant increase in the degree of support offered to farmers, with both higher and more predictable payments. Therefore, it is not surprising that in Lithuania the main impact of the payments is evidenced in a greater willingness to operate larger farms. Seeing that the returns to agricultural activities are likely to rise, farmers are less interested in diversification and have no desire to leave land uncultivated under GAEC. This pattern is repeated in Slovakia: the switch from the pre-accession policy to the SAPS induces a significant rise in the numbers who wish to stay in agriculture. However, the characteristics of those seeking to stay or expand vary between Lithuania and Slovakia. The decisions to stay or grow were poorly explained by the set of variables available for the analysis in Slovakia, whilst in Lithuania farmers' characteristics were shown to be dependent on age, succession status and off-farm work experience. In Slovakia, the likelihood of expansion was related to managerial experience and farm location (LFA regions). In Lithuania, expansion plans were linked to lifecycle variables (age and succession status).

In analysing the differences between the EU15 countries and the NMS, it should be noted that what has been studied in the NMS is not so much the effect of a switch from

coupled to decoupled payments but the effect of the introduction of CAP payments as a result of EU accession. From this point of view, the differences in responses between the EU15 and the NMS are understandable as farmers respond to contrasting policy changes. The main conclusions regarding the NMS are that the introduction of CAP payments gives incentives for farmers to stay longer in farming and to grow, and that CAP payments also make farmers in the NMS less interested in diversification.

Farmers' attitudes and expectations

Can differences in farmers' attitudes and expectations be linked to diverging behavioural intentions to adjust to the 2003 CAP reform? To analyse this question, we utilised the pooled sample of farmers interviewed in the five countries studied, and investigated whether there are significant differences in farmers' attitudes to agriculture and policy support amongst the member states. An ANOVA-based analysis was developed regarding farmers' attitudes towards support and off-farm work, and the relationship to intentions to exit and grow.

This comparative cross-country analysis generates several important insights for policy. First, most farmers still possess a protectionist mindset and do not accept the idea that they could survive or be competitive without policy support. The sampled farmers strongly disagree with statements advocating the removal of policy support, and, at the same time, express preferences for the full utilisation of agricultural land for production and for concentration on farming. More than one-third of the respondents strongly disagreed with the notion that good farming skills are sufficient to run a profitable business whatever the design of European policies. At the same time, half of the respondents think that the CAP system of support imposes restrictions on their future farming plans. So, it appears that farmers rely on policy support although a large proportion of them realise that this support might be conditional on some restrictions on their farming activities. The only farmers who endorse policy liberalisation are those who are largely based in sectors that traditionally receive little CAP support (pigs and poultry).

Secondly, the often advocated strategy of diversification and development of multiple income sources still presents difficulties for a substantial proportion of European farmers. This is due to a mixture of beliefs that farmers should focus on the production of food and fibre, and a lack of appropriate skills and off-farm opportunities. More than 40% of the respondents do not think that they can easily find a job off-farm or increase the number of hours devoted to off-farm work. This emphasises once again the limitations of rural development policies that are focused solely on the farming community. Farmers are unlikely to create a significant number of new jobs through the pursuit of enterprise diversification, which is an infeasible option for many, and their own future prosperity depends on the availability of work in the non-farm rural economy. Pessimism surrounding the opportunities for diversification is not confined to the relatively poorer NMS. In fact, upland grassland farmers in England are the most pessimistic about their ability to adapt.

Third, although the overwhelming majority advocate protection, farmers are more flexible in terms of the instruments through which policy support might be delivered. One of the positive messages emerging from this research is that the majority of respondents agree with the need for farmers to produce attractive landscapes and positive environmental externalities, and to be paid for this. The non-pecuniary benefits of farming also feature prominently. The latter are crucial for understanding why farmers'

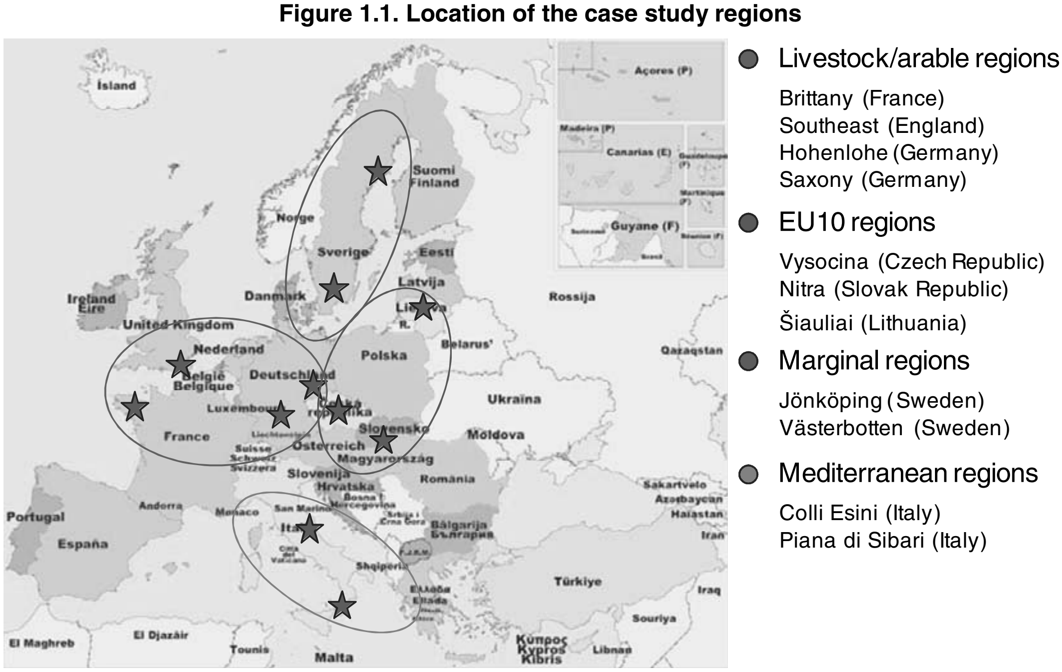
responses to policy reforms have been rather modest, or at least more modest than expected.

Finally, the strongest opposition to policy liberalisation comes from farmers in the NMS. Newcomers to farming in these countries strongly reject policy liberalisation, and endorse notions that farmers should concentrate on agriculture, which corroborates with the previously mentioned intentions to stay longer in agriculture or grow. For them, diversification seems to be associated with liberalisation tendencies. These views are likely to have important implications for the decision-making processes surrounding agricultural policy reform in the European Union. The new entrants to the Union are expected to strengthen political opposition to agricultural policy reform and to undermine attempts to extend the reform measures, including capping and further modulation of the Single Payment Scheme.

Agent-based regional modelling

The impact of decoupling on structural change is one of the key issues related to the 2003 reform. Will structural change speed up after the introduction of decoupled payments, or will it slow it down? An important part of the IDEMA project has been the use of modelling to study the impact of decoupling on agricultural structural change. This was done for selected regions of the enlarged European Union. The model used for this investigation is AgriPoliS (Kellermann *et al.,* 2008), an agent-based spatial and dynamic simulation model of agricultural structural change (Happe, 2004; Happe *et al.,* 2006). The origin of this model dates back to work by Balmann (1997), who studied path-dependencies in agricultural structural change with an agent-based approach. Whereas Balmann's model was based on a hypothetical farm structure, AgriPoliS can be calibrated to empirical farm data and regional statistics (Sahrbacher and Happe, 2008).This makes the model applicable for policy analysis and empirically based analysis of regional structural change.

Figure 1.1. Location of the case study regions



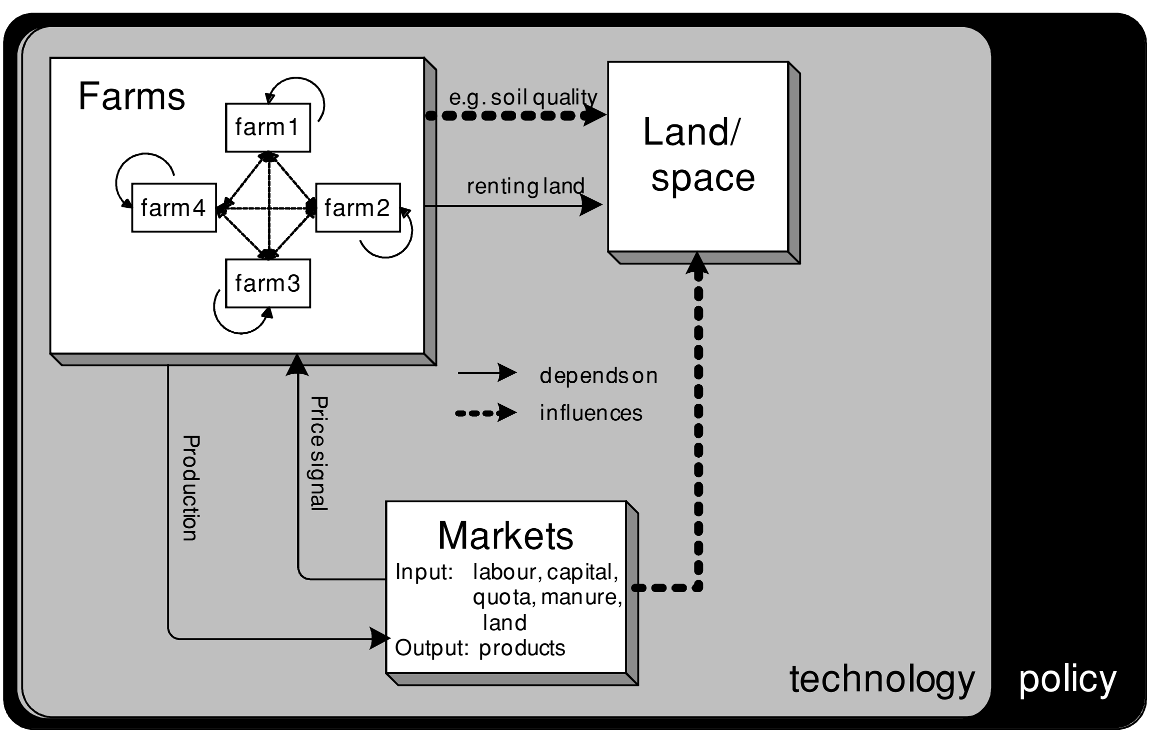
Source: Sahrbacher *et al.* (2005).

In IDEMA, we adapted AgriPoliS to 11 case study regions (Figure 1.1) in the EU25 (Sahrbacher *et al.*, 2005). These case study regions were chosen to cover a diversity of farming in Europe. The case-study regions are characterized by the following criteria: agronomic (North/South), socio-economic (high-income/low-income regions), mode of operation (intensive/extensive agriculture), scale of farm operation (small/large) and legal form (private/corporate).

The AgriPoliS model

The core of AgriPoliS is the understanding of a regional agricultural structure as a complex, evolving system (Happe, 2004). The key entities in the model are a population of individual farms which evolve subject to their current state and to changes in their environment (e.g. CAP reform). This technological and policy environment consists of other farms, factor and product markets, and land/space. Space is represented by a two dimensional grid of equally sized cells or plots. Five different landscape layers are used to represent the structure of agriculture and the landscape in each region (for details, see Kellermann *et al.*, 2008). As a result, the model can simulate from policy to individual farms and changes in cropping patterns at the plot level based on farm-agent behaviour. This regional agricultural system is shown schematically in Figure 1.2, which shows the interactions between the three central components of agricultural structures: farms, markets and land.

Figure 1.2. A conceptual model of a regional agricultural system

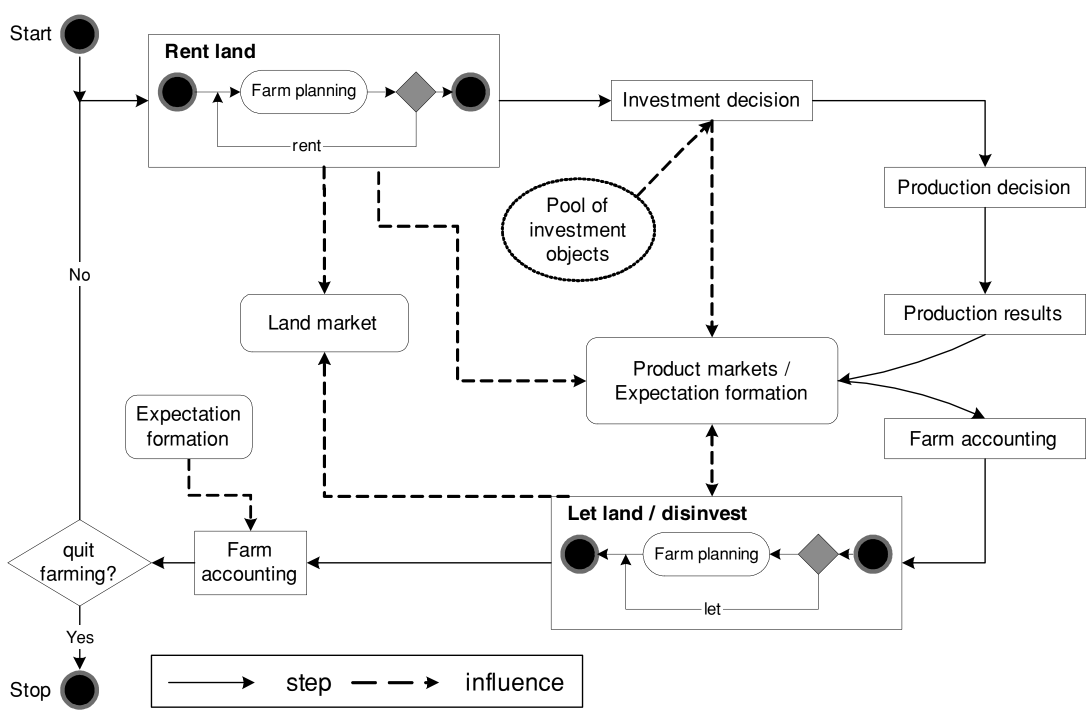


Source: Kellermann *et al.* (2008).

Farm agents are assumed to act autonomously and to maximise family income (or profit for corporate farms) from their economic activities. For this, production and investment decisions are made simultaneously based on a recursive mixed-integer linear programme. However, farm decision-making is "bounded rational", since decision-making is myopic and strategic aspects are only included in a rudimentary manner. Except for price information on land rents and product and input prices, individual farms in AgriPoliS do not consider other farms' production decisions, factor endowments, size, etc. Farm agents are also bounded rational with respect to expectations; in the majority of cases they follow adaptive expectations. In the model, policy changes are anticipated by farmers one period in advance and included in the decision-making process.

Figure 1.3 displays the decision hierarchy for an individual farm agent during one period of simulation. The most important actions undertaken by a farm agent are renting land (renting additional land and disposing of unprofitable land), investment, production, farm accounting, and the decision whether to quit farming or stay in the sector.

Figure 1.3. Course of events in one planning period for one farm agent



Source: Kellermann *et al.* (2008).

Farm agents can produce goods normal to the region or which might be expected to be produced as a result of policy reform. In order to produce, farm agents utilise buildings, machinery, and facilities of varying type and capacity. With respect to this, AgriPoliS implements economies of size; with increasing investments in capacity, unit investments costs decrease. Moreover, labour is assumed to be more effectively used with increasing size. AgriPoliS also aims to mimic the effect of technological progress; it is assumed that, with every new investment, unit costs of production decrease by a certain proportion.

Farms can engage in rental activities for land, production quotas and manure disposal rights. Labour can be hired on a fixed or hourly basis, and farm family labour can be offered for off-farm employment. To finance farm activities and to balance short-term liquidity requirements, farm agents can take up long-term and/or short-term borrowings. Liquid assets not used within the farm can similarly be invested with a bank at market rates of interest for government bonds. Farm agents quit production and withdraw from the sector if equity capital is zero, if the farm becomes illiquid, or if the opportunity costs of farm-owned production factors are not covered. Finally, farm agents are differentiated not only with respect to their specialisation, farm size, factor endowments and production technology, but also with respect to managerial ability.

At this development stage, agents in AgriPoliS interact indirectly by competing on factor and product markets. Interaction is organised by markets that explicitly coordinate the allocation of scarce resources such as land or the transaction of products. In this respect, the land market is the central mode of interaction between farm agents.

Evaluated policy scenarios

The AgriPoliS simulations were run over a 13-year period from 2001 to 2013 (the end of the current EU programming period). We considered three policy scenarios in the EU15.

- A benchmark scenario which represents continuation of the Agenda 2000 framework with coupled payments beyond 2004 (referred to as AGENDA).
- The actual 2003 CAP reform, including partially decoupled payments, as implemented or phased in each modelled region starting in 2005 (REFORM).
- A bond scheme where the obligation to keep land in good agricultural and environmental condition (GAEC) in the REFORM scenario is removed (BOND). In this scenario, the SPS for each farm is not distributed as a payment per hectare of managed land, but goes directly to the farmer. In other words, the farmer can produce or choose to leave the sector and still receive support.

New member states (EU10)

Due to space restrictions, we do not present detailed results for the NMS in this paper. Since these countries went from pre-accession policies directly into decoupled CAP payments, they require additional clarification. Briefly, it was evident from AgriPoliS results that the impact of accession dominates the effect of decoupling. However, results vary between the three countries analysed. In the Czech Republic and Slovakia, EU accession meant significantly higher payments to agriculture, while in Lithuania payments were comparably high before accession. Consequently, the introduction of CAP payments has a negligible impact on structural change in Lithuania, while structural change slows down considerably in Czech Republic and Slovakia. For analysis and results for the NMS, we refer the reader to the following IDEMA deliverables: Czech Republic (Jelinek *et al.,* 2007), Lithuania (Stonkute *et al.,* 2007) and Slovakia (Blaas *et al.,* 2007).

Impacts of decoupling on farming in EU15

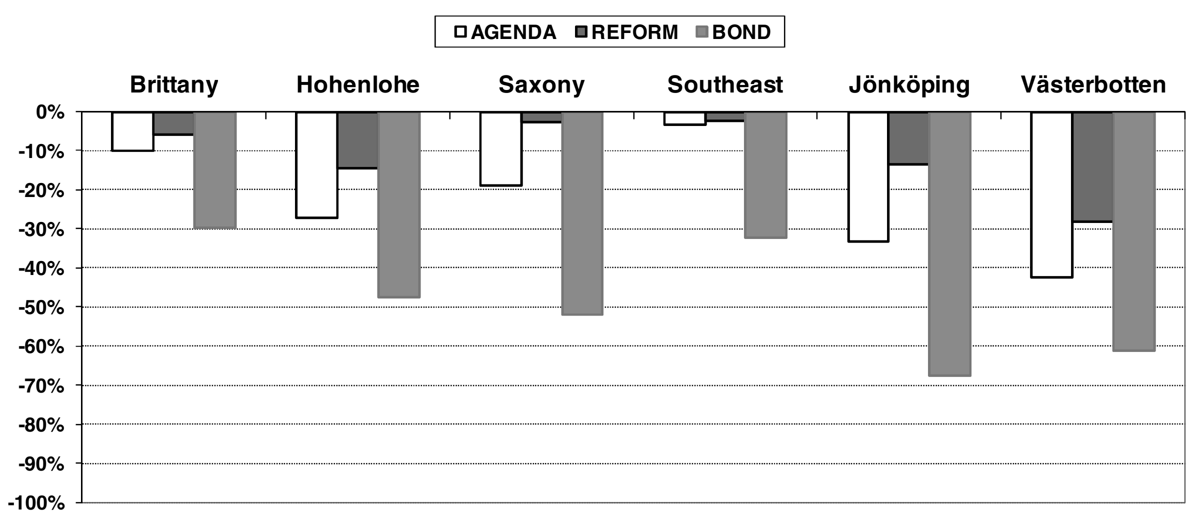
As previously stated, a key advantage of AgriPoliS is that it models structural change in space and time. In this section, we present results regarding the impact of the 2003 reform on farm structure, income, land rental prices and land use for six regions in the EU15.

Farm structure

AgriPoliS results presented in Figure 1.4 show that the REFORM scenario slows down structural change compared with a continuation of Agenda 2000 (Sahrbacher *et al.,* 2007). As a consequence, average farm size shown in Figure 1.5 is also smaller in the REFORM scenario (i.e. farms grow more slowly) compared to AGENDA in 2013. The rationale behind this result is that particularly farmers with grassland remain in the sector, because decoupled payments provide additional income opportunities. For these farms, simply maintaining some or all grassland in good agricultural and environmental condition is more profitable than off-farm work.

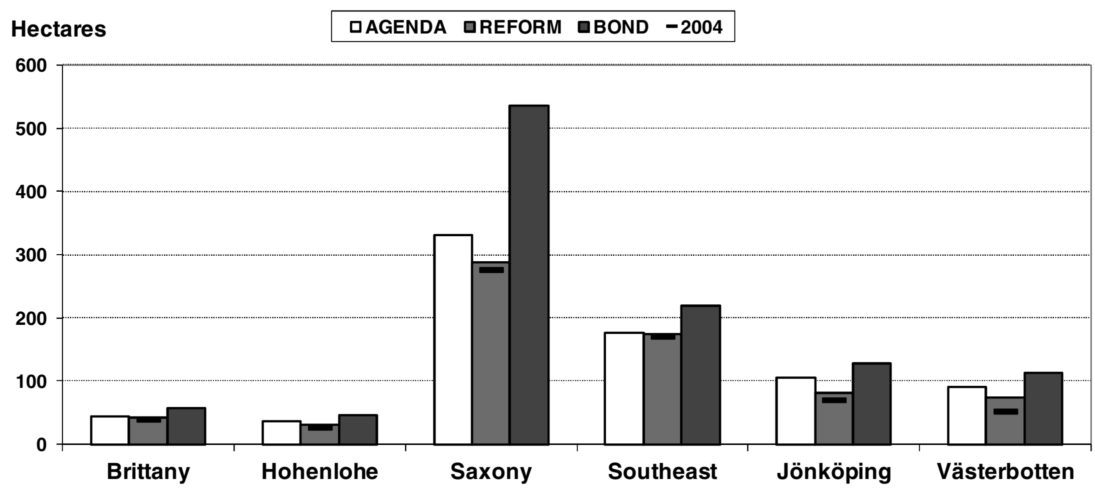
The hypothetical BOND scheme scenario implies that the linkage between the SPS and land is broken, such that the payment is granted to the farmer independent of any farming activity. This scenario represents to some extent a gradual phasing-out of direct payments to agriculture since, over time, more and more payment entitlements will belong to farmers who have left the sector (e.g. have retired). AgriPoliS results for this scenario demonstrate that the bond speeds up structural change considerably in all regions compared to both AGENDA and REFORM (Figure 1.4), which also results in a significantly larger average farm size in all regions (Figure 1.5).

Figure 1.4. Change in number of farms from 2004 to 2013 under alternative scenarios



Source: Sahrbacher *et al.* (2007).

Figure 1.5. Average farm size in 2013 under alternative scenarios

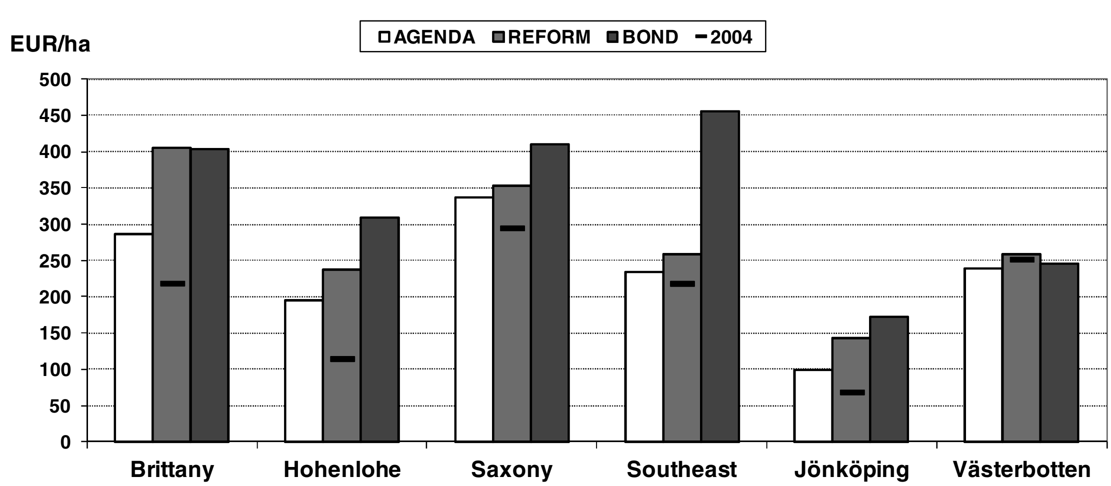


Source: Sahrbacher *et al.* (2007).

Farm income and land rental prices

The impact of decoupling on farm income is particularly relevant, because both the former direct payments and the decoupled SPS have the purpose of providing farmers with a stable income. AgriPoliS results show that average farm income increases due to decoupling in the REFORM scenario compared to AGENDA. This is shown in Figure 1.6 using average profit per hectare as an indicator of farm income: this is higher in all regions in 2013 when direct payments are decoupled from production. Income increases because decoupling gives farmers more freedom to choose whether or what to produce, and because product prices increase as a result of lower total EU production volumes (these price changes were taken from ESIM and fed into AgriPoliS).

Figure 1.6. Average profit in 2013 under alternative scenarios

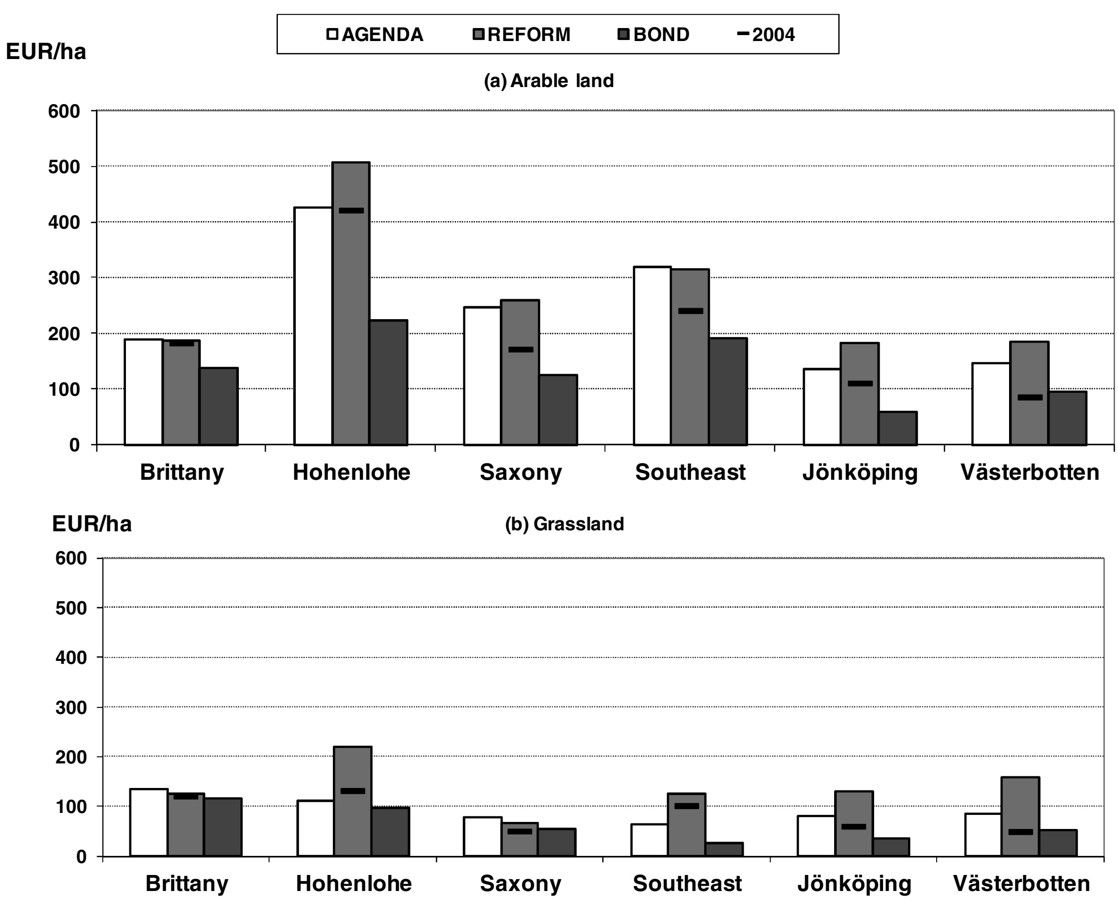


Source: Sahrbacher *et al.* (2007).

As might be expected, decoupling does not overcome the problem of capitalisation of payments into land values. Figure 1.7a shows that decoupling leads to increased arable land rental prices in Hohenlohe, Jönköping and Västerbotten. Grassland rental prices increase significantly in regions that had considerable cattle payments prior to decoupling, since such payments were redistributed to agricultural land as part of the reform (Figure 1.7). Rental prices in Brittany do not increase, due to a regulated land market (Latruffe and Le Mouël, 2006).

Breaking the link between the SPS and land in the BOND scenario implies that the decoupled payment should no longer capitalise in land rental prices, as it is not necessary to have land to collect the payment. AgriPoliS results for this scenario show that land rental prices fall significantly in all regions, except Brittany, compared to AGENDA, Figure 1.7. The lower land rental prices combined with increased efficiency due to structural change compensate for payments leaving the sector with exiting farmers. The resulting effect is higher average profit per hectare in all regions compared to AGENDA, as illustrated in Figure 1.6. In several regions, i.e. Hohenlohe, Saxony, Southeast and Jönköping, there is a significant increase in profits even compared to the REFORM, which implies improved competitiveness.

Figure 1.7. Average arable and grassland rental prices in 2013



Source: Sahrbacher *et al.* (2007).

Land use

An interesting policy question in the light of continued CAP reform is what implications a bond-type scheme would have for land use, and in particular for the area of land which becomes not profitable for agricultural production and which we assume becomes abandoned. Table 1.2 shows developments on the modelled land market as a result of introduction of the BOND scenario in 2005. It can be seen that the large numbers of farms that exit the sector in 2005 release significant areas (i.e. > 10%) of land to the land market in all regions except Brittany. Even farms remaining in the sector release land in this scenario, mainly in the form of grassland due to a decline in beef and milk production. However, this does not translate into equivalent areas of abandoned land. As shown in the row "Land rented by other farms" in Table 1.2, remaining farms are able to take advantage of the greater volume of land released to the land market to increase farm size (Figure 1.5). Nevertheless, the bond scenario leads to abandonment of land, principally grassland, and in particular in Hohenlohe and Jönköping. In the other regions, remaining farms continue to manage 89-99% of all land.

Note that even more land would have been abandoned in Jönköping if it were not for agri-environmental schemes which were sufficient to ensure that around 50% of the area of semi-natural grassland was preserved. The existence of national support in Västerbotten (which otherwise has similar production conditions to Jönköping) – coupled primarily to milk production at 0.10 EUR/kg – was sufficient to buffer most effects of the bond. Hence, in evaluating the effects of CAP reform, it is important to consider the implications of interactions with Pillar 2 policy instruments. Obviously, the wide-scale land abandonment in Hohenlohe and Jönköping is likely to be negative for landscape value and biodiversity (Brady *et al.,* 2009).

Table 1.2. Farms quitting, area released and area left idle due to introduction of a bond scheme in 2005 compared to 2004

%

	Brittany	Hohenlohe	Saxony	South-east	Jönköping	Västerbotten
Number of farms	-18	-28	-47	-23	-44	-34
Land released by quitting farms	5	21	15	16	51	25
Total area released	16	32	30	19	53	32
Land rented by other farms	15	13	19	9	22	12
Abandoned land	1	19	11	10	31	11

Source: Sahrbacher *et al*. (2007).

Conclusions

The IDEMA project analysed impacts of decoupling EU agricultural support from production. The central element of the 2003 CAP reform is the introduction of the Single Payment Scheme (SPS) which is linked to land but decoupled from production. Both the 2003 reform and a hypothetical bond scheme were analysed compared to continuation of the previous Agenda 2000 framework to the end of the current programme period, 2013. The more radical bond scheme was designed to test the implication of the link to land,

i.e. the obligation to keep land in Good Agricultural and Environmental Condition (GAEC). The bond scheme effectively breaks this link, as farmers still receive the decoupled payment even if they leave the sector.

Farmers' attitudes

Survey results revealed that most farmers do not accept the idea that they could survive or be competitive without policy support. There is, however, no strong evidence that farmers would drastically change their strategic decisions to exit agriculture in response to the reform (with some exceptions in Sweden depending on the policy in place). The strongest opposition to policy liberalisation comes from farmers in the NMS. There is also pessimism surrounding the opportunities for diversification. More than 40% of respondents do not think that they can "easily" find a job off-farm or increase the number of hours devoted to off-farm work. The majority of respondents agree with the need for farmers to produce attractive landscapes and positive environmental externalities, and to be paid for it.

The main conclusions regarding the NMS are that the introduction of the new CAP payments provides greater incentive for farmers to remain in agriculture and to grow, but makes them less interested in diversification.

Impacts of the 2003 CAP reform

Survey and regional modelling results indicated that the impacts of the 2003 CAP reform are moderate compared to continuation of the previous Agenda 2000 framework of coupled direct payments. The greatest impacts occur in the beef and sheep sectors, particularly in regions with high production costs. Individual member state decisions to partially couple payments to production help to maintain beef and lamb supply that otherwise would have declined. Decoupling leads to a small shift towards crops which were not eligible for direct payments under Agenda 2000 or pre-accession. Some land is also taken out of commodity production and managed according to the minimum GAEC obligation, primarily in high-cost regions. Lower aggregate supply of agricultural products due to decoupling changes the net trade position of the European Union from a clear net exporter position to a more neutral situation or even a net importer situation (Balkhausen and Banse, 2006).

There is no strong evidence that farmers intend to drastically change their strategic decisions to exit agriculture. AgriPoliS results indicate that structural change slows down when direct payments are decoupled according to the 2003 reform. In turn, the 2003 reform may reduce farmers' off-farm labour supply as farmers take advantage of the new income opportunities that arise as a result of the reform (i.e. the option of minimal land management without having to produce).

It is clear that the existence of a link between payment entitlements and land is crucial for the impacts of the 2003 reform. Model results show that a bond type of decoupled payment leads to a faster rate of farm exits and a strong increase in average farm size, compared with the 2003 CAP reform. With such a scheme, many farmers leave the sector if off-farm jobs are available, as the decoupled payment is granted to a farmer independent of land or any farming activity (it is only based on historical production). However, in most cases average profits per hectare would be higher under the bond scheme, due to significantly lower land (rental) prices and size economies due to farm growth in this scenario. However, the bond scheme is shown to result in abandonment of agricultural land, varying between 1 and 31% of total agricultural area depending on the

region). Hence, there might be motivation to strengthen agri-environmental schemes under a bond alternative in affected regions to preserve landscape values (depending of course on public willingness to pay for landscape preservation).

Continued reform?

The 2003 CAP reform was intended to make European agriculture more competitive and market-oriented with less distortion of production and trade, and at the same time to provide income support to farmers and to prevent abandonment of land. As we approach the end of the current programme period in 2013 and the arguments for continued CAP reform are debated, it is important to ask whether the 2003 CAP reform has achieved these objectives. The reform has undoubtedly increased market orientation and improved farm incomes. A move to a full and uniform decoupling in all regions would improve the situation even further, but not in a dramatic way. At the same time, it can be argued that the objective of improving competitiveness has not been achieved due to slower structural change and higher land rental prices that followed from the reform. Implementation of a bond-type scheme would constitute a better option from a competitiveness perspective, but this solution gives little value for money and may be difficult to achieve for political reasons. A more realistic and efficient solution for society is to gradually phase out the Single Payment Scheme and instead use targeted support (under Pillar 2) to preserve landscape and environmental values in the particular regions that would be adversely affected by such a reform (e.g. increasing agri-environmental payments for preserving extensive grasslands). Nevertheless, it is likely that emotional arguments for continuing some type of general support payments will be made (e.g. for the provision of unspecified public goods). However, given the negative impact of such payments on competitiveness, particularly in regions favourable to agriculture, the motivation and social opportunity costs of making these payments available to all EU farmers should be carefully evaluated.

Notes

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2. This chapter represents a synthesis of the research performed within the IDEMA project which was supported by the European Community's Sixth Framework Programme (SSPE-CT-2003-502171), *www.agrifood.se/IDEMA*.
3. FADN is the European Commission's system of collecting accountancy and production data for a sample of farms in each of the member states.

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Chapter 2

The economic impact of allowing partial decoupling under the 2003 Common Agricultural Policy reforms

Alan Renwick, Torbjorn Jansson, Steven Thomson,
Cesar Revoredo-Giha, Andrew Barnes and Gerald Schwarz[1]

The agreement to decouple European Union (EU) direct farm payments from production and to introduce the Single Payment Scheme (SPS) was formally made by the Council of Agricultural Ministers in June 2003. Due to concerns raised, the SPS provided member states the scope to retain some coupled support and this option was taken up by some member states but not others. This chapter, using conceptual and empirical analyses, assesses whether and to what extent partial decoupling is affecting the single market, and the effect it has on those countries and sectors that have embraced full decoupling. The results of a modelling exercise (using the CAPRI model) highlight that production in coupled countries is higher than would be the case if they had decoupled, and this has subsequent impacts on other EU member states through price and trade effects. This is particularly the case in the beef sector. Though the aggregate EU production and price impacts are generally small, the production impacts on certain member states and regions are more marked. Overall welfare levels in the European Union would have been higher if full decoupling had been implemented, and these gains would have been highest in the countries that remained coupled, particularly France and Spain.

The agreement to decouple European Union direct farm payments from production and to introduce the Single Payment Scheme (SPS) was formally made by the Council of Agricultural Ministers in June 2003. The European Commission noted that during the pre-reform discussions concerns were raised by some member states that full decoupling of Common Agricultural Policy (CAP) support might lead to "abandonment of (agricultural) production, the lack of raw material supply for processing industries, or to social and environmental problems in areas with few economic alternatives" (EC, 2008). As such, under the reformed CAP, the SPS provided member states with the scope to retain some coupled support. In addition, the national envelopes established under the Agenda 2000 reforms were extended to enable up to 10% of the national ceiling for any sector's Pillar 1 payments to be diverted into national envelopes which could be used to support "specific types of agriculture which are important for the protection or enhancement of the environment, or for improving the quality and marketing of agricultural products", otherwise known as Article 69 measures.[2] Furthermore, member states were also allowed to introduce voluntary modulation alongside the compulsory EU modulation as a means of redirecting support towards Pillar 2 rural development measures.

The most important aspect of the 2003 CAP reform package was the replacement of production subsidies (e.g. Arable Area Payments Scheme and Suckler Cow Premium, Sheep Annual Premium) with a single direct payment, conditional on meeting cross-compliance requirements that farmers meet minimum animal welfare, quality and environmental standards. Many studies (see Renwick *et al.*, 2008; Halmai *et al.*, 2006; Swinbank, 2005) have discussed how a complex CAP model has now developed as member states were given options for implementing the SPS, specifically options to:

- implement the SPS at any time between 2005 and 2007;
- re-allocate part of the support through the national envelope (Article 69 measures);
- choose from the regional, historic, static-hybrid or dynamic hybrid models of the SPS; and
- introduce voluntary modulation (only taken up by Portugal and the United Kingdom, and within the United Kingdom there are some differences in its use).

In addition, there were also limits on the levels of coupled payments retained for different sectors, as indicated in Table 2.1. As this table also highlights, these limits were amended following the CAP Health Check in 2009.

Under the 2003 Luxembourg agreement, member states were given the option to choose from three SPS implementation models: the "historic" model; the "regional" (or flat-rate) model; and, the "hybrid" model. With the historic model, SPS payments are farm-specific and relate to the support received in the reference period (average of 2000-02). The regional model uses a per-hectare payment to all farmers in a region, whilst the hybrid model uses a mix of the historic and regional payments. Specifically, the hybrid model can be static (as in Northern Ireland where the relative proportions of historic and regional payments remain the same) or dynamic (as in England where there is gradual movement from the historic model to a fully regional model).

Eligibility for SPS payments are conditional on cross-compliance, with farmers being required to respect Statutory Management Requirements (SMRs) relating to public, plant and animal health, environmental and animal-welfare requirements whilst maintaining

land in Good Agricultural and Environmental Condition (GAEC). The SMRs and GAEC suggest that some public goods are provided by farmers in return for the SPS payment.

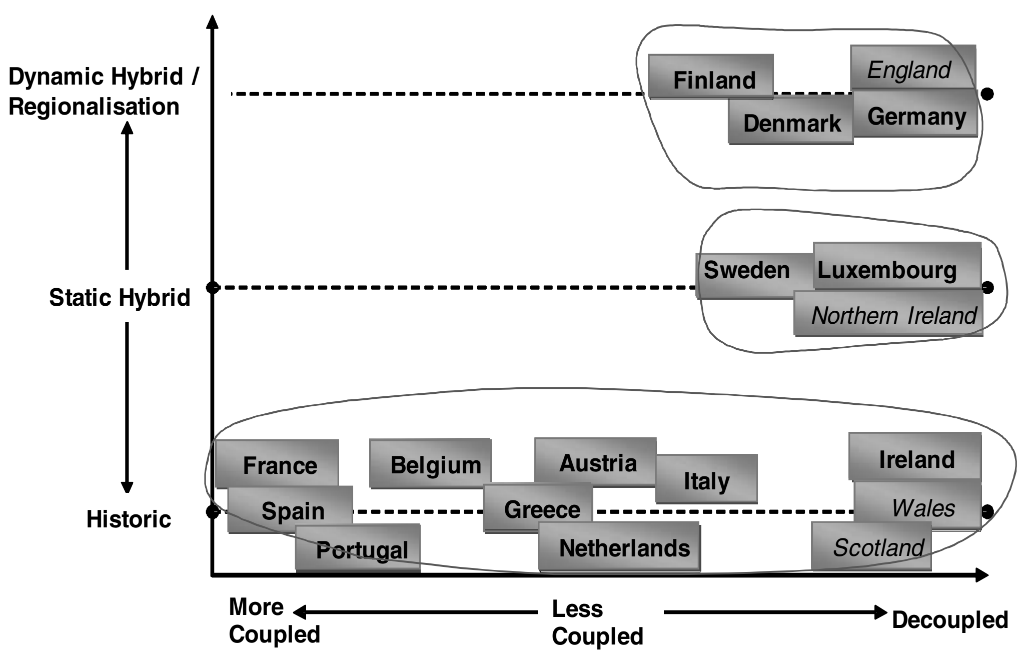
The flexibility in implementing the SPS has meant that there is a range of models and different levels of decoupling across member states. Some countries, notably France and Spain, continued to maintain as much coupled direct payments as possible, with many other EU15 countries operating largely decoupled payments or only maintaining some partial coupling (usually in the beef sector). Figure 2.1 shows the diversity in implementation models and levels of decoupling across the EU15.

Table 2.1. Level of coupled support for selected products pre- and post-2009 CAP Health Check

Sector	Maximum rate of coupled support (%)	2009 CAP Health Check Outcome
Cereals and oilseeds	25	To be decoupled by 2010
or supplementary durum wheat aid	40	To be decoupled by 2010
Sheep and Goat	50	No change
Beef		
Slaughter Premium – Adults	40	To be decoupled by 2012
and Suckler Cow Premium	100	No change
or Special Beef Premium	75	To be decoupled by 2012
or Slaughter Premium – Adults	100	To be decoupled by 2012
plus Slaughter Premium Calves	100	To be decoupled by 2012

Source: Adapted from European Commission (2009a and 2009b).

Figure 2.1. Schematic representation of SPS implementation model and degree of decoupling in the EU15 (and within the United Kingdom)



The main purpose of this paper is to consider the economic impacts arising from these alternative approaches to implementation of the 2003 reforms, particularly relating to the degree of coupling of payments. With the aid of a simple simulation model, the next section considers the possible effects on production and prices of maintaining coupled payments and highlights the need for an empirical study to help improve understanding of the actual impacts. Following a description of the modelling exercise undertaken, the results which arise are discussed. The final section briefly summarises the main findings.

Partial decoupling

Considerable conceptual and empirical work has been undertaken concerning decoupling of agricultural support, in particular by the OECD (for example see OECD, 2001, 2005a, 2005b, 2006; Goodwin and Mishra, 2002, 2003, 2005; Rude, 2006; Bhaskar and Beghin, 2009). In addition, a number of modelling and other empirical studies have been undertaken at EU and member state level concerning various aspects of the 2003 CAP reform (OECD, 2003; Sckokai and Moro, 2006; and the IDEMA project[3]). However, relatively little work has been undertaken examining the possible impacts of the decision to implement partial rather than full decoupling. When the issue of decoupling was raised during the Mid-Term Review of the Agenda 2000 reform, analysis was undertaken of its likely impact and also the potential implications of the watering-down of the full decoupling proposals to allow partial decoupling (for example, Renwick *et al*., 2003). Though conceptual in nature, this work highlighted that, when compared with a number of options for partial decoupling, full decoupling was the preferred policy in terms of economic efficiency.

Simulation exercise

In this section, some of the potential supply and price effects of partial decoupling are illustrated using a simple partial equilibrium model.[4] In broad terms, the model represents a customs union of two countries (A and B). Both countries produce two goods (1 and 2), and their markets are protected from foreign competition by trade barriers, although the two countries are free to trade between themselves. Therefore, the law of one price applies, and both countries face the same prices (assuming that there are no transportation costs). This basic situation is generalised by considering the effect on the results of including more countries in the customs union.

Thus, two situations are simulated. The first considers the case when there are only two countries and one of them (country A) places a coupled payment on the production of good 1. The second considers the situation where there are ten countries in total in the customs union but only one of them (country A) supports the production of good 1. The purpose of the second case is to explore whether the effects of partial decoupling become negligible when only one of a number of countries adopts partial decoupling (i.e. when the proportion of subsidised production under coupled payments in the customs union is small).

In order to simplify the analysis, a number of assumptions are made. First, it is assumed that the decoupled payments have no production-increasing effect, i.e. there are no indirect wealth and risk effects associated with the payments. Second, the coupled payment is simulated as a lump-sum payment per unit of the good produced (i.e. not in the exact form of the regime of direct payments in existence before the CAP reforms of 2003). Third, within the model, the costs of production of good 1 in country A are

assumed to be higher than for the same good in country B. Therefore B produces the good more efficiently.

Figures 2.2 and 2.3 present the results of the simulation exercise in terms of aggregated supply (and demand) and prices (the weighted average of each price for both countries) for several values of the premium paid to good 1 in country A. These are presented for the case where there are two countries in the customs union (solid lines) and when there are ten (dotted lines). In the figures, the fully decoupled case is given by the value of the variables when the premium paid is zero.

When there are only two countries in the customs union, the effect of the coupled payment is to increase the production of good 1 in country A and overall production of good 1 (Figure 2.2). This has the impact of decreasing the price for good 1, because of the free movement of goods. The coupled payment for good 1 in country A, within the single market, leads to lower prices for all producers (Figure 2.3) and distorts production patterns. That is, the more inefficient country A expands production of good 1 at the expense of the more efficient country B. Furthermore, the distortion in production of good 1 also affects production and prices for good 2, as shown in Figures 2.2 and 2.3, with the supply of good 2 falling and its price rising as the premium paid to good 1 increases.

Figure 2.2. Production impacts of coupled payment for good 1 in country A

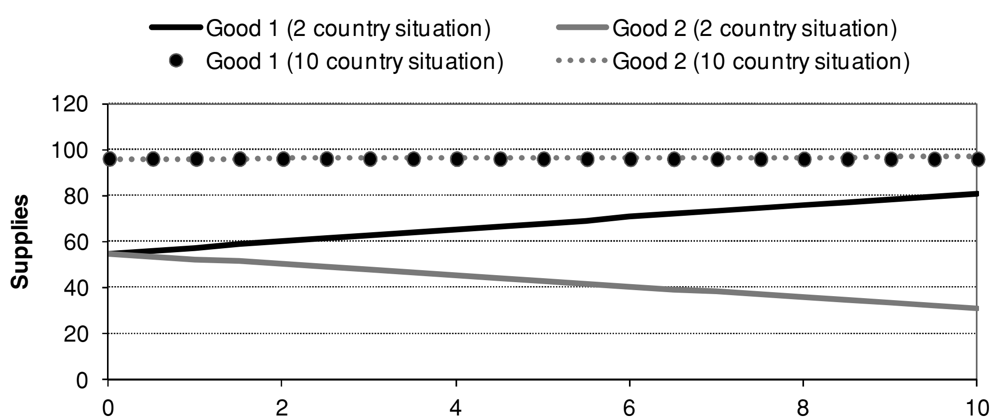
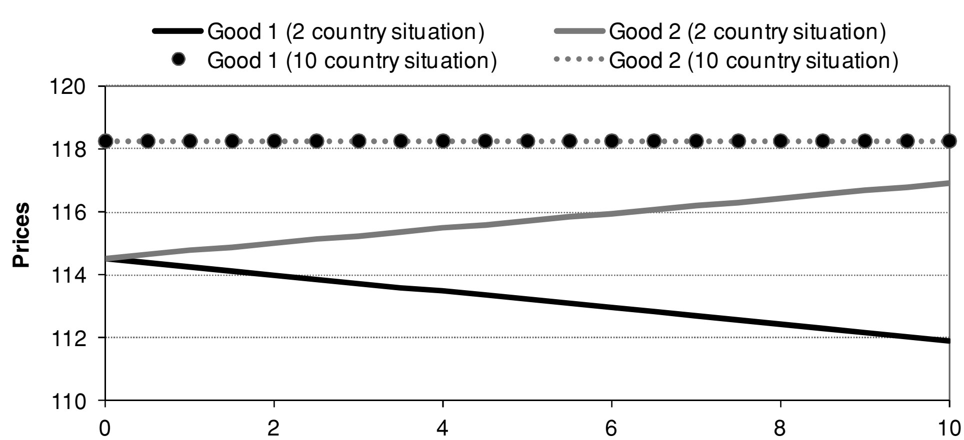


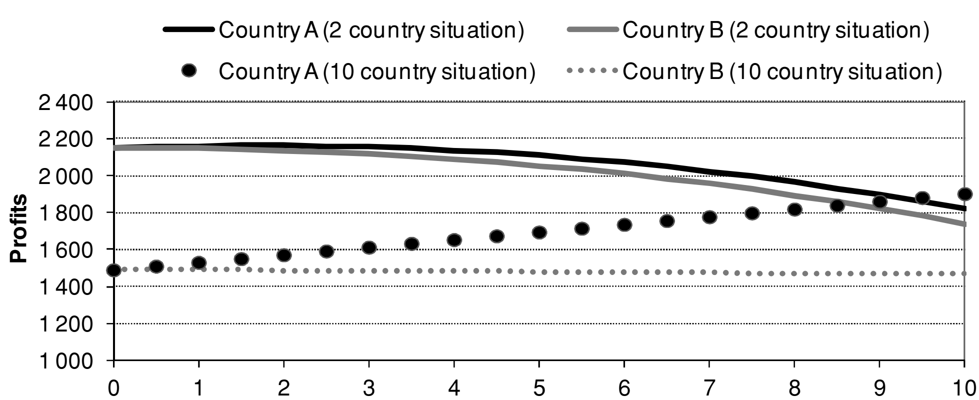
Figure 2.3. Price impacts of coupled payment for good 1 in country A



The simulation results for the case when there are ten countries in the customs union and only one uses coupled payments to subsidise good 1 are also presented in Figures 2.2 and 2.3. These highlight that, if the output of the sector receiving the payment represents a small proportion of the total output of the custom union, then the depressing effects on output and prices becomes negligible.

Figure 2.4 highlights the impact on the profitability of production of the coupled payment. In the two-country/two-good situation, the profits of country A slightly increase with low values of the coupled payment. However, higher values of such payment actually depress the profits of both countries. This negative impact arises because (under the assumptions of the model) the coupled payment prompts a supply response that leads to a price reduction for the commodity to the extent that the market price for the good receiving the coupled payment is depressed by a greater proportion than the coupled payment (therefore the total revenue per unit of commodity, i.e. market price plus coupled payment, is lower than the market price without coupled payment). If the proportion of the production under coupled payments is small (i.e. illustrated by a custom union with ten countries), then the profits of the country that applies the partial coupled payments actually increase, with the payment per unit, leaving the profits in the remaining countries almost untouched.

Figure 2.4. Impact on profits of coupled payment for good 1 in country A



The above simulation exercise highlights a number of factors which are important in determining the extent of the impact of partially coupled payments. These include: the value of the payment; the proportion of overall production that is coupled and; the relative competitiveness of producers. Whilst the exercise usefully highlights some of the potential impacts of partial decoupling, it is clear that the actual impacts may be influenced by a whole range of factors.

For example, if production of a good subject to coupled payments is not profitable in its own right (as is often the case with agricultural products within the European Union), then the incomes of those producers receiving the payments might be reduced compared to a fully decoupled situation, even in the absence of any price-depressing effect. This is because part of the payment will have to be used to subsidise loss-making production, whereas in a decoupled situation producers would be able to cease production and keep the whole of the decoupled payment as income (less a small cost to ensure that the regulatory requirements such as maintaining land in good agricultural and environmental condition are met). At the other extreme, if all production is profitable in its own right, then partial/full decoupling is unlikely to override these market signals.

In the simulations, it is assumed that producers do not use the decoupled payment to subsidise production. However, there has been much discussion as to the likely direct and indirect production effects of decoupled payments (see for example Westcott and Young, 2004; OECD, 2005; Serra *et al.*, 2005; Sckokai and Moro, 2006). The most direct production-inducing effect is if producers continue to treat the payment as coupled (i.e. as part of their farming income) and produce similar levels of output as to the situation prior to decoupling. For example, Renwick and Revoredo (2008) highlight that in the first year after decoupling in the United Kingdom, production levels were virtually identical to the pre-decoupled situation despite the fact that a number of enterprises were clearly unprofitable. However, it might be argued that this was more of a reaction to the uncertainty surrounding decoupling rather than farmers making longer-term production decisions. Less directly, there are also possible production-inducing effects from decoupled payments arising from their impact on wealth and attitudes to risk (OECD, 2005). If this is the case, then the difference between a partial and full decoupling scenario might be smaller than highlighted by the simulations.

A further confounding effect when considering the impact of coupled payments in agriculture is the fact that some products (e.g. cereals) are used as inputs in the production of other products (e.g. livestock). In this situation, increased production of the input arising from a coupled payment may in fact reduce costs of production for the other producers. However, in a similar way, the contraction of other crops or livestock due to the substitution effect in production may increase the cost of final goods that use the substitute goods. This highlights that the structure of production (including own- and cross-price elasticities of supply and demand) are important factors in determining the actual impacts of coupled payments.

Adopting partial rather than full decoupling has the potential to impact on production, and this impact may or may not be negligible. In terms of understanding the impact within the EU, a range of factors will be important in addition to those discussed above. These include:

- the extent of uptake of the option by member states;
- the proportion of production within the member state that remains coupled;
- the relative weight of the payment;
- the relative share of the member states exercising the option in overall EU production;
- the importance of the product within the European Union; and
- the relative profitability of the product in the absence of support.

A further important point was made by the OECD (2001), although in the context of decoupling. They argued that a policy may lead to the same equilibrium outcome as would have occurred without the policy, but that it may still have the potential to be distorting if the situation changes. For example, under the very high prices for cereals witnessed in 2007/8, the level of production with and without coupled payments in the cereal sector might be expected to be similar. However, if prices were to fall again to their 2006 levels (of around GBP 60 to GBP 70 per tonne) when relatively little production in the European Union was profitable, there may well be a different production response between the decoupled and partially decoupled situation.

Quantifying the impact of partial decoupling

The previous analysis has highlighted the potential implications of partial decoupling on prices, production and revenues. However, a number of factors make quantifying the actual impact from available statistics challenging. These include: the relatively short period since implementation; the staggered nature of implementation across countries and sectors; and the complexity of capturing the impact of other key drivers (for example, the food price spike of 2008).

Detailed analysis of production changes since the introduction of decoupling has been undertaken by Thomson *et al.* (2009) using FADN data. The results of this analysis highlight few distinct differences in production trends between those countries that fully decoupled and those that did not. The one exception appears to be in the beef sector where there is a divergent trend emerging between France who maintained the maximum allowable degree of coupling and countries such as the United Kingdom and Germany who fully decoupled.

The potential complexity of the issues involved and the lack of long-run data on the impact of partial decoupling support the use of an approach that, whilst taking account of up-to-date data, is able to simulate the development of markets within the European Union over time with and without decoupling. Therefore the approach adopted is to use a well recognised partial equilibrium model (the CAPRI model) to consider the development of agricultural markets up to 2013 (the end of current policy period) and to examine the impacts on production, prices and revenues. The next section briefly describes the key features of the model.

CAPRI model

The CAPRI model combines a representation of agricultural supply based on positive mathematical programming with a global trade model for agricultural commodities.[5] The supply module of CAPRI covers the most important agricultural activities in EU27 at a regional level (NUTS 1[6] in the United Kingdom, NUTS 2 in the rest of the European Union). The supply module is able to simulate changes in farmers' behaviour in response to a changed direct payment scheme (such as the implementation of the SPS in the European Union). The market model allows the impact on the market price of any changes in production as a response to the direct payment to be fed back to farm-gate prices. It also simultaneously allows the simulation of policy changes at the market level (export subsidies, intervention, import tariffs, tariff rate quotas). Though the core of CAPRI is well documented, it is useful to consider how the SPS is handled within the model.

The payment scheme for subsidies to farmers under the current legislation is part of the optimization procedure of CAPRI. The design of the direct payment and SPS adheres closely to the mechanisms defined by the EU regulations. The basic entity of the direct payment system in CAPRI is the premium. Each premium is associated with 1) a list of eligible agricultural activities, 2) a national or regional ceiling in monetary or physical terms, and 3) information as to how the premium amount is computed, i.e. per slaughtered head, hectare harvested, or historical or actual yield. The ceilings mentioned under 2) are used to decrease the payments if the ceilings are overshot.

For the premiums defined in the 2003 CAP reform, a special routine removes premiums that are to be decoupled, and adds a corresponding amount of money to the SPS. The payment is modelled as an amount per hectare that is invariant to the cropping

choice of the producer, except for land abandonment. In CAPRI, therefore, the SPS as well as the single area payment scheme in the new member states influence land rents, but hardly affect the choice of crop mix, except for marginal land abandonment. With this implementation, the "decoupled" payments are not fully decoupled in CAPRI, but have a small general production effect. Nevertheless, the degree of coupling is small compared to the "coupled" payments, and is not crop-specific.

In effect, the SPS payment rates are computed in two steps. First, the total payment per NUTS 2 region is calculated (for the historical reference year) taking into account payment ceilings, national coupling options and the choices made regarding the implementation of the single farm payment (for example regional flat rate, hybrid model, single area payment and/or Article 69 choices). The total regional payment is then divided by the regional eligible area to obtain the average SPS amount per hectare in each region, with the total regional amount as the payment ceiling. This approach means that it is possible to capture regional differences in payment rates, if not farm-by-farm differences.

Scenarios

In essence, two main scenarios were compared with the CAPRI model.

- Baseline Scenario — continuation of the current reform situation up to 2013 (i.e. with partial decoupling and Article 69).[7]
- Full Decoupling Scenario — complete removal of all coupled payments including those under Article 69 and transfer of these payments to the SPS.

In order to gain a better understanding of the potential role individual countries may play, the scenarios were re-run on the assumptions that: only France decoupled; only Spain decoupled; and countries that maintained some form of coupled payments (with the exception of France and Spain) decoupled.

The results are presented in terms of changes from the baseline scenario in 2013, i.e. the differences in levels of key variables (production, prices, welfare, etc.) in 2013 between a situation where payments are fully decoupled, compared to that in which the 2003 reforms are continued.

Results

In order to simplify analysis, the results presented here are those salient to assessing the key impacts of partial decoupling as highlighted above.[8] Results are presented in terms of the impact of all countries fully decoupling on prices, crop areas and livestock numbers, levels of production and welfare for the European Union as a whole, and at the member state level.

Prices

Table 2.2 highlights the projected changes in EU price under various unilateral decoupling scenarios (Spain only, France only, other countries that have maintained coupled payments only) and if all payments were decoupled across the whole of the European Union. Given how the decoupling has been implemented, it is not surprising that the model predicts that the sector most affected is the beef sector, where prices are projected to rise by over 5% if all countries decouple. The role of France in the EU

market is highlighted by the fact that if they unilaterally decoupled, prices for beef are projected to be just under 2.5% higher.

Table 2.2. Change in prices under decoupling scenarios

Percentage change from baseline scenario in 2013

	Spain only	France only	Other countries	All fully decoupling
Soft wheat	0.0	0.1	0.3	0.5
Barley	-0.2	0.1	0.0	0.0
Rape seed	0.0	0.7	0.0	0.7
Sunflower seed	0.0	1.1	0.2	1.4
Soya seed	0.0	0.3	0.0	0.2
Beef	1.5	2.4	1.4	5.4
Pork meat	0.0	0.0	0.0	0.0
Sheep and goat meat	0.6	0.2	0.1	1.0
Poultry meat	0.0	0.1	0.0	0.1

Production

Table 2.3 highlights the impact of full decoupling across the European Union on the production of the major commodities where coupling still exists. It is evident that in terms of overall production full decoupling is not projected to have a major impact when compared to the baseline scenario of continuation of the 2003 reform situation. The largest impact is a projected fall of just under 2% in rape seed production in the EU15. At the member state level, Table 2.3 highlights generally small changes in production (where larger changes are signified, this is generally from relatively small base levels of production, and therefore the changes are not large in absolute terms).

In terms of the earlier conceptual analysis, some of the changes may seem counter-intuitive, and it is worth exploring these further as they highlight the complex interdependencies in the agricultural system and the difficulty of capturing these within a modelling framework. For example, in the United Kingdom it might be expected that producers would gain from full decoupling elsewhere, and that production would increase across the main sectors. However, this does not appear to be the case for barley and sheep production, where small declines are computed compared with the baseline. The (small) decline in barley production occurs in almost all countries. It is due to the lower price of barley, which arises from the lower feed cereals demand because of the smaller number of animals. Sheep meat production declines due to increased exports of lambs from the United Kingdom. CAPRI features young animal trade within the EU15, and following the general decoupling of support in continental Europe, the price increase of lambs makes exports from the United Kingdom more attractive.

For Greece, the results indicate a strong positive effect on the production of soft wheat and barley. What is not shown is a corresponding decrease in the production of durum wheat. In the baseline, the Greek implementation of Article 69 for durum wheat corresponds to a payment of about EUR 60 per hectare. When that premium is decoupled, the profitability of durum wheat relative to other cereals is drastically changed. In addition, the estimated elasticity among cereals in Greece is high compared to the elasticity of the aggregated cereals production (considering cross-price effects), and thus the change in profitability results in a change in the composition of cereals production in Greece. Similarly, Article 69 affects cereals production in Italy.

Table 2.3. Change in production under full decoupling

Percentage change from baseline scenario in 2013

	Soft wheat	Barley	Rape seed	Beef	Pork meat	Sheep and goat meat	Poultry meat
EU region							
European Union 27	0.01	-0.54	-1.31	-1.03	0.01	-0.78	0.08
European Union 25	0.00	-0.56	-1.33	-1.10	0.01	-0.92	0.08
European Union 15	-0.01	-0.65	-1.83	-1.21	0.02	-0.95	0.09
European Union 10	0.03	-0.07	0.20	0.15	-0.02	0.04	0.06
EU country							
Belgium and Luxembourg	1.16	-0.15	10.43	-1.80	-0.02	-0.34	0.03
Denmark	1.35	-0.32	4.02	-7.60	0.02	-2.75	0.12
Germany	0.41	-0.42	0.69	0.52	0.02	0.18	0.07
Austria	0.48	-0.25	1.64	-3.41	0.02	0.30	0.13
Netherlands	1.33	-0.76	0.65	-3.19	0.04	0.14	0.08
France	-0.76	-3.18	-9.54	-2.96	0.01	-0.91	0.23
Portugal	15.08	13.52	n/a	-1.73	0.04	-2.42	0.21
Spain	0.80	-0.22	15.94	-2.76	-0.03	-2.01	-0.03
Greece	26.27	23.08	n/a	-1.36	0.02	-0.88	0.18
Italy	-6.96	10.26	8.38	1.29	0.06	-1.53	0.09
Ireland	1.11	-0.65	12.28	1.03	0.03	-0.72	0.13
Finland	0.38	-0.21	18.05	-9.72	0.00	-21.95	0.03
Sweden	0.84	-0.19	2.91	-4.00	0.11	-0.51	0.17
United Kingdom	0.54	-1.05	2.54	1.54	0.02	-0.41	0.10

In Portugal, cereals production also increases. However, here the underlying mechanism is not Article 69, but the direct payments in the beef sector. Decoupling of suckler cow and slaughter premia results in fewer grazing animals and less need for fodder crop production. Thus, land use changes from grazing and fodder towards arable cropping.

A particularly strong negative production effect is simulated for sheep and goats in Finland, where meat production decreases by 22% and the flock numbers by 75%. This large effect is attributable to the high dependence of Finnish producers on aid. In fact, the (computed) profitability in the baseline is already negative, and removing a coupled subsidy of about EUR 31 per head has a major effect on gross value added per sheep. However, Finland also maintains an extensive national subsidy system in parallel to the CAP one. This is not included in CAPRI, and it is thus possible that taking these national subsidies into account would reduce the negative results for Finland.

Table 2.4 highlights the predicted changes in selected crop areas and livestock numbers. At the EU level, the cattle herd itself is projected to decline by around 5% for suckler cows. In contrast, little change in cereal production is forecast, and only moderate reduction in oilseed rape production. These figures suggest that the limited extent of coupling in the arable sector is having a negligible impact on the sector at the level of the

European Union as a whole, whilst in the beef sector there is an impact, albeit relatively small in terms of cattle numbers.

In terms of individual member states, there are more marked changes in terms of areas sown and livestock numbers. For example, suckler cow numbers in those countries that have maintained coupled payments are projected to fall markedly. In contrast, those countries that have fully decoupled see small increases in herd numbers as a response to the projected price rise.

Table 2.4. Change in crop areas and livestock numbers under full decoupling

Percentage change from baseline scenario in 2013

	Soft wheat	Barley	Rape	Suckler cows	Male adult cattle	Ewes and goats
EU region						
European Union 27	0.00	-0.07	-0.87	-4.98	-0.27	-0.98
European Union 25	-0.01	-0.07	-0.90	-5.05	-0.30	-1.12
European Union 15	-0.03	-0.07	-1.45	-5.10	-0.39	-1.16
European Union 10	0.03	-0.07	0.19	-2.61	0.49	-0.03
EU country						
Belgium and Luxembourg	1.05	0.08	-0.26	-5.80	2.70	1.44
Denmark	1.29	-0.31	0.99	4.93	-21.80	-4.08
Germany	0.39	-0.40	0.22	5.07	0.77	0.47
Austria	0.45	-0.25	1.35	-13.41	-0.13	0.67
Netherlands	1.20	-0.74	0.00	3.93	-5.48	0.86
France	-0.82	-3.25	-5.06	-9.46	0.46	-2.02
Portugal	13.97	12.85	n/a	-24.55	1.11	-3.21
Spain	0.89	0.07	18.91	-13.05	-1.42	-4.49
Greece	27.27	22.78	n/a	5.16	-4.18	0.22
Italy	-9.86	12.63	5.81	3.00	1.57	0.08
Ireland	1.06	-0.63	0.00	3.92	0.55	1.74
Finland	0.37	-0.18	0.18	-9.00	-17.03	-75.07
Sweden	0.80	-0.12	0.04	4.65	-8.65	1.80
United Kingdom	0.50	-1.03	0.28	3.32	1.33	1.49

In order to assess the overall impact on the revenues generated by particular agricultural sectors, it is necessary to combine price and production changes (Table 2.5). At the EU level, the slight decline in cereal and oilseed production (Table 2.3) under full decoupling is not matched by price rises (Table 2.2), and therefore revenues from these crops drop slightly. However for meat production (and beef in particular) the projected price rises do seem to offset the decline in production and revenues increase, albeit very slightly. The decline in production does reduce input costs slightly, and overall gross value added (GVA) rises by around 1% in the EU27 and by slightly more in the EU15.

In terms of agricultural revenue (Table 2.5), virtually all EU countries see a small increase in GVA under the scenario of full decoupling, the only exception being Greece. In addition, in most cases, any projected fall in livestock numbers (Table 2.4) seems to be more than offset by increased prices leading to small rises in revenues from meat production.

Table 2.5. Change in sector revenues under full decoupling

Percentage change from baseline scenario in 2013

EU region	Cereals	Oilseeds	Meat	Inputs	Single payment premiums	GVA at producer prices plus premiums
European Union 27	-1.06	-0.95	1.35	-0.16	0.38	0.95
European Union 25	-1.17	-1.09	1.37	-0.16	0.40	0.99
European Union 15	-1.44	-1.51	1.52	-0.17	0.50	1.07
European Union 10	0.01	0.29	0.33	-0.10	-0.11	0.21
Belgium and Luxembourg	0.57	11.21	1.12	0.01	0.03	1.98
Denmark	0.17	4.69	-0.23	0.13	0.75	1.09
Germany	0.20	1.39	1.70	0.81	0.02	0.90
Austria	0.21	1.87	0.78	-0.32	-0.09	1.33
Netherlands	0.98	0.00	0.65	0.27	1.63	0.65
France	-1.34	-10.17	1.30	-0.82	0.87	1.92
Portugal	-1.27	54.90	0.98	-1.61	4.28	2.98
Spain	-2.68	7.49	0.47	-0.92	1.30	1.06
Greece	-9.06	109.03	0.90	0.06	0.04	-0.16
Italy	-5.70	3.59	2.85	0.83	-0.40	0.38
Ireland	0.19	13.43	4.40	3.07	0.00	1.71
Finland	-0.05	18.81	-1.71	-0.08	0.28	1.10
Sweden	0.29	3.57	0.61	0.12	-0.12	1.90
United Kingdom	0.36	3.18	2.84	1.56	0.12	1.27

GVA: Gross Value Added.

The impact of moving to full decoupling on consumers, producers and taxpayers is highlighted in Table 2.6. For the EU27, there is a projected increase of just under EUR 600 million in 2013 in the fully decoupled case when compared with the 2003 reforms. The table highlights that the bulk of this gain is received by the EU15 with only a small gain to the Central and Eastern European member states (EU10[9]). This is largely to be expected given the nature of support through Europe. Consumers generally lose, due to the projected increases in prices for some commodities. However, this is more than accommodated for by increases in agricultural income, in part due to higher commodity prices but also due to the fact that producers no longer have to undertake loss-making enterprises in order to receive support payments.

It may appear surprising that the model indicates that budgetary impacts arise from the switch between partially and fully decoupled payments. This occurs because under the baseline scenario some ceilings of the coupled payments are not reached and the payments are not fully used (and hence some of the budget is saved). However, this is not the case under full decoupling when the whole (or a larger share) of the overall budget ceiling is used.

The clear picture that emerges is that the welfare gains are felt most strongly in those countries that currently have maintained coupled payments, namely, France and Spain. The United Kingdom suffers a small loss due to the fact that the gains to its agricultural sector are offset by higher food prices. The negative welfare effect for United Kingdom is due mainly to the fact that the country is a net importer of meat. Thus, the consumer loss exceeds the producer gain, and the efficiency gain shows up as a welfare gain somewhere else, i.e. where the imported meat is produced (which is not distinguished by CAPRI on the level of intra-EU trade).

Table 2.6. Change in welfare measures

Absolute change from baseline scenario in 2013 in million EUR

	Total[1]	Consumer (money metric)[2]	Producer (agricultural income)	Taxpayer (FEOGA budget outlays Pillar 1)
European Union 27	596	-962	1798	150
European Union 25	588	-958	1785	150
European Union 15	579	-929	1750	156
European Union 10	9	-29	35	-6
Non-European Union	-230	-204		
Belgium and Luxembourg	22.11	-29.12	55.62	0.08
Denmark	1.72	-17.85	27.8	6.47
Germany	35.16	-113.47	166.94	0.57
Austria	23.03	-18.24	41.98	-0.7
Netherlands	4.46	-41.67	65.24	12.33
France	314.3	-214.98	606.89	65.52
Portugal	57.47	-23.1	107.07	23.03
Spain	173.55	-86.55	345.84	59.66
Greece	-36.84	-24.72	-15.66	0.75
Italy	-15.14	-147.56	122.94	-15.58
Ireland	34.73	-13.92	48.91	-0.21
Finland	-0.28	-11.23	12.94	1.63
Sweden	3.25	-26.03	29.38	-0.86
United Kingdom	-38.3	-160.58	134.33	3.28

1. Total does not equal sum of others as includes processing revenues and tariff revenues.

2. Change in consumer welfare is measured by money metric (Money metric is a monetary value of the consumer "welfare". It is obtained from the indirect utility function. Behind it is a computation of "how much consumer budget is needed at the new prices in order to be as well off as in the baseline scenario". If the consumer needs more money (because prices are higher) in order to reach the same utility level, then that amount is taken as the "welfare loss" (Just *et al.*, 2004, p. 170).

CAP Health Check

Although the analysis undertaken did not include the changes to the CAP arising from the Health Check agreement, it is possible to draw some conclusions as to the likely impacts of the changes to the CAP under the agreement as highlighted in Table 2.1. The move to further decoupling is likely to lead to welfare gains, although the fact that full decoupling has not been implemented in the key beef sector (as well as sheep and goats) will limit these gains. A further factor that needs to be taken into account is that some countries (France in particular) have extended the use of the former Article 69 (now Article 68) after the Health Check. Whilst our analysis highlighted that Article 69 had relative little impact in its 2003 form (other than for the durum wheat sector) any further coupling under the new Article 68 is likely to reduce the welfare gains from the Health Check reforms.

Conclusions

This paper has examined the impact of the compromise decision to exempt some sectors from the requirement to fully decouple payments under the 2003 reforms of the CAP. Through using conceptual and empirical analyses, it assessed whether and to what extent partial decoupling is affecting the single market and the impact it has on those countries and sectors that have embraced full decoupling.

With the help of a simulation model, the potential impacts of maintaining coupling were considered. The analysis highlighted that the nature of the impact depends upon the underlying conditions (supply and demand elasticities, etc.) and that a range of factors are important in determining the extent of the impact.

Due to the recent nature of the reforms and the way they were implemented, detailed analysis using econometric or other techniques was not really viable. Therefore, a partial equilibrium modelling framework (CAPRI) was used to simulate the situation within the European Union within the scenario of full decoupling. Use of the CAPRI model proved very useful for understanding the likely impacts in the European Union and in particular provided improved understanding of the impacts that arise because of the complex linkages within the agricultural sector both within and across countries. The results highlighted that production in coupled countries is higher than would be the case if they had decoupled, and this has subsequent impacts on other EU member states through price and trade effects. This is particularly the case in the beef sector. Though the aggregate EU production and price impacts are generally small, the production impacts on certain member states and regions are more marked. Overall welfare levels in the European Union would have been higher had full decoupling been implemented, and these gains would have been highest in the countries that remained coupled, particularly France and Spain.

Notes

1. This chapter is based on research undertaken for Defra and the Scottish Government, and the usual disclaimers apply. The contact is Alan Renwick, Land Economy and Environment Research, Scottish Agricultural College, Rural Policy Centre, United Kingdom (alan.renwick@sac.ac.uk).
2. Although these regulations were originally covered under Article 69 and are referred to as such in this paper, they will now be dealt with under Article 68, following the CAP Health Check in 2009.
3. More information on the IDEMA project can be found at *www.sli.lu.se/idema/idemahome.asp*.
4. Full details of the model can be found in Annex I of Renwick *et al.* (2008).
5. The CAPRI model is widely used and well documented and details of the methodology of the model including the underlying assumptions can be found at *www.capri-model.org/*.
6. NUTS is an abbreviation of Nomenclature of Units for Territorial Statistics, a hierarchical system of administrative regions used by Eurostat. The size of regions at each NUTS level differs by member state. In England, for example, NUTS 1 regions correspond to each of nine Government Office Regions, while Bulgaria has only two NUTS 1 regions.
7. It should again be noted that research was undertaken before the CAP Health Check.
8. Fuller results can be found in Renwick *et al.* (2008).
9. EU10 refers to the ten countries which joined the European Union in 2004.

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Part II

The Impact of the Single Payment Scheme on Land Markets and Farm Structure

Chapter 3

European Union land markets and the Common Agricultural Policy

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This chapter analyses the impact of the Common Agricultural Policy (CAP) direct payments on land markets in the European Union. It starts with a theoretical model, followed by an overview of the empirical findings. Next is presented the empirical evidence of a natural experiment, i.e. the accession of several countries to the European Union where as a result of accession CAP measures have been introduced, and of the impact of the Single Payment Scheme (SPS) reform in the old EU member states (EU15). The results provide preliminary evidence and are mainly based on theoretical analysis and expert interviews. The main limitations are the scarcity of the data on land values and the short time span since the implementation of decoupled CAP subsidies in the European Union.

Economic theory, as well as empirical findings, suggests that the way in which agricultural support is provided has an influence on land markets, because payments capitalise to some degree into land values, affecting both the sales and rental price of land. This also has effects on the transfer efficiency of, for example, support and structural change.

However, the type of agricultural support is not the only factor influencing land markets. The development of land markets and the evolution of land sales and rental prices are affected by various factors, such as agricultural yields, productivity, profitability and urban and environmental pressures. The legal framework and the institutional setting also affect the investment behaviour of farmers and hence the development of rural land markets (Blancard *et al.*, 2006; Giovarelli, 1999). In addition, transaction costs in land market imperfections, such as credit constraints, insurance market imperfections, imperfect property rights, transaction costs of farm organization and restructuring can play an important role (Ciaian and Swinnen, 2006; Cungu *et al.*, 2008; Vranken and Swinnen, 2006; Kancs and Ciaian, 2010). Many of these conditions differ greatly between and within the EU member states.

This chapter analyses the impact of the CAP direct payments on land markets in the European Union. It starts with a theoretical model, followed by an overview of the empirical findings. Next, we present the empirical evidence of a natural experiment, being the accession of several countries to the European Union where as a result of accession CAP measures have been introduced, and of the impact of the Single Payment Scheme (SPS) reform in the old EU member states (EU15).

The results from our paper provide preliminary evidence and are mainly based on theoretical analysis and expert interviews. The main limitations of our study are the scarcity of the data on land values and the short time span since the implementation of decoupled CAP subsidies in the European Union. Hence, it is important to emphasize that the empirical evidence presented here, while suggesting some important effects, is preliminary, and the findings require further study to be confirmed with more elaborate datasets.

The basic model

Coupled subsidies

For reasons of exposition, we start with a simple model of the agricultural sector, in which we consider two factors used to produce one agricultural good $Q = f(A, K)$. Land (A) and the composite of labour and capital (K) are combined in a constant-returns-to-scale production function. Output market clearing and input market-clearing conditions determine the output and input prices. We begin with the assumption of constant elasticities of factor supply and the elasticity of demand.

The capitalisation of agricultural support payments into land values depends largely on the land supply, input substitution elasticities, and whether subsidies are linked to land or not (for more details, see Ciaian *et al.*, 2010). The more inelastic is land supply, the more subsidies are capitalised into land values. Everything else being equal, subsidies linked to land (area payments) are more capitalised into land values than other coupled subsidies (Floyd, 1965; Alston and James, 2002).

If land supply is fixed, then area payments are fully capitalised into land value. Coupled production subsidies are fully capitalised into land value if, additionally to zero land supply elasticity, either the supply elasticity of other inputs is perfectly elastic or if factor proportions are fixed. In other situations, the benefits from coupled subsidies are shared between land and other production factors. If demand elasticity is not perfectly elastic, then consumers also benefit from coupled subsidies. Theoretically, agricultural policy's impact on land values may be very large (e.g. fully capturing the subsidies).

In empirical studies, the land supply elasticity is usually found to be rather low, mostly due to natural constraints. For example, based on an extensive literature review, Salhofer (2001) concludes that a plausible range of land supply elasticity for the European Union is between 0.1 and 0.4. Similarly, Abler (2001) finds a plausible range between 0.2 and 0.6 for the United States, Canada and Mexico.

Input substitution elasticities are a further crucial factor determining the distributional consequences of agricultural policies.[2] With area payments, farms have an incentive to substitute other inputs for land, which increases land demand and leads to the capitalisation of subsidies into land values. A high elasticity of substitution between land and other inputs will induce a high impact of an area subsidy on land value, as high elasticity of substitution indicates strong substitutability between land and other farm inputs in the production process. Subsidies which are not targeted at land have the opposite effect. A high elasticity of substitution between land and other farm inputs reduces the impact of these subsidies on land value (Floyd, 1965; Gardner, 1983; Alston and James, 2002). Based on 32 studies, Salhofer (2001) reports average elasticities of substitution between land and labour of 0.5, between land and capital of 0.2, and between land and variable inputs of 1.4 for Europe. Similar values are reported in Abler (2001) for the United States and Canada.

Decoupled subsidies

The capitalisation of decoupled subsidies depends on the nature of implementation, i.e. whether decoupled subsidies are decoupled from sectoral choice, from land, or from both.

The SPS is decoupled from production, but land is needed to be able to activate SPS entitlements. Capitalisation of the SPS into land values depends on the number of entitlements distributed to farmers relative to the total eligible area (Ciaian *et al.*, 2008; Courleux *et al.*, 2008; Kilian and Salhofer, 2008).

If the number of entitlements is larger than the total eligible area, then the SPS is capitalised into land values. With fixed land supply, the SPS is fully capitalised into land values. Otherwise, the capitalisation of the SPS is partial, and it decreases as land supply elasticity increases. The capitalisation of the SPS also depends on the implemented SPS model.

However, if the number of entitlements is smaller than the total eligible area, then the SPS is not capitalised into land values. The SPS benefits accrue to farmers. This result is general, and does not depend on the size of the land supply elasticity and the SPS model (for more details, see Ciaian *et al.*, 2010).

Empirical insights from literature

The empirical attempts to estimate the impact of agricultural support policies on land rents and land prices can be grouped into two broad categories: land value/price studies and land rent studies. Whereas the former study policy impacts on farmland prices, the latter investigate the policy impact on the farmland rental rates. The main reason why authors use one approach instead of the other is usually determined by the data: the availability of either land values (typically from regional datasets) or rental data (typically from farm-level surveys).

It is important to point out that virtually all of the existing studies relate to North America (the United States and Canada). To our knowledge, only a few papers cover the EU countries (Goodwin and Ortalo-Magné, 1992; Duvivier *et al.*, 2005; Patton *et al.,* 2008). Moreover, none of these measures the impact of the SPS.

In comparison with the hypotheses of theoretical models, several conclusions follow from the empirical studies (for more details, see Ciaian *et al.*, 2010).

First, coupled agricultural support policies do increase land rents and land prices, albeit less than theory predicts. Land rents/prices do not appear to capture the full value of coupled subsidies, at least in the short to medium run, but they do capture a substantive share of subsidy payments (most studies report 20-80%). The reviewed literature on land value and land rental rate determination suggests that land prices and land rental rates are determined by a large number of factors, such as policy support, land use alternatives, competition on the land market, inflation etc., and this may explain these discrepancies between theory and empirical evidence.

Second, decoupled policy payments do affect land rents and land prices.[3] One way to interpret these results is that in the real world there are no truly decoupled subsidies. All "decoupled" subsidies applied in the European Union or the United States impose certain restrictions on farms or are accompanied by other measures[4]. Therefore, it is rather difficult to compare the empirically estimated impact of decoupled and coupled policies. Perhaps, the subsidy that most closely resembles the decoupled subsidy definition is the Production Flexibility Contract (PFC) payments introduced in 1996 by the Federal Agricultural Improvement and Reform (FAIR) Act in the United States. The Act decoupled subsidies from contemporaneous production and removed all planting restrictions, including set-aside requirements. With the exception of certain fruits and vegetables, producers were given complete planting flexibility, while they still received subsidies based on their 1985 program yield and their 1995 acreage base.[5]

Third, landowners benefit from all support programs, both coupled and decoupled. All reviewed studies find that one additional unit of payment results in an increase of less than one land price unit. While these findings are not surprising in relation to decoupled subsidies, most of the empirical literature relates to coupled subsidies that would be expected to have most (if not all) of their final incidence on land. However, the reviewed studies have found a surprisingly small share of coupled subsidy benefits going to landowners.

Fourth, the difference between the estimated impact of coupled and decoupled subsidies is not statistically significant. Comparing the empirical results from different studies, we find evidence that coupled payments do not have a significantly different impact on land value from decoupled payments. For example, Duvivier *et al*. (2005) find

that the elasticity of Belgian land values with respect to partially coupled support (compensatory payments) is between 0.12 and 0.47. Kirwan (2005) estimates that the marginal effect of all government subsidies in the United States on farmland rental rates is between 0.2 and 0.4. In contrast, Taylor and Brester (2005) find that the elasticity of land value with respect to market price support is between 0.16 and 0.32.

There are only a few studies which compare how the subsidy capitalisation differs between decoupled and coupled subsidies. Goodwin *et al.* (2003) find that, as predicted by theory, coupled subsidies (LDP)[6] have a higher impact on land value than decoupled subsidies (PFC). The estimated marginal effect on land value is 6.6 for LDP and 4.9 for PFC. In contrast, the results of Lence and Mishra (2003) suggest that decoupled payments (PFC and MLA) have a stronger impact on rents than coupled subsidies (LDP). Moreover, the coupled subsidies are found to decrease rents. These estimates suggest that rents increase by around 85 cents for each dollar paid per hectare under the PFC and MLA. In the case of LDP, land rent is estimated to decrease by around 24 cents per each subsidy dollar.

Evidence from EU accession

Several central and eastern European countries joined the European Union in 2004 and 2007. Accession was to affect land markets in these new member states (NMS) directly by freeing them and integrating them into the single EU market. However, this process has been held back by the derogations granted by the European Union which allowed the NMS to maintain existing national provisions restricting the acquisition of agricultural land or forests by foreigners for a transitional period. Nevertheless, EU accession has influenced the NMS rural land markets indirectly through various interactions.

First, it has improved the functioning of other factor markets (including credit and technology) and output markets. These other market imperfections were major limitations on the functioning of land markets in the NMS. With improvements in these other markets, farm productivity, investment and profits have grown, leading to a rise in the demand for land and in land values in the NMS. Furthermore, it has stimulated foreign and domestic investment in the food industry and agribusiness, with sizeable spillovers onto farming and land.

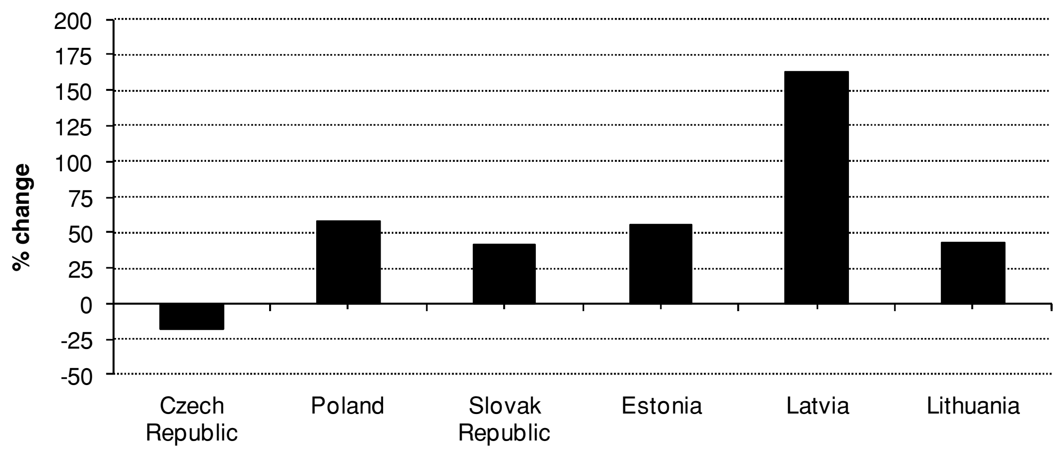
Finally, EU accession has led to a large increase in subsidies for NMS farmers through the CAP. Although for a transition period the NMS farms only receive a proportion of the subsidies given to EU15 farms, the subsidies represent an appreciable share of NMS farm incomes. Moreover, since most of the subsidies are linked to either output or land, they tend to stimulate a rise in land prices.[7] Theoretical analyses show that, even in the presence of land market transactions and imperfect competition, most of the subsidies that are linked to land would ultimately go to landowners through increased land prices (Ciaian and Swinnen, 2006). Furthermore, if credit market imperfections feature prominently, the increase in land prices may even be larger than the increase in land subsidies.

Consequently, a substantial portion of these subsidies ultimately go to the landowners, by stimulating the demand for land and thus increasing NMS land prices over recent years, in both the land sales and rental markets. Between 2000 and 2005, sales prices of agricultural land increased in real terms (i.e. deflated by the Consumer Price Index) by around 50% in Poland and Lithuania, and by almost 250% in Latvia. Similarly,

real rental prices grew by more than 50% in the Czech Republic between 2000 and 2005 and by more than 90% in Slovakia between 2001 and 2005.

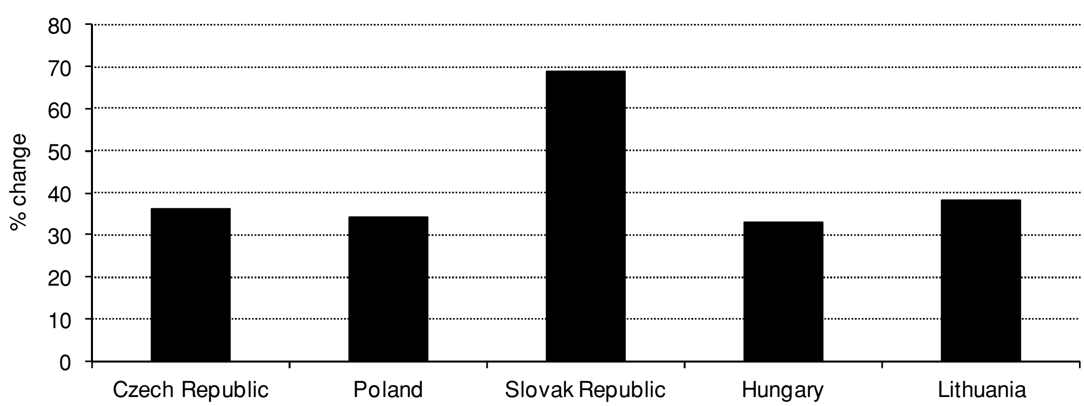
The increase in land prices was exceptionally strong around the time of EU accession. If one compares prices just before accession (2003) to those one year after accession (2005), sale prices rose in real terms by 35% in Poland, 21% in Slovakia, 50% in Estonia, 31% in Lithuania and 143% in Latvia. Over the same period, rental prices grew by between 15% and 45% in Hungary, the Czech Republic, Poland, Slovakia and Lithuania (Figures 3.1 and 3.2).

Figure 3.1. Change in land sales prices in EUR/ha between 2003 and 2005



Source: Swinnen and Vranken (2009).

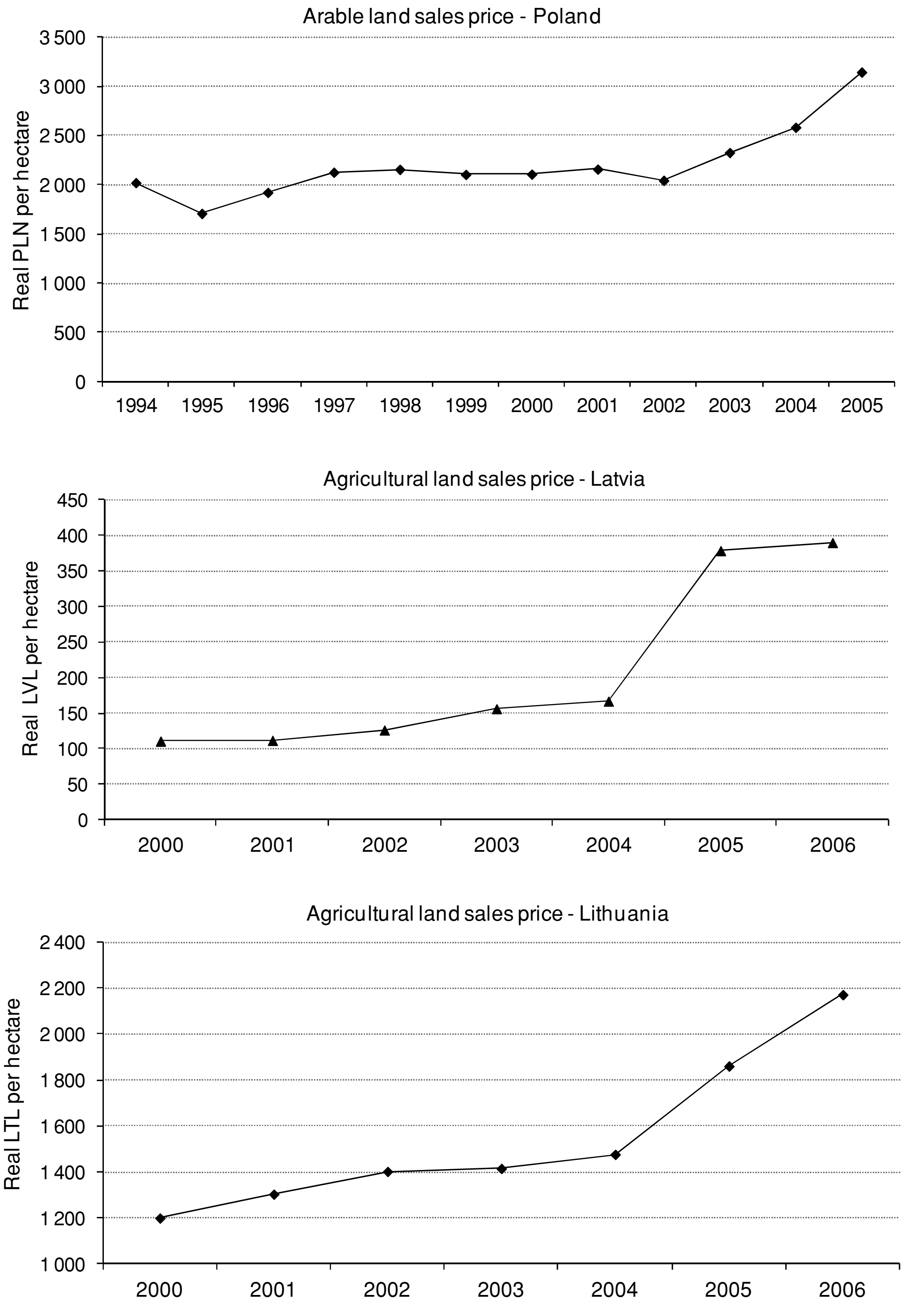
Figure 3.2. Change in land rental prices in EUR/ha between 2003 and 2005



Source: Swinnen and Vranken (2009).

The striking impact of EU accession, and hence of introduction of CAP measures, is illustrated in Figure 3.3, which presents the evolution of sales prices in real terms in Poland, Latvia and Lithuania. The figure reveals that in each of these countries, real sales prices were relatively constant during the years preceding accession, but experienced strong growth with accession in 2004.

Figure 3.3. Evolution of land sales prices in Poland, Latvia and Lithuania
(National Currency per hectare – real prices)



Source: Swinnen and Vranken (2009).

Evidence from the 2003 CAP reforms

Hypotheses

The CAP reform of 2003 launched the policy by which farm subsidies are determined as a fixed set of payments per farm – the Single Payment Scheme (SPS). Under the SPS, the farmer is entitled to a yearly payment depending on the number of payment entitlements and eligible hectares which (s)he possesses. The EU member states could choose among three SPS implementation models: historical, regional and hybrid. Under the historical model, the SPS payment is farm-specific and equals the support which the farm received in the reference period. This is the most common SPS model in the EU15. Under the regional model, an equal per-hectare payment is granted to all farms in the region. The reform of the CAP mostly represents a shift from area payments and livestock payments to the SPS. Therefore, both coupled and decoupled payments need to be considered.

The impact of the pre-reform (before the shift to the SPS) CAP subsidies on land values depends on whether the payment concerned is related to area or to livestock. Area-based payments are partially capitalised into land values and it appears that they have more bearing on land values than livestock-based payments do.

The impact of the SPS depends on the ratio between the eligible area and the total number of entitlements. If the number of entitlements is larger than the total eligible area, then the SPS is capitalised into land values.

The regional (and hybrid) model is expected to lead to greater capitalisation than the historical model because, for a given land base, more entitlements are allocated under the regional model than under the historical one.

A shift from the coupled subsidy system to the SPS should reduce land values in the short run. In the long run, the effect on land values depends on the tradability of entitlements, but one should expect lower capitalisation with the SPS than with the previous subsidy system.

If the SPS is capitalised into land values, then the effect of the SPS is expected to be more pronounced for less fertile land. This is because the previous subsidy system had a weaker effect on the price of less fertile land, as the level of subsidies was linked to productivity and thus less fertile land received less support. Under the SPS, less fertile land can be used to activate entitlements. At the same time, agricultural and non-agricultural drivers of land values are not as influential for less fertile land. This enables easier identification of the impact of the SPS on the value of less fertile land than on the value of more fertile land.

If the SPS is capitalised into land values, then the SPS may lead to changes in relative land prices for different types of land, and the regional and hybrid models may change the relative prices of land among regions. The first effect stems from the ability of the SPS entitlement to be activated for various land types, and thus the ramifications of the SPS are expected to be uniform across all eligible land. The second effect is owing to the possible redistribution of subsidies among regions by the regional and hybrid models, and consequently an increase in land values by the SPS in regions that obtain more subsidies through the SPS relative to the previous subsidy system.

The decoupling that accompanied the introduction of the SPS may lead to higher land prices. Decoupling subsidies from production allows farms to respond to market signals

better, for example by adjusting the farm production structure, which may increase farm profitability. Higher farm profits would increase competition for land and lead to higher land prices. This effect is independent of the SPS payments (Ciaian *et al.*, 2010).

Data and country coverage

The empirical analysis in this paper is based on a combination of several data sources. In particular, we combine insights from comparative data analyses based on data from Eurostat and the Farm Accountancy Data Network (FADN) with data analyses and information collected from a series of country and regional (sub-country) studies.

The countries covered (EU study countries) are Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Spain, Sweden and the United Kingdom.

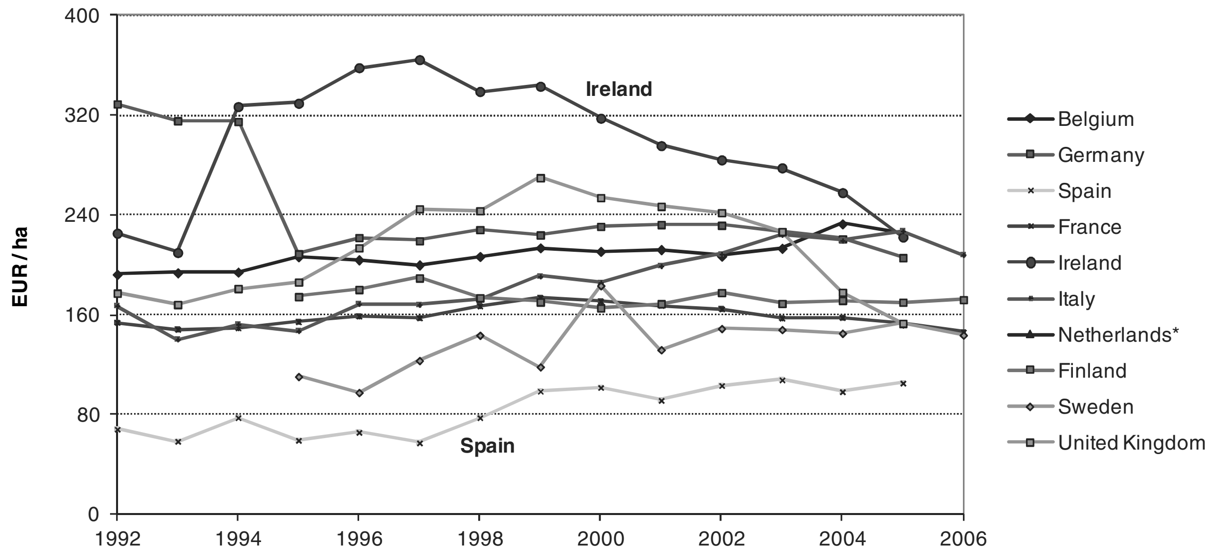
Land market developments in the EU study countries

The amount of land which is rented and sold and the volumes of rental and sales transactions differ greatly among the EU study countries (Figures 3.6 and 3.9). Farms in Belgium, France, Northern Ireland and Germany are more likely to rent land (more than 65% of the land used). In Sweden, farms rent approximately 50% of the agricultural land used. In contrast, the prevalence of land renting is lowest (17%) in Ireland. In the rest of the EU study countries, farms rent between 34% and 43% of the land used. The share of rented farmland of the total Utilized Agricultural Area (UAA) is increasing in most of the EU study countries.

Agricultural land prices, both sales and rental, also vary widely across the EU study countries. The variation in rental prices is somewhat lower than in sales prices but large differences are likewise apparent. The difference in rental prices between the lowest and highest country was around six to one in 1992 and more than seven to one in 2006 (Figures 3.4 and 3.5). In the peak years, sales price differentials between the most and least expensive countries exceeded twenty to one — ranging from around EUR 2 000/ha in parts of Sweden to over EUR 40 000/ha in parts of the Netherlands. These figures imply that awarding the same amount of subsidy per hectare of agricultural land would have quite diverse impacts on land prices (Figures 3.7 and 3.8).

The evolution in agricultural land prices over the past decade have been diverse as well. Over the period from 1992 to the present, real farmland sales prices have decreased by around 25% in Greece, while increasing by around 250% in Ireland. Developments in rental prices since 1992 range from a decline of around 25% in Finland to a rise of around 55% in Spain (Ciaian *et al.*, 2010).

Figure 3.4. Evolution of real rental prices for agricultural land in the EU study countries 1992-2006

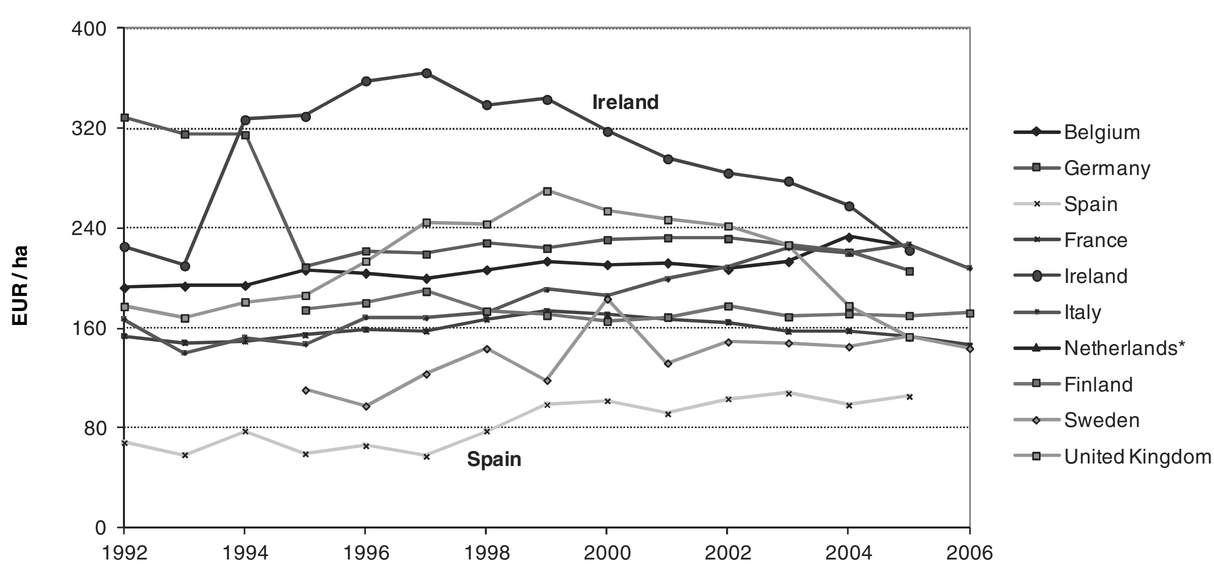


* Not in the figure.

For 1992-96, GDP deflator for Germany, OECD; for 1997-2007, harmonised indices of consumer prices, euro area, Eurostat.

Source: Ciaian, Kancs and Swinnen (2010).

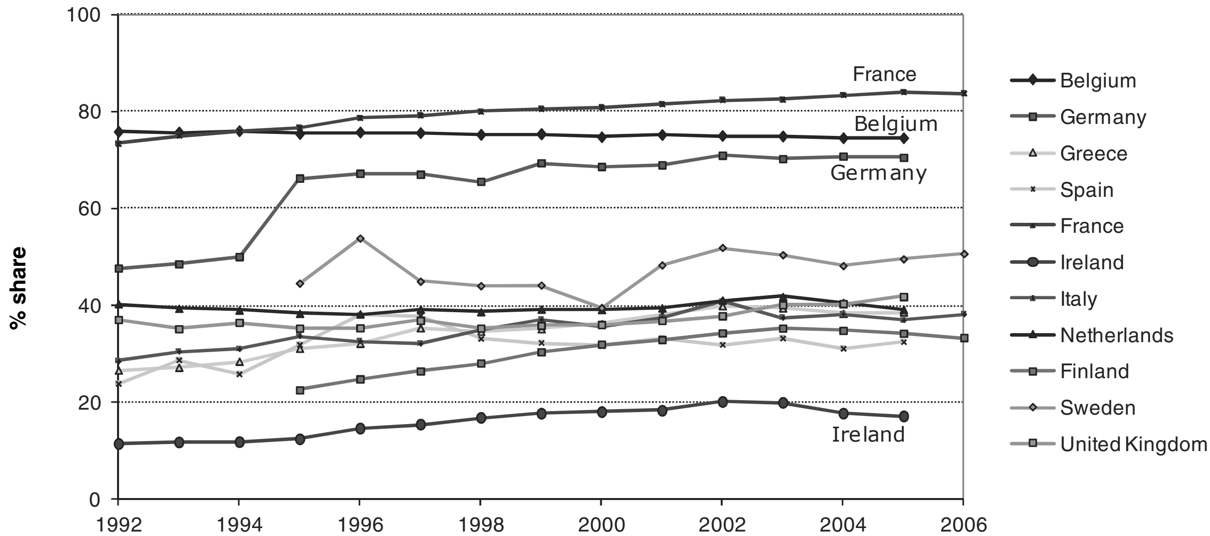
Figure 3.5. Evolution of rental price indices for agricultural land in the EU study countries 1992-2006



For 1992-96, GDP deflator for Germany, OECD; for 1997-2007, harmonised indices of consumer prices, euro area, Eurostat.

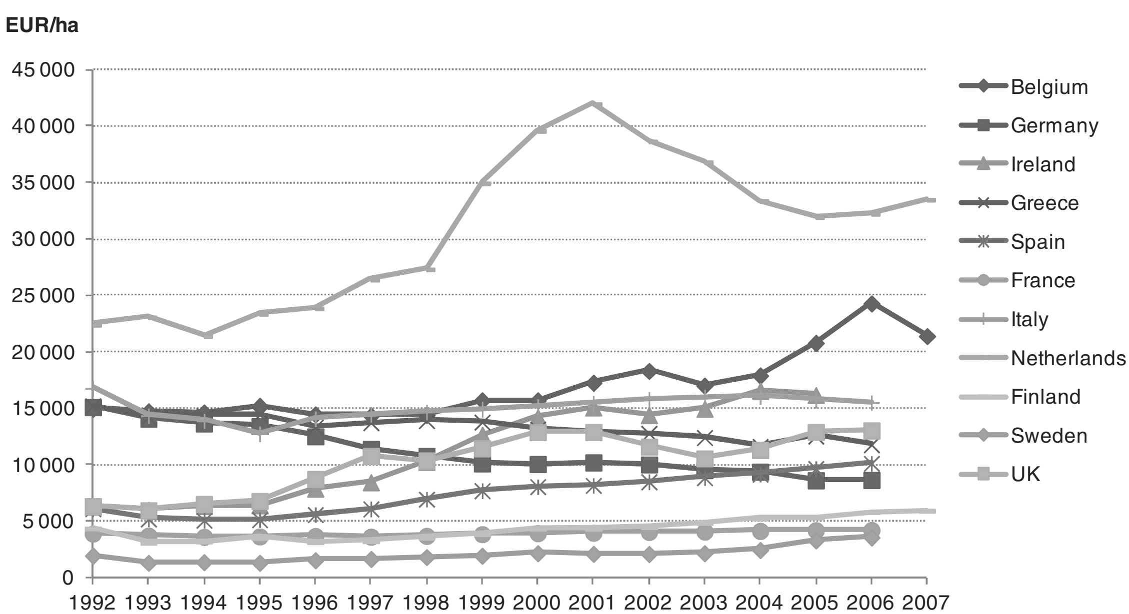
Source: Ciaian, Kancs and Swinnen (2010).

Figure 3.6. Evolution of rented share of total agricultural area in the EU study countries 1992-2006



Source: Ciaian, Kancs and Swinnen (2010).

Figure 3.7. Evolution of real sales prices for agricultural land in the EU study countries 1992-2007

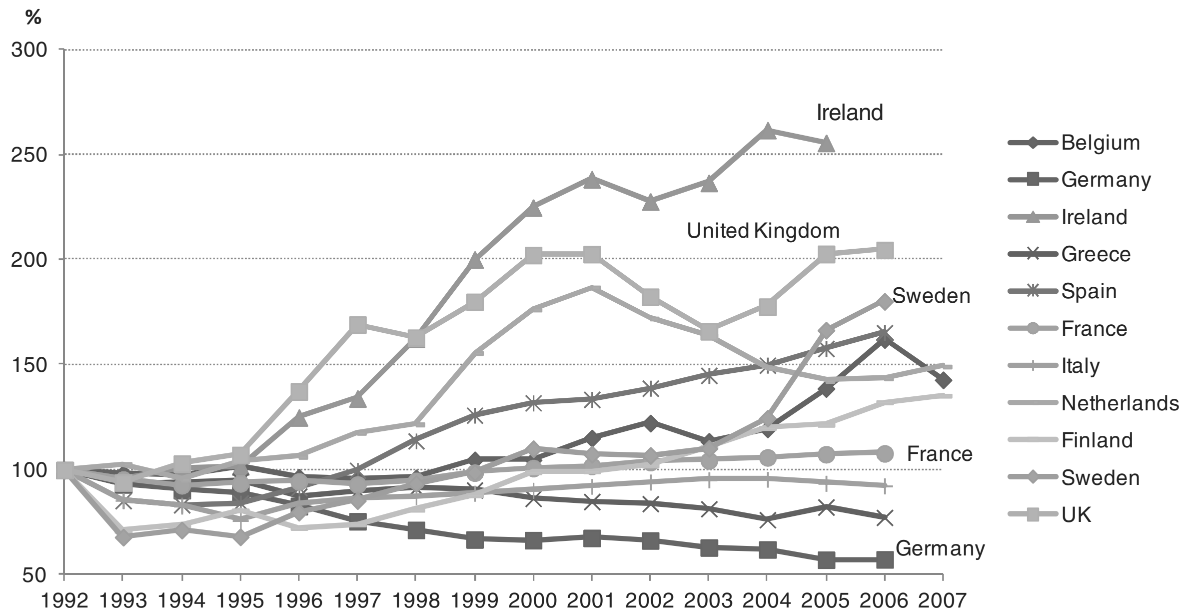


For 1992-96, GDP deflator for Germany, OECD; for 1997-2007, harmonised indices of consumer prices, euro area, Eurostat.

Source: Ciaian, Kancs and Swinnen (2010).

Figure 3.8. Evolution of sales price indices for agricultural land in the EU study countries, 1992-2007

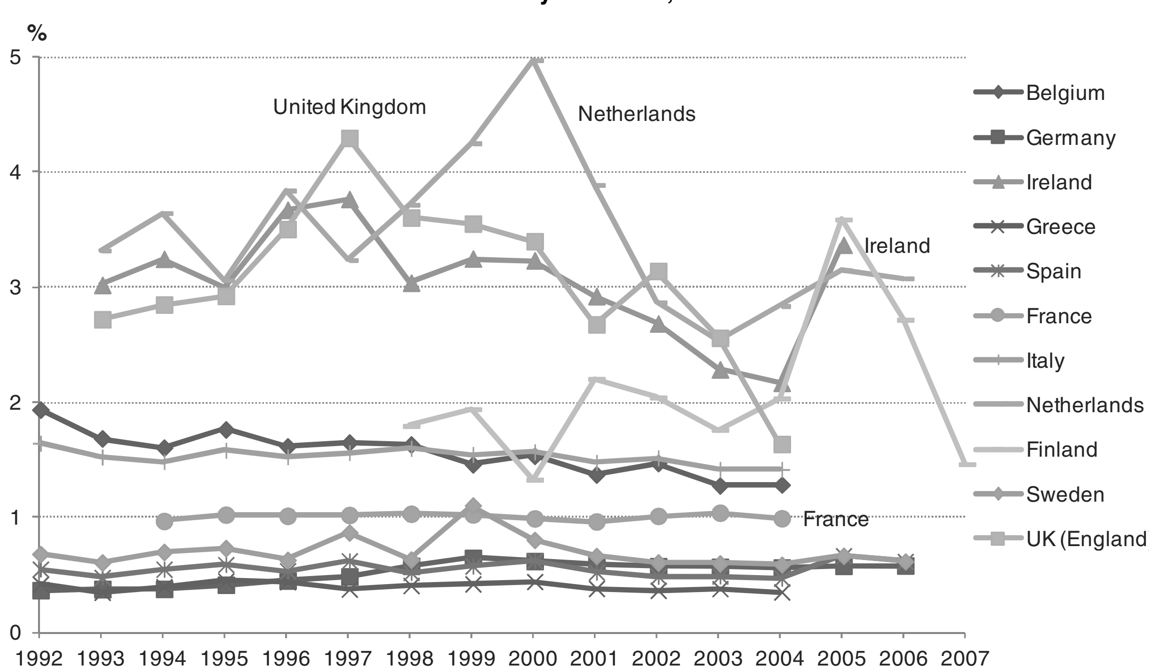
(% change, 1992=100)



For 1992-96, GDP deflator for Germany, OECD; for 1997-2007, harmonised indices of consumer prices, euro area, Eurostat.

Source: Ciaian, Kancs and Swinnen (2010).

Figure 3.9. Evolution of agricultural land sales as a percentage of total Utilized Agricultural Area in the EU study countries, 1992-2007



Source: Ciaian, Kancs and Swinnen (2010).

Regulations and taxes

Land market regulations affect land prices and exchanges, especially land rentals. Rental prices for agricultural land tend to be more regulated by governments than sales prices. In one-third of the EU study countries, the maximum rental prices are set by the government.

The duration of rental contracts is regulated in some of the EU study countries, and this influences the responsiveness of the rental market to agricultural policy changes. The length of rental contracts is regulated by the government in Belgium and France (with a minimum contract duration of nine years), the Netherlands (six years minimum) and Spain (five years minimum). In several EU study countries (e.g. France), the renewal/inheritance of rental contracts is also regulated. In these countries, formal rental markets are stickier, and the time lag is longer in adjusting to policy changes. The prevalence of land renting is typically higher in countries with strict rental market regulations, such as Belgium and France. These two countries have the highest minimum lengths of rental contracts (nine years) and the highest shares of rented area (77% and 75% in 2006, respectively) among all the EU study countries.

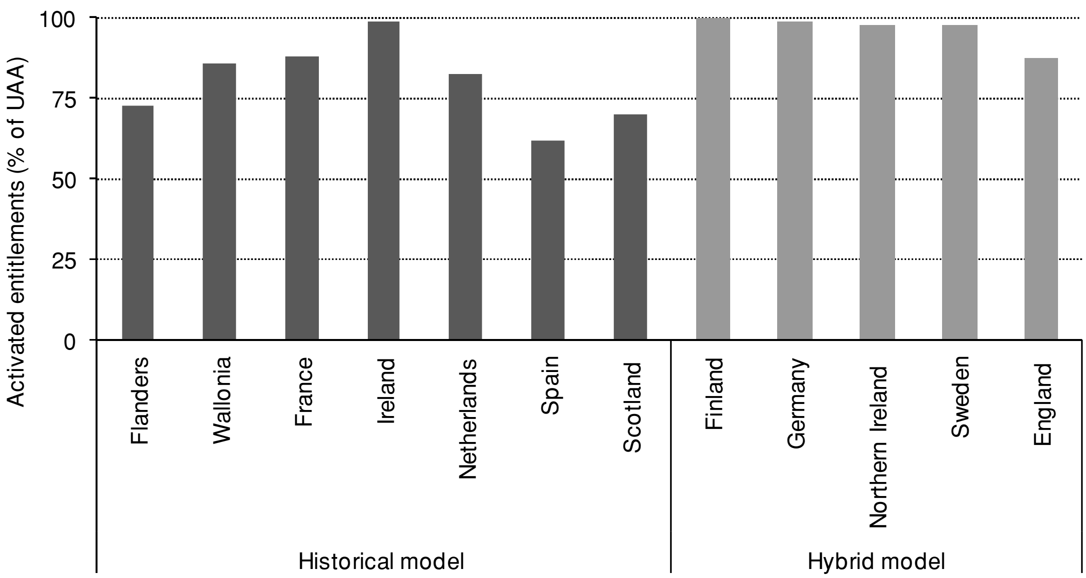
Land taxes differ significantly across the EU study countries. Three kinds of tax regulations that affect market participants' decisions to buy, own or sell agricultural land have been studied: sales taxes, purchase taxes and ownership taxes. Tax rates for land transactions are heterogeneous across the EU study countries, spanning from 1% for low-value land in the United Kingdom to 18% for high-value farmland in Italy. The same applies to ownership taxes, ranging from a 0% tax rate on farmland in Finland to over 15% in the southern European Union countries (Ciaian *et al.,* 2010).

SPS entitlements: activation, trade and valuation

The share of non-activated entitlements of the total distributed entitlements is low. For most EU study countries, it is less than 3%. The value of non-activated entitlements tends to be lower than the value of activated ones. Non-activated entitlements mainly stem from the absence of eligible area and administrative burdens. The share of activated entitlements tends to be somewhat higher in countries using the hybrid model than in those using the historical one. We find that this might be owing to specific criteria relating to the implementation of the hybrid model (Figure 3.10). There is a wide variation in the face value of entitlements among and within the EU study countries. This variation seems to be determined by the commodity structure, the level of support provided in the reference period, the SPS model applied, and implementation details.

There are large differences among the EU study countries in the restrictions on trading entitlements. EU regulations allow entitlements to be tradable but certain constraints are imposed by the European Union. Member states have some flexibility in introducing additional country-specific limitations on entitlement tradability. Spain, Italy and France have the tightest restrictions on entitlement trading. The trade of entitlements is most often conducted directly among farmers, although sometimes market agents or farm organisations play a role. Spain appears to have the most developed entitlement trading system, similar to an auction. There is no informal trading in entitlements, except among family members. An informal entitlement market was not found in any of the EU study countries, because, in order to receive payments, entitlement holders need to be identifiable. However, unofficial 'trade' may occur among members of the same family.

Figure 3.10. Share of activated entitlements in the total Utilized Agricultural Area



The data are for 2006 or 2007 depending on the country.
Source: Ciaian, Kancs and Swinnen (2010).

The entitlement market tends to be smaller in regions under the hybrid model compared with the historical model. Under the historical model, trade is likely to be driven by structural change because the SPS was implemented in 2005-07, but the SPS entitlements were distributed based on land use in 2000-02. With the hybrid model, entitlement trading is driven by a combination of decoupling and the fact that relatively more entitlements were allocated than with the historical model. Structural change is less of an influential factor in the entitlement market under the hybrid model, as entitlements were distributed based on the area used in the first year of the SPS application. Differences in the implementation features of the two SPS models may explain the higher volume of trade with the historical model than with the hybrid one. This is chiefly evident in the short run, which is investigated in this paper. Preliminary evidence suggests that the trade in entitlements is also affected by the functioning of land markets, restrictions on the tradability of entitlements, the availability of an opportunity to consolidate entitlements, and the amount of naked land.[8]

Entitlements are most often traded with land. Evidence from the EU study countries shows that, with few exceptions, entitlement trades are usually accompanied by land.

Our data show that the market price for entitlements in most EU study countries is between one and three times the annual face value of the entitlement. A simple calculation would indicate that with perfect markets and without uncertainty, the entitlement price would be in the range of four to five times the face value if the SPS were to run until 2013 or in the range of ten to twenty if the SPS were to run indefinitely.

Several factors may explain the observed gap in the entitlement price between theoretical expectations and empirical evidence: 1) uncertainty about the future of the SPS (e.g. modulation and the health check); 2) the additional costs of the SPS (e.g. administrative costs); 3) the taxes and fees imposed on transactions; and 4) credit

market imperfections. The low market price of the entitlements may also reflect the capitalisation of the SPS into farmland values (Ciaian *et al.,* 2010).

Impact of SPS implementation

Our theoretical framework and the empirical evidence in the literature suggest that the impact of the SPS on land markets depends on several factors, including the SPS model applied and specific implementation features, market imperfections, transaction costs, market structure and other policies.

On average, the impact on land markets of the switch to the SPS appears to have been weak, and it has not led to lower capitalisation than under coupled policies, although there has been variation among the EU study countries and regions. Preliminary evidence presented in this paper indicates that on average the impact has been limited. We do not observe major declines in land prices with the shift to decoupled policies, which implies that there are no significant reductions in the capitalisation of support.

The introduction of the SPS appears to have had a larger impact on land rents than on farmland sales prices. The net effect on land values also depends on the rate of SPS capitalisation into land values and on the relative significance of the SPS compared with other drivers of land values. The empirical evidence from this paper implies that the relative weight of the SPS in determining farmland prices against that of other drivers of land values is higher for rents than for sales prices.

Preliminary evidence reveals that the historical model leads to lower capitalisation of the SPS into land values than the regional or hybrid models. In countries with the hybrid model, capitalisation appears to be driven by the low amount of naked land. In countries with the historical model, the impact of the SPS appears to be substantially weaker. Where SPS land capitalisation occurs, the most influential factor tends to be structural change combined with constrained entitlement trading (most notably in Belgium). In countries such as Greece, there is little activity on the land market, and hence there is little capitalisation of the SPS. In Ireland, the possibility to consolidate entitlements has reduced the pressure of the SPS on land markets, and SPS land capitalisation appears to be minimal.

We also find that, instead of reducing capitalisation, introduction of the SPS appears to have increased capitalisation in the least productive regions. The SPS seems to have put a floor on land values in less productive regions (e.g. in Sweden and parts of the United Kingdom). The clearest evidence of the influence of the SPS on land values is higher land values for less fertile land (e.g. grassland). This finding could also be caused by the redistribution that came with the hybrid model.

In countries with regulated rental prices, implementation of the SPS seems mainly to affect unofficial markets. In these member states, there is little effect on official prices (since these are regulated), but where regulations lead to the existence of unofficial markets for agricultural land, the SPS tends to increase both rental prices (e.g. Belgium) and volumes on the unofficial market (e.g. Belgium and the Netherlands).

Distribution of SPS benefits

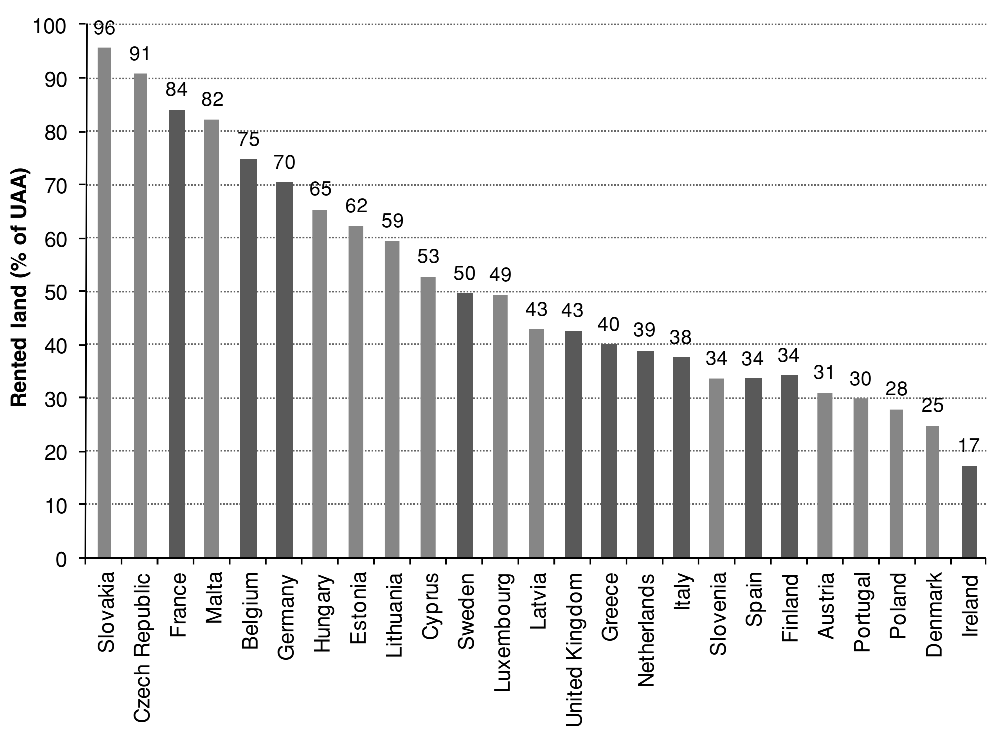
Landowners tend to benefit more from the hybrid model than from the historical model. More specifically, landowners benefit more under the hybrid model through two channels. The first is the capitalisation of the SPS into land values. This is mostly the case

where low amounts of naked land drive up land values. The second channel concerns the implementation features of the hybrid model. Under the hybrid model, the number of entitlements that farmers receive is equal to the total eligible area in the first year of the SPS application. This has enabled some non-farming landowners to obtain entitlements either by cancelling the existing rental contracts and applying for entitlements themselves or by adjusting rental contracts to ensure that entitlements return to them after the contract expires, or by undertaking other similar arrangements.

The distribution of the SPS payments to landowners appears to differ markedly among the EU study countries. From our country studies, it seems that landowners benefit most from the SPS in Finland and Sweden (60-100% of the value of the entitlement) and least in Greece and Ireland (0-10%). In the other countries, the benefits that accrue to landowners from the SPS are in the low to medium range (10-60%).

The distribution of the SPS additionally depends on whether landowners are also farmers, which varies among the EU study countries (Figure 3.11). As mentioned above, the prevalence of renting land differs greatly among the EU study countries. The evidence in this paper suggests that, in Germany, Northern Ireland and Sweden, a substantial share of SPS benefits will be channelled to non-farming landowners. This finding also holds (but to a lesser extent) for England, Finland and Scotland. In the rest of the EU study countries, a lower share of the SPS will go to non-farming landowners, either because renting land is less common or because there is little capitalisation of the SPS into land values (or both). In these countries, farmers appear to gain the largest proportion of the SPS (Ciaian *et al.,* 2010).

Figure 3.11. Share of rented land in EU member states, 2005



Source: Ciaian, Kancs and Swinnen (2010).

Notes

1. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission. Pavel Ciaian is from the European Commission, DG Joint Research Centre (IPTS); d'Artis Kancs, Centre for Corporate Sustainability, Hogeschool-Universiteit Brussel; Johan Swinnen, LICOS Centre for Institutions and Economic Performance and Center for European Policy Studies (CEPS). and Liesbet Vranken of the LICOS Centre for Institutions and Economic Performance

2. A substitution elasticity measures how easy it is to substitute one input for other in the farm production function.

3. The theoretical literature on decoupled subsidies shows that fully decoupled agricultural support policies have no effect on land values if markets are competitive and transaction costs are not prohibitive. It also shows that decoupled policies may affect land values only in the presence of some market imperfections.

4. For example, in the case of the SPS, the payments have to be activated with land. In order to receive the decoupled subsidies, farmers must have a corresponding amount of land at their disposal. The total subsidies that a farm can receive are constrained by the amount of subsidies received and land used in the reference period. However, the SPS is not conditional on cultivating the land. Thus, the SPS is still connected to land in some way although it is decoupled from contemporaneous production.

5. Additionally to PFC payments, Marketing Loss Assistance (MLA) payments are decoupled in the United States. MLA was introduced as part of the "emergency assistance" provided to US agriculture in 1999. As part of an appropriations act signed into law in October 1998, USD 2.857 billion in additional payments were made to farmers to compensate them for the loss of markets for 1998 crops. Subsequent acts provided additional MLA payments of USD 5.5 billion for 1999 crops, USD 5.465 billion for 2000 crops, and USD 4.6 billion for 2001 crops. For the crops eligible for PFC payments, the MLA payments were proportional to the PFC payments made in that year, with a maximum payment per person of USD 19 888. Hence, the MLA payments can be viewed as supplementary or "top-up" PFC payments (OECD, 2005), and have sometimes been referred to as "double AMTA" payments (Goodwin and Mishra, 2002).

6. The Federal Agriculture Improvement and Reform Act of 1996 (the 1996 FAIR Act) initiated a programme of non-recourse marketing assistance loans and loan deficiency payments (LDP) for 16 crops, including corn and soybeans. The purpose of this program was to provide producers a financial tool to help farmers market their crops throughout the year. The non-recourse loans allow farmers to store production and sell it when market conditions are favourable. The crop is employed as collateral for the loan. The loans are non-recourse in that the farmer has the option of repaying the loan by delivering the crop to the Commodity Credit Corporation at loan maturity.

7. Since the 1992 MacSharry reform and the Agenda 2000 reform, the vast majority of CAP subsidies are so-called direct payments. The direct payments were partially introduced in NMS from the date of accession and then gradually increased. Direct payments from the EU budget are granted to farms in the form of area payments. The

NMS are allowed to add a restricted amount of subsidies from their own budget (so-called "top-ups") as area payments or as coupled animals and/or crop payments.

8. Non-activated eligible land for which the SPS is not claimed represents "naked land". The total amount of naked land tends to be smaller with the hybrid model (or regional model) than with the historical model. The explanation lies in the characteristic that the total number of entitlements in the hybrid model is equal to all eligible land at the time of SPS implementation; by contrast, in the historical model entitlements are tied to the number of hectares that generated subsidies in the reference period. As a result, the hybrid model is expected to put stronger pressure on capitalisation of the SPS into land values.

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Chapter 4

The impact of the Health Check on structural change and farm efficiency: a comparative assessment of three European agricultural regions

Filippo Arfini and Michele Donati[1]

An assessment of the effect of the regionalized single payment system on farm behaviour and farm economic performances is proposed for understanding the potential consequences for European Union farms. The methodology adopted for this purpose is based on positive mathematical programming (PMP) integrated with a cluster analysis technique. The PMP model is used for assessing farm responses towards changes in policy and market scenarios, while cluster analysis is implemented for mapping the characteristics of the farms before and after the regionalization introduction, thus observing the dynamics in production composition and economic results. The simulations demonstrate a differential capability of farms in reacting to new policy and market scenarios, and how regionalization contributes to reducing differences in the production and economic characteristics of the investigated farms.

The European Commission has always considered the Common Agricultural Policy (CAP) as a dynamic political tool that aims to link the agricultural sector with the evolution of the economic, financial, social and political dynamics that distinguish the member states of the European Union (EU). From this standpoint, the Health Check is much more than a simple assessment of the state of health of EU agriculture; it is a drawing up of the "new rules" that manage the relations between farms and the market, on which the future efficiency and survival of farms, and the production sectors that characterise entire EU agricultural regions, will depend.

The new Regulation (EC No. 73/2009) has the objective of reforming the current structure of the CAP and has continued the modernisation process introduced in 2003 by the Fischler reform (DG Agri, 2009; Borchard, 2008). The aim of the European Commission is to set up a legislative framework geared to preparing European agriculture for the further reform which is to be defined after the review of the European Union budget. In the meantime, the set goals are not so much of the strategic type but rather more of the tactical type. They are founded on the attempt to render European agricultural policy more "simple", "efficient" and "effective", and more focused on coping with the changes that most closely concern European society, and hence the Commission itself: food security, land management, viable rural areas, competitiveness in a global market, climate change, water management, the development of renewable energy sources and the preservation of biodiversity.

One of the aspects that distinguish the Regulation EC No. 73/2009 is the maintenance of the decoupled payment in order to guarantee farmers a certain level of financial security, allowing them to respond better to signals from the market, to supply the food sector, and to create a basis for providing public goods (DG Agri, 2009; Borchard, 2008). The latter action is developed by the full implementation of direct payments fully decoupled from farmers' production decisions without influencing their market orientation. In this framework, the proposal to move from the concept of rights acquired by the farms in the past to the adoption of decoupled payments calculated on a regionalised basis can be a challenge for many farms and for the entire agriculture sector. The change proposed, which is accompanied by other measures that are maintained (cross compliance) and introduced (stronger modulation), could, in addition to bringing about a redistributive effect between regions and farms (Anania, 2008; Arfini, 2006), also lead to a redistributive effect between production sectors, affecting the competitiveness of the farm activities and of the sectors to which such farm activities belong. All this could lead to variation in the competitiveness of the farms and hence of the sectors involved.

The aim of this paper is therefore to assess the effects of this "non-reform" on the competitiveness of farms, considering the set goals as regards the role of decoupled aid, and the capacity to react to market variations in different European environments (Frascarelli, 2008; Canali, 2008).

It is therefore justifiable to wonder, in this sense, how the Health Check measures (regionalised single payment system SPS, modulation, abolition of set-aside, and milk quotas) can affect the competitiveness of European farm businesses, *i.e.* the capacity to adapt the organisation of the farm production, improving its productive and economic performance compared to the "historic" SPS currently in force. In this context, farms are under the framework of SPS and receive a full decoupled payment. The real innovation introduced by the reform that can potentially modify the existing equilibrium of farm

holders is the regionalization of direct subsidies according to the average aid per hectare calculated for a homogeneous region: a specific European region or the whole of the Euopean Union. In theory, the modification of subsidy level will not change land allocation, but will change farmer incomes and will modify (for better or worse) farmers' sensitivity to market price variation.

Furthermore, it is justifiable to wonder whether these measures work in different ways in the different European agricultural regions, creating comparative advantages that make certain regional supply chains more efficient than others. For this reason, the analysis considers all the farm holders belonging to the FADN sample in three European agricultural regions: Veneto (Italy), Ile-de-France (France), and Belgium. At the same time, the objective of this study is also to capture the strategy of these farm holders and to observe their path towards greater efficiency.

Methodology

The assessment of the effects of the Health Check regulation by the introduction of SPS regionalization on European farms is conducted by analysing, in addition to economic performance and farming system, the change in the farm's strategy as a consequence of the new policy and market scenario.

We propose the adoption of a model that integrates the Positive Mathematical Programming (PMP) approach — which represents the characteristics of the farms and simulates the effects of the agricultural policy measures — with a cluster analysis technique able to group farms characterized by the same production strategy and economic characteristics.

The PMP model

In its classical form, PMP as presented by Paris and Howitt (1998) is an articulated method consisting of three different phases, each of which is geared at obtaining additional information on the behaviour of the farm so as to be able to simulate its behaviour when maximizing total gross margin (Paris and Howitt, 1998; Arfini and Paris, 2000). The PMP method has been widely used in the simulation of alternative policy and market scenarios, utilising micro technical-economic data relative both to individual farms and to average farms that are representative of a region or a sector (Arfini *et al.*, 2005). The success of the method is largely attributable to the relatively low requirement for information on farm activities and, first and foremost, to the possibility to use databases, such as the FADN (Arfini *et al.*, 2005).

Notwithstanding the numerous studies that have adopted the PMP approach using FADN data, the methodology nonetheless comes up against a limitation consisting of the lack of specific production costs per farm enterprise. The lack of this information poses a problem during the calibration phase of the model, when the estimation of the cost function requires a non-negative marginal cost for all enterprises of a single holding (Paris and Arfini, 2000).

This problem is dealt with in this analysis by resorting to an approach that utilises dual optimality conditions directly in the estimation phase of the non-linear function. The approach represents an extension of the Heckelei proposal (2002), according to which the first phase of the classical PMP method can be avoided by imposing first-order conditions directly in the cost function estimation phase by introducing the value of the rented land,

given from the market, as a dual value. This procedure requires the use of information external to the FADN dataset and provided by experts or by regional investigations. The main disadvantage of this procedure is that the external data are not always homogeneous with the characteristics of the farms covered in the FADN sample. For several reasons, the rental value of the land may change within the region, and the dual price of the land may also be quite different for different farm types according to their production sector (milk or cereals), their size, their level of specialization and the specific characteristics of each farm holder. In sum, the value of the rented land is not easy to collect and can lead to miss-specification of PMP models.

Moreover, as a guide to the correct estimation of the explicit production cost per crop, we propose the consideration of the information relative to the total variable costs available in the European FADN archive. This innovation becomes particularly important as it enables us to perform analyses utilising the EU data base without having to resort to parameters that are exogenous to the model.

According to this new approach, the PMP model falls into two phases: 1) the estimation of specific accounting variable costs per crop through the reconstruction of a non-linear function of the total variable cost observed for each individual farm of the FADN sample; and 2) the calibration of the observed production situation through the solution of a farm gross margin maximization problem, in the objective function of which the cost function estimated in the previous phase is considered.

The first phase is defined by an estimation model of a quadratic cost function in which the squares of errors are minimised:

$$\min_{u} LS = \frac{1}{2}\mathbf{u}'\mathbf{u} \qquad [1]$$

subject to

$$\mathbf{c} + \boldsymbol{\lambda} = \mathbf{R}'\mathbf{R}\bar{\mathbf{x}} + \mathbf{u} \qquad \text{se } \bar{x} > 0 \qquad [2]$$

$$\mathbf{c} + \boldsymbol{\lambda} \leq \mathbf{R}'\mathbf{R}\bar{\mathbf{x}} + \mathbf{u} \qquad \text{se } \bar{x} = 0 \qquad [3]$$

$$\mathbf{c}'\bar{\mathbf{x}} \leq TVC \qquad [4]$$

$$\mathbf{u}'\bar{\mathbf{x}} + \frac{1}{2}\bar{\mathbf{x}}'\left(\mathbf{R}'\mathbf{R}\right)\bar{\mathbf{x}} \geq TVC \qquad [5]$$

$$\mathbf{c} + \boldsymbol{\lambda} + \mathbf{A}'\mathbf{y} \geq \mathbf{p} + \mathbf{A}'\mathbf{s} \qquad [6]$$

$$\mathbf{b}'\mathbf{y} + \boldsymbol{\lambda}'\bar{\mathbf{x}} = \mathbf{p}'\bar{\mathbf{x}} + \mathbf{s}'\bar{\mathbf{h}} - \mathbf{c}\bar{\mathbf{x}} \qquad [7]$$

$$\mathbf{R} = \mathbf{L}\mathbf{D}^{1/2} \qquad [8]$$

$$\sum_{n=1}^{N} u_{n,j} = 0 \qquad [9]$$

By means of the model [1]–[9], a non-linear cost function can be estimated using the explicit information on the total farm variable costs (TVC) available in the FADN database. The restrictions [2] and [3] define the relationship between marginal costs derived from a linear function and marginal costs derived from a quadratic cost function. $\mathbf{c} + \boldsymbol{\lambda}$ defines the sum of the accounting variable costs and the differential marginal costs. The latter are implicit in the decision-making process of the entrepreneur and are not accounted for in the holding's accounts. Both components are variables endogenous to

the minimization problem. To guarantee consistency between the estimate of the total specific costs and those effectively recorded by the farm accounting system, the constraint [4] ensures that the total estimated explicit cost should not be greater than the total variable cost observed in the FADN database. Equation [5] defines that the costs estimated by the model by the non-linear cost function must at least equal to the value of the total variable cost (TVC) measured. In order to guarantee consistency between the estimation process and the optimal conditions, restriction [6] introduces the traditional condition of economic equilibrium, where total marginal costs must be greater than or equal to marginal revenues. The total marginal costs also consider the use cost of the factors of production defined by the product of the technical coefficients matrix $\mathbf{A}'$ and the shadow price of the restricting factors *y*; while the marginal revenues are defined by the sum of the product selling prices, *p*, and any existing coupled subsidies. The additional constraint [7] defines the optimal condition, where the value of the primal function must correspond exactly to the value of the objective function of the dual problem. In order to ensure that the matrix of the quadratic cost function is symmetric positive semi-definite, the model adopts Cholesky's decomposition method, according to which a matrix that respects the conditions stated is the result of the product of a triangular matrix, a diagonal matrix and the transpose of the first triangular matrix [8]. The estimated matrices are presented in Annex 4.1. Last but not least, restriction [9] establishes that the sum of the errors, *u*, must be equivalent to zero.

The cost function estimated with the model [1]–[9] may be used in a model of maximization of total gross margin, ignoring the calibration restrictions imposed during the first phase of the classical PMP approach. In this case, the dual relations entered in the preceding cost estimation model guarantee the reproduction of the situation observed. The model therefore appears as follows:

$$\max_{x\geq 0} ML = \mathbf{p'x} + \mathbf{s'h} - \left\{ \frac{1}{2}\mathbf{x'\hat{Q}x} + \mathbf{\hat{u}'x} \right\} \qquad [10]$$

subject to

$$\mathbf{Ax} \leq \mathbf{b} \qquad [11]$$

$$A_j x_j - h_j = 0 \qquad \forall j = 1,...,J \qquad [12]$$

The model [10]–[12] precisely calibrates the farming system observed, thanks to the non-linear cost function entered in the objective function, which preserves the (economic) information on the levels of production effectively attained. The matrix *Q* estimated is reconstructed using Cholesky's decomposition: $\mathbf{\hat{Q}} = \mathbf{\hat{R}'\hat{R}} = \mathbf{\hat{L}\hat{D}\hat{L}'}$. Constraint [11] represents the restriction on the structural capacity of the farm, while the relation [12] enables us to obtain information on the hectares of land (or number of animals) associated with each process *j*. Once the initial situation has been calibrated through the maximization of the corporate gross margin, it is possible to introduce variations in the public aid mechanisms and/or in the market price levels in order to evaluate the reaction of the farm to the changed environmental conditions. The reaction of the farm production plan takes into account the information used during the estimation phase of the cost function, where it is possible to identify a true matrix of the firm's choices, i.e. *Q*.

This PMP model can be used in two different contexts: 1) the estimation of the explicit variable accounting cost (*c*) related to each activity whose data are collected by the FADN, and 2) the estimation of the total variable cost per crop perceived by the

farmer ($\mathbf{c}+\boldsymbol{\lambda}$). This latter provides an information set useful for evaluating farm behaviour by means of the definition of a new profit function.

An additional element to consider is given by the introduction of full decoupling, and the related SPS, in the model. This aspect is given by a specific constraint that links *ex ante* the entitlement value — per unit — to the number of entitlements. Only the eligible area represented by eligible crops can benefit from the decoupled payment.

$$ham_n \leq hdir_n \quad \forall n = 1,...,N \qquad [13]$$

$$ham_n + hamd_n \leq \sum_{j=1}^{J} h_{n,j} \quad \forall n = 1,...,N \qquad [14]$$

Equation [13] ensures that the variable related to the admissible area ham_n should be less than or equal to the number of entitlements in each farm, $hdir_n$, where n represents the n^{th} farm ($n=1,...,N$). The second constraint [14] means that the land admissible to the payment, ham_n, plus the land admissible but not payable because not linked to the number of entitlements owned, $hamd_n$, must be less than or equal to the total land attributed to the eligible farm crops. Obviously, only the variable ham_n is present in the objective function.

In the case of regionalization, the structure of the constraints does not change, but rather the value of each entitlement, which will be equal for all the farms belonging to the same region. Moreover, the j admissible activities cover the whole farm surface.

The cluster analysis

The second methodological component tries to identify homogenous groups of farms and to describe their strategy in respect of their structure and production choice. For this purpose, the analysis adopts a multivariate technique articulated in the detection of principal components and the method of cluster analysis (k-mean) that identifies a set of homogeneous farms in two different reference scenarios: the baseline scenario and the new policy scenario. This procedure allows us to describe the effect of the policy measure and the dimensions of the new strategies adopted by each farm.

The scenarios

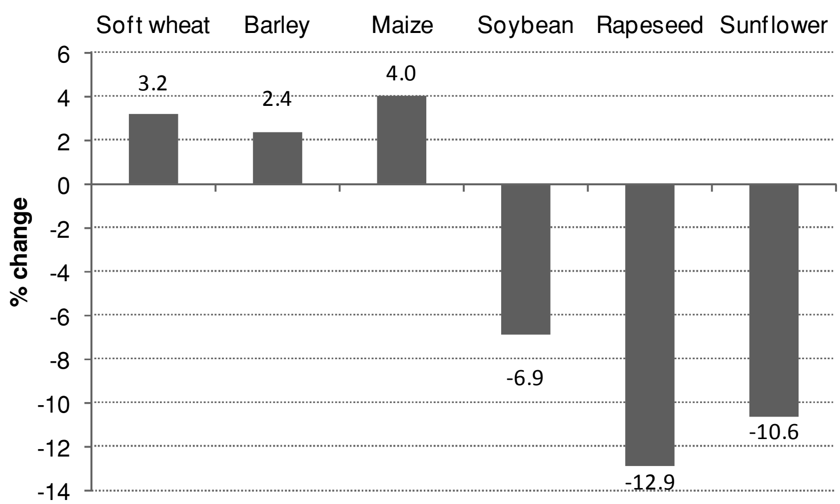
Considering the new Regulation that put in practice the Health Check (Regulation EC No. 73/2009), three policy scenarios are considered and compared with a Baseline scenario that reproduces the situation in terms of land allocation and revenues, costs, subsidies and incomes existing before the reform:

- *Single-region scenario "S_Reg":* payments are regionalized using specific flat rates differentiated for the three regions considered; the modulation rates are set at 10% for the range EUR 5 000 to EUR 300 000 and 14% for the range above EUR 300 000;
- *Single region and market scenario "S_Reg_P":* the "S_Reg" scenario with market prices for 2015; these price changes are added to scenario S_Reg.

- *European Union region and market scenario "EUReg_P":* payments are calculated on a flat-rate basis at the EU level (the EU15 considered as a homogenous area); the modulation rates are established at 10% for the range EUR 5 000 to EUR 300 000 and at 14% for the range above EUR 300 000; this scenario also considers market prices at 2015.

The market scenarios are developed using the prices for the year 2015 provided by FAPRI projections (2010) (Figure 4.1).

Figure 4.1. Price changes according to FAPRI projections 2015 compared to 2009



Source: Authors' interpretation of FAPRI results.

As mentioned in the previous section, in the case of the transition from the historic SPS to a regionalized one, the unitary value of the payment and the overall number of the entitlements available to the individual farms both change. The transition implies a process of redistribution, not only among farms but also among sectors. At the same time, modulation also generates redistributive effects inasmuch as it "erodes" the SPS in the farms under examination, thus affecting the overall economic results (Table 4.1). To this end, the transition from the "historic" SPS to a "regionalized" SPS leads to a general reduction of the unitary subsidies received by the farms only in some regions – in the case of a homogeneous region equal to the actual region, while the adoption of a homogeneous region corresponding to the whole of the EU produces a general reduction of payments for all the three regions considered. The introduction of modulation reduces the level of payments especially in intensive regions.

Table 4.1. Value of entitlements across scenarios
EUR/ha

Regions	Baseline (2009)	S_Reg	S_Reg_P	S_EUReg_P
	Without modulation			
Veneto	450	307	307	264
Ile-de-France	311	284	284	264
Belgium	376	441	441	264
	With modulation			
Veneto	426	286	286	246
Ile-de-France	292	259	259	241
Belgium	356	406	406	247

Initial data and results obtained

Initial data

The sample of data used consists of farms contained in the European FADN data base for the year 2007 (Table 4.2). To be more specific, the farms considered are situated in three European regions that are all different as regards their geographical location, and the productive and structural characteristics of their farming systems: Veneto, Ile-de-France, and Belgium[2]. The regional sample of farms was, moreover, stratified on the basis of the specialist production identified by the economic-technical orientation to which they belonged. The analysis considers only the farm type related to arable crops, which is one of the most important sectors at European level. The characteristics of farm types by region in the baseline scenario are shown in Annex Table 4.2.

Table 4.2. Brief description of the FADN sample
2007 (Italy), 2006 (Ile-de-France, Belgium)

Region	Number of farms	Mean UAA	COP (with rice) production	Mean gross saleable production	Mean total variable cost	Mean subsidy
	Farms	Hectare	% of UAA	EUR/ha	EUR/ha	EUR/ha
Veneto	211	41	88	1 973	750	426
Ile-de-France	141	140	94	1 045	473	292
Belgium	93	54	65	2 045	978	356

UAA: Utilized agricultural area. COP: cereals, oilseeds and protein crops.
Source: authors' interpretation of FADN results.

Impact on land allocation and farm revenue

The results provided by the analysis of the selected farms in the three European regions show different consequences with respect to the capability to react to policy scenario and market evolutions. In the three regions, the introduction of regionalization on a regional basis will not produce significant changes in land allocation. Considering all the farms, on average, only in Veneto is there a small change due to the presence of rice on some farms where the payments are still high and partially coupled and will be fully decoupled under the Health Check implementation (Table 4.3). Only in this case is there a re-allocation of some crops with the introduction of regionalization. The reductions of

the entitlement value do not produce any variation in terms of land allocation but only a variation in farm revenue (Table 4.4).

Table 4.3. Impact on land allocation

	Baseline (2009)	S_Reg	S_Reg_P	S_EUReg_P
	Hectares	% change with regard to baseline		
Veneto region				
Wheat	2 265	-0.1	6.3	6.3
Maize	2 679	0.0	20.6	20.6
Rice	301	-11.2	-14.8	-14.8
Soya	2 105	1.1	-32.3	-32.3
Sugarbeet	424	2.5	13.3	13.3
Tobacco	246	0.2	-0.3	-0.3
Temporary grass	318	0.3	-5.6	-5.6
Others	262	0.6	-2.8	-2.8
Total	8 600	0.0	0.0	0.0
Ile-de-France region				
Wheat	9 714	0.0	-4.1	-4.1
Barley	3 798	0.0	8.5	8.5
Maize	437	0.0	21.7	21.7
Rapeseed	3 434	0.0	-25.5	-25.5
Dry pulses	1 044	0.0	80.6	80.6
Sugarbeet	875	0.0	8.4	8.4
Others	579	0.0	-11.1	-11.1
Total	19 880	0.0	0.0	0.0
Belgium				
Wheat	2 230	0.0	6.0	6.0
Barley	864	0.0	-15.4	-15.4
Rapeseed	105	0.0	-4.0	-4.0
Sugarbeet	739	0.0	0.5	0.5
Potatoes	652	0.0	-4.2	-4.2
Others	423	0.0	6.3	6.3
Total	5 013	0.0	0.0	0.0

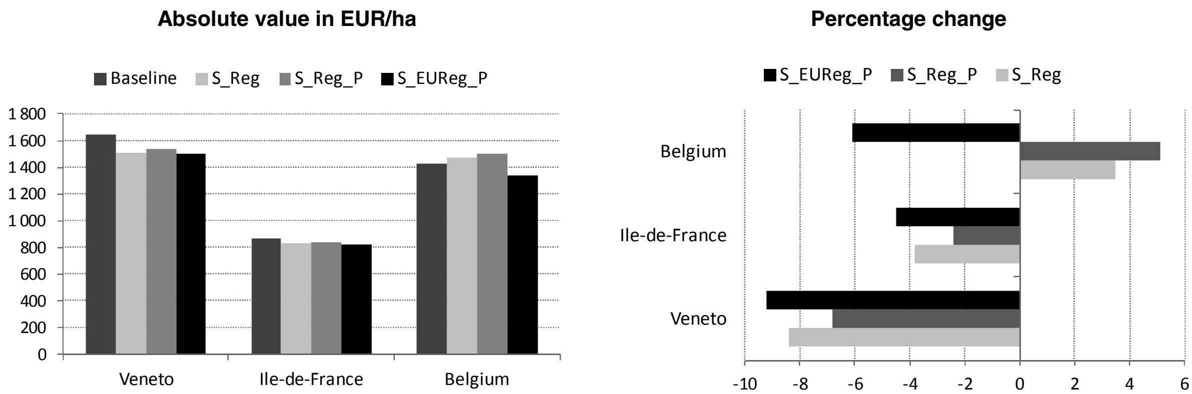
Table.4.4. Economic impact

	Baseline (2009)	S_Reg	S_Reg_P	S_EUReg_P
	EUR/ha		% change with regard to baseline	
Veneto region				
Gross saleable production	1 973	-0.1	3.8	3.8
Net aids	426	-32.9	-32.9	-42.1
Modulation	25	-12.8	-12.8	-28.9
Total variable costs	750	-0.3	6.2	6.2
Gross margin	1 650	-8.4	-6.8	-9.2
Ile-de-France region				
Gross saleable production	1 045	0.0	0.8	0.8
Net aids	292	-11.1	-11.1	-17.3
Modulation	19	28.9	28.9	18.6
Total variable costs	473	0.0	-0.6	-0.6
Gross margin	864	-3.8	-2.4	-4.5
Belgium				
Gross saleable production	2 045	0.0	0.4	0.4
Net aids	356	14.0	14.0	-30.8
Modulation	20	73.4	73.4	-14.0
Total variable costs	978	0.0	-1.5	-1.5
Gross margin	1 424	3.5	5.1	-6.1

With the introduction of a scenario that combines policy intervention and price variation (scenarios S_Reg_P and EUReg_P), it is clear how only price variation induces farmers to modify their production plans and shows that farmers are sensitive to market signals. It is also interesting to note how the same crops have different evolutions in the three regions. Maize would increase in Veneto and in Ile-de-France, but decrease in Belgium; while soft wheat would increase in Veneto and Belgium but reduce in Ile-de-France.

As regards the economic impacts of the introduction of regionalization on a single-region basis (scenario S_Reg), the reduction of gross margin compared to the baseline scenario is significant in Veneto (-8.4%), and moderate in Ile-de-France (-3.8%), while in Belgium (which is one region) gross margin increases (+3.5%) (Table 4.4 and Figure 4.2). Market intervention with regionalization (scenario S_Reg_P) pushes farmers into modifying their specialization in cereals with a different emphasis in the three regions according to their specialization. In Veneto, corn (maize) and wheat increase, in Ile-de-France corn and barley increase, while in Belgium only wheat increases. At the same time, economic performance (measured as Total Gross Margin) improves in all the farms, but still decreases with respect to the baseline for Veneto (-6.8%) and Ile-de-France (-2.4%), while in Belgium it grows by 5.4%. With the regionalization scenario considering the EU15 as a single homogeneous region, the economic performances are considerably modified in all the farms for all the three regions. The reduction of the SPS values reduces the gross margin by 9.2% in Veneto, by 4.5% in Ile-de-France and by 6.1% in Belgium, compared with the baseline scenario.

Figure 4.2. Gross Margin comparison between regions



Impact on farm strategies

Farm strategies are here evaluated by considering the dynamics of the observed farms considered as single entities. In this case, using cluster analysis, it is possible to observe the behaviour of groups of homogeneous farms under the policy scenario that introduces regionalization by considering the European Union as a single region and price variation according to the FAPRI projections. The variables considered in the clustering process are the gross saleable production per hectare, the total variable costs per hectare, the subsidy level per hectare, the incidence of cereal production of the total UAA and, finally, the UAA class of each farm.

In each region, six groups (clusters) of farms are identified according to their structural characteristics and their specialization level in average with respect to each group of farms (Appendix 2):

- *Veneto*: Cluster 1 – Small and low-intensity farms; Cluster 2 – Small and cereal specialised farms; Cluster 3 – Small and low-efficiency farms, Cluster 4 – Large, intensive tobacco farms; Cluster 5 – Large and extensive farms, Cluster 6 – Small very low intensity farms.
- *Ile-de-France*: Cluster 1 – Large cereal-oriented farms; Cluster 2 – very large, highly intensive farms; Cluster 3 – Small, low-intensity farms; Cluster 4 – Small, cereal-oriented farms ; Cluster 5 – Average cereal farms; Cluster 6 – Very large cereal farms;
- *Belgium*: Cluster 1 – Extensive cereal-oriented farms; Cluster 2 – Low-intensity non-cereal farms ; Cluster 3 – Large intensive non-cereal farms; Cluster 4 – Intensive cereal farms; Cluster 5 – Very large intensive farms; Cluster 6 – Small, cereal-oriented farms.

The introduction of the scenario of European regionalization (EUReg_P) highlights a common pattern for the farms in the three regions: a reduction in the degree of disparity between the groups of farms. The six groups of farms identified for each region are characterized by a dynamic of concentration in some specific clusters. More specifically, Veneto region shows a migration towards cluster 1 (62 farms), cluster 2 (50 farms) and cluster 3 (37 farms), while farms belonging to cluster 4 and cluster 5 do not change due to the presence of tobacco and the extensive methods adopted in their management (Appendix 2). In Ile-de-France, a substantial group of farms changes the initial cluster by

moving to the fifth group (average cereal farms) which becomes the most representative (from 17 to 48 farms) cluster. Only two farms belonging to cluster 2 (very large, highly intensive farms) do not change their global strategies. In Belgium, there is also a polarization, from intensive farms towards more extensive farms specializing in cereals (cluster 1 and cluster 6), while the very large intensive farms are quite stable (Table 4.5).

Table 4.5. Distribution of farms among clusters

Veneto

Clusters		S_EUReg_P						Total
		1	2	3	4	5	6	
Baseline	1	6	3	13				22
	2	47	45					92
	3	4	2	14				20
	4				4			4
	5					58		58
	6	5		10				15
Total		62	50	37	4	58		211

Ile-de-France

Clusters		S_EUReg_P						Total
		1	2	3	4	5	6	
Baseline	1	19				10	3	32
	2		2					2
	3			19		20		39
	4	4		2	14			20
	5	3		6	1	6	1	17
	6					12	19	31
Total		26	2	27	15	48	23	141

Belgium

Clusters		S_EUReg_P						Total
		1	2	3	4	5	6	
Baseline	1	14			2		7	23
	2	11	3		1			15
	3		4	6	1	2		13
	4	6	2		8		2	18
	5	2	2			15		19
	6	1					4	5
Total		34	11	6	12	17	13	93

Conclusions

The methodological approach developed in this study allows us to fully use the FADN information in order to develop useful appraisals of the farm dynamics induced by market evolution and agricultural policy mechanisms. The results show different capabilities to react to policy measures and to market conditions by farms belonging to the same farm type in three different European regions where efficiency is related to the capacity to adapt to new market scenarios. In addition, it is clear how regionalization may contribute to reducing the differences among farms by introducing a more equitable CAP instrument than was planned by the Health Check. However, the redistribution effects among regions may lead some farms finding it more difficult to manage the challenges provided by the market and to a drastic reduction in the meaning of the "safety net" for many farms.

Notes

1. Department of Economics, University of Parma. Financial support received from the European Commission (Research project FACEPA — Farm Accountancy Cost Estimation and Policy Analysis of European Agriculture, FP7/2007-2013 contract No. 212292) and from the Italian Ministry of Education, University and Research (Scientific Research Program of National Relevance 2007 on "European Union policies, economic and trade integration processes and WTO negotiations") is gratefully acknowledged.
2. The regions considered represent the sample used in the context of the EU-FACEPA research project, of which this paper is an output.

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Annex 4.A.1

Table 4.A1.1. Estimated Q matrices

Veneto

	Durum wheat	Soft wheat	Maize	Barley	Rice	Soybean	Sugar beet	Tobacco	Alfalfa
Durum wheat	**0.07715**	0.02290	0.01451	0.01181	0.01149	-0.01553	0.00216	-0.03009	0.00540
Soft wheat		**0.03611**	-0.01200	0.00305	0.01331	-0.01066	0.00064	-0.09271	0.01680
Maize			**0.02521**	0.01994	0.01810	0.01830	0.00079	0.06566	-0.00446
Barley				**0.07953**	0.03432	0.02461	0.00054	0.03126	0.00693
Rice					**0.05703**	0.04033	0.00195	0.01189	0.00017
Soybean						**0.04393**	0.00107	0.06121	-0.01068
Sugarbeet							**0.00114**	0.00179	0.00089
Tobacco								**0.30201**	-0.04036
Alfalfa									**0.01953**

Ile-de-France

	Soft wheat	Durum wheat	Barley	Maize	Dry pulses	Sugar beet	Rapeseed	Sun flower	Other industrial
Soft wheat	**0.01200**	0.04650	0.02304	0.02625	0.03063	0.00543	0.02086	0.01769	0.04205
Durum wheat		**0.18011**	0.08927	0.10170	0.11864	0.02101	0.08087	0.06855	0.16286
Barley			**0.11317**	0.09380	0.06914	0.00378	0.21084	0.13541	0.01838
Maize				**0.13314**	0.09978	0.01065	0.16138	-0.04753	0.12848
Dry pulses					**0.14119**	-0.00031	0.02559	-0.02849	0.20911
Sugar beet						**0.00840**	0.01384	-0.00705	0.01160
Rapeseed							**0.54237**	0.27381	-0.13686
Sunflower								**0.64857**	-0.26356
Industrial									**0.**45949

Belgium

	Soft wheat	Barley	Maize	Dry pulses	Potatoes	Sugar beet	Other industrial	Vegetables	Rapeseed
Soft wheat	**0.02923**	0.06010	-0.00393	-0.00272	0.01606	0.00833	0.02561	0.03687	0.00938
Barley		**0.16198**	-0.00803	-0.00494	0.02815	0.01556	0.05831	0.06923	0.01063
Maize			**0.00461**	0.00851	0.00751	-0.00006	0.00033	0.01075	0.01003
Dry pulses				**0.01650**	0.01773	0.00133	0.00524	0.02783	0.02153
Potatoes					**0.03240**	0.00731	0.02230	0.05840	0.03306
Sugar beet						**0.00272**	0.00806	0.01490	0.00599
Other industrial							**0.02676**	0.04588	0.01739
Vegetables								**0.10826**	0.05689
Rapeseed									**0.03628**

Table 4.A1.2. Characteristics of farm type by regions in the baseline scenario

Veneto

Clusters	Gross saleable production	Variable costs	Net aids	Class of UAA	Cereal incidence
	EUR/ha				% of UAA
1	1 901	523	408	2	62.4
2	2 049	745	425	1	99.3
3	1 570	759	434	2	51.2
4	5 680	3 592	2 713	4	14.3
5	1 866	625	379	5	62.2
6	1 695	492	426	1	14.6

Ile-de-France

Clusters	Gross saleable production	Variable costs	Net aids	Class of UAA	Cereal incidence
	EUR/ha				% of UAA
1	970	374	290	4	85.3
2	4 098	2 176	224	5	57.9
3	910	391	283	2	73.2
4	894	414	304	2	92.3
5	942	461	352	3	74.3
6	1 040	487	283	5	72.6

Belgium

Clusters	Gross saleable production	Variable costs	Net aids	Class of UAA	Cereal incidence
	EUR/ha				% of UAA
1	1 259	491	350	3	78.2
2	1 778	537	295	3	53.7
3	3 937	2 344	255	4	42.4
4	1 642	1 021	467	3	64.0
5	2 027	921	344	5	64.3
6	1 360	720	739	2	91.4

UAA: Utilised Agricultural Area.

Part III

The Impact of Dairy Reform

Chapter 5

European Union dairy policy reform: impact and challenges

Roel Jongeneel[1]

Recent Common Agricultural Policy (CAP) reforms have affected dairy policy, including the milk quota system, and increased the market orientation of the sector. A modelling exercise, using the European Dairy Industry Model (EDIM), simulates an initial sharp decline in the EU milk price in response to the decrease in the intervention prices of butter and SMP after 2003, followed by a period of stability and an increase from 2007/08 as the demand for dairy protein products increases over time and EU milk supply is still restricted by quotas. The phasing out of the milk quota following the implementation of the 2009 Health Check is estimated to lead to an increase in milk production and a decrease in the milk price both within and without the European Union. The gap between EU domestic and border prices is expected to continue to narrow. Looking at developments in dairy markets between 2000 and 2007, the study finds that milk prices did not decrease as much as expected because the intervention prices were no longer binding, in particular for skimmed milk powder. The income of dairy farms increased as decline in milk prices was more than compensated by the introduction of dairy premium and higher farm productivity due to the increase in farm size. However, since 2007, incomes of dairy farmers have strongly fluctuated as both milk and feed prices have been highly variable in opposite directions.

The dairy sector makes a substantial contribution to the European Union's agricultural turnover in many member states, as well as in the European Union as a whole. More than one million dairy producers supply close to 150 million tonnes of milk annually. At the same time, within the EU27, the size and agricultural importance of the dairy sector varies considerably between member states and across regions due to agronomic, economic, historic and other factors. The milk processing industry is estimated to employ about 400 000 people. As regards public expenditure, the total budget expenditure for the milk sector (including an estimate for the amount of direct aid) rose from about EUR 2 750 million in 2005 to about EUR 4 500 million in 2007 (ECA, 2009).

The EU dairy market is regulated by the Common Market Organisation (CMO) for milk and milk products, consisting of the classical combination of policy instruments (import duties, export refunds, and intervention purchases for butter and skimmed milk powder) aimed at supporting the raw milk price, and thus the incomes of dairy farmers. Alongside public intervention, there are other arrangements aimed at supporting the private sector's stockholding role, such as mandatory and optional aid for private storage for butter, skimmed milk powder (SMP) and cheese. Moreover, measures exist which encourage domestic consumption, such as aids in the milk and the milk products sector, and which reduce the supply of specific products, such as the butter, concentrated butter and cream withdrawal scheme.

One of the most noticeable elements of the European Union's dairy CMO is the milk quota system, which effectively limits the milk farmers can supply. Milk production in excess of the available quota rights is subject to a (prohibitive) levy (the super levy). Milk quotas were introduced in order to preserve the sustainability of the classical dairy CMO, which came under pressure from the increasing surplus of dairy products and the associated boost in expenditure on export refunds in the early 1980s. By controlling milk production, exports and export refund outlays were effectively curbed. As such, milk quotas indirectly contributed to stabilizing the raw milk price at a relatively high level, and thereby to supporting the agricultural income of milk producers. Since the milk quota regime was introduced, milk quota has become a scarce production factor which is reflected in significant quota rents, where these rents vary depending on member state, region and the possibilities of exchanging quota between farmers. In addition to the already mentioned border tariff protection, trade in dairy products is further influenced by an (import) licence system and tariff rate quotas, with the within-quota tariff being lower than the general applied (and bound) tariff.

In the course of time, European Union dairy policy has been further adjusted and directed to a stronger market orientation. Policy developments, including reductions of intervention prices and specific quota increases of various amounts to member states, together with most recent market developments, have recently caused quota to no longer be binding in most member states and regions of the European Union. With the Luxembourg Agreement following the Mid-Term Review (MTR) on 26 June 2003 (2003 CAP reform), the spotlight shifted again to the EU's milk quota regime, because the Agreement stipulated that the milk quota system should come to an end in 2015. Within the 2009 Health Check reform of the Common Agricultural Policy (CAP), the Council of Ministers endorsed the proposal of milk quota abolition, and suggested an increase of quota by 1% annually from 2009 to 2013 to allow a "soft landing" for the milk sector towards quota abolition. In this context, it is especially important to clarify what economic effects can be expected from abolishing the milk quota regime.

This paper aims at evaluating the main impacts of the European Union's recent dairy policy reforms, i.e. the effects of the 2003 CAP reform of the dairy sector (see Council Regulations Nos. 1255/1999 and 1788/2003, later integrated into the Single CMO) and the 2009 Health Check reform. In addition, some future challenges will be discussed. This is done taking into account as much as possible the policy objectives of the CAP. Since these objectives concern issues at market level as well as at farm level, effects at both levels are examined.

Analytical framework of analysis

Policy objectives

Evaluation of the European Union's recent dairy policy reforms and deliberation about future challenges firstly require a clear view of the policy objectives of the European Union's dairy policy. Key objectives mentioned in the Council regulation (EC) No. 1255/1999 of May 1999 on the common organization of the market in milk and milk products are: stabilising markets, reducing imbalances between demand and supply, stimulating the consumption of milk, ensuring a fair standard of living for the agricultural community, enhancing competitiveness, supporting prices, etc. (see also ECA, 2009). Note that certain objectives (e.g. stimulating the consumption of milk by young people) may at the same time be an objective in themselves as well as a link in the causal chain between an instrument and another objective (e.g. contributing to price support, fair living standards for farmers). Note further, that not only should objectives be clear, but also information on the target value of the objectives is necessary if one wants to quantify numerically to what extent the objectives are achieved (e.g. in order to evaluate how many dairy farmers receive a "fair" income requires a precise specification of "fairness" in terms of net income per litre, family household income, or some other clearly specified definition of income). This aspect of evaluation requires further development within the project.

The European Union's dairy policy contains a number of policy instruments which affect the milk product markets. Figure 5.1 presents a brief graphical overview of this. The market framework presented in Figure 5.1 could have been drawn for various dairy products, but for the moment this is left unspecified[2]. It should be noted that not all elements of the EU's dairy policy are visible or explicit in this graph (e.g. intervention purchases for butter and SMP, or programmes influencing demand). Key elements in the market for milk products are the policy instruments such as the milk quota, import levies and export refunds, tariff rate quotas (quota volume as well as within-quota tariff), and intervention. Because the milk quota imposes a restriction on the production of raw milk by the primary sector, the quota restriction is not directly visible in Figure 5.1, which focuses on milk products. However, in an indirect way, the milk quota affects the supply of raw milk to the dairies, as their main input for producing the derived milk products.

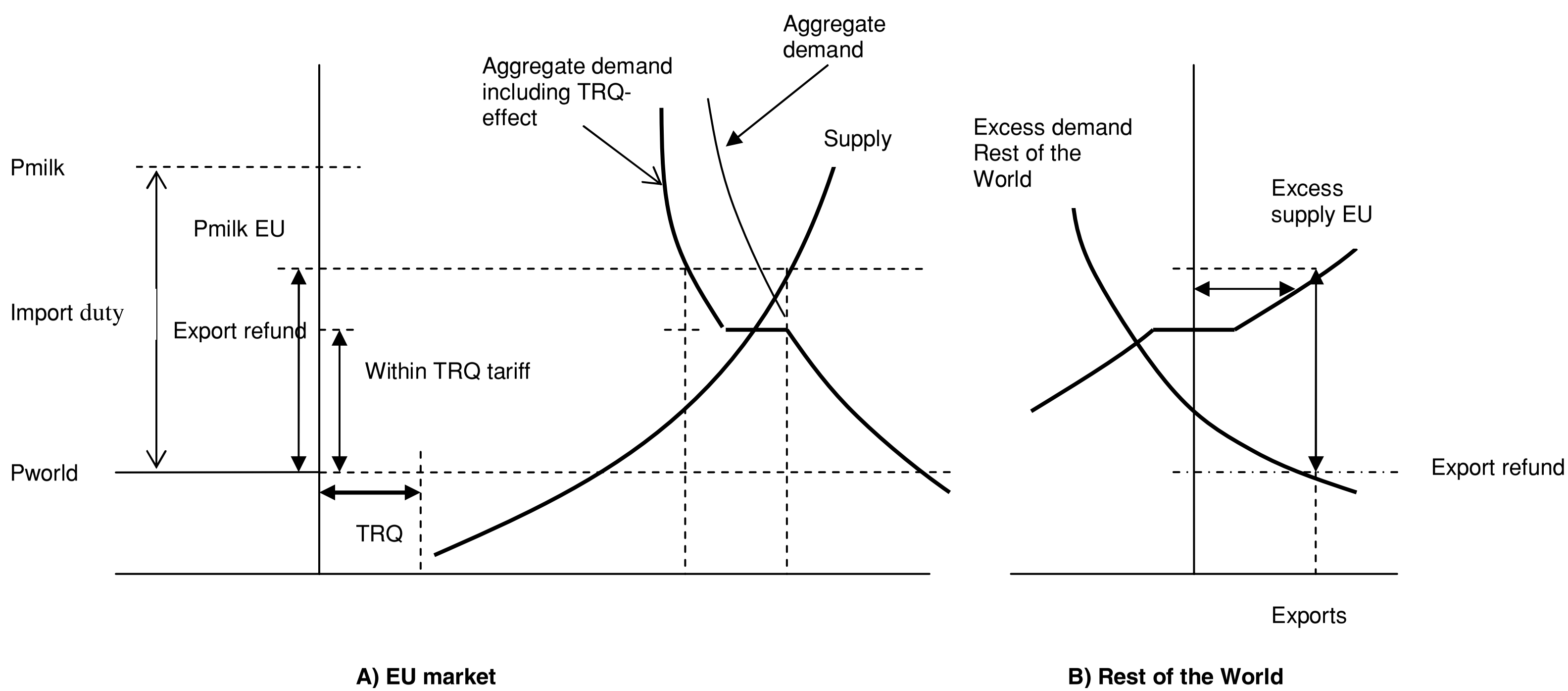
The (total) supply of dairy products in the European Union comes from processed products derived from raw milk of EU origin, as well as from imports of milk products. Products entering the EU market face an import duty, which contributes to supporting EU prices at a higher level than the world market price. The net demand for milk products produced from raw milk of EU origin is a function of the aggregate demand within the European Union (including the net impact of demand manipulating measures such as marketing aids to milk products and withdrawal schemes for butter and cream), less imports. Imports of milk products face an import duty, which effectively helps to

establish a maximum price for this product in the European Union. If the milk product price tends to increase beyond the EU entry price, a flow of imports is induced, creating additional supply and thus generating a downward pressure in the milk product price whenever it tends to surpass the EU entry price level. Note that the import duty potentially contributes to stabilization of prices as well as to balancing demand and supply. As illustrated in the graph, the import duty may be but not necessarily has to be prohibitive. If it is prohibitive, while the European Union is still more than self-sufficient in the milk product (surplus production), it is not the import duty but the export refund or buying-in price of the intervention scheme (which operates only for butter and SMP), which determines the milk product price.

Some imports may enter the European Union as part of the tariff rate quotas (TRQs) which were agreed as part of the WTO Uruguay Round Agreement on Agriculture (URAA) in order to ensure sufficient market access. These imports are subject to quantity limits and monitored (by an import licence system). Note that as long as there is a positive difference between the EU's internal market price and the world market price plus the within-TRQ tariff rate, then under normal conditions the TRQ quotas are expected to be filled, since the EU market provides an attractive opportunity for third-party exports. In the graph below, this implies that, above this threshold value, the (net) aggregate demand for dairy products in the European Union will be partly met by foreign supplies and thus can be interpreted as being reduced by the TRQ volume. Note that the TRQs affect market balance. As was already observed, export refunds and the intervention buying-in price, when effective, are determining the price level in the European Union. Since export refunds and the intervention price are determined in such a way that they contribute to supporting a certain price level in the European Union, the intervention prices are relatively independent of the world market price level, whereas in contrast the export refunds are not. This intervention price *cum* export refunds system not only contributes to the milk price level, but also to dairy product price stabilization. Moreover, both measures contribute to balancing demand and supply within the European Union. There is also an inter-temporal aspect which has to be considered (not represented in Figure 5.1). When due to intervention purchases stocks of milk products are built up at some point in time, these will have to be released at a later time. Participants in the market may anticipate this, which might then influence price formation and/or potentially destabilize the market at another moment (in particular, when stocks-to-use ratios have become large).

Although export refunds are available, the total amount of export refunds is limited by commitments made by the European Union in the URAA. This is monitored by export licences. The limitation on export subsidies may imply that, after a certain amount (the restricted volume or value), the export refunds are no longer effectively impacting on the market. The floor to the domestic price will then be determined by the intervention price. Whereas intervention purchases take products out of the market (thereby "artificially" increasing the demand for the milk product), other measures such as aids to consumption (school milk) and withdrawal schemes rely on the same mechanism of demand management. To a certain extent, they can be seen as the mirror side of supply management (quotas) in the raw milk market. Note that these schemes also have a market-balancing impact.

Figure 5.1. A stylized and preliminary presentation of an EU milk product market



The issue of competitiveness is related to the milk product price differential between the EU price level and the world market price level. If this differential is positive, EU milk products will in principle not be competitive, i.e. the European Union not being able to export profitably without export refunds bridging the price gap. If intervention prices and export refunds are reduced (over time), competitiveness can be argued to improve because less export refunds are needed to bridge the price gap between European Union and world markets.[3] However, when viewed from a free market perspective, as long as the price gap is positive, the EU milk product will not be competitive unless and to the extent that export refunds are available. The reality is however more complicated. At different moments in time, the intervention prices for selected milk products have been lower than the world market prices (see also Figure 5.3 below), allowing exports without any export refunds (e.g. SMP). Moreover, in reality, and in particular for the non-bulk products (e.g. special cheeses), it holds that these refunds can be and are differentiated with respect to quality, so that certain product types can be exported without export refunds, even if for the standardized types of these products export refunds are still a prerequisite for export.

Moreover, also with respect to the intervention scheme, there can be a limitation in the maximum amounts of intervention. If these become binding, the intervention price no longer acts as a price floor, and the domestic price will undershoot this institutional minimum price level. As such, the sector can be 'enforced' to be competitive, with its degree of competitiveness being co-determined by the prevailing policy framework. Crucial elements in the assessment of competiveness are impacts of the intervention price declines decided on and implemented with the 2003 CAP reform, and how these relate to world market (or border) prices, as well as how the share of unsubsidized exports evolves and the extent to which limitations to the expenditure of export refunds or intervention purchases play a role.

Impact assessment of the 2003 reform and 2009 Health Check on the milk market

Several studies have analysed the impacts of the recent dairy policy reforms, among which Réquillart *et al.*, 2007; Bouamra-Mechemache *et al.*, 2008 (both relying on the EDIM model); Chantreuil *et al.*, 2008 (using the AGMEMOD model); Witzke and Tonini, 2008 (using the CAPSIM model); Jongeneel and Tonini, 2009; and Jongeneel *et al.*, 2010). In the following discussion, we rely mainly on results obtained in the EDIM analysis (see in particular Bouamra-Mechemache *et al.*, 2009). This study played a key role, which is reflected for example in quota rent estimates they made, and which were often used as a starting point for the other studies. Moreover, the EDIM model, which is a spatial partial equilibrium model, has a high level of detail with respect to modelling the different policy instruments, while it also considers a large number (14) of dairy products and preserves balance constraints between dairy products.

2003 CAP reform

The 2003 CAP reform included for the dairy sector 1) a 25% decrease in the intervention price for butter over four years from 2004/05 to 2007/08; 2) a 15% decrease in the intervention price for SMP over three years from 2004/05 to 2006/07; 3) gradual increases in milk quota implemented during the period 2006/07 to 2008/09 in EU15; overall, the EU27 milk quota to increase by 1.1% to reach 140 million tonnes in 2008/09, and 4) the introduction of direct payments in 2004/05. These payments are considered as fully decoupled and as such do not affect the level of production which only depends on market prices.

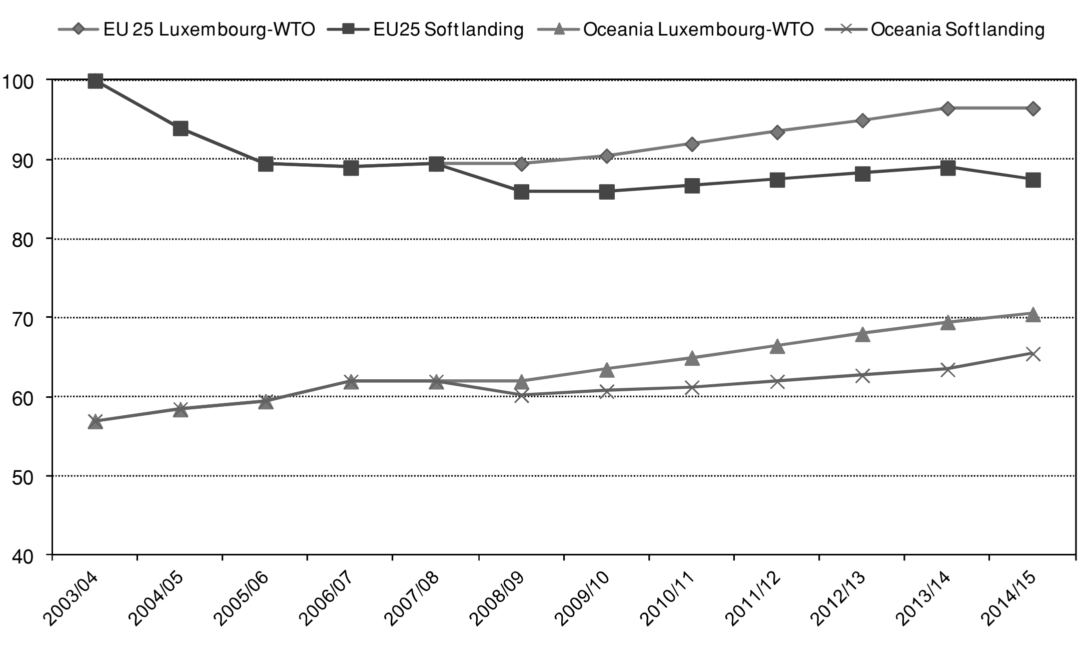
Figure 5.2 shows the calculated impact of the 2003 CAP reform on the evolution of raw milk prices, both within the EU25 and for its key competitor Oceania assuming "normal" conditions on world markets. It includes the impact of empirically estimated autonomous changes in the demand for dairy products both in the EU domestic market and in the rest of the world. Similarly it includes changes in the production costs (technical progress). Three phases can be distinguished:

- The EU milk price first sharply declines until 2005/06 in response to the decrease in the intervention prices of butter and SMP.
- Then it remains roughly stable until 2008/09. A smaller decrease in the intervention price and a slight increase in production quotas are compensated by the increase in domestic demand. Moreover, as long as subsidies are needed to support domestic dairy product prices, subsidies are adjusted so that the raw milk price remains stable.
- The EU raw milk price regularly increases afterwards. EU supply is still restricted by milk quotas, which are still binding for a majority of member states. At the same time, the demand for dairy products increases over time. More precisely, whereas the demand for protein in the EU increases over time, the demand for fat remains roughly stable. This induces an increase in the SMP price while the butter price remains constant and very close to the intervention price. The evolution in SMP and butter prices in turn explains the increase in farm milk price.

The presented impacts presume that a new WTO agreement has been implemented, following the Falconer proposal of autumn 2007 (including removal of EU export subsidies, tariff reductions for butter, powder and cheese of 23%, 63% and 21% respectively, and doubled TRQ import quotas for butter and cheese).

Figure 5.2. Impact of recent dairy policy reforms on the price of raw milk in EU25

Index 100 = EU25 price in 2003/04



Source: Bouamra-Mechemache *et al.* (2009).

2009 Health Check reform

The European Commission's Health Check proposal involves a 2% quota increase in 2008 followed by further increases of 1% per annum from 2009 to 2013. By gradually increasing the quota, the Commission, anticipating quota abolition in 2015, aims to smoothly phase out the quota system and create a so-called 'soft landing' scenario (the calculations assume that a WTO agreement has been implemented similar to the 2003 CAP reform scenario).

Relaxing the milk quota constraint will lead to an increase in the EU's milk production. The supply increase induces a milk price decline both within and outside the European Union (Figure 5.2). Relative to the Luxembourg scenario, the EU's milk price will decline by a further 9% in 2014/15. The decline in milk prices will erode the quota rents, with the average quota rents in the EU25 being close to zero (less than EUR 0.02 per kg) in 2014/15. But if the milk quota rent comes close to zero, this implies that the quotas are on the edge of being binding. For this reason, the situation projected for 2014/15 becomes very close to a no-quota situation. As a consequence, removing the quotas in 2015/16 is estimated to lead to only a limited further increase in production under this scenario.

As regards dairy product markets, it turns out that EU25 production is 3.6% higher than in the Luxembourg scenario (while the potential increase is 7%). In most countries the quota is no longer binding (except in Austria, Belgium, Ireland, Italy, Netherlands and Spain). Following the increase in milk production, both the production and exports of dairy commodities increase while their prices decrease. An exception is butter for which the WTO agreement has a positive impact on its world market price. In the European Union the price of butter drops more than the price of SMP, because the European Union is not competitive on the world market for butter (recall that the new WTO agreement implied the removal of all export subsidies). As a consequence, the additional butter production needs to be consumed in the European Union. This can only be achieved by a significant drop in the butter price. On the other hand, the increase in SMP production is absorbed by higher EU consumption as well as through an increase in EU exports. Because EU exports increase, the world market price for dairy products will go down by 3 to 6% depending on the type of product. This explains the negative impact on dairy product prices and on the farm milk price in Oceania, which drops by about 3%. Although there still remains a price gap between the European Union and Oceania, it nevertheless substantially narrows over time.

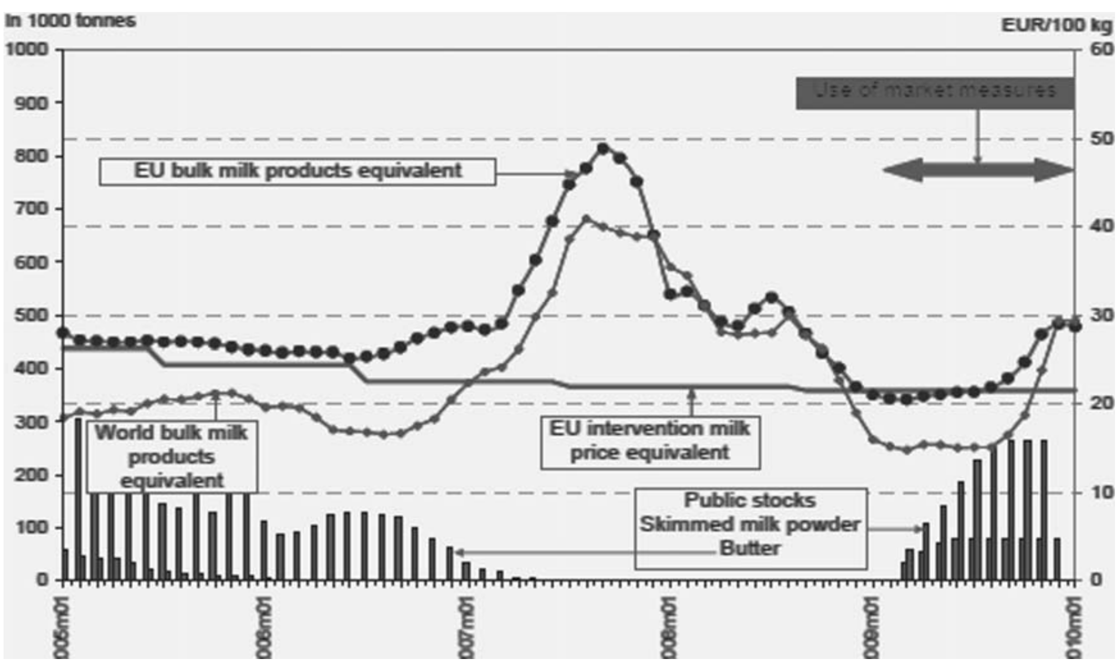
Recent market developments

The modelling analysis of the reforms provided above primarily focused on assessing the impacts of structural and long-term patterns, and as such did not include a detailed analysis of incidental shocks. In general, the low price elasticities of supply and demand, as assumed in the models, confirm that relatively small shocks in demand or supply can cause large changes in price. As is shown in Figure 5.3, from April 2007 the average milk price started to increase, peaking in November of the same year. Then, with some ups and downs, the milk price declined throughout 2008, achieving its lowest level in April 2009, after which a gradual increase took place. Several factors contributed to this price volatility. In 2006/07 there was an unexpected high demand for dairy products in Asia, stimulated by high economic growth, so that prices of substitutes (vegetable oils) also increased. On the supply side, droughts in New Zealand and other places, and the high feed prices (induced by three droughts in a six-year period in Australia and by the

increased demand for ethanol in the United States) had a negative impact on milk supply. In 2008/09, a worldwide recession hit the global economy (the credit crisis) and there was a melamine scandal in China, all having negative impacts on the demand for dairy products. Moreover, on the supply side, an increase in milk supply was observed for Brazil and New Zealand.

As Figure 5.3 shows, these incidental factors had a significant impact on EU milk prices, with the 2009 milk price in the European Union hitting the intervention price floor. As Figure 5.3 also shows, after the European Union started to intervene by buying butter and SMP, it turned the tide, and the raw milk price gradually started to increase. From late 2009 onwards, the milk price seems to have returned to its longer-term growth path and at a level beyond the intervention price level, as was already predicted by the modelling analysis presented above. Note that Figure 5.3 also shows that the EU milk price and the world market price of milk have recently become close (with the market intervention period in 2009 as an exception).

Figure 5.3. Evolution of European Union and world raw milk prices, 2006-10



Source: EU Commission (2010).

Selected impacts at dairy farm level

Over recent decades, the European dairy farm sector has gone through a tremendous structural change. Under the quota system this has not come to a standstill (see, for example, Huettel and Jongeneel, 2008). This is illustrated here for the EU9 countries because only for these countries are data available for the period from the start of the dairy quota system in 1984 (Table 5.1). These nine EU member states together produced in 2009 some 85% of milk in the EU27. Since 1983, the number of dairy farms in the EU9 has shown a strong decline, strongest in Italy (-81%) and Denmark (-85%). As Table 5.1 further shows, at the same time the average size of a dairy farm increased

substantially in all countries. Dairy farms in the United Kingdom and the Netherlands were the biggest in the EU9 in 1983, and still belong to the category having the highest amount of dairy cows per farm in 2007.

For the period 1989-2006, farm-gate prices for milk in the selected EU member states were relatively stable, varying between roughly 30 and 35 cents/kg of milk (Italy being an exception, with significantly higher milk prices). During the years 2001-06, milk prices gradually declined in almost all member states. The calculated average milk price paid was around EUR 32/100 kg in 2001 and declined in the five following years to around EUR 28-29/100 kg in 2006 (-11%). In fact, until 2007 milk prices did not go down as much as might have been expected on the basis of the Luxembourg Agreements (-20%). A main reason for this was that the intervention price level (e.g. for SMP) was no longer binding. In this period, the European Union introduced milk premiums (EUR 3.55/100 kg milk) as a compensation for the intervention price declines implied in the 2003 CAP reform. Together with the national envelope, the compensation (milk premiums now integrated into the single payments per farm) in those years was sufficient to offset the decrease of milk prices.

Table 5.1. Number of farms with dairy cows and cows per average dairy farm in 1983 and 2007, for selected member states

	1983		2007		Index 2007 (1983=100)		
	Farms	Cows/farm	Farms	Cows/farm	Farms	Cows	Cows/farm
Belgium	48 740	20	13 320	39	27	54	197
Denmark	35 480	28	5 380	101	15	55	362
Germany	396 920	14	101 070	40	25	73	288
France	420 430	17	93 120	41	22	53	241
Ireland	91 440	18	21 320	50	23	64	276
Italy	331 530	8	62 790	30	19	71	376
Luxembourg	2 510	27	1 090	37	43	59	136
Netherlands	63 540	40	24 510	60	39	58	150
United Kingdom	57 600	58	28 140	69	49	58	120

Source: Jongeneel *et al.* (2010, 11). Based on Eurostat. (Data for Germany in 1983 exclude the former DDR).

As far as FADN data are available (till 2007), the results indicate on average an improvement in the incomes of dairy farms in EU9 (Table 5.2). The decline in milk price was more than compensated by the milk premium as well as by the increase in farm scale (labour productivity). More recently (2007-09) however, with the fluctuation of milk prices, incomes of dairy farmers have also fluctuated very strongly (partly because feed and milk prices have shown contrasting evolution patterns).

Table 5.2. Family farm income per family working unit (dairy farms)

Thousand EUR

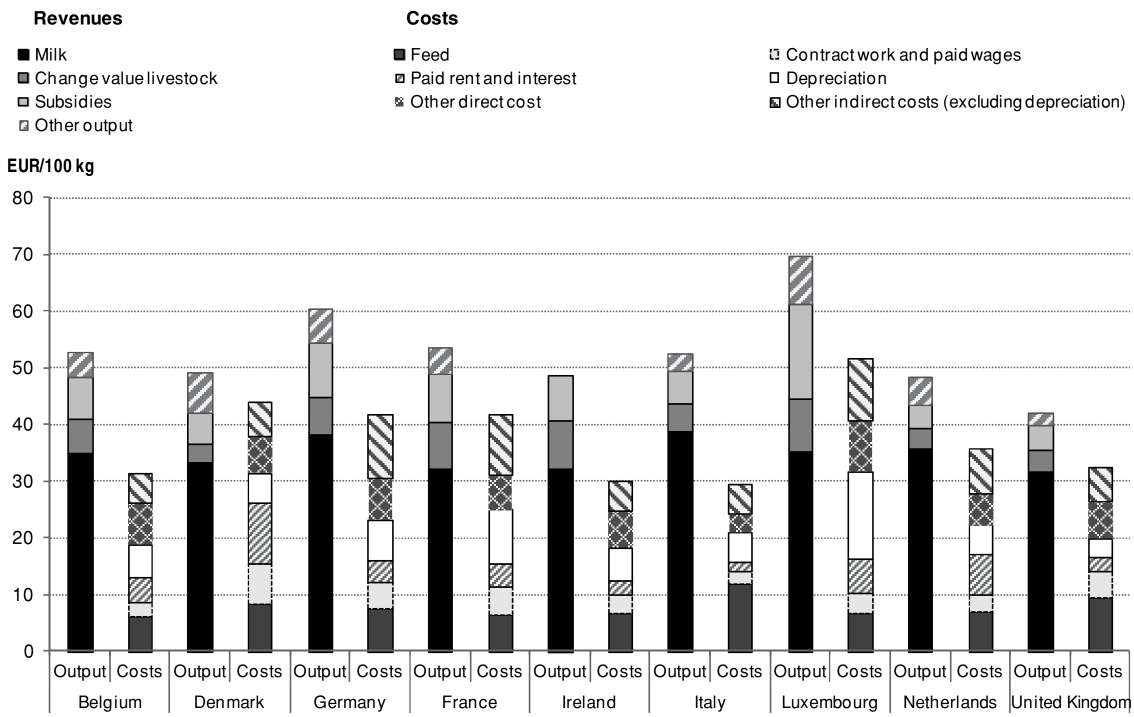
	2000-03	2004-07	Index 2000-03=100
Belgium	25.8	34.3	133
Denmark	14.3	28.6	200
Germany	17.4	27.1	156
France	16.8	18.5	110
Ireland	24.1	30.6	127
Italy	26.3	38.6	147
Luxembourg	26.5	32.4	122
Netherlands	27.6	35.8	130
United Kingdom	27.0	37.0	137
EU9[1]	22.9	31.4	140

1. Unweighted average.

Source: Jongeneel *et al.* (2010, 15). Calculations based on FADN data.

As Figure 5.4 illustrates, dairy farms in the European Union show differences with respect to the level as well as the composition of revenues and costs. Compared to Germany, France and Ireland, the share of the returns of milk in total returns is high (more than 70%) for countries like Denmark, the Netherlands and the United Kingdom. Danish, Dutch and British dairy farms are on average more specialised than dairy farms in most other member states. Figure 5.4 also provides information about per-unit costs of production (including depreciation), although imputed costs for land or (family) labour are not taken into account. Note that, as such, this per-unit cost of production measure can be interpreted as a short-run indicator on competitiveness. Dairy farmers in Germany and France have on average relatively high total (paid) production costs, although the costs associated with purchased feed are low. Dairy farmers in Denmark and in the Netherlands have relatively high costs of interest and rent payments, while these (fixed) costs are lower in Ireland and the United Kingdom. The relatively high costs of interest and rent payments in the Netherlands may partly reflect the European Union's supply management policy, since Dutch farmers have, over a period of many years, invested in dairy quota at a high price level. Despite a decrease in the value of the milk quota in recent years, about 25% of total assets of dairy farms are still associated with milk quota. With abolishment of the quota system in 2015, their associated balance sheet value will vanish (negative wealth effect). As Figure 5.4 indicates, revenues generally exceed paid costs, but this may no longer be the case when full imputed costs for family labour, capital and land are accounted for.

Figure 5.4. Revenues and paid costs per 10^2&0 kg milk (including depreciation)

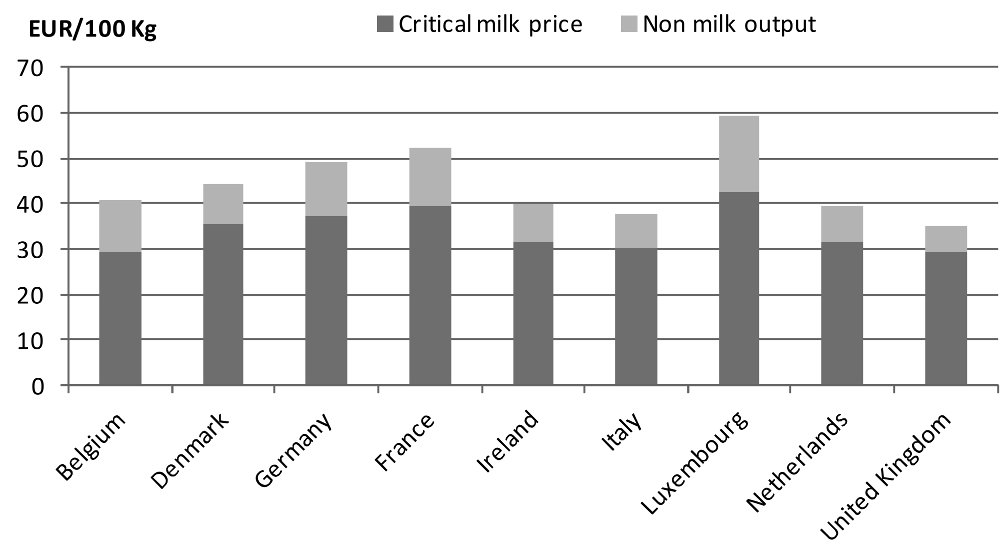


Source: Jongeneel *et al.* (2010), calculation based on FADN data 2007.

An alternative indicator, which avoids the estimation of imputed remunerations for quasi-fixed production factors and comes closer to actual behaviour, is the so-called critical milk price (Figure 5.5). The critical milk price is equal to the milk price a farmer needs to cover his costs (including depreciation) and ensure continuity of farming. The measure is corrected for the revenues obtained from other outputs (e.g. beef, payments, et cetera). The lower the critical milk price, the more competitive are dairy farms. The (unweighted) average value of non-milk outputs for the selected member states was EUR 10.06/100 kg and varies significantly between them. The standard of living is approximated by the amount of money farmers actually extract from their farm operation for consumption purposes. The observed amount which farmers extracted for consumption purposes varied from EUR 3.05/100 kg (Denmark) to EUR 10.74/100 kg (France), with the (unweighted) average being EUR 7.87/100 kg. For the observed period 2006/07, the average critical milk price was EUR 34.08/100 kg of milk. The United Kingdom has the lowest critical milk price (EUR 29.14/100 kg), with Luxembourg, France and Germany having relatively high critical milk prices. The Netherlands belongs to the group of member states having low critical milk prices (see United Kingdom, Italy, Belgium, Ireland).

Figure 5.5. Total costs milk and critical milk price per 100 kg of milk

Average 2006 and 2007



Source: Jongeneel *et al.* (2010, 17); calculations based FADN.

It should be noted that the averages at member state level presented in Figure 5.5 hide a lot of variation within member states. As an example, Jongeneel *et al.* (2010) show that some 10% of Dutch dairy farmers have a critical price lower than 25 cents per kg, while about 15% of the dairy farmers have a critical milk price higher than 40 cents per kg. Scale economies are important: larger farms (herd size larger than 75 cows) have on average a 10-20% lower critical milk price than smaller farms (herd size smaller than 50 cows). Not only do large farms have a relatively low level of per unit production costs (in particular labour costs), but they also need less money per kg of milk produced to cover their accepted consumption level.

Evaluation

In order to evaluate the two dairy policy reforms considered here, there needs to be clarity about what it is they are intended to achieve. This implies assessing the performance of the European Union's dairy policy in meeting its original objectives and delivering benefits to the "targeted recipients." Alongside the policy objectives referred to before (market stabilization, fair standard of living, enhancing competitiveness and supporting prices), the efficiency issue is also relevant from an economic point of view.

Without striving for completeness, it can be argued that until recently the EU dairy policy has succeeded in stabilizing the market (milk price). While the intervention prices for SMP and butter have been substantially reduced (the European Union's present equivalent intervention price for raw milk is EUR 0.21/kg), this initially led only to a limited actual price decline, due to favourable market circumstances. However, when market circumstances worsened (2008-09), the milk price significantly declined to the low intervention price level. Since the EU's milk production did not actually increase, no direct relationship is observed between the increases in the milk quota during the period 2006-09 and the decline in the milk price. It was the intervention buying that in 2009 provided the necessary buffer to mitigate the downward path of prices.

As regards the selected indicators on the situation at farm level, these support the argument that the EU dairy policy has contributed to the farmers' standard of living. Although the price of raw milk has declined in real terms, this decline has been gradual, and less strong than the increase in farm scale and the rate of farms exiting the industry. It has also become clear that the actual price decline has been in general less than the decline in the intervention prices, implying that the institutional price floor is not binding. However, since the compensatory direct payments have been based on the latter, even though no full compensation of the institutional price declined was granted, in reality the compensation has been more than sufficient. As a consequence of these developments, family farm income per family working unit has increased over the reform period considered. However, this does not exclude that a lot of dairy farms are not competitive (e.g. results from farm level costs and revenues as well as from the critical milk price analysis) and that further structural adjustment in the sector seems both unavoidable as well as being required to improve the viability of (the remaining) dairy farms.

As was shown in the market analysis, the gap between the EU price and the world market price of milk has been narrowed, indicating an increasing orientation of the European Union's dairy sector to the world market. At the same time, since this difference is projected to be still positive for the coming years, the European Union is, at least for specific products (e.g. butter), not yet competitive enough to export without export subsidies.

As regards the support of prices, it has already been noted that the intervention price for butter and SMP have been substantially lowered (equivalent to a raw milk price support of EUR 21/100 kg). In 2009, farmers for the first time experienced the significance of the reduced intervention prices. As became clear from the farm-level analysis, a large number of dairy farms experience losses at such a low price level (see the critical milk price analysis).

Evaluating the efficiency of the reforms is a complex issue. From a general point of view, reducing distortionary policy interventions will lead to an improvement of efficiency. As signalled in Bouamra *et al.* (2008), the net welfare gains of the reforms are, however, rather limited. The main impact of both reforms is a transfer of surplus from producers to consumers (income redistribution). The taxpayer is hardly affected, as most instruments have disappeared (export subsidies, production subsidies), and direct payments are identical in all scenarios by assumption; thus, the only differences relate to import taxes. Two reasons for the very small net gains in this static framework are: first the generally inelastic domestic demand for dairy products, which implies that deadweight losses are generally small; and second the leakage effect (part of the gains being received by foreign consumers), because the increase in production is mainly exported to world markets and leads to a relative decrease in the world market price.

Note that such recent developments underscore that the dairy sector is increasingly integrated with the rest of the global economy, in particular with energy markets and currency markets (exchange rate impacts). Disturbances in these related markets will create spill-over effects on to the dairy sector and may add to market instability and price volatility.

Outlook and challenges

As follows from the modelling analysis, one would expect that, based on the evolution of structural factors, the milk price will show a gradual increase both in the EU and on the world market. According to the OECD-FAO (2010) outlook, world milk production is expected to grow at about 2% per annum over the period 2005-19, while the increase of milk output in the European Union will be limited to only 0.1% per annum. According to the FAPRI projection, the growth of EU milk production may be 0.4% per annum, which is substantially higher than the OECD-FAO projection, but still among the lowest growth rates observed in the world. World trade in dairy products is projected to increase at about 1% per annum, which is less than the average increase in production. This reflects that dairy production in exporting countries is projected to grow less fast than production in importing countries. However, New Zealand is projected to increase its market share, which is already high, even further in the future. As such, the impact of weather on New Zealand's milk production, which was already a factor contributing to the recent price volatility, may become even more critical in the future. The OECD-FAO projections show a gradual increase in world market prices for butter, cheese and SMP. Since this price increase exceeds expected inflation, the period of declining real dairy prices has come to an end, according to these recent projections. The OECD-FAO projected milk price for the EU in 2019 is EUR 28/100 kg (FAPRI projects a price of about EUR 29.5/100 kg), which although higher than the intervention price, still implies a real price decline of about 3%. As such, the development of the milk price in the European Union is less favourable than the one projected for the world market.

Neither the model simulations nor the outlook projections account for price volatility caused by 'non-normal' factors and shocks. However, as argued by Keane and Connor (2009), price variability for dairy products (butter, SMP) on the world market is larger than has been the case on the EU market. Since 2000, they observe increasing price volatility in the EU dairy market. With the European Union being more oriented to the world market, and the increasing integration of dairy with other markets (energy) in the (global) economy, the price volatility faced by EU farmers in the future is expected to increase and become one of the characteristics of the new environment. In order to cope with this challenge, new forms of risk management and the availability of up-to-date and independent surveillance information on developments on EU and world dairy markets will become important.

Other challenges relate to sustainability, biodiversity, regional and climate issues. Abandoning the milk quota may lead to a significant reallocation of regional milk production in the European Union, with inefficient regions (e.g. mountainous areas) losing production. Although this may be considered a gain from an efficiency perspective, to the extent that dairy farming in such regions contributes to sustainable land management, the preservation of biodiversity and/or rural viability, from a broader policy perspective alternative targeted policies (such as tailored agri-environmental schemes) may be needed to avoid politically unacceptable losses in this regard.

Conclusions

The European common market regime for dairy products has entered an important stage. Having been in operation since 1984, milk quota will be abolished in 2015. The 2003 CAP reform implied a substantial lowering of institutional prices (SMP -15%;

butter -25%) and announced the final abandonment of the quota system in 2015. As part of the 2009 Health Check, the EU Ministers of Agriculture decided to gradually phase out milk quotas by a per annum quota increase of 1%, apportioned over member states up to 2015. Despite quota enlargement, total milk product in the European Union has hardly changed in the period 2006-09, implying that most member states then underutilised their quotas.

Relating the observed outcomes at market and farm level to the policy objectives leads to the conclusion that the European Union’s dairy policy until recently has been rather successful in achieving its goals. As became clear from the recent dairy market disruptions, however, the European Union’s current dairy policy mechanism fails to contribute to price stabilisation. Rather, the lowered intervention prices now provide a safety net, protecting farmers from extreme downside price risks. Alongside the current intervention mechanism providing a “last resort” safety net provision, the single farm payment also contributes to stabilising farm incomes.

According to our best estimate, the long-run EU milk price (in 2019) will be about EUR 0.29/kg without a new WTO agreement, or EUR 0.27/kg with a new WTO agreement. Both estimates are significantly lower than the average critical milk price level observed for the nine European Union member states considered in this analysis (but substantially higher than the European Union's equivalent intervention price for raw milk). However, if structural adjustment (increasing farm scale) can do its work, a significant proportion of dairy farms will be able to supply their milk at this price (for example, already about one third of Dutch dairy farms currently have a critical milk price less than or equal to EUR 0.30/kg). As such, using policies that facilitate rather than hinder structural adjustment is important.

The dairy policy reforms imply an increasing withdrawal of the public sector and thus will involve a rebalancing of roles and responsibilities between the private and the public sectors (for example, development of private-public risk management schemes, ensuring independent high-quality and timely market information) as well as between private stakeholders (for example, contracting, bargaining procedures).

Notes

1. Head of Agricultural Policy Unit, Agricultural Economics Institute (LEI), Wageningen University and Research Centre, Netherlands. This chapter presents a synthesis of several dairy research projects in which the author has been involved, often in collaboration with others (see acknowledgement in the references). He is solely responsible for any errors in this analysis.
2. Although not explicitly dealt with here, it is recognized that various milk products are related to each other due to the specific characteristics of dairy manufacturing. Most of the manufacturing processes of milk products are multi-output production operations and are technically interdependent. For example, in cheese making, by-products such as whey are inevitable, and producers cannot cut production of whey even if it may have little value. As another example, in order to produce more butter, one has to produce more skimmed milk powder, casein and/or other low-fat or non-fat products.
3. This may imply that (marginal) dairy farms which currently can just survive are forced after the price decline either to leave the sector or to improve their competitive performance

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Chapter 6

The impact of decoupling and price variation on dairy farmers' strategy: overview of theoretical and real effects

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The reform of the Common Agricultural Policy (CAP) in 2003 has resulted in substantial changes to the way in which dairy farmers are subsidized. Moreover, dairy farmers are also facing an unprecedented situation with major price fluctuations of agricultural raw materials. In this chapter, we discuss the cross effects on the productive strategy of French dairy farms due to the 2003 reform and to price variation. A model based on mathematical programming has been developed to determine how dairy farmers might re-evaluate their systems to identify an optimal production plan. While respecting the principle of agent rationality (maximization of profit), the model incorporates the economic risk related to the volatility of input and output prices. Thus, the model maximizes the expected utility of income while taking into account a set of constraints: regulatory, structural, zoo-technical, agronomic and environmental. This model allows a large choice in term of intensification level (input use) and productive combination. The model is applied to four types of dairy farms to show their different reactions to the reform. The simulations show how the implementation of the single payment scheme encourages farmers to increase the share of grassland. However, the increase in cereal prices is a strong incentive for farmers to intensify forage production in order to free up land for crop production. The decoupling of premiums for male bovines led farmers to reduce, all things being equal, this activity in order to increase cereal production.

Dairy farmers, in 2007, were facing an unprecedented situation on the markets with the soaring prices of agricultural raw materials. They then had to deal with the significant falls in those prices in the years 2008 and 2009. These fluctuations may lead them to change their system in order to adapt their production to this unstable economic situation. For French farmers, these changes occurred simultaneously with the implementation of the reform of the Common Agricultural Policy (CAP), decided in 2003. A key driver of this reform was the World Trade Organisation (WTO) Doha Round negotiations. Three innovations were introduced: 1) the decoupling of direct support based, in France, on the amount of direct subsidies received in 2000-02 (historical approach); 2) the modification of the dairy Common Market Organisation: the intervention prices of industrial dairy products (butter and powder) were reduced, and subsidies were granted to farmers according to their dairy quota; 3) deduction of part of the direct subsidies from Pillar 1 of the CAP to fund Pillar 2 (modulation).

In this context, the aim of this chapter is to study the behaviour of dairy farmers relating to the CAP reform with different hypothetical prices. A Mathematical Programming model is used and applied to different French dairy farms to represent the diversity of technical systems. In addition to their dairy enterprise, dairy farms often have cereal or beef production enterprises. In order to represent the diversity of technical systems, we consider four different types of farming according to the intensification of forage area and the level of specialization (grazing, semi-intensive, milk + cereals, milk + young bull). In this way, we can identify if farms have a different response to the reform according to their technical practices. This model pays particular attention to the interactions between the feeding system and the management of land, and also to the farmer's sensitivity to price changes. Thanks to these specifications, the model offer a large choice of production combinations (specialisation or diversification) and technical practices (level of intensification).

This chapter is divided into two parts. In the first part, a description of the mathematical model is presented; in the second part, some simulations are made to analyse the impact of the CAP reform on dairy farms. They try to give arguments around these following questions: 1) how do CAP reform and agricultural price variations influence dairy producers' incomes? and 2) how does decoupling change the balance of different kinds of production on a dairy farm?

Materials and method

In order to study the adaptation of farmers' practices in response to the implementation of the 2003 CAP reform, a mathematical programming model was built. This method allows us to identify the effects of the decoupling on the production system (i.e. the allocation of land areas to different crops, the level of intensification, environmental impact, etc.). An econometric model would not meet this objective because in that type of model there is no change of farmer's practice; the structure is constant. With the mathematical programming method, the model can stop certain activities or increase others.

Bio-economic model: a farm-level approach

We built a bio-economic model which takes into account the farmer's response to price variation and several technical and biological elements in order to represent as accurately as possible the functioning of a dairy farm. Mathematical Programming is a

technique which enables us to represent the farm functioning in reaction to a set of constraints. It is an appropriate technique because its assumptions correspond to those of classic microeconomics: rationality and the optimising nature of the agent (Hazell and Norton, 1986). This method allows us to study threshold effects and to calculate dual values of inputs (marginal yields). Farm-level modelling enables simultaneous consideration of production, price and policy information.

Any model derived from mathematical optimisation has three basic elements (Matthews *et al.*, 2006): 1) an objective function, which minimises or maximises a function of the set of activity levels; 2) a description of the activities within the system, with coefficients representing their productive responses; and 3) a set of constraints that define the operational conditions and the limits of the model and its activities. Given the objective function, the solution procedure determines the optimal solution considering all activities and restrictions simultaneously.

The model optimises the farm plan, which represents the quantities of different outputs produced and inputs used. The economic results follow from those quantities and their prices. The model is used to estimate the effects of institutional, technical and price changes on the farm plan, economic results and intensification indicators.

Many studies have demonstrated that farmers typically behave in a risk-averse way (Hardaker *et al.*, 2004). As such, farmers often prefer farm plans that provide a satisfactory level of security even if this means sacrificing some income. For the farmer, the main issue raised by variability of price and production is how to respond tactically and dynamically to opportunities or threats in order to generate additional income or to avoid losses. Moreover, during the years 2007, 2008 and 2009, prices of agricultural commodities were subject to strong variations so that we had to take the farmer's sensitivity to price volatility. For example, the price of milk paid to the producers nearly doubled through 2007, from EUR 240/tonne to EUR 380/tonne before strongly decreasing to EUR 220/tonne in April 2009. Since the beginning of 2010, milk price seems to be on an increasing trend. Prices of cereals such as wheat have followed the same fluctuations. Cereals play a special role in dairy farming because they can be both input and output.

Lambert and McCarl (1985) present a mathematical programming formulation that allows identification of the expected utility function. Their approach, which does not require an assumption of normally distributed income (unlike the E-V, MOTAD and Target MOTAD methods), can accommodate the assumption that the utility function is monotonically increasing and concave (risk-averse). Patten *et al.* (1988) reformulated this approach as Utility Efficient Programming (UEP). Moreover, Zuhair *et al.* (1992) show that the negative exponential utility function (with Constant Absolute Risk Aversion, CARA) can better predict farmers' behaviour than cubic and quadratic functions. The CARA function is a reasonable approximation to the real but unknown utility function: the coefficient of absolute risk variation can be validly applied to consequences in terms of losses and gains for variations in annual income. The UEP method enables the model to take into account asymmetric price distribution: the skewness becomes an element of decision as well as the variation amplitude. Thus, the model maximizes the expected utility of the income as follows:

$$\text{Maximize: } E[U] = p\, U(k, r), \quad r \text{ varying} \qquad [1]$$

with: $U_k = 1 - \exp(-r_a \times Z_k)$

where Z is the net farm income for state k, and r is a non-negative parameter representing the coefficient of absolute risk aversion:

$$r_a = (1 - \lambda)r_{min} + \lambda r_{max}, \text{ for } 0 \leq \lambda \leq 1 \quad [2]$$

where λ is a parameter reflecting variation in risk preference, and r_{max} and r_{min} are upper and lower bounds of the coefficient of absolute risk aversion (r_a).

In a more detailed form, the income Z is defined by:

$$\begin{aligned} Z = &\sum_a (T_a \times mY_a) \times 305 \times mP \\ &+ \sum_a (aS_a \times aW_a \times aP_a) \\ &+ \sum_a (T_a \times (SP_a + SPBM_a)) \\ &- \sum_{a,p} (T_a \times (Qcf_{a,conc,p} \times cfP_{conc} \times 91.25 + I_a)) \\ &+ \sum_c (X_c \times (Y_c \times cP_c - I_c - nQ_c \times nP + pr)) - FC \end{aligned} \quad [3]$$

- The main part of the income Z is given by milk revenues: the milk quantity multiplied with Ta the total number of animal of type a (dairy cows, heifers, calves and young bulls); mYa the milk yield (litre/day) per animal by mP the milk price (EUR/litre).
- There is then the meat revenue with aS_a the number of animals sold, aW_a the animals' average carcass weight (kg) and aP_a the meat price (EUR/kg). At the end of the lactation, cull cows are sold and benefit from the female slaughter premium (SP_a) and young bulls benefit from the special premium for bovine male ($SPBM_a$).
- Then we take out livestock costs as: $cfQ_{conc,p,a}$ the quantity of concentrate feed ingested (kg/day/animal), cfP_{conc} the concentrate feed price (EUR/kg per type of concentrate *conc*); I_a the specific inputs for animals (artificial insemination, medicines, herd book, minerals).
- We add the crop revenue as: X_c the cultivated area (ha) for each type of crop c (wheat, maize (corn), rapeseed, pea, maize silage, pasture, hay and grass silage); Y_c the crop yield (kg/ha); cP_c the crop price (EUR/kg); I_c the specific crop inputs (seed, treatments and harvesting); nQ_c the nitrogen quantity (kg/ha); and nP the nitrogen price (EUR/kg).
- Finally we consider the fixed costs FC (electricity, water, mechanisation, buildings, rent for land, insurance, taxes and other fixed costs). These fixed costs are specific to each type of farming.

The central element in the Linear Programming model is the dairy cow. The model represents the operation of a dairy farm for a one-year period. The classical duration of lactation is 305 days, followed by 60 days of drying off. The year is divided into four seasons of 91.25 days. The fecundity rate is lower for the most productive cows, thus decreasing the number of calves per cow per year. Regarding the progeny, it is assumed that, according to the intensification level of the type of farming, 25% to 35% of the dairy cows are replaced per year by heifers raised on the farm. Concerning female calves which are not assigned to replace cows, the model can choose between: 1) selling the calves at

the age of 8 days; and 2) keeping the calves until two years old and then selling to the slaughterhouse (with the female slaughter premium).

Regarding plant production, the forage crops produced in France are mainly maize silage, grass silage, hay and pasture. All farmers aim for forage self-sufficiency; the purchase and/or sale of forage are not considered because these are activities linked to exceptional events (e.g. drought or exceptional harvest) in these areas. Farmers must comply with the set-aside requirement in order to benefit from the crop premium: we use a binary variable which is 0 if the farmer does not set aside land, and 1 if he does. It is assumed that the cereals are sold at harvest time, *i.e.* no crop storage except for wheat used to feed the cows.

Thornton and Herrero (2001) show a wide variety of separate crop and livestock models, but the nature of crop-livestock interactions, and their importance in farming systems, makes their integration difficult. That is why, in order to precisely describe the operation of a dairy farm, this model considers four important characteristics: 1) the seasonality of labour and grass production, 2) the response of crop yield to nitrogen use, 3) the non-linearity of milk yield per cow, and 4) the interaction between crop and animal production.

Four periods *p* (spring, summer, autumn and winter) are distinguished in the model. It allows for seasonal specification of grass production and grassland use (Berentsen *et al.*, 2000). Seasonal variations enable us to integrate differences in the growth potential of grass during the growing season as well as the evolution of the nutrient content of grass. Moreover, we introduce seasonal labour constraints by allocating labour needs to each activity according to the work peaks (harvesting and calving). It is assumed that the farmer and his family/associates execute all the work, and thus there is no option to hire temporary labour. The model is more able to reflect temporal conditions thanks to the addition of these parameters.

For each period *p*:

$$\sum_a \left(\left(Wt_{a,p} \times T_a \right) + \left(Wt_{c,p} \times X_c \right) \right) + FL \leq AL_p \times AWU \qquad [4]$$

The global working time per period (with $Wt_{a,p}$ the working time per animal; $Wt_{c,p}$ the working time per ha of crop; *FL* is the fixed labour) has to be lower than the labour availability per period (AL_p the available labour for each annual work unit (*AWU*)).

Crop yield depends on the quantities of nitrogen used. Godard *et al.* (2008) formulated an exponential function, which satisfies economic requirements for attaining a mathematical optimum (the yield curve has to be concave and strictly increasing) and is consistent with its expected agronomic shape and with parameters with an agronomic interpretation.

$$Y_c = Ymax_c - (Ymax_c - Ymin_c) \times e^{-\sum t_i N_i} \qquad [5]$$

where Y_c is yield for each crop, and $Ymin_c$ and $Ymax_c$ are respectively the minimal and maximal yield (different according to the type of farming and its level of intensification); t_i represents the rate of increase in the yield response function to a nitrogen source *i* (e.g. manure, slurry, chemical nitrogen) the quantity of which is N_i. This enables us to take the increasing price of nitrogen into account and also the flow of organic nitrogen (such as manure) on the farm (Manos *et al.*, 2007).

In order to give more flexibility to the model, milk production per cow is not fixed. Farmers have the possibility to choose the milk yield per animal in a range of 1 000 litres below the dairy cow's genetic potential. It is also possible for farmers to produce beyond the genetic potential (Brun-Lafleur *et al.*, 2009); in this case, nutritional requirements needed to produce one litre of milk are increased (from 0.44 to 1.2 energy units per litre of milk, and from 48 to 140 units of protein per litre of milk) (Faverdin *et al.*, 2007).

With these three elements, we can very accurately represent the feeding system. The quantity ingested per cow per day is determined by using nutritional requirements in biological unit *b* (energy and protein), and the composition of forages and concentrate feed in equation 6 (INRA, 2007). The concentrate feeds *conc* available in the model are soybean meal, rapeseed meal, wheat, production concentrate and milk powder.

For each nutrient unit *b* and period *p:*

$$\sum_{a}\left(T_a\left(MR_{a,b}\times 365+mY_a\times LR_{a,b}\times 305\right)\right) \leq \sum_{a,c}\left(T_a\times\left(fQ_{c,p,a}\times fnc_{c,p,b}\times 91.25\right)\right) + \sum_{a,conc}\left(T_a\times\left(CfQ_{conc,p,a}\times Cfnc_{conc,p,b}\times 91.25\right)\right) \qquad [6]$$

with: $MR_{a,b}$ the maintenance requirement (in energy and protein)

MYa the milk yield (in litre per animal per day)

$LR_{a,b}$ the lactation requirement (in energy and protein for one litre of milk)

$fnc_{c,p,b}$ the forage nutrient content (in energy and protein per kg of forage)

$fQ_{c,p,a}$ the forage consumption (kg) for each crop *c*, each period *p* and each type of animal *a*

$Cfnc_{conc,p,b}$ the concentrate feed nutrient content (in energy and protein per kg of concentrate)

$CfQcon_{c,p,a}$ the concentrate feed consumption (in kg per day per concentrate per period per animal)

The global nutritional needs for the herd must not exceed the availability in forage and concentrate feed.. Moreover, the forage consumption (for each type of forage *c*) has to be lower than the forage production:

subject to:

$$\sum_{a,p}\left(T_a\times\left(fQ_{c,p,a}\times 91.25\right)\right)\leq X_c\times Y_c \text{ for each type of crop } c. \qquad [7]$$

Consequently, in order to maximise the farm's income, the model determines the optimum for the following endogenous variables: number of each type of animal (T_a and aS_a for sale); milk yield per cow (mY_a in kg per cow per day); concentrate feed and forage consumption for each type of animal and per period ($CfQ_{conc,p,a}$ and, $fQ_{c,p,a}$ in kg per animal per day per season); the crop rotation (X_c in ha); the level of nitrogen fertilisation (nQ_c for chemical nitrogen and manure, in kg); and crop yield (Y_c in kg per ha).

The model tries to offer the largest choice of technical practice for crop and animal production. That is why we choose to incorporate each "quantity variable" (as ha and kg)

as endogenous variables in the model. Thus, the model has access to all possible situations, e.g. the model can choose a full grass diet for a cow which produces 7 000 litres of milk or a full maize diet for the same cow. The model will therefore calculate the optimal quantity of input and output.

The constraints

Regarding the farm structure, the model incorporates the agricultural area, the milk quota and the available labour resources. As regards building constraints, we assume that the number of cows can increase by 10% in comparison to the base year: the implementation of the programme to control pollution of agricultural origin has motivated many dairy farmers to construct new buildings with more places than required. Regarding crops, the model meets the requirements for rotation frequency and cropping pattern (Mosnier *et al.*, 2009).

We also include three environmental measures as constraints in the model: 1) the Nitrate Directive No. 91/676/EEC requires that farmers cannot exceed organic nitrogen application rates of 170 kg per hectare (slurry and manure); 2) farmers have to keep grasslands aged over five years; 3) in addition to the CAP premiums, a premium for the maintenance of extensive livestock systems or "premium for grassland" is attributed (EUR75/ha), if there is at least 75% of grass in the total farm area and if the stocking rate is below 1.4 "livestock units" per hectare of grass.

Calibration: one model for four types of farming

In France, there is a high diversity of dairy farms in terms of location (mountains/plains), intensification (intensive/extensive), feeding system (pasture, maize silage) and specialisation of production (specialised/diversified). In this context, our choice focused on the four main types in the plains of France: these regions are not located in the less favoured areas and do not benefit from these specific supports, and we exclude the mountain areas that have a different milk production system. The data come from the annual survey of the *Institut de l'Elevage* (2008) with more than 600 dairy producers in the plains regions. Each type of farming is the result of the aggregation of several farms (from 20 to 45) representing similar structures and production methods (Table 6.1).

- The "Grass-based farm" is a 78 ha family farm with 285 000 litres of milk quota. It produces milk with a large area of grass, which provides high fed autonomy. The milk yield per cow is low (6 000 litres per year) but the prices of milk and meat are higher thanks to a better milk composition and heavier carcasses (Normand or Montbeliarde cow). The age of first calving is 30 months and the calving period is in the spring. Cows are housed for four months while they consume maize. It represents 8% of the dairy farms in this area.

- The "Semi-intensive farm" is a 50 ha family farm with 290 000 litres of milk quota (18% of the farms in the plain region). The calving period is in the autumn, which is why the use of maize is higher. The cows are more productive: Prim' Holstein with a milk yield of 8 500 litres per year.

- The "Milk + cereals farm" is a highly intensive system with 137 ha and 460 000 litres of milk quota. Each cow can produce 8 500 litres per year, and consequently the use

of maize in the ration is not limited. Dairy production is the main activity on the farm, but cereal cropping is developed in parallel (wheat, rape seed, maize and pea). It represents 22% of the farms in the plains regions.

- The "Milk + young bulls farm" has 100 ha and 400 000 litres of milk quota. It is the most representative system of the area: 30% of dairy farms. It has the same characteristics as the previous type, but young bull fattening activity replaces the cereal activity. The model can choose to fatten (or not) the males and buy (or not) other male calves to reach 80 young bulls. These animals are slaughtered when they are 20 months old. The young bulls benefit from the male slaughter premium (EUR 80/animal) and the special premium for male bovines (EUR 110/animal).

Table 6.1. Farm data for 2005

	Grass-based farm	Semi-intensive farm	Milk+cereals farm	Milk+young bulls farm
Share of the system in France (%)	8%	22%	30%	18%
Total area (ha)	78	50	137	100
Milk quota (litres)	285 000	290 000	460 000	400 000
Annual Work Units (no.)	1.7	1.5	2.0	2.7
Building capacity (no.)	62	37	59	122
Restocking rate (%)	0.25	0.35	0.37	0.4
Dairy genetic potential (l/year)	6 000	8 500	8 500	9 000
Max crop yield (kg/ha/year)				
Wheat	6 100	8 100	8 100	8 100
Maize	n.a.	n.a.	10 000	n.a.
Rapeseed	n.a.	n.a.	3 800	n.a.
Pea	n.a.	n.a.	5 000	n.a.
Maize silage	10 200	12 200	15 200	14 200
Grass silage	8 500	8 500	8 500	8 500
Grass	8 500	7 000	6 000	6 000
Hay	8 500	7 500	7 500	7 500
Milk price (EUR/litre)	330	310	310	310
Meat price (EUR/kg)	3.0	2.6	2.6	2.6
Dairy cow carcass weight (kg)	375	325	325	325

n.a.: not available.

The farms of this study are located in plains areas and do not benefit from a protected designation of origin. Therefore, the milk processors, who collect the milk, produce cheese, yogurt, ice cream, and liquid milk, but also butter and milk powder which can be sold on the global market. In producing this milk, there are no specific price-premium requirements (e.g. a special feed regime).

A calibration step is necessary; the model's results and the empirical observations have to be close. We choose the year 2005 as baseline (i.e. before the implementation of the 2003 CAP reform).

Table 6.2 gives the price level and price variation for the main inputs and outputs. With these values, we build, for each product, a random distribution of price (for

1 000 states of nature *k*) within the range of variation and compute the model to calculate the expected utility. The use of the UEP method allows us to calculate the risk premium for each type of farming because we know the utility level.

$$E[U] = p\ U(k, r) \qquad [8]$$

with: $U_k = 1 - \exp(-r_a \times (RP - Z_k))$

where: U is the level of utility, r_a the coefficient of absolute risk aversion, Z the income, and RP the risk premium.

We choose an appropriate value of the coefficient of absolute risk aversion in order to calibrate the model. Bontems and Thomas (2000) show that the ratio risk premium / income should be around 5%. Thus, the value of the coefficient of risk aversion is about 0.5 for the four types of farming. The results of the model are close to reality for the four main key criteria: income, milk yield per cow, share of cereal in total area, and share of maize silage in forage area.

Table.6.2. Price level and price variation for inputs and outputs

	2005 price level	Price variation
	EUR/kg	%
Milk (EUR/litre)	0.31	10
Meat (culled cow)	2.60	20
Meat (young bull)	2.90	20
Cereal crops		
Wheat	0.120	30
Maize	0.110	30
Rapeseed	0.240	30
Pea	0.130	30
Concentrate feed		
Cereal	0.140	30
Soybean meal	0.220	30
Rapeseed meal	0.180	30
Chemical nitrogen	0.150	30

Results

Theoretically, the decoupling of aid has no effect on income because it does not affect the amount of payment; only the method of payments different. However, decoupling can change production activities by making some products less attractive than before. The effect of direct payments on agricultural markets is one of the controversial issues in the WTO Doha Round agenda, and is generating considerable discussion both in these negotiations and in the economics literature. Dewbre *et al.* (2001) show that market price support is a relatively inefficient means of transferring income to farmers, and, furthermore, that it does so at the expense of relatively large distortions in world markets. They show that, on the contrary, land-based payments are highly effective at transferring income to farmers, while reducing world market price impacts. However, according to Chau and De Gorter (2005) direct land-based payments may induce an inefficient farmer, who is not able to cover his fixed costs and who, without the payment, would exit the market in the long run, to keep on producing. Moreover, Guyomard *et al.* (2004) show

that land-based payments also influence farmers' productive behaviour: farmers choose to produce the most profitable activities and the land-based and headage-based payments increase the profitability of such activities. Therefore, coupled payments also have distortionary effects on price, and encourage inefficient farmers to keep on producing.

The European Union decided to implement a new income support program by fully decoupling the previous input-based payments. Cahill (1997) defines a policy as fully decoupled if it does not influence the production decisions of farmers receiving payments, and if it permits free market determination of prices. It is a concept centred on the adjustment process and not only on equilibrium values. He also defines effective full decoupling as that which results in a level of production and trade equal to what would have occurred if the policy were not in place. This concept is centred on the equilibrium quantities. OECD (2001) shows that decoupled policy always have effects on production, and describe several effects leading to this result: i) risk-related effects referring to policy measures that, usually, increase the wealth of the farmers and thus the incentive to produce for risk-averse farmers; ii) dynamic effects which relate to the policy measures that change current and future incomes and may affect current decisions. In a long-term perspective, farmers make intertemporal choices involving current and future income. Dynamic effects commonly affect investment decisions.

The model gives the opportunity to study the impact of this CAP reform on the economic performance of farmers and their productive choices: allocation between animal and vegetable production, intensification or extensification strategy. We compare the baseline situation (year 2005 with fully coupled premium) to two different scenarios (Table 6.3):

- S1 is the implementation of the 2003 CAP reform (decoupling, modulation, and the obligation to maintain the surfaces in permanent pasture) all other things being equal (except for milk price for which the intervention prices were reduced and offset by direct aid). The amount of the direct payment is based on the historical reference of the baseline (number of ha and head which benefited from premium);

- S2 proposes, in addition, to take a look at the impact of rising price as the agricultural sector. From the year 2007 to 2009, prices of agricultural commodities were subject to significant variations. For example, the price of industrial dairy products such as skim milk powder (0% fat) nearly doubled through 2007, from EUR 2 400/tonne in January to EUR 4 000/tonne in August before strongly decreasing to EUR 1 400/tonne in January 2009. Therefore, the price of milk paid to the producer also increased in 2007 and more in 2008 (by +30%) before dropping in April 2009 (EUR 220/tonne). Prices of cereals such as wheat and maize followed the same evolution: they doubled in 2007, from EUR 140/tonne in June to EUR 280/tonne in December. The price then decreased to reach EUR 110/tonne in February 2010.

In these simulations, the farm structure (land, workforce, milk quota) is constant, and the model does not make investments to change this structure. This analysis is thus focused on the short-term impacts of the implementation of decoupling: changes in production, and income evolution.

Table 6.3. Degree of decoupling and price variation according to the scenarios

		Baseline (fully coupled)	**S1** Partial decoupling	**S2** Partial decoupling and price variation
Premium		Value	Degree of decoupling	
Crop premium	EUR/ha	380	75%	75%
Set-aside premium	EUR/ha	380	100%	100%
Slaughter premium	EUR/head	80	60%	60%
Special premium for bovine male	EUR/head	210	100%	100%
Direct milk aid	EUR/litre	35.5	100%	100%
Price				
Milk	EUR/litre	0.31	0.275	0.29
Cereal (wheat)	EUR/kg	0.12	0.12	0.18
Meat (culled cow)	EUR/kg	2.6	2.6	2.9
Concentrate feed (soybean meal)	EUR/kg	0.22	0.22	0.32
Fertilizer (nitrogen)	EUR/kg	0.15	0.15	0.25

The CAP reform: a stable income

The first item discussed concerns the impact of the CAP reform on the economic performance of the farms studied. In France, the single payment is granted on the basis of the amount of direct aid allocated, during the 2000-02 period, according to the production factors: land, animals and quota (the historical model). It remains closely correlated to the farm's size. Moreover, France also chooses to not fully decouple some subsidies (the decoupling is partial): the crop premium is partially decoupled (75%) as well as the slaughter premium (60%) and other animal premiums (suckler cow, ewe); but direct subsidies based on the milk quota, special premiums for bovine male (SPBM) and set-aside premiums are fully decoupled (Table 6.3).

In the S1 scenario, the implementation of the CAP reform has little influence on economic performance (Table 6.4). The income is stable for two reasons. The 5% modulation (budgetary transfer of support from Pillar 1 to Pillar 2 for rural development) of direct payments decreases the total output. This is partly offset by a decrease of variable costs (grass-based production is cheaper than silage-based production). Even if income is stable, the weight of the payment in income rises strongly with the allocation of the direct milk aid as compensation for the decrease of institutional prices. The CAP reform increases the dependence of farmers on direct public support as showed by Chatellier (2006). There is also a great disparity between intensive and extensive systems: farms with cereal or fattening activities receive the largest amount of subsidies.

Table 6.4. Implementation of the CAP reform taking into account price increases

Average per farm		Grass-based Farm			Semi-intensive Farm			Milk +cereals Farm			Milk +Young bull Farm		
		Baseline	S1	S2	Baseline	S1	S2	Baseline	S1	S2	Baseline	S1	S2
Income	EUR	54 100	53 600	61 600	55 700	55 100	62 600	120 600	116 700	150 500	120 400	119 300	133 200
Crop area													
Grain prices	EUR/t	120	120	180	120	120	180	120	120	180	120	120	180
Cereals	ha	10.7	6.3	13.0	16.4	12.9	16.2	91.0	90.7	85.9	18.0	60.0	59.1
Maize silage	ha	5.3	3.2	6.5	14.7	10.0	14.4	20.0	19.3	24.4	45.4	22.4	21.3
Grassland	ha	62.0	68.5	58.5	15.5	23.6	16.0	13.7	14.7	14.4	29.6	10.0	10.6
Set-aside	ha	0.0	0.0	0.0	3.4	3.4	3.4	12.3	12.3	12.3	7.0	7.6	9.0
Premium for grassland		yes	yes	yes	no	no	no	no	no	No	no	no	no
Animal activity													
Dairy cows	Nber	57	57	56	34	34	34	54	56	54	50	46	45
Young bull	Nber										77	0	0
Milk yield	l/year	5 290	5 250	5 330	8 500	8 500	8 500	8 500	8 500	8 500	8 920	9 000	9 000
Milk yield	l/ha of forage area	4 440	4 270	4 600	9 630	8 650	9 580	13 670	13 580	11 900	5 950	12 670	12 590
Concentrates	Kg/year	290	230	240	1 100	1 080	1 100	2 020	2 020	1 250	1 130	1 330	1 320
Nitrogen application	Kg/ha	132	132	130	112	112	112	64	64	64	147	74	72
Working time	Hr/AWU/year	2 020	2 000	2 010	1 570	1 520	1 570	1 900	1 900	1 910	2 060	1 310	1 280
Economic results													
Total output	EUR	145 200	142 000	158 200	135 500	130 600	147 800	303 100	298 500	340 100	294 200	247 900	285 300
Milk output	EUR	94 000	84 100	88 300	89 900	79 800	84 100	142 600	126 500	133 400	124 000	110 000	116 000
Meat output	EUR	32 500	32 500	34 900	15 700	15 700	17 300	23 200	23 200	25 600	102 300	29 400	21 000
Crop output	EUR	6 800	4 000	13 500	15 300	12 100	22 700	88 200	88 100	120 300	16 800	61 300	92 800
Total subsidies	EUR	11 900	21 300	21 400	14 600	23 100	23 700	49 100	60 800	60 800	51 100	62 200	65 500
Variable costs	EUR	32 000	29 500	36 400	33 700	29 800	38 100	86 500	86 200	91 000	84 200	57 400	63 100
Fixed costs	EUR	59 100	58 900	60 100	46 100	45 700	47 100	96 000	95 700	98 600	89 600	86 300	88 900
Marginal yields													
Additional milk quota	EUR/t	347	299	269	231	183	163	229	185	158	290	208	174
Additional milk yield	EUR/l	n.c.1	n.c.	n.c.	268	267	407	589	635	900	n.c.	242	569
Additional area	EUR/ha	177	159	403	745	459	859	871	604	1040	722	356	864

n.c.: not a constraint.

The decoupling causes a significant decline in the shadow value of an additional litre of milk quota (from -8% to -20% depending on the type of farming) and an additional hectare of land available (from -20% to -50%). Regarding milk marginal yield, the work of Bouamra-Mechemache *et al.* (2008) and Moro *et al.* (2005) within the framework of the European Dairy Industry Model project confirms these results. The marginal costs (per tonne of milk) estimated by their computable general equilibrium model range between EUR 141/tonne to EUR 163/tonne (50% of the price of milk) for the French dairy farm after the CAP reform. Nevertheless, these marginal yields remain positive and, consequently, expanding the farm is economically beneficial. It is reassuring that the results of our farm-level model are close to those of the general equilibrium model; this suggests that the calibration of the model is precise.

In the S2 scenario, we simulate the reform with the rise of prices which occurred in 2007 and 2008 (Table 6.3). This increase in agricultural production prices improves the income for all the types of farming studied, from 7% to 36% (Table 6.4). This situation, very economically beneficial for the farms, helps to reduce the share of direct payments in income.

Decoupling: an incentive to produce with more grassland?

This section pays special attention to the distribution between silage maize and grassland in the forage area (intensification strategy versus extensification strategy) with the partial decoupling of the crop premium in France.

In S1 scenario, the implementation of the reform leads to the extensification of dairy production with a decrease in cereal and silage maize cropping and an increase in grassland (for the grass-based, semi-intensive and milk + cereals farms, see Table 6.4). The decoupling of 75% of crop premium (maize silage included) rebalances the choice between grass and maize but is not enough to encourage farmers to comply with the criteria for the premium for grassland (the grass-based farm is the only one to benefit from this premium). These results confirm those highlighted by Ridier and Jacquet (2002). Regarding environmental criteria (nitrogen application, livestock unit per ha of forage, and milk produced per hectare of forage), the decoupling has a positive impact and encourages farmers to extensify their production. With the increase of grass, the measure of maintaining surfaces in permanent pasture is never a constraint. Moreover, none of the farms studied see its production limited through the application of the Nitrate Directive.

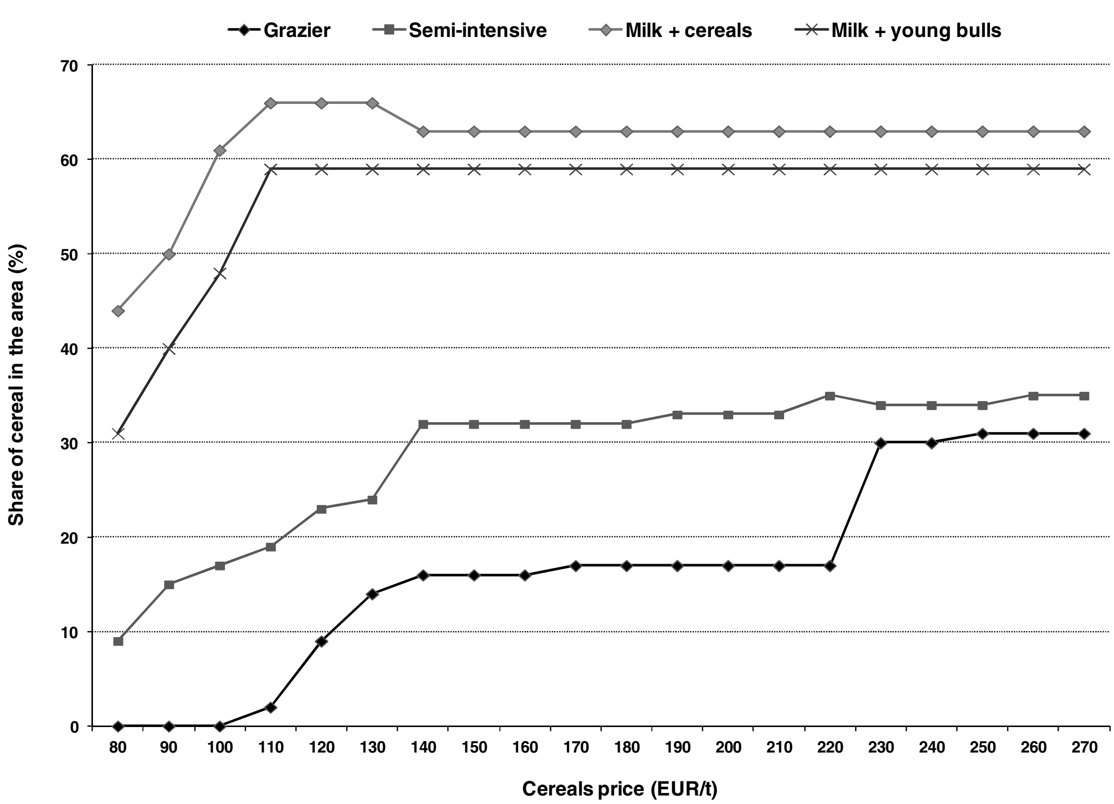
Nevertheless, the model does not take into account some other elements, which affect farmers' behaviour. Many farmers will continue to focus on maize, since feeding management of dairy cows based on grass is more complex (nutritional values constantly change). Moreover, the labour constraint may curb the use of pasture, since it requires driving the animals to the plots and bringing them back for milking. Similarly, the greater use of milking robots requires grassland around the robot, which must be accessible at all times.

In the more favourable price conditions of 2007 and 2008 (S2), farmers sought to increase their cereal production by converting to cereals those areas which were previously under grass. The decline in gross margin of crop production caused by the decoupling is more than offset by the rise in prices: the marginal yield of an additional hectare of land increases by 20% between the baseline and S2 (and more than double for the grass-based farm). The gains generated by cereal production are higher than the

savings arising from grass-based milk production. The model therefore proposes a production system close to the 2003 situation in its pattern crops and livestock composition. The milk + cereals farm, on the contrary, reduces a little its share of cereals in favour of its maize silage area. Indeed, with the rise of cereal prices, concentrate feed prices also increases. Therefore, the farmer reduces the quantity of concentrate feed for the cows (from 2.020 kg to 1.250 kg) and increases the share of forage in the diet.

Figure 6.1 shows the evolution of the share of cereals in the total area in the decoupled situation according to the cereal price. Farmers increase cereal production when cereal price increases. But the more intensive farms, which have the highest yields and the best techniques, take advantage more rapidly of a lower price and thus reach their rotation limits faster. At the same time, all types of farming reduce the share of grass in the diet of dairy cows and replace it by maize silage to intensify milk production. The intensity of this decline depends primarily on the yield and on the production costs of cereal crops and maize silage. We can also see that the "grass-based" farm chooses to no longer meet the criteria of the "premium for grassland" when cereals price exceed EUR 220/tonne.

Figure 6.1. Proportion of cereals in the total area according to the cereals price



The increase of cereal price encourages farmers to develop these crops. However, it appears that maintaining milk production is always a priority for farmers, regardless of the price considered (milk and cereals). Indeed, the costs incurred to establish a dairy operation are often too high for farmers to consider abandoning milk for cereal production. This is especially true because the agricultural area of dairy farms is often far below the threshold of profitability traditionally met with amongst specialised crop farms.

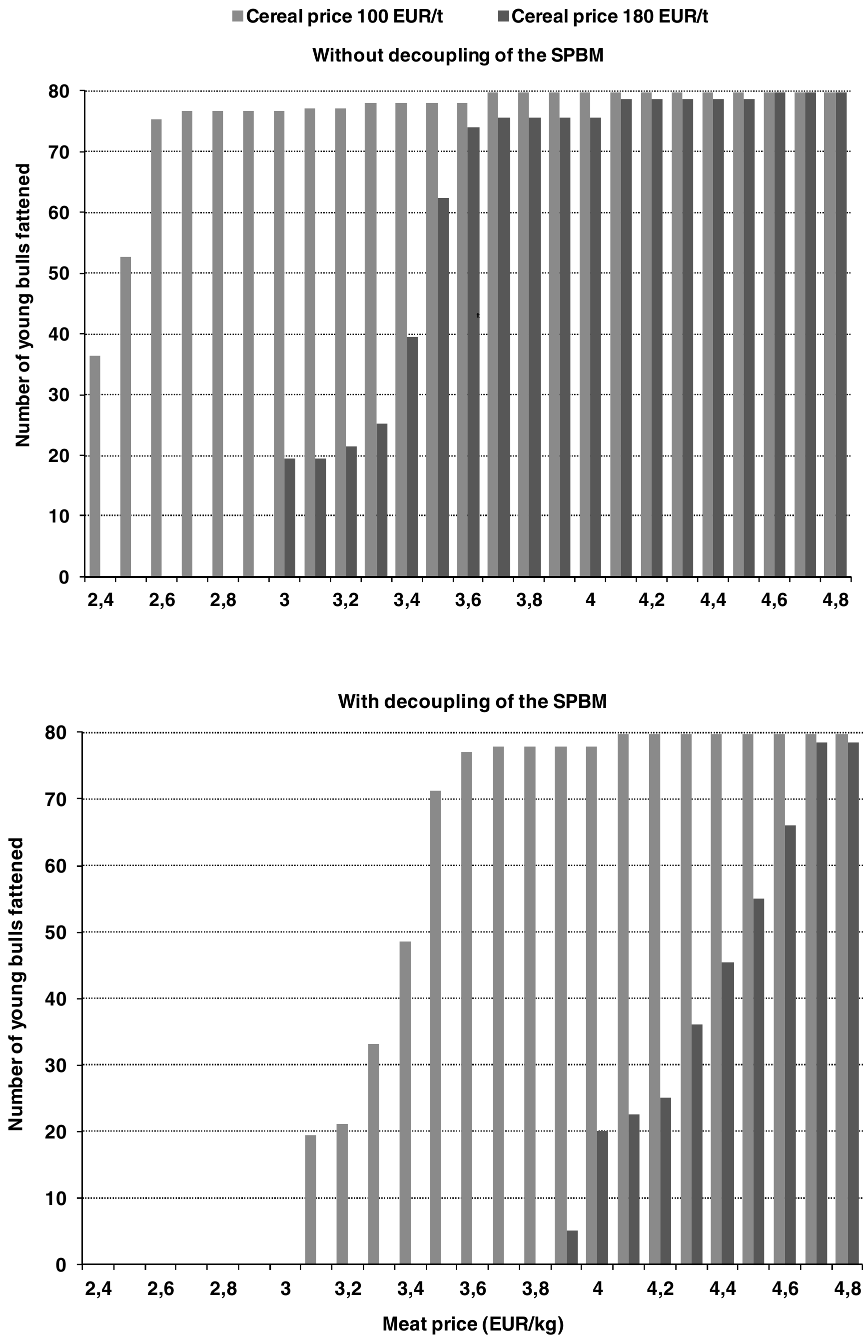
The decoupling: cessation of the fattening activity?

This section focuses on young bull fattening activity. The premium for these animals (SPBM) is totally decoupled, leading to a decrease in gross margin per animal of EUR 210 (plus EUR 48 for the slaughter premium). Our question focuses on maintaining this production, which benefited previously from large amounts of aid. The model is used to determine the choice of the farmer in this situation.

The implementation of decoupling encourages farmers to stop the fattening activity. The "Milk + young bull" farm completely ceases this production and uses the freed area to produce cereals (Table 6.4). Milk yield per cow is increased to the maximum (9 000 litres/year) in order to reduce the number of cows and thus the requirement in maize silage. Therefore, the farmer can produce more cereals. The model offsets the profitability of the feedlot with cereal crops. This change of production allows a decrease in working time (-40%), thus freeing permanently 1.2 AWU. Stopping the production of young bulls also decreases nitrogen emission (-50%).

Figure 6.2 shows that the fattening activity is conditioned both by meat and cereal prices because these are concurrent activities for the land. When cereal price increases from EUR 100/tonne to EUR 180/tonne in a non-decoupled situation (top of Figure 6.2), the meat price has to increase to more than EUR 3/kg to make the fattening activity more profitable than cereals. However, the full decoupling of the SPBM and the increase in the price of meat in 2007 and 2008 are not enough to encourage farmers to resume the fattening activity. In this situation (with a cereals price at EUR 180/tonne), the price of meat needs to increase by 30% (EUR 3.9/kg) to encourage farmers to start fattening bulls. Moreover, the cereals price rise also affects the concentrated feed of which bulls are large consumers. The full decoupling of the SPBM is strongly disadvantageous to this production: the price of meat has to increase by almost EUR 1/kg to offset this effect. In other words, farmers do not lose money by continuing to fatten bulls, but they could earn more by replacing this production with cereals.

Figure 6.2. Fattening of young bulls according to meat and cereals prices



SPBM: Special Premium for Bovine Meat.

Discussion

The model correctly reflects what occurred in French cereal production after the implementation of the reform. The French Agriculture Ministry database (Agreste) shows that the cultivated area in soft wheat increased from 4.78 million hectares in 2007 to 5.07 million hectares in 2008, following the rise in price, and then decreased to 4.75 million hectares in 2009. The evolution was similar for maize and rapeseed. In this case, the decoupling of subsidies modifies farmer behaviour: it restores to prices their role as indicators of the market situation, and farmers take their decisions based on those prices. The model also gives a good simulation of the evolution of dairy production in France. Despite the decoupling, the dairy activity remains the most profitable enterprise, and farmers produce up to their milk quota.

However, after three years of direct payments, we observe a difference between the model results and real farmers' choices, especially for beef production. The *Institut de l'Elevage* (2010) shows that the number of young bulls did not decrease in France in 2008 and 2009, despite implementation of full decoupling.

Theoretically, if the direct payments are supposed to have minimum effects on production, we identify several links between direct payments and farm production, which can explain the observed difference.

- *Long-term production requirements.* Agricultural production is a long-term activity, and farmers cannot change their system in a short time. Farmers develop their production enterprises (livestock fattening, cereals, etc.) within the framework of their labour organization, their use of equipment, and also the financial position of their farm, and these elements cannot be easily challenged.

- *Eligibility criteria for the payment.* Farmers have to meet the cross-compliance conditions (environmental and animal welfare measures) to get the payment. They also have to maintain the land in a good agronomic condition. These eligibility criteria may also create a link between payments and production.

- *Sociology/psychology of the farmer.* Some of these elements can also influence the farmer's decision. For example, cessation of fattening means not using an important set of buildings. Most farmers do not consider not using their buildings to their full capacity even if it is more advantageous from a business point of view.

- *Anticipation of a new reform.* Farmers are all aware that the CAP will be subject to further reform in 2013.Direct payments are now based on historical references, but farmers do not yet know the modalities of the future CAP reform. Some of them, anticipating the next reform, may want to maintain production in order to justify future payments (re-coupled or not).

- *Trade organization.* Farmers are price takers, and have no influence on prices, which are exogenous to the model. For the fattening activity, many farmers produce under a contract with a slaughterhouse. It is reasonable to assume that these companies will maintain this contractual policy to ensure sufficient production volumes and avoid significant price variations. Farmers who work with company under a contract (with a known price for a period) are less likely to alter their production.

- *Value of property assets*. Hennessy (1998) shows that direct payments modify the wealth of farmers and thus the incentive to produce for risk-averse farmers. Usually, policy measures increase expected farm income and reduce farm income variability. For a risk-averse farmer, this may lead to two distinct effects. The first is an insurance effect that results from the reduced income variability. The second is a wealth effect arising from the increased expected income, leading the farmer to adopt riskier behaviour. Both the insurance and the wealth effects may contribute to increased production.

The theoretical effect of decoupling, shown by the model, is not observed for beef production. We suggest that when the farmer owns the factors (land, buildings, machines, animals, etc.), he tries to use these inputs, even though he could increase his income with another productive combination. Femenia *et al.* (2010) show that the effect of the direct payments on wealth is underestimated for the farmer who owns the factor (land) on which payments are based. The capitalization of agricultural income support programs in farmland prices generates large wealth effects. These effects are a consequence of the importance of income support in farming profits, and generate modest changes in production levels.

Conclusions

The farm-level mathematical programming method is suitable for analysing the impact of public policy on dairy farmers' behaviour. The technique allows placing the technical, biological, structural, environmental and regulatory realities at the heart of the producer's choice. Because we consider the interactions between types of production (both plant and animal), the main laws of biological response and the seasonality of agricultural production, the model represents, as realistically as possible, farmers' behaviour, and supplies economic, technical and environmental responses to the implementation of the 2003 CAP reform. Moreover, by applying this model to four types of dairy farm, we can identify if the CAP reform causes different impacts according to the technical system. However, the limitations of the method based on instantaneous adjustment of production factors and perfect information should be kept in mind, along with the idea that the actors are primarily guided by the desire to maximise their income (while other considerations may play a more important role). Moreover, model prices are not endogenous variables, *i.e.* the producer does not make his decisions in light of the evolution of global supply. Based on the current construction, some improvements are possible, such as to integrate other goals (such as minimisation of labour and minimization of environmental impacts) into the objective function. In a context of increased volatility in prices, the UEP method could be modified to better integrate farmers' expectations facing the direction (positive or negative) of price changes. Moreover, if this type of model is suitable to study the short-term impact of an evolution in public policy, it cannot predict a long-term evolution without taking into account changes in the farm structure.

In term of public policy, this study has confirmed that the decoupling of supports to agriculture theoretically encourages dairy farmers to adopt a more extensive production system. The full decoupling of crop premium encourages farmers to use a larger share of grass in the cow's diet instead of maize. All things being equal, and given the considered prices, the 2003 CAP reform also encourages farmers to stop fattening bulls. This enterprise has to face a great loss of profitability with the full decoupling of the SPBM

(EUR 210/head). The increase in the price of agricultural commodities has a positive impact on the economic results, but it does not change the situation for young bulls, and contributes to an increase in cereal areas. However, the CAP reform partially reaches its goal of restoring to prices their role as indicators of the market situation. Indeed, after three years of decoupling, we observe that farmers react to price changes for cereals, but not for beef. We highlight the fact that, when farmers own their assets, decoupling has little effects on production.

All this is guided by the decisions of the Member States that are changing the CAP in accordance with the WTO negotiations and market trends. The CAP Health Check outlines future income support policy by addressing important issues for dairy farmers such as the phasing out of the milk quota which is already a subject of controversy. This last point leads to important questions for dairy producers and will certainly change the productive equilibrium on French dairy farms.

Note

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Part IV

The Impact of CAP Reform on the Agro-Food Industry

Chapter 7

Scenar 2020-II: Decomposition analysis to understand policy impacts on agricultural primary production and related processing sectors

Peter Nowicki and Hans van Meijl[1]

This analysis, using a suite of models and statistical methods, decomposes the individual effects of various policy components on the outcome of three policy scenarios developed as part of the Scenar 2020-II study: a reference scenario, a conservative scenario, and a liberalisation scenario. A brief description of the economic modelling framework, policy representation and scenarios is presented, followed by an analysis of the impact of border measures, of the blending requirements of the EU Renewable Energy Directive, and of Pillar 1 and Pillar 2 payments of the Common Agricultural Policy on agri-food trade, agri-food production and land use. The decomposition analysis helps to identify the elements that drive the effects of policy reform.

Scenar 2020-II[2] is a scenario study that compares plausible alternative policy pathways over the long term — that is, for a policy framework — and in our case this means referring to the horizon of 2020. The point is to understand the different trajectories of agriculture and the rural economy at the ground level under the influence of two contrasting policy lines in relation to a business as usual projection of policy implementation (e.g. the removal of milk quotas is scheduled for 2015, and the mandated share for biofuel mixing in transportation fuel gradually increases to 10% by 2020 following the implementation of the Renewable Energy Directive, etc.). The two contrasting scenarios are complete liberalization of the agricultural economy, on the one hand, and a conservative approach of maintaining regional agricultural production structures in place, on the other.

The importance of understanding what happens on the ground means that a variety of interconnected factors have to be taken into account at the same time. The Scenar study tries to do this by a dual approach: a combination of economic models and a SWOT analysis of regionalized factors relating to the economic, social and physical environment. The economic modelling included a global trade model (LEITAP), a partial equilibrium model specialised in the agricultural economy at the EU member state level (ESIM), and a partial equilibrium model specialised in agricultural activities at the EU NUTS 2 regional level (CAPRI). The SWOT analysis used statistical references, land cover data and the outcomes of the economic modelling (providing projections up to 2020), along with expert information.

Importance of identifying individual policy effects

The intention of Scenar is to provide information for policy-making at the EU level, but the techniques employed – and the scenario structure itself – could be used at a lower territorial level. Because of the variety of data sources, the information gathered and processed was available at member state, NUTS 2 and in the territorial units used for the FARO project (a combination of NUTS 3 and 2 levels reflecting the structure of employment basins within the European Union). This paper explores some of the applications that could be made by decomposition of commodity production and processing output coming from some of the modelling work at the EU level.

With regard to one of the parameters studied in Scenar – agricultural production – the conclusion was that the alternative policies had little effect on overall production, but in some regions there was a significant effect. This already signals the utility of such an exercise to identify individual commodity as well as regional responses to policy implementation. The mechanisms of response are different: in one case, more labour is retained, in another case capitalisation increases productivity. A similar net effect at the EU level covers the fact that in one policy setting there is increased abandonment of farm units than in another, and that certain agricultural activities are more affected than others. The likely change in agricultural income, for instance, can be portrayed at a regional level, as can be the shift in agricultural practice.

Individual policy effects can be further explored in terms that put into perspective the viability of agricultural practice over the long run and which can point out the relative importance of specific policies that affect the agricultural economy and territorial development. For the relative importance of agriculture is diminishing in terms of its

contribution to regional Gross Value Added, but it remains a principal occupant of rural space.

Economic modelling

The modelling work has employed computable general equilibrium (LEITAP) and partial equilibrium (ESIM, CAPRI) models. The intention has been to use the same suite of models as in the initial Scenar study.[3] Although it is difficult to obtain fully consistent results from the different models, by harmonising scenarios and linking a selected number of model results and parameters, consistency between model results is improved (Table 7.1). The downscaling focuses on effects of different scenarios for specific regional issues not handled by a model directly.

Table 7.1. Schematic overview of the models: geographical and sectoral coverage

	Agricultural	Rest of economy
Global	LEITAP	LEITAP
EU/national	ESIM	LEITAP
NUTS 2	CAPRI	Downscaling

To perform the analysis, a modelling framework has been constructed, consisting of three economic models (LEITAP, ESIM and CAPRI). In this modelling framework the long-term economic and environmental consequences of different scenarios are quantified and analysed, starting from 2007[4] up to 2020, for several regions in the world and all 27 European Union countries. The main contribution of LEITAP is in the WTO policies (affects all sectors, not only agriculture) and the interaction with the rest of the economy (other industries and factor markets). ESIM's main contribution is the projection of developments in EU agricultural markets into the future. CAPRI's main contribution is modelling changes in CAP policies and their regional impact (NUTS 2 level). The downscaling is based on regional sectoral employment shares and results from CAPRI and LEITAP are combined to analyse changes in total regional employment per scenario.

LEITAP is a global computable general equilibrium model that covers the whole economy including factor markets and is often used in WTO analyses (Francois *et al.*, 2005) and CAP analyses (Meijl and Tongeren, 2002). More specifically, LEITAP is a modified version of the global general equilibrium Global Trade Analysis Project (GTAP) model. Agricultural policies are treated explicitly (e.g. production quotas, intervention prices, tariff rate quotas, (de)coupled payments). Information is used from the OECD's Policy Evaluation Model (PEM) to improve the production structure (Hertel and Keening, 2006) and a new land allocation method, that takes into account the variation of substitutability between different types of land (Huang *et al.*, 2004), as well as a new land supply curve are introduced (Meijl et al., 2006; Eickhout *et al.*, 2009). Recently the model has been extended with biofuels (Banse *et al.*, 2008) and rural development policies (Nowicki *et al.*, 2009). The ESIM and CAPRI models are EU27 partial equilibrium models for the agricultural sector at country and NUTS 2 levels, respectively, with a strong focus on the CAP. The regional decomposition and the very detailed description of agricultural production in CAPRI enables the modelling of CAP policies in more detail compared with ESIM and LEITAP. Moreover, the CAPRI model

also calculates environmental indicators and it has recently been extended by Pillar 2 policies (Nowicki *et al.*, 2009). ESIM contains a detailed description of the biofuel markets.

Total agricultural land use is endogenous in the LEITAP model by the introduction of a land supply function based on detailed biophysical data. Total agricultural land use is given to the partial equilibrium models. Yields are determined by a trend and an endogenous part dependent on prices. In ESIM yields are determined by an exogenous trend and output prices, while in LEITAP they are determined by an exogenous trend and production factor prices. Substitution effects between production factors play an important part in the LEITAP model. The elasticities of substitution are based on the GTAP database and model.

From the above, it is clear that the different models are overlapping each other; but they are also complementary, with each model having its strengths and weaknesses. The approach is such that the different models analyse the same scenarios. Moreover modelling results are copied from one model to the other, e.g. productivity and efficiency changes related to human and physical capital are copied from LEITAP to CAPRI. This does, however, not guarantee that the model results are fully identical. Differences in model results occur due to differences in type of models, definitions and aggregations of variables, modelling of policies and underlying data (especially behavioural parameters and costs and revenue shares).

CAP policy implementation in the economic modelling

With regard to Pillar 1 and 2 CAP measures, the experience gained in modelling the effect of modulation has been applied (Nowicki *et al.*, 2009). Two points are, firstly, the adaptation of the modelling structure to reflect the full decoupling programmed for 2013 and, secondly, the incorporation of the Pillar 2 payments within the modelling structure.

Decoupling of Pillar 1 money from production is difficult in agricultural commodity models, as the impact of decoupling is not yet empirically known. In CAPRI, the decoupled payment is modelled as a direct payment linked to land, but where the amount paid is the same regardless of how the land is used, as long as it is not abandoned. Thus, the payment has the effect of increasing land rents (compared to no policy), increasing agricultural income and of preventing land abandonment, but, once introduced, changing the decoupled payment has no effect on the choice between various products or on the choice to produce or to simply keep land under good condition. Wealth and insurance effects are not modelled, and neither is the potential effect on farm viability, since neither risk nor single farms are explicitly modelled in CAPRI.

A similar approach has been chosen for the general equilibrium model LEITAP. In LEITAP, decoupled direct payments are also modelled as payments linked to land. It is assumed that land in all agricultural sectors that are eligible for single farm payments receives the same payment rate. Therefore, the payment has no effect on the choice between eligible crops within agriculture. However, in this economy-wide model the payment favours agricultural sectors relative to manufacturing and service sectors; this is called the general equilibrium effect. Due to the payments, farm income increases and more production factors stay within the agricultural sector. Thus, for example, land abandonment is less. The general equilibrium effect of decoupled payments is a linking element where output of the LEITAP model is used in ESIM.

A key feature of Pillar 2 policies is that some measures, like physical and human capital investment, have dynamic impacts. For example, training increases labour productivity, and increased labour productivity has a positive impact on yields; an investment in one year has cumulative effects over following years. To include these dynamics the LEITAP model has been extended to include a recursive dynamic version with endogenous technological change by specifying a relation between investments and productivity change.

The analyses of Pillar 2 policies cannot reasonably be performed separately for each of the 46 rural development measures, and are thus grouped according to fundamental similarities in the economic mechanisms and how these are handled by each of the models. We model separately six groups of Pillar 2 measures. We distinguish between:

- Axis 1: human capital investments and physical capital investments.
- Axis 2: Less Favoured Area (LFA) and Natura 2000 payments and environmental measures.
- Axis 3 (including LEADER): regional measures.

Table 7.2 displays the way they are implemented in the models and the key assumptions. LEITAP covers all measures explicitly, CAPRI models Axis 2 measures explicitly and the other measures via a link with the LEITAP model. ESIM does not treat Pillar 2 policies explicitly but receives the impact of all Pillar 2 measures via a link with LEITAP, and ESIM is therefore not included in Table 7.2. Human, physical capital and regional investments have productivity effects modelled in LEITAP. These productivity effects together with the impact of Pillar 2 policies on endowment prices, GDP, CPI and total agricultural land use are provided from the LEITAP model to the ESIM and CAPRI models.

Table 7.2. Treatment of rural development measures* in quantitative models

	Treated in model	How it is implemented (information needed)
01 – Human Capital Investment [111-115, 131-133]	LEITAP	Payments influencing the total factor productivity in agriculture Rate of return on investment is 40% (Evenson, 2001) Deadweight loss is assumed to be zero
	CAPRI	Via link with LEITAP
02 – Physical Capital Investment [121-126]	LEITAP	Payments which influence the total factor productivity due to capital investments in all agricultural sectors Rate of return on investment is 30% (Wolff, 1996; and Gittleman, ten Raab & Wolff, 2006) Deadweight loss is assumed to be zero
	CAPRI	Via link with LEITAP
03 – LFA Land Use Support [211, 212]	LEITAP	Income payment linked to land in agricultural sector. FADN data are used to distribute payments across sectors
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data and CLUE results
04 – Natura 2000 [213]	LEITAP	Income support linked to land in agricultural sector. FADN data are used to distribute payments across sectors
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data and CLUE results. Conditional on extensive technology being used

Table 7.2. Treatment of rural development measures* in quantitative models (*continued*)

	Treated in model	How it is implemented (information needed)
05 – Agri-Environment measures [214-216]	LEITAP	On the one hand, income support linked to land in agricultural sector and, on the other hand, a yield and labour productivity loss. FADN data are used to distribute payments across sectors
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data. 50% of the support directed towards TF8 farm types 1, 2, 3, 4 and 8 is conditional on extensive technology being used, for remaining amounts extensive as well as intensive technology is eligible
06 – Forestry [221-227] 07 – Diversification [311-313] 08 – General rural development [321-323, 331, 341] 09 – LEADER [411-413, 421, 431] 10 – Technical assistance [511, 611]	LEITAP	Investment support for non-agricultural activities that increase productivity Rate of return on investment is 30%. Deadweight loss is assumed to be zero
	CAPRI	Via link with LEITAP

*The RD measure numbers are indicated between square brackets [#].

Decomposition technique for estimating individual policy impact

The future of the agricultural sector in the European Union now seems set in a very different context than when originally investigated in the first Scenar 2020 study. Two major items are the increased volatility in agricultural commodity markets and the effect of mandated blending of biofuels. But in other respects the situation has not evolved much since a few years ago: an ageing farm population within the European Union, an important wage differential between the agricultural and other economic sectors, the increasing productivity that is coming from investment in human and physical capital, and the role of land as a buffer among the factors of production. The interplay between all of these items is the reason for introducing a decomposition technique for estimating individual policy impact upon the agricultural sector.

The following figures present the results of the decomposition of the trade growth for crops (wheat, other grains, oilseeds, sugar, horticulture, other crops) livestock (primary and processed cattle, pork and poultry products) and agri-food products. Agri-food products present the total of primary and processed agricultural and food commodities, including crop and livestock products. (Table 7.3)

Table 7.3. Composition of LEITAP categories: crops, livestock, agri-food

Crops	Livestock	Agri-food
Paddy rice; wheat; cereals grains n.e.c.; oilseeds; sugar cane; sugar beet; vegetables; fruit; nuts; plant-based fibres; crop n.e.c.	Raw milk; cattle; sheep; goats; horses*; animal products n.e.c.; wool*; meat products of cattle, sheep, goats, horses; meat products n.e.c.	Paddy rice; wheat; cereals grains n.e.c.; oilseeds; sugar cane; sugar beet; vegetables; fruit; nuts; plant-based fibres; crop n.e.c.; raw milk; cattle; sheep; goats; horses*; animal products n.e.c.; wool*; meat products of cattle, sheep, goats, horses*; meat products n.e.c.; dairy products; vegetable oils and fats; sugar; processed rice; food products n.e.c.; beverages and tobacco products

* Commodities in LEITAP but not in ESIM. n.e.c.: Not Elsewhere Classified.
Source: GTAP classification.

To identify the separate impact of individual CAP, trade and biofuel policies on the scenario outcomes the total scenario impact has been decomposed into the following effects:[5]

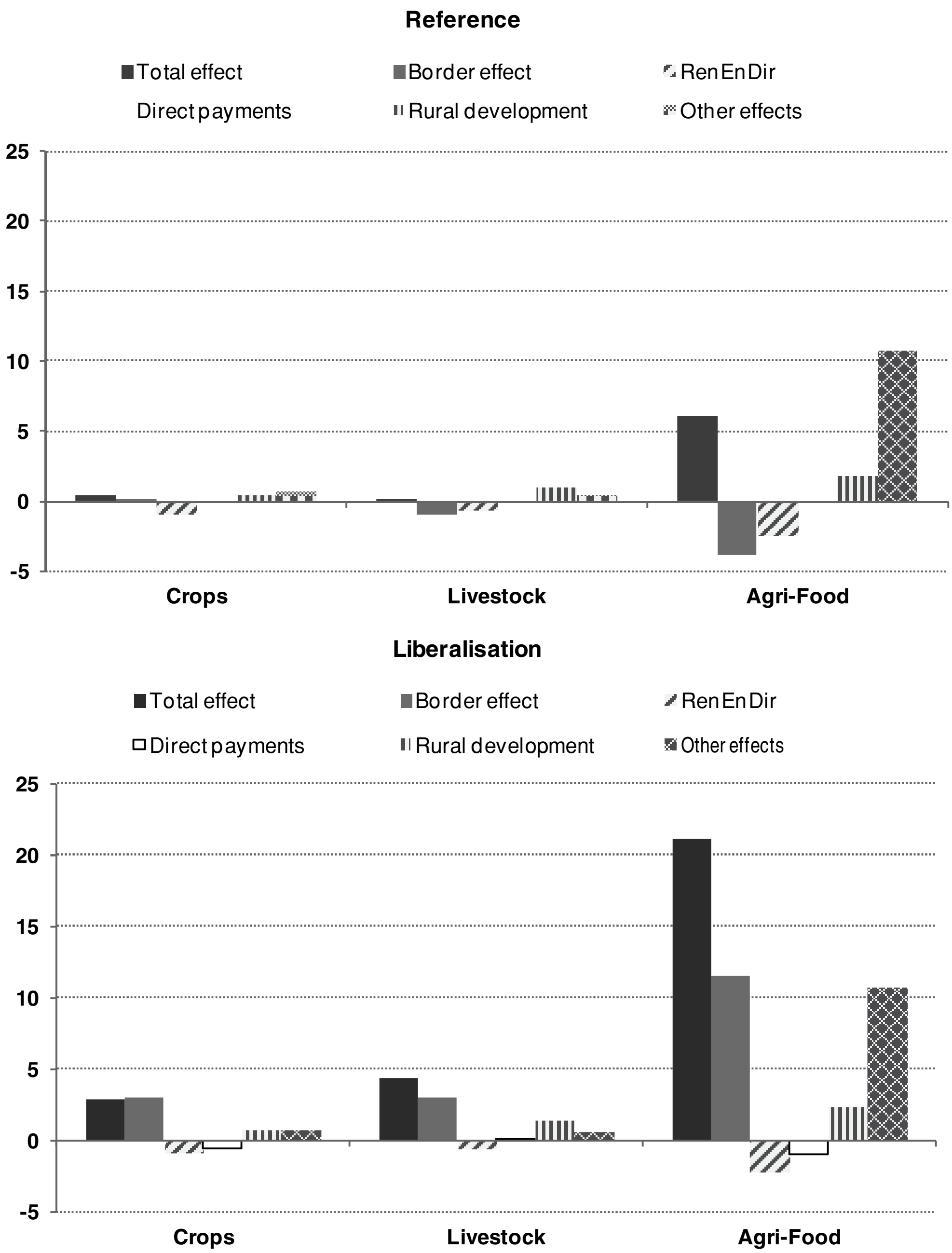
- *Total effect*: Scenario outcome, includes all policy and other effects of the following sub-items.
- *Border effect*: Isolates the impact of changes in trade polices measures on the import and export side. In the Reference and Conservative CAP scenario this is mainly the impact of the Falconer WTO proposal (including abolition of all export subsidies) and the bilateral trade agreements. In the Liberalisation scenario this is the total abolition of all export subsidies and import tariffs.
- *RenEnDir:* Identifies the impact of the introduction of the mandatory blending requirements of the EU Renewable Energy Directive.
- *Direct payments*: Identifies the impact of changes in direct payments (Pillar 1). It is the change in direct payments implemented under the Health Check reform and the scenario-specific assumptions up to 2020. The cuts in direct payments are 30%, 15% and 100% in respectively the Reference, Conservative CAP and Liberalisation scenarios.
- *Rural development*: Identifies the consequences of the transfer of additional funds to all Pillar 2 measures under different scenarios. The increase in EAFRD payments are 105%, 45% and 100% in respectively the Reference, Conservative CAP and Liberalisation scenarios. The budgets are distributed across RD measures according to the current distribution in the RD plans.
- *Other effects*: Impact of change in population, production factor supply and productivity. It is calculated as a separate scenario run. It is also mathematically equivalent to the difference between the total effect and the policy effects above, considered individually.

Figures 7.1 and 7.2 depict import and export growth in agri-food trade in the EU27. Export growth of the European Union in the Reference scenario is limited and mainly positive due to other effects (GDP and population growth) that lead to higher consumption in the world (Figure 7.1). The other effects are higher for processed than for crops and livestock commodities as in general these products are demanded more as income grows (higher income elasticity of demand). The impact of the Falconer proposal is reflected in the impact of the border effect. The impact is negative for livestock and agri-food products. The latter is surprising as the EU27 gets enhanced access to other markets due to lower import barriers. However, this negative impact is mainly caused by the abolition of export subsidies, especially in the dairy sector. The impact of rural development spending is slightly positive on agri-food exports as especially human and physical capital investments improve productivity and therefore competiveness. The impact of the Renewable Energy Directive is negative as more biomass products are needed for domestic demand. Another factor is that the increased crop production inside the European Union due to the Directive leads to higher production factor and therefore product prices inside the EU27 relative to the prices in other countries. The impact of reducing direct payments is very small, indicating that direct payments are fairly decoupled. In the Liberalisation scenario (Figure 7.1) exports increase by 20% instead of 5% in the Reference scenario. The difference is mainly caused by increased liberalisation (border effect) and therefore increased access of the EU27 to third markets. This impact is visible for crops, livestock and the whole agri-food sector. In particular, EU27 exports of

processed food products increase due to increased market access in the Liberalisation scenario.

Figure 7.1. Decomposition of the change in exports between 2007 and 2020 in agri-food trade EU27

Reference and liberalisation scenario, in billion USD



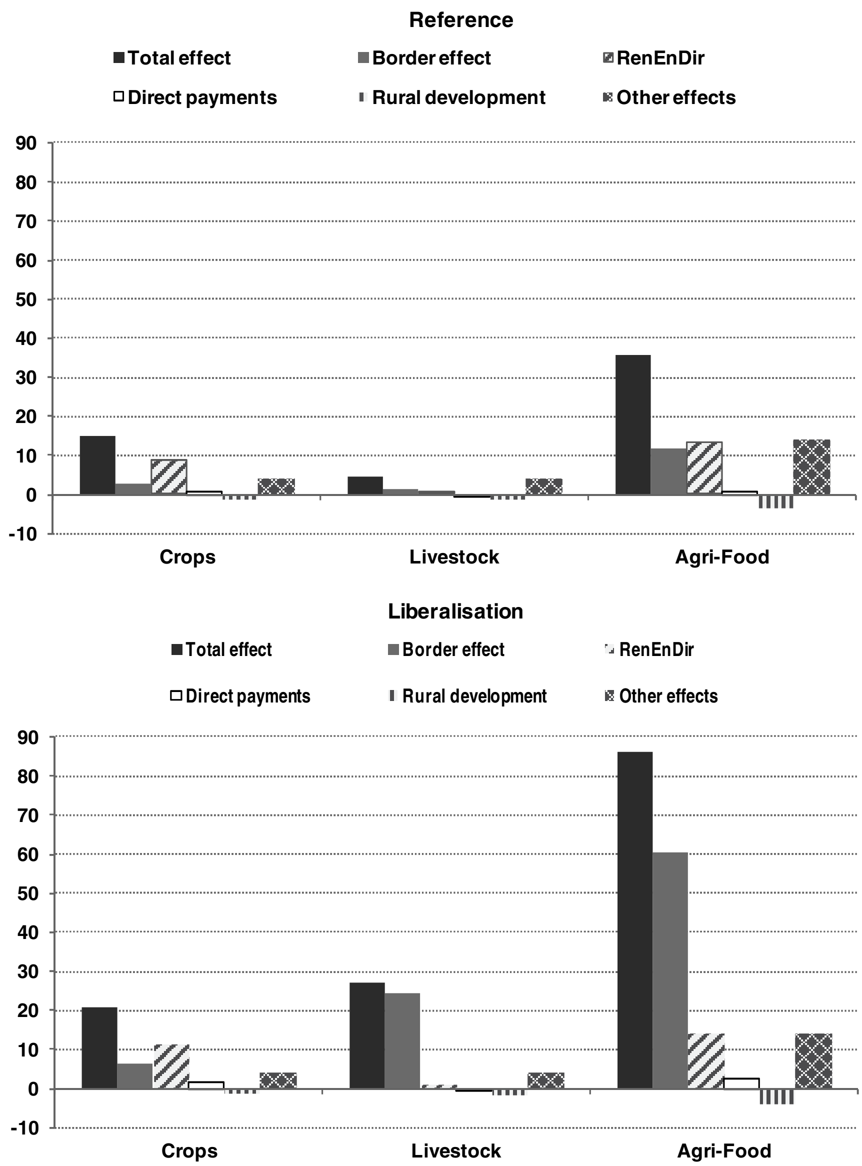
Source: LEITAP results.

In the reference scenario import growth of agri-food products in the EU27 is substantial and driven by liberalisation (Falconer proposal), other effects and by the EU Renewable Energy Directive. The impact of the other effects is higher for processed products than for crops and livestock as income growth leads to relatively higher demand

for processed products than crops and livestock products. The Renewable Energy Directive leads especially to import growth of crops and therefore also agri-food products. The impact of the border effect is not so high for crops and livestock (in particular) in the Reference scenario, as it is assumed that most protected commodities are assumed to be treated as a sensitive product in the Falconer proposal, with the result that reduction in import tariffs is limited. In case of liberalisation (Figure 7.2), imports increase in particular due the impact of modifying the border effect. This effect is very high for livestock and processed commodities, which are not treated as sensitive anymore as the relatively high level of protection is abolished.

Figure 7.2. Decomposition of the change in imports between 2007 and 2020 in agri-food trade EU27

Reference and liberalisation scenario, in billion USD



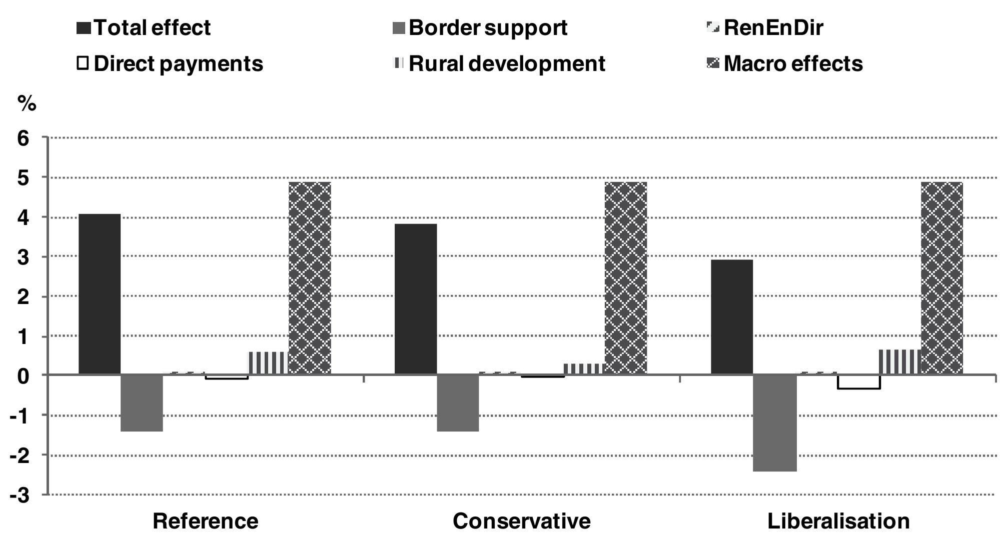
Source: LEITAP results.

Policy effects upon aggregated commodity production

In this section we examine the impact of various policies and macro-economic drivers on production and land use in the EU27 in the three main scenarios. The following figures present the results of the decomposition of the production growth for agri-food, livestock and biofuel crop products.

In Figure 7.3 production growth of all agri-food products (primary agriculture and processed food products) is 4.1% in the Reference scenario. Without policy changes the growth would be 4.9% due to other effects such as growth in technological change and production factors. The negative contribution of the border effect due to the Falconer proposal is dominant among the policies and equal to -1.4%. The contribution due to the cut in direct payments of 30% in the Reference scenario is limited to -0.1%, indicating that the decoupled payments have only minimal production effects. A positive contribution to the production of agri-food products is due to the EU Renewable Energy Directive (0.1%) and all rural development measures (0.6%); with regard to the EU Renewable Energy Directive, this concerns especially oilseeds, grain and sugar. The rural development impact is mainly caused by human and physical capital investments, which lead to a higher productivity and therefore production growth.

Figure 7.3. Decomposition of growth (volume) in agri-food production EU27, 2007-20



Source: LEITAP results.

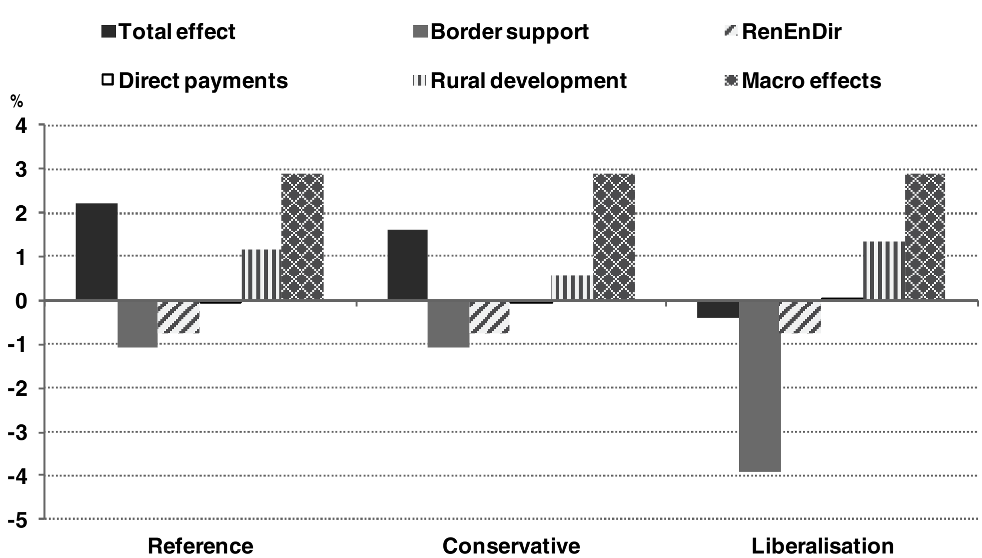
The main difference between the Conservative CAP scenario and the Reference scenario is that fewer Pillar 1 payments are transferred to Pillar 2. As Pillar 1 payments are fairly decoupled and some Pillar 2 payments, such as human and physical capital investments, have positive productivity and production effects, the net effect on production is surprisingly lower in the Conservative scenario than in the Reference scenario. In Figure 7.4, it can be seen that the main difference between the bars in the Reference and Conservative CAP scenarios is that the grey bar is lower in the Conservative CAP scenario than in the Liberalisation scenario. As this is the main difference between the scenarios the blue bar indicating the total effect is also lower for

the Conservative CAP scenario. As this figure depicts the total agri-food production, the difference due to this relatively small policy change is small. The growth of agri-food production is lowest in the Liberalisation scenario. The main difference with the other scenarios comes from abolishing border support (-2.4%). The impact of abolishing direct payments is small (-0.35%) as they are fairly decoupled.

Figure 7.4 shows the decomposition of growth in livestock production. Livestock products observe a small positive production growth in the Reference and Conservative scenarios and a negative production growth in the Liberalisation scenario. The other effects (3.0%) in the Reference scenario have the highest positive contribution to the small positive livestock production growth of 2%. The impact of higher rural development measures is also positive and equal to 1.5%, mainly due to the productivity gains of capital investments. The impact of border effect (-1%) in the Reference scenario is negative, as most livestock products are assumed to be sensitive products. The impact of the Renewable Energy Directive is negative (-0.75%) as feedstocks and production factors (land) become more expensive.

In the Conservative CAP scenario the production growth of livestock products becomes slightly lower. The main difference from the Reference scenario is that the lower rural development spending has a smaller positive contribution. In the Liberalisation scenario the production growth of livestock products turns from more than 2% positive to -4% negative production growth. This is mainly due to a higher negative impact of border support (-4%) due to complete liberalisation. The difference is large, as the assumption is that in the Falconer proposal many protected products (cattle, pork and poultry) are sensitive products. Removing direct payments has a negligible impact on livestock as Pillar 1 payments are fairly decoupled.

Figure 7.4. Decomposition of growth (volume) in livestock production EU27, 2007-20

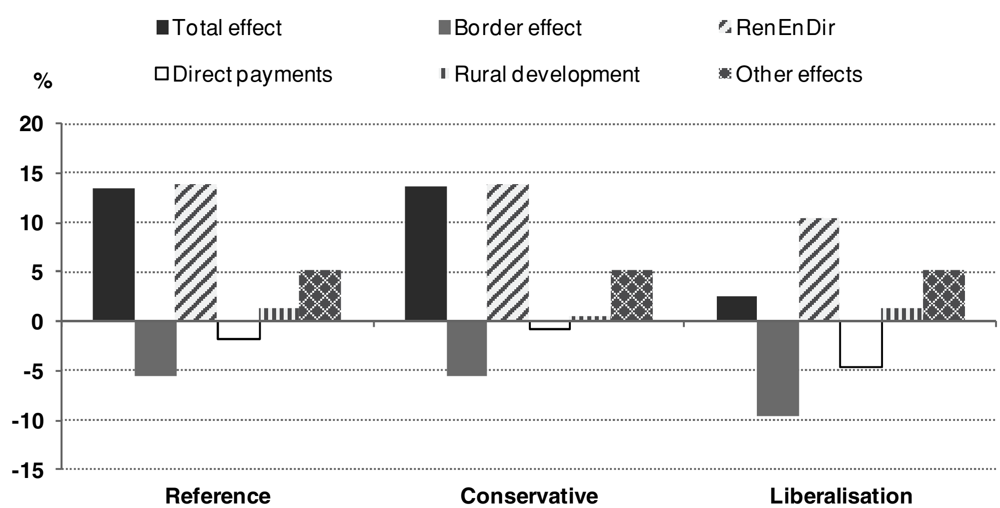


Source: LEITAP results.

Projections for individual livestock commodities are discussed in the following section. It is important to be aware that these projections are made with a partial equilibrium model, ESIM. But considering the projected change in aggregated livestock volume, globally ESIM produces similar results as with LEITAP. Under the Liberalisation scenario, the volume of production of total livestock declines by 6% between 2007 and 2020 for the EU27, but under the Reference scenario it increases by 4%.

Figure 7.5 shows production growth of the crops (grains, oilseeds, sugar) that can also be used for biofuels. The main driver for this positive production effect is the positive contribution due to the EU Renewable Energy Directive (14.6%). The negative contribution of the border effect that can be attributed to the Falconer proposal is also substantial and equal to -5.6%. The contribution due to the cut in direct payments of 30% in the Reference scenario is -1.7% indicating that the decoupled payments have small production effects. This negative impact is due to the assumption that decoupled payments are linked to land in our methodology and biofuel crops are relatively land intensive relative to other agricultural sectors and other sectors in the rest of the economy. A positive contribution to biofuel products is due to all rural development measures (1.5%). If RD measures were to become more targeted to biofuels in the future, as this is an explicit target in the Health Check agreement, this impact might be more substantial. Without policy changes the growth would be 5% due to other effects such as growth in technological change and production factors.

Figure 7.5. Decomposition of growth[1] in the production of crops[2] that can also be used for biofuels, EU27, 2007-20[3]



1. In terms of volume.

2. Grains, oilseeds and sugar.

3. Biofuels are treated as a blend of cereals, oilseeds and sugar in the current LEITAP model. Ethanol is not a separate product in LEITAP and this has the disadvantage that the high trade tariff on ethanol cannot be treated explicitly. This has a serious drawback in the analyses of changes in border support in the various scenarios as ethanol is assumed to be a sensitive product under the WTO agreement and gets only fully liberalised in the Liberalisation scenario. In this report we address this shortcoming by using ESIM outcomes as ESIM is able to quantify this effect as ethanol is a separate product and differences in import tariffs are explicitly modelled. ESIM scenario results indicate that due to liberalisation the impact on biofuel production is 75% of the impact in the Reference scenario. This ratio is used to adjust the impact of the Renewable Energy Directive, border support and the total effect.

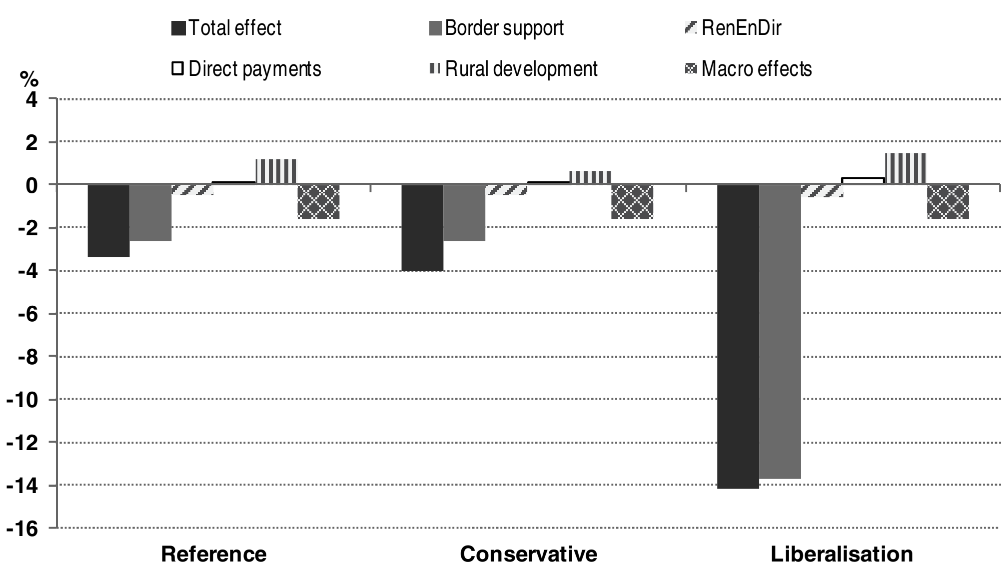
Source: LEITAP results.

The growth of biofuel crop production is much lower in the Liberalisation scenario. The main difference with the other scenarios comes from abolishing border support (-9.6%) and a lower impact of the EU Renewable Energy Directive (10.5%), as more biofuels will be sourced from imports. The impact of abolishing of all direct payments is more pronounced.

Policy effects on separate agricultural sector commodity production

Having looked at the aggregated livestock sector, it is worthwhile to investigate the policy influence upon separate parts, and we do so with illustrations from the beef and dairy sectors. In Figure 7.6, we clearly see the impact of the loss of board protection in the case of liberalisation, in which there would be a massive displacement of beef sourcing from outside of the European Union. In this case, RD measures would be the only real source of support to beef production, with some encouragement to extensive grazing.

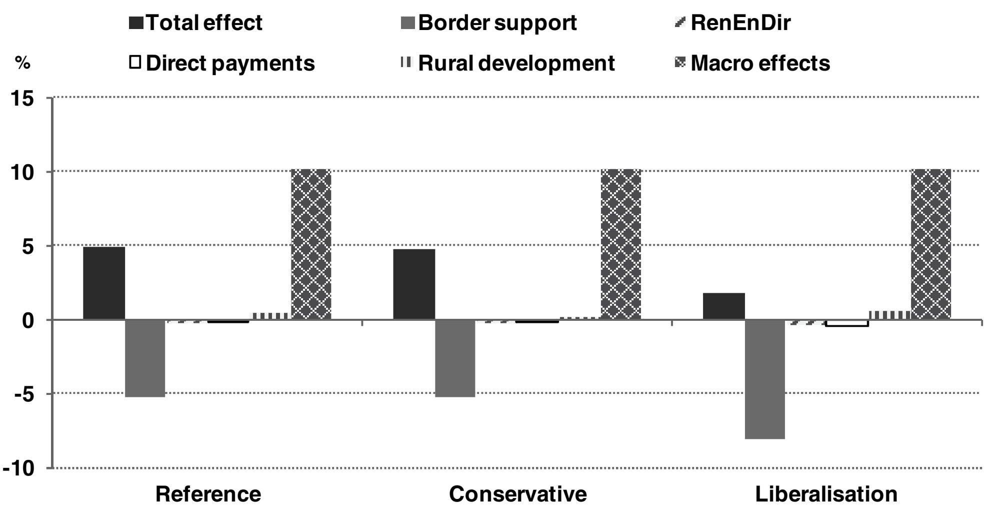
Figure 7.6. Decomposition of EU27 beef production changes 2007-20



Source: LEITAP results

With regard to the dairy sector, Figure 7.7 shows that general macro-effects very much outweigh the impact of liberalisation. In fact, the overall demand and added value for dairy products is high not only within the European Union, but around the world with the growth of GDP. Other policy measures have a limited influence on the prospects of the dairy sector under any scenario, demonstrating the EU dairy sector is inherently competitive enough to withstand the vicissitudes of policy changes, even in terms of easier access of foreign producers to the EU market.

Figure 7.7. Decomposition of EU dairy production changes 2007-20



Source: LEITAP results

Agricultural land use

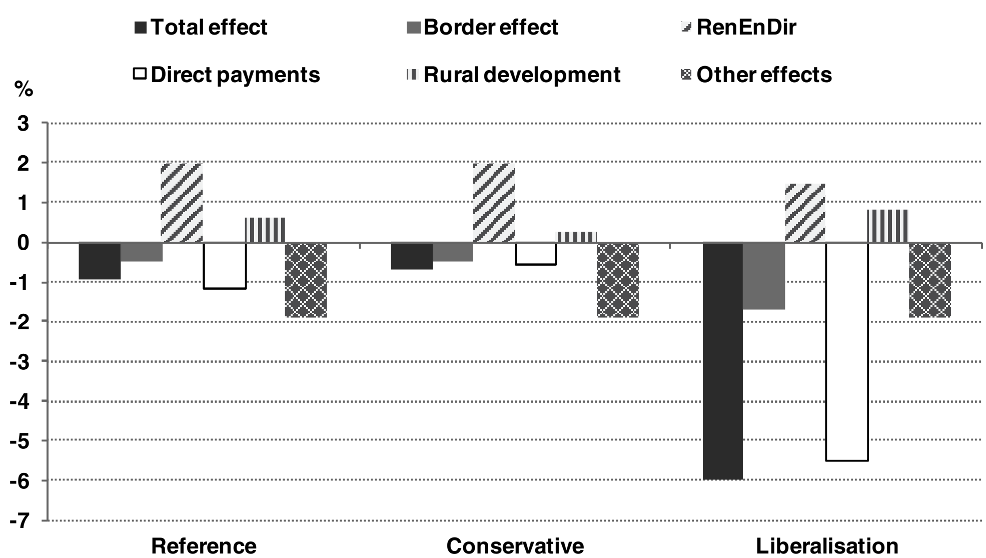
The development of land use is negative in the EU27 in all three scenarios: -1%, -0.8% and -6% in the Reference, Conservative CAP and Liberalisation scenarios, respectively. The decomposition shows that it is the policy effect that causes the difference between the scenarios, as the other effects are similar between the three scenarios (Figure 7.8).The impact of other effects is negative, indicating that yield increase outweighs the additional demand by population and income growth. Border support in particular has a more negative impact in the Liberalisation scenario. The reduction of direct payments plays an important role in the land-use story in the EU27. The impact is dominant in the Liberalisation scenario, causing quite some agricultural land to be taken out of production. This is mainly caused by the requirement linked to direct payments that land has to be kept in good agricultural condition. Abolishing the support is releasing this commitment. The Renewable Energy Directive and increasing rural development money keep land in production. Within the rural development measures, it is particularly the LFA, Natura 2000 and environmental measure payments that keep land in production.

In the Conservative CAP scenario the demand for land is slightly higher in the EU27 due to higher direct payments than in the Reference scenario. In the Liberalisation scenario more land will be taken out of production in the EU27. Reduced market support and no direct payments lead to abandonment of marginal land in particular.

In the EU12 the other effects have a positive influence on land use, whereas this influence is negative in the EU15. The main difference is the higher income growth in the EU12. The other policies have a lower impact in the EU12 than in the EU15. The exception is the impact of the EU Renewable Energy Directive, which is a little higher in the EU12. The impact of rural development money is less than in the EU15, as the budget is smaller and a smaller share is spent on LFA, Natura 2000 (N2K) and environmental measures, and a large share is spent on physical and human capital investments. The

impact of abolishing direct payments is dominant, although the impact is half that in the EU15.

Figure 7.8. Decomposition of agricultural land-use changes
EU27, 2007-20



Source: LEITAP results.

Conclusions

The interest of decomposition method has been demonstrated; for example, the two production sectors based on bovine ruminants have very different responses to individual elements of the same set of policy instruments. It is instructive to put the above discussion into the overall context of EU agricultural land-use change. Figure 7.8 clearly shows the reaction of the agricultural sector to multiple policy influences and the particular policy instruments that may need to be given specific attention in their use to be identified. This is a singular benefit of the scenario approach, particularly when associated with the capacity to decompose policy impact.

The major general conclusions with regard to the impact on policy changes on agricultural production and rural areas are as follows.

- Alternative policy scenarios seem to have little impact on the overall production levels of agro-food complex (although more on income and farm structure), with the exception of for livestock and mixed arable / livestock.
- "Liberalisation" would:
  - affect production levels, mainly through increased market access rather than through the absence of income support; and
  - show a significant impact on income and agricultural assets, including land (though this may help to facilitate the structural adjustment process).
- At the regional level, however, the (negative) impact may be more significant.
  - A process of liberalisation would lead to intensification in the most competitive regions and an extensification of production in others.

  - Adjustment processes in agriculture might be accompanied by an adverse or supportive economic and social situation.
- An increasing number of rural areas will become increasingly dependent on other sectors and will be driven by factors outside of agriculture.

More specific commodity conclusions are as follows.

- Impact of EU policies on agri production
  - Growth in crop production is principally stimulated by the Renewable Energy Directive (RED).
  - Limited impact of rural development measures is noted; human and physical capital investments stimulate productivity growth.
  - Reduction in border support reduces prospects for beef sector even as consumption increases (through cross-price effects with white meat in an enlarged market area).
  - Less protected agri-food products are only driven by macro-effects.
- Commodity markets
  - Real price evolution for arable crops are generally negative, except those related to RED. Liberalisation affects ethanol price and therefore cereal prices negatively.
  - A liberalising trend at first affects milk, beef and sheep prices more than pork, poultry and egg prices.

Notes

1. Agricultural Economics Research Institute (LEI-WUR), The Hague.

2. Nowicki, P., V. Goba, A. Knierim, H. van Meijl, M. Banse, B. Delbaere, J. Helming, P. Hunke, K. Jansson, T. Jansson, L. Jones-Walters, V. Mikos, C. Sattler, N. Schlaefke, I. Terluin and D. Verhoog (2009) *Scenar 2020-II – Update of Analysis of Prospects in the Scenar 2020 Study* – Contract No. 30-CE-0200286/00-21. European Commission, Directorate-General Agriculture and Rural Development, Brussels, *ec.europa.eu/agriculture/analysis/external/scenar2020ii/index_en.htm*.

3. CLUE-s is not employed in this exercise for detailed land-use projections, considering the tightness of the budget and the time period allocated for the chain of modelling operations.

4. The years 2002 or 2003 for CAPRI, depending on the type of data being used; this is indicated in the text. The year 2007 for LEITAP is estimated and extrapolated data.

5. Technically, the decomposition has been implemented by a sequence of consecutive scenario runs of where each decomposed element has been added. This method gives only an indication or approximation of the size of the various impacts. This is because the size of the impacts is dependent on the order of the scenarios (path dependency). As the initial situation for the various scenarios is slightly different the height of the bars cannot be compared one-to-one across scenarios. Finally, cross or interaction effects are not separated out.

Chapter 8

The impact of the European Union sugar reform on the beet processing sector

Sergey Gudoshnikov[1]

The sugar sector was reformed in 2006 along the lines of the 2003 Common Agricultural Policy (CAP) reform, with reductions in administered prices partially compensated by decoupled payments. The public intervention system was also gradually replaced by private storage, the quota system simplified and payments were made to producers and companies who renounced their quotas. This resulted in major reductions in the area under beet production, with five countries completely abandoning sugar beet production. The number of growers decreased sharply but yields increased. The restructuring programme became successful after incentives were raised: it resulted in about 5.5 million tonnes of production quotas being renounced and a decrease in the number of sugar factories between 2005 and 2009. This has led to greater efficiency in the sector. Domestic market development had significant impacts on trade and the world market: The European Union became the world's leading net importer, EU exports declined and world market prices increased. As a result, the cost of export refunds decreased.

The EU sugar beet policy in the pre-reform period

The sugar Common Market Organization (CMO) was created in 1968 as part of the Common Agricultural Policy (CAP) in order to guarantee European beet sugar producers a fair income, to provide self-sufficiency in sugar, and to ensure that supplies reached domestic consumers at reasonable prices. The sugar regime encouraged beet sugar production and deterred imports from the world market. The regime consisted of four pillars: price guarantees, production quotas, production levies and export refunds, and border protection, which later became a system of preferential import quotas. Budget expenditure associated with the regime was relatively negligible as funding was derived from profit-bearing prices paid by consumers.

The first major change of the sugar CMO occurred in 1975 following the United Kingdom's accession to the EEC in 1973. At the time of accession, the United Kingdom imported on an annual basis about 2 million tonnes of raw sugar under the British Commonwealth Sugar Agreement. As part of their accession agreement, a preferential import programme was agreed to with traditional developing suppliers, known as the African, Caribbean and Pacific (ACP) countries. The ACP Sugar Protocol effectively translated a United Kingdom commitment to the Commonwealth into a European Union commitment to the ACP. However, preferential access was reduced from about 2 million tonnes of white value imported by United Kingdom refineries to 1.3 million tonnes of raw sugar. Preferential import quotas have since become an integral part of the sugar CMO. Moreover, although the ACP imports initially just covered the gap between domestic production and demand in the United Kingdom, increased production within the European Union after 1975 resulted in the necessity to export an equivalent quantity of sugar. Re-exports at world prices that were lower than those paid by the European Union to ACP exporters triggered export refunds charged to the European Community budget.

The expansion of the European Union between 1980 and the 1990s marked the entry of two additional countries with refining capacities (Portugal and Finland). In order to accommodate the needs of their refineries, new adjustments to the import regulations were introduced which allowed raw sugar imports from countries outside of the ACP Protocol (82 000 tonnes from Cuba and Brazil) to be imported under Most Favoured Nation (MFN) arrangements. In March 2001, the European Union adopted the "Everything-but-Arms" (EBA) initiative which gives duty-free access to all exports from least developed countries, with the exception of arms and armaments. In the case of sugar, however, the EBA free access initiative was phased-in up to 2009, when duty-free access was finally allowed.

With the exception of the above changes, the sugar regime, normally reviewed every five years, remained largely unchanged from the system originally established in 1968. In 2005, the EU sugar balance was as follows:

- Production – 21.697 million tonnes, raw value
- Consumption – 16.765 million tonnes
- Imports – 2.417 million tonnes
- Exports – 6.639 million tonnes

Goals of the European Union sugar reform

The goals of the reform were as follows.

- To integrate the sugar sector in the reformed CAP, drastically reducing budgetary support to sugar exporters.
- In terms of the sugar balance sheet in raw sugar equivalent, to cut production by about 6 million tonnes to 13-14 million tonnes, to reduce exports by about 4-4.5 million tonnes to 1.4 million tonnes, and to double sugar imports to about 4.5 million tonnes.

Major features of the reform

On 24 November 2005, EU Ministers of Agriculture reached agreement on the reform of the sugar regime. The major features of the reform were as follows.

- Reference prices, which replaced intervention prices, would be reduced by 36% over four years starting from 2006/07. The 2006/07 white sugar support price of EUR 631.9/tonne would be reduced to EUR 404.4/tonne by the end of the transition period in 2009/10 (Table 8.1).
- Intervention (an obligation of the Commission to buy from the industry any unsold quota sugar at a guaranteed price) after the four-year transition would be abolished and replaced with a system of private storage. Producers taking advantage of the scheme would be paid a private storage aid. Intervention during the transition period would be limited to 600 000 tonnes per marketing year and the buying-in would take place at 80% of the reference price of the following marketing year.
- To compensate farmers leaving the sector, direct payments would cover 64.2% of their income loss.
- A restructuring fund would pay a basic EUR 730/tonne over the first two years to producers who renounced their quotas and quit the industry, with at least EUR 73/tonne going to ex-growers (the fund would be paid for by a levy on continuing processors). To qualify for this aid, which fell to EUR 625/tonne in 2008/09 and EUR 520/tonne in 2009/10, sugar companies had to give up their rights to quotas, stop production and close at least one factory (or factories), restore the factory site to good environmental conditions, and help redeploy factory staff.
- The quota system was simplified. The "A" and "B" quotas were merged into a single quota. The previous basic maximum (A+B) quotas would apply for the first four years as there will be no compulsory quota reduction applicable during that time.

Table 8.1. Evolution of EU reference prices for sugar

	2006/07	2007/08	2008/09	2009/10
White sugar, EUR/tonne	631.9	631.9	541.5	404.4
Cumulative reduction in %		0	14	36

The key objectives of the reform were to reduce sugar output by about 6 million tonnes. It was decided not to introduce compulsory quota cuts for EU manufacturers, but to implement a voluntary restructuring scheme. Under the system of voluntary quota renunciation, which was funded by a restructuring levy on production, the least efficient producers were encouraged to exit the industry early on, with the highest level of compensation (EUR 730/tonne) offered in the 2006/07 and 2007/08 seasons. The scheme came into operation on 1 January 2006; however, by the end of January 2007, the deadline for renunciations for 2007/08, less than 2.2 million tonnes had been renounced and the programme appeared to be in trouble. In September 2007, new elements to the restructuring scheme were agreed to by the EU Council of Ministers in order to improve its attractiveness. These included additional payments of EUR 237.50/tonne to farmers who gave up quotas, and fixing the share of the growers and machinery contractors to 10%. A waiving of the restructuring levy was introduced on withdrawal of sugar production during the 2007/08 season if renounced for the 2008/09 season, and a two-stage mechanism was announced for renunciation with producers allowed to submit volumes on 31 January and 31 March 2008.

This revised package substantially improved incentives for producers to renounce production quotas. After the modifications in the rules for quota renunciation were approved in 2009, 3.3 million tonnes of quota were given back for 2008/09 and 0.1 million tonnes for 2009/10. Aggregating the figures shows that there was a decrease of almost 5.217 million tonnes, white value, in the EU's supported sugar production since the sugar market reform came into effect in 2006. The Commission has practically reached its initial goal of reducing sugar production by 6 million tonnes.

What has been achieved by 2010?

The post-reform situation is illustrated in Table 8.2. In the beet-growing sector, areas under beet decreased by about 700 000 hectares (ha) between 2005 and 2009. Five countries (Bulgaria, Ireland, Latvia, Portugal and Slovenia) stopped producing sugar beet, while in seven other countries areas were decreased by more than 50% (Finland, Greece, Italy, Lithuania, Portugal, Czech Republic and Slovakia). The number of beet growers was sharply reduced, but losses were partly compensated by higher sugar yields. Similar to the beet-growing sector, beet processors also underwent considerable restructuring. The number of sugar factories was reduced from 188 in 2005 to 106 in 2009. Of importance, the average capacity of an individual factory, a universal measurement of industrial efficiency, has increased.

The reform has stimulated efficient producers to increase production, while due to severe cuts in prices high-cost producers have abandoned sugar production or have consolidated production to achieve efficiency goals.

Table 8.2. Post-reform situation for sugar

	Unit	2009/10 level	% change compared to 2006/07
EU reference price	EUR/t	404.4	-36
EU minimum beet price	EUR/t	26.29	-45
Production under quota	Million tonnes	13	-32
Imports	Million tonnes	3.5 — 4	+50
Exports	Million tonnes	1.37	-70

New-look EU sugar balance sheet

With the renunciation of about 5.5 million tonnes of production quota, the EU balance sheet took on a new appearance (Table 8.3). The 2008/09 supply-demand situation showed a distinct deficit: domestic output was considerably smaller than internal demand, and export availability declined dramatically while import demand grew. The European Union's historic role as an exporter of subsidised white sugar came to an end with the last-ever tender for export subsidies on 25 September 2008. On the other hand, as early as 2008/09, the European Union became the world's leading net importer of sugar.

The deficit in 2008/09 was a structural one and is not likely to disappear in the foreseeable future. In other words, domestic production is limited by quotas to around 14.5 million tonnes, raw value, and stagnant consumption (the long-term ten-year average growth rate does not exceed 0.9% per annum) imply the necessity of annual imports of around 4.5 million tonnes, raw value, as against the average for the past five years of 3.1 million tonnes. Therefore, one may conclude that, in terms of the EU sugar balance sheet, the main results brought about by the radical reform of the EU sugar regime are the end of large-scale white sugar exports to the world market and a hefty growth in import demand.

Table 8.3. EU27 sugar balance

'000 Million tonnes of raw sugar

	2009/10	2008/09	2007/08	2006/07	2005/06	2004/05	2003/04	2002/03
Production[1]	17 355	15 445	17 833	18 739	20 598	21 926	20 210	20 886
Consumption	19 937	19 742	19 570	19 612	18 495	17 734	18 517	18 218
Exports[2]	2 025	705	1 658	1 592	8 077	6 042	4 418	6 228
Imports[2]	3 720	3 675	3 075	3 340	3 196	3 343	2 414	2 712

1. Including raw cane sugar production from French Overseas Departments.
2. Including exports/imports of individual new country-members before the latest EU enlargements in 2004 and 2007.
Source: ISO statistics and forecasts.

Although in general terms the situation is quite clear, there are still a number of complications. For example, European sugar production has increased significantly in 2009/10. Both beet and sugar yields have shown a remarkable improvement boosted by the warm weather and further advances in developing high-yielding beet varieties. An early start to planting and a warm April that year boosted plant development, while good sunshine until October lifted sugar content Moreover, the area under beet increased to 1.541 million hectares, up 4.5% from the previous crop year. Of importance, the reported area includes acreage for beet used for ethanol production.

While quota sugar production remains well under control and does not exceed 13.1 million tonnes, out-of-quota production is expected to have increased to 4.3 million tonnes (Table 8.4). However, this figure includes a beet-based ethanol output equal in sugar equivalent to 1.1 million tonnes.

Following a considerable increase in sugar output in 2009/10, the sugar sector managed to convince the Commission to increase the limit for out-of-quota sugar in excess of the WTO limits to 1.37 million tonnes. At the end of January 2010, the Commission allowed an additional 0.5 million tonnes of exports of out-of-quota sugar in response to the considerable increases in European sugar production in 2009/10. The allowance was announced as a temporary measure. According to the European

Commission, this fully respects the EU's international obligations and has been made possible by the exceptional market conditions at both the EU and world levels, since the current world market prices are significantly higher than the EU reference price (EUR 404.4/tonne or USD 586.9/tonne as against the current level of world market prices of about USD 600/tonne).

The decision has met with strong criticism by major sugar exporters. On 1 February, Australia, Brazil and Thailand called for the immediate withdrawal of the additional export of 0.5 million tonnes of sugar, insisting it was illegal under WTO rules. The three states, which won a WTO dispute against the European Union in 2005, warned they would not rule out further action, including the possibility of reopening the case, which could lead to retaliation. The European Commission, however, insists that it had "done a careful analysis which shows that quantities authorised for export did not benefit from any subsidy and so cannot be counted as part of the subsidized export allowed under WTO rules".

Table 8.4. EU Sugar production in 2009-10
'000 tonnes, white value

	Quota production	Out of quota production
Austria	351	80
Belgium	676	183
Czech Republic	372	111
Denmark	372	29
Finland	81	5
France (including overseas departments)	3 237	1 176
Germany	2 898	1 464
Greece	159	
Hungary	105	42
Italy	503	
Lithuania	90	10
Netherlands	805	166
Poland	1 406	55
Portugal (including Azores)	1	
Romania	105	
Slovakia	112	32
Spain	498	115
Sweden	293	87
United Kingdom	1 056	197
Total	**13 121**	**4 347**

International implications

The EU sugar reform was widely expected to bring about higher world market prices. The immediate effect of the massive decreases in export availability of EU sugar was, however, muted. This can be explained by the fact that the first years of the reform coincided with seasons of record sugar output in India and further rapid expansion of sugar production in Brazil.

The absence of the previously guaranteed supply of EU sugar has nevertheless taken a toll on the 2009/10 season, during which both India's and Brazil's sugar outputs were far

below expectations due to bad weather in mid-2009. World market prices reached a 29-year high.

On the import front, the sugar regime reform has not changed the concept of restricted market access for imported sugar, and imports to the EU market remain highly regulated. Imports from all sugar producers not party to preferential trade agreements remain subject to the out-of-quota import tariffs: EUR 339/tonne in the case of raw sugar and EUR 419/tonne in the case of white sugar. Due to the prohibitive import duty, most sugar imported to the European Union must be delivered under one of the existing preferential access schemes, including:

- the ACP/India Sugar Protocol to be replaced by Economic Partnership Agreements (EPA) trade regime as from 1 October 2009;
- deliveries under the EBA initiative;
- regional tariff rate quota (TRQ) for sugar under the West Balkan Free Trade Agreement; and
- WTO quotas under the WTO most-favoured-nation principle (WTO schedule CXL) – the quotas agreed at the time of accession of Finland, and later of Bulgaria and Romania to the European Union.

Our analysis shows that, in general, in the case of preferential exporters, the reform of the EU sugar regime works towards the same goals as within the Community. On the one hand, the reform stimulates efficient producers to increase production, which can be directed to the still-lucrative EU market with prices considerably higher than those of the world market, while market access continues to improve considerably. On the other hand, due to severe cuts in prices, high-cost producers are expected to abandon sugar production or to consolidate production to achieve efficiency goals.

There are a number of developing countries, with preferential access to the EU market which have undertaken ambitious projects aimed at increasing both efficiency and the output of their sugar industries so as to take full advantage of their better market access to the European Union. An important consideration is that after the reform, with the consequent cut in European domestic production, preferential exporters have received not only rights to export more, but also face higher demand. Obviously, the situation varies greatly from country to country.

There are clear winners and losers of the reform. In the winning camp there are low-cost producers who are meeting a new and challenging environment by expanding cane supply and processing capacities, and thus further lowering costs of production and improving efficiency. Sudan's potential here is particularly remarkable. On the losing side, there are high-cost producers who are not able to cut their production costs nor ready to take advantage of the better market access to the European Union. So far, only St. Kitts and Nevis have decided to abandon sugar production.

Note

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Part V

The Impact of CAP Reform on the Distribution of Support and Income

Chapter 9

The impact of SPS implementation options on the distribution of support

Dr. Werner Kleinhanss[1]

This chapter uses the example of France and Germany and data from the EU FADN to project the distributional effects of the Single Payment Scheme (SPS) based on historical or regional references. For Germany, the principles of the hybrid and regional models are described and their effects on the distribution of direct payments, production and income by region, farm and farm size are estimated. The period 2004-13 is characterised by significant transfers of entitlements, from intensive beef fattening and dairy farms to extensive, grazing cattle farms, as well as a moderate regional redistribution in favour of regions with natural handicaps. Differences occur depending on farm size. The analysis of income developments over 2004-09 suggests some influence of SPS developments on income up to 2007, but as of 2008 changes in income levels are mainly driven by price developments, with larger farms appearing to adjust better to price decreases than smaller ones. Finally, a brief outline is given about the effects of possible alternative options of direct payments at the European Union level.

The Mid-Term Review and the Health Check reforms of the European Union's Common Agricultural Policy (CAP) include numerous options for national implementation of the Single Payment Scheme (SPS). After the far-reaching decoupling of Direct Payments, further reforms and changes of support measures are necessary with respect to the financial guidelines to be established for the period after 2013.

In this paper, the characteristics and distributional effects of the SPS based on historical or regional references are briefly described. Referring to Germany, the principles of the hybrid and regional models and their effects on the distribution of direct payments, production and income are shown. Finally, a brief outline is given about the effects of possible alternative options of direct payments at the European Union level.

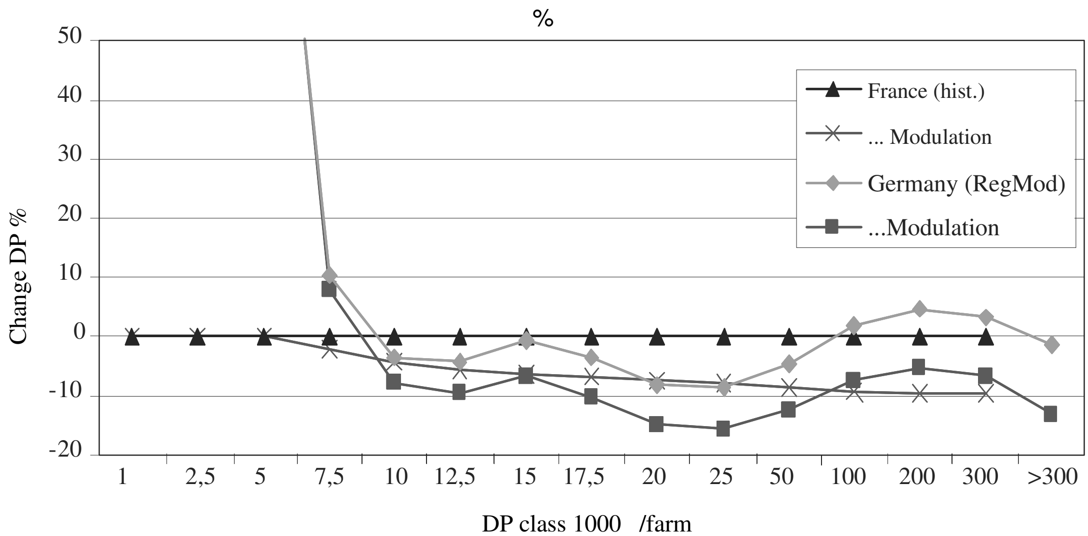
Impacts of national implementations of SPS

A central decision of the Mid-Term Review of the CAP in 2003 is the far-reaching decoupling of Direct Payments by the Single Payment Scheme (SPS). Instead of the former coupled Direct Payments related to eligible crops or livestock, decoupled payments are brought together, and entitlements are defined per hectare of eligible land. Member States are allowed to define entitlement levels on historical references at the farm level (historic model), on regional references (regional model) or a combination of both (hybrid model). The entitlements can be activated only by proof of eligible areas.

Changes of the direct payments are shown in the following examples of France (historical model) and Germany (regional model). The model calculations are carried out on basis of EU FADN data. Starting from 2007, the payments are projected for 2013, for both the historical model in France, and the fully established regional model in Germany. In addition, premium reductions based on the modulation scheme are taken into account, though without consideration of co-financing and the backflow of Pillar 2 funds.

With the historical model applied in France, the premium volume of farms remains constant[2] (Figure 9.1), the premiums are progressively reduced by modulation by up to 10% for farms with Direct Payments over the franchise of EUR 5000. In contrast, a strong premium rearrangement arises in Germany with the static hybrid model introduced in 2007.[3] Farms with a premium volume up to EUR 7 000 have strong premium increases on average. Farms with EUR 10 000 to EUR 50 000, representing structural conditions of West Germany, have to expect premium losses from 5 to 10%. Slight premium increases arise in farms with EUR 100 000 to EUR 300 000, and in even bigger companies (dominant in the eastern part) the premium volume remains steady. Premium reductions up to 13% are to be expected in the bigger companies due to modulation.

Figure 9.1. Change of Direct Payment due to National Implementation ± Modulation (Germany, France), 2013



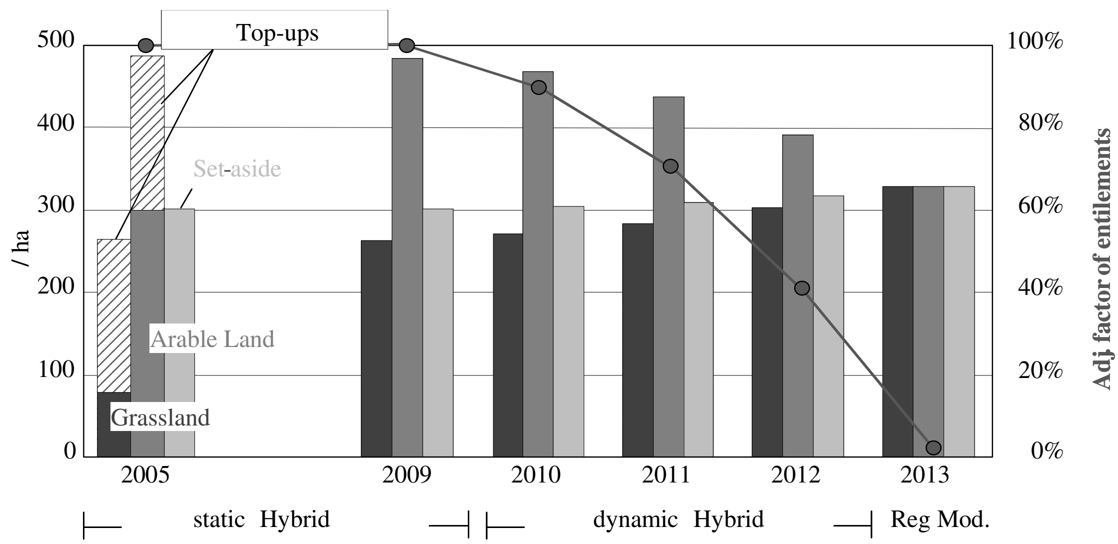
DP: Direct Payments.

Source: EU-FADN-DG AGRIL-3, own calculations.

Implementation and impacts of SPS in Germany

In Germany, the SPS was implemented in 2005, and nearly complete decoupling of direct payments was carried out. Starting as a hybrid model combining area-based entitlements and individual farm top-ups, the entitlement levels will be harmonised for all eligible areas, but regionally differentiated by Bundesländer by 2013. Also, a regional equilibration of premium volume is being carried out between the federal states, changing the former Länder budget by -5 to +14 %. The gradual transformation over time is being realised with a hybrid model. Regionalised area-related payment claims are combined with farm individual top-ups which are based on part of the livestock premia and on the total of milk and sugar premia. Levels of the payment claims and their temporal development are illustrated in Figure 9.2. In 2005, the level of the payment claims for arable land (including land set-aside) was about EUR 300/ha, while for grassland it was about EUR 80/ha. Provided that a farm raised eligible animals or produced milk in the reference period, the premiums derived are added as so-called top-ups on the entitlements for arable and grassland (with the exception of set-aside). The level of the payment claims remains constant until 2009 (except the dynamic adaptation from the upgrading of milk of sugar premia -> static hybrid model). From 2010, a progressive adaptation of the levels of the payment claims (dynamic hybrid model) occurs up to the full harmonisation in 2013.

Figure 9.2. Adjustments of entitlements in the German SPS scheme
(example**)**

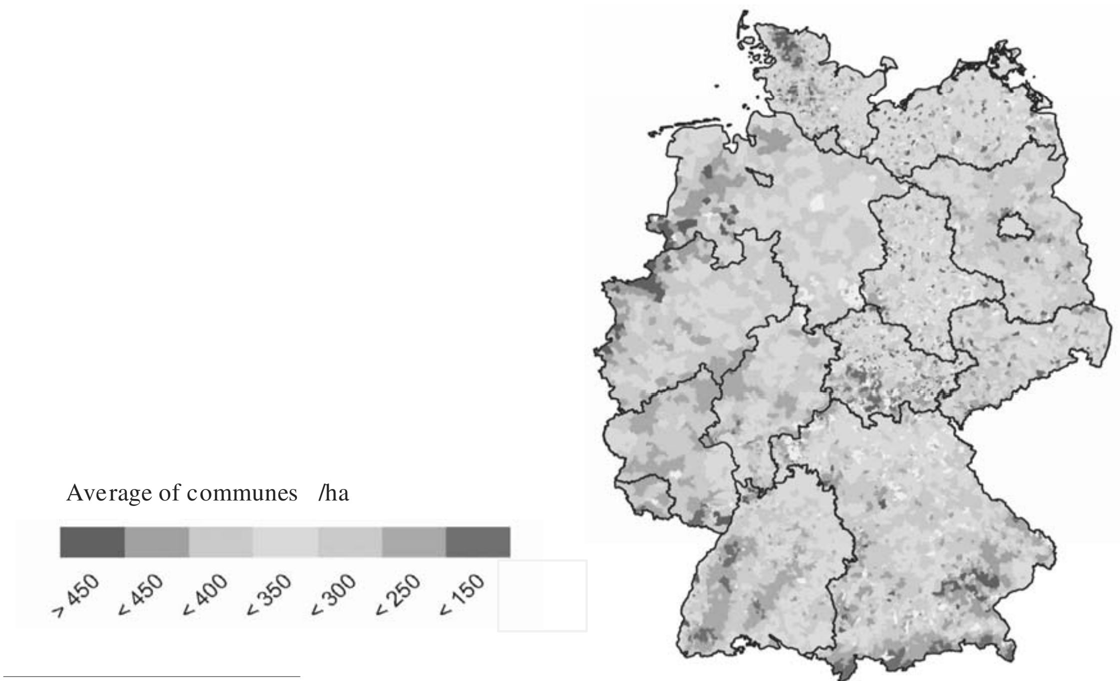


Source: Kleinhanss, vTI (2008).

Level and change of the payment claims

We refer to a study of the Technology University of Munich (Salhofer *et al*., 2009) commissioned by the Federal Agricultural Ministry (BMELV). The contractor was granted access to the central payment claims data bank for the analysis of payment distributions. Some results are shown next. Map 9.1 shows the level of the payment claims at the municipal (commune) level. Premium levels of less than EUR 150/ha are to be ascertained in the low mountainous areas in the west and the south as well as in the pre-alpine area of Bavaria, reflecting high shares of grassland and low livestock densities. Large areas with high shares of arable land show a level of payment claims of EUR 250 to EUR 350/ha. The highest level of the payment claims of EUR 450/ha and more are in areas with high concentration of bull fattening and milk production (the north, north-west and southeast). Red spots in eastern Germany point to the fact that specialised beef and milk production is often concentrated in large farms which cover the whole area of a municipality.

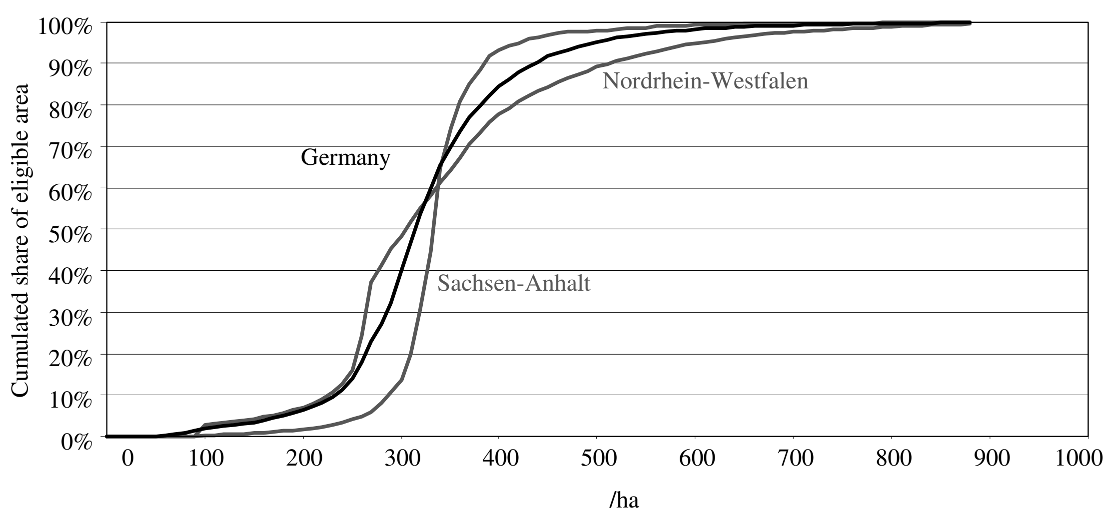
Map 9.1. Regional entitlements levels in 2005



Source: Salhofer *et al*. (2009)

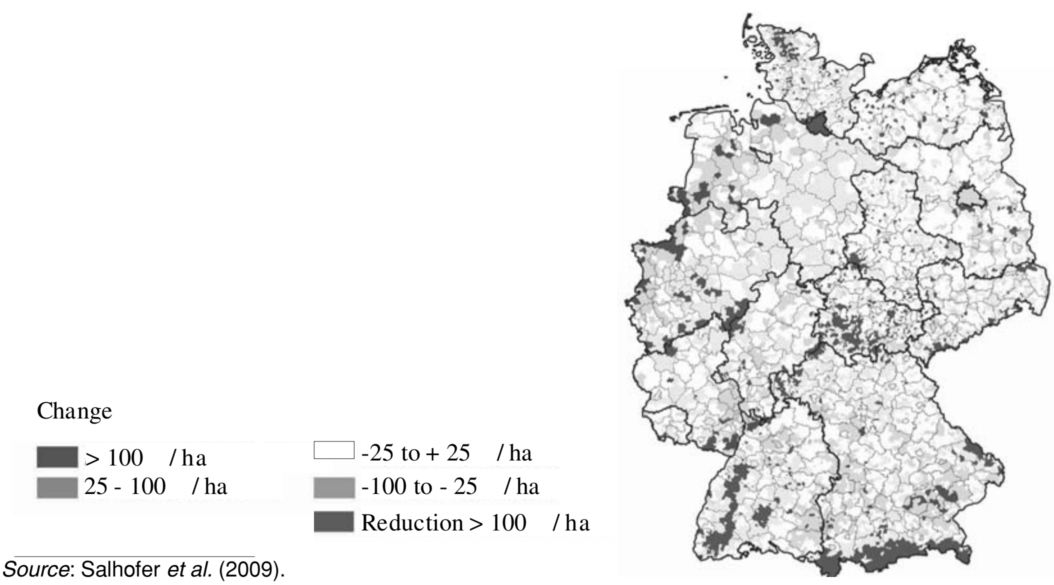
Figure 9.3 shows the cumulative frequency of direct payments for eligible areas for Germany as a whole, and in two federal states in 2007. In Germany, the payment claims for the lower and upper 10% of land is less than EUR 250/ha and more than EUR 450/ha, respectively. Länder with high shares of arable production (e.g. Sachsen-Anhalt) show a lower variation of Direct Payments than those with a high concentration of beef and milk production (e.g. Nordrhein-Westfalen).

Figure 9.3. Distribution of entitlements/ha of eligible area, 2007



Map 9.2 shows the future changes of payment claims due to full transition to the regional model in 2013. Premium increases of more than EUR 100/ha are to be expected in mountainous regions. This can be traced back to the upgrading of the level of the payment claims for grassland. On the other hand, premium losses of more than EUR 100/ha appear in areas with high concentration of bull fattening and milk production (northwest and south). In wide areas, no significant premium changes are to be expected. Nevertheless, it was found that the direct payments are redistributed above all to the disadvantage of farms with intensive beef and or milk production. Extensive cattle farms and farms located in less favoured areas are gaining.

Map 9.2. Change of entitlement levels between 2005 and 2013



Source: Salhofer *et al.* (2009).

Analysis of the effects of the SPS on base of FADN data

The evaluations and model calculations were carried out for balanced samples of farms for the period in 2004 (financial year 2003/4) to 2009 (2008/9) drawn from the national FADN (Testbetriebe). In the first two financial years, exclusively coupled direct payments were granted. The decoupled payments within the scope of the hybrid model are reflected first in 2006 (financial year 2005/6). Starting from 2010, a projection of premiums of the dynamic hybrid model as well as for the regional model in 2013 is made.

The farms are selected by orientation of production and grouped by size classes. Selection criteria used for the clusters[4] are described in Table 9.1. Weighted averages are computed using aggregation factors.

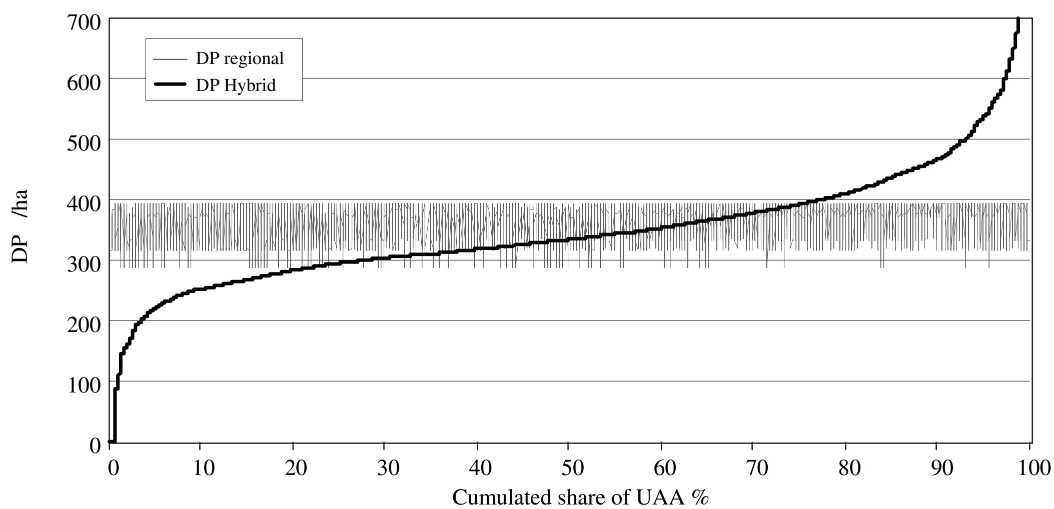
Figure 9.4 shows the distribution of the Direct Payments for the aggregated shares of land. The distribution is comparable to those shown before: entitlement levels in 2007 were less than EUR 250/ha for 10 % of land and higher than EUR 450/ha for another 10%. In 2013, the premium levels vary between 280 and EUR 380/ha depending on the location of farms in the Bundesländer and the administratively determined entitlement levels. Premium rearrangements can be derived from the comparison of the graphs referring to 2007 and 2013.

Table 9.1. Classification of farm size

Size class	Arable farms ESU	Livestock farms Heads
1	8 < 16	1 < 25
2	< 40	< 50
3	< 100	< 75
4	> 100	< 100
5	Legal enterprises	> 100

Figure 9.4. Distribution of entitlement levels related to UAA

Hybrid (2007) versus regional flat rates (2013) Germany



DP: Direct Payments; UAA: Utilized Agricultural Area.

Source: EU-FADN-DG AGRIL-3; own calculations.

The development of direct payments between 2004 and 2009, as well as the changes to be expected by 2013 compared to 2009, are shown in Figure 9.5. In the first phase, the development is gradually influenced by adjustments of milk and sugar premia:

- As a result of the introduction and the upgrading of the milk premiums, a near doubling of Direct Payments arises for dairy farms with up to 100 dairy cows. For the bigger farms, the increase is only half, because of larger arable areas and diversification. The milk market reform is also reflected in the premium increase of farms with up to 50 bulls that often pursue bull fattening combined with milk production.
- The introduction and the upgrading of the sugar beet premiums is reflected in an increase of direct payments for arable farms of size class 2 to 4.

Substantial premium losses appear in the period studied only for farms with bull fattening (from 50 to 100 bulls). Between 2005 and 2006, the premiums decreased by 10 to 15% due to conversion of cattle premiums in favour of grassland premia.

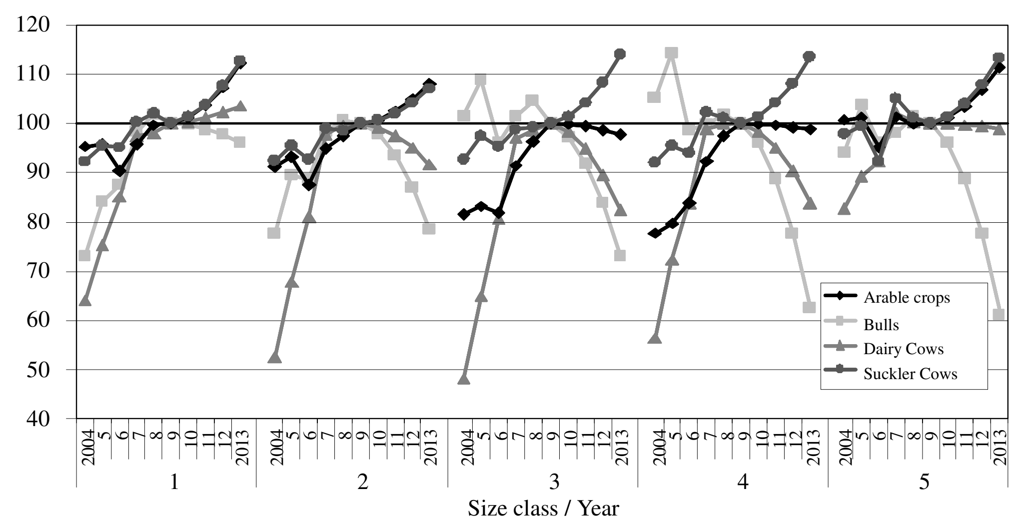
The adjustment of payment claims by 2013 differs by farm type:

- For arable farms with up to 40 ESU (European Size Unit) as well as for legal entities located in the east, the premium level rises by up to 10%, while it decreases for the remaining size classes.
- Small dairy farms will get slightly higher premia, mainly due to the upgrading of grassland entitlements. This is also valid for size class 5 which lies above all in eastern region, with larger UAA and more diversification. However, farms dominant in West Germany with 25 to 100 cows have to expect premium losses of about 10 to 20%.
- Farms specialised in bull fattening will have premium losses of 20 to 40% by 2013. Including the premium adaptation that had already occurred by 2009, the premium volume decreases to about half compared to the previous system with coupled premiums.
- Companies with suckler cows have to expect premium increases up to 12% by 2013; they profit above all from the introduction and upgrading of the payment claims for grassland.

In sum, it can be seen that the implementation of the SPS leads to a strong redistribution of Direct Payments to the disadvantage of intensive beef fattening and dairy farms. Also, a moderate regional redistribution occurs in favour of extensive and grassland-based cattle farms, as well as less favoured regions.

Figure 9.5. Development of Direct Payment by type size and of farms

% of 2009



Source: BMELVT Tesbetriebe; Kleinhanss.vT1 (2010).

Beside differences between farm types, variation within the farm types is considerable. This is shown for farms with bull fattening and milk production (Figure 9.6). About 60% of farms represented by FADN data will have premium losses up to 50%, while another 10% can expect premiums increased by more than two thirds.

The development of production is shown in Figure 9.6. For arable farms, UAA is used as an indicator. In farms of size class 1 to 4, the UAA increases according to trend

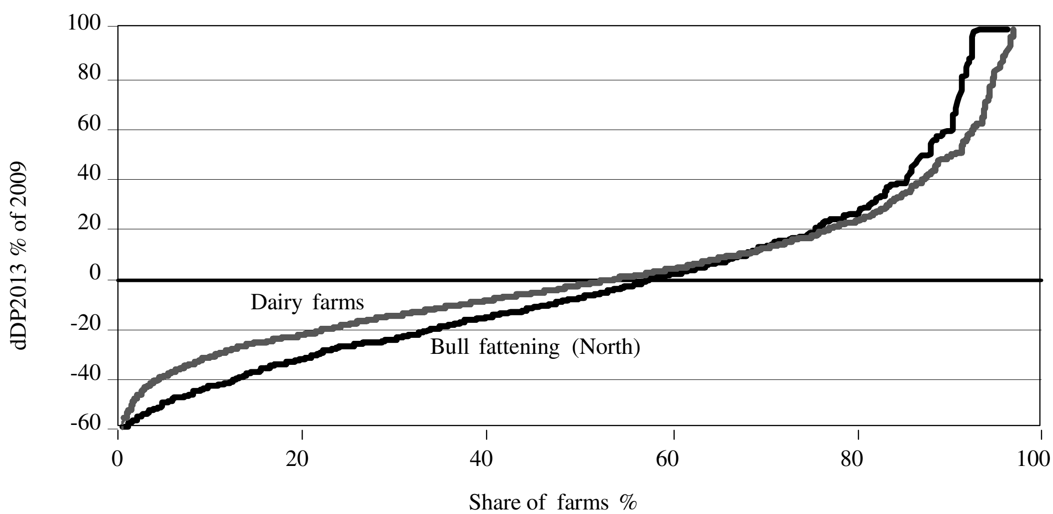
by 1 to 2% annually. However, in the legal entities (east region), UAA decreases, led by previously rented areas being taken over by newly established private farms or by partnerships, as being more profitable and competitive on the land rental market. Small dairy farms have reduced dairy cow numbers by about 10%, due in part, however, also to structural change. Milk quotas are being taken over predominantly from farms with 50 to 100 cows, which have increased their herd sizes continuously.

A different picture arises for farms with suckler cows. The smaller of these farms have reduced their cow numbers by around 20%. This can be traced back to additional controls in connection with cross-compliance requirements, or to the fact that managers have also well understood decoupling, and that receiving premia based on former cow numbers without keeping suckler cows creates higher income. Only in Group 3 were cow numbers expanded up to 2008 by around 10%, which can be interpreted as a reaction to market signals.

In bull fattening, the small farms have not reacted with production adaptation, while those of the size classes 2, 4 and 5 reduced their production up to 25 %. Farms of size class 3 have expanded by about 10% and therefore reacted to market signals.

Figure 9.6. Distribution effects of regional flat rates (2013)

Compared to hybrid model (2009)

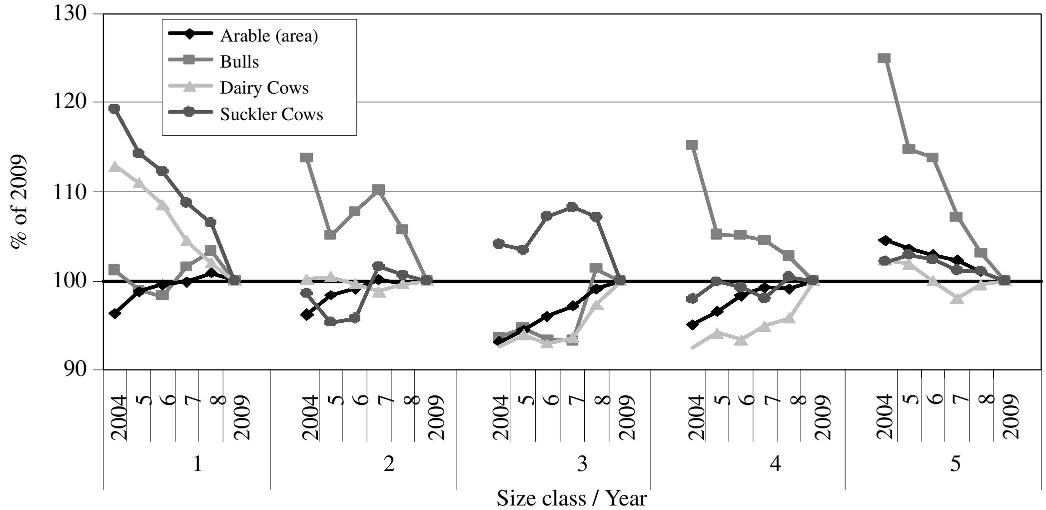


DP: Direct Payments.

Source: BMELVT Tesbetriebe; Kleinhanss.vTI (2010).

Figure 9.7. Development of production by type and size of farms

% of 2009 levels

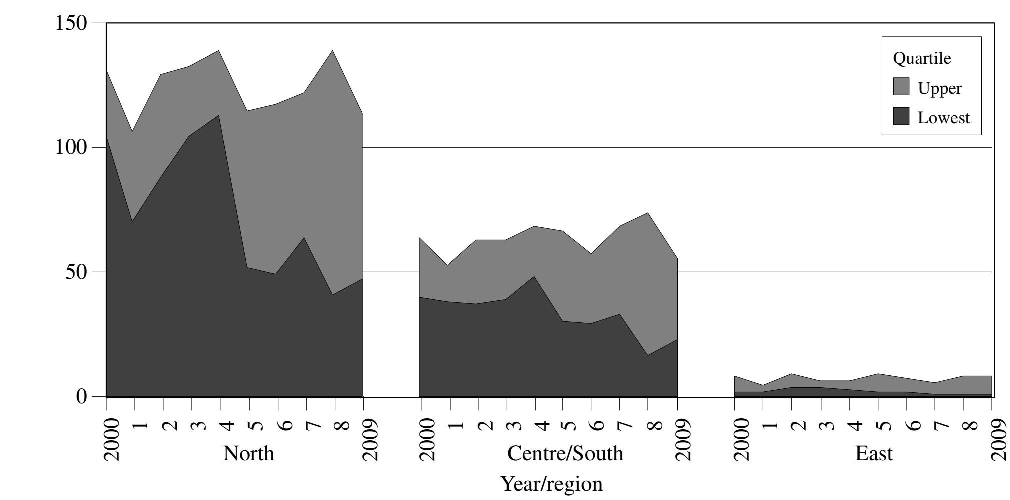


Source: BMELVT Tesbetriebe; Kleinhanss.vTI (2010).

According to another evaluation (Figure 9.8), it appears that the extent of bull fattening was almost stable for the total of farms in the upper and lowest quartiles (classified with respect to average income since 2000). Since decoupling, bull numbers were strongly reduced in farms of the lowest quartile but were expanded in farms in the upper quartile. This adjustment in favour of the most profitable farms took place above all in the north, while the adaptation reaction was much less in the south. Finally, this picture also illustrates the low importance of bull fattening in the eastern region.

Figure 9.8. Development of bull fattening in specialised farms

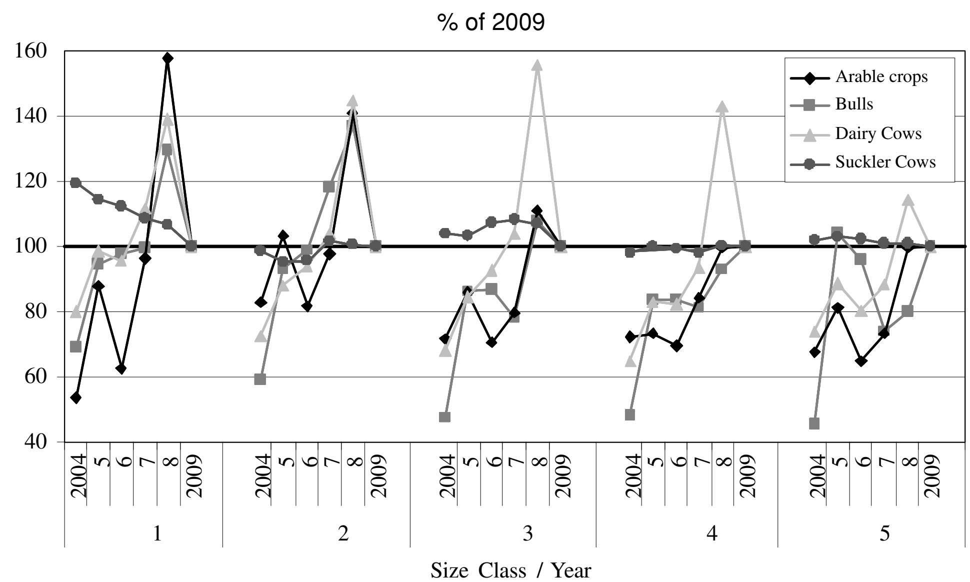
1 000 Heads



Source: BMELVT Tesbetriebe; Kleinhanss.vT1 (2010).

The income development, expressed by the "adjusted profit plus labour costs"[5] was influenced until 2007 partly by the rearrangement of the SPS; in 2008, however, it was influenced above all by the high prices of arable crop products and milk, as well as in 2009 by the strong drop of milk prices (Figure 9.9). The income development of farms with suckler cows continuously decreased. Arable farms had a positive income development till 2007. The income of the size classes 1 and 2 rose until 2008 by about half, but fell back in the subsequent year again to the 2007 level. Bigger farms have obviously succeeded in stabilising the price level in 2009 by futures contracts and in securing their high income levels. Bull fattening farms also showed a positive income development, which is overshadowed, however, in the smaller farms by the price trend of milk and in the big farms by the prices of arable crop products.

Figure 9.9. Development of income (adjusted profit + labour costs)



Source: BMELVT Tesbetriebe; Kleinhanss.vTI (2010).

Alternative direct payment arrangement options

The last section will focus on the first results from model calculations with respect to alternative arrangements of direct payments (Bureau *et al.*, 2010). Regional or EU-uniform flat rates per hectare are examined, derived from the premium budget of EU member states or EU27 together. In addition, progressive premium reductions by premium level of farms (equivalent to modulation) are considered, as well as upper direct payment limits related to labour capacity (< EUR 15 000/AWU for farms with direct payment > EUR 50 000).

The model calculations are carried out on the basis of individual farm data from the EU FADN. These data refer to 2013 and include a complete implementation of the regional models of SPS in England and Germany as well as an entire upgrading of payment levels in the new EU member states. The distributional effects of flat rates are close to the German regional model. Indeed, uniform EU-based flat rates induce clear re-distributions to the disadvantage of the EU15 and in favour of most new member states. The premium limitations with respect to AWU lead to significant premium reductions for farms with more than EUR 100 000 of direct payments, above all in Germany, the

United Kingdom, France and Italy. In the new Member States, only relatively low reductions arise from this alternative, due to the higher labour input of those farms.

Model calculations based on the transformation of half of Pillar 1 premiums in favour of Pillar 2 payments (without considering co-financing) show above all strong income losses in the bigger farms, because the transfer efficiency of Pillar 2 payments with respect to income is perhaps only half that of Pillar 1 payments.

Notes

1. Johann Heinrich von Thünen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Farm Economics, Germany.
2. Based on the Health Check reform, the payments in France that are still coupled have been redistributed mainly in favour of suckler cows and grassland-based milk production (Chatellier and Guyomard, 2010).
3. Rearrangements between the former Direct Payments and the implementation of the hybrid model since 2005 are not considered.
4. The stratification in production direction occurs separately for each group; overlapping above all in the smaller farms, e.g. between bull fattening and milk production.
5. This indicator is commonly used for income comparisons between private farms and legal entities.

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Chapter 10

The CAP Health Check in France: A significant redistribution of payments?

Vincent Chatellier and Hervé Guyomard[1]

This chapter presents an analysis of the consequences of the implementation, in France, of the Health Check of the Common Agricultural Policy (CAP). The simulations, conducted with the Farm Accountancy Data Network (FADN), demonstrate a shift of direct payments in favour of extensive grazing farms, mainly those with a high proportion of pasture in their rotation. By contrast, crop farms and farms with intensive production of cattle are losers. The redistribution of direct payments permitted through modulation and Articles 63 and 68 of the European Council (EC) Regulation is favourable to disadvantaged areas, particularly mountainous areas. This change in the CAP is moving towards increased standardization of the amount of decoupled payments per hectare. In addition, it promotes a more focused allocation of resources for the protection of natural resources and compensation for environmental and territorial services.

The Common Agricultural Policy (CAP) has been subject to a continuous process of revision since 1992 (Borzeix *et al.*, 2006; Bureau, 2007), and was again reformed on 20 November 2008 (European Council, 2009). Another step was thus taken in the course set in the early 1990s, which can be summarized as follows: progressive dismantling of direct price support (Butault, 2004); compensation for lost income through direct payments that are increasingly disconnected from current agricultural production (a process known as the decoupling of direct Pillar 1 payments); granting of direct Pillar 1 payments made contingent on compliance with directives and regulations and on maintaining the land in good agricultural and environmental condition (GAEC) (conditionality constraint); and simultaneously increasing environmental aid (especially in the form of agri-environmental measures) and territorial aid (primarily in the form of compensatory payments for natural handicaps). These Pillar 2 payment programmes are funded with resources diverted from Pillar 1 on a "communicating vessels" principle (a process known as modulation).

The Community decisions adopted on 20 November 2008 were the outcome of a political compromise providing member states with considerable leeway in terms of domestic implementation (European Council, 2009). In the case of France, the decisions were handed down by the Minister responsible for agriculture on 23 February 2009 (Ministry of Agriculture and Fisheries, 2009). In this context, this paper is divided into three sections. The first recapitulates the principal decisions made at the Community and domestic levels in the framework of the CAP Health Check. This is necessary for understanding the new Community regulations on agricultural support as well as subsequent domestic decisions. The second section details methodological elements explaining the rationale of this study. It presents, in the following order, the data source (the Farm Accountancy Data Network, or FADN), the method for classifying agricultural holdings on the basis of farm type and geographical zone, and the assumptions underlying our simulations of the CAP Health Check. The third section describes the economic impacts for French farms of the legislation passed on 23 February 2009.

The Health Check of the CAP

The CAP Health Check is presented in three steps: the first details the main developments contained in the EU regulations of November 2008, the second describes the latitude given to member states in applying these regulations, and the third examines the choices made by the French Minister.

EU regulations resulting from the decisions of 20 November 2008

The EU decisions of 20 November 2008 represent a continuation of the 2003 reform of the CAP (Butault *et al.*, 2005). Besides abolishing compulsory set-aside and changing the rules of intervention, the rules adopted address the following elements.

An increase in the decoupling rate

As of 2012, the CAP Health Check requires full decoupling of all direct payments (OECD, 2001), except for the option to retain the suckler cow premium and the sheep and goat premium (Gohin, 2008).

The CAP reform of 2003 authorised member states to maintain coupling of some direct payments previously granted on a per-hectare or per-head (of cattle) basis (partial coupling). In France, direct payments continued to be coupled: in the case of arable crops (cereals, oilseeds and protein crops) at 25%; in the case of livestock products at 100% for the suckler cow premium and the calf slaughter premium, at 40% for the adult beef slaughter premium, and at 50% for the sheep premium. In other countries with less productive and geographic diversity, the issue of the decoupling intensity was considered less crucial (Piet *et al.*, 2006; Chatellier and Guyomard, 2008). Thus, Ireland, Luxembourg and the United Kingdom opted for application of full decoupling. Germany (Kleinhanss, 2005), Italy, and Greece also retained the full decoupling principle with the exception of the seed sector and other specific crops, but Austria, Belgium, and the Netherlands applied partial coupling to seeds and livestock products.

An invitation to greater harmonization of per-hectare decoupled payment levels

In France, as in many other countries and/or regions, the single farm payment (SFP) was implemented on the basis of the “historical” model. The amount of the SFP received by each farm corresponds to direct payments (coupled with production factors) received during the 2000-02 reference period. To activate the SFP (the activation constraint), the farmer must own or lease a number of hectares at least equal to the number of single payment entitlements. Farmers are not obliged to produce in order to receive the SFP, but they must comply with several Directives and Regulations, and maintain their land in good agricultural and environmental condition (GAEC) (the conditionality constraint). Consequently, by its very nature, the historical model freezes the distribution of budgetary support across farms (Chatellier, 2006). In other member states, the model for implementing decoupling differs (Boinon *et al.*, 2006).

In this context, the Health Check encourages, but does not oblige, member states having retained the historical model to progressively adopt a more standardized SFP mechanism across farm categories. The reason for this suggestion is to address the objection that, over time, it will become increasingly difficult to justify granting budgetary support to farms solely on the basis of historical precedent.

A mandatory increase in modulation

The modulation rate of CAP Pillar 1 payments will rise from 5% in 2008 to 10% in 2012. The appropriated funds will be channelled to Pillar 2, where they will be earmarked for the “new challenges:” climate change, renewable energies, biodiversity, and water management (according to unspecified mechanisms). They will also go towards funding innovation in these four environmental fields and accompany the dismantling of dairy quotas. All the moneys raised are retained by the member states.

Elimination of dairy quotas by 2015

In order to achieve the progressive elimination of the European Union dairy quota, its level will be increased by one per cent per year, starting in 2009. This change in the rules of the Common Market Organisation (CMO) will in all

likelihood have an impact on the location and dynamics of dairy farms, as well as downstream processing facilities. In France, after 25 years of dairy quotas, the issues raised by this decision are particularly relevant in view of its unique mode of managing quotas (free right to produce, free allocation of the quantities "released" to priority farmers, strong link between the quota and the land, administrative management of supply at the *Département* level, etc.), and because less favoured areas contribute to the national milk supply in a fairly substantial way (Lelyon *et al.*, 2008).

Latitude of the member states in applying the regulations

Successive reforms have left the CAP less and less common and more and more *à la carte* in its implementation. Nonetheless, it continues to be mainly financed from Community funds. In fact, only Pillar 2, which is much smaller than Pillar 1, is co-financed from national budgets. This state of affairs gives rise to at least two closely linked problems: justifying Community funding of measures that are implemented differently across member states, and, more generally, justifying the very goals of the CAP, especially those pursued by the decoupled payments of Pillar 1.

These questions regarding the legitimacy of a CAP which, although funded from a common purse, is increasingly heterogeneous, need to be viewed in the context of discussions (already underway) regarding the financial position of the post-2013 European Union, to the extent that there will be no shortage of requests that a portion of the agricultural resources be diverted to targets that some will feel are a higher priority, more strategic, or sources of growth or productivity gains: training, research, employment, etc. This is all the more likely in that, in addition to questions over its goals, the CAP is also criticised for its unfair distribution of budgetary support, – especially in countries such as France which have retained the historical model. Under both the historical model and the regionalised flat-rate model, the larger an operation, the more the decoupled direct payment it will receive (all other things being equal). In the historical model, this distribution is largely frozen to reflect conditions during the 2000-02 reference period.

The decisions taken in November 2008 therefore allow member states considerable leeway in implementing the EU regulations. This creates more problems for France than for other member states (Ministry of Agriculture and Fisheries, 2008), mainly because France is less advanced in the reform process (historical model, partial decoupling, central role played by government in managing the milk supply, etc.) and must contend with a greater diversity of productive and geographical realities. However, a member state can juggle various measures in order to tailor the distribution of direct Pillar 1 and 2 aid. This "tool box", as the French Minister of Agriculture calls it, contains:

- *Voluntary modulation.* In addition to the mandatory modulation of direct Pillar 1 payments (see above), member states have the option of implementing a more far-reaching voluntary modulation. This option was chosen by the United Kingdom.
- *Article 47.* This article allows member states using the historical model to incrementally adjust the value of entitlements in at least three pre-established steps and in accordance with objective and non-discriminatory criteria such as

the agricultural potential or environmental criteria. Funds released by this process are reallocated on a regional basis.

- *Article 68*. This article authorises a country to withdraw as much as 10% of direct payments from Pillar 1 and divert it to five objectives: 1) environment, and the quality and marketing of products; 2) compensation for geographical or sectoral handicaps; 3) higher decoupled per hectare payments in areas at risk of agricultural abandonment (decline); 4) assumption of a portion of crop insurance premiums in the arable crops sector; and 5) participation in mutual funds for combating animal and plant diseases.
- *Article 63*. This article authorises member states to divert some or all of the savings from increased decoupling to establish payment entitlements or to increase the value of the payment entitlements on the basis of the type of agricultural activities exercised by farmers during one or more years in accordance with objective and non-discriminatory criteria such as the agricultural potential or environmental criteria. The Health Check postulates incremental decoupling of all Pillar 1 budgetary support except, at the discretion of the member state, the suckler cow premium and the sheep and goat premium.

French decisions handed down on 23 February 2009

The great variety of available tools makes it possible that a single destination point can be (could have been/might be) reached via several different paths. Accordingly, decoupled direct payments that are more consistent per hectare can be (could have been/might be) achieved by shifting from the historical model to a flat-rate model. The French Minister of Agriculture took another route, maintaining the principle of decoupled direct payments based on historical references, but generally making generous use of Articles 63 and 68 of the toolbox to instigate a significant redistribution from cropland toward pasture. Voluntary modulation and Article 47 did not find favour in France.

Diversion of a portion of agricultural supports towards four goals

The French choices target the following four goals:

- to set up a new mode of support for pastures (EUR 970 million, including the domestic contribution and the agri-environmental grass premium);
- to consolidate the economy and employment throughout the territory with support for vulnerable production types (EUR 265 million, including the domestic contribution);
- to establish instruments for hedging climate and health risks (EUR 140 million, off-budget, from the Ministry of Agriculture and with contributions from commercial operations); and
- to promote sustainable agricultural development by increasing support for farming systems that are more environmentally sensitive (EUR 129 million, including the domestic contribution).

Reallocation of credits under Articles 63 and 68, and modulation

To ensure that these four objectives are adequately funded, a budgetary redeployment is implemented involving the three previously mentioned tools: compulsory modulation, Article 68, and Article 63. The selected targets are achieved by allocating funds to the thirteen items presented in Table 10.1 (source of funding is also indicated).

Table 10.1. Reallocation of budgetary support* attributable to domestic Health Check decisions of 23 February 2009

Allocation of funding	Source of funding
[I] "New support for grazing": EUR 970 million	
(1) Payment for productive grasslands (700)	Article 63
(*) Agri-environmental grass premium (240, including 64 in national contributions)	Additional modulation of 5%
(2) Fodder payment (30)	Article 63
[II] "Consolidation of vulnerable production types": EUR 265 million	
(3) Sheep and goats (135)	Article 68
(4) Milk from mountains (45)	Article 68
(5) Durum wheat in traditional areas (8)	Article 68
(6) Suckling calves (4.6)	Article 68
(7) Open field vegetables and potatoes (30)	Article 63
(8) Supplement to compensatory payments for natural handicaps (42, including 19 in national contributions)	Additional modulation at 5%
[III] "Support for sustainable systems of production": EUR 129 million	
(9) Protein plants (40)	Article 68
(10) Organic, maintenance and conversion (57, including three in national contributions)	Article 68 (and additional modulation)
(11) New challenges (32, including 14 in national contributions)	Additional modulation at 5%
[IV] "Establishment of an instrument for hedging risk": EUR 140 million	
(12) Crop insurance (100, off-budget from Agriculture Ministry and contributions from commercial operations)	Article 68
(13) Health fund (40, off-budget from Agriculture Ministry and contributions from commercial operations)	Article 68
Total [I] to [IV]: EUR 1 504 million (including 100 in national contributions) Less agri-environmental grass premium: EUR 240 million (including 64 in national contributions) Total redeployed: EUR 1 264 million (including 36 in national contributions)	

* Annual estimation in 2013.

In the first instance, we observe the extent of the budgetary redistribution: EUR 1.5 billion according to figures published by the Ministry of Agriculture and Fisheries (domestic contribution estimated at EUR 100 million, not counting the instrument for hedging risk that is assumed, off-budget, by the Ministry and by commercial operations). By way of comparison, Community and domestic contributions to agriculture and rural areas in France amounted to EUR 12.2 billion in 2008, of which EUR 5.7 billion were in decoupled direct payments (single payments), EUR 2.7 billion in coupled direct payments, and EUR 1.8 billion in

direct Pillar 2 payments. Of these EUR 1.5 billion, EUR 240 million (or 16%) are for the agri-environmental grass premium, whose funding is thus assured.[2] As of 2013, the maximum potential redistribution on a full-year basis will be EUR 1.26 billion (including a EUR 36 million domestic contribution).

The primary vehicle for this redistribution will be the new assistance, to the amount of EUR 700 million (Table 10.1), for productive grassland. This is followed, though at a considerable distance, by support for sheep and goats (EUR 135 million annually) and increased support for crop insurance (EUR 100 million annually). An analysis focused exclusively on targets and beneficiaries might be misleading; it would be more appropriate to analyse budgetary inflows and outflows together, so that the net contributors and recipients of funds disbursed under the decisions rendered on 23 February 2009 can ultimately be identified by farm type, region, etc.

A method for simulating measures resulting from the CAP Health Check

A simulation was carried out to assess the redistributive impacts of the French decrees of 23 February 2009 on direct payments and farm income. In order to better understand the strengths and weaknesses of this analysis, the next section presents its key methodological features, namely the choice of data source, the method for classifying farms, and our main assumptions regarding the allocation of funds to farms.

Data source and farm classification

The simulations were performed using individual data from FADN for fiscal year 2007. Of the various farm databases available (Chantry, 2003), FADN is unique in that it incorporates detailed information on their structures, economic returns, and financial positions. Each farm in the sample (7 377 units) is assigned a weighting coefficient,[3] allowing it to be extrapolated to represent 322 300 commercial holdings.[4]

Simulations were run for each farm in the sample, and the results then aggregated into composite indicators and categorized using a typological grid cross-matching the 22 metropolitan administrative regions to the following types of production (Box 10.1).

The distribution of commercial agricultural holdings across the seven farm types and 22 administrative regions is presented in Table 10.2. In the case of types with a sample size of fewer than 15 individuals, the results are not considered to be representative (these are labelled “N/A”). When assessing the regional effects of the CAP Health Check, it is important to take into consideration the prevalence of each farm type in the agricultural mix of the region.

Box 10.1. Definitions of types of production

Arable crops. All farms having fewer than five units of grazing livestock and engaged in the following farming activities: No. 13 Specialist cereals, oilseed and protein crops; No. 14 General field cropping; No. 60 Mixed cropping; No. 71 Mixed livestock, mainly grazing livestock; No. 81 Field crops-grazing livestock combined; and No. 82 Various crops and livestock combined.

Cattle, dairying. All farms with more than five dairy cows. This definition makes it possible to group all domestic milk production into a single type.

Cattle, rearing/fattening. All farms with fewer than five dairy cows and more than five head of cattle.

Mutton sheep. All farms with more than five units of grazing livestock and fewer than five head of cattle.

Pigs and poultry. All farms with fewer than five head of grazing livestock and belonging to farm types No. 50 "Specialist pig/poultry" and No. 72 "Mixed livestock, mainly pig/poultry". Consequently, beef and/or sheep farms with a sideline of pigs or poultry are not included in this type, but rather in the previous types.

Wine. All farms with fewer than five head of grazing livestock and belonging to farm types No. 37 Vineyards with a designation of origin and No. 38 Other wine.

"Other" farm types. All farms with fewer than five head of grazing livestock and belonging to farm types: No. 28 Market gardening, No. 29 Flowers and mixed horticulture, and No. 39 Fruits and other perennials.

Table 10.2. Number of farms by production type and the regions of France

	Arable crops	Milk cows	Beef cows	Sheep and goats	Pigs and poultry	Wine	Others	Total
Alsace	2 000	1 100	500	100	0	2 100	200	6 100
Aquitaine	5 400	3 000	8 000	1 100	500	6 800	1 700	26 600
Auvergne	1 000	7 500	7 000	1 200	100	0	0	16 800
Basse-Normandie	1 400	9 200	2 600	300	100	0	200	13 700
Bourgogne	3 300	1 300	6 800	400	100	2 900	200	14 800
Bretagne	4 500	16 700	2 200	400	2 800	0	900	27 600
Centre	10 100	1 400	3 400	700	100	1 100	600	17 400
Ch.-Ardennes	5 600	3 000	1 000	0	0	6 600	0	16 100
Corse	100	0	700	200	0	200	200	1 500
Franche-Comté	400	4 800	500	300	0	200	100	6 300
Haute-Normandie	1 200	3 200	1 700	200	0	0	300	6 600
Île-de-France	3 200	0	200	200	0	0	300	3 900
L-Roussillon	1 700	600	1 300	900	0	10 400	2 600	17 500
Limousin	100	600	7 900	800	0	0	100	9 600
Lorraine	800	4 100	2 600	200	0	0	100	7 800
Midi-Pyrénées	7 700	3 700	10 600	4 600	700	900	1 500	29 700
Nord-Pas-de-Calais	3 000	5 300	1 500	0	100	0	200	10 000
Pays de la Loire	3 100	11 000	9 100	600	400	1 300	1 500	27 000
Picardie	4 500	3 500	1 600	100	0	400	0	10 100
Poitou-Charentes	6 000	2 000	3 900	1 500	400	2 700	500	17 000
PACA	2 200	100	400	1 400	0	4 000	4 100	12 200
Rhône-Alpes	3 600	8 200	4 600	1 600	200	3 100	2 700	23 900
France	70 900	90 500	77 900	16 800	5 700	42 500	18 100	322 300

Source: AGRESTE – RICA France 2007 / INRA SAE2 Nantes calculations.

Main assumptions retained in the simulation

Our estimates are designed to evaluate the economic impact that changes to the method for allocating direct payments resulting from the decrees passed on 23 February 2009 will have on farms. This impact is measured against the reference situation (historical model), with all other factors being held constant, *i.e.* no allowance is made for farmers adapting their production to the new situation or for productivity gains, which vary across the categories of farming operations (Butault, 2006). Similarly, movements in output prices (Gohin and Latruffe, 2006) and/or factors of production are not taken into consideration, regardless of whether they are caused by the decisions or are exogenous.

The impact of measures identified by the CAP Health Check is evaluated in euros per farm and/or as a percentage of total direct payments (Table 10.3) and/or income.[5] In recognition of the wide fluctuations in the prices of agricultural produce in recent years (especially cereals and dairy products), the impact of the budgetary redistribution is reported as a five-year average (period 2003-07, in constant 2007 EUR). It is important that this impact, expressed as a percentage of revenues, be discussed from the standpoint of final income. In the same vein, depending on the type of farm, the sometimes extensive use of hired farm labour may have the effect of creating a significant gap between farm income and family income (Table 10.4).

First, the simulation evaluates the economic impact on each farm of the disbursements under Article 63 (EUR 760 million, of which EUR 630 million are in direct payments for cereals, oilseed and protein crops and EUR 130 million for livestock premiums[6]) and under Article 68 (estimated at EUR 390 million) and the increase in the modulation rate (estimated at EUR 310 million nationwide). Evaluation of the budgetary appropriation posed no particular challenges, since the item “Subsidies” in FADN makes it easy to identify the amount of the single payment and of the coupled aid that will be decoupled in 2010.

Second, for each of the 13 expenditure items, the simulation assigns to every farm values that sum to EUR 1.26 billion (of which EUR 36 million are from the domestic contribution). The assumptions used to apportion these funds should by no means be construed as a prediction of the decisions that will finally be forthcoming from the task forces established by the Minister of Agriculture, whose mandate is to provide details regarding the technical application of the mechanisms decided upon.

Table 10.3. Level of direct payments per farm
EUR, 2007

	Arable crops	Milk cows	Beef cows	Sheep and goats	Pigs and poultry	Wine	Others	Total
Alsace	27 500	34 700	N/A	N/A	N/A	1 900	N/A	18 700
Aquitaine	24 000	27 100	25 200	14 700	N/A	2 900	8 700	17 700
Auvergne	34 300	29 200	42 100	24 400	N/A	N/A	N/A	34 300
Basse-Normandie	30 500	30 200	33 100	N/A	N/A	N/A	2 600	30 100
Bourgogne	49 000	53 300	47 400	N/A	N/A	2 300	N/A	38 600
Bretagne	12 600	27 100	24 600	N/A	10 600	N/A	8 200	21 900
Centre	45 000	47 600	49 700	33 100	N/A	4 000	5 900	41 500
Champagne-Ardennes	57 800	59 800	50 400	N/A	N/A	1 900	N/A	34 900
Corse	N/A	N/A	28 700	20 700	N/A	5 200	17 800	21 000
Franche-Comté	36 900	31 300	38 000	N/A	N/A	900	N/A	30 400
Haute-Normandie	42 700	41 800	44 400	N/A	N/A	N/A	N/A	40 300
Île-de-France	55 100	N/A	N/A	N/A	N/A	N/A	4 000	50 100
Languedoc-Roussillon	29 300	27 500	44 700	30 000	N/A	5 500	7 000	13 000
Limousin	N/A	31 600	35 900	25 100	N/A	N/A	N/A	34 200
Lorraine	46 200	51 100	50 100	N/A	N/A	N/A	N/A	49 600
Midi-Pyrénées	31 100	28 900	34 700	27 900	N/A	6 500	9 600	29 000
Nord-Pas-de-Calais	22 200	33 100	34 600	N/A	N/A	N/A	N/A	29 100
Pays de la Loire	26 300	31 800	35 200	N/A	N/A	1 700	7 400	28 700
Picardie	53 100	51 700	60 100	N/A	N/A	N/A	N/A	51 200
Poitou-Charentes	37 400	52 100	42 500	29 400	N/A	8 000	3 400	33 100
PACA	22 800	N/A	N/A	45 800	N/A	2 400	4 300	13 100
Rhône-Alpes	21 200	25 600	32 400	21 100	N/A	1 500	7 800	20 800
France	36 200	33 700	37 800	27 000	8 000	3 500	6 500	28 900

N/A: Not representative. *Source:* AGRESTE – RICA France 2007 / INRA SAE2 Nantes calculations.

Table 10.4. Current revenues before income taxes per family farm job
EUR, average over five years

	Arable crops	Milk cows	Beef cows	Sheep and goats	Pigs and poultry	Wine	Others	Total
Alsace	24 500	20 900	N/A	N/A	N/A	N/A	31 900	26 400
Aquitaine	15 800	14 600	12 100	7 100	7 100	N/A	17 100	14 500
Auvergne	21 200	13 600	20 300	7 000	7 000	N/A	N/A	16 100
Basse-Normandie	28 000	19 200	17 200	N/A	N/A	N/A	N/A	19 300
Bourgogne	31 700	22 400	21 100	N/A	N/A	N/A	35 700	26 200
Bretagne	18 600	21 600	18 900	N/A	N/A	18 600	N/A	20 700
Centre	35 600	24 100	26 600	14 100	14 100	N/A	31 400	30 300
Champagne-Ardennes	46 400	28 200	29 600	N/A	N/A	N/A	119 700	66 200
Corse	N/A	N/A	19 300	16 700	16 700	N/A	23 500	17 300
Franche-Comté	20 500	18 500	20 400	N/A	N/A	N/A	61 200	19 500
Haute-Normandie	29 800	25 600	23 700	N/A	N/A	N/A	N/A	25 700
Île-de-France	44 300	N/A	N/A	N/A	N/A	N/A	N/A	38 900
Languedoc-Roussillon	13 200	15 600	20 900	14 700	14 700	N/A	7 300	11 700
Limousin	N/A	17 400	19 700	12 000	12 000	N/A	N/A	18 800
Lorraine	31 300	24 300	24 600	N/A	N/A	N/A	N/A	24 800
Midi-Pyrénées	15 400	15 100	16 000	11 400	11 400	N/A	6 600	14 700
Nord-Pas-de-Calais	23 400	22 600	23 100	N/A	N/A	N/A	N/A	22 300
Pays de la Loire	26 900	20 200	21 300	N/A	N/A	N/A	18 000	21 100
Picardie	36 500	27 300	28 100	N/A	N/A	N/A	N/A	34 000
Poitou-Charentes	30 200	25 700	23 400	19 000	19 000	N/A	49 100	29 300
PACA	17 900	N/A	N/A	14 400	14 400	N/A	24 600	20 900
Rhône-Alpes	18 500	16 500	13 700	13 800	13 800	N/A	19 700	17 500
France	27 300	20 400	19 400	13 400	13 400	18 100	34 000	22 700

N/A: Not representative. *Source:* AGRESTE – RICA France 2007 / INRA SAE2 Nantes calculations.

- As to the EUR 700 million of direct payments allocated to grasslands, our choices for the simulations are particularly pertinent because this is a key element of the reallocation of funding. In keeping with statements made in a speech by the Minister of Agriculture, the areas eligible for this premium include permanent pasture and temporary pasture deemed "productive". However, not all productive grassland areas are treated equally under this new aid. Specifically, areas are accounted for differently depending on the farm's stocking density (expressed here in terms of head of grazing livestock per hectare of primary forage area, where roadways are included in forage areas) and the farm's total area of pasture (up to 50 hectares per farm). Also, the pastures of farms with a stocking density below 0.5 are automatically disqualified from receiving the aid. In operations with a stocking density between 0.5 and 0.8, these areas are counted, but are weighted with a coefficient that increases linearly from 0.625 when the density is 0.5 to 1 when it reaches 0.8. On farms in which the stocking level exceeds 0.8, pasture is fully counted. The maximum level of aid applies to the first 50 hectares, with the remaining pasture counted at 50%.
- As to the EUR 30 million assigned to fodder, this support takes the shape of per-hectare payment for all fodder crops (except temporary pasture) – principally fodder maize, but also fodder beets, fodder cabbage/kale, etc. The amount of payment per hectare (approximately EUR 20) is uniform across France.
- As to the EUR 30 million assigned to potato and vegetable crops, the aid allocation to farms is proportional to the area planted.
- As to the EUR 135 million assigned to the sheep and goat sector, the envelope was first split into two parts in proportion to the sizes of the suckler and dairy ewe and goat populations; only goats in mountain and high mountain zones and in Corsica were included in this calculation. The envelope assigned to sheep (estimated at EUR 131.6 million) was then distributed as (coupled) aid per head of ewes; and similarly for goats (EUR 3.4 million). In addition, the simulation accounts for an increase in the amount of the single farm payment for sheep farms that will take effect in 2009 (EUR 25 million).
- As to the EUR 45 million allocated to dairy operations in the high mountain, mountain, and Piedmont zones, aid is distributed on up to a maximum of 100 000 kg of milk per farm, with consideration given to the transparency of the GAEC (typical French association of farmers). This threshold was established to reflect the ceiling on payments of this new aid to each farm.
- As to the EUR 8 million earmarked for the production of durum wheat in traditional zones, the amount of aid is determined per hectare at a rate that is uniform across the farms in these zones.
- As to the EUR 4.7 million earmarked for suckling calves, the amount of aid reflects the number of head on a uniform basis. To better target this very specific population, only regions in the great basin in south-western France (i.e. the traditional zones of production) are eligible for this new aid.

- As to the EUR 42 million allocated to supplement the compensatory allowance for permanent natural handicaps, the simulation assumes that only the first 25 hectares are eligible.
- As to the EUR 40 million assigned to the protein crop sector, we extrapolate that this support will be distributed in the form of a per-hectare aid to farms that had land under these crops in 2007. This choice was made necessary by the fact that it is difficult to identify farms that will immediately switch to growing these crops following the introduction of earmarked aid.
- As to the EUR 57 million allocated to promoting organic agriculture, we opted for a lump-sum and uniform premium. This premium is available to farms currently involved in organic farming or converting to it. An alternative to this option, payment of a per hectare premium, would tend to skew production toward larger farms at the expense of those operating on a smaller scale (such as organic vegetable farming).
- As to the EUR 32 million allotted to "new challenges", support is distributed in the form of supplemental aid classified as "other direct agri-environmental aid" under FADN (excluding the agri-environmental grass premium). As in the case of protein crops, it is difficult to predict what farms will take this route.
- As to the EUR 100 million allocated to supporting crop insurance, the funds are allocated on the basis of the value of plant production. Here again, it has proved impossible to speculate on whether farmers will opt for these insurance contracts immediately. They will incur additional expenses if they sign on.
- As to the EUR 40 million allotted to the health fund, the support is allocated on the basis of the value of animal production.

The amount of the budgetary appropriations exceeds the total 13 expenditure items by EUR 223 million. The excess is used to fund prior commitments, in particular the Community's contribution to the agri-environmental grass premium.

Redistribution resulting from the CAP Health Check

The measures introduced in France in the context of the CAP Health Check should result in a decrease in direct payments flowing to regions specialised in arable crops. Thus, in regional averages, the cut to direct payments per farm is EUR 7 800 in Ile-de-France (or -16% of direct payments), EUR 6 400 in Picardie (-12%), and EUR 5 700 in the Centre region (-14%). The impact is also negative in Haute-Normandie (- EUR 3 700) and in Poitou-Charentes (- EUR 2 300). In these last two regions, the presence of cattle farms mitigates the severity of the impact. Conversely, decisions springing from the CAP Health Check are favourable to large-scale production of grazing livestock: +EUR 4 500 of direct payments per farm in Auvergne (+13%), +EUR 4 000 in the Limousin (+12%) and +EUR 3 800 in Franche-Comté (+12%). Thus, the redistribution amounts to a transfer from regions in the plains to ordinary disadvantaged zones and mountainous zones, where animals are mostly pastured (Institut de l'Elevage, 2009).

In general, the redistribution is at the expense of large-scale arable (Cereal, Oilseed and Protein) cropping and to the benefit of grazing livestock production. More precisely, the principal effects by type of production are as follows:

- Large-scale arable crop farmers in France lose EUR 5 900 in direct payments (Table 10.5). This corresponds to a 16% cut to direct payments (Table 10.6), equivalent to 17% of income when averaged over five years (Table 10.7). Proportionately, income losses are greater in Midi-Pyrénées (-24%) and Bourgogne (-24%) than in Ile-de-France (-17%) and Picardie (-16%). In Bretagne, the loss of direct payments is less dramatic (- EUR 800, or -6%), owing to the high proportion of farms producing open-field vegetables (these crops benefit from specific aid). The decline in the incomes of large-scale arable crop farmers is quite substantial in the case of units located in intermediate zones, where yields are modest and incomes often lower than in specialised zones. However, potential adaptations by farmers and productivity gains — two variables that may contribute to mitigating the impacts — are not factored into our simulations. Moreover, cuts to the amounts of direct payments are large when expressed as a percentage of total direct payments received or income, but are less daunting from the perspective of production or total revenues. This observation reminds us to what extent the future income of large-scale arable crop farmers will be principally dependent on prices.

- Nationwide, dairy farmers will experience an average EUR 600 (or +2%) increase in direct payments. Since direct payments to milk production are already decoupled, allocations disbursed under Article 63 only affect dairy farmers indirectly via the agricultural products associated with the principal activity. Therefore, they are less penalized at this level than large-scale farmers. The impact of the CAP Health Check differs considerably between regions that have traditional grazing lands (+22% in Auvergne, +18% in Rhône-Alpes, +16% in Franche-Comté) and zones of more intensive farming in which fodder maize and cereal crops occupy a key position in the rotation (-9% in Picardie, -8% in Poitou-Charentes, -7% in Nord-pas-de-Calais). An analysis in terms of various technical systems reveals that specialised grazing operations (less than 10% of total forage area under maize fodder) experience an increase in direct payments of EUR 5 700 (or +23% of income) on a national average. Conversely, diversified dairy operations lose out (-6% of income), as do those that devote more than 30% of their total forage land to maize fodder (-3%). While dairy farms in mountainous areas will temporarily benefit from the decisions of the Minister responsible for agriculture, it is important to assume a longer-term perspective, i.e. to bear in mind the fact that milk quotas are likely to be abolished by 2015. This eventuality creates the risk that a future decline in the price of milk may weigh more heavily on mountain farms to the extent that they experience lower labour productivity gains and the cost of gathering the milk is higher than in the plains (Chatellier and Delattre, 2006).

- Nationwide, beef cattle farmers will receive an average EUR 500 (or +1%) more in direct payments. As in the case of dairy farms, there are pronounced differences between administrative regions, depending on the specific activity (calf rearing, calf rearing and fattening, specialised fatteners) and the degree of specialization in beef production. Thus, beef cattle producers suffer a loss of direct payments equal to EUR 7 600 in Picardie (-13%) and EUR 4 300 in Haute-Normandie (-10%). This is because these farms are often intensive and involve vast areas of arable crops. At the other extreme, beef cattle farms in Limousin profit from the measures in the reform (+EUR 3 000, or +9%), as do those in Auvergne, Aquitaine and Basse-Normandie. Farms in these regions frequently receive the full benefit of the new grassland premium and, sometimes, additional funds available from the compensatory allowance for permanent natural handicaps.

- Nationwide, sheep and goat farms will receive an average of EUR 7 800 more in direct payments per farm (+29%, equivalent to +43% in income over a five-year average). These benefits are greater than those received by other grazing livestock producers because sheep and goat farmers not only benefit from the new support for grasslands, but also from the new sheep and goat premium, while retaining the most of the benefits from the sheep and goat premium. Though this latter is now decoupled, the successor to the coupled premium continues to be allotted, at a level of 87.5%, on the basis of individual historical references. Furthermore, as of 2009 these farmers will receive further decoupled aid amounting to EUR 25 million from the reserve. The income of sheep and goat farmers in mountainous zones will increase by nearly 60%, though that is on top of an initial income level per job that is decidedly lower (EUR 12 200 per farm for the five years 2003 to 2007) than the French average for all farm types (EUR 22 700, see Table 10.4).

- In the case of farms categorised as pigs and poultry, wine, and others, the impact of the CAP Health Check is generally minimal, in terms of both absolute value and percentage of income or sales. Expressed as a percentage of direct payments, the impact may appear artificially inflated owing to the low initial amounts.

To complete our analysis of the redistributive effects of the CAP Health Check, we ranked French farms by deciles according to the level of direct payment per farm (Table 10.8). Thus, for example, 29% of direct payments were concentrated on farms in the top decile in 2007, versus 27% after application of the measures in the CAP Health Check. Although losing an average of EUR 7 800 per farm, they continue to earn the highest incomes (EUR 46 400 per family farm) even after the reform. On the other hand, farms in the bottom decile are scarcely affected.

Table 10.5. Farm-level impacts of the CAP Health Check
EUR

	Arable crops	Milk cows	Beef cows	Sheep and goats	Pigs and poultry	Wine	Others	Total
Alsace	-5 200	-900	N/A	N/A	N/A	400	N/A	-1 700
Aquitaine	-3 800	-500	1 200	5 000	N/A	700	700	-100
Auvergne	-6 800	6 400	2 300	15 300	N/A	N/A	N/A	4 500
Basse-Normandie	-3 800	600	1 900	N/A	N/A	N/A	1 300	500
Bourgogne	-9 700	-2 900	1 400	N/A	N/A	1 000	N/A	-1 500
Bretagne	-800	-600	-1 800	N/A	-800	N/A	1 900	-600
Centre	-8 800	-4 100	-1 600	-1 200	N/A	700	600	-5 700
Champagne-Ardennes	-9 500	-3 000	-3 900	N/A	N/A	1 000	N/A	-3 700
Corse	N/A	N/A	-100	5 200	N/A	1 200	900	1 200
Franche-Comté	-7 000	4 900	-100	N/A	N/A	800	N/A	3 800
Haute-Normandie	-6 200	-2 700	-4 300	N/A	N/A	N/A	N/A	-3 700
Île-de-France	-9 100	N/A	N/A	N/A	N/A	N/A	2 400	-7 800
Languedoc-Roussillon	-2 400	3 200	-600	6 800	N/A	500	900	600
Limousin	N/A	5 100	3 100	13 400	N/A	N/A	N/A	4 000
Lorraine	-9 000	200	-2 800	N/A	N/A	N/A	N/A	-1 400
Midi-Pyrénées	-4 800	2 300	1 300	9 500	N/A	-200	100	1 000
Nord-Pas-de-Calais	-2 400	-2 200	-3 200	N/A	N/A	N/A	N/A	-2 300
Pays de la Loire	-4 200	-200	-700	N/A	N/A	1 400	2 100	-500
Picardie	-8 000	-4 700	-7 600	N/A	N/A	N/A	N/A	-6 400
Poitou-Charentes	-7 200	-3 900	1 100	5 100	N/A	-400	600	-2 300
PACA	-1 100	N/A	N/A	13 900	N/A	600	1 100	2 100
Rhône-Alpes	-2 800	4 500	1 400	5 800	N/A	800	600	1 900
France	-5 900	600	500	7 800	-600	600	1 000	-500

N/A: Not representative.
Source: AGRESTE — RICA France 2007 / INRA SAE2 Nantes calculations.

Table 10.6. Impacts of the CAP Health Check as a % of total direct payments

	Arable crops	Milk cows	Beef cows	Sheep & goats	Pigs & poultry	Wine	Others	Total
Alsace	-19%	-2%	N/A	N/A	N/A	19%	N/A	-9%
Aquitaine	-16%	-2%	5%	34%	N/A	22%	8%	-1%
Auvergne	-20%	22%	5%	63%	N/A	N/A	N/A	13%
Basse-Normandie	-13%	2%	6%	N/A	N/A	N/A	49%	2%
Bourgogne	-20%	-5%	3%	N/A	N/A	42%	N/A	-4%
Bretagne	-6%	-2%	-7%	N/A	-8%	N/A	23%	-3%
Centre	-20%	-9%	-3%	-4%	N/A	18%	10%	-14%
Champagne-Ardennes	-16%	-5%	-8%	N/A	N/A	51%	N/A	-11%
Corse	N/A	N/A	0%	25%	N/A	23%	5%	6%
Franche-Comté	-19%	16%	0%	N/A	N/A	88%	N/A	12%
Haute-Normandie	-15%	-7%	-10%	N/A	N/A	N/A	N/A	-9%
Île-de-France	-17%	N/A	N/A	N/A	N/A	N/A	60%	-16%
Languedoc-Roussillon	-8%	12%	-1%	22%	N/A	9%	13%	5%
Limousin	N/A	16%	9%	54%	N/A	N/A	N/A	12%
Lorraine	-20%	0%	-5%	N/A	N/A	N/A	N/A	-3%
Midi-Pyrénées	-15%	8%	4%	34%	N/A	-3%	1%	3%
Nord-Pas-de-Calais	-11%	-7%	-9%	N/A	N/A	N/A	N/A	-8%
Pays de la Loire	-16%	-1%	-2%	N/A	N/A	84%	28%	-2%
Picardie	-15%	-9%	-13%	N/A	N/A	N/A	N/A	-12%
Poitou-Charentes	-19%	-8%	3%	17%	N/A	-6%	19%	-7%
PACA	-5%	N/A	N/A	30%	N/A	23%	25%	16%
Rhône-Alpes	-13%	18%	4%	28%	N/A	56%	8%	9%
France	-16%	2%	1%	29%	-7%	17%	15%	-2%

N/A: Not representative.
Source: AGRESTE — RICA France 2007 / INRA SAE2 Nantes calculations.

Table 10.7. Impacts of the CAP Health Check in % of mean income over five years

	Arable crops	Milk cows	Beef cows	Sheep and goats	Pigs and poultry	Wine	Others	Total
Alsace	-18%	-2%	N/A	N/A	N/A	1%	N/A	-4%
Aquitaine	-19%	-2%	7%	51%	N/A	3%	3%	-1%
Auvergne	-26%	31%	9%	171%	N/A	N/A	N/A	20%
Basse-Normandie	-11%	2%	9%	N/A	N/A	N/A	3%	2%
Bourgogne	-24%	-6%	5%	N/A	N/A	2%	N/A	-4%
Bretagne	-3%	-2%	-8%	N/A	-3%	N/A	6%	-2%
Centre	-21%	-10%	-5%	-6%	N/A	2%	2%	-14%
Champagne-Ardennes	-16%	-6%	-10%	N/A	N/A	1%	N/A	-4%
Corse	N/A	N/A	-1%	27%	N/A	4%	4%	6%
Franche-Comté	-30%	17%	0%	N/A	N/A	1%	N/A	13%
Haute-Normandie	-17%	-7%	-15%	N/A	N/A	N/A	N/A	-10%
Île-de-France	-17%	N/A	N/A	N/A	N/A	N/A	12%	-15%
Languedoc-Roussillon	-14%	15%	-2%	35%	N/A	6%	3%	4%
Limousin	N/A	17%	12%	91%	N/A	N/A	N/A	16%
Lorraine	-22%	0%	-8%	N/A	N/A	N/A	N/A	-3%
Midi-Pyrénées	-24%	9%	6%	54%	N/A	-2%	0%	5%
Nord-Pas-de-Calais	-8%	-6%	-10%	N/A	N/A	N/A	N/A	-7%
Pays de la Loire	-12%	-1%	-2%	N/A	N/A	6%	7%	-2%
Picardie	-16%	-11%	-20%	N/A	N/A	N/A	N/A	-13%
Poitou-Charentes	-20%	-8%	4%	20%	N/A	-1%	2%	-6%
PACA	-5%	N/A	N/A	77%	N/A	2%	3%	7%
Rhône-Alpes	-12%	17%	8%	30%	N/A	3%	2%	8%
France	-17%	2%	2%	43%	-2%	1%	3%	-2%

N/A: Not representative.
Source: AGRESTE — RICA France 2007 / INRA SAE2 Nantes calculations.

Table 10.8. Impacts of the CAP Health Check on French farms (all production types) disaggregated by decile for the amount of direct payment per farm

	"Direct payment per farm" deciles										Total
	1	2	3	4	5	6	7	8	9	10	
Number of farms	32 200	32 200	32 200	32 200	32 200	32 200	32 200	32 200	32 200	32 200	322 000
Situation in 2007, prior to implementation of Health Check measures											
Direct payment per farm (EUR)	30	3 740	11 290	16 730	21 190	26 720	32 480	40 200	51 870	85 270	28 950
Direct payment per AWU (EUR)	10	1 440	6 640	10 940	13 760	17 470	20 050	23 240	24 580	31 120	14 550
Direct payment per hectare of UAA	3	177	304	341	356	360	374	380	382	390	363
Direct payment as % of income	0%	13%	53%	68%	79%	87%	96%	91%	93%	83%	69%
Share in total direct payments	0%	1%	4%	6%	7%	9%	11%	14%	18%	29%	100%
Income per family AWU (EUR)	35 900	22 200	17 200	20 100	20 700	22 500	24 600	30 100	33 200	50 200	29 000
Situation after implementation of Health Check measures											
Direct payment per farm (EUR)	940	4 540	11 920	17 920	22 270	28 000	33 000	38 910	49 540	77 500	28 450
Direct payment per AWU (EUR)	330	1 750	7 010	11 710	14 460	18 300	20 370	22 490	23 480	28 290	14 300
Direct payment per hectare of UAA	95	215	321	366	374	377	380	368	365	355	357
Direct payment as % of income	2%	15%	54%	69%	80%	88%	96%	90%	93%	82%	69%
Share in total direct payments	0%	2%	4%	6%	8%	10%	12%	14%	17%	27%	100%
Income per family AWU (EUR)	36 600	22 800	17 700	21 100	21 500	23 500	24 900	29 300	31 800	46 400	28 600

AWU: Agricultural Work Unit; UAA: Agricultural Utilized Area.
Source: AGRESTE — RICA France 2007 / INRA SAE2 Nantes calculations.

Conclusions

The net impact of the decisions by the French Minister responsible for agriculture with respect to application of the CAP Health Check to France is a slight narrowing of the gap between the levels of direct payment per farm (Table 10.8) and a greater consistency in the amount of decoupled direct payment per hectare (Velazquez, 2008). Furthermore, the measures adopted permit a more targeted allocation of funds to the protection of natural resources and remuneration of environmental and territorial services (Bureau and Mahé, 2008). The redistribution of support is to the detriment of producers of arable crops and to the benefit of producers of grazing livestock, particularly those engaged in extensive systems.

Any analysis of the CAP Health Check must be set against the broader context of discussions (which have already begun) on the financial prospects of the European Union during the period 2014-20. At issue is whether decisions made at the domestic level will be adequate, in the long term, to justify the "French agricultural model" to the other Member States (Cooper *et al.*, 2007), in light of the fact that the latter often pursue simpler agricultural policies and have to contend with less diversity in terms of agricultural products, structures and geography. From this perspective, two avenues need to be prioritised (Guyomard *et al.*, 2007): increasing the share of funds dedicated to risk management (health, climate, price, income); and increasing budgets for "new challenges" in the area of the environment (quantitative and qualitative water management, protection of biodiversity, reduction of greenhouse gases). However, several provisions, in particular retention of the agri-environmental grass premium and new aid for productive grasslands, should help greater account to be taken of environmental and territorial goals, thus bolstering the legitimacy of the public's support for French agriculture and farmers.

In the wake of the decisions of 23 February 2009, only 75% of the current suckler cow premium will remain coupled — along with the new sheep and goat premium and various smaller premiums — accounting for a total of approximately EUR 900 million (in contrast to coupled payments amounting to over EUR 2.7 billion in 2008). France will thus be able to provide objective evidence to its European partners that it has taken a major step towards practising an agriculture that is more sensitive to market signals, namely prices (through greater decoupling of Pillar 1 aid) and, simultaneously, towards an agricultural policy focused on the environment and the land (for example, by means of the new support for grasslands, increased assistance for more sustainable production methods). This new, greater share of decoupled support in total support should strengthen the Community's position in negotiations on domestic supports to agriculture (Bureau *et al.*, 2007; Guyomard *et al.*, 2007) currently being conducted under the aegis of the World Trade Organization (WTO). This presupposes that, on one hand, there will be diplomatic breakthroughs in the floundering Doha Round, and, on the other hand, that the classification of the single payment in the "green box" will be retained (Oxfam *et al.*, 2006; Swinbank and Tranter, 2006). Finally, to the objection that decoupled payments continue to be granted on the basis of the historical model, we can reply that the link with the past of every farm has been very slightly weakened.

Notes

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2. In 2013, the agri-environmental grass premium (EUR 240 million) will be co-financed at the following rates: 75% from European Community funds (EUR 176 million) and 25% from domestic funds (EUR 64 million). The rate of domestic contribution is currently lower.

3. This weighting coefficient, which varies from one farm to another, is calibrated using the Census of Agriculture on the basis of three criteria: administrative region, type of farming, and economic size (as measured by the Standard Gross Margin). The last element corresponds to an estimate of the farm's potential value added. It is calculated by applying the coefficients, which vary according to the region, to physical units of production (area and head of livestock). It is measured in terms of Economic Size Units (1 ESU = 1 200 EUR).

4. FADN only contains information on operations that are classified as "commercial", i.e. with a Standard Gross Margin exceeding 8 ESU and manned by more than 0.75 agricultural work units. At the national scale, this represents 60% of farms, 85% of jobs, 92% of the utilised agricultural area, and a little over 95% of the Standard Gross Margin.

5. The indicator used for income is Family Farm Income (FFI). This indicator, from the agricultural accounting plan, is calculated as follows: agricultural production (output during the fiscal year, net of animal purchases) – intermediate consumption – rents and leases – insurance + discounts, rebates, and remittances – income and sales taxes – payroll charges (wages + social contributions) + lump-sum reimbursement of Value-Added Tax + operating subsidies + insurance benefits + transfer of liabilities + other current management products + financial products – financial fees – depreciation expenses. Social contributions by the farmer are not deducted when calculating the FFI.

6. The amount of the allocation is equivalent to 55% of coupled aid for general cropping areas and to 12.5% of the initial coupled animal premiums.

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Chapter 11

Distribution of agricultural direct payments: the case of France

Pierre H. Boulanger[1]

This chapter examines some facts concerning French distribution of agricultural direct payments. France has developed a hybrid historical model in its attempt to renew a strong "market support and direct payment" pillar, mostly with environmental and territorial targeted subsidies. It grants to Pillar 1 a "rural development" dimension and magnifies the related responsibilities attributed to national authorities without observing the co-funding principle, thereby jeopardising the relevance of the Pillar 2. Evidence on the French distribution of direct payments suggests three sound assumptions: 1) reforming the direct payment system cannot be driven by equity considerations alone but also by public policy efficiency, especially when contemplating the diversity of the agricultural sector; 2) distribution of support has to be considered in line with policy objectives, but remains frequently incoherent; and 3) the partial redistribution of support which results from the 2009 Health Check of the Common Agricultural Policy shows that French conservatism is progressively declining.

The mechanisms of the Common Agricultural Policy (CAP) have been significantly altered since the 1992 reform. Direct payments were introduced as sector-based compensatory support for the decrease in guaranteed prices. Supporting farm income was thus the main objective of this instrument. By construction, it was biased towards commodities supported in the past, and thus towards areas with high yields. With the 2003 reform, the flexibility given to the national authorities in decoupling these subsidies has been creating further heterogeneous situations across commodities and production processes, between and within the member states. The French option has frozen the past distribution of support in order to avoid income and wealth effects; to maintain specific types of production; and to avoid sudden land abandonment. When preparing the post-2013 CAP, the distribution of the main financial tool of the CAP has been causing explicit concern but is far from being a new issue.[2] By running against the public legitimacy of this policy, it jeopardises the long-term preservation of these public payments — at least in their current composition.

The release of nominative data on farm subsidy recipients has shed some light on a massive and complex redistributive system. Adopted in November 2005 by the European Commission, the European Transparency Initiative has led to two waves of disclosures. In September 2008, beneficiaries of rural development measures were compulsorily disclosed. In April 2009 followed those of market support and direct payments.

The aim of this paper is to shed some light on the allocation of farm subsidies in France, which is the main European Union (EU) market commodity producer and the main recipient of EU direct payments. First, the institutional framework of direct payment redistribution is pointed out. The implementation and management of decoupling provides a unique occasion to redistribute Pillar 1 support. Given the flexibility inherent in the 2003 CAP reform, the responsibility for such decisions has been left to member state appraisal. As a result, the distribution issue has been increasingly left to member state competence.

In 2007, the first year of partial decoupling achievement in France, 16.5% of subsidy recipients received half of all direct payments. There are several possible dimensions when studying the support allocation issue. The sector-based one is preferred because it corresponds to the historical *raison d'être* of the support. In this context, French arable crop producers have been the main financial recipients of the direct payment mechanism — and by being a core livestock production input, cattle breeders have also benefited indirectly from crop support.

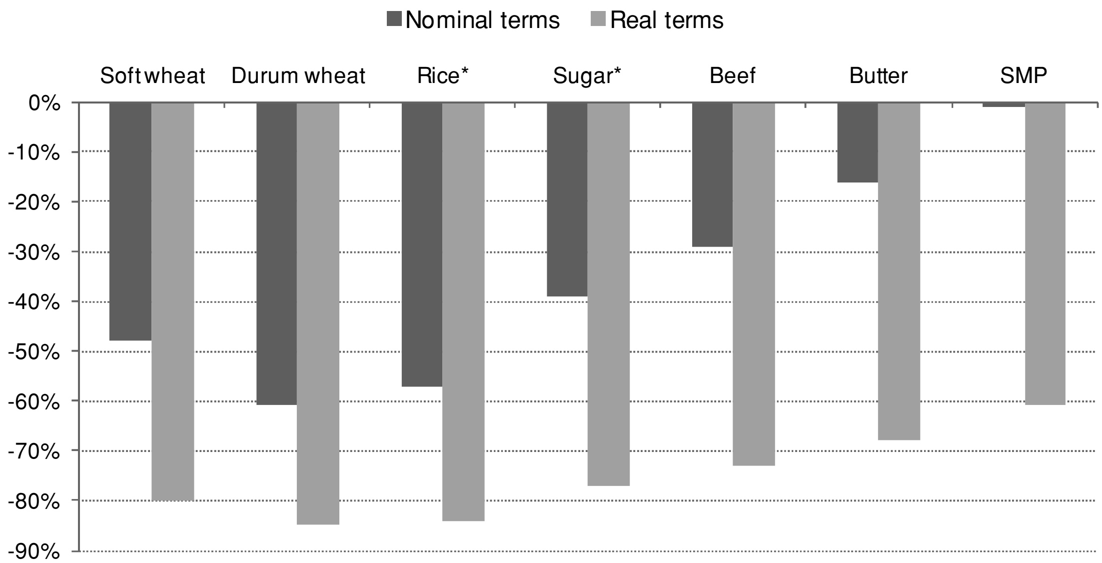
The potentially redistributive elements of the 2009 CAP Health Check are explained in the next section of the paper. The assessment considers the French options regarding new provisions implemented from 2010 on. The assumption of a French hybrid historical decoupling model and the premises of a strategy for the CAP beyond 2013 are then discussed. The paper concludes with some thoughts on the renewed political economy regarding direct payment distribution and rationale.

Direct payment distribution: an institutional approach

In order to alter support based almost exclusively on prices to a more market-oriented and budget-limited agricultural policy, the 1992 reform started to shift the main mechanism from guaranteed prices to direct "compensatory" payments. Its implementation allowed a theoretical targeting of farm support since policy makers were able to determine the amounts (coupled or decoupled to market prices and production;

static or dynamic), the criteria (respecting cross-compliance or providing specific amenities) and timing (bounded or not). In this context, the 1992 reform initiated the progressive targeting of the EU farm support.[3]

Figure 11.1. Cumulative change in European Union price support in nominal and real terms
1991-2008

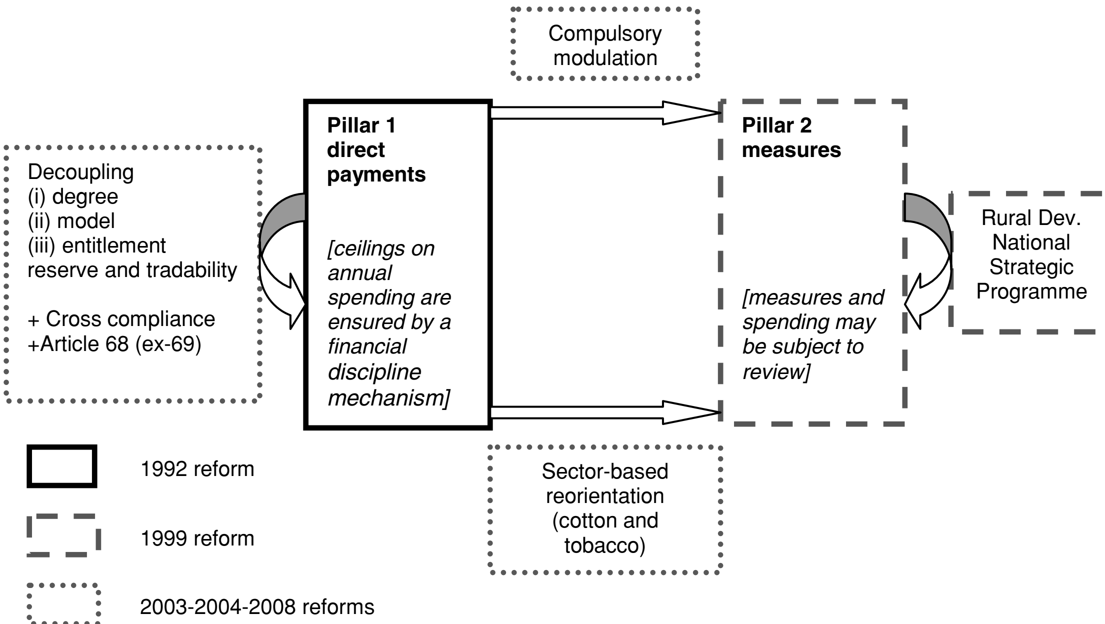


* 1992-2008. SMP skim milk powder

Source: European Commission (2009).

Direct payments to crop areas were computed, by hectare, considering 1) national and regional average yields, and 2) scheduled price support decreases. Livestock direct premiums per head were revalorised and/or created. The aim was to compensate the negative effects on farm incomes and wealth resulting from the decreases in price support illustrated with Figure 11.1. The 2000, 2003 and 2009 reforms accentuated this trend, and decoupled partially direct payments from production levels and prices. Compensatory payments have been made "permanent" as they were not time-bounded and were systematically provided to all newcomers. Figure 11.2 summarises the institutional channels which aim at redistributing the past price policy support. The framework's construction and interpretation are gradually explained below.

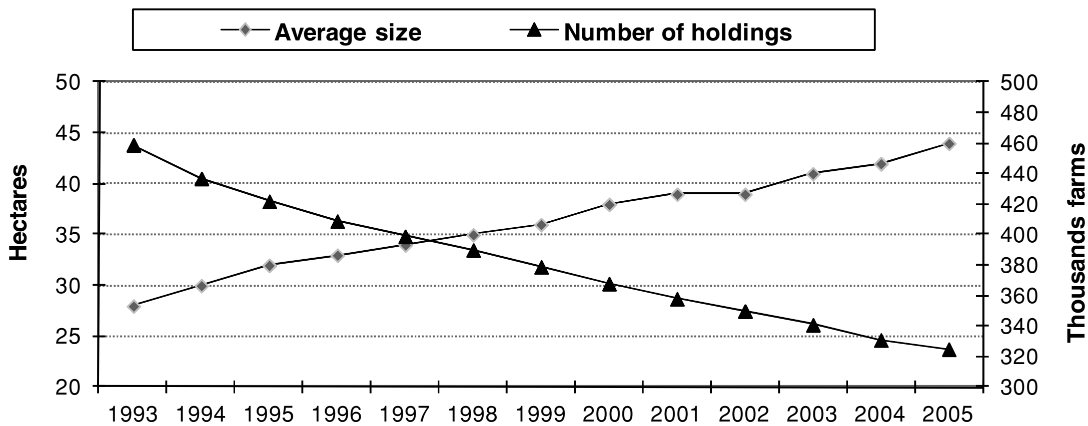
Figure 11.2. Redistributive institutional framework of CAP support reforms



The historical price market policy has benefited the largest and most intensive farm holdings. Indeed, the higher the volume of production, the higher was the support. As a result, distribution of support was discussed by policy makers when negotiating the 1992 MacSharry reform.[4] However, this did not lead to an effective mechanism able to counterbalance the concentration of support on a few farm structures, sectors and geographic areas. The concentration of direct payment recipients was, and still is, not consistent with the distribution of its cost, which is shared out among taxpayers.

The agricultural sector faces dynamic economic forces which foster adjustments. Economic growth has drastically reduced the share of the agricultural sector in both GDP and total employment. Productivity gains have been higher in agriculture than in manufacturing (Martin and Mitra, 2001). These gains have been labour-saving, and have thus contributed towards reducing agricultural employment and increasing holding sizes. Dupraz, Latruffe and Mann (2010) considered the factors which force on-farm labour use, especially the level and type of agricultural support. They demonstrate that, in France, direct payments tend to discourage labour demand, whereas green or investment-targeted measures promote contract and hired labour in France. Ciaian, Dries and D'Artis Kancs (2010) present empirical results on EU agricultural labour adjustments (job destruction and creation). Significant differences between and among member states can be attributed to farm structural disparities. Indeed, regions with small average farm sizes display higher labour adjustments than those with larger average farm sizes.

Figure 11.3. Evolution of French average size and number of holdings for arable crops
1993-2005



Source: Data from ONIC-ONIOL/SCEES-DPEI; author's interpretation.

Figure 11.3 illustrates the evolution of French average size and number of holdings producing arable crops. On the one hand, the number of holdings dropped by roughly 30% between 1993 and 2005. On the other hand, the average size of arable crop holdings increased by half during the same period. This concentration of arable areas is in line with the concentration of support[5], and interacts with the concentration of capital. Because it provides a wealth and insurance effect, subsidies influence farmers' attitudes to risk (Hennessy, 1998). The assumption of decreasing risk aversion tends to increase investments in capital. As a result, the agricultural sector shows a concentration of both land and capital.

The 1992 reform did not limit direct payments for cereal, oilseeds and protein crops via restrictions on set-aside compensation as initially put forward by the Commission. Capping the total amount a farm may receive – though considered in the first proposals – was withdrawn in the final agreement. However, the exemption from compulsory set-aside for small holdings – those producing up to the equivalent of 92 tonnes of cereals- had been agreed. For the main livestock compensatory payments, i.e. the special premium for male bovines and the suckler cow premium, a stocking density rate criteria and a maximum number of heads were approved.

The 1999 reform continued the compensation of guaranteed price decreases with direct payments. However, in contrast to the 1992 reform, compensation was partial in order to counteract criticisms of overcompensation.[6] Indeed, full compensation did not consider income increases from restructuring and entrepreneurial schemes on farm holdings, potential decreases in farm input prices, or off-farm activity development.

Following the 2003 reform, the implementation and management of decoupling schemes provided a unique occasion to redistribute Pillar 1 direct payments. Given the flexibility inherent in the Luxembourg agreement, the responsibility for such a decision lies with the member state. The full historic model possessed the ability to almost freeze the past distribution of support whereas the fully regionalised model redistributed it within a specified territory (region).

Compulsory and voluntary redistributing tools

Beyond the adopted model of decoupled support, EU members have implemented voluntary and/or compulsory tools which aim at redistributing historical direct payments. First, on a voluntary basis, national reserves of Single Farm Payments (SFPs) may be created by means of a linear percentage reduction in the holding reference amounts (up to 3% of the total entitlement value) and the incorporation of non-attributed SFPs or not activated for three years.

The objective of a national reserve is to grant additional decoupled payments to new farms or selected recipients. Awarding additional decoupled payments depends on features such as the absence of entitlements for farmers entering the sector; for farmers who inherited land, leased out land or bought land during the reference period.[7] Recipients can also be farmers who have restructured their production or invested in their holding during or directly after the reference period. The national reserve can be temporary, i.e. a transitory tool to ease the transition from coupled to decoupled direct payment scheme-for instance in Germany or the United Kingdom, which plan to close the reserve once the decoupling process has been completed. These two countries share a liberal view as regards the regulation of SFP markets (Kroll, 2008). The national reserve can also be permanent, i.e. it is conceived as an intervention tool for administratively managing entitlement transfers-as in most of the other member states.

Second, SFP tradability or transfer modalities may have a significant impact on the distribution of direct payments. Member states may decide that SFPs can be fully transferred or used within one specific territory, i.e. one *département* in France, one *Länd* in Germany, one region in the United Kingdom[8] or Italy, the whole country in Portugal or the Netherlands. In case of definitive (i.e. final) SFP transfers – with or without land – a part of the SFP value may be charged (taxed) and transferred to the national reserve. According to whether or not these restraints are activated, it becomes possible to create an administrative SFP market with a potentially redistributive impact. Table 11.1 presents some selected national situations (as planned), and Table 11.2 focuses on the taxation of French entitlement transfers.

Table 11.1. Selected planned modalities of SFP national reserve management

	England	France	Germany	Italy	Netherlands	Portugal	Spain
Initial deduction	4.2%	2.2%	1%	3%[3]	0.25%	2%	3%
Maximum deduction from transfer							
without land	0%	30%[1]	0%	30%[1]	0%	10%	30%[1]
with land	0%	10%[2]	0%	10%[2]	0%	0%	10%[2]

1. During the first three years of implementation: 50%; transfer to young farmers: 0%.
2. Except for transfers of an entire holding: 3% (during the first three years: 5%); transfer to young farmers: 0%.
3. Approximation from global data.

Source: Adapted from Kroll (2008) and Anciaux (2005); author's interpretation.

Table 11.2. SFP's entitlement taxation in France from 2010 onwards

	Transfer with land			Transfer without land	
	UAA < *départemental* threshold	UAA > *départemental* threshold		Any transfer	Transfer of the entire holding
	Transfer of a fraction of the holding	Transfer of a fraction	Transfer of the entire holding		
Transfer of entitlement to any farmer	3%	10%	3%	30%	3%
Transfer of entitlement to a relative	0%	10%	0%	30%	0%
Transfer of entitlement to a new farmer	0%	10%	0%	30%	0%
Transfer of entitlement to a young farmer	0%	0%	0%	0%	0%

Utilised Agricultural Area (UAA) aggregates all arable areas including fallow, temporary and permanent grassland or land under permanent crops.

The *départemental* (or sub-*départemental*) threshold refers to two plot units as defined by Article L.312-5 of the French Rural Act.

A "relative" represents a family relationship up to the second generation, i.e. the purchaser should be the wife/husband, sister/brother, mother/father, or grandmother/grandfather of the transferor.

A "new farmer" has started a new agricultural business within five years.

A "young farmer" is new to the agricultural sector, i.e. she/he was not running an agricultural business for the last five years.

Source: Data from French Ministry of Food, Agriculture and Fisheries; author's interpretation.

Third, the 2003 reform introduced a stylised "cross-compliance" regime where payments are linked to farmers achieving certain environmental, animal welfare and quality standards. Cross-compliance makes full payment conditional upon some standards established at national levels. This may potentially exclude some historical direct payment recipients.

Fourth, Article 69[9] allowed the member states to adopt sector-based reorientation by using up to 10% of national sector-based ceilings to grant the corresponding sectors additional payments for "*specific types of farming which are important for the protection or enhancement of the environment or for improving the quality and marketing of agricultural products*".[10]

Two redistributive tools have been made compulsory in order to fund Pillar 2 measures. The first is a compulsory modulation introduced by the 2003 reform which reduces all direct payments from Pillar 1 via a 5% uniform flat rate from 2007. A EUR 5 000 franchise (exemption from charging for every holding but creating a kind of low-threshold effect) exempts farmers receiving less than EUR 5 000 a year from the modulation.

Second, compulsory sector-based financial transfers were agreed in April 2004 for the tobacco and cotton regimes. They aim to reorient a share of the sector-based direct payments (taking into account, as for decoupled payments, a 2000-02 reference period) towards rural development programmes implemented in the respective production areas.

Finally, the financial discipline mechanism — if activated — may potentially affect the distribution of direct payments. The 2003 CAP reform introduced this new tool in order to prevent any overspending on direct payments with reference to annual budgetary ceilings for the 2007-13 period. In order to avoid any future overspending, the European Commission is able to propose reductions in EU15 direct payments.[11] The modalities of such cuts may consider differentiated rates of reduction.

The 2009 CAP Health Check[12] adjusted the 2003 reform redistributive mechanisms. It decoupled further direct payments, and allowed member states implementing a historic model to move towards a more regional one, especially in view of the progressive integration of further sectors into the decoupling scheme. Cross-compliance standards have been amended. The Health Check led to increments in the compulsory modulation rate to reach 10% in 2012 and to further 4% cuts for payments above EUR 300 000. It also introduced a EUR 100 and a 1 hectare minimum requirement. Article 68 replaced Article 69, and provided more flexibility in its implementation. It increased the scope of potential funded measures and split the historically supported sector constraint as regards new funded expenditures. Finally, member states had to review their rural development plans in order to consider "crucial new challenges for European agriculture"[13]: climate change, renewable energy, water management, biodiversity and dairy restructuring measures.

Apart from compulsory modulation and cotton and tobacco sector-based reorientation, the implementation of measures which affect the distribution of CAP support depends on the decisions of member states. Within a common framework, they have the competency to partially retain or alter the distribution of CAP payments; see Figure 11.2, which schematises the institutional channels aiming at redistributing the support based on past price policy.

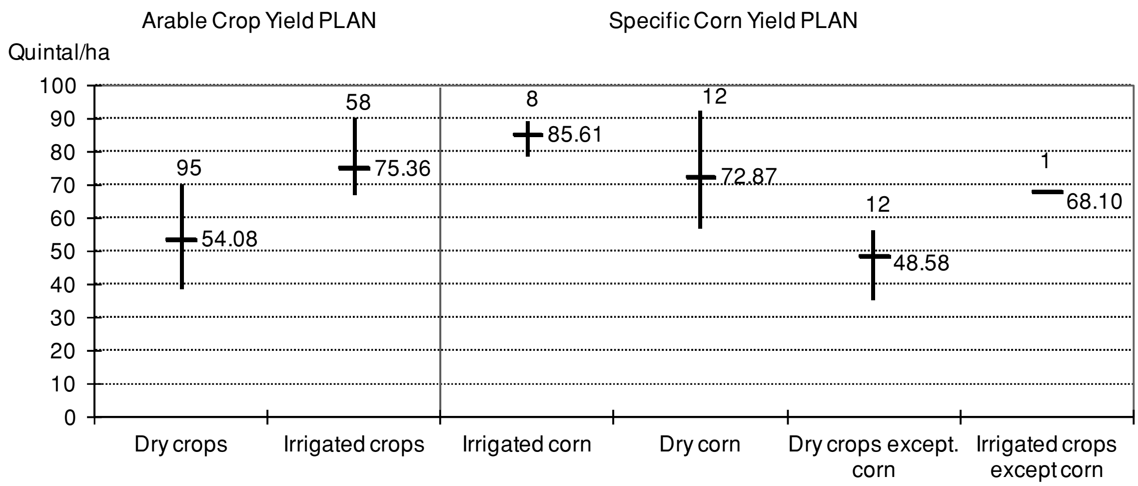
The per-hectare payments which followed the 1992 reform were computed on the basis of 1986-1991 yields. Hence, the *département* scale has been privileged. In a few cases, a *sub-département* scale has been settled on, in order to reflect yield differences more finely. These references could also distinguish irrigated land or irrigated corn in order to provide them with higher compensatory payments. Thus, the "crop plan" (*plan céréales*) distinguished: 1) 38 *départements* or *sub-départements* with a single reference yield for all arable crops — there is no specific support as regards corn or irrigation processes, 2) 57 *départements* or *sub-départements* with differentiated reference yields for dry or irrigated arable crops, and 3) 12 *départements* or *sub-départements* with differentiated reference yields for irrigated corn, dry and/or irrigated other arable crops. This fragmentation of administrative areas illustrates the strong political power of farm lobbies — which have thus been better able to capture past rents. The dispersion in crop yield references used in coupled direct payment computation is presented in Figure 11.4.

With the 1992 reform, the final per-hectare subsidy by *département* (or *sub-département*) was based on two thirds of the *départemental* (or *sub-départemental*) theoretical yield and one third of the national theoretical yield. In October 1997, the share of local and national theoretical yields has been balanced, each contributing equally to the per-hectare subsidy computation. This change resulted from the establishment of a new socialist government in June 1997 led by Prime Minister Lionel Jospin. Equity and territorial cohesion motivations led to this adjustment in the formula for direct payment computation.

The same government negotiated the 1999 reform. Agenda 2000 initiated a convergence of national rate of support for arable crops. Guaranteed prices for cereals were reduced by 15% between 1999 and 2001, and compensated by increases in the direct payment rate. At the same time, the national rates of support for arable crops have converged in line with the decoupling process. In 2002 and 2004 respectively, the rates of support for oleaginous and protein crops were decreased and converged with that for cereals (a specific per-hectare subsidy coupled to protein crop production was created in 2004 to compensate the decrease in compensatory payment rate).

Figure 11.4. Crop yield reference plan used in coupled direct payment computation by French departements/sub-departements

Quintal per hectare with average and number of French départements/sub-départements for each class



This crop yield reference plan has been fixed since 2002 in order to decouple direct payments partially. The final amount of subsidy per hectare results from the association of the *départemental/sub-départemental* yield reference and the national rate of support.

Source: Data from French Ministry of Food, Agriculture and Fisheries; author's interpretation.

In addition, following the Agenda 2000 reform, France started to implement voluntary modulation through individual rates of direct payment cuts. For their computation, French authorities privileged small and family farms by considering three criteria for the addition of a flat and progressive rate: 1) the labour force used on the holding, 2) the Standard Gross Margin (SGM) evolution of the holding, and 3) the total amount of direct payment received (uniformity of treatment). The rationale of this formula rested on politics rather than economics. The modulation mechanism was aimed at financing a targeted contract for farmers (*Contrat Territorial d'Exploitation* or *CTE*) supporting rural development and environmental amenities within their farm activities.

However, French voluntary modulation was stopped in 2002 due to complex computation criteria (fostering farmers' criticisms), the election of a new conservative government close to the farming lobby, and the lack of concluded CTEs. It was the last attempt by French authorities — prior to the 2009 CAP Health Check — to challenge the distribution of farm subsidies. The outcomes of the Health Check, negotiated by a French conservative government, illustrate that future CAP reforms may be independent of the political nature of the French government.

The hybrid status of the French historical decoupling scheme

Examining the French options as regards the new provisions provided by the CAP Health Check tends to indicate the premises of a strategy for the CAP beyond 2013. The Health Check agreement deepened the 2003 reform, and new redistributive tools permit further flexibility in national and regional implementation.

France had to make up for the lost opportunities of the 2003 reform implementation, for three main reasons. First, the legitimacy of a historical decoupling model was — and still is — declining rapidly. Taxpayers are increasingly reluctant to pay subsidies to large

farmers based on increasingly out-of-date production levels and yields. Farmers themselves are sceptical about a public support model which discriminates between farm holdings and territories on the basis of past production processes and commodities. Despite the possible grant of SFPs to newcomers, the amounts (values) of SFPs are thoroughly incoherent with their needs and duties — or with their entrepreneurship prospects. Citizens wonder at the rationale of a massive sector-based redistribution mechanism, especially in a period of economic crisis.

Second, any partial decoupling of support deserves a renewed justification. Third, and consequential to the two previous points, French authorities had to demonstrate their ability to anticipate the expected 2013 CAP reform. Hence, relaxing its conservative stance and adopting adjustments in the distribution of direct payments were indispensable.

French decisions as regards the CAP Health Check resulted from a decentralised debate which involved all stakeholders from French administration, farming and agribusiness sector, environmental, consumer and landowner organisations. The ministerial document for the French debate gave an apparent idea of the key offensive positions of France in the confirmation of the Pillar 1 of the CAP.

In February 2009, the French authorities presented four objectives that the reorientation of direct payments would have to fulfil from 2010 onwards: 1) setting up new support for grass-based livestock and fodder; 2) strengthening the rural economy and employment in the territories; 3) setting up a risk management scheme; and 4) promoting sustainable development. These four objectives would mobilise a total of roughly EUR 1.6 billion, of which 80% (EUR 1.280 billion) would result from shifted spending within the Pillar 1 of the CAP — by means of Articles 63 and 68[14] — 20% (EUR 321 million) would be transferred from Pillar 1 to Pillar 2 by means of an increased rate of compulsory modulation.[15]

The matrix in Table 11.3 presents these redistributive objectives linked to the respective financial provisions. Accordingly, 18.8% of French direct payments – supported by the EU budget —would be targeted in 2010 in view of the four new objectives.

Table 11.3. French redistributive options following the CAP Health Check, from 2010 onwards

	Pillar 1		Pillar 2[1]	Total amount
Tool Objective	Use of Article 63 New (or re-valued) SFPs for:	Use of Article 68 New subsidies for:	Use of Article 7 Further funding (by means of the increased rate of modulation) for:	
(i) Setting up new support for grass-based livestock and fodder	► Productive grassland *EUR 707 million* ► fodder *EUR 30 million*		► Agri-environmental grass premiums *EUR 240 million* *EU: EUR 176 million* *FR: EUR 64 million*	*EUR* 977 million *EU: EUR 913 million* *FR: EUR 64 million*
(ii) Strengthening the rural economy and employment in the territories:	► Potatoes and field vegetables *EUR 30 million*	► Sheep and goats *EUR 135 million* ► Milk in mountain areas *EUR 45 million* ► Durum wheat in traditional areas *EUR 8 million* ► Suckling calves *EUR 4.6 million*	► Compensatory allowances for natural handicaps *EUR 42 million* *EU: EUR 23 million* *FR: EUR 19 million*	*EUR* 264.6 million *EU: EUR 245.6 million* *FR: EUR 19 million*
(iii) Setting up a risk management scheme		► Risk management tools *EUR 100 million*		100 million *EU: 100 million*
(iv) Promoting sustainable development		► Protein crops *EUR 40 million* ► Maintenance of organic farming[3] *EUR 50 million*	► Organic farming conversion *EUR 7 million* *EU: EUR 4 million* *FR: EUR 3 million* ► New challenges *EUR 32 million* *EU: EUR 18 million* *FR: EUR 14 million*	129 million *EU: EUR 112 million* *FR: EUR 17 million*
Total amount	*EUR* 767 million	*EUR* 382.6 million[2]	*EUR* 321 million *EU: EUR 221 million* *FR: EUR 100 million*	*EUR* 1 470.6 million *EU: EUR 1 370.6 million* *FR: EUR 100 million*

1. The EU budget funds the Pillar 1 direct payments, whereas both European (EU) and national (FR) budgets fund the Pillar 2 measures.

2. Article 68 allows new spending without any individual new charging. New supports result from unspent direct payments (EUR 130 million). They cover the establishment of a risk mutual fund (EUR 40 million, from 2011, objective iii) and support for crop rotations (EUR 90 million, only in 2010, objective iv).

3. From 2011, subsidies for organic farming conversion from Pillar 2 should be funded from Pillar 1 (objective iv).

Source: Data from French Ministry of Food, Agriculture and Fisheries.

The arable sector is the main contributor to the reorientation process, as presented in Table 11.4.

Table 11.4. Redistributed support from further French decoupling by commodity[1]
2010

	Initial amount of support	*Share of total*	Charging rate	Charged amount	*Share of total*	Remaining amount	*Share of total*
	EUR million	%	%	EUR million	%	EUR million	%
Arable crops	1 154	*72.0*	55.5	640	*83.4*	514	*61.4*
Suckler cows[1]	183	*11.4*	50.8	93	*12.2*	90	*10.8*
Slaughters	181	*11.3*	12.7	23	*3.0*	158	*18.9*
Ewes and she-goats	86	*5.3*	12.7	11	*1.4*	75	*8.9*
Total	1 604	*100.0*	47.8	767	*100.0*	837	*100.0*

1. Use of Article 63.

2. Suckler cow premiums remain partially decoupled (25%).

Source: Data from French Ministry of Food, Agriculture and Fisheries; author's calculations.

The arable sector is the main contributor to the reorientation process. On the one hand, 55.5% of the amount resulting from the full decoupling of arable crop direct payments will be redistributed in view of the new objectives. On the other hand, Article 68 spending will require the charging of basic SFPs and suckler cow premiums at a linear rate of 4.5%, in addition to unspent direct payments. Since most of the SFPs result from past arable crop direct payments, the arable sector should be the main budgetary contributor of Article 68's targeted support. However, one should stress that the charged arable farm holdings will benefit from further expenditures resulting from the activation of new measures from both articles (e.g. risk management subsidies, or modernization support).

A new coupling rationale

Roughly nine tenths of direct payments may be decoupled by the time of an eventual 2013 reform. The French authorities had originally decided on a territorial and environmental re-coupling scheme. The use of Articles 63 and 68 shows a shift in the budget towards grass-based livestock producers characterised by extensive, less-favoured areas and/or environmentally friendly farm holdings. Most of the new support is coupled either to environmental/extensive practices or to specific territories. For sheep and goat support, this coupling is indirect since its distribution tends to follow a path similar to that of agri-environmental support, as demonstrated below.

The French authorities decided to partially decouple suckler cow premiums (25%), and anticipated the full decoupling of slaughter premiums in 2010. They also decided to fully decouple the she-goat premium and to set up a new coupled and higher-valued premium with the use of Article 68. These decisions illustrate the environmental and territorial focus which the French authorities wish to grant to Pillar 1 subsidies. We use Pearson and Spearman correlation coefficients in order to provide evidence for this assertion,[16] measuring the strength of distribution path considering Pillar 2 environmental

and territorial support on the one hand, and Pillar 1 disaggregated subsidies on the other hand.

Table 11.5 presents unequivocal results. The distribution of direct payments coupled to suckler cows on the one hand, and to ewes and/or she-goats on the other hand follow distribution paths similar to those of environmental and territorial measures.

Table 11.5. Pillar consistency issue: the French case
2007

Pillar 1 Pillar 2	SFP	Arable crop payment	Suckler cow premium	Slaughter premium	Ewe and/or she-goat premium	All direct payments
Environmental and territorial measures	-0.279***	-0.416***	0.498***		0.726***	-0.184*
	-0.334***	-0.435***	0.446***	Non sig.	0.656***	-0.252**
				Non sig.		
	--	--	++		+++	-

This table presents 1) Spearman and 2) Pearson coefficients of correlation at the 10% (*), 5% (**) and 1% (***) levels of statistical significance. These coefficients measure the strength of association between two variables – but not the causality. They equate to (-1) in presence of perfect negative correlation, (0) in absence of any correlation, (1) in presence of perfect positive correlation.

We use data at the French *département* level (92) which reflects the administrative level of French direct payment implementation. Data on all French (metropolitan) farm holdings are used (506,926 recipients) and not only professional holdings (335,233 recipients) in order to consider the broad spectrum of agricultural and rural actors. Pillar 2 environmental and territorial support covers compensatory allowances for natural handicaps, agri-environmental grass premiums, sustainable agriculture and territorial management contracts, and other agri-environmental measures. For each *département*, we divide the amount of subsidy by the number of Annual Work Units (AWU) in order to take into account the income support dimension of the CAP.

Source: Data from French Ministry of Food, Agriculture and Fisheries; author's calculations.

The partial redistribution of support which results from the Health Check shows that French conservatism is progressively declining. This observation can be commented as follows.

First, a re-legitimised CAP is a way to preserve direct payments – and related EU budgetary flows. Thus, France has developed a hybrid model when attempting to renew the CAP with a strong Pillar 1 mostly through new targeted subsidies and not through common historical SFPs. Within the French historical decoupling model, the use of Articles 63 and 68 enhances a kind of uniformity in SFPs per hectare. However, one should bear in mind that less than 20% of French direct payments will be targeted in line with CAP Health Check objectives. Thus, this does not remove the need for a sound reform of the French direct payments scheme after 2013.

Second, the French authorities grant to the Pillar 1 a rural development dimension, magnifying the related responsibilities attributed to national authorities without observing the co-funding principle. This jeopardises the relevancy of CAP dichotomisation, which tends to exist only for historical and budgetary reasons. It thus confirms the sensitivities which surround the CAP and budget reforms.

Conclusions

The distribution of farm support has to be considered in view of policy objectives. Equity is an important factor in ensuring that public support goes to holdings which need or deserve it. This is not a goal in itself, but is closely linked to the objective of the public policy implemented. On the one hand, equity matters if the objective is to support farm incomes. Since decoupled payments are labelled within the EU regulations as income support, equity is relevant as regards the distribution of SFPs. On the other hand, equity matters less if the objective is to pay for positive externalities, public goods or non-market commodities generated by farm activities — since the more externalities are provided, the more public support may be legitimised. Finding a European consensus on the objectives of a renewed CAP appears crucial here.[17]

Breaking the linkage between the amount of support received and the market-commodity dimension which could result from present (and past) farming activity is however a prerequisite. This rupture remains the core challenge in direct payment improvement since the 1992 reform (Mahé and Roe, 1996). From 2010 on, less than 20% of French direct payments — entirely supported by the EU budget — are targeted in the light of recent policy objectives. The CAP remains a sector-based redistributive policy which tends to slow down structural adjustments and suffers from weak low-income targeting (OECD, 2003). As a result, in spite of marginal adjustments resulting from the CAP Health Check, equity continues to be a burning topic which is deferred to national discretionary decisions.

One should acknowledge the new political economy of the rationale for and distribution of direct payments (Josling and Tangermann, 2009). The 1992 and 2003 market-oriented reforms resulted from persistent external pressures. Hence, after almost two decades of policy improvement, the EU benefits to an impressive degree as regards expected internal support concessions to be made within the Doha Round,[18] if one believes that EU SFPs respect green-box criteria. Hence, reform of the direct payment system for the post-2013 period is mostly pushed by internal considerations — in line with the 1997 Buckwell Report.[19] One should take into account that the motivation of direct payments has to shift from income to amenity support. A sector-based income policy does not appear relevant at the European Union level, and nor does a policy which remunerates local amenities. These raise subsidiarity, and budgetary, issues which exacerbate national authority trade-offs, and involve a widening number of stakeholders from environmental, pro-development, consumer or taxpayer groups. This leads to the formation of broad civil-society alliances or unexpected coalitions[20] on CAP reforms, whereas farmers' unions appear divided with internal tensions and a declining number of adherents.[21] Public support provided on the scale of a heterogeneous EU is not sustainable without clear acceptance by society. This new political environment is strengthened by the increasing political power bestowed on the European Parliament, i.e. co-decision-making on CAP issues from 2010 onwards. When setting up the post-2013 CAP, equity will still be a major political matter, especially if one considers that the rationale (and related distribution) of EU direct farm payments has to shift from income to amenity support.

Notes

1. Research and Teaching Fellow, GEM Sciences Po, Paris, France, and Goethe University, Frankfurt am Main, Germany.
2. On the farm income and support distribution issue, see Allanson and Hubbard (1999), Butault and Lerouvillois (1999), Butault, Chantreuil and Dupraz (2002), and Chatellier, Colson and Daniel (2004).
3. On the effective targeting issue of agricultural policies, see OECD (2007).
4. "*Income support, which depends almost exclusively on price guarantees, is largely proportionate to the volume of production and therefore concentrates the greater part of support on the largest and the most intensive farms. So, for example, 6% of cereals farms account for 50% of surface area in cereals and for 60% of production; 15% of dairy farms produce 50% of milk in the Community; 10% of beef farms have 50% of beef cattle. The* effect *of this is that 80% of the support provided by FEOGA is devoted to 20% of farms which account also for the greater part of the land used in agriculture. The existing system does not take adequate account of the incomes of the vast majority of small and medium size family farms.*" Communication of the Commission to the Council, COM(91)100 *The Development and Future of the CAP*, Reflections Paper, Brussels, 1 February 1991.
5. In parallel, support creates an incentive for inefficient farmers to stay in the agricultural sector – and to continue or not to produce with decoupled subsidies. This trend may reduce the concentration of holdings. Also, the capitalisation of support into the agricultural land prices slows down structural adjustments. Increasing flexibility in labour, land and capital market may reduce the magnitude of such barriers.
6. According to Garzon (2006), the increases in per-hectare payments accompanying wheat price reductions and in headage payments accompanying beef price reductions were reduced from 100% of the difference between the old and new prices to 50% and 80% respectively. The milk price decrease was compensated at 65%, with a direct payment coupled to the size of quota.
7. The reference period for computing entitlement values refers to the three-year period 2000-2001-2002.
8. The United Kingdom defined 6 regions: England (moorland), England (handicapped areas), England (others), Northern Ireland, Scotland, and Wales.
9. The 2009 CAP Health Check updated Article 69, which became Article 68 along with new modalities.
10. Article 69, Council Regulation No. 1782/2003 of 29.09.2003.
11. New member states are excluded from financial discipline and modulation mechanisms during the phasing in period for direct payments, which ends in 2013 (2016 for Bulgaria and Romania).
12. The CAP Health Check refers to the political agreement adopted on 20 November 2008 and three related regulations: Council Regulation (EC) No. 72/2009 of 19 January 2009 on modifications to the Common Agricultural Policy, Council Regulation (EC) No. 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, and Council Regulation (EC)

No. 74/2009 of 19 January 2009 amending Regulation (EC) No. 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

13. Council Regulation (EC) No. 74/2009 of 19 January 2009 amending Regulation (EC) No. 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

14. This amount considers EUR 130 million of new support which will result from unspent direct payments. As a matter of fact, Article 68 allows new spending without any further individual charging. In France, this will cover the establishment of a risk mutual fund (EUR 40 million, from 2011, objective iii) and support for crop rotations (EUR 90 million, only in 2010, objective iv).

15. Since rural development measures are co-funded by member states, the increased amount devoted to the Pillar 2 of the CAP will induce an increase in national spending. Hence, the EU and French budgets will contribute to the extra EUR 321 million with EUR 221 and 100 million respectively.

16. The same methodology has been employed by Trouvé and Berriet-Solliec (2008), who analyzed the distribution of support from the CAP's Pillar 2 in view of the European objective of cohesion. Based on data from 56 European regions, they find that Pillar 2 fails to achieve both inter and intraregional cohesion. They conclude that the increasing influence given to regions in implementing the CAP reinforces this inconsistency. By contrast, the originality of the present analysis consists of 1) using data at the French *département* level, which reflects the administrative level of French direct payment implementation and 2) considering decoupling support in France and the latest CAP adjustments. Shucksmith, Thomson and Roberts (2005) evaluate the territorial impact of the CAP and rural development policy (ESPON project). They suggest that Pillar 1 expenditures go to EU15 richer regions because of their large farms, location and farm type. These are inconsistent with economic cohesion objectives whereas Pillar 2 of the CAP is more consistent with cohesion objectives within Member States, though not between them.

17. On the long-term challenges that face European agriculture along with the need for new public and private policies, see Boulanger and Messerlin (2010).

18. On European aggregate measurement of support reduction, see Jean, Josling and Laborde (2008). For a global overview of WTO disciplines of agricultural support, see Orden, Blandford and Josling (2011).

19. This Report (European Commission, 1997) made clear that the CAP has to continue to move away from sector-based policy which distorts agricultural commodity markets towards a territorially defined and integrated policy which remunerates public goods and amenities resulting from agricultural activities.

20. For instance, an unexpected joint position paper on the future of the CAP from the European Landowners' Organisation and Birdlife International was released in January 2010; and a proposal paper gathering together 15 French environmental and development NGOs (Groupe PAC 2013) was published in February 2010.

21. For instance, during the CAP Health Check negotiations, the FNSEA (the largest French farmers' union) was split between financial losers and winners, i.e. crop and livestock producers.

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Part VI

The Impact of CAP Reform on the Environment

Chapter 12

The impact of CAP reform on the environment: some regional results

Mark Brady[1]

This chapter presents the findings of a European Union (EU) project, IDEMA, on the potential environmental impacts of the 2003 CAP reform for a selection of case-study regions. Due to the complexity of the issues at hand and the lack of historical data, the assessment was based on dynamic agent-based modelling with the extended AgriPoliS model. Our results indicate small impacts in relatively productive regions, since land use remains largely unchanged. In marginal agricultural regions, however, decoupling is shown to have a negative impact on biodiversity and landscape mosaic because of the homogenisation of land use that results from land being taken out of production. Existing agri-environmental schemes and national support acted to buffer the full potential impacts of decoupling on landscape values in these regions. The modelled effects of the reform would have been more radical if there had been no link between the decoupled payment and land, i.e. the GAEC obligation.

Characteristic of Europe is its diversity of historical agricultural landscapes that echo a rich cultural heritage, provide semi-natural habitat for a wide range of species, and generate value to society through e.g. recreation, tourism and ecosystem services (Swinton *et al.*, 2007; Benton *et al.*, 2003; OECDb, 2001). These landscapes have evolved over centuries, and are dependent on continued management for their preservation (Scherr and McNeely, 2008). Factors that influence farm profitability and hence production decisions can therefore have profound effects on the landscape and biodiversity.

Over the past 20 years, the Common Agricultural Policy (CAP) has been gradually reformed towards increasing market orientation. In the 1970-80s, price-related support dominated agricultural policies in the European Union (EU), as in other OECD countries. Starting with the MacSharry reform in 1992 and continuing with the Agenda 2000 reform a large share of price support in the European Union was replaced by direct payments per hectare of land and per head of livestock for eligible crops and breeds. The 2003 reform constituted a further and more radical change of European policies for supporting farmers (Andersson, 2004). The central element of the reform is decoupling of direct payments from production via a Single Payment Scheme (SPS), which is paid per hectare of agricultural land. It is paid regardless of whether the farmer produces commodities or not — and hence is independent of the individual farmer's production decisions — as long as the land is kept in Good Agricultural and Environmental Condition (GAEC).

The reform was intended to make European Union agriculture more competitive and market-oriented, and at the same time to provide support to farmers with less distortion of production and trade. However, in the public debate preceding the 2003 reform, it was argued that a decoupled SPS would lead to substantial abandonment of production in numerous regions and sectors, and an exodus from the most disadvantaged rural areas (Commission, 2003). Given the cultural and environmental values associated with European landscapes, the prospect of reduced agricultural activity was a cause for concern, as manifest in the concepts of the European model of Agriculture and Multifunctionality (Cahill, 2001). This follows from the argument that countryside services are produced jointly with commodities, and hence a decline in production would lead to a concomitant loss in services (Hodge, 2000). Despite this, and the recognition of the existence of multi-functional agriculture in parts of the European Union, there is contention about the dependence of landscape services on subsidies to commodity production (Harvey, 2003).

This paper presents some of the findings of a large EU project, IDEMA[2]: on the long-term effects (i.e. to 2013) of the 2003 reform on farm structure, landscape mosaic and biodiversity for a cross-section of EU regions. Due to the heterogeneity of agricultural and socio-economic conditions in the European Union, adjustments to decoupled policies and potential landscape impacts are likely to vary widely between regions. To make the assessment feasible, a sub-set of five case-study regions — reflecting some of the diversity of the enlarged European Union — were selected for analysis. These ranged from very extensive northern conditions in Sweden to intensive regions in the Mediterranean. Due to the complexity of the issues at hand and the lack of historical data, impacts are quantified using a spatial agent-based modelling approach which is described below.

Theoretical insights on decoupling and environment

A fundamental insight from the literature is that a standard static or marginal economic analysis is not suitable for analysing the impacts of decoupling because it has the capacity to affect farmers' strategic decisions (e.g. to invest or exit farming). As a consequence, the analysis is done in a dynamic setting where changes in the farmers' production opportunities can be considered (OECDa, 2001; Romstad, 1999). For example, if some farms close down as a result of decoupling, the opportunity for the remaining farms to expand will improve as more land enters the rental market, and, as a consequence, will result in a smaller reduction in agricultural activity than would be implied by a static analysis.

A basic feature of the 2003 reform is that farmers now have greater freedom to choose what and how to produce, whilst total support to the sector is largely unchanged. This additional freedom or relaxation of institutional constraints on farmers' decision environment has two important implications. First, greater freedom implies that the cost of producing commodities and non-commodities alike should decline. Second, environmental provisioning (e.g. maintenance of landscape qualities) should become relatively more profitable, given unchanged agri-environmental schemes (OECDb, 2001). Consequently, the potential negative impacts of decoupling on the environment might be counteracted or buffered by reduced costs and the increased relative profitability of agri-environmental schemes. However, the strength of the effects is likely to vary between regions, because the relative returns from commodity production and levels of agri-environmental schemes both vary throughout the European Union.

The obvious concern is that decoupling will lead to dramatic declines in agricultural activity in high-cost or marginal regions. However, since high-cost regions tend to be relatively more dependent on Pillar 2 agri-environmental schemes and national support schemes that remain coupled to production, it is likely that these payments will buffer some of the most serious potential consequences of decoupling for the environment (since farmers in these regions will still not be reliant on world market prices alone for their income). In the case of agri-environmental schemes, this could be by encouraging a switch in farming focus from commodity production to "minimizing the costs" of landscape provisioning (e.g. instead of semi-natural grasslands being a by-product of beef production, beef could well become a by-product of environmental conservation), or, in the case of national support, result simply in reduced returns to fixed factors rather than reduced output (i.e. milk quota and land rents must fall to zero before output is affected by reductions in coupled support).

Significant impacts of the reform in relatively productive or low-cost regions are unlikely, since commodity production should prevail on most land despite decoupling. In these regions, a degree of substitution from "eligible crops" to previously unsupported crops can be expected as the relative profitability of the latter increases. The environmental impacts of decoupling in low-cost regions will consequently be conditional upon the environmental characteristics of the substituted crops. From a landscape perspective, greater crop diversity is generally positive for the landscape (Benton *et al.*, 2003) whereas the pollution characteristics of any particular crop are an empirical issue (Shortle and Horan, 2001).

Coupled MacSharry/Agenda-type direct payments affect the relative price of alternative land uses in that the relative price of eligible crops increases (i.e. crops that are eligible for support such as grains and oilseeds). In this way, farmers are provided with an

artificial incentive to grow eligible crops, which distorts the market for agricultural products. In some high-cost regions, the coupled payment has been sufficient to induce farmers to grow crops that otherwise would not have been profitable (i.e. the area payment was higher than the land rent). In this way, coupled payments have made it profitable to maintain a greater diversity of commodity production, and hence land uses, in high-cost regions. In contrast, they have contributed to less diversification and hence greater homogenization of the landscape in low-cost regions. Decoupling can be expected to reverse these affects.

The focus of the environmental assessment in IDEMA was therefore on the value of environmental services provided by agricultural landscapes for the reasons argued above. The principal measures used for this purpose are indicators based on changes in land use; specifically landscape mosaic and biodiversity value, which are described more fully below. These indicators are also considered to be positively correlated with other values of landscapes, such as recreation, knowledge-pool, cultural heritage and amenity. However, a complementary assessment of the impact of decoupling on pollution risk is also provided.

Agent-based approach to environmental assessment

In the assessment, we use an empirical agent-based model (ABM) that is capable of simulating the long-term consequences (i.e. to 2013) of CAP reform on land use and farming practices in a real agricultural region. This was done by extending an existing ABM of regional structural change in agriculture, the Agricultural Policy Simulator or AgriPoliS (Balmann, 1997; Happe *et al*., 2006), for the purpose. The agent-based approach allows us to represent important aspects of the heterogeneity of farms, and their behaviour in space and time. We provide here only a short description of AgriPoliS and our modelling assumptions. For more details, see the chapter by Brady *et al*. (2010) in these proceedings, or for full documentation, see Kellermann *et al*. (2008).

Overview of the AgriPoliS model

The observed population of farms in a region is modelled in AgriPoliS as a multi-agent system in which individual farm-agent behaviours and their interactions — principally competition for land — are defined through an optimization framework, with land use resulting as an emergent property of the system. The “optimizing” behaviour of farm agents is modelled using mixed integer programming, which is well suited to the task of combining economic, ecological and biophysical aspects of landscape evolution. Anonymous survey data on individual farms (i.e. FADN) and regional economic statistics were used to calibrate the model to a real agricultural landscape (Sahrbacher and Happe 2008).

Spatial representation in AgriPoliS is by a two-dimensional grid of equally sized cells or plots (Happe, 2004). Five different landscape layers are used to represent the structure of agriculture and the landscape in each region (Kellermann *et al*., 2008).

- The ownership layer denotes the ownership or rental of a specific plot.
- The soil layer reflects the distribution of any number of different land or soil quality types, which determines what types of (endogenous) agricultural land use are feasible on a particular plot.

- The block layer replicates the distribution of contiguous areas of a particular land type that are separated from land of the same type, by either another land type or physical borders that are protected through say legislation (e.g. hedgerows, ditches, roads), and hence, for all intensive purposes, can be assumed to be permanent boundaries that are not affected by agricultural policy.
- The allocation layer represents the allocation of plots to farms and reflects farmers' land rental decisions.
- The fifth layer reflects a farm's cropping decisions, i.e. a field comprising a number of contiguous plots used for a particular activity (e.g. wheat).

Consequently, the modelling framework can simulate from policy to individual farms and changes in cropping patterns at the plot level based on farm-agent behaviour. In this idealized representation, all land uses other than agricultural ones, such as forestry, lakes, and urban development, are subsumed into a single plot type: non-agricultural land. This abstraction is based on the assumption that only agricultural land use is affected by changes in agricultural policy, and hence all other features of the landscape remain unchanged. A further simplification is that AgriPoliS models the landscape synthetically, rather than as the actual location of farms and land as seen on a map. Using a landscape calibration algorithm, AgriPoliS generates a statistically similar landscape based on the size distribution of agricultural blocks and non-agricultural land in the region. This approach captures some important characteristics of the actual landscape (field size distribution and fragmentation) while other characteristics are ignored (field shape).

Model assumptions and drivers of land use change

The following assumptions are made about the decision environment of farm-agents. First, it is assumed that individual farmers aim to maximise net family income given their family's land, wealth and labour endowments. The area of agricultural land in the region is limited and the opportunities for employment in other sectors determine the opportunity cost of on-farm labour. The family's wealth endowment determines their cost of capital. The landscape is represented by a set of agricultural land blocks of varying size and distance from farmsteads in the region. Labour and capital are substitutes in the model whereas field-size and capital are complements. These relationships imply that families (and regions) with a low opportunity cost of labour will utilize relatively more labour in the farm enterprise and that cost savings can be achieved by farm and field expansion. Finally, farmers influence the landscape through their land use decisions (i.e. which blocks to farm, and how) that, in turn, are influenced by the nature and level of agricultural support. Given the existence of a competitive land market (as assumed in the model), rented land will over time gravitate to the most efficient or profitable producers (i.e. those that can extract the highest rent/profit from each plot).

The shadow price of land (i.e. implicit land rent) is a crucial policy variable, because the higher the potential land rent, the less sensitive land use will be to changes in market and policy conditions (identical reasoning applies to quota-constrained outputs such as milk). Factors that reduce implicit land rents over time will therefore influence structural change and hence need to be distinguished from the impacts of decoupling support. For example, rising off-farm wage rates as a result of growth in other sectors is a particularly critical factor, as this implies that the returns from farming need to increase over time if farmers are to maintain income parity and remain in the sector. Further, off-farm employment opportunities vary considerably between regions and have the potential to

buffer the impacts of decoupled support where the opportunity cost of labour is low; this is important to be aware of when considering the regional comparisons in the empirical results. Finally, the joint distribution of block size and distance of blocks from farmsteads are important physical constraints on farm expansion (since transport is costly).

Environmental indicators

The ability to model land use change as an emergent property of the interaction between individual farm-agents — through space and time — provides a basis for simulating and evaluating the impacts of changes in agricultural policy on landscape quality via changes in farm-agent behaviour. This is done by incorporating into the model mathematical functions that relate changes in land use to environmental variables. The functions used to measure changes in mosaic and biodiversity are described below.

Landscape mosaic

The more diverse and heterogeneous a landscape, the more complex its mosaic, and hence the more it can potentially contribute to amenity, recreational, cultural and knowledge values. Hence, mosaic complexity can be taken as a general indicator of landscape value. Changes in the landscape mosaic were measured using Shannon's Diversity Index (SDI):

$$H = -\sum_{i=1}^{I} p_i \ln(p_i) \qquad [1]$$

where H denotes mosaic diversity, I is the set of different land uses, $i \in I$, and p_i is the share of the total land area covered by the i^th^ land use (i.e. $p_i = a_i \big/ \sum_i a_i$ where a_i is the area of land use *i*). It can be shown that, for any given number of land uses, there is a maximum possible diversity, $H_{\max} = \ln I$, which occurs when all land uses are present in equal area, *i.e.* $p_i = 1/I$ for all *i*. According to this indicator, mosaic value increases if the area of a relatively scarce land use (i.e. $p_i < 1/I$) increases or a relatively common land-use (*i.e.* $p_i > 1/I$) decreases (and *vice versa*). This is consistent with our understanding that humans prefer a mosaic landscape (as observed in some reference year) compared to a more homogenous landscape.

Biodiversity value

To measure biodiversity, we draw on the *species-area* relationship — one of community ecology's few genuine laws — which defines the relationship between the expected number of species and habitat area. This approach to modelling biodiversity is also used by, for example, Nelson *et al.* (2009). If one graphs the number of species s_i supported by a particular habitat (i.e. an agricultural land use) *i,* against its area a_i, then the data are well approximated by a power function (Rosenzweig 1995):

$$s_i = c_i a_i^{z}, \qquad [2]$$

where the parameter c_i is the species *productivity* of land use *i*. The higher is *c*, the more species a habitat is likely to support. In contrast, z is a scale parameter that determines how species productivity changes in response to habitat area. We then calculated

biodiversity or species value as the expected number of unique species in the landscape, $\sum_i s_i$, the upper value of which is constrained by the total area of agricultural land, $\bar{A}$, such that $\sum_i a_i < \bar{A}$. Since c_i and z are positive constants, the marginal diversity value of habitat is positive $\left(ds_i / da_i > 0 \right)$ but decreasing in area $\left(d^2 s_i / da_i^2 < 0 \right)$ since $z < 1$. Hence any reduction in habitat area will be negative for its contribution to biodiversity -which follows common perception – but the strength of the impact will depend on the relative scarcity of the habitat and its species productivity. In other words, a relatively large reduction in a common habitat would imply a relatively small reduction in biodiversity value, whereas a small decrease in relatively scarce, productive habitat would imply a relatively large loss in value. The impact of a land use change at the landscape level on biodiversity could therefore be either positive or negative depending on the marginal biodiversity value of competing farmland habitat (e.g. grassland or arable crops).

This indicator has a number of characteristics that are both appealing and useful for policy analysis. Firstly, given observations of species and habitat area, the species productivity factor can be calibrated by rearranging Equation 1 and plugging in the relevant data, that is

$$c_i = \frac{s_i}{a_i^{\,z}}. \qquad [3]$$

Secondly, Equation 1 is a homothetic function because it is homogeneous of degree *z*. This implies that only relative values of *c* are needed to rank different land allocations in terms of their contribution to biodiversity. Hence, given some information about the relative values of *c* for different habitat, the species-area relationship can be used to *rank* the impacts of changes in agricultural habitat on biodiversity. This is important because few surveys tally all species (Magurran, 2004). Since *z* typically falls within a narrow range (0.18-0.25) for a diverse suite of ecosystems, we set it to 0.19 (Rosenzweig, 1995).

In the model, we use the number of threatened or red-listed species as a proxy for uniqueness and hence value (IUCN, 2001) — fundamental to the nature of biodiversity value is the number of different or unique species present in the landscape (Weitzman, 1992). Red-listing considers a range of characteristics that are relevant to value (in particular regional and global scarcity) and is the central indicator in international conventions on biodiversity (e.g. Countdown, 2010). Red-listed species represent as well a subset of total species, and, given that the most species-rich habitats in our case-study regions are also those supporting most red-listed species (i.e. pasture and grasslands compared to intensive arable crops), our biodiversity measure can be considered a weighted index of biodiversity value, which is what we require.

Results of environmental impact assessment

Environmental assessment in IDEMA focused primarily on the implications of decoupling for preservation of landscape values (Brady *et al.*, 2009). An important reason is that the principal environmental risk associated with decoupling is the loss of landscape values that are produced jointly or in conjunction with agricultural commodities (because decoupling reduces the level of returns to commodity production). Land abandonment, in particular, may result in the loss of landscape values. We provide nevertheless an abridged assessment of the impact on pollution risk at the end of this section (for detailed results, see Brady *et al*., 2007).

Case-study regions

The case-study regions were selected to capture some of the diversity of the EU25. Selection focused on the following characteristics: agricultural (North/South); socio-economic (high /low income); mode of operation (intensive/extensive); scale of operations (small/large farm); and legal form (private/corporate). Further, because decoupling is more likely to have significant landscape effects in marginal regions – due to commodity production becoming unprofitable at the margin – we biased selection away from the most competitive agricultural regions. Table 12.1 provides an overview of farm and landscape structure in each region.

The criterion South implies Mediterranean, which is represented by the two Italian regions, Marche and Calabria. These and Vysočina in the Czech Republic are low-income regions with poor employment opportunities outside of agriculture. Intensive regions are defined by high input levels per ha of land (e.g. labour, nutrients and chemicals). The Mediterranean regions are the most intensive followed by Vysočina. The two Swedish regions, Jönköping and Västerbotten, are considered extensive because the area of grassland is high and livestock density low (Table 12.1). However, milk yield per cow is relatively high. These regions also provide a contrast with respect to the various Pillar 2 instruments of the CAP and how they might interact with the SPS. Jönköping has a large area of semi-natural grassland that is important for conservation of biodiversity and its mosaic of arable land adds value to a landscape otherwise dominated by spruce forest. Consequently, agri-environmental schemes are relatively common in this region. In addition, farmers in Västerbotten are also entitled to complementary national support coupled primarily to milk production (at EUR 0.10/kg).

Vysočina is typical of historical landscape degradation in the new member states (NMS) and the urgency of environmental problems (Jelinek *et al*., 2007). Extreme expansion and amalgamation of fields during the Communist era has resulted in gigantic fields (frequently over 100 ha) that are both prone to erosion and increase the risk of flooding. Much of the historical mosaic and species-rich habitat such as pasture was also destroyed. On the other hand, Mediterranean landscapes are characterized by perennial crops and small fields (0.5-2 ha) which contribute to a mosaic considered integral to tourism. Farms are also small by northern European standards but produce higher-value products such as grapes, olives, fruits and vegetables. Calabria has conditions and an output mix (fruits and olives) that are similar to those found in Spain and Greece. Marche has features closer to continental agriculture, having a mix of arable crops and wine-grapes.

Table 12.1. Farm and landscape structure of selected regions

		Sweden		Italy		Czech Republic
		Jönköping	Västerbotten	Marche	Calabria	Vysočina
Indicator						
Total UAA[1]	Ha	134 216	74 414	49 082	29 176	393 726
Lower limit on farm size	Ha	2	2	All farms	All farms	1
Number of farms	Nbr	3 824	2 506	5 785	10 626	3 433
Average farm size	Ha	35	30	8.5	2.7	114
Grassland area	% of Uaa	82	80	2	5	21
Livestock density	LU/ha	1.1	0.8	1.6	0.9	0.8
Normal yield (barley)	t/ha	3.5	2.3	4.1	-	5.2
Milk yield per cow	Kg/year	9 000	9 000	n.a.[3]	7 260	6 175
Landscape structure						
Share of agricultural land	%	14	n.a.[3]	85	85	77
Meidan block size	Ha	1.41	1.48	0.32[4]	0.85	10.63
Mean block size	Ha	1.76	2.23	0.71	2.05	19.26
CV block size[5]		1.27	1.36	1.61	1.87	1.26

n.a.: not applicable.
1. Utilized Agricultural Area.
2. Minimum area of land to be defined as a farm in statistics.
3. Concentrated along river valleys.
4. Arable land only.
5. CV or Coefficient of Variation as indicator of variability in block size.

Policy scenarios evaluated

The AgriPoliS simulations were run over a 13-year period from 2001 to 2013 (the end of the current CAP programme). We considered three policy scenarios in EU15, these being:

- A benchmark scenario which represents continuation of the previous Agenda 2000 policy framework with coupled payments beyond 2004 (referred to as AGENDA).
- The actual 2003 CAP reform, including partially decoupled payments, as it was implemented in each MS starting in 2005 (REFORM).
- A bond scheme where the obligation to keep land in good agricultural and environmental condition (GAEC), as in the REFORM scenario, is removed (BOND). In this case, the SPS for each farm is not distributed as a payment per hectare of managed land, but goes directly to the farmer. Hence, the farmer can produce or choose to leave the sector and still receive support.

Note, for new member states (NMS), i.e. Vysočina in Czech Republic, AGENDA mirrors the pre-accession policy framework continued beyond 2004 and REFORM represents the phasing-in of CAP decoupled payments on accession to the European Union. Consequently, the impact of the REFORM for Vysočina is more likely to reflect the implications of a substantial increase in payments under the CAP, rather than decoupling of historical support.[3] The BOND scenario has identical interpretations across all regions. Details of the policy framework for Vysočina can be found in Jelinek *et al.*

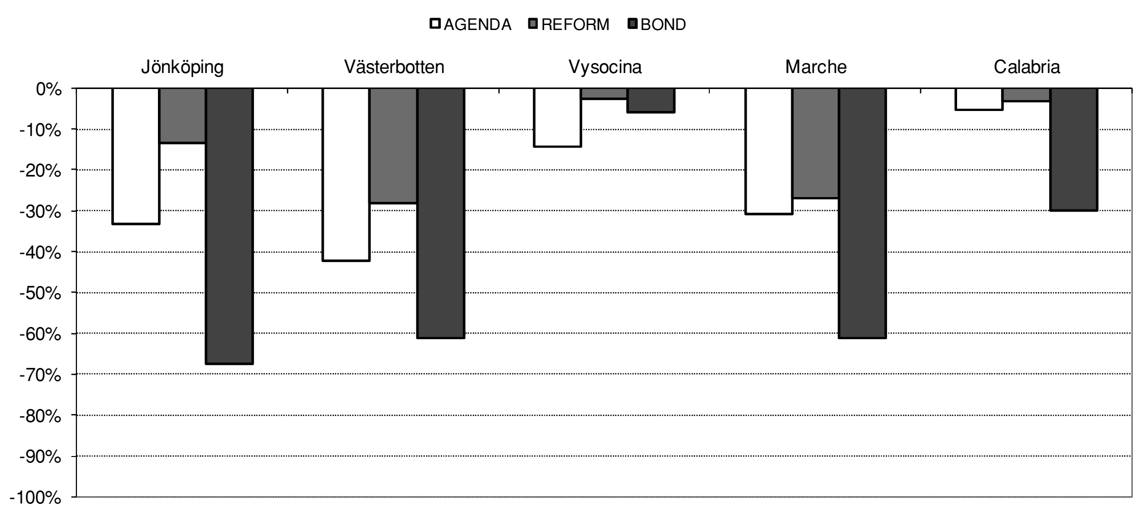
(2007), for the Swedish regions in Sahrbacher *et al.* (2007), and for the Mediterranean regions in Lobianco and Esposti (2006).

Impacts of decoupling on farm structure

As a basis for understanding the consequences of decoupling for landscape, we first present the modelled impacts on farm structure. Compared with the continuation of production support (AGENDA), decoupling (REFORM) is shown in Figure 12.1 to slow the rate of farm exits, and hence growth in farm size (Figure 12.2) in all regions. This is because farm agents have the alternative of not producing and simply maintaining land in GAEC, a relatively low-cost measure. For these farms, maintaining their least productive land in GAEC is, according to the model, more profitable than commodity production or off-farm work opportunities. This effect was least noticeable in the Mediterranean because only a minor area of land was taken out of production and most significant in the Swedish regions because of the large areas of grassland.

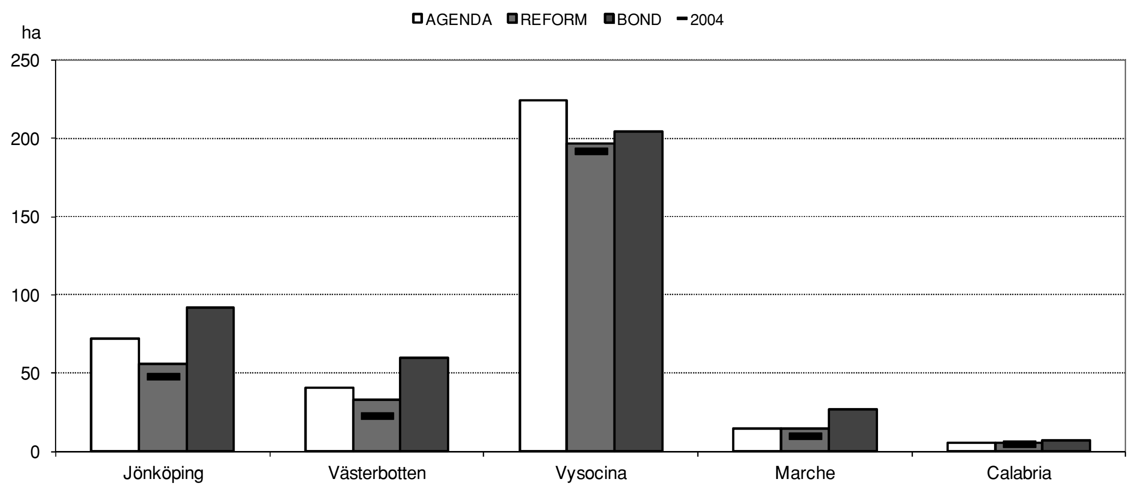
The BOND results demonstrate that the GAEC requirement slows structural change considerably in EU15 regions as shown in Figures 12.1 and 12.2 (but avoided "abandonment" of land in the most extensive regions, see below). The GAEC requirement had little impact on farm structure in Vysočina because of poor off-farm work opportunities. Thus the type of decoupling scheme — with or without a land management obligation — has potentially important implications for structural change and hence the landscape.

Figure 12.1. Change in number of farms from 2004 to 2013 with the Agenda 2000 scenario, actual implementation of the 2003 reform and bond scenario



Source: Brady *et al.* (2009).

Figure 12.2. Average farm size in 2013 with the Agenda 2000 scenario, actual implementation of the 2003 reform and bond scenario



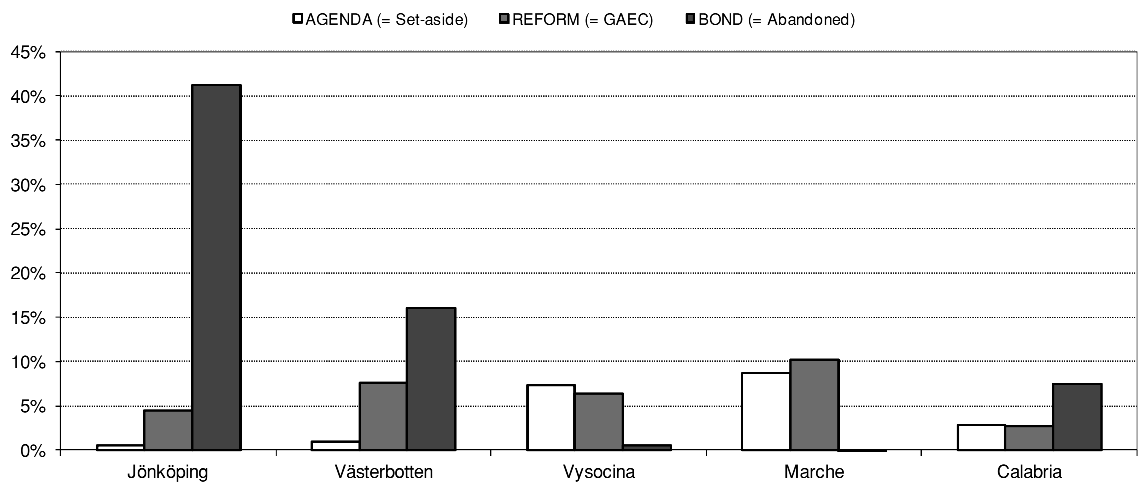
Source: Brady *et al.* (2009).

Impact on land use

Figure 12.3 shows the impacts on land use in terms of the resulting areas of set-aside, GAEC and Abandoned land for the three scenarios, relative to the total agricultural area in 2004. In focus here is the area of land abandoned under BOND (theoretically, no land should be abandoned in REFORM due to the GAEC obligation). To begin with, note that under BOND only a very small area is abandoned in Vysočina and nothing in Marche, despite relatively large areas of minimum GAEC appearing in REFORM. This is because the areas of GAEC shown in Figure 12.3 mirror, approximately, the historical areas of obligatory set-aside that still needed to be maintained at the time of the 2003 reform, rather than representing voluntary idling of land by farm agents (NB: this requirement was recently waivered by the European Union in response to, at the time, rising global food prices). Consequently, the set-aside/GAEC areas in these regions are used for commodity production when farm agents are given full freedom to choose land use under BOND.

Land abandonment of sharply varying degree is shown to occur in the other regions. The most substantial effects, as expected, occur in the extensive regions of Jönköping and Västerbotten. It may be somewhat surprising that the area abandoned is much larger in these regions than the area of GAEC since, theoretically, the GAEC area reflects the area of land not profitable to farm at market prices alone. This occurs in the model because the Swedish GAEC obligation requires semi-natural grassland to be grazed by ruminants (a relatively costly obligation that mimics agri-environmental schemes), but which is eliminated in the BOND scenario. Thus, this result reflects the stringency of the Swedish requirements rather than the profitability of commodity production itself after the 2003 reform. In Calabria, a relatively small area related to olives is abandoned because continued production was the least-cost way of meeting the GAEC obligation for this land. For impacts of BOND on land use in some of the other regions modelled in IDEMA (i.e. Brittany, Hohenlohe, Saxony, South-east United Kingdom), see the paper by Brady (2010) in these proceedings.

Figure 12.3. Area of set-aside, GAEC or abandoned land in 2013, relative to total agricultural area in 2004



Source: Brady *et al.* (2009).

Impacts on landscape mosaic

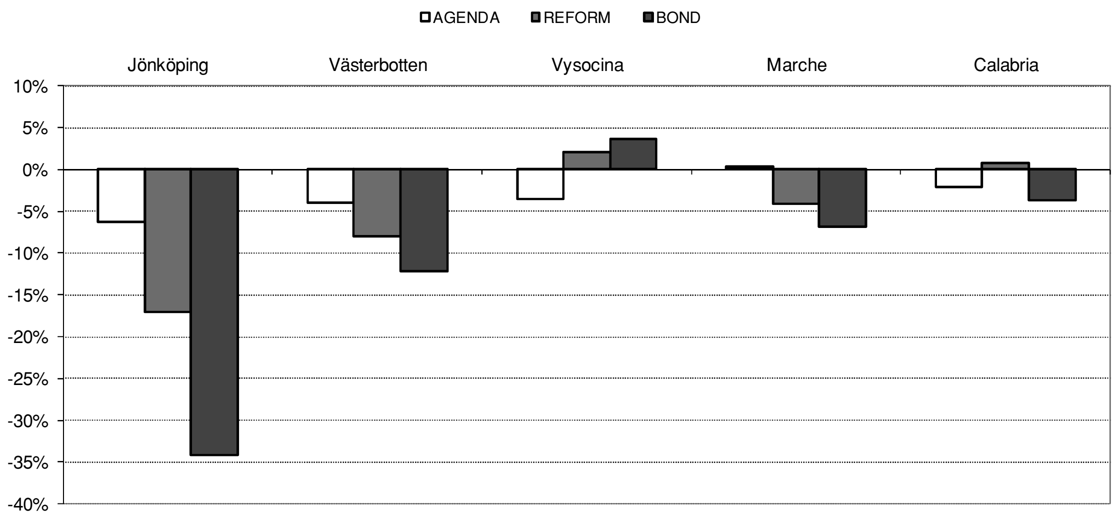
The modelled impacts of decoupling on landscape mosaic are summarized in Figure 12.4 as measured by Shannon's Diversity Index (SDI). Each column in Figure 12.4 shows the change in mosaic compared to the observed situation in 2004. A negative value indicates that mosaic has deteriorated (i.e. become more homogenous), which is most pronounced for all scenarios in Jönköping and Västerbotten. In these extensive regions, REFORM lead to a significant reduction in the area of grain and grass-fodder, yet the GAEC condition ensured that land was not abandoned, and hence avoided the larger deteriorations in mosaic occurring under BOND. Nevertheless, mosaic deteriorates compared to AGENDA because managing land according to minimum GAEC results in an increase in the area of the dominant land use, grass. In this sense, the SPS provides an incentive to homogenize the landscape in extensive regions. Mosaic declined less in Västerbotten compared to Jönköping because national milk support is sufficient to maintain land in production.

In regions where cultivation of crops remains largely profitable after decoupling in the REFORM and BOND scenarios (Czech and Italian regions), the potential impact on mosaic is not obvious but depended on the specific changes in the regional crop mix that occurred as a result of decoupling (i.e. the particular substitution effects between common and less common crops). Mosaic improves in Vysočina as a result of REFORM (i.e. accession) because the area of grain – the dominating crop type in 2004 – declined, and the area of less common fodder crops increased, due to an increase in the relative profitability of intensive beef production. Mosaic improved further under the BOND scenario due to increased crop diversification. On the other hand, AGENDA (i.e. pre-accession) resulted in a slightly larger area of grain and hence reduced mosaic.

In the Mediterranean regions, REFORM results in fairly small but opposite effects on mosaic due to region-specific changes in the crop mix. The BOND scenario causes a somewhat larger reduction in mosaic in Marche due to reductions in the areas of durum wheat, sugar beet, sunflower and silage crops, and in Calabria due to reductions in soft wheat and olives. This implies that continued production of these crops was the most

cost-effective way to fulfil the regional GAEC requirements. Overall, the effect of the GAEC obligation on mosaic in Vysočina and the Mediterranean regions is fairly small since market prices are sufficient to maintain most land in commodity production: hence the GAEC obligation was shown to be redundant in these regions for maintaining landscape. Instead, some substitution between crops occurs, the effects of which are crop- and region-specific.

Figure 12.4. Change in landscape mosaic in 2013 compared to 2004
Shannon's Index



Source: Brady *et al*. (2009).

Impacts on biodiversity

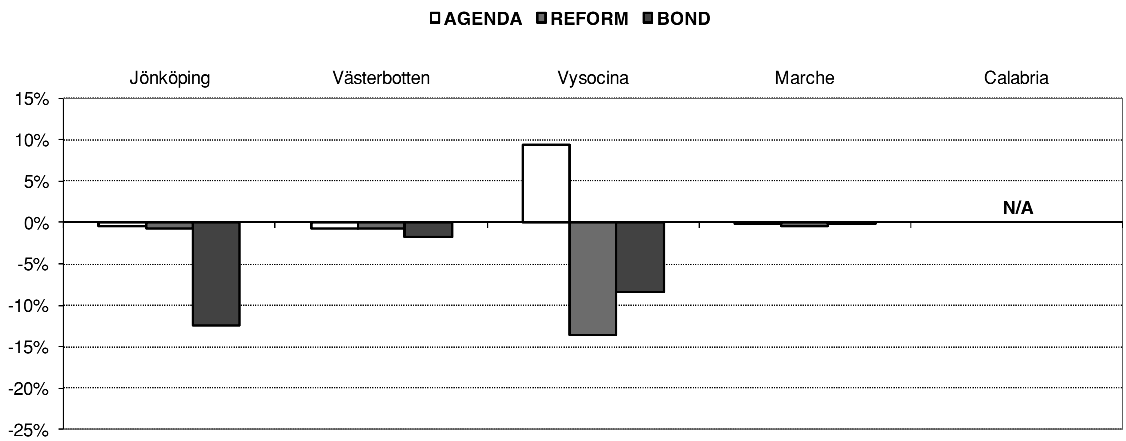
Impacts on biodiversity are shown in Figure 12.5 to vary substantially between regions and policy scenarios, and to differ substantially from the policy impacts on mosaic. For Jönköping, REFORM had little impact on biodiversity, unlike the impact on mosaic. This result is attributable to the similarity, as described above, of the GAEC obligation and agri-environmental schemes for semi-natural grassland. Despite a significant decline in modelled beef output under REFORM due to decoupling of headage payments, farm agents reorganised livestock holdings to minimise the cost of landscape management by switching to sheep from cattle. As indicated above, only 49% of the semi-natural grassland area is preserved in Jönköping under the BOND scenario (i.e. in absence of the GAEC obligation). Additional simulations indicate that this proportion would fall towards zero if agri-environmental payments were also eliminated. In this sense, existing Pillar 2 payments act to buffer the landscape impacts of decoupling, but not entirely. Note, however, that the substantial decline in mosaic (-36%) and land abandonment (41%) in Jönköping under BOND does not translate into a proportional reduction in biodiversity; a result of the diminishing marginal productivity of habitat. As shown in Figure 12.5, biodiversity falls by only 15% according to our indicator (but this is potentially serious as it represents the loss of around 26 red-listed species).

Impacts on biodiversity were similar across all scenarios for Västerbotten because coupled Pillar 2 national support, which remains unchanged in all scenarios, buffers the impacts of decoupling on production. Since arable grassland is the dominant habitat in

this region, the reduction in area under BOND (-16 %) has only a marginal impact on biodiversity (because the marginal biodiversity value of arable grassland in this region is low).

Figure 12.5. Relative change in biodiversity in 2013 compared to 2004

Percentage change in number of species



N/A: Not applicable.

Source: Brady *et a*l. (2009).

Reduced biodiversity in the REFORM and BOND scenarios for Vysočina might seem inconsistent with the corresponding improvements in mosaic shown in Figure 12.4, since land use diversity is generally supposed to be important for maintaining biodiversity. The primary driver of biodiversity conservation in this region is the area of pasture. Pasture is not only the ecologically most productive habitat but it is also scarce, which translates into high marginal biodiversity value according to the species-area relationship. As such, even a small reduction in the area of pasture causes a relatively large reduction in biodiversity. In terms of mosaic, the reduction in pasture area is compensated for by increased diversity of arable crops. AGENDA (i.e. pre-accession policy) results in increased biodiversity because it favours suckler/extensive beef production (due to lower payment levels) and hence a greater area of pasture. Perhaps surprisingly, the BOND scenario is better for biodiversity than REFORM. This result is due to two complementary effects: an increase in the relative profitability of suckler beef production which requires pasture, and the EUR 110/ha agri-environmental payment to pasture/grassland which raises the relative profitability of this land use in BOND. Hence pasture area and biodiversity decreased relatively less compared to REFORM, which is more favourable to intensive beef production.

The modelled losses in biodiversity in Vysočina illustrate the problem of having a minimum land management obligation when biodiversity is dependent on preserving specific habitats. Even though agricultural activity is maintained, important habitats may still be lost, denying the general proposition of joint production between farming and the environment.

For Calabria, both decoupling scenarios result in significant reductions in the area of managed olive plantation. However, due to uncertainty about the importance of agriculture for biodiversity conservation in this region, we do not present a biodiversity index (*i.e.* we have not been able to investigate the ecological consequences of ceasing to manage perennial habitat). A similar effect did not occur for Marche because of the

relatively small area of olives. Reduced mosaic value for Marche under BOND did not translate into lower biodiversity value because different arable crops in the region were assumed to have equivalent habitat value (i.e. can substitute for each other). Since the total area of arable habitat remained unaffected by decoupling, so did biodiversity value according to our indicator.

Impact on pollution risk

The model shows that impacts on pollution risk are fairly insignificant across all regions, which implies that decoupling has no general implications for pollution; see Brady *et al*. (2007) for detailed results. This is because pollution is influenced primarily by crop-specific characteristics given the geophysical characteristics of a region, and the balance between crop and livestock output, rather than production per se. In the more intensively cultivated regions (Vysočina and the Mediterranean) decoupling lead to increased areas of previously unsupported crops. The concomitant change in the pollution characteristics of the crop mix resulted in changes in levels of pollution as measured by nitrogen surplus (Figure 12.6). In Vysočina and Marche the area of more pollution-prone crops increased as a result of decoupling and consequently nitrogen surplus increased. On the other hand, a reduction in the area of nitrogen-intensive crops in Calabria resulted in a lower nitrogen surplus. However, an increase in the area of vegetables, which consume more chemicals and water, resulted in increased chemical (not shown) and water inputs in Calabria (Figure 12.7).

In high-cost regions, it seems reasonable to expect that pollution risk would decline with decoupling due to the reduction in the cultivated area. However, the results for Jönköping illustrate that this may not necessarily be the case for nutrient surpluses and hence water quality. Unlike chemical sprays, nutrient surplus is not a function of land use alone but also of livestock numbers and hence manure volume. In Jönköping, both livestock numbers and the cultivated area decrease in the decoupling scenarios but the volume of manure decreases proportionately less than the area of land suitable for spreading manure (i.e. land in cultivation and excluding GAEC). Hence, the nutrient surplus in total and as measured in kg/ha increases in 2013 compared to 2004 in all scenarios. Ultimately, the impact of agriculture on water quality will depend on the geophysical capacity of the region to assimilate excess nutrients. In Jönköping, this capacity is quite high due to heavy soils and long water pathways to the sea.

Finally, the REFORM (and BOND) resulted in accelerated soil loss in Vysočina (Figure 12.7) (NB: erosion risk was only modelled for Vysočina since it is not a significant issue in the other regions). This result is explained by substitution to more erosion-prone crops rather than decoupling per se. Given the serious nature of soil erosion problems in the Czech Republic, this result should be of great concern. There seems in other words to be a pressing need to coordinate erosion prevention measures and CAP payments.

Figure 12.6. Change in nitrogen surplus

kg/ha utilized agricultural area

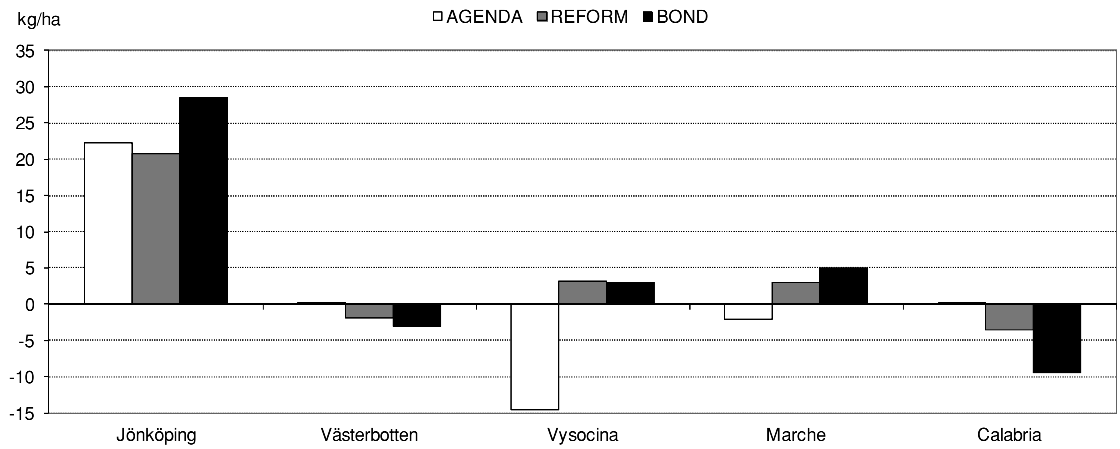
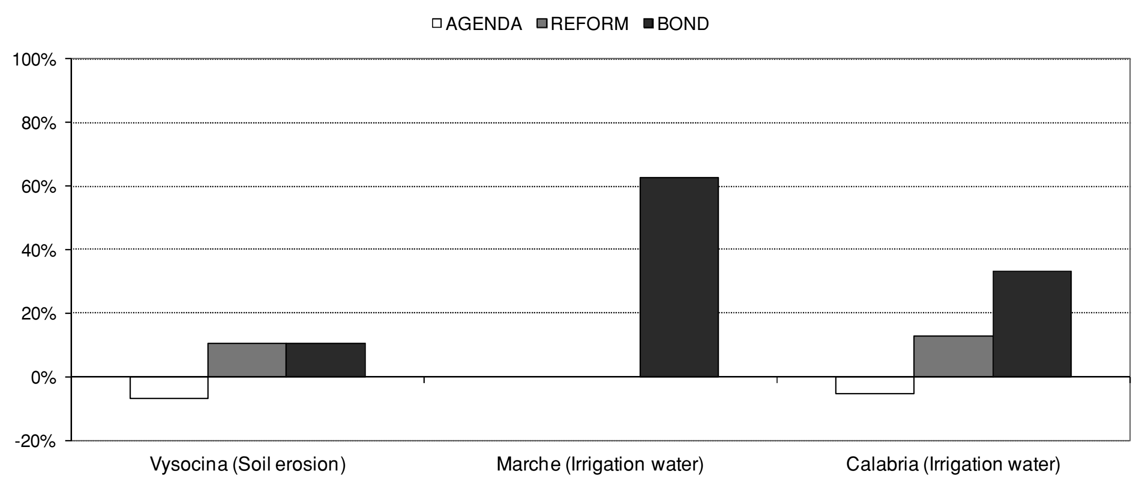


Figure 12.7. Change in soil loss (Vysočina) and water input (Marche and Calabria)



Conclusions

The environmental impacts of decoupling EU agricultural support from production presented in this paper were assessed as part of the IDEMA project. Both the 2003 CAP reform and a more extreme bond-type scheme were analysed. The central element in the 2003 reform was the introduction of the Single Payment Scheme (SPS) which is linked to land via the obligation to keep land in Good Agricultural and Environmental Condition (GAEC), but decoupled from production. In the hypothetical bond scheme, we test the implications of the GAEC obligation by allowing farmers to collect the bond payment even if they leave the agricultural sector, and hence break the link between payments and land.

Decoupling and implications for the environment

Our results demonstrate that the 2003 reform could have negative consequences for the environment — principally landscape values — but only under particular circumstances. In the most extensive regions (Jönköping and Västerbotten) with relatively high production costs, the reform was shown to have a negative impact on the landscape mosaic compared to continuation of the Agenda 2000 framework. Since the GAEC obligation for arable land represents a minimum management requirement, the SPS provided an incentive to homogenize land use – increasing the area of the dominant land use, grass (i.e. grass-sown fallow/set-aside). On the other hand, by mimicking existing agri-environmental schemes, the GAEC obligation for semi-natural grassland ensured preservation of biodiversity values associated with this land (by requiring annual grazing by ruminants). Existing agri-environmental schemes and national support were also shown to reduce or buffer, to some degree, the full potential negative impacts of decoupling direct payments from production in these regions.

Modelled impacts were least in regions with favourable conditions for agriculture (Vysočina and Mediterranean regions), because most land was continued to be used in commodity production by farm agents despite the 2003 reform. Hence in these regions GAEC proved to be a redundant obligation in view of the fact that market prices were sufficient to keep land in commodity production and hence meet payment requirements. Environmental outcomes of decoupling were, as a result, capricious in these regions, depending on crop choices and environmental heterogeneity. Under these circumstances, the SPS merely raises land rents — see Brady *et al.* (2010) in these proceedings — without contributing to environmental quality. In the Czech region where the intensity and scale of arable farming is recognised as being detrimental to landscape value, we found nothing in the design of the GAEC obligation that provides incentives to improve the situation. On the contrary, things became worse for biodiversity and soil erosion due to EU accession and the accompanying higher payment levels: GAEC is after all a minimum standard and hence does not prevent over-use. So, even though agricultural activity was maintained, important habitats may still be lost despite continuation of direct support.

Our overall conclusion regarding pollution risk is that it is largely unaffected by decoupling. However, our results indicate that change in the ratio of livestock to cultivated area could induce undesirable pollution effects (via concentration of manure spreading) in high-cost regions. In situations where there is a direct relationship between input levels and cultivated area, such as the use of chemicals, then inputs can be expected to decrease in proportion to the area taken out of production. This effect was shown to be significant in high-cost regions. Otherwise, factors such as crop characteristics, choices of agricultural management practices, and biophysical features of the landscape determine pollution levels. As such, the need for non-point source pollution policy seems unchanged as a result of decoupling, especially in intensively cultivated regions.

In summary, the GAEC obligation (as modelled here) did not prove to be a sufficient measure to avoid all the negative environmental consequences of decoupling. Rather, our results imply that the SPS has serious weaknesses as a means of procuring environmental stewardship, which is also supported in theory. Any flat-rate payment scheme — and the SPS clearly qualifies as such — will be inefficient when either the costs or benefits of environmental provisioning are heterogeneous (Fraser, 2009). Under these circumstances, cost-effectiveness calls for spatially differentiated environmental policy instruments (Wätzold and Drechsler, 2005). The key problem is the immense heterogeneity of agri-

environmental conditions in the enlarged European Union. Insufficient flexibility is available under the stipulations of Pillar 1 support — by definition a common policy — to handle environmental heterogeneity. What is more, the stricter the environmental conditions associated with GAEC obligations, the higher the costs to farmers of meeting payment obligations; and hence the less the SPS will support farm incomes, the overriding goal of direct support. The SPS is therefore not generally justified as an efficient environmental instrument. More efficient (and effective) environmental policy instruments are needed to match the local requirements for conservation and landscape enhancement than is provided by the SPS. This flexibility is available under the auspices of Pillar 2 agri-environmental schemes.

Environmental public goods from agriculture: what to pay for?

The argument for taxpayers financing the provisioning of environmental public goods by farmers is compelling: under-provision of public goods is a classical instance of market failure. The relevant empirical questions that remain are therefore:

- where are these goods being generated by farmers?
- what levels are being generated? and
- how much risks being lost if direct payments (i.e. SPS) are reduced?

In some regions of the EU, the existence of environmental public goods is unequivocal, e.g. semi-natural grasslands in Jönköping County in Sweden provide habitat for several hundred endangered plants, as do other extensive grassland regions in the EU. In other regions, there is no compelling evidence of a link to public goods, as is the case for a large, intensively farmed wheat field where the overriding concern is the generation of negative externalities such as nitrate pollution and soil erosion (e.g. Vysočina). There is in general insufficient knowledge about the effects of agricultural practices on biodiversity (Kleijn and Sutherland, 2006, 2003) and the ecosystem services provided by biodiversity (Zhang *et al.,* 2007). It is therefore of the utmost importance, given the limited budgets for environmental protection and other important societal goals, that claims of public good provision are backed up by evidence. Otherwise, there is a real risk that purported payments for public goods (e.g. a general payment to all EU farmers) will in fact simultaneously support the continued degradation of the environment that has been brought about by the intensification of agriculture over recent decades, while providing insufficient environmental support in regions or situations where it is genuinely motivated.

Notes

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2. The IDEMA project was supported by the European Community's Sixth Framework Programme (SSPE-CT-2003-502171*), www.agrifood.se\IDEMA*.

3. Prior to accession, payments for agricultural land were EUR 10/ha, rising first to EUR 57/ha on accession and progressively to EUR 244/ha after 2008. An environmental payment of EUR 110/ha for grassland was also introduced.

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Chapter 13

Environmental consequences in Austria of the 2003 CAP reform

Franz Sinabell and Erwin Schmid[1]

A core element of the European Union 2003 Common Agricultural Policy (CAP) reform was to decouple income support from production. Such subsidies have been classified as environmentally harmful by the OECD. This chapter reports ex ante *estimates of the environmental consequences of this policy reform and compares observed outcomes of agri-environmental indicators. The findings show that the CAP reform of 2003 actually brought about environmental improvements which the previous reform (Agenda 2000) had promised but did not deliver.*

Production-linked subsidies have been the predominant transfer vehicle in agriculture in many countries over several decades. Such subsidies are classified by OECD as environmentally harmful (Portugal, 2002; Steenblik, 2002), and some observers maintain that on a global scale agriculture is the primary threat to the environment (Clay, 2004). Hence, attempts to quantify the impact of subsidies granted to this sector and the magnitude of their consequences for the environment are of substantial interest. The reform of the Common Agricultural Policy (CAP) of the European Union in 2003 provides an interesting opportunity to analyze the consequences of farm subsidies on the natural environment, because European Union (EU) agriculture is substantially subsidised and reliable agri-environmental indicators are available (OECD, 2001, 2002).

This chapter reports the results of *ex ante* simulations of the environmental consequences of the 2003 CAP reform, and compares observed outcomes of agri-environmental indicators before and after the reform. The model used for the analysis was designed to quantify causal relationships between subsidies, agricultural production and environmental indicators. If both observations and model results show an improvement in the environmental situation, it is a strong indication that the change was actually brought about by the policy reform and is not just a lucky coincidence.

We use a model that incorporates the complex set of regulations in both EU farm policy and a further layer of national policies affecting production and management decisions in many ways. The model used for this analysis is disaggregated at regional, commodity and policy levels to capture a wide range of production responses to policy changes. In addition, agri-environmental indicators have been incorporated, and thus the model is capable of measuring pressures and driving forces in a consistent framework.

An analysis of the Agenda 2000 reform of the CAP (implemented in 1999) concluded that it had significant economic costs but almost no effects on the environment — neither positive nor negative (Wier *et al.,* 2002). For the case of Austria, we analyze whether this conclusion holds for the 2003 CAP reform as well. We describe core elements of the CAP by focusing on major subsidy programmes and a selection of environmental indicators that are used in our model analysis. The agricultural sector model employed and the details of its implementation are then presented, followed by the model results and observations of agri-environmental indicators. We conclude with a summary of the results and further options to improve the environmental performance of the CAP.

CAP measures, subsidies and the environment

A brief description of recent CAP reforms

In the early years of the CAP, market price support was the dominant way of subsidizing farmers; it was therefore consumers who were mainly supporting farm incomes. Domestic prices of major commodities were significantly higher than world market prices, which boosted production and made export subsidies necessary. When this system could no longer be sustained due to internal and external pressures, a substantial reform was implemented in 1992. A significant share of support was shifted towards direct payments coupled to certain crops and livestock heads. Such 'partly decoupled' payments were coupled to the use of land for arable crops and a given number of heads of livestock but not to the level of output.

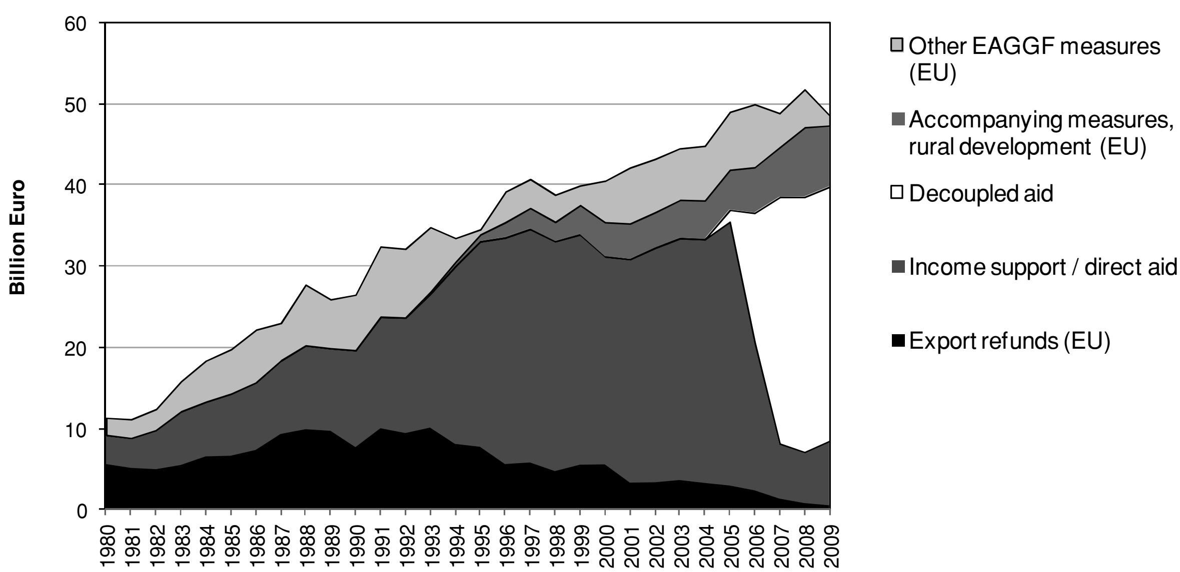
Direct payments have been mainly financed by shifting funds previously used for export subsidies and market interventions. The relative importance of taxpayers in the support of agriculture increased after 1992 (see breakdown of CAP subsidies in

Figure 13.1). This process was further reinforced by the Agenda 2000 reform, agreed at the Berlin Council meeting in 1999 (see Wier *et al.*, 2002, for details). Administrative prices of cereals, oil crops and beef were further reduced, and the corresponding direct payments were raised.

Apart from modifications of measures concerning farm commodities (now dubbed Pillar 1 of the CAP), an additional approach was established: the programme for rural development (Pillar 2 of the CAP). This programme integrated the "accompanying measures" of the 1992 CAP reform (payments for farms in less-favoured areas, agri-environmental measures, programmes to facilitate rural adjustment), and introduced new instruments such as modulation (reduction of payments for larger farms) and cross-compliance (environmental standards for recipients of CAP payments).

In July 2002, the Commission published a mid-term review of the Agenda 2000 reform. A final compromise on the proposals of a further CAP reform was reached on 26 June 2003; see Greek Presidency, 2003). The key element is the introduction of a decoupled "single farm payment" (see decoupled aid in Figure 13.1). It was introduced in many EU Member States in 2005 and has since then replaced premiums formerly linked to heads of livestock or land (see income support / direct aid in Figure 13.1).

Figure 13.1. CAP expenditures between 1980 and 2009



Source: European Commission, Directorate General for Agriculture, Agriculture in the European Union, Statistical and Economic Information, various issues.

From 1 January 2005 on, farmers in most European Union member states no longer needed to sow certain crops or raise certain livestock in order to obtain financial support. Since then, production decisions are expected to be based on market signals, and consequently resource allocation is likely to improve. Single farm payments are calculated on the basis of direct payments received in the reference period 2000-02. Among other conditions, land has to be maintained in "good agricultural and environmental condition" (see Article 5 of Council Regulation (EC) No. 1782/2003). In some member states, the reform has been implemented only partially: countries may opt to retain a given percentage of direct payments for arable crops, sheep and goats, bulls

and steers and suckler cows, or some share of the slaughter premium (see European Commission, 2010 for country details). As a consequence, the volume of production-related direct aids (the dark grey area labelled income support / direct aid in Figure 13.1) shrunk from EUR 32 billion to EUR 6 billion between 2005 and 2010.

Agriculture and environmental indicators

A coherent way to evaluate the environmental improvements after policy reforms is to monitor indicators. Apart from its work on environmentally harmful subsidies, OECD has developed a set of internationally accepted environmental indicators. In the field of agriculture, the work on indicators has been fruitful and recent publications allow sound country comparisons (OECD, 2001). Consequently, the current CAP reform gives an opportunity to analyse how environmental indicators may change due to the abolition of subsidies that were previously linked to farm output.

OECD (2001) classified agri-environmental indicators according to the following categories:

- agriculture in the broader economic, social and environmental view with contextual information (such as agricultural value added, farm employment) and information on farm financial resources (farm income, agri-environmental expenditures);
- farm management indicators of whole farms (organic farming, farm management plans), and of nutrient, pest, soil, land, irrigation and water management;
- use of farm inputs and natural resources concerning nutrient use (nitrogen balance and efficiency), pesticide use and risk, and water use (water use intensity, water efficiency, water stress); and
- environmental impacts of agriculture with respect to soil and water quality, land conservation, greenhouse gases, biodiversity, wildlife habitats, landscape and ecosystem diversity.

In the quantitative analysis, we concentrate on indicators related to soil, water and air, the environmental components which were identified above to be at risk in the European Union due to agricultural production and hence addressed by agri-environmental programmes. The analysis is consistent with the Driving force-Pressure-State-Impact-Response (DPSIR) concept used by the European Environment Agency (2004). This concept resembles the Driving force-State-Response (DSR) model formerly developed by the UNCSD in its work on sustainable development indicators. Originally, the Pressure-State-Response (PSR) model was developed by Rapport and Friend (1979) and subsequently adopted by the OECD's State of the Environment group.

Modelling the implementation of the 2003 CAP reform in Austria

Modelling agri-environmental policies at sector level

The Positive Agricultural Sector Model Austria (PASMA) is employed to estimate the impact of the 2003 CAP reform on selected economic and environmental indicators. It is designed to model both production linked support measures and decoupled payments. It also includes the program for rural development with 32 agri-environmental measures and the program for Less Favoured Areas.

The model maximises the sum of gross value added plus “other subsidies” according to Economic Accounts of Agriculture (EAA) terminology.[2] It is calibrated to historic crop, forestry, livestock, and farm tourism activities by using the method of Positive Mathematical Programming (Howitt, 1995). This method assumes a profit-maximizing equilibrium (e.g. marginal revenue equals marginal cost) in the base run and derives the coefficients of a non-linear objective function from a linear programming model. The calibration method allows deriving marginal costs from observations of average costs and observed levels of production activities. Two major conditions need to be fulfilled: 1) the marginal gross margins of each activity are identical in the base run, and 2) the average Positive Mathematical Programming (PMP) gross margin is identical to the average Linear Programming (LP) gross margin of each activity in the base run. These conditions imply that the PMP and LP objective function values are identical in the base run. This method has been modified and applied in several models (e.g. Lee and Howitt, 1996; Heckelei and Britz, 1999; Arfini and Donati, 2003).

Another important assumption needs to be made: assigning marginal gross margin effects to either marginal cost, marginal revenue, or fractionally to both. In PASMA, the marginal gross margin effect is completely assigned to the marginal cost, and consequently coefficients of linear marginal cost curves are derived. An extension of the PMP method, the multi-variant production approach suggested by Röhm and Dabbert (2003), is also implemented. Their reasoning is that it is easier to switch from management practice A (e.g. standard production with growth regulator) to practice B (without growth regulator) when producing wheat than to switch from wheat to maize. We build on this approach, with one exception. Organic farming is not assumed to be a management variant of the Röhm and Dabbert type but to be a fully separate practice, which can be split into management variants of its own (with and without winter cover crops, etc.).

Therefore, the model differentiates between conventional and organic production systems (crop and livestock) through separate feed and fertilizer balances at regional and structural scales. Transfers between these two production systems are not allowed in the model; however, they compete for the same resources (i.e. land and labour). Consequently, linear marginal cost curves are derived for all activities of both production systems for the base period.

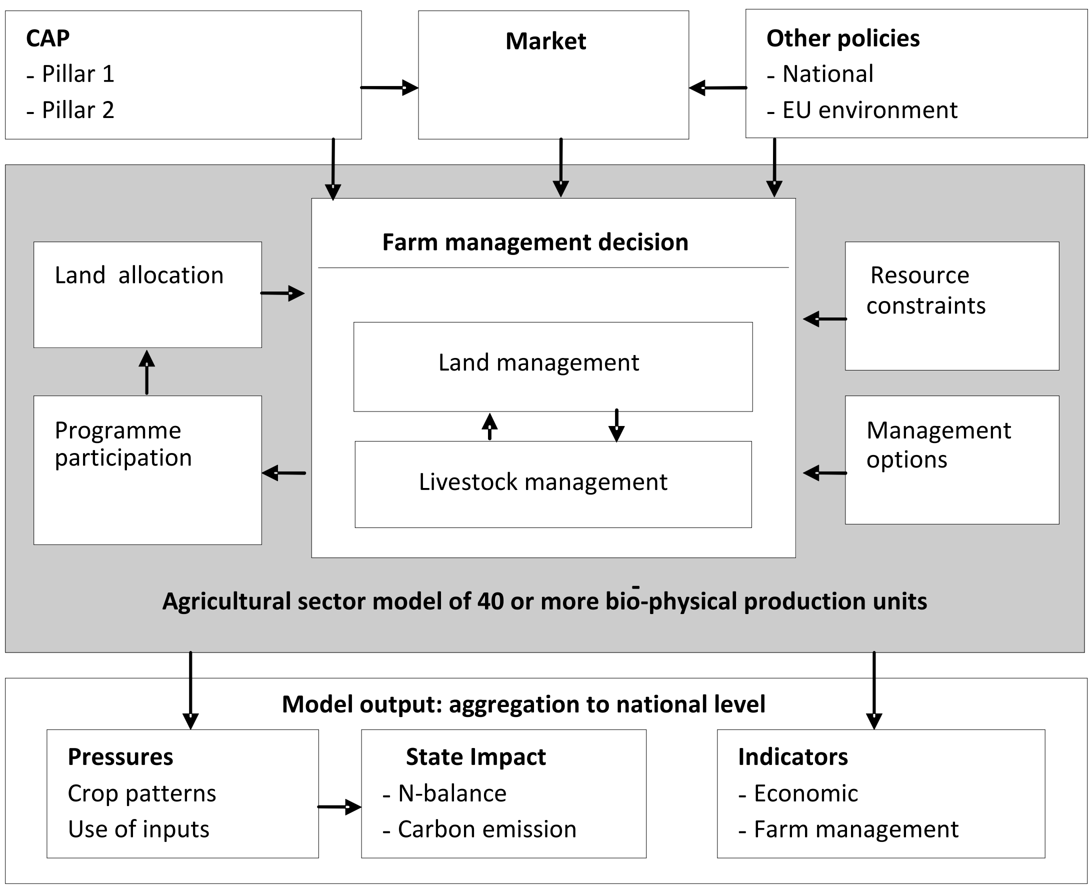
In PASMA, linear approximation techniques are utilized to combine the PMP calibration method with an aggregation method that builds convex combinations of historical crop mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1991); details of its implementation are provided in Schmid and Sinabell (2005). Other model features such as convex combinations of feed mixes, expansion, reduction and conversion of livestock stands, a transport matrix, and imports of feed and livestock are included to allow reasonable responses in production under various policy scenarios.

Model implementation

PASMA is designed to adequately depict the political, natural, and structural complexity of Austrian farming (Figure 13.2). It is regionally differentiated to account for spatial and structural heterogeneity. Regional results are aggregated at the national scale following the methodology of the EAA. In Austria, about 85% of all payments to farms come from three sources: direct payments (= single farm payment from 2005 on), the agri-environmental programme ÖPUL, and the programme for farmers in Less Favoured Areas.

Agri-environmental policies are of major significance for Austrian farming. This is best illustrated by the fact that the volume of such premiums (EUR 645 million) has exceeded the volume of direct payments (EUR 500 million in 2004) over long periods. Given their importance, not only instruments of Pillar 1 of the CAP are modelled in detail, but also Pillar 2 policies.

Figure 13.2. Structure of the Positive Agricultural Sector Model Austria (PASMA)



The construction of the model ensures a broad representation of production and income possibilities that are essential in comprehensive policy analysis. Data from the Integrated Administration and Control System (IACS), Economic Accounts of Agriculture (EAA), the recent Agricultural Structural Census (ASC), the Austrian Farm Accountancy Data Network (FADN), the Standard Gross Margin Catalogue, and the Standard Farm Labour Estimates (Greimel *et al.*, 2002) provide the necessary information on resource and production endowments for 40 regional and structural production units (i.e. alpine farming zones, Less Favoured Areas) in Austria. Consequently, PASMA can estimate production, labour, income, and environmental indicator responses for each of the units.

Due to its partial approach, the model treats the farm sector without any behavioural interaction with other sectors of the economy or with the rest of the European Union's agriculture. Policies and prices are given exogenously, and output changes are assumed not to affect equilibrium prices (demand is perfectly elastic). Price expectations are based

on forecasts by the OECD (2004b) which provides two sets of price estimates (one with the Agenda 2000 reform in place, and the other after the implementation of the 2003 CAP reform). Mark-ups for organic products are based on Freyer *et al.* (2001).

Apart from the core elements of the 2003 CAP reform outlined below, several reform details are important for our analysis. For cereals (apart from rye), the intervention price remains practically unchanged. For other crops, regulations were simplified but not all production-related premiums have been abolished (notably durum wheat, protein crops, starch potatoes and energy crops). A reformed milk quota system will be maintained until the 2014-15 marketing year. Prices of butter and skimmed milk powder will be cut asymmetrically in four stages. The milk quota will be moderately expanded in 2006 and a decoupled quota premium will add up to the single farm payment.

Ex ante model results and indicators before and after the CAP 2003 reform

Description of modelled scenarios

Two types of comparisons are presented.

- In the first comparison, modelled environmental consequences of two reform scenarios are compared to a baseline scenario without a policy change.
- The second comparison concerns observations of agri-environmental indicators between two periods, one before and one after the reform was implemented.

The model simulations compare a policy with subsidies partly linked to production (Agenda 2000) versus one with decoupled subsidies (2003 CAP reform). All other variables affecting the decision of farmers are left changed (notably prices, land use restrictions, incentives of the agri-environmental programme). We compare the base-line scenario, i.e. a continuation of the Agenda 2000 reform in Austria, with two scenarios:

- *Council decoupling:* This scenario models decoupling – the introduction of the single farm payment, given that the 'good agricultural and environmental condition' of land is maintained.[3]
- *Austrian decoupling:* This scenario is similar to a) allowing for several exceptions of the reform. It models the actual implementation in Austria. Within limits, payments coupled to heads of livestock (suckler cows and heifers), and to the output of beef (40% of the slaughter premium) are not be abolished.

In the model scenarios, organic farming and the adoption of agri-environmental measures will not be affected by the reform directly, but indirectly. The assumption is made that the conditions of the programme for rural development (the framework of agri-environmental measures) and specific market conditions for organic products do not change. This implies that farmers would get commodity mark-ups for organic production similar to those observed presently. Farmers would be free to enter or quit the agri-environmental programme in the scenarios.[4] A moderate rate of technical progress and constant real input prices are given exogenously. More details of the implementation of the reform in Austria are documented in Schmid, Sinabell and Hofreither (2007) and in Sinabell and Schmid (2003).

Model results of the 2003 CAP reform versus continuation of Agenda 2000

In the model analysis, an attempt is made to isolate the effect of decoupling and its conditions. Therefore, we compare scenarios for the same year (2008) with an identical programme for rural development. The effects of the 2003 CAP reform are compared to a baseline scenario (continuation of the Agenda 2000 reform; see Table 13.1):

- The sum of gross value added plus subsidies will increase moderately, and farm income is likely to be stabilised by a single farm payment, even though there would be some justification for assuming that this payment is actually a transfer to households.
- In all scenarios, arable land will be turned into grassland because the profitability of crops declines due to lower production incentives. A consequence is that fewer inputs that are potentially environmentally harmful will be used.
- Some livestock products decline (in particular beef), while others do not change significantly (pork) or adjust within given limits (i.e. milk due to relatively high assumed prices and the maintenance of the quota system).
- In general, "cross compliance" conditions (among them maximum numbers of livestock per hectare, and good agricultural practices) are of no environmental consequence in Austria. This is due to two factors: 1) the requirements of the agri-environmental programme are stricter, and 2) almost all land is managed according to the rules of this programme.
- Indicators measuring soil fertility (organic carbon), air pollution (methane emission), and water quality (surplus of nitrates, livestock density) show diminishing pressures on the environment. This is mainly due to changing land uses (expansion of grassland while arable land is reduced) and a smaller cattle herd.
- The area of arable land that is organically farmed decreases slightly, but to a lesser extent than that of conventionally managed arable land. This can be explained by the assumption that support for organic farming in 2008 will be the same as before the reform.

The environmental benefits of the 2003 CAP reform are primarily the consequence of changing land uses (more grassland means more soil organic matter compared to arable land) and a smaller herd of bulls (less methane emission, fewer livestock units and less nitrogen surplus). According to the model results, declining outputs of crops and beef will not be compensated by a corresponding rise of pig or poultry production; therefore, the benefits of lower production levels will not be offset. The fact that the conditions of the single farm payment do not allow afforestation is interpreted as positive because summer tourists in Austria have a preference for open agricultural landscapes (Hackl and Pruckner, 1997).

After the 2003 CAP reform, the opportunity cost of adopting farm practices, which are widely assumed to be environmentally friendly, are lower. This view is supported by the model results. A comparison of studies analysing the effects of the 2003 CAP reform shows that our results on economic indicators confirm others (FAPRI-Ireland Partnership, 2003; and OECD, 2004a and 2004b). Moreover, the changes in the levels of environmental indicators are comparable to those identified by a team of researchers (LEI, IAP and IAM, 2003) who analyzed the likely effects of the CAP reform before it was officially decided.

Table 13.1. The CAP reform 2003 in Austria: a comparison of model results and observations

	Scenario Council decoupling	Scenario Austrian implementation	Observed
	Percentage *vs.* Agenda 2000 scenario		Percentage change 2002/03 *vs.* 2007/08
Economic, factor use and output indicators			
Gross value added plus other subsidies	+1.2	+0.7	+2.2
Variable cost livestock products	+0.5	+2.5	+9.0
Variable cost crops	-1.0	-0.8	+19.0
Arable land	-1.5	-1.7	-0.8
Meadows and pastures	+2.8	+3.1	-7.1
Output of beef	-5.0	-3.3	-2.3
Output of pork	+0.1	±0.0	-5.3
Farm management and environmental indicators			
Organic farming	+2.8	+3.0	+34.2
Organic farming subsidies	+0.7	+1.0	+11.7
Soil cover during winter	-1.4	-1.6	n.a.
Livestock units (total)	-1.1	-0.3	-3.5
Average livestock units per hectare	-2.0	-1.0	+1.9
Methane emission	-1.3	-0.5	-1.9
Carbon storage in soil	+0.1	+0.1	+2.2
Nitrate from manure	-1.0	-0.1	-3.5
Nitrate from mineral fertilizers	-1.0	-0.9	-10.2
Nitrogen surplus (OECD method)	-0.7	±0.0	-39.0

n.a.: not available.
Source: Schmid, Sinabell and Hofreither, 2007 and own results and BMLFUW, various years.

Agri-environmental indicators before and after the CAP reform

In the last column of Table 13.1, the percentage change of variables of interest between the periods 2002/03 and 2008/09 is presented. The major differences between the scenarios of the model simulation and the observed reality are

- output and input prices increased considerably, whereas no change was assumed in the model analysis;
- the requirement to set aside arable land was abolished, whereas land use was constrained in the model analysis; and
- a significant conversion of agricultural land into forest land took place, whereas this was ruled out in the model analysis.

The comparison between the situation in 2002/03 and 2008/09 shows that many indicators show less environmental impact. These findings corroborate the general findings of the model analysis, even if the scenario assumptions deviated from what happened in reality.

Despite the intuition that higher output prices would induce more intensive farming practices, the opposite came true. One reason is that not only output prices surged but also input prices. The second reason seems to be that the abolition of the production incentive of coupled payments effectively made Austrian agriculture more extensive. Organic

production has become even more profitable, mainly due to the willingness of consumers to pay premium prices for organic food on a larger scale than expected in the model scenarios. Soaring costs for fertilizers and commercial feed may have contributed to this adjustment.

Conclusions

The 2003 reform was a further step in the CAP development consequent to that launched in 1992. According to our model results, the 2003 CAP reform makes production less intensive, and reduces the use of potentially harmful agricultural inputs. A comparison of agri-environmental indicators in the periods 2002/03 and 2008/09 corroborates these findings.

According to the model results, major benefits such as less erosion and more carbon sequestration in topsoils are a consequence of changing land uses (expansion of grassland at the cost of arable land). In reality, more land was turned into forest land, a change that was not possible in the model analysis due to a deliberate constraint. Fewer methane emissions and lower nitrogen losses are due to a reduction of smaller herd sizes, in particular beef.

Single farm payments, which replace direct payments, are granted only if certain conditions are met, in particular the maintenance of a “good agricultural and environmental condition.” In countries such as Austria, where agri-environmental measures are widely applied, these conditions do not provide additional positive environmental effects. The reason is that the minimum standards of the agri-environmental programme are stricter than the 'cross compliance' requirements of the 2003 CAP reform.

Our results are for Austria, but we think they hold for other EU member states with structural similarities. However, comparable studies covering other countries are necessary to verify this. The model presented in this paper could be a tool for such an analysis, even if the data requirements are challenging for such an endeavour.

Notes

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2. Gross value added is "output of the agricultural industry" (revenues are measured at "basic prices" which include crop and livestock premiums) minus "total intermediate consumption"; "other subsidies" include decoupled payments (= single farm payments), and most rural development transfers (e.g. agri-environmental payments and transfers to farms in Less Favoured Areas), but do not include investment aids (Eurostat, 1997).

3. Several minor payments will still be linked to certain crops (durum wheat, protein crops, energy crops, starch potatoes). The "cross compliance" condition refers to a set of environmental, food safety and animal welfare standards (see Greek Presidency, 2003).

4. In the scenario analysis, we made the assumption of an unchanged programme to isolate the effect of decoupling. However, in the new programme for rural development (Council Regulation (EC) No 1698/2005), which was implemented in 2007, conditions for agri-environmental measures changed moderately compared to the previous programme.

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Part VII

The Impact of CAP Reform on Rural Development

Chapter 14

The impact of the CAP on regional employment: a multi-modelling cross-country approach

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The research reported in this chapter refers to five European Union (EU) selected regions (Emilia Romagna, Italy; East Wales, United Kingdom; Anatoliki Makedonia and Thraki, Greece; Östergötland, Sweden; and Kassel, Germany) to identify and measure the Common Agricultural Policy's (CAP) effects on employment throughout regional economies. It accounts for agricultural and non-agricultural effects, and covers the diversity of EU rural regions. A framework of three different approaches was developed and then applied to these five regions in order to trace out the current and anticipated employment effects of Pillars 1 and 2 changes. The focus of this work is to consolidate the conclusions derived from the different models applied in order to deduce valuable policy generalizations and to derive conclusions which may guide policymakers in making decisions related to regional and rural development. The results demonstrate that CAP funding, particularly for Pillar 2, contributes to the maintenance of employment in the farming sector but also in the non-farming sector, thus serving as a permanent regional "stimulus" package.

In the context of an unprecedented economic crisis, the impact of the CAP on general employment levels, either increasing or sustaining employment, is attracting the interest of the public and media, since today all policy tools devised and introduced throughout the European Union target directly or indirectly employment. Further output shrinkage and the consequent increase in the proportion of the jobless will hurt the economy and may cause social discontent. Now that the effectiveness of various stimulus packages is discussed, CAP funding may play the role of a raw model of the effectiveness of such policies since it has been operated for a long time and has been reformed several times.

Thus far, CAP reforms rarely mention employment objectives as a primary goal, since the premise that the free market system is irreplaceable and never leads to faults was indisputable. Nevertheless, maintaining high employment levels in the economy, and particularly in the rural regions of the European Union, remains a highly priority and it would be of extreme interest to see how the most recent CAP reform could affect employment, not only for the agricultural sector, but for the whole rural area.

Since 1992, CAP reforms have been streamlined several times, culminating with the 2003 reform, which brought about striking changes in the fundamental structure of CAP design and philosophy. Most of the studies of CAP reform effects have focused on certain agricultural sectors and certain countries (Colman *et al.,* 2002; Gohin, 2006; Goodman and Mishra, 2005; Hennessy *et al.*, 2004; Ooms and Peerlings, 2005; Serra *et al.,* 2005a; Woldehanna *et al.*, 2000), and have offered substantial contributions on further policy improvements. Certainly, changes in employment levels are strongly associated with several other parameters (output growth, investment trends, technology adoption, human capital) studied by others (Ahearn *et al.*, 2005:2006; Alasia *et al.*, 2009; El-Osta *et al.*, 2004; Woldehanna *et al.*, 2000), but a focus solely on rural employment levels can offer insights in assessing the CAP's effectiveness and facilitate the introduction of more effective policies. Understanding how and why the CAP's Pillar 1 and Pillar 2 influence rural employment constitutes a challenge, as CAP measures target a wide range of objectives causing counterbalancing and complex effects.

This paper addresses the relationship between CAP reform and rural employment in a multi-modelling and cross-country context, possibly providing general European Union lessons. The paper tries to reflect in a comprehensive way a few of the findings emerging from a Sixth Framework Programme EU-funded project. To achieve this objective, five rural areas, scattered throughout Europe, were selected, and then Pillar 1 and Pillar 2 effects on the region's economy and on employment were studied. Whereas results can be influenced by the application of different approaches, they can also offer a more comprehensive picture of the region studied. Therefore, case studies primarily based on in-depth interviews, Positive Mathematical Programming (PMP) and an Input-Output model were employed in all the regions, coupled with local observations on the regions' outlook and performance.

The paper is organised as follows: the next section provides a general background to the methodologies applied, followed by a further section describing the major characteristics of the selected regions. In the fourth section, a cross-regional assessment is made, based on the outcome from the application of the methods, and the closing section provides recommendations for future policy modifications and revisions.

Methodological background

The complexities of rural economic relations, combined with a diverse range of interdependent CAP measures, limit the effectiveness of a single methodological approach to the relationship between CAP reform and employment. Thus, several methodological approaches have been employed to assess the CAP's impacts and to estimate the probable employment effects. Applying more than one approach may enrich the results and provide a detailed picture of the anticipated changes from different angles, but may also end up with contradictory findings. The methodological approaches, applied in five European Union countries, are mixed-method case studies, Positive Mathematical Programming and Input-Output analysis. In addition, certain other methodological approaches (productivity analysis and an econometric model for choice experiments) have been applied in some of the regions under investigation. While details on the methodologies applied can be found in the relevant literature (Langstaff *et al.*, 2008; Arfini and Donati, 2008; Loizou *et al.*, 2008), a brief description is provided here:

Analysis of documentary evidence and representative in-depth interviews

Pillar 2 measures have always been considered as a means for reconfiguring regional structures (Shortall, 2008) representing a change from an agri-centric policy view to a broader multi-sectoral one (Scott, 2004). The current approach is mainly focused on the effects of Pillar 2 and is a mixed-method case study intended to provide an understanding of the impacts on predominantly rural regions. The approach tries to explain how Pillar 2 interacts with the structure and performance of the local rural economy (Yin, 1994) instead of identifying effects on rural employment. Applied in all five EU regions, the method followed a coordinated two-stage data gathering process, an investigation of secondary data offering a contextual framework for the overall study, and in-depth semi-structured interviews with representatives of different interest groups.

First, a regional profile was developed to provide the context in which key informants operate and to inform the process of analysis. Then, key informants were identified and interviewed to explore their perspectives on policy issues. Participants in the interview process — drawn mainly from policy makers, business managers, regional NGO officers and LEADER group managers — were invited to respond to and interact with a set of pre-drafted thematic questions. Finally, analysis explored patterns within the multiple data sources, in order to provide support for explanations of the casual relationships (Midmore *et al.*, 2008).

Positive Mathematical Programming (PMP). PMP was applied to identify and measure policy-induced changes at the individual farm level and then upscaled to regional level. The methodology was common to all case regions, and FADN data were used. Regional models allowed the assessment of the main effects of two different policy scenarios: full decoupling, and full decoupling plus price variations. A special sub-model, implemented within the PMP model, captured labour allocation inside the farm with respect to new production plans induced by CAP reform (Arfini *et al.*, 2003; Heckelei, 2002; Júdez *et al.*, 2001; Paris and Arfini, 1995).

Input-Output Analysis (I-O). This approach was selected to assess impacts on output, household income, and employment on the whole regional economy of the selected regions. I-O analysis constitutes a tool which can be used to show how industries are linked together through supplying inputs for the output of an economy. Thus, building a regional I-O table provides a clear picture of the structure of the economy, and the

existing relationships amongst various regional sectors can be identified. First, regional input-output tables were constructed using the accurate and widely adopted Flegg-Weber technique (Flegg *et al.*, 1997). Second, following the GRIT (Generation of Regional Input-Output Tables) approach (Jensen, 1990), these non-survey regional input-output tables were hybridized with the addition of survey data on key rural economic transactions. The application of the model allowed the estimation of various I-O linkage coefficients (multipliers) for each region, i.e. involving Chenery-Watanabe direct linkages, Rasmussen-Hirschman linkages (output, income and employment multipliers), Mattas-Shrestha I-O elasticities (output, income and employment elasticities), and Papadas and Dahl supply-driven multipliers (Chenery and Watanabe, 1958; Hirschman, 1958; Mattas and Shrestha, 1991; Papadas and Dahl, 1999; Rasmussen, 1956). This facilitated the identification of the most important economic sectors (as regards their potential to enhance regional employment, income and output levels), the estimation of indirect and total economic impacts, and ultimately comparable results among the selected regions. Results from the PMP model were fed into the I-O model to observe the indirect and induced changes for the whole economy (Mattas *et al.*, 2005; Miller and Blair, 1985).

The case study regions

The five European Union regions (all, apart from Östergötland in Sweden, at NUTS 2 level) were selected from across the European Union on a range of criteria to represent the diversity of the European rural regions. The regions are: Emilia Romagna, Italy; Anatoliki Makedonia and Thraki, Greece; East Wales, United Kingdom; Kassel, Germany; and Östergötland, Sweden. The main characteristics of each region are illustrated in Table 14.1.

These regions are relatively large and internally diverse, representing different types of rural conditions within the European Union. The main differences, identifying particular regions, include: a growing population and a large number of cooperatives in Emilia-Romagna; a high percentage of employment in agriculture and semi-arid production conditions in Anatoliki Makedonia and Thraki; a shortage of affordable rural housing and relative under-funding of Pillar 2 in East Wales; severe demographic problems in the Kassel region; and a focus on rural entrepreneurship and SME development along with high standards of IT infrastructure in Östergötland. The mountainous areas of East Wales are characterised by high rainfall and large areas that can only support extensive livestock production. The Kassel region is predominantly arable, whereas Östergötland contains a mixture of more remote forested areas, inaccessible islands within the region's archipelago, and containing the most productive arable lands in Sweden, the open plains area.

Overall population densities vary greatly between the regions, from 43 inhabitants per square km in Anatoliki Makedonia and Thraki, to 189 per square km in Emilia-Romagna. High variations in population density also exist within the regions, with the majority of populations being concentrated around the main cities. The significance of agriculture's contribution to the regional economies and employment varies noticeably. Significant variations between regions also exist with regard to infrastructure — especially transport links, health, education and the provision of information technology. Disparities also exist in terms of economic development, ranging from low levels for Anatoliki Makedonia and Thraki to very good conditions for Emilia Romagna and Kassel. A key contributor to this diversity relates to the range of Rural Development Programme (RDP) or Pillar 2

measures implemented, from Italy, where all permitted measures were implemented in the 2000-2006 period, to Greece, where only a minimal number of the voluntary measures were adopted.

Table 14.1. Economic structure and employment levels of the regions

	Emilia Romagna	Anatoliki Makedonia and Thraki	East-Wales	Kassel	Östergötland
Land use	Mountainous in south-west, fertile arable flatlands in the north-east	Mountainous and semi-mountainous, with arable land on coastal plains, some irrigated	Large areas of upland, with high rainfall, predominantly used for livestock	Predominantly arable, grassland along rivers and in former border regions between W. and E. Germany	Fertile central open plains, semi-open and forest in north and south, Baltic Sea archipelago to the east
Area (km^2)	22 123	14 157	7 634	8 288	9 987
Population ('000 persons)	4 169.5	607.7	1075.1	1 255.7	416.3
Population density (person/km^2)	189	43	145	152	39
GDP/capita (EUR)	29 670	11 799	28 954	26 668	27 824
Employment in rural sector	4.4%	12%	10.7%	2%	2%
Unemployment	3.4%	5.1%	2.4%	10.3%	7%
Accessibility	Good transport infrastructure	Currently peripheral; potentially a major route to new EU countries	Peripheral in central area	Centre of Germany, good new road and rail infrastructure, but perceived locally as remote	Peripheral, especially archipelago
Infrastructure	Good	Insufficiently developed	Poorly developed in central area	Good	Good overall
Economic development	Good	Poor	Medium	Good	Medium

A cross-regional assessment

This section develops a cross-region assessment to identify the main impacts of the CAP and RDP reforms on the economic structures and employment levels of the five regions. The assessment is based on results from the application of the three separate methodologies which aimed to identify the main existing differences and similarities between regions and consequently to draw conclusions relating to policy effectiveness.

Qualitative assessment of the CAP impacts

Evaluating the impacts of Pillar 2 reforms upon farm and non-farm employment was undertaken through qualitative research that included a detailed initial desk-based documentary analysis, in-depth interviews with stakeholders and key decision-makers in each region, followed by cross-case comparison. The main inferences drawn from this

research can be divided into three broad themes: i) the effects of the CAP and RDP reforms on the rural economy, ii) the interaction of these reforms with other policies, and iii) consequent impacts on farm and non-farm employment (Table 14.2).

Unanimous views were revealed regarding the relationship between the rural economy and RDP reform: development of the rural economy depends specifically on the degree of support received through RDP. The support of agriculture is disproportionate to its importance for the rural economy. CAP reforms have not increased jobs in the regions; at best, they manage only to maintain the existing level. A negative consequence of the reforms is the unequal distribution of support from Pillar 1, which supports income rather than the employment level of the region. In addition, the need for further CAP changes is emphasized in all regions, suggesting that the key measures of CAP are ineffective and inappropriate to safeguard future development. For example, views that current Pillar 1 support helps to create a subsidy-dependence culture among the farmers were widely expressed. Finally, in all regions, most interviewees wanted to gradually diminish the scope of Pillar 1 and correspondingly strengthen Pillar 2.

Table 14.2. Qualitative results on CAP impacts

Main themes	Perceptions agreed amongst stakeholders and decision makers
Rural Development Programmes upon rural economy	Agricultural sector receives disproportionate support RDP determines the development of the rural economy Retains labour in agriculture rather than increases labour Creates an unequal income distribution Needs streamlining but not abolishing Needs more effective and appropriate measures Gradual move towards Pillar 2
Interaction between CAP and other policies	Lack of coherence Bureaucracy further deters RDP participation RDP poorly managed Waste of scarce resources
Rural Development Programmes upon employment	Sustains current employment levels or at least prevents further decline Preserves the environment to a large extent No significant effect on women's employment Diversification and infrastructure support can enhance employment opportunities

Respondents expressed a variety of views relative to their own region. In Östergötland, interviewees emphasized economic dependencies between urban and rural areas, which they believe determines the future development of a rural region. In Emilia Romagna, respondents frequently mentioned that the lack of cooperation among farmers arises as a result of insufficient impetus from the CAP reforms. However, the fundamental conclusion was that while RDPs do serve as unique development and employment tool for any EU region, this effectiveness can be enhanced further by changes that allow flexibility according to the region's specific needs.

On the interaction between CAP/RDP reforms and other policies, there was expressed a lack of coherence leading to confusion, which is exacerbated when combined with bureaucratic procedures. This lack of coherence and coordination between the CAP/RDP measures and other policies can result in a waste of scarce resources. In addition, focusing on specific actions and leaving out important regional dimensions weaken the dynamics of the RDPs.

Throughout the case study regions, respondents conceded that RDPs have indeed played a significant role in maintaining employment levels or at least in decelerating the rate of employment decline. Notably, however, respondents raised the issue of women's employment. By enhancing female job opportunities, more stable demographic development can be maintained; but it was argued that current RDPs have little to offer for broadening women's job opportunities, since only a few programmes relate to women's labour (e.g. agro-tourism). Refocusing RDPs on activities such as child care, training and improved social structures can provide new incentives for women to stay in rural areas and to find a job. In addition, supporting general infrastructure was felt to be essential for a vibrant rural region. It is worth mentioning that LEADER+ is perceived as a programme that reinforces the labour market and should be extended by broadening its effectiveness.

Positive Mathematical Programming – changes on farming activities and employment

CAP reform will definitely affect the enterprise mix, and changing the enterprise mix at farm level affects on-farm employment too, as adopting new activities could require more or less labour and could also change input requirements and output flows. To trace out the course of anticipated changes at farm level and then to aggregate them to regional level, a Positive Mathematical Programming (PMP) model was applied in all case study regions. This model, utilizing mainly FADN data provided by the EU Commission, simulated the post-reform conditions at farm level, and envisioned two scenarios: the first (S1) concerns the option of total decoupling payments for all agricultural products (including milk); the second (S2) includes the first scenario and also anticipates product price changes as they are recorded in the EUROSTAT database. The baseline scenario reflects the farm structure before the application of the horizontal Regulation EC 1782/2003, based on observed conditions in farming prior to 2005. The simulation results indicate significant changes in different indicator variables in each region (land allocation, livestock structure, economic impact of the reform and farm employment), which have resulted from the 2003 CAP reform.

Land allocation is predicted to be the primary change in farming activities due to policy reforms, especially following the introduction of decoupled payments. As can be seen from Table 14.3, farmers in all case study regions are most likely to reduce land allocated to cereals. The magnitude of this land reallocation varies among the case study regions depending on the importance of cereal production. Fodder crops will gain ground, as the new regime provides better opportunities and higher returns. Nevertheless, cereal production will continue, mainly on highly efficient farms, and assuming, of course, the continuation of the current supportive regime. This behaviour of farmers could be justified under a strategy of minimizing costs and responding to market signals.

In the livestock sector, due to the changes in subsidies and in the production cost of feed crops, shifts among activities are anticipated. Generally, dairy cows and sheep will remain at the same levels of production, while beef production will drop; a positive effect on overall gross margins is expected (Table 14.4).

Table 14.3. Land use effects of the CAP reform

Crops	Emilia Romagna		Anatoliki Makedonia and Thraki		East Wales		Kassel		Östergötland	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
	Variation (%)		Variation (%)		Variation (%)		Variation (%)		Variation (%)	
Wheat	-15.9	-9.3	-4.0	-8.9	-68.4	-74.4	-28.1	-39.8	-21.2	-51.9
Barley	-24.9	-22.2	9.3	-5.4	-83.3	-82.7	-24.1	-43.2	-27.4	-10.4
Other cereals	-28.7	39.0	-73.3	-73.1	-64.9	-63.4	-8.7	8.2	-34.0	-1.9
Fodder crops	14.8	11.7	-	-	4.0	4.0	13.1	15.3	13.8	14.1
Oilseeds	-6.3	-49.6	-	-	-31.2	-41.5	-12.9	19.5	-7.8	20.9
Tobacco	-	-	-58.7	-64.4	-	-	-	-	-	-

Table 14.4. Economic Impacts of the CAP Reform

% differences from baseline scenario

	Emilia Romagna		Anatoliki Makedonia and Thraki		East Wales		Kassel		Östergötland	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Gross Saleable Production	-5.3	-8.8	1.3	6.8	-15.8	-34.8	4.5	7.0	-2.0	-15.3
Net subsidy	83.2	83.2	-5.6	-1.7	31.5	31.5	19.7	19.7	8.5	8.5
Variable costs	-5.3	-6.1	29.3	33.7	-24.4	-39.5	3.8	4.3	-6.5	-19.4
Gross margin	22.3	3.4	-2.9	2.4	383.8	351.0	52.1	74.4	101.6	129.3

Furthermore, an attempt is made to extrapolate these changes in enterprise mix to anticipated employment changes at regional level (Arfini and Donati, 2008). The employment changes are depicted in Table 14.5 by region and farm type. The two types of labour considered in the PMP analysis — family and hired workers — show a decrease in all case study regions due to decoupling. This is attributed to a reduction in the production costs by substituting farming activities (cereals and industrial crops) with fodder crops and other good farming practices (GFPs). Thus, overall, a significant reduction in employment levels in the farm sector is expected, that may be regained later if the farm sector turns out as more efficient and competitive.

Table 14.5. CAP reform impacts on farm and off-farm employment according to farm type

(% differences from baseline scenario)

		Emilia Romagna		Anatoliki Makedonia and Thraki		East Wales		Kassel		Östergötland	
Farm Type[a]	Type of Labour	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
FT 1	Family	-0.1	-0.5	0.0	0.0			-5.2	-5.2	-0.3	-0.3
	Non-family	-3.8	-1.0	-1.4	-1.3			-26.4	-26.4	-21.9	-21.9
FT 3	Family	-0.9	-0.8								
	Non-family	-3.9	-4.5								
FT 4	Family	-6.2	-3.1	-13.1	-12.0	0.0	0.0	-0.4	-0.1	0.0	-0.2
	Non-family	-48.4	11.0	-67.9	-46.8	-35.1	-37.0	12.2	26.0	-19.6	-19.4
FT 5	Family	-0.2	-0.3								
	Non-family	-0.6	-0.6								
FT 6	Family	-1.2	-1.2					-0.4	-0.4	0.0	0.0
	Non-family	-8.0	-2.5					-9.0	2.0	-24.4	-23.7
FT 7	Family	-1.7	-1.0					-0.3	-0.1		
	Non-family	-32.6	-22.2					-34.6	-6.1		
FT 8	Family	-1.2	-1.2	-0.1	0.0	0.0	0.0	-2.7	-2.7	0.0	0.0
	Non-family	-26.7	-22.6	-50.2	-35.8	-22.8	-22.9	-14.4	-14.4	-22.3	-22.2

[a] FT1: field crops, FT2: horticulture, FT3: permanent crops, FT4: animal production, FT5: granivores, FT6: mixed cropping, FT7: mixed livestock, FT8: mixed crop-mixed livestock.

Input-output analysis: economic and employment effects

Finally, an attempt was made to translate the output and input change in the farming sector into total output and employment change at the regional level encompassing the whole economy. In this particular analysis, I-O is applied to represent structural rural economic relations and to examine impacts in terms of output, household income and employment which result from CAP changes. A hybrid regional I-O model was constructed, applying the GRIT regionalization technique for all case study regions, offering the opportunity to compare the structure and dynamics of their economies.

A careful inspection of the case study regional I-O tables reveals some profound differences in the structure of the regional economy, which are reflected more clearly when I-O multipliers are calculated. The importance of similar sectors and their dynamics (reflected in terms of multiplier size) varies substantially among case study regions; such significant differences raise important issues for the design of RDPs. Sectoral diversity among case study regions demands flexibility in Pillar 2 programmes in order to effectively improve regional economic prospects. Table 14.6 illustrates such diversities by depicting the employment multipliers for five sectors. It is clear that employment-stimulating sectors vary significantly among regions.

Table 14.6. Employment multipliers

Rasmussen and Hirschman Linkage Coefficients

	Emilia Romagna	Anatoliki Makedonia and Thraki	East Wales	Kassel	Östergötland
Textiles	1.807 (13) [a]	5.828 (1)	1.157 (63)	1.282 (15)	1.068 (47)
Agriculture	1.295 (23)	1.069 (35)	4.444 (1)	1.122 (20)	1.076 (46)
Food products and beverages	2.866 (3)	3.407 (4)	-	2.010 (3)	1.471 (14)
Coke, refined petroleum products	1.105 (28)	4.130 (3)	-	-	1.836 (4)
Chemicals and chemical products	3.151 (2)	1.604 (13)	1.293 (37)	1.687 (4)	1.486 (13)

a. Rasmussen and Hirschman Linkage Coefficients demonstrate the direct and indirect backward linkages of the economic sectors. In parentheses is given the rank order in terms of the magnitude of the employment multipliers.

The potential impact of CAP reforms was evaluated utilizing information from the PMP model related to crop and livestock production changes. Feeding the results of scenario S2 into the I-O structure, the total (output, income and employment) effects were estimated as miniscule (Table 14.7). In particular, decoupling causes only minor losses to the regional economies in terms of output, income and employment.

Table 14.7. Total output, employment and household income impacts in the regions: Scenario 2

Region	Output		Employment		Income	
	EUR million	% change[a]	Persons	% change[a]	EUR million	% change[a]
Emilia Romagna	-8.016	0.002	-18	0.00	-0.479	0.00
Anatoliki Makedonia and Thraki	-7.144	0.06)	-388	0.18	-0.418	0.03
East Wales	-11.436	0.038	-167	0.036	-2.816	0.034
Kassel	1.112	0.002	133	0.02	1.393	0.01
Östergötland	-82.393	0.04	-57	0.03	-16.139	0.03

a. Percentage change from baseline levels of the regional total output, employment and household income, respectively.

In addition, the potential impacts of Pillar 2 measures were evaluated for the specific case of the Greek region. Implementation of these measures stimulates regional economies as they cause significant fund inflows to rural development activities that finally generate output, income and employment for the whole region (Table 14.8). Thus, Pillar 2 measures transmit employment benefits beyond the farm sector, causing substantial effects in other economic sectors. This tends to justify the general trend, followed by the Health Check, to shift funds from Pillar 1 to Pillar 2. Hopefully, the structural change caused by the shift will generate permanent employment benefits for the economy.

Table 14.8. Output, income and employment impacts due to RDP
The Greek case

	Output		Income		Employment	
	EUR million	%	EUR million	%	Persons	%
Rural Development Programme 2007-13 (funds inflows EUR 507.8 million)						
Primary	35.150	*5.10%*	2.604	*2.98%*	1914	*16.30%*
Secondary	538.882	*78.13%*	62.475	*71.50%*	6381	*54.35%*
Tertiary	115.709	*16.78%*	22.298	*25.52%*	3447	*29.36%*
Total[a]	**689.741**	***6.01%***	**87.377**	***5.45%***	**11742**	***5.32%***

a. Shares (%) show contributions to current regional total output, employment and household income.

Conclusions

Nowadays, policy interventions to save the economy from an unprecedented meltdown are being devised throughout the European Union and are being challenged, a paradigm of the effectiveness of support policies can be provided by studying the CAP case. In addition, CAP effects on employment would be of primary interest when jobless rates skyrocket throughout the European Union and any policy that keeps the employment engine running constitutes a lifesaving action. This paper offers a comprehensive view of the employment impacts of CAP reform (Pillars 1 and 2), reflecting the findings of an EU-funded project in a cross-country comparison. The results offer a clear message about how the reform has affected farming activities and rural employment generation. The longer-term consequences of the reform may be difficult to evaluate precisely; however, the research evidence indicates that the rural sector is moving towards a more competitive farm structure, fewer people are being employed in agriculture, and agriculture is becoming more sensitive to price signals from world markets. In this context, the effective implementation of policy measures becomes important for regions characterized by rural and economic diversities. Policy action should respond to these regional disparities, taking advantage of market trends and prospects to create competitive advantages for farms and to support development opportunities.

The cross-regional comparison revealed, first, that the effect of Pillar 2 measures is considered modest, highly bureaucratic in nature, and to work better through support for improved farm business efficiency if combined with Pillar 1 reforms. This could result in stabilising employment levels in the farming sector or at least stemming their decline. Pillar 1 reforms create changes in the mindset of farmers who adopt a strategy of alterations in land use aiming to reach the maximum level of revenue. This has negative consequences for rural employment. Certain sectors have the potential to enhance output, income and employment, and therefore a policy promoting their expansion is indispensable.

Certainly, the methodologies applied in this study may have shortcomings in evaluating the exact impacts of the CAP reforms on rural employment in different contexts. However, the results indicate clearly that Pillar 2 measures can mitigate any negative impacts from Pillar 1. The former need to play a more effective role, especially in more peripheral and less accessible territories, and should be better combined with

other mechanisms of economic development, especially regional policies. This is not the case so far, and the degree of coherence between rural development policies requires a more integrated perspective to provide desirable results.

The reform allows member states considerable leeway to design their own version of the CAP that will better correspond to their vision of agricultural policy. Such policy actions by Member States, coupled with an efficient combination of Pillar 2 measures with structural funds spending, may have positive effects on rural employment. In particular, modulation appears desirable, but views on the pace of this kind of funds transfer seem polarized. One perspective infers that agriculture is the main element of rural activity, and therefore, indirect employment created by agriculture logically explains the focus on farm-based development. Another standpoint emphasizes supporting employment in sectors outside agriculture, taking into account the needs of all rural businesses. Nevertheless, the consensus is that Pillar 2 policies have the potential to contribute to the maintenance and creation of rural employment. The integration of Pillar 2 measures along with stimulation of the environmental features of production and socially responsible farming systems underpinned by agri-environmental schemes could result in enhanced employment in rural areas. However, these policies should be distinguished relative to different circumstances, and specifically they should be more flexible taking into account the particularities (economic, cultural, and social) affecting the specific contexts they are applied.

Note

1. Konstadinos Mattas, School of Agriculture, Department of Agricultural Economics, Aristotle University of Thessaloniki, Greece; Filippo Arfini, Department of Economics, Section of Agricultural Economics, University of Parma, Parma, Italy; Peter Midmore, Aberystwyth University, School of Management and Business, Penglais, Aberystwyth, Ceredigion, United Kingdom; Michael Schmitz, Justus-Liebig-University of Giessen, Institute of Agricultural Policy and Market Research, Giessen; Yves Surry, Department of Economics, Swedish University of Agricultural Sciences, Uppsala, Sweden.

This work mainly draws upon a FP6 EU-funded projects, CARERA (CT022653) partly FoodIMA (CT044283), and is an attempt to reflect a synthesized view of the findings. The co-authors represent the main leaders of the group and acknowledge the contribution of several people working in the respective teams; it is impossible to mention all of them.

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Chapter 15

The impact of modulation as a policy instrument

Peter Nowicki, Kaley Hart and Hans van Meij[1]

In the current situation of limited empirical evidence on the impact of modulation, a combination of modelling and non-modelling approaches is used in a study for Directorate General Agriculture and Rural Development in order to provide a comprehensive analysis of consequences on distribution of funds and budgets, farm structure, socio-economic conditions (competitiveness, farm income, employment, quality of life) and environmental quality. This chapter analyses a variety of economic outcomes achieved through a range of modelling methods.

Modulation as a policy instrument

The term modulation was first used in relation to the Common Agricultural Policy (CAP) during the 1992 MacSharry reforms, and was related to a proposal to impose a ceiling, or cap, on the amount of subsidy that an individual farmer could receive from the CAP. During the Agenda 2000 CAP reform, the meaning of modulation changed, to describe a policy mechanism for shifting funding from the part of the CAP budget dedicated to providing income support payments to farmers (Pillar 1) to the newly introduced Rural Development Regulation,[2] known as Pillar 2. At the time, there was little support for such a mechanism being introduced on a compulsory European Union (EU)-wide basis, and the final agreement resulted in "voluntary modulation" being introduced, giving member states the option to redirect up to a maximum of 20% of Pillar 1 funds[3] to their rural development programme (RDP) budgets.

The 2003 CAP reform initiated a shift away from support for agricultural production along with a greater emphasis on sustainability, the environment and rural development. Amongst a number of fundamental changes to the operation of Pillar 1 funds, an agreement was reached that made modulation a compulsory policy mechanism for all EU15 member states to implement, with later obligations for the new member states.

The legal basis for this, the current, form of modulation, was laid down in Article 10 of Council Regulation (EC) No. 1782/2003 of 29 September 2003, which specified that all farms within the current EU15 would be subject to compulsory modulation from 2005 at levels of 3% in 2005, 4% in 2006 and 5% for 2007-12, and that these resources would be allocated between member states according to a set of objective criteria to be spent on rural development measures. Compulsory modulation does not apply to the twelve new member states that acceded to the European Union in 2004 and 2007 until their Pillar 1 payments reach the same level as those for the EU15. This will be 2013 for the EU10, and 2016 at earliest for Bulgaria and Romania. Compulsory modulation does not apply to the French overseas departments, Azores and Madeira, or to the Canary or Aegean Islands.

The aim of this study was to explore the economic, social and environmental effects of introducing compulsory modulation, both under current rates and rules (the baseline scenario), and a potential future scenario (the Health Check scenario), based on the Commission's proposals for increasing modulation as part of the CAP Health Check. The results should help to bring about a greater understanding on the degree to which these benefits are tangible, and how they might change under possible higher rates of modulation in the future. This paper builds on the *Study on the economic, social and environmental impact of the modulation provided for in Article 10 of Council Regulation (EC) No 1782/2003* commissioned by the Directorate General for Agriculture and Rural Development of the European Commission (Contract No. 30-CE-0162480/00-47, Nowicki *et al.*, 2009).

Methodology of the study on the impact of modulation[4]

The methodological approach that has been taken to understand the impact of modulation is based on several different types of analysis, which can be divided into two broad categories: a modelling approach and a non-modelling approach (Nowicki *et al.*, 2009). The modelling approach allowed for results to be generated on impacts across the EU27, and for simulations of the likely changes of these impacts under different rates of modulation, while the non-modelling approach allowed for more qualitative, context-

specific insights into the impacts of modulation to be made. The use of models also permitted an exploration of any differences that might emerge from changes to rules relating to franchise levels, co-financing requirements, or allocation of funds within Pillar 2 to specific measures, albeit based on a set of generalised assumptions.

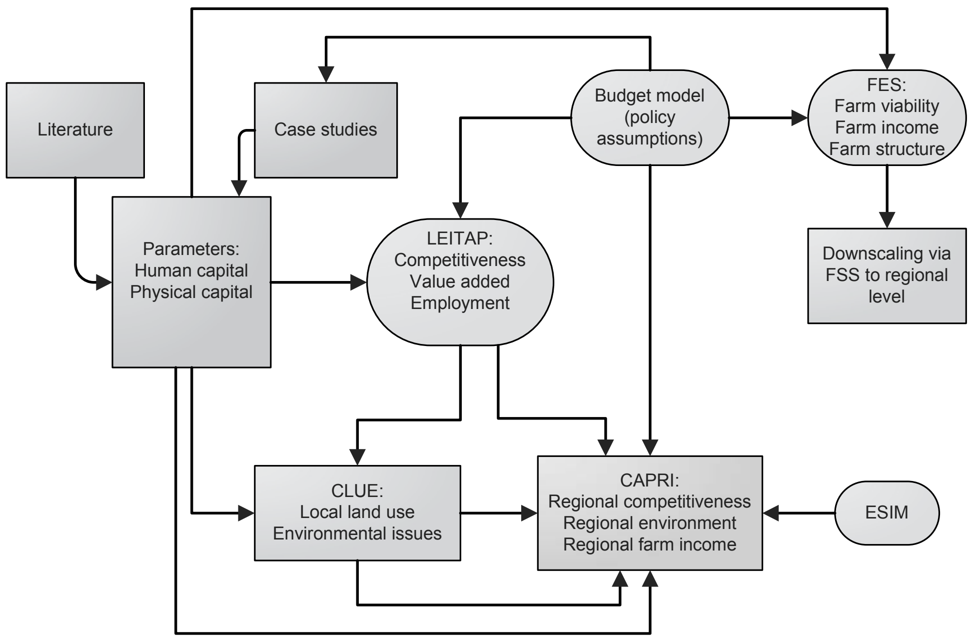
The modelling approach consists firstly of a custom-built budget model, which allows the transfers of money involved from the national cuts in the Pillar 1 through to the expenditure for each measure within member states' Rural Development Programmes to be tracked. Secondly, a suite of economic models place the Pillar 1 reductions and the additional budget available for Pillar 2 measures within the framework of the world economy, from both a general and partial, or sector-specific (agriculture), perspective. Finally, a land-use model attributes changes in land-use that are calculated by the economic models to particular areas, on the basis of a 1 km grid covering the European Union. The use of economic models to understand the impact of Pillar 2 expenditures was carried out for the first time, and was informed by insights acquired from the non-modelling approach. The non-modelling approach included a literature review, case studies undertaken in eight member states, questionnaires to member state authorities for agriculture and rural development, and an assessment of standard indicators compiled within the Common Monitoring and Evaluation Framework for EU rural development policy.

A number of difficulties were encountered in identifying the precise impacts of compulsory modulation on the range of themes addressed by this study, some methodological, and some relating to data availability. These are to be expected in a relatively new policy area and included: the lack of empirical studies (*ex post*), especially on the effectiveness and efficiency of Pillar 2 measures, lack of data, the use of analytical tools that were not in every case specifically designed to accomplish the task required, and the need for complementary research in a context where time and human resources were limited. The quantitative modelling approach was therefore limited to *ex ante* analyses and based on strong assumptions.

Figure 15.1 demonstrates that the modelling approach is integrally associated not only with the budget model and the other economic and land-use models, but also with the case studies, and the modelling approach also draws on a literature review in order to investigate the exogenous parameters and multiplier coefficients that are used in the modelling approach. Where such information is not available, assumptions with regard to parameters and multipliers have to be made by the modellers, on the basis of the best available expert knowledge. In order to model the economic and environmental impacts of modulation, it is necessary to find a means of linking agricultural commodity parameters with regional / territorial aspects. The global economy-wide dimension is covered by the economic model, LEITAP (Francois *et al.*, 2005; Meijl *et al.*, 2006; Eickhout *et al.*, 2007; Banse *et al.*, 2008). ESIM provides more agricultural detail for the EU25 countries (Banse and Grethe, 2007), CAPRI distributes this impact to the regional (NUTS 2) level (Britz *et al.*, 2008), and FES to the farm level. Dyna-CLUE provides a detailed analysis of land cover change, thereby giving a spatial representation of the economic modelling outcomes (Verburg *et al.*, 2008; Verburg and Overmars, 2009).

Models are shown with their output contributions in this study. Rounded fields indicate national levels and squared fields regional levels. The budget model provides basic information to all models and to the case studies, which, together with literature provide the basis for the assumptions regarding the parameters for human and physical capital that are used in the models.

Figure 15.1. Quantitative impact analysis



Analysis of modulation within the modelling framework

Modelling modulation has been made through a set of linked models. The modelling was carried out in two steps: first, Pillar 1 was reduced, and second, the money was introduced into the Pillar 2. The first step is usually quite straightforward (Table.15. 1), with the main challenge being the modelling of decoupled payments. The second step is more complicated since modelling Pillar 2 has never been done before. Introductory comments regarding the treatment of rural development measures are provided below (Table 15.2). One important aspect of agriculture is its contribution to public goods. The models used in this study are not suited for analysing this aspect, and the current literature in the field does not allow for any consistent implementation in modelling policy interventions.

Table.15.1. Treatment of Direct Payments (Pillar 1) in models

Treated in Model	Implementation of Direct Payments
LEITAP	Farm payments are implemented as primary factor payments in the various agricultural sectors. Coupled payments are directly coupled to sectors. Decoupled payments are implemented as an equal payment rate to land in all eligible sectors, and therefore do not provide an incentive to switch between eligible sectors and between production factors used within the eligible sectors.
FES	Farm payments are directly calculated and implemented at farm level.
CAPRI	Effects of changes in farm payments are analysed at the regional farm and sector level, distinguishing between a large number of premium types. Decoupled premiums such as milk and sugar premiums are distributed over the eligible crops of the regional farm. Coupled premiums are linked to agricultural activities at the regional level.

Table 15.2. Treatment of rural development measures[1] in quantitative models

	Treated in model	How implemented (information needed from other models/case studies)
01 – Human Capital Investment [111-115, 131-133]	LEITAP	Payments influencing the total factor productivity in agriculture. Rate of return on investment is 40% (Evenson, 2001). Deadweight loss assumed to be zero (sensitivity analysis is done with 25% deadweight loss).
	CAPRI	Via link with LEITAP.
	FES	Payments on investment at farm level.
02 – Physical Capital Investment [121-126]	LEITAP	Payments which influence the total factor productivity due to capital investments in all agricultural sectors. Rate of return on investment is 30% (Wolff, 1996; Gittleman, ten Raab and Wolff, 2006). Deadweight loss is assumed to be zero (sensitivity analyses done with 25% deadweight loss).
	CAPRI	Via link with LEITAP.
	FES	Payments on investment at farm level.
03 – Less Favoured Area (LFA) Land Use Support [211, 212]	LEITAP	Income payment linked to land in agricultural sector. FADN data are used to distribute payments across sectors.
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data and CLUE results.
	FES	Farms receive LFA or mountain area support when they are in these areas (income support).
	Dyna-CLUE	LFA support adds to the relative preference for the location for arable land or grassland (only for current agricultural land within LFA regions).
04 – Natura 2000 [213]	LEITAP	Income support linked to land in agricultural sector. FADN data are used to distribute payments across sectors.
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data and CLUE results. Conditional on extensive technology being used.
	Dyna-CLUE	Agricultural land in Natura 2000 areas receives a higher relative preference (as compared to no support) for agriculture (only for current HNV agricultural land within LFA regions).
05 – Agri-Environment measures [214-216]	LEITAP	On the one hand, income support linked to land in agricultural sector, and on the other hand, a yield and labour productivity loss. FADN data are used to distribute payments across sectors.
	CAPRI	Regional direct support. Distribution over sectors and regions based on FADN data. 50% of the support directed towards FADN 'TF8' farm types 1, 2, 3, 4 and 8 is conditional on extensive technology being used; for the remainder, extensive as well as intensive technology is eligible.
	FES	Payments linked to land.
06 – Forestry [221-227] 07 – Diversification [311-313] 08 – General rural development [321-323, 331, 341] 09 – LEADER [411-413, 421, 431] 10 – Technical assistance [511, 611]	LEITAP	Investment support for non-agricultural activities that increase productivity. Rate of return on investment is 30%. Deadweight loss is assumed to be zero (sensitivity analysis is done with 25% deadweight loss).
	CAPRI	Via link with LEITAP.
	Dyna-CLUE	For forestry: conversion of arable land to forestry or grassland in erosion sensitive areas is stimulated by lowering the relative preference of current arable land in erosion-sensitive areas.

1. The RD measure numbers are indicated between square brackets [#].

Following the intervention logics for the rural development measures, the economic models and the land use model employed are able to perform a series of analyses in order to provide insight on the thematic issues in the study, some of which are elaborated upon

in Section 4 below. These analyses cannot reasonably be performed separately for each of the 46 rural development measures, and are thus grouped according to fundamental similarities in the economic mechanisms and how these are handled by each of the models. As an elaboration of this principle, Table 2 presents the groupings of rural development measures, the models that are used for their analysis, and the relationships between the models.

Scenarios

Two principal scenarios were chosen for the Modulation study, each subject to a number of sensitivity analyses (not further dwelt upon in this article). These are set out in Box 15.1.

Box 15.1. The two principal scenarios of the Modulation study

Baseline scenario

Compulsory modulation as agreed as part of the 2003 CAP reform (Article 10 of Council Regulation 1782/2003).

- Franchise: EUR 5 000.
- Modulation rate: 5%.
- EC distribution key: current EAFRD (minimum 80% in member states, 90% in Germany).
- RDP allocation: current EAFRD.
- Member states co-financing: current EAFRD.

Sensitivity analysis (around the baseline)

Modulation rate:

(a) 0%
(b) 20%

Franchise:

(a) EUR 0
(b) EUR 10 000

Health Check scenario

With targeting to "New Challenges."

- Franchise: EUR 5 000.
- Modulation rate = 13% (banded, or 'progressive', modulation).
- European Community distribution key:
  - 1st 5% = current EAFRD (minimum 80% in member states, 90% in Germany).
  - Additional compulsory modulation stays within member states.
- RDP allocation: targeted to New Challenges.
- Member states co-financing: current EAFRD.

Sensitivity Analysis (around Health Check)

- RDP allocation: proportional to current EAFRD.
- Member states co-financing: 0%.

The first principal scenario, the 'baseline scenario', is the current system of compulsory modulation, in which there is a 5% cut of Pillar 1 direct payments that applies to beneficiaries receiving more than EUR 5 000 per year. The proportion of funds returned to the member states are calculated according to an allocation key, and are

further allocated between the Pillar 2 measures for each member state in the same way as in their individual parts of the European Agricultural Fund for Rural Development (EAFRD) budget.

The second principal scenario, the “Health Check scenario,” relates to the Commission’s proposals for higher rates of modulation as set out in the Commission Communication of 20 May 2008 concerning the “Health Check” of the CAP. This scenario consists of an additional 8% rate of compulsory modulation, introduced progressively between 2009 and 2012, and further increased according to the level of Pillar 1 direct payments received, as set out in Table 3. This additional modulation is then distributed to measures that can meet the “New Challenges” indicated in the Commission’s Proposal for a Council Regulation amending Regulation (EC) No. 1968/2005 on support for rural development by the EAFRD[5] of 20 May 2008, specifically Annex II – Indicative types of operations related to priorities referred to in Article 16a. This distribution pattern is weighted according to an interpretation of the proposal, and the same proportional allocations of the additional funds are made for each member state.

Results

Budget

In the baseline scenario, compulsory modulation of 5% in the period 2007-13 results in a reduction of EUR 8.2 billion in the ‘Direct Payments’ budget for the EU15 as a whole (Table 15.4). For the individual EU15 member states, this implies a reduction of the overall “Direct Payments” budget of between 1% and 4%. The addition of the modulation funds to the EAFRD budget for the EU15 increases this budget by nearly 20%. However, the increase in the EAFRD budget varies significantly between individual EU15 member states, mainly depending on the relative shares of ‘Direct Payments’ and EAFRD in the total budget, which is in turn affected by the allocation criteria[6] determining the proportion of the total EU core EAFRD budget received by individual member states. As a result, countries where EAFRD constitutes a relatively small proportion of the total budget, such as Denmark, the United Kingdom and the Netherlands, face an increase in their EAFRD budget of 56-94%, whereas countries where the EAFRD constitutes a high share of the total budget, such as Austria and Finland, show an increase of only about 6%. In addition, as a result of the “return key”, some countries lose from the redistribution of modulation funds: these member states are mainly located in north western Europe, Finland being the exception. Countries that benefit from the redistribution are located in Southern Europe. It is important to note that the addition of EUR 8.2 billion of modulation funds to the EAFRD budget also results in an increase of EUR 7.2 billion of national co-financing as well as EUR 7.2 billion of private funding. This means that, overall, the total budget available for Pillar 2 in the EU15 increases by 14%.

In the Health Check scenario, modulation in the period 2009-12 results in an additional reduction of EUR 5.1 billion of the Direct Payments budget for the EU15 as a whole (Table 4). As a consequence, the EAFRD budget 2007-13 for the EU15 increases by EUR 5.1 billion relative to the Baseline Scenario (+10%). If voluntary modulation funds in the United Kingdom and Portugal are deducted, the net increase of the EAFRD budget 2007-13 amounts to EUR 4.4 billion. As in the Baseline scenario, the increase in the EAFRD budget for the individual EU15 member states varies greatly, mainly depending on the shares of Direct Payments and EAFRD in the total budget. The addition

of an additional EUR 4.4 billion of modulation funds in the Health Check scenario to the EAFRD budget results in an increase of EUR 3.7 billion of national co-financing and EUR 5.2 billion of private funding. Overall, the total budget available for Pillar 2 in the EU15 increases by 8%.

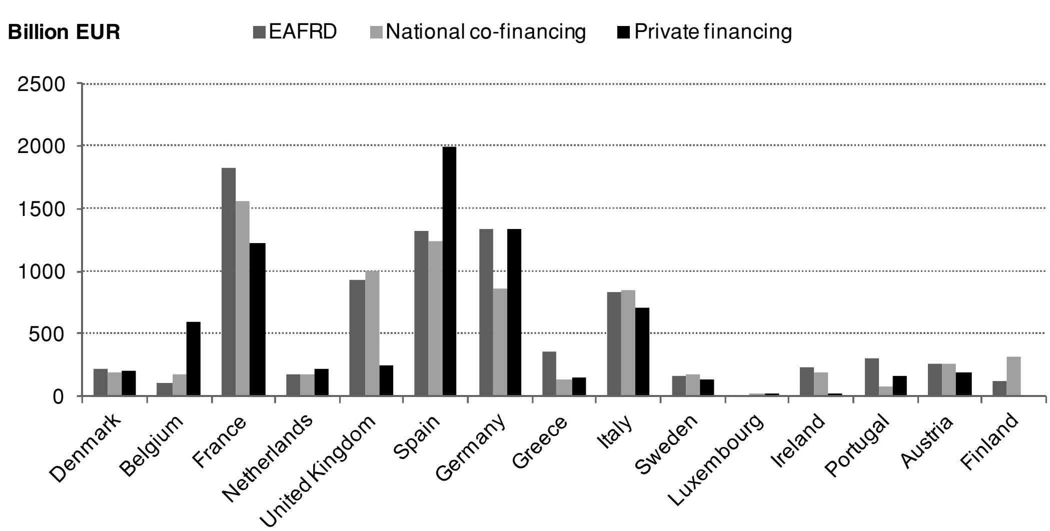
Table.15.4. Direct Payments, EAFRD and P2 budget in the Baseline and Health Check Scenario in the EU15, 2007-13

	Baseline scenario		Health Check scenario	Health Check scenario relative to baseline scenario	
	Billion EUR	%	Billion EUR	Billion EUR	%
Direct Payments budget before modulation	254.4		254.4		
Modulation Pillar 1	8.2		13.3	5.1	63
'Direct Payments' budget	246.2		241.1	-5.1	-2
Decrease Direct Payments budget due to modulation		3		5	
EAFRD budget before modulation	42.8		42.8		
Modulation available for Pillar 2	8.2		13.3	5.1	63
EAFRD budget	50.9		56.1	5.1	10
Increase EAFRD budget due to modulation		19		31	
Pillar 2 budget	166.5		179.8	13.3	8

Source: Budget Model (LEI).

The addition of EUR 8 billion of compulsory modulation funds to the EAFRD budget 2007-13 in the EU15 implies an increase of EUR 7 billion of national co-financing and also EUR 7 billion euro of private funding. Figure 15.2 shows the division for the EU15 member states.

Figure 15.2. Breakdown of increase in Pillar 2 budget induced by 5% compulsory modulation funds, 2007-13



Farm structure

Any analysis of the effects of modulation on farms structures has to be set within the context of significant trends in structural change that are brought about by non-policy drivers. For example, the past twenty years has witnessed a decline in the overall number of farms accompanied by an increase in the overall size of farm holdings. These trends are fairly consistent between different member states, with most of the case study countries identifying average annual decreases in farm numbers of between 2 and 3%. This trend is predicted to continue, with a 25% decrease in the number of farms anticipated between 2003 and 2020, with a rate of decrease of around 2.5% per year in the EU15 and 4% per year in the EU10 (as developed in the Scenar 2020 project[7]). Key drivers affecting these trends include market drivers, such as the level of commodity prices, and changes in policy support, such as the decoupling of support payments from production.

Amidst these drivers of structural change, compulsory modulation, especially at relatively low levels, is unlikely to have a significant impact upon farm structural change. However, as rates of modulation increase, its role in driving structural change may increase, particularly for those holdings experiencing an overall decline in their Pillar 1 payments, and as a result of increased funding availability for Pillar 2 measures, such as early retirement, or support for young farmers which are focused at facilitating structural change and the improved efficiency of farm holdings. On the other hand, increased levels of investment in Axis 2 measures, such as the Less Favoured Area (LFA) and the agri-environment measures, may serve to slow down structural change as these measures may help to keep in business a proportion of smaller holdings, particularly extensive livestock holdings, which might otherwise have been abandoned or amalgamated into larger, more profitable holdings.

From the budget model, it is possible to derive the proportion of modulated funds that might be allocated to different rural development measures, giving some indication of the proportional impact that modulation is likely to have. In relation to Axis 1 measures, within which the early retirement, farm modernisation and infrastructure measures sit, the contribution of modulated funds ranges from up to 10% of the total Axis 1 budget in Greece, Italy, Luxembourg, Austria, Portugal, Sweden and Ireland, between 10-20% of the budget in Germany, Spain and Greece, and over 20% in Belgium, Denmark, France and the Netherlands.

The FES model is designed to analyse the potential changes in the number of farms over time (Table 15.5). According to the FES model, changes in number of farms in the EU15 member states as a result of reductions in Pillar 1 direct payments under both the baseline scenario and the Health Check scenario are negligible. The highest decreases are in Denmark (-0.6%), Germany and Sweden (both -0.1%). The very few farm businesses that are terminated altogether do so for financial reasons. It has not been possible to model the impact that the increased funding available for Pillar 2 measures might have on farm structures, and the model can also not account for what happens to the land of the farms that have ceased to exist.

Given these negligible changes in the number of farms in both scenarios, we do not present changes in the other farm structure indicators based on the FES model, as these show the same negligible changes.

Table 15.5. Number of farms as a result of reductions in Pillar 1 direct payments under the Baseline and Health Check Scenarios in the EU15 member states, 2013

	Number of farms 2013	Change in the number of farms in 2013 relative to the Baseline Scenario (%)			
	Baseline Scenario	No modulation	Baseline+ EUR 10 000 franchise	Baseline + 20% modulation	Health Check Scenario
EU15, change to Baseline Scenario (%)	3 032 485	0.02	0.01	-0.06	-0.02

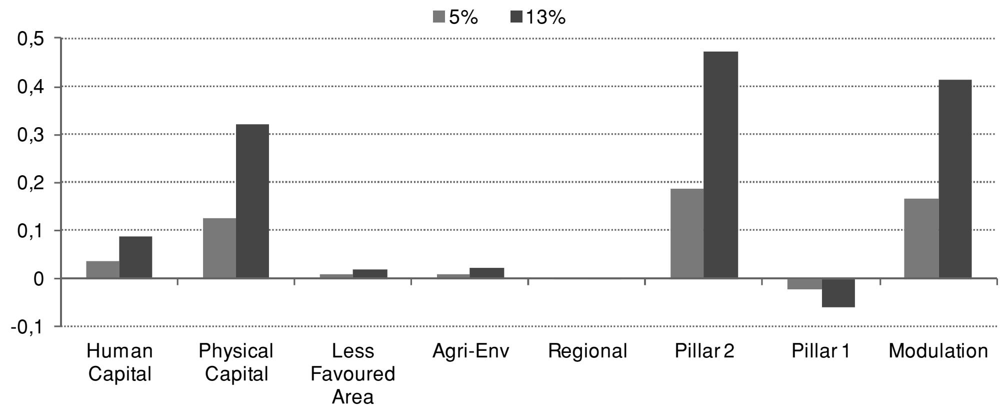
Source: FES model, based on FsourceADN data.

Production

Both the economic models (LEITAP and CAPRI) show that modulation, under the baseline scenario, has an overall positive, albeit small, production effect, although there are some differences between regions and products. This effect increases under the Health Check scenario. LEITAP suggests that the overall production effect under the Health Check scenario is positive for primary agriculture, with an overall increase in production of almost 0.4% compared to no modulation (Figure 15.3). In addition to the overall impact of modulation under the Health Check scenario, both Figures 15.3 and 15.4 also distinguish the impact of various groups of Pillar 2 measures, the impact of the whole Pillar 2 and the impact of reducing Pillar 1. The impact of Pillar 2 on production is positive (0.47%), while reducing Pillar 1 payments as a small negative production effect (-0.06%). The negative production effect of reducing Pillar 1 payments is limited as payments are decoupled. Pillar 2 payments, especially Axis 1 measures, increase production due to higher productivity growth and due to co-financing that increases the total subsidy budget available strongly. The positive production effect of modulation is primarily due to the impact of physical capital investments, which aim to increase productivity, thereby lowering costs and prices. Lower prices, in turn, slightly increase demand and competitiveness, both of which lead to increased production. Part of the explanation for the large impact of these measures is that a large share of Pillar 2 money (~25%) is spent on these measures, and hence a greater proportion of modulation funds will also be allocated to them. The same productivity impact can be expected as a result of investment in human capital; however, the impact is lower, since less money is distributed to these measures (~8%). The production impact of the LFA and agri-environment measures is slightly positive, due to the fact that these payments keep some areas in production.

Figure 15.3. EU27 production volume of primary agriculture — 5% / 13% modulation

% change relative to no modulation in 2013

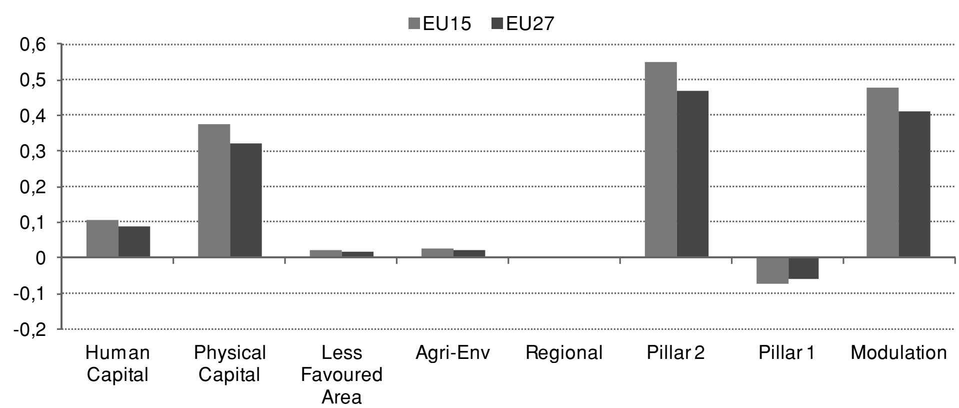


Source: LEITAP.

Looking at the increased rates of modulation under the Health Check scenario compared to the no modulation scenario, Figure 15.4 shows that the impact for EU15 is larger (0.45 % increase) than for the EU27 (0.4% increase) as modulation only applies to the new member states (excluding Romania and Bulgaria) from 2012, while it is in place for the EU15 for the whole 2007-13 period.

Figure.15.4. Production volume of primary agriculture – EU15 / EU27

% change of the Health Check scenario relative to no modulation in 2013



Source: LEITAP.

The impact is measured in 2013, assuming the application of modulation over the 2007-13 period. If one extends the period, the dynamic effects with regard to physical and human capital will mean that the impact, relative to the baseline scenario, becomes larger over time. This is because the effects are cumulative, in other words productivity gains in one year remain more or less constant over time,[8] and every year adds a new productivity gain. The effect of reducing Pillar 1 direct payments and, for example, LFA payments remains more or less the same, as they are income payments.

Farm income

Assessing the impacts of modulation on farm income and farm household income is not straightforward. While Pillar 1 direct payments have a direct income effect, this is not the case for the majority of Pillar 2 measures, and so the degree to which Pillar 2 measures – those focused at the agricultural sector – are considered to have an income effect first needs to be established. Within this study, it has been assumed that expenditure under the LFA measures are pure income payments, that expenditure under human and physical capital measures has an income effect according to assumptions on investment rate returns, and that expenditure under the agri-environment measure is income-neutral.

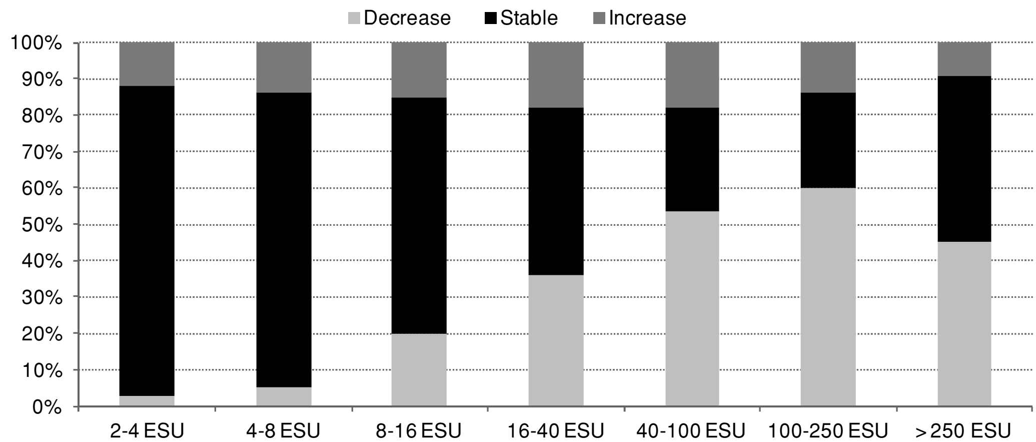
In general, we assume that those farm types where Pillar 1 direct payments make up a high proportion of income are likely to experience a greater negative impact on overall farm incomes from reductions in Pillar 1 payments, and that this impact is likely to increase under the Health Check scenario as modulation rates increase. However, this impact should be mitigated to a certain extent by the additional availability of funds available through Pillar 2, which are augmented by additional national co-financing and private funds. The extent to which this takes place will depend on the ability of different farms to access funding from Pillar 2. It should also be noted that a proportion of funds will be redistributed away from the farming sector to non-farming beneficiaries.

Data on the impacts on modulation on farm incomes and farm household income has been calculated based on the FES (using FADN data), CAPRI and LEITAP models, and on information provided within the case study reports.

Changes in farm income according to farm size

For analysing which farms benefit and which farms lose from modulation, farms were grouped according to changes in farm income under the Health Check Scenario into three types: farms with an increase in income above 0.5%, farms where income remained rather stable (change between -0.5 and +0.5%), and farms with an income decline above 0.5% in 2013. For the EU15 as a whole, it appears that there is a tendency that the larger the farm size, the larger the proportion of farms that face an income loss (Figure 15.5). However, this trend does not apply to the group with the largest farm size, likely as a result of banded modulation. The proportion of farms that benefit from modulation is remarkably similar for all size groups, and fluctuating between 9 and 18%. When considering the individual member states, the same trend can be perceived for the proportion of farms that face an income decline, although the absolute levels of the proportion rather differs among them. The proportion of farms according to farm size that benefits from modulation varies considerably amongst member states. It is moderate in Germany, Greece, Italy, the Netherlands, Portugal, and Spain and is relatively high in the United Kingdom, where many medium-sized farms are likely to benefit from the application of the franchise in the Health Check Scenario. In most countries, except for Belgium, Denmark and Portugal, the proportion of smaller-sized farms that experience an income increase exceeds that of the larger-sized farms.

Figure.15.5. Changes in farm income under the Health Check Scenario according to farm size in the EU15, 2013

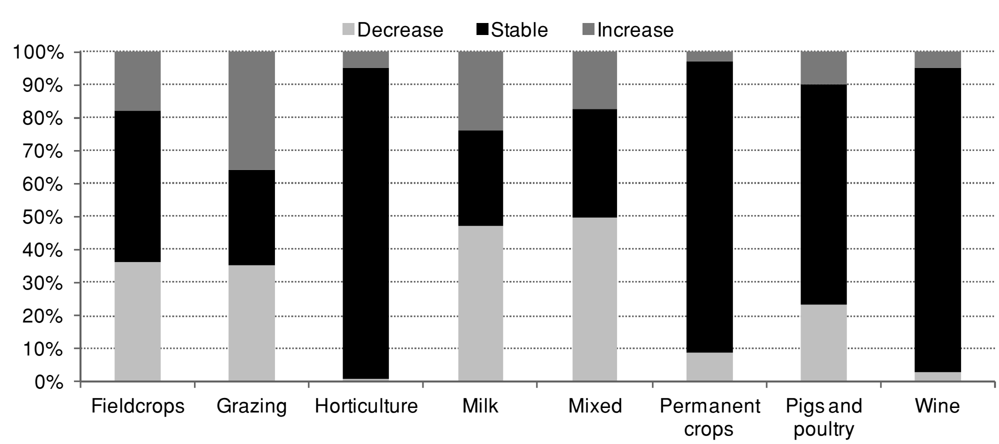


Increase: change in FFI>0.5%; stable: change in FFI between -0.5% and + 0.5%; decrease: change in FFI>-0.5%.
ESU: European Size Unit.
Source: FES model, based on FADN data.

Changes in farm income according to farm type

An analysis of which farm types benefit and lose under the Health Check scenario in the EU15 in 2013 shows that farm incomes on horticultural, permanent cropping, pigs and poultry, and wine farms are hardly affected (Figure 15.6). The proportion of Direct Payments in farm income is rather small on these farm types. Grazing and milk farms have the highest proportion of benefiting farms (25-35%), mainly due to increased LFA payments. About one fifth of mixed and field cropping farms also experience an income increase. On the other hand, a considerable proportion of field crops, grazing, milk and mixed farms face an income decrease, varying from about one third for field crops and grazing farms to nearly 50% for milk and mixed farms. This average EU15 picture can by and large also be perceived in the individual member states. The Health Check scenario evidently results in a redistribution of funds within farm types rather than among farm types.

Figure 15.6. Changes in Farm Income under the Health Check Scenario according to farm type in the EU15, 2013



Increase: change in FFI>0.5%; stable: change in FFI between -0.5% and + 0.5%; decrease: change in FFI>-0.5%.
Source: FES model, based on FADN data.

Gross Value Added

Figure 15.7 shows percentage change in total Modified Gross Value Added (MGVA: GVA of agricultural activity plus value of premiums), divided by UAA in all regions, to indicate the regional distribution of the income effects. The colour yellow indicates regions where there is approximately no change, darker shades of red denote larger losses in MGVA per hectare, and green shades denote increases. There are broadly speaking different classes of regions where income decreases:

- In north-western Europe, due to a (general) redistribution of the FEOGA budget for the north-west towards the EAFRD budget in the south.
- In beef-producing regions, due to the more protected beef markets and coupled premiums.
- In the new member states, because they are almost exclusively indirectly affected via the lower market prices.

Figure 15.7. Change in gross value added plus premiums per hectare in Health Check scenario versus baseline

Simulation results from the partial equilibrium model CAPRI. The map shows the relative difference in Gross Value Added plus premiums between the Health Check and the baseline scenarios for 2013.

In Sweden, Austria and in particular in Finland, the return of modulated money in the form of agri-environment measures (including co-financing and top-ups) is relatively large, and contributes to supporting agricultural income there by supporting the provision of environmental services. Authorities in regions with farms experiencing a potential decline in income as measured by MGVA may increase payments for EAFRD measures in areas where the maintenance of specific farming practices or systems is a priority.

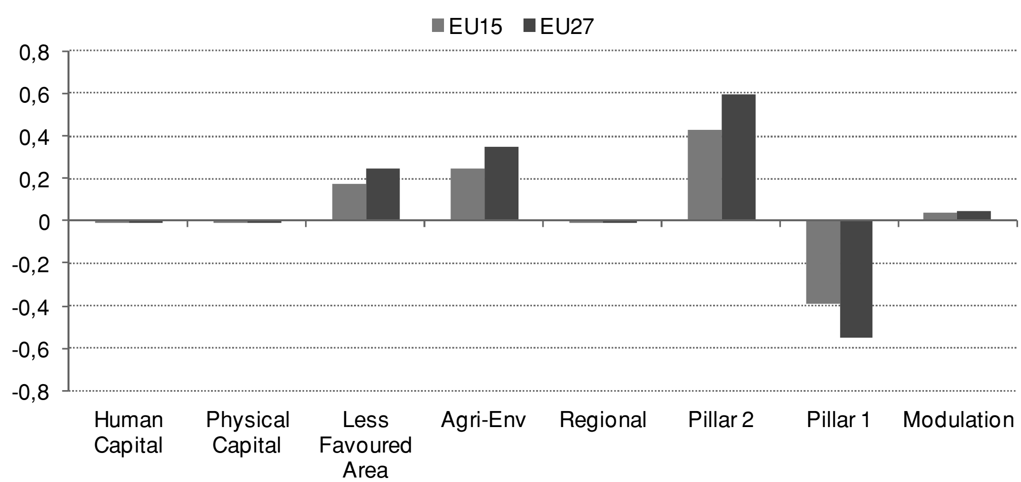
Environment / land use

The results from LEITAP show that, under the Health Check scenario, a greater proportion of land would be under production than is the case without compulsory modulation. The model indicates that compulsory modulation has a very small positive effect on land use, retaining some land under production across the EU27 that might otherwise have been abandoned or have moved into alternative land uses, such as forestry (Figure 15.8). While the reduction of Pillar 1 payments alone would be likely to see a small proportion of land go out of production, the increased availability of funding in Pillar 2, particularly in relation to the agri-environment and LFA measures, more than makes up for this.

In practice, these results seem surprisingly small. Given the extent of implementation of agri-environment and LFA measures, with schemes operating in all 27 member states, one might have anticipated greater effects on land use than those modelled; however, the general orientation of response indicated through the modelling is certainly what we would expect to see in reality.

Figure 15.8. Agricultural land use – EU15 / EU27

% change Health Check scenario relative to no modulation in 2013



Source: LEITAP, 2008

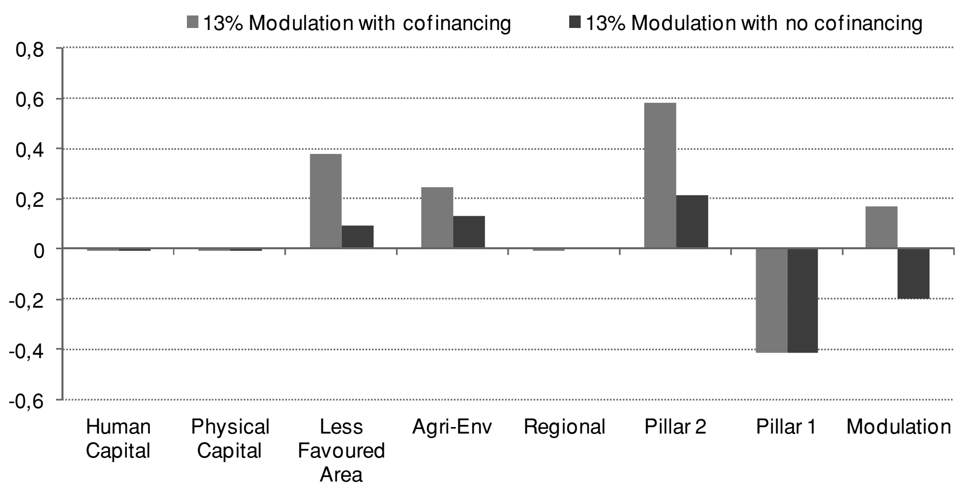
Figure 15.9 illustrates the influence of national co-financing on compulsory modulation receipts within Pillar 2 on these results. Without national co-financing, these figures indicate that, despite the positive effects of the LFA and agri-environment measures, land would continue to leave agricultural production. This highlights the importance of sufficient funds being allocated to such schemes to allow their coverage to be adequate to retain sufficient land of high nature and landscape value under agricultural use.

LEITAP also suggests that compulsory modulation under the Health Check scenario leads to a greater retention in the area of grassland than the area of arable land. Figure 15.10 shows that, under the Health Check scenario, approximately 0.6% more grassland is retained in production than would be the case without compulsory modulation — largely due to Pillar 2 environmental measures — while the area under

crops is reduced by 0.3%, largely as a result of the reductions in Pillar 1 payments. These losses are likely to be primarily from marginal arable areas. This effect is mainly influenced by payments made under the agri-environment, LFA and Natura 2000 measures, a greater proportion of which are focused on livestock systems than arable farmland. This would appear to indicate that increased expenditure on such measures is helping to reduce grassland decline at the margins, although, as above, the impact is likely to be more significant in reality.

Figure 15.9. Impact of co-financing on EU27 land use of primary agriculture with 13% modulation

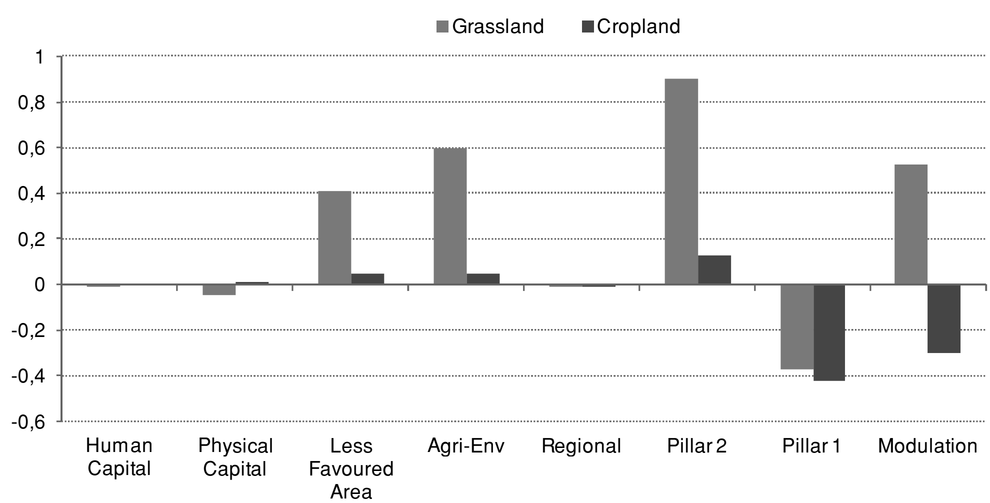
% change relative to no modulation in 2013



Source: LEITAP, 2008.

Figure 15.10. EU27 Agricultural land use – grassland / cropland

% change Health Check scenario relative to no modulation in 2013



Source: LEITAP, 2008.

The impact of modulation

This study of the impact of modulation has been undertaken through a double perspective of two different scenarios: a baseline scenario of compulsory modulation at 5%, and a Health Check scenario based on a 13% modulation rate, as elaborated in the Commission proposals in May 2008. As the effects of modulation *per se* are quite limited in comparison with the macro-trends affecting agriculture since the 1950s, it is often the higher modulation rate that provides an indication of what the influence of modulation might in fact be.

The results of the combined analysis are consistent for the two primary observations coming from the study. Firstly, the reduction of Pillar 1 payments made through the modulation process – at the level that occurs at present – has a negligible influence on agricultural commodity production and on the viability of farm businesses generally. However, the impact on farm income is naturally negative. Secondly, there are beneficial effects in evidence as a result of the availability of additional modulated funds within Pillar 2 – both for farmers and to other actors within the rural economy. This is in a large part due to the fact that these measures have clear objectives, and are targeted at areas of identified need, and the total amount of money available is higher due to co-financing requirements. As a result, Pillar 2 measures are able to provide the leverage intended, whether it is in increasing productivity and competitiveness through Axis 1, maintaining and improving the environment through Axis 2, enhancing the vitality of the rural economy through Axis 3, or encouraging local leadership and partnership through Axis 4 (the LEADER programme). However, the transaction costs of targeted payments and the monitoring costs are not quantitatively taken into account in this study.

Modulation can lead to a significant transfer of support between farms of differing type and size. Logical deduction from the existing pattern of payments suggests that, in general, modulation tends to lead to a redistribution of funds from:

- Larger to smaller farms, although the participation of rather small farms in many Pillar 2 measures is low in many member states.
- Larger arable farms to:
    - Livestock farms, including a significant proportion of more extensive farms, which are the main recipients of Axis 2 money, but also dairy farms, potentially accessing funding under all axes.
    - Other farm types which are able to access physical and human capital investments under Axis 1.
    - Forestry and farm/forestry enterprises (through the forestry measures).
    - Beyond the agricultural sector to the broader rural economy.

However, when considering the impacts of compulsory modulation, it is important to remember that its effects extend considerably beyond a simple readjustment to the funds available within the two Pillars, as the additional funds that are made available for Pillar 2 are then augmented by national co-financing and, for certain measures, by private-sector contributions. The funds provided by the member states themselves, therefore, make a substantial contribution to the impact of Pillar 2 resources. In contrast, the financial gain or loss from changing the level of the ‘franchise’ – the part of Pillar 1 payments that are not taken into consideration for the modulation amounts – is minor. As such, compulsory

modulation acts as a conduit for leveraging an increase in funding available for rural areas, both to the agricultural sector and beyond.

The study has sought to explore the impacts of modulation through the use of economic models. This has revealed the considerable methodological and data challenges inherent in a complex policy evaluation exercise of this kind.

- Empirical information about the impact of modulation and especially the impact of Pillar 2 measures is very scarce. Therefore, *ex post* information hardly exists.
- Public goods are not included in the modelling, although they are an important part of Pillar 2.
- Environmental impacts are difficult to generalize, as the impacts vary locally.
- Pillar 2 is a complex set of measures with different impacts, depending on how they are implemented. Therefore, only a stylized approach for each measure can be implemented, and the approach taken includes grouping the measures.
- Lack of empirical information about deadweight.
- Transaction costs have not been addressed.

Reliable *ex post* information is extremely scarce. Since these measures may be a growing element of the CAP, it is recommended that further investment both in analytical tools and data collection (at different geographical levels) is prioritized at both the member state and EU levels. The availability of good-quality, precise and comparable empirical evidence on the impacts of these new measures at local, regional and member state level is critical to inform future policy evaluations.

If modelling is to be used to predict the impacts of different policy scenarios in relation to new and more targeted measures with greater confidence, then again empirical evidence of the efficiency and effectiveness of these measures is crucial. For example, information about the rates of return to human and physical capital investments is needed, the level of deadweight or crowding-out effects, transaction costs, and the impact of environmental measures on yields. EU-wide economic models need to be developed further to enable them to reflect more locally differentiated impacts, including by farm type, based on the different ways in which measures are implemented in different locations. The work currently being undertaken in EUruralis 3.0 and the Seventh Framework Project project CAPRI-RD is a good start in this regard. Another large area of research, not taken into account in this study, is the conceptualization, modelling and monetization of public goods.

Notes

1. Peter Nowicki and Hans van Meijl, Agricultural Economics Research Institute (LEI-WUR);Kaley Hart Institute for European Environmental Policy (IEEP).
2. Council Regulation 1257/1999 of 17 May 1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF), and certain amending and repealing Regulations.
3. The legal basis for voluntary modulation was set out in Article 4 of Council Regulation 1259/99.
4. Contract No. 30-CE-0162480/00-47 of the Directorate General for Agriculture and Rural Development with LEI and IEEP: *http://ec.europa.eu/agriculture/analysis/external/modulation/index_en.htm*.
5. COM(2008) 306 Final.
6. Article 69 of Council Regulation 1698/2005 sets out the allocation criteria for the EAFRD budget between member states, which consider: past performance (allocations under the 2000-06 programming period), amounts reserved for Convergence regions; and additional amounts relating to specific situations and needs based on objective criteria (not defined).
7. *ec.europa.eu/agriculture/publi/reports/scenar2020/index_en.htm.*
8. It declines over time due to depreciation.

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Chapter 16

Spatial structure of agricultural production in France: the role of the Common Agricultural Policy

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This chapter analyses the regional dynamic and spatial distribution of agricultural production in France. The analysis is based on data obtained at two spatial levels: region and département*, and the data cover the period from 1990 to 2006. Different methods are applied to analyse the French production structure: maps and regional specialization are combined with regional concentration, the calculation of spatial autocorrelation and a local indicator of spatial association. These methods are applied to ten agricultural sectors. Results indicate that the activities which are regionally concentrated are not inevitably spatially autocorrelated, especially for production activities which are supported by the Common Agricultural Policy (CAP). A more specific analysis was conducted to determine the factors influencing the spatial dynamics using as an application the dairy sector (which is revealed as the most spatially autocorrelated). This approach was applied using spatial econometric models for dairy production in 1995 and 2005. It shows that market signals are more important in determining the dairy farm location in 2005 than they were in 1995. Environmental regulations also become more relevant in 2005 than in 1995, and seem to decelerate the rate of concentration amongst dairy farms.*

This chapter examines the spatial structure of agriculture and its recent changes in French regions. The increased regional specialization and the increased spatial concentration of agricultural production are largely explained by comparative advantage and agglomeration economies.

Right from the beginning of the formulation of the European Union (EU)'s Common Agricultural Policy (CAP), policy makers have shown great interest in the regional and spatial aspects of the CAP. The French policy aimed at not supporting the movement towards concentration of production in certain areas. The objective was also to support the less favoured areas (with natural disadvantages). Despite this determination, many regions viewed their production as specialised.

Since the late 1980s, with the shifts in EU agricultural policy, governments have attempted to promote a rural economy by the diversification of agricultural management, and encouraging the growth potential of rural areas. At the same time, it has promoted regional differentiation, considering the physical conditions in each area. Currently, although agricultural activities are still present in all regions, there are several areas that specialise in one or only a few sectors. The centre of France (the Paris basin) forms the main cropping area in the country, while dairy production is concentrated in north-western France.

When the regional development of a certain activity is analysed, it is done with the purpose of finding out which regions have been able to increase their share in the activity, and which regions have lost their position. Regions that increase their share may or may not be neighbours, indicating that the picture of a study done from a regional perspective can differ considerably when compared to a study done from a spatial perspective. When an activity is fully concentrated in only a few regions, it makes quite a difference whether these regions are contiguous, or spread across the country (Elhorst and Strijker, 2003).

In this article, regional and spatial changes in ten agricultural sectors are analysed, using different methods to measure these changes. The analysis is based on a data set of agricultural production in EUR million (at constant prices) from the French budgetary account for agriculture, during the period 1990-2006. A spatial econometric model was applied to the special case of dairy, for the year 1995 and the year 2005, to determine the effects of *département*-specific demographic, environmental, political, and market factors, as well as to test for the influence of spatial agglomeration economies on the geographic distribution of the French dairy sector.

Regional specialisation

Regional specialization is defined as the fraction of the sector production of the region relative to its national share of French production.

$$Sp\acute{e}_r = \frac{1}{2}\sum_i \left| y_r^i - \overline{y^i} \right| \quad (1)$$

where y_r^i denotes the share of the production of the sector i in the total agricultural production in the region r, *and* $\overline{y}^i$ denotes the share of the sector i in the agricultural production in France.

This coefficient[2] measures how specialised a region is in a particular agricultural sector relative to its distribution across the country. The more the coefficient tends to one, the more the productive structure of the region is different from that of the country, and the more its level of specialization is higher. This coefficient is applied to ten agricultural sectors: crops, horticulture and market gardening, fruits, wine with geographic indication, other wine, beef cattle, poultry, dairy and other sectors over the period 1990 to 2006 (Table 16.1).

Table 16.1. Regional specialization coefficients

Region	Hallet	Hallet	Evolution[a]	First specialization	Second specialization
	1990	2006		2006	2006
PACA	0.57	0.61	0.15	Horticulture, market gardening	Fruit
Ile-de-France	0.51	0.48	-0.10	Cereals	Horticulture, market gardening
Languedoc-Roussillon	0.54	0.48	-0.44	Other wine	Horticulture, market gardening
Champagne-Ardenne	0.42	0.39	-0.21	Wine quality	Cereals
Limousin	0.40	0.38	0.05	Beef cattle	
Bretagne	0.41	0.38	-0.06	Pig	Poultry
Lorraine	0.34	0.35	0.14	Cereals	Dairy
Aquitaine	0.31	0.34	0.45	Wine quality	Poultry
Poitou-Charentes	0.33	0.33	0.18	Other wine	Cereals
Franche Comté	0.34	0.32	-0.14	Dairy	Beef cattle
Auvergne	0.29	0.30	0.17	Beef Cattle	Dairy
Centre	0.29	0.30	0.09	Cereals	
Basse Normandie	0.34	0.29	-0.20	Dairy	Beef cattle
Bourgogne	0.28	0.29	-0.03	Wine quality	Beef cattle, cereals
Picardie	0.30	0.29	0.09	Cereals	
Haute-Normandie	0.30	0.28	-0.01	Cereals	Dairy
Nord pas de Calais	0.25	0.24	0.13	Horticulture, Market gardening	Dairy
Alsace	0.25	0.22	-0.33	Wine Quality	
Pays de la Loire	0.24	0.21	-0.04	Poultry	Beef cattle
Midi Pyrénées	0.17	0.19	0.15	Cereals	Beef cattle, fruit
Rhône-Alpes	0.17	0.15	-0.02	Fruit	Wine quality
France				Cereals	Beef cattle and dairy

a. The evolution is calculated through a regression line, and we use the sine of the slope angle of this regression line, which is ranges within [-1,1].

b. Through the budgetary accounts of agriculture of 2006, the French agricultural production (except subsidies) rises to EUR 57.8 billion. 56% came from the vegetable productions, 13% from the dairy production and 12% from the production of beef cattle (Livestock Institute).

Source: Authors' calculations from the budgetary accounts of agriculture1990-2006 AGRESTE, France.

Ten of the 22 French regions are increasing their level of specialization over time. This specialization could come from the increase in the production of the sector in which the region is mainly specialised (e.g. regions of Aquitaine and Poitou-Charentes) or from the decrease in the production of the other non-principal sectors (e.g. the region Centre).

Regions specialised in livestock production show different trends; the regions of Brittany and Pays de la Loire, specialised respectively in pig and poultry, tend to diversify their production because of the increase in the share of the cereals production. On the other hand, the regions of Limousin and Auvergne, which are more extensive production regions, tend to increase their level of specialization.

Dairy production is mainly produced in the north-west of France and to a lesser degree in the east of France. However, the only regions which are specialised in dairying are the Basse-Normandie and the Franche-Comté. We note also that those regions tend to diversify their production by developing other livestock productions, especially beef and pig production.

We also apply this analysis at the *département*[3] level to see the heterogeneity within the regional level (Figures 16.A2. and 16.A3). Results show that there are more specialised *départements* than regions. This can be explained by the fact that regions where *départements* have opposite tendencies or different specializations will tend on average to be diversified. This is the case of the Brittany region which tends to diversify its production while some of their *départements* tend to be specialised and the other to be diversified. This is also the case of the *départements* of the Basse-Normandie region, which are specialised in different production activities which mean that the region (on average) tends to be diversified.

Sectoral concentration

The Gini coefficient has been used to identify the degree of regional concentration of a certain activity[4]. The Gini coefficient G of the agricultural activity is defined as:

$$G = \frac{2}{M^2 \bar{z}} \left[\sum_i \lambda_i \left(z_i - \bar{z} \right) \right] \qquad (2)$$

$z_i = x_i / y_i$, where x_i denotes the share of the *département*'s production of the sector *i* in the French production of the sector *i*, y_i the share of the agricultural production of the *département* in the French agricultural production, λ_i is the rank of the *département* according to the increasing intensity of z_i, $\bar{z}$ is the mean of z_i and *M* denotes the number of spatial units being studied (90 *départements*).

The Gini coefficient equals 0 when the activity is evenly distributed over the *départements*, and equals 1 if the activity is fully concentrated in just one *département*. A change in its value over time shows the extent to which the activity has become regionally more concentrated or less concentrated.

The Gini coefficient only yields information about the degree of regional concentration. If two regions switch positions, the Gini coefficient value remains unchanged.

Table 16.2. Sectoral concentration coefficients (Gini Index)

Sectors	Gini 1990	Gini 2006	Evolution*	CAP
Cereals	0.42	0.40	0.02	Supported
Beef cattle	0.50	0.51	0.05	Supported
Dairy	0.57	0.58	0.05	Supported
Horticulture/ market gardening	0.55	0.57	0.22	Not supported
Poultry	0.70	0.71	0.00	Not supported
Fruit	0.72	0.75	0.14	Not supported
Pig	0.73	0.75	0.18	Not supported
Quality wine	0.86	0.86	-0.05	Not supported
Other wine	0.90	0.92	0.10	Not supported
Other	0.45	0.51	0.33	
Agriculture (all sectors)	0.35	0.36	0.11	

* The evolution is calculated in the same way as in the preceding section.

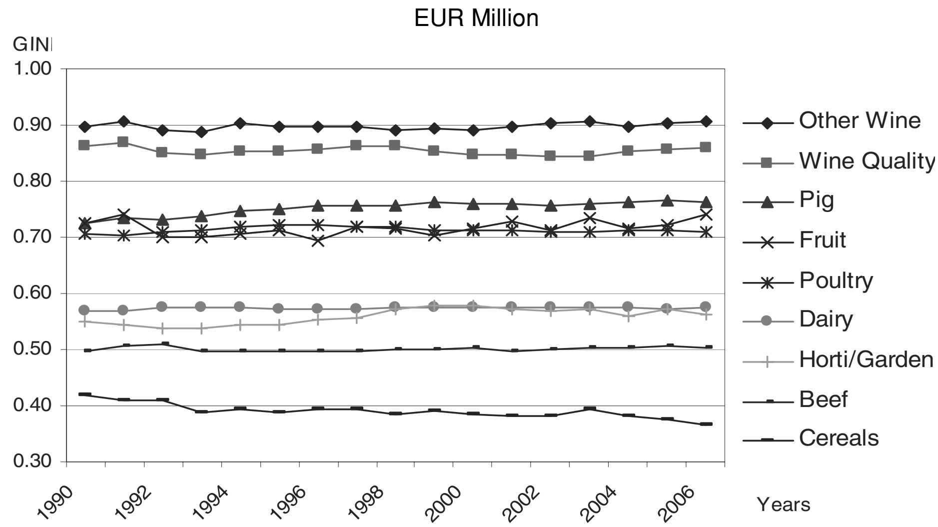
Source: Authors' calculations from the budgetary accounts of agriculture1990-2006 AGRESTE, France.

Table 16.2 shows that agricultural products which are supported by the CAP are the less geographically concentrated. Indeed, policy instruments (support price and direct payments) lead to limit the concentration of the production towards the locations of demand (Daniel, 2003). They incite most regions to produce even if they are not close to the market or do not have comparative advantages.

The top ten *départements* produce respectively, 25%, 34% and 42% of the cereals, beef and dairy production. For dairy production, the quota regime has limited the concentration of the production into a few regions. For beef cattle production, direct payments have also limited concentration, because of the historical references used (Daniel *et al*. 2008).

The most concentrated production is of wine (Figure 16.1). The Gini coefficient value is 0.86 for wine with geographic indication (quality wine) and 0.92 for other wine in 2006. This concentration has remained more or less unchanged for quality wine because of the relationship of quality to geographical origin. For cereals production and beef cattle production, the distribution is more homogeneous across the country.

Figure 16.1. Evolution of Gini Indices applied to different agricultural production sectors for the period 1990-2006



Source: Authors' calculations from the budgetary accounts of agriculture1990-2006 AGRESTE, France.

The Gini coefficient provides information on the development of the regional production structure, but it does not take geographical proximity into account. However, we are looking for the existence of agglomeration externalities within the agricultural production. To do so, other methods need to be used to analyse the spatial structure of the agricultural activities in a quantitative way.

Spatial autocorrelation

To detect spatial structure, we may calculate Moran's I tests for spatial autocorrelation. Data $\{z_i\}$ are said to be spatially autocorrelated if neighbouring values are more alike than those further apart.

Moran's I statistic is defined as[5]:

$$I_t = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(z_{it}-\bar{z}_t)(z_{jt}-\bar{z}_t)}{(\sum_{i=1}^{n}(z_{it}-\bar{z}_t)^2)\times\sum_{i,j}^{n} w_{ij}}, t=1,......,T \qquad (3)$$

where w_{ij} is the (i,j)[th] element of the matrix W, describing the spatial contiguity of *départements* under study. There are different ways to define the spatial weight matrix: a binary contiguity matrix, a distance-based spatial weight matrix with or without a critical cut-off, and many others (Anselin, 1988; Fingleton, 2003). The one we use to calculate Moran'I statistics is the first-order spatial contiguity matrix, where w_{ij} is equal to one if locations share at least a common border and zero otherwise.

Moran's *I* has a sampling distribution which is approximately normal. The expected value of Moran's *I* is $E(I) = -\frac{1}{n-1}$, and the interpretation is similar to that of the product

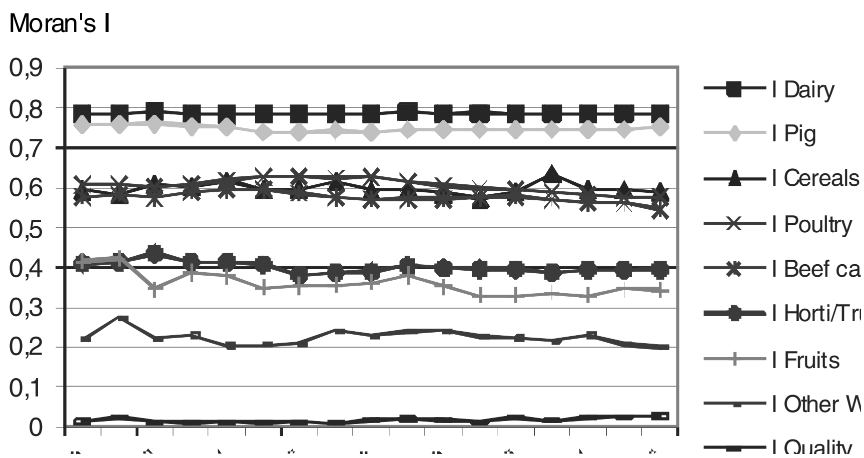
moment correlation coefficient. Informally, +1 indicates strong positive spatial autocorrelation (*i.e.* clustering of similar values), 0 indicates random spatial ordering, and -1 indicates strong negative spatial autocorrelation (*i.e.* a checkerboard pattern). Given *I*, E(*I*) and Var(*I*), we can easily test the null hypothesis (H_0) of no spatial autocorrelation against the two-tailed alternative (H_1) that the data are spatially autocorrelated. Note that the use of standardized variables makes the Moran's I statistics comparable across time.

Figure 16.1 displays Moran's I statistic for different agricultural production sectors (EUR Billion) for the period 1990-2006 for the 90 French *départements* of our sample. Inference is based on the permutation approach with 9999 permutations (Anselin 1995). It appears that all Moran's I statistics differ in a statistically significant way from zero, and that all agricultural production sectors are positively spatially autocorrelated. This result suggests that the distributions of agricultural production sectors are by nature clustered over the whole period.

Comparing the results for 1990 and 2006, Moran's I statistics are almost unchanged over the period, especially for dairy sector.

Figure 16.2. Evolution of Moran'*s I* applied to different agricultural production sectors for the period 1990-2006

EUR Million



Source: Authors' calculations from the budgetary accounts of agriculture 1990-2006 AGRESTE, France.

Moran's I statistic is a global statistic and does not allow us to assess the regional structure of spatial autocorrelation. In order to gain more insight into how regions with high or low agricultural production are located in France, we now analyze local spatial autocorrelation using Local Indicators of Spatial Association (LISA) (Anselin 1995). Local spatial autocorrelation statistics provide a measure, for each unit in the region, of the unit's tendency to have an attribute value that is correlated with values in nearby areas.

The LISA for each region i and year t is written as:

$$I_{it} = \frac{n}{\sum_{i,j}^{n} w_{ij} \times \sum \left(z_{it} - \bar{z}_t\right)^2} \left(\left(z_{it} - \bar{z}_t\right) \sum_{j=1}^{n} w_{ij} \left(z_{jt} - \bar{z}_t\right) \right) \quad (4)$$

where z_{it} is the observation in region i and year t, and $\bar{z}_t$ is the mean of the observations across regions in year t.

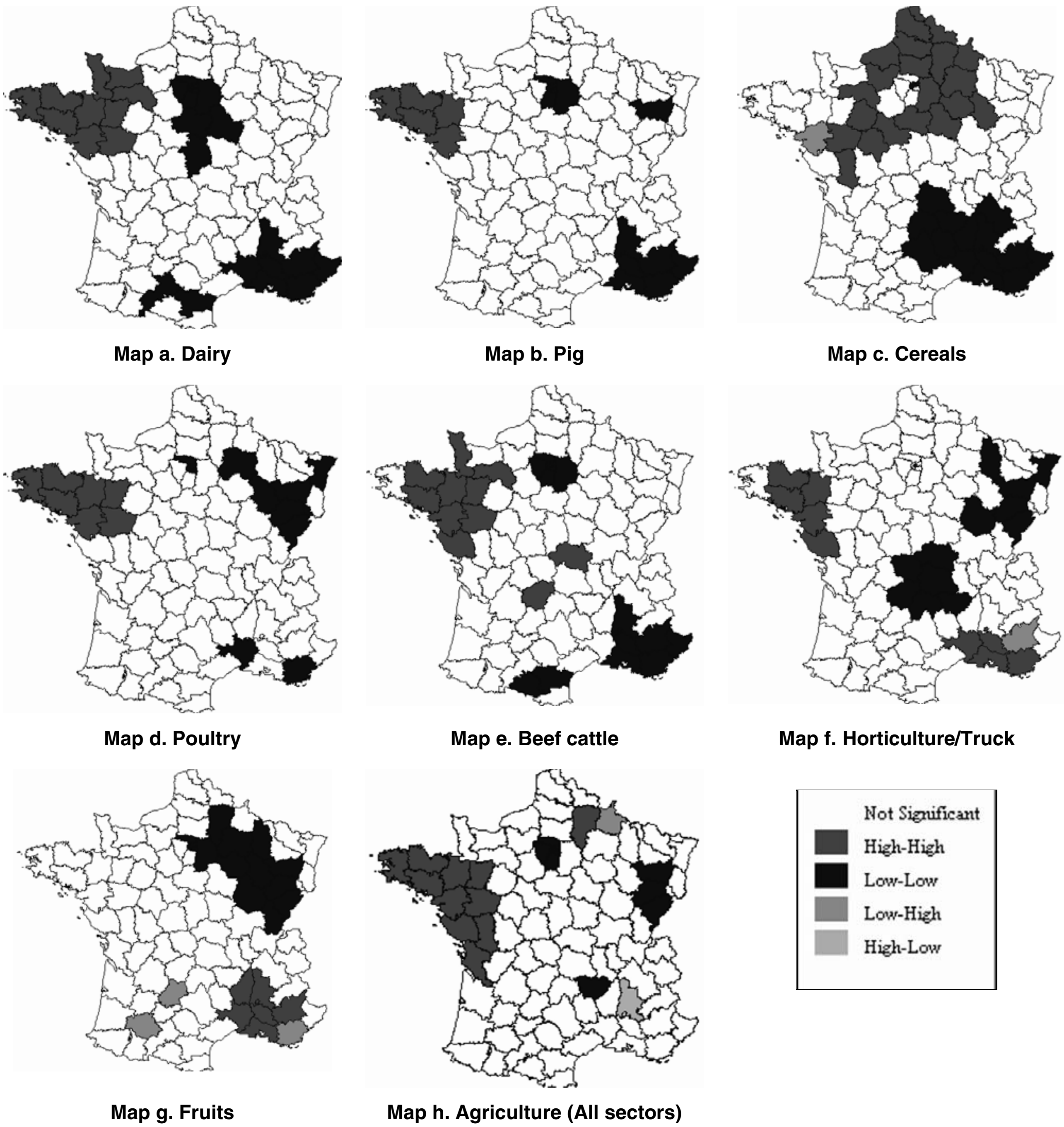
The high-high and low-low locations (positive local spatial autocorrelation) are typically referred to as spatial clusters, while the high-low and low-high locations (negative local spatial autocorrelation) are termed spatial outliers. While outliers are single locations by definition, this is not the case for clusters, and the cluster itself likely extends to its neighbours as well.

Figure 16.3 shows cluster maps for the production value of the different agricultural sectors studied[6]. Dairy production is clustered in North-Western France (Grand-Ouest). We note that other animal production activities (pig, beef, and poultry) are also clustered in the Grand-Ouest, suggesting the existence of agglomeration externalities in this region benefiting all animal productions. To these animal products is added the horticulture and market gardening sectors which are a new cluster in the region; this did not exist twenty years ago. Indeed, horticulture and market gardening are historically clustered in the south-east of France. The Bouches-du-Rhône *département* remains the first *département* producing horticultural and vegetable product worth EUR 345 million, being the driving force of the south-east region.

Spatial dynamics are more regional than sectoral; the region of Grand-Ouest benefits from positive dynamics in many agricultural sectors. This assumption is confirmed by the last cluster map (Figure 16.3, Map h) concerning the agricultural production (all sectors); indeed, we see the Grand-Ouest as a driving force in the agricultural production. However, in Map h we can also see two outliers (atypical regions). First, the Drôme *département* shows a high value of agricultural production (about EUR 700 million) compared to its neighbours which show rather low values. Indeed, the Drôme is specialised in a quality agricultural production; it is the leading *département* in organic farming (especially for fruits). Second, the Ardennes shows a negative autocorrelation (low-high spatial association).It accounts for production of about EUR 437 million, whereas it is contiguous to *départements* that show a high level of agricultural production (i.e. *département* of Marne and Aisne), in particular thanks to the production of champagne.

To go further with these observations, we focus on the dairy sector — which shows the highest level of spatial autocorrelation — to determine which factors could influence the location of dairy farms and to verify the existence of agglomeration externalities. We then develop a spatially explicit, *département*-level model of dairy inventories (number of farms).

Figure 16.3. Cluster maps (LISA) for production value of agricultural sectors in 2006 (significant at 5%)



Source: Authors' calculations from AGRESTE: Provisional budgetary accounts of agriculture in 2006.

Spatial regression models

Over recent decades, the French dairy sector has gone through tremendous structural change. Since the introduction of the milk quotas, the number of dairy farms has shown a strong decline, while the average size of a dairy farm has increased substantially. One of the major justifications for the introduction of milk quotas in 1984 was to preserve the small family dairy farm throughout the European Community. Such farms needed high support prices to maintain their incomes; the only way to prevent the larger farms from increasing their output to take advantage of these prices and thus to expand was to impose quantitative restrictions. However, this policy has done little to preserve the family farm structure of European dairying. Dairy farms have continued to grow larger, small farms have continued to go out of business, and the large operators have grown to dominate with an even larger share of total output. In addition, quota restrictions sought to freeze the geographic distribution of dairy production by *département* as it was in 1983. As a consequence, dairy production has been sustained in mountainous zones and less competitive areas. However, at the same time, a concentration of production has occurred in some productive regions, yet to a lesser degree than in non-EU countries that do not have dairy quotas.

Following Cliff and Ord (1981), the spatial econometric literature has developed a large number of methods that can address spatial heterogeneity and dependence by specifying a spatially lagged dependent variable (spatial autoregressive model), or by modelling the error structure (autoregressive disturbance model). In the absence of spatial autocorrelation, different methods such as instrumental variables or maximum likelihood can be used to estimate models with endogenous variables. However, the presence of endogeneity in a spatial context has generally been ignored. "As a consequence, researchers have often been in the undesirable position of having to choose between modelling spatial interactions ignoring feedback simultaneity, or accounting for endogeneity but losing the advantages of a spatial econometric approach" (Rey and Boarnet, 2004).

We use the Kelejian and Prucha (2007) method, which enables us to analyze both endogeneity and simultaneous spatial interactions. This method makes it possible to develop a non-parametric heteroskedasticity and autocorrelation consistent (HAC) estimator of the parameter variance-covariance (VC) matrix, namely SHAC within a spatial context.

Consider the following model where we distinguish between exogenous (X) and endogenous (Y) variables as well as spatial autocorrelation (Wy):

$$y = \rho Wy + Xb + Y\gamma + u \qquad (5)$$

where $\boldsymbol{y}$ is the $(n \times 1)$ vector of observations on the dependent variables; X is a $(n \times k)$ matrix of observations on k exogenous variables with b as the corresponding $(k \times 1)$ vector of parameters; Y is $(n \times r)$ matrix of endogenous variables with γ as the corresponding $(r \times 1)$ vector of parameters; and u is $(n \times 1)$ the vector of error terms; ρ is the scalar spatial autoregressive parameter and W is a $(n \times n)$ spatial weight matrix of known constants with a zero diagonal. An element w_{ij}^{*} of the matrix describes the link between an observation in location i and an observation in location j, and so the W matrix represents the strength of spatial interaction between locations. We first use the first-order spatial contiguity matrix. However, contiguity matrices appear restrictive in terms of their

spatial connection definition (Cliff and Ord, 1981). Therefore, we also use a geographical distance function, as most empirical studies have done (Fingleton, 1999, 2000; Le Gallo, 2002; Le Gallo et al. 2003; Rey and Boarnet, 2004), defined as:

$$\begin{aligned} & w_{ij}^* = 0 \; if \; i = j \\ & w_{ij}^* = 1/d_{ij}^2 \; if \; d_{ij} \le D \quad and \quad w_{ij} = w_{ij}^* \Big/ \sum_j w_{ij}^* \\ & w_{ij}^* = 0 \; if \; d_{ij} > D \end{aligned} \tag{6}$$

where d_{ij} is the great-circle distance between the centroids of locations *i* and *j*, and *D*[7] is the critical cut-off. In our application, *D* is equal to 115 km since this is the minimum distance that guarantees connections between all *départements*. Each matrix is row-standardized so that it is relative and not absolute distance that matters. The main advantage of using the geographical distance-based weights is that they can be considered as exogenous to the model and as a good proxy of transport cost (Arbia *et al*. 2009). However, these matrices assume equal importance to all *départements* located at the same geographical distance without taking into account the economic potential of the *départements* or their accessibility (Keilbach, 2000; Dall'Erba, 2004; Virol, 2006). To better represent real spatial interactions, we also use time-road distance where the cut-off *D* is 90 minutes. This weight matrix takes into account accessibility in terms of the time needed to go from one location to another, and also the road infrastructure between locations. However, because infrastructure may change (e.g. new highways) the time weight matrix can also change over time. However, because of lack of data, the same weight matrix – that of the year 2007[8] – is considered for the model for the year 2005 and that for the year 1995.

The asymptotic distribution of the instrumental variable estimators of the parameters in (5) depends critically on the quantity: $\Psi = n^{-1} H' \Sigma H$, where $\Sigma = E(\sigma_{ij})$ denotes the variance-covariance matrix of $\boldsymbol{u}$ and $\boldsymbol{H}$ is the full matrix of instruments. Following the Kelejian and Prucha (2007) SHAC estimator, the $(r, s)^{th}$ estimated element of $\boldsymbol{\Psi}$ is:

$$\hat{\Psi}_{rs} = n^{-1} \sum_{i=1}^{n} \sum_{j=1}^{n} h_{ir} h_{js} \hat{u}_i \hat{u}_j K(x) \tag{7}$$

where $K(x)$ is the Kernel density function. In this study, we use the Parzen-Kernel density function as given by Andrews (1991):

$$K(x) = \begin{cases} 1 - 6x^2 + 6|x|^3 & for \; 0 \le |x| \le 0.5 \\ 2(1 - |x|)^3 & for \; 0.5 \le |x| \le 1 \\ 0 & otherwise \end{cases}$$

in which x= $\boldsymbol{d_{ij}} / \boldsymbol{d_{max}}$; $\boldsymbol{d_{ij}}$ is the distance between location ***i*** and location ***j;*** and $\boldsymbol{d_{max}}$ is the bandwidth.

Variable description

The geographical units used in our analysis are *départements* (Figure 16.A1). We consider all French continental *départements* [9] except Paris and *La Petite Couronne* region. This region, which comprises three *départements*, surrounds Paris, making agricultural activities virtually nonexistent; consequently agriculture data is not available for this area. Descriptive statistics and data source of variables are summarized in Table 16.A1 in Annex.

The dependent variable considered in this application is the number of dairy farms in the *département* (y). To capture location economics within the dairy sector, we include the spatial lag of the dependent variable (Wy) (Roe *et al*. (2002) and Larue *et al*. (2009)). According to Krugman (1991), local increasing returns could arise from the presence of industry-specific infrastructure and services, which improve the diffusion of information and knowledge among farmers. We expect the spatial lag to be positively related to the dairy farms inventories, so that the performance of a single dairy farm improves when other dairy farms are located nearby.

Agglomeration economies can also arise from general economic activities facilitating access to input and output services. Hence, we consider the number of feed processing plants (variable Feed Plants) as a measure of the availability of protein-rich feed. We hypothesize that the proximity to cattle feed firms influences a dairy farmer's location decision, since the *départements* with a large number of competing firms will probably offer lower prices. On the other hand, animal feed firms may find it advantageous to locate in close proximity to dairy farmers to reduce average transport costs. Thus, the location of cattle feed plants is endogenous. We also measure the accessibility to output markets by including the number of dairy processing plants (Milk Plants) which is also considered as an endogenous variable.

Urbanization economies refer to the advantages gained from using a common labour pool, public services and infrastructure, and from having access to market areas for inputs and outputs (Elbert and McMillen, 1999). These positive externalities may lead to urban growth; however, urbanization also implies competition for land and consequently a decrease in the availability of land for agricultural uses. Therefore, urbanization can affect agriculture in both positive and negative ways. We use the *département*'s population as a measure of market size; the *département*'s unemployment rate as a measure of the availability of local labour; and land converted into artificial (built-up) uses in each *département* as a measure of the competition for land.

The Common Agricultural Policy (CAP) encourages a better spatial distribution of agricultural production by preventing the desertification of disadvantaged areas, such as mountain and isolated regions, and the concentration of production activities in more competitive areas, which is often associated with environmental pollution (Ben Arfa *et al*. 2009). To study the influence of agriculture policy support on dairy farms location, we include COP (cereal, oilseed and protein crops) direct payments (ADCOP) and Pillar 2 measures[10] (ADENV) as well as young farmer payments (YFP). Those variables concern all farms and not necessarily dairy farms.

To measure the influence of the inputs market, we include the price of rural land (Price Land). We also measure the role of the output market by including the price of milk in each *département* (Price Milk).

Dairy production activities and other agricultural activities occur in the same areas and can complement each other by sharing common natural and human resources. However, they can also compete with one another for land and other limited inputs. In order to determine the sign and significance of the relation between dairy and other types of farming activities, we consider the number of pig and poultry farms and the number of cattle farms in the *département* as well as in the neighbouring *department* [(w+1)Pig and (w+1)cattle respectively].

Concern for the environment is growing rapidly; as a consequence, environmental regulations are also increasingly aimed at reducing the negative impact of livestock production. The variable used in the model is the surface area, per *département*, defined as "vulnerable". These vulnerable zones are areas where the water nitrate content is almost or exceeds 50 mg/m^3. *A priori*, we can expect that these measures will reduce the concentration of livestock production, especially in areas considered environmentally vulnerable. Therefore, we hypothesize a negative effect on dairy farm production and density. At the same time, an area has a higher likelihood of being classified as vulnerable when it is characterized by a high concentration of livestock operations and therefore large quantities of manure. Thus, this variable is endogenous.

Environmental conditions and topography condition the natural habitat of plants and animals, and therefore agriculture. To measure the influence of climate conditions on dairy farm location, we consider the monthly variation (standard deviation) of rainfall and temperature. To account for topographic conditions, we introduce a binary variable that takes the value 1 when the *département* altitude is between 200 and 500 meters, and the value 0 otherwise (Relief).

Finally, we include the latitude and longitude location of every *département* as exogenous instruments to account for the spatial configuration of *départements* and as overall instruments for the entire group of endogenous regressors.

We estimate six models to emphasize the importance of spatial agglomeration economies in determining the spatial patterns of dairy production and differences between 1995 and 2005.

Table 16.3 provides 1995 and 2005 SHAC estimates using three different weight matrices. Overall, empirical results seem to be robust to the choice of the weight matrix. However, based on the results of the modified Sargan test, which accounts for the heteroskedasticity of error term (Fingleton and Le Gallo, 2008), we recommend the use of the time-road weight matrix (SHAC 1/min^2), since in this case the instruments are independent of the residuals (p-value=0.12). Table 16.4 reports the SHAC elasticity[11] calculated at the mean point. We make a distinction between local elasticity and spatial lag elasticity, the former corresponding to an impact elasticity in time series while the latter is similar to a long-run elasticity, taking into account the spatial multiplier (defined as $\frac{1}{1-\rho}$).

Table 16.3. Estimated SHAC Models for dairy farms in 2005 and in 1995

Variables	SHAC Model for 2005			SHAC Model for 1995		
	Cont	1/dist^2	1/min^2	Cont	1/dist^2	1/min^2
Intercept	-1131.60	-979.44	-1509.11	3549.99	3710.88	880.45
Rho	0.65***	0.57***	0.63***	0.68***	0.57***	0.68***
Milk Plants	43.02***	42.17***	36.3***	96.56***	88.38**	48.2
Feed Plants	24.17**	18.4**	22.18*	10.68	6.9	13.3
Price Milk	91.45**	106.96***	122.82***	-76.38	-45.14	46.31
Price Land	7.47***	8.13**	8.62***	8.65*	10.44*	10.58**
Population	0.33	0.23	0.34	-0.27	-0.4	0.25
Unemployment	22.6	14.08	1.12	12.6	-8.03	-25.19
Arti-area	-5.84*	-6.73*	-6.7	-3.54	-3.21	-4.17
(W+1)Pig	-0.13	-0.05	-0.15	-0.34	-0.38	-0.77**
(W+1)Cattle	-0.11**	-0.13**	-0.15**	-0.01	-0.02	-0.0004
Sdev-rain	-9.96***	-22.92***	-22.08***	-7.48	-10.67	-4.68
Sdev-temp	-237.15**	-288.15***	-278.13**	-310.69	-417.71**	-444.95*
Relief	70.71	34.86	68.42	-52.65	-105.35	95.00
YFP	15.11***	17.24***	21.18***	12.53***	15.32***	19.47***
ADCOP	-0.63	-0.13	0.79	-1.84	-4.16	-8.21*
ADENV	-10.64	-13.83*	-17.36*	-35.36	-43.44	-39.65
Vulnerable-Z	-11.82**	-13.38***	-19.47***	-11.59	-8.73	-2.4
R^2	0.93	0.92	0.9	0.92	0.91	0.89
Df	73	73	73	73	73	73
Sargan p-value	0.0324	0.026	0.12	0.04	0.055	0.06

***,**,*: statistically significant at 1. 5, 10% levels respectively.

Table 16.4. Elasticities calculated at the mean point in 2005 and in 1995

Variables	SHAC 1/min^2 2005		SHAC 1/min^2 1995	
	Local elasticity	Spatial lag elasticity	Local elasticity	Spatial lag elasticity
Milk plant	0.26	0.76	0.24	0.75
Feed plants	0.1	0.29	0.04	0.12
Price milk	2.41	6.95	0.85	2.62
Price land	0.29	0.83	0.20	0.62
Population	0.09	0.26	0.04	0.14
Unemployment	0.19	0.56	-0.17	-0.51
Arti-area	-0.26	-0.76	-0.11	-0.34
(W+1)Pig	-0.04	-0.1	-0.23	-0.71
(W+1)Cattle	-0.12	-0.36	0.0004	0.0014
Sdev-rain	-0.73	-2.1	-0.11	-0.35
Sdev-temp	-1.23	-3.56	-1.54	-4.74
Relief	0.03	0.07	-0.02	-0.07
YFP	0.84	2.41	1.05	3.23
ADCOP	0.03	0.09	-0.24	-0.75
ADENV	-0.12	-0.34	-0.14	-0.43
Vulnerable-Z	-0.29	-0.83	-0.03	-0.10

The Wald test yields a p-value of 0.0976 and suggests that the coefficients are statistically different between the two time periods. It provides some evidence that a structural change occurred between 1995 and 2005.

Agglomeration variables are significant and positively related to dairy farmer locations for both 2005 and 1995. The magnitude of rho (ρ= 0.63 and 0.68 for 2005 and 1995 respectively) suggests a strong spatial dependence, which means that neighbouring *départements* are likely to have a similar number of dairy farms. As a result, the presence of a developed dairy sector in the neighbouring *départements* will promote dairy activities within the *départements*. It is interesting to note that the impact of ρ increases when endogeneity is controlled.[12] The decrease in the ρ value from 1995 to 2005 suggests that the location of dairy farms in 1995 may be mainly explained by spatial externalities specific to the dairy production sector, whereas in 2005 other factors may explain location of dairy farms.

With respect to the industrial sector, the number of dairy processing plants is positive and significant at the 1% level for 2005. However, for 1995 their level of significance depends on the definition of the weight matrix (it is not significant for the time matrix because, as mentioned above, the time weight matrix may be different between 2005 and 1995 because of highway infrastructure improvements). This result confirms the mutual and strong relationship between dairy farms and the dairy processing industry, and their need to be near each other. Accessibility to feed processing plants is only positive for 2005; however, it is less significant than for the dairy processing industry. In fact, transport costs of animal feed are lower (typically one delivery per month and no need for refrigeration systems) than those of milk, which explains the weaker linkage between animal feed industry and dairy farmers. The decrease in the number of processing firms over the ten years and their heterogeneous distribution over space tends to increase transport costs, and, as a result, market accessibility has become more important in 2005 than it was in 1995.

While the milk price is not a determinant of dairy location in 1995, it is highly significant and positive in 2005. In 1995, the milk support price was more important, and farmers did not have to worry about prices because these were guaranteed. Since the 2003 CAP reform, milk support prices have been coming down, and milk sales have become more important; they represent 68% of the total income[13] of specialised dairy farms and 53% of the total income of diversified farms (Livestock Office). Milk price has thus become more crucial in the economic viability of farms. Hence, *a priori*, it is not surprising to find in 2005 a higher number of dairy farms in regions with a higher milk price. However, we must be cautious when interpreting this variable since milk price elasticity seems relatively high (Table 16.4, local elasticity=3.24). In fact, this result may be related to the nature of the variable: milk prices[14] are relatively similar across *départements* (prices only varied from EUR 0.275 to 0.325/litre for 2005), and so small changes in prices may artificially inflate the coefficients.[15] As a consequence, discretion must be exercised when assessing the true impact of this variable. The land price variable is positive for both time periods, suggesting that in general dairy farms are more likely to be located in areas with high agronomic potential, providing favourable conditions for forage and cereal production. Moreover, a characteristic of the French dairy policy is that milk quotas are linked to the land. As a result, a producer who wishes to increase milk production must necessarily acquire or rent additional hectares. Therefore, the quota system may promote competition between dairy farmers for land, causing prices to rise.

Urbanization variables such as population and unemployment rates seem to have little impact on dairy production. The *département*'s population is used here as a proxy for local demand. However, the market relationship between dairy producers and consumers is not so direct. Dairy products can be distributed in regions other than that where they are produced. With regard to the unemployment rate, French dairy farms, contrary to farms in other EU countries[16], are mainly family structures; they have an average quota of 267 500 kg milk/year; and non-family workers represent only 6% of the total workforce. Because dairy farms in France are generally tended by the farmers and their family members, labourers from outside are seldom needed; the variable is therefore not significant. Finally, the rate of land conversion per year is significant and negative at 10% level only for 2005, suggesting increasing competition for land between agriculture and urbanization. However, this does not seem to be the only source of competition; indeed the presence of other agricultural activities is important factor in the location of dairy farms. However, there is a change between the two time periods examined; pig farming is significant and negative in 1995, suggesting competition between dairy and pig sectors in this period, while in 2005 it is cattle farming which becomes more important and negatively related to dairy sector because of the switch-over facility between those sectors.

Environmental variables are significant predictors of *département* dairy production. As expected, stable temperatures have a favourable effect on dairy activity. However, it is interesting to note that rainfall variability is significant for 2005 and not for 1995; this suggests that there is a change in rainfall variability which has occurred between the two time periods. Besides, the elasticities of these two variables are among the highest, especially for 2005 (-0.81 for rainfall and -1.45 for temperature). Contrary to our expectations, relief is not significant. Examining more closely the relationship between the distribution of dairy farms and geography, we observe two areas: a zone of plains and a mountain zone. Our relief variable only takes into account the dairy farms situated on the plains; however, the mountain zone is not negligible since it represents 14% of milk production and 20 % of dairy farms. In further research, the use of other topographic variables may be considered (i.e. the *département*'s average slope or the mountainous surface area per *département*).

With regard to agricultural policy subsidies, we note the positive impact of young farmer premiums for both 1995 and 2005 although the elasticities of this variable are higher in 1995 than in 2005. In general, this aid benefits more than 65% of young farmers and represents between EUR 8000 and 22400 per farm (Livestock Office, 2007). The importance of this variable may be related to the high investment and entry costs in dairy farming and the necessity of this aid for young farmers to enter the sector. It may also testify to a general dynamic atmosphere of areas and an optimistic attitude since the renewal of agriculture is a sign of confidence in the future. *A priori*, CAP direct subsidies may be another important factor in maintaining agricultural production and more precisely in promoting the dairy sector since they represent about 74% of dairy farmers' incomes[17] (Livestock Office, 2007). However, COP subsidies are significant only for 1995. In fact, the COP direct subsidies have decreased and substituted by Pillar 2 subsidies, which is why the latter are significant in 2005 but not in 1995. COP subsidies are negatively related to the location of dairy farms in 1995; this could be explained by the fact that the cereal farms receive the largest share (over 50%), of the COP subsidies: while dairy farms only get 25% of the COP subsidies. In the same way, the Pillar 2 subsidies are aimed at promoting an extensive and multifunctional agricultural model and at maintaining agriculture and rural development in disadvantaged areas. The negative

sign of this variable in 2005 indicates that dairy farms are not generally located in these areas, also suggesting the existence of other animal production activities (i.e. beef cattle) that are more extensive than dairy production activities.

Environmental regulation is significant only for 2005. This is not surprising because of the growing concerns about environmental quality degradation. The restrictions on animal density as well as limitations on the level of organic nitrogen (livestock manure) have a negative impact: the larger the surface of the *départements* under environmental restrictions, the fewer the dairy farms, *ceteris paribus*. The constraints of the national Code of Good Agricultural Practices are stronger in vulnerable zones. Every farmer must establish an annual provisional fertilizing scheme. The maximum nitrogen supply coming from livestock manure is limited to 170 kg per hectare per year. Farmers must plant cover crops in winter and plant grass buffer strips along water courses. This necessitates investments to modernize buildings and equipment and which were not always anticipated. Thus, dairy farms are not all well prepared for the new challenges. This is especially true for small dairy farms: not only has their number drastically decreased over the last decade, but many of them will probably disappear in the medium term, in particular because of the environmental regulations forcing farmers to upgrade their livestock production facilities to the standards required (Chatellier *et al*. 2008). Indeed, the environmental compliance cost would be about EUR 850 per livestock unit, which would represent an annual expenditure of EUR 15 to 20 per 1 000 litres of milk (Le Gall *et al*. 2004). However, to determine the real effect of these environmental measures, further research is needed to study their impact on other animal breeding activities such as pig and poultry production. Analysis at the scale of a *canton* or *commune*[18] will reveal the impact of these measures more accurately.

Conclusions

This chapter contributes to the literature by providing insight into the regional and spatial structure of agricultural production in France. It interesting to note that regional specialization tends to be reinforced and in some cases it took place automatically because of the maintenance of production in some regions better than in others. We note that agricultural production activities which are supported by the CAP are better distributed across the country, but at the same time are spatially autocorrelated, and thus clustered in neighbouring regions. Therefore, we enquire into the factors underlying spatial concentration and into the existence of agglomeration economies in agricultural productions.

By applying a non-parametric heteroskedasticity and autocorrelation consistent spatial econometric model — which enables us to handle simultaneous equations and spatial endogeneity — to the case of dairy production (inventories), the presence of spatial agglomeration economies was confirmed in the dairy sectors in both 1995 and 2005. This indicates that dairy farms benefit from sharing industry-specific infrastructure and services, thus improving the performance of each individual farm when other dairy farms are located nearby. Agglomeration economies also arise from the development of the industrial milk processing sector close to agricultural areas, which improves access to the input and output markets. In fact, we find that market access variables become increasingly important determinants of the location of dairy farms. These agglomeration forces promote livestock production activities in competitive areas, but this concentration is often associated with environmental problems. In order to address this, the European

Union has implemented environmental regulations that aim at limiting concentration, *ceteris paribus*.

We have found that a structural change took place between 1995 and 2005. Indeed the impacts of the various factors of location changed during that period. This can be attributed, to some extent, to the 2003 reform of the Common Agricultural Policy. This policy change has encouraged farmers to adapt their production to market demands. This is consistent with our results since market prices and market accessibility have become key determinants of dairy production. For example, while milk prices were not significant factors in 1995, they were, in 2005, essential determinants of the location of dairy farms. This finding is all the more interesting nowadays, when the situation of the dairy sector in the EU countries is difficult, with high milk price volatility. Indeed, the EU Commissioner has said (see Montague-Jones, 2010) that new mechanisms are needed to fight extreme price volatility without upsetting the natural evolution of markets.

Notes

1. Nejla Ben Arfa, LARESS, ESA Angers PRES l'UNAM / CNIEL – ABIES/AgroParisTech; Karine Daniel, ESA Angers PRES l'UNAM – INRA SAE2 LERECO UR 1134 Nantes; Carmen Rodriguez, LARESS, ESA Angers PRES l'UNAM; and Scott J. Shonkwiler, Department of Resource Economics, Reno, Nevada 89557-0105. This work was supported by the CNIEL, Crédit Agricole, GROUPAMA, SEPROM and PSDR-GO (CLAP). The views defended here are the authors' and not necessarily those of the organizations mentioned.
2. This coefficient is also called the coefficient of Hallet (2000).
3. One of the large districts into which France is divided for administrative purposes. France has 100 *départements* which are grouped into 22 metropolitan and four overseas regions. All regions have identical legal status as integral parts of France.
4. This analyse is performed at the *département* level.
5. Cliff and Ord (1981) provide a formal derivation of this formula.
6. We do not present the cluster map for wine production (quality and other) because the low value of the Moran's I suggests low spatial autocorrelation.
7. The robustness of the model is also tested by using others cut-off for geographical and time-road distance. However, we do not present all results since they are very similar.
8. The time weight matrix is provided by Odomatrix 2008, INRA UMR 1041 CESAER, Dijon ; from Route 500® IGN
9. The island of Corsica and French Overseas départements and Territories are also excluded because they are separated by sea or oceans, implying spatial discontinuity in data.
10. Pillar 2 measures include agri-environmental payments (PHAE, MAE, CTE, CAD) as well as compensation for natural handicaps (ICHN).
11. The elasticity is calculated in a partial equilibrium context, so we do not take into account the feedback effect of endogenous variables.
12. Compared to the spatial lag model which does not take into account variable endogeneity, results are not presented here but can be provided by authors upon request.
13. Total revenues = agricultural revenues + subsidies. Source: FADN EU, European Commission DG AGRI-G3 / Processed by INRA-SAE 2 Nantes 2007.
14. Source: *Monthly Dairy Survey* 2005
15. A similar result is found by Isik (2004) for the US dairy sector which shows a high milk price elasticity (2.67).
16. The United Kingdom has an average quota of 834 650 kg/year, where non-family worker represent 40% of the total AWU. *Source*: FADN EU and Livestock Office.
17. Dairy farmer incomes include income from milk, beef and veal, vegetable production, subsidies and other sources.
18. In metropolitan France, there are 95 *départements,* 337 *arrondissements*, each encompassing a number of cantons, and finally 36 000 communes.

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Annex 16.A1

Table 16.A1.1. Summary statistics

Variables	Description	Mean	Std.Dev	Min	Max	Source
Dependent Variable						
Y	Number of dairy farms in the *département*	1 095.07	1259.22	1.48	5673.24	SCEES[1]
Independent variables						
Price milk	Price of milk	28.88	1.21	27.43	31.59	Livestock Office [2]
Price land	Price of land	42.42	16.36	16.15	121.75	SAFER
Population	Population	308.75	227.94	37.98	1328.83	INSEE[3]
Unemployment	Unemployment rate	9.42	1.85	5.80	14.60	INSEE[3]
Arti-area	Surface of artificial land (land competition)	49.44	20.82	8.32	119.68	SCEES[4]
(W+1)Pigs	Number of pigs in the *département* as well neighbouring *département*	303.42	704.05	0.00	3781.00	SCEES[1]
(W+1)Cattle	Number of cattle in the *département* as well neighbouring *département*	1 292.15	1 337.84	0.00	5 075.00	SCEES[1]
Sdev-rain	Monthly variation of rainfall (standard deviation)	39.99	9.85	25.46	70.91	Climate Institute
Sdev-temperature	Monthly variation of temperature (standard deviation)	5.70	0.62	3.63	6.68	Climate Institute
Relief	*Département* altitude (dummy variable)	0.39	0.49	0.00	1.00	IFEN[5]
YFA	Young Farmer Allocations	60.54	37.69	0.00	174.00	Livestock Office
ADCOP	COP subsidies	50.93	37.59	0.00	148.19	SCEES[6]
ADENV	Environmental subsidies	12.09	13.15	0.40	75.08	SCEES[6]
Endogenous variables						
Wy	Number of dairy farms in the neighbouring *départements*					
Milk plants	Dairy processing plants	7.01	7.14	0.00	33.00	SESSI[7]
Feed plants	Feed processing plants	4.81	7.60	0.00	57.00	SESSI[7]
Vulnerable-Z	Number of *communes* per *département* classed as environmentally vulnerable zones	26.79	23.87	0.00	82.00	IFEN[5]
Instrumental variables						
Harbours	Commercial harbours	0	1	0	3	SESSI[7]
Roads	Local transport infrastructure	42	15	5	79	
Natura 2000	Share of land classed as Natura 2000	12	10	1	49	IFEN
Soil	*Soil quality:* % limestone % clay % organic carbon	 78 211 17	 90 53 6	 0 97 10	 457 353 47	IFEN

1. Structure Survey 2005.
2. Dairy Survey.
3. Census of Population.
4. TERUTI Survey.
5. French Institute for Environment.
6. Agriculture Public Support (budgetary accounts of agriculture, AGRESTE).
7. Annual Business Survey.

Figure 16.A1.1 Number of dairy farms per *Département* in France

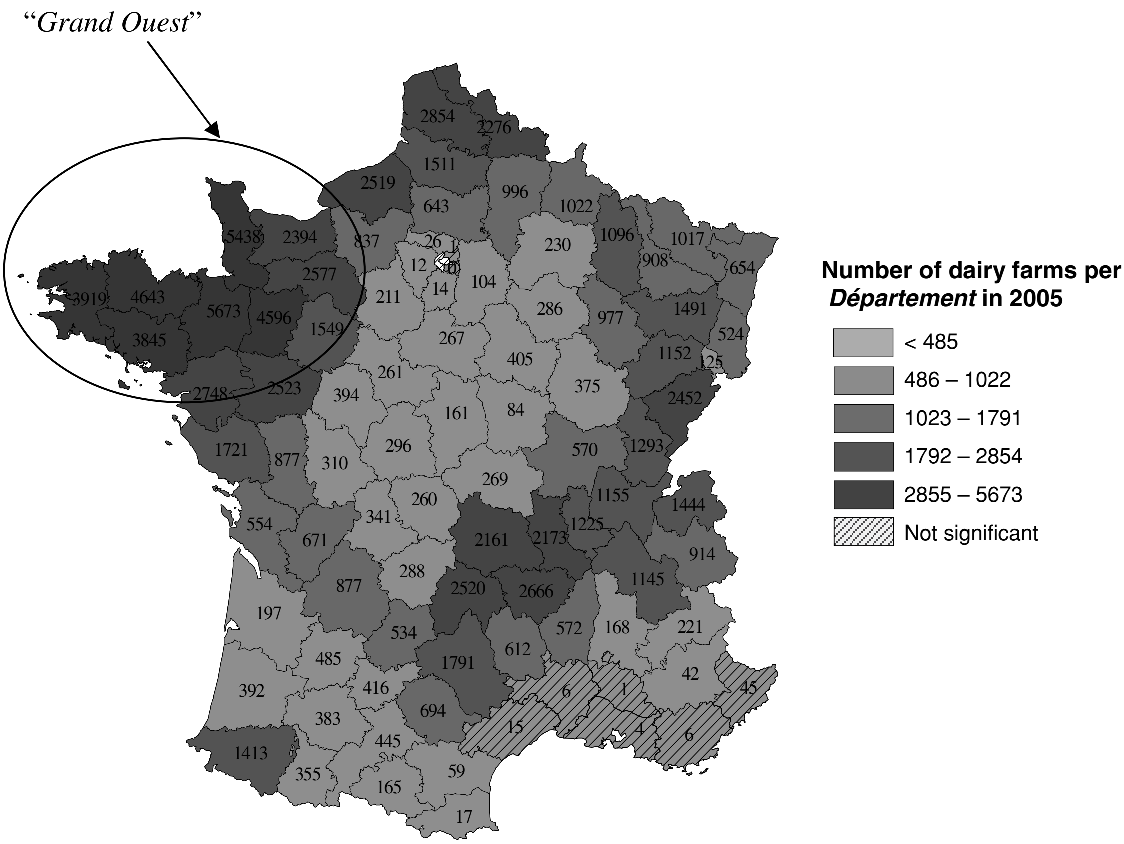


Figure 16.A1.2. Evolution of the specialization index at the regional level
1990-2006

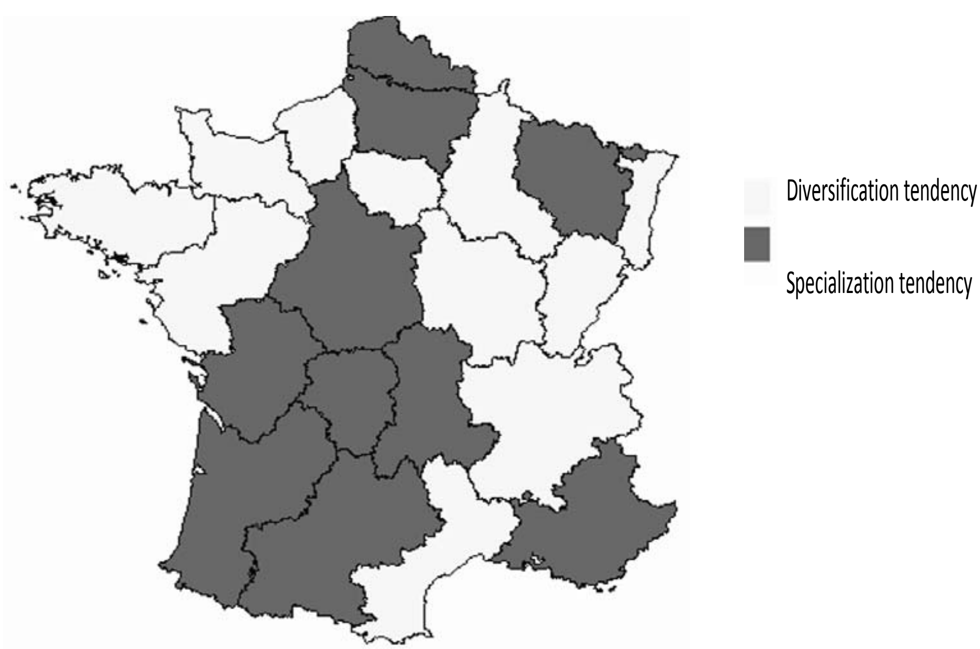
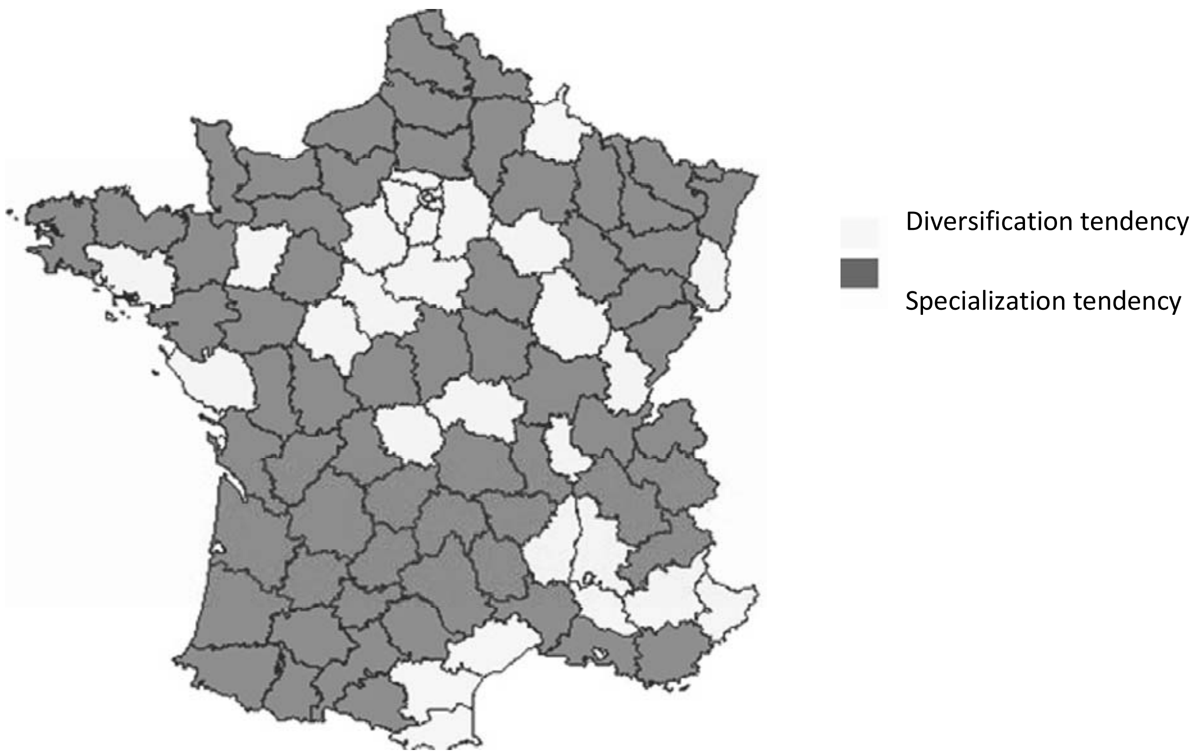


Figure 16.A1.3. Evolution of the specialization index at the *Département* level

1990-2006



Source: Authors' calculations from the budgetary accounts of agriculture 1990-2006.

Annex

OECD Workshop on the Disaggregated Impacts of CAP Reform

10-11 March 2010

AGENDA

Wednesday 10 March 2010	
9:30 to 9:45	**Welcome and introduction by Raed Safadi, Deputy-Director of Trade and Agriculture, OECD** Purpose of the workshop
9:45 to 11:15	**Session 1. Impact of decoupling on agricultural markets and farm performance** Chair: Martin von Lampe, OECD ***Presentations*** • Impact of decoupling and modulation in the European Union: A sectoral and farm level assessment, by Mark Brady, Swedish University of Agricultural Sciences, Sweden (IDEMA project) • Impact of partial decoupling on prices, production and farm revenues, by Alan Renwick, Scottish Agricultural College, Rural Policy Centre, United Kingdom ***Discussants*** • Annette Hürrelmann, EU Commission • Yves Surry, Swedish University of Agricultural Sciences (SLU), Sweden ***General discussion***
11:45 to 13:00	**Session 2. Impact of the Single Payment Scheme on land markets and farm structure** Chair: Jean-Christophe Bureau, AgroParisTech ***Presentations*** • The functioning of land markets in the EU member states, by Jo Swinnen, Catholic University of Leuven, Belgium • Impact of the Health Check on structural change and farm efficiency: a comparative assessment of four European agricultural regions, by Filippo Arfini, University of Parma, Italy ***Discussant*** • Alfons Balmann, IAMO, Germany ***General discussion***

14:30-16:00

Session 3. Impact of dairy reform

Chair: Annette Hürrelmann, EU Commission

Presentations

- Impact of the removal of milk quotas, by Roel Jogeneel, LEI, Netherlands
- From the abolition of milk quotas to contracts between producers and processors: implications for dairy farmers in the West of France, by Baptiste Lelyon, Institut de l'élevage, France

Discussant

- Pavel Vavra, OECD/TAD

General discussion

16:30-18:00

Session 4. Impact of CAP reform on the agro-food industry

Chair: Susanne Langguth, Südzucker

Presentations

- CAP reform and the agro-food industry, by Hans van Meijl, LEI, Netherlands
- Impact of the EU sugar reform on the sector, by Sergey Gudoshnikov, ISO

Discussant

- Jorge de Saja, Director of the Spanish Confederation of animal feed producers (CESFAC)

General discussion

Thursday, 11 March 2010

9:30 to 11:00

Session 5. Impact of CAP reform on the distribution of support and income

Chair: Andrew Woodend, DEFRA

Presentations

- Impact of SPS implementation options on the distribution of support, Werner Kleinhanss, Johann-Heinrich von Thünen-Institut, Germany
- The Health Check of the CAP in France: A significant redistribution of budgetary payments? (*Le bilan de santé de la PAC en France : une profonde redistribution budgétaire?),* by Vincent Chatellier and Hervé Guyomard, INRA France

Discussant

- Pierre Boulanger, GEM, Sciences Po, France

General discussion

11:30 to 13:00 **Session 6. Impact of CAP reform on the environment**

Chair: Wilfrid Legg, OECD

Presentations

- Impacts of Decoupled Agricultural Support on Farm Structure, Biodiversity and Landscape Mosaic, Mark Brady, Swedish University of Agricultural Sciences, Sweden (IDEMA project)
- Phasing out of environmentally harmful subsidies: Consequences of the 2003 CAP reform, by Franz Sinabell, Austrian Institute of Economic Research (WIFO), Austria
- Economic, social and environmental impact of modulation, by Hans van Meijl, LEI, Netherlands

Discussant

- Eirik Romstad, Norwegian University of Life Sciences, Norway

General discussion

14:30-16:00 **Session 7. Impact of CAP reform on rural development**

Chair: Yves Surry, SLU

Presentations

- Impacts of CAP reform on rural employment: a multimodeling cross country approach, by Konstadinos Mattas, Aristotle University of Thessaloniki, Greece
- Spatial structure of agricultural production in France: role of the Common Agricultural Policy, by Nejla Ben Arfa, LARESS — École Supérieure d'agriculture d'Angers

Discussant

- Katarzyna Zawalinska, Polish Academy of Sciences, Institute of Rural and Agricultural Development, Poland

General discussion

16:30-17:00 **Conclusion by Frank Van Tongeren, OECD**

What do we know about the impact of the current CAP? What future work is needed to better evaluate existing policies and alternative options for the future?

Disaggregated Impacts of CAP Reforms

PROCEEDINGS OF AN OECD WORKSHOP

The Common Agricultural Policy (CAP) is an important policy for the European Union and accounts for about 40% of the EU budget. Ever since its inception in 1958, the CAP has been regularly reviewed and adjusted to improve its performance and adapt to changing circumstances. At a time when the post-2013 future of the CAP is being discussed and major challenges such as food security and climate change lay ahead, it is important to review the impact of past reforms and to draw lessons for the design of future policies.

While the studies in these proceedings often take account of national and international market effects of agricultural policies, they tend to focus on the impact of policies on farms and at the regional and local levels. Today, the European Union is composed of very diverse regions that are affected very differently by any given farm policy, depending on the structural characteristics of the farms' and regions' economies.

This report collects papers presented at the OECD Workshop on Disaggregated Impacts of CAP Reforms, held in Paris in March 2010, which focused on recent reforms. In particular, it examined the implementation of the single payment scheme since 2005 and the transfer of funds between different measures. Special attention was also paid to reforms of the sugar and dairy sectors with respect to the quota system and the restructuring of both these industries. The papers also look at the impact of the new direct payment system on land use, production and income.

Please cite this publication as:

OECD (2011), *Disaggregated Impacts of CAP Reforms: Proceedings of an OECD Workshop*, OECD Publishing.
http://dx.doi.org/10.1787/9789264097070-en

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ISBN 978-92-64-09653-0
51 2011 02 1 P