LAND, LABOUR AND CAPITAL MARKETS IN EUROPEAN AGRICULTURE

DIVERSITY UNDER A COMMON POLICY

EDITED BY

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AND
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PREFACE AND ACKNOWLEDGEMENTS

This volume is one of the final outputs of the "Comparative Analysis of Factor Markets for Agriculture across the Member States" (KBBE-2009-1-4-04) project, referred to hereafter as the Factor Markets project. The Factor Markets project is a collaborative project, funded by the European Commission under the 7th Research Framework Programme (FP7). It ran between 31 August 2010 and 31 August 2013 under the supervision and coordination of the Centre for European Policy Studies (CEPS), Brussels. It involved the active participation and commitment of 16 other research teams from all across Europe: the Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO, Germany), the Institut National de la Recherche Agronomique (INRA, France), the Centre of Planning and Economic Research (KEPE, Greece), the Stichting Dienst Landbouwkundig Onderzoek (SDLO, Netherlands)[1], the Agrifood Research Finland, Economic Research (MTT, Finland), the Slovak Agricultural University of Nitra, Department of Economics (SAU, Slovakia), the Department of Economics of the Swedish Agricultural University (SLU), the Rural Economy Research Centre (TEAGASC, Ireland), the Technical University of Munich, Environmental Economics and Agricultural Policy Group (TUM, Germany), the University of Milan, Department of Economics, Management and Quantitative Methods (UMIL, Italy), the Alma Mater Studiorum Università di Bologna, Department of Agricultural Economics and Engineering (UNIBO, Italy), the Università Cattolica del Sacro Cuore, Institute of Agricultural and Food Economics (UCSC, Italy), the University of Kent, Economics Department (UNIKENT, UK) the University of Primorska, Faculty of Management Koper (UPR, Slovenia), the University of Warsaw, Faculty of Economic Sciences (UNIWARSAW, Poland), and the Johann Heinrich von Thünen-Institut (TI, Germany).

[1] SDLO will be referred to as as LEI, Wageningen University and Research Centre (LEI-WUR) in the rest of this volume.

The general objective of the project was to analyse the functioning of factor markets (land, labour and capital markets) for agriculture in the EU-27 and candidate countries (one of which – Croatia – has now entered the recently enlarged EU-28). The Factor Markets project compared these different markets, their institutional framework and their impact on agricultural development and structural change, as well as their impact on rural economies, for the member states, candidate countries and the EU as a whole. The ultimate aim of this in-depth analysis was to contribute to the policy reflection at the EU level and provide solid grounds for the design of new policy instruments under the Common Agricultural Policy (CAP) and also other national regulations.

The project resulted in the publication of 68 working papers which were edited and published throughout its three-year duration, and which can be found on the Factor Markets Website http://www.factormarkets.eu and on the CEPS website, under the Factor Markets Special Publication Series http://www.ceps.eu/category/book-series/factor-markets-working-papers. The key findings of these papers are summarised in the chapters in this volume. At the same time, some papers have also been published (or accepted for publication) in academic journals.

The project was punctuated by a series of meetings: a kick-off meeting (21 October 2010, CEPS), a first workshop (18–19 October 2011, Milan, Italy), a second workshop (24–25 September 2012, Ljubljana, Slovenia), and a final conference (2–4 June 2013, Sevilla, Spain). The final conference was jointly organised by the International Agricultural Trade Research Consortium (IATRC) on the occasion of its 2013 Symposium. We would like to thank Tassos Haniotis of the European Commission – who was Chair of the IATRC 2013 Organising Committee – for the excellent collaboration with the team leaders in the organisation of this joint event.

This project benefitted from the support of many teams and individuals; we would like thank all the research team leaders and their team members for the active role they played in bringing the project up to completion. The team leaders were: Štefan Bojnec (UPR), Alessandro Olper (UMIL), Jan Pokrivcak (SAU), Ewa Rabinowicz (SLU), Alfons Balmann (IAMO), Sophia Davidova (UNIKENT), Jan Fałkowski (UNIWARSAW), Lindsay Shutes (LEI-WUR), Trevor Donnellan (TEAGASC), Laure Latruffe (INRA), Kyösti Pietola (MTT), Martin Banse (TI), Klaus Salhofer (TUM), Paolo Sckokai (UCSC), Davide Viaggi (UNIBO), Eleni Kaditi (KEPE-CEPS).

We would also like to thank in particular Eleni Kaditi for her crucial assistance in getting the project on track and in managing the project during its first 18 months; Pavel Ciaian (JRC, European Commission) and d'Artis Kancs (JRC, European Commission) for their highly valuable contribution towards the design of the project (and analysis afterwards); Anne Harrington, Jackie West, Anil Shamdasani and Els Van den Broeck (the CEPS editorial team) for their (as usual) excellent editorial contributions to the working papers and this volume, and who were essential in the dissemination of the project results; and Sally Scott for her reliability, her continuous assistance and the key role she played in managing the financial and administrative aspects of the project.

Finally, we would like to thank the Factor Markets Scientific officer, Dr. Hans-Jörg Lutzeyer (European Commission), for his scientific and technical assistance throughout the duration of the project, as well as many colleagues from the European Commission for their active interest in this project and collaboration on specific aspects.

Johan Swinnen and Louise Knops

1. FACTOR MARKETS: DIVERSITY UNDER A COMMON POLICY

JOHAN SWINNEN AND LOUISE KNOPS

1. Introduction

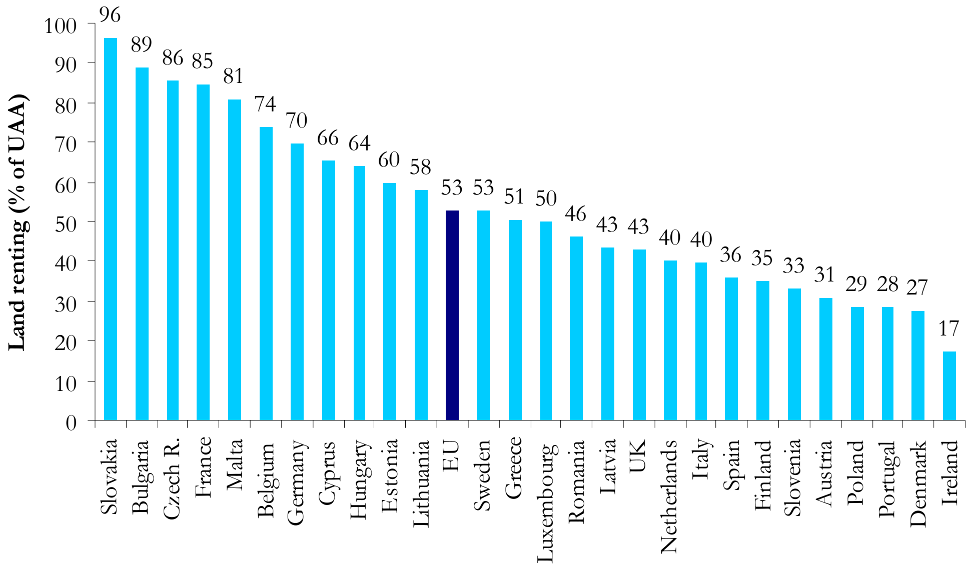
Well-functioning factor markets are an essential condition for the competitiveness and sustainable development of agriculture and rural areas. At the same time, the functioning of the factor markets themselves is influenced by changes in agriculture and the rural economy. Such changes can be the result of technological change, of globalisation and European market integration, of changing consumer preferences, and of changes in policy. In particular, changes in the Common Agricultural Policy (CAP) over the past decade have affected rural factor markets.

The general objective of the Factor Market project was to analyse the functioning of factor markets for agriculture in the EU-27, including the candidate countries. The Factor Market project compared the different markets, their institutional framework and their impact on agricultural development and structural change, as well as their impact on rural economies, for the member states, candidate countries and the EU as a whole.

This book summarises the main findings of the studies in the project, which include both comparative analyses across the member states and candidate countries and an in-depth analysis of key issues determining the functioning and impact of each of the factor markets for agriculture and rural economies.

The chapters in this book confirm the strong heterogeneity of rural factor markets in the EU. As an illustration of the variations in factor markets and their governance, consider Figure 1, which shows the share of rented land in agricultural land use for all the member states. The figure shows the remarkable variety of situations in the EU. While the EU average is close to 50%, the share of rented land varies from around 10% to around 90%. Interestingly, there is no East-West divide since the variations appear to be equally large in the Western and Eastern member states. In addition, there are major differences in land regulations, as we demonstrate in Chapter 7. These differences can have major implications for structural change and productivity, for income distribution and for the impacts of the CAP, with most of the subsidies linked to land.

Figure 1.1 Share of Land Renting (%)



Source: Eurostat.

The diversity in factor markets and their governance among EU member states is remarkable given that labour and capital markets are integrated in an EU single market (as should land acquisitions and investments, since these are part of the capital market regulations) and that there has been a *common* agricultural policy and an integrated market for the past 50 years. Such variations are likely to have an important effect, not just on the functioning of all the factor markets, but also on the competitiveness of the agricultural sector, on structural change, and rural development in general. These variations are also likely to cause different interactions between factor markets and EU policies such as the CAP, as they may react differently to reforms, and because they may cause differential effects of the reforms.

The insights we gained from this project, and which are summarised in this book, will hopefully contribute to a better understanding of the fundamental economic factors affecting EU agriculture and rural areas.

This may lead to a better targeting of various policies, such as the CAP, environmental policies, etc., with the ultimate aim of improving the competitiveness of the sustainability of the sector.

The book is organised in four parts and in the rest of this chapter we summarise the key findings of each one of them.

2. Rural Land Markets

Rural land markets have always been, for obvious reasons, very important for EU agriculture. However, since the MacSharry reforms of the early 1990s, many of the CAP payments are linked to land use. The 2003 CAP reform reformed the payments but there is still an important link to the land markets. Therefore, given the importance of the relationship between CAP payments and land markets, an important focus of the Factor Markets project has been placed on understanding the interaction between agricultural policies and rural land markets. Several studies in the Factor Markets project analysed the impacts of agricultural policies on land markets, both from a theoretical and an empirical perspective.

2.1 Impact of agricultural policies on land markets

In order to correctly model policy impacts on land markets, it is important to integrate both first- and second-order (direct and indirect) effects. There are many theoretical and empirical studies that have analysed and compared the impacts of various income support instruments (market price support, production subsidies, factor subsidies, coupled and decoupled payments, etc.) on farmers' decisions and income in developed countries. A lot of these studies consider only the direct first-order effects of policy instruments since they assume that input/factor prices faced by farmers are exogenous and not affected by policy instruments. In addition to these direct first-order effects, however, most of the implemented agricultural policies also induce further second-order adjustments. Farm subsidies affect not only the employed factor reward but, through altered farmer incentives, they also affect factor demand, factor prices, inter-sectoral factor allocation, factor ownership etc.

In Chapter 2, Paul Feichtinger and Klaus Salhofer give an overview of the literature on the determinants of agricultural land prices and the effects of government support policies. Almost all empirical studies on the determination of land prices either refer to the net present value method or the hedonic pricing approach. While the two approaches have different theoretical bases, they converge in their empirical implementation.

Empirical studies use a broad range of variables to explain land values and the authors organise these into six categories. Their meta-regression analysis indicates that, on average, a 10% decrease of agricultural support would decrease land prices by 3.3% to 5%. Therefore, a considerable part of farm subsidies is captured by initial owners of land instead of operating farmers. They conclude that model assumptions, data structure and estimation techniques do have a significant influence on capitalisation estimates for different support measures.

In Chapter 3, Pavel Ciaian, d'Artis Kancs and Johan Swinnen analyse the effects of the Single Payment Scheme (SPS) with and without farm structural change, and focus on how income distributional effects and farm restructuring are impacted by the SPS under: alternative entitlement tradability, cross-compliance and CAP 'greening' requirements, different SPS implementation models, the entitlement stock, market imperfections and institutional regulations. The authors find that the SPS implication details are very important factors in the distributional effects, since farmers' benefits can range from 100% of the SPS value to a negative policy incidence, and farm structural change may also be hindered by the SPS.

In Chapter 4, Paul Feichtinger and Klaus Salhofer investigate the impact of different CAP support measures on land rents and land allocation, explicitly taking land heterogeneity into account. They argue that price support before the 1992 MacSharry reform and area payments as implemented in the CAP and SFPs in the historical model, all favour land of higher quality (productivity). This is because of the way area payments are implemented in the CAP. By contrast, SFPs in the regional model and uniform area payments uniformly distribute support with respect to land quality. They find that price support will change land use to a smaller extent, as do uniform area payments. SFPs do not change land use compared to a situation without support, as long as all land uses are entitled to payments. However, SFPs do change land use, compared to the situation before the 2003 reform. Some of the land is made idle or converted from crop to grassland.

In Chapter 5, Kristine Van Herck, Johan Swinnen and Liesbet Vranken analyse the impact of direct payments (DPs) on land rents in the new member states of the EU. Land rents and direct payments increased significantly at the time of EU accession. They estimate that up to 25% of DPs is capitalised in land rents. In addition, their results show that capitalisation of DPs is higher in more credit-constrained markets, while capitalisation of DPs is lower in countries where more land is used by corporate farms, reflecting a stronger bargaining position of corporate farms in these countries. Their results imply that the functioning of other markets (in particular rural credit markets) are not only affecting access to land by farmers and structural change, but also influence the distributional effects of agricultural subsidies.

In Chapter 6, Davide Viaggi, Fabio Bartolini, Marco Puddu and Meri Raggi analyse the expected effects of the most recent CAP reform of 2013 on land markets, through a case study on Italy. In particular, they assess the potential impact of the proposed policy reform (in particular concerning the regionalisation of payments) on land markets. Their results point towards a reaction of the land demand and supply to the shift from the historical to the regionalised payments, due to the differentiated and opposite effects that the reform would have on different farm types and sub-regions. They find that the regionalisation would potentially result in increased rental prices and in a tendency to re-allocate land.

2.2 *Impact of land regulations*

It is important to take into account the variety of land market regulations. Markets for agricultural land are subject to institutional regulations, both national and EU-wide. The land market regulations are diverse across among EU member states and candidate countries, as is agricultural land itself.

In Chapter 7, Johan Swinnen, Kristine Van Herck and Liesbet Vrancken give an overview of land markets and regulations in Europe. They document major differences in regulations in both rental and sales markets. They develop indicators of land regulation to provide a quantitative measure for regulation. They use these indicators to illustrate large differences among the old and the new member states.

In Chapter 8, Laure Latruffe, Laurent Piet, Pierre Dupraz and Chantal Le Mouël investigate the influence of land regulations, and their interaction with CAP subsidies, on sale prices of farmland in France. They study the determinants of agricultural land price in several regions in France over the period 1994-2011, using individual plot transaction data, with a particular emphasis on nitrate zoning regulations and on agricultural subsidies. They find a positive but relatively small capitalisation effect of the total subsidies per hectare. The data revealed that agricultural subsidies are capitalised, at least to some extent, but the magnitude of such capitalisation depends on the region considered, on the type of subsidy considered, and on the location of the plot in a nitrate surplus zone or not. Only land set-aside premiums significantly capitalise into land price, while single farm payments have a significant positive capitalisation impact only for plots located in a nitrate-surplus zone.

2.3 *Impact of climate change, biodiversity and energy policies*

In Chapter 9, Peter Dixon, Hans van Meijl, Maureen Rimmer, Lindsay Shutes and Andrzej Tabeau study the impact of climate change and biodiversity policies on European land markets. They assess the complex interplay between global Renewable Energy Directives (RED) and the United Nations programme to Reduce Emissions from Deforestation and forest Degradation (REDD). They use a recursive-dynamic global Computable General Equilibrium model. They find that whilst both RED and REDD are designed to reduce emissions, they have opposite impacts on land use. RED policies are found to extend land use whereas the REDD policy leads to an overall reduction in land use and intensification of agriculture. This suggests that the protection of forests and woodlands in some developing countries reverses their comparative advantage as they move from being land-abundant to land-scarce regions.

In Chapter 10, Martin Banse, Andrea Rothe, Andrzej Tabeau, Hans van Meijl and Geert Woltjer analyse the consequences of enhanced biofuel production on agricultural land demand. Their modelling combines the analysis of biofuel policies in a multi-sectoral economic model (MAGNET) with variation of the functioning of capital and labour markets. The multi-sectoral modelling system predicts changes in land demand under different conditions of how factor markets work.

2.4 *Land distribution and social comparison*

In Chapter 11, Jan Fałkowski takes an alternative perspective by focusing on the role of social comparisons in agricultural land markets. In this chapter, he investigates the extent to which farmers' propensity to buy land is related to the difference between them and their neighbours in terms of land ownership, drawing on the concept of relative deprivation. Using micro-level data from the transition period in Poland, he finds that interpersonal comparisons may have motivated farmers' behaviour in the land market. He argues that the propensity to purchase land was positively correlated with experiencing relative deprivation but that this relationship waned over time: late in the transition period it was weaker than at the beginning.

3. Rural Labour Markets

For the past century there has been an important restructuring of the economies in Europe and, with it, a reallocation of labour. An important element of this has been an outflow of labour from agriculture. The creation of the EU and the introduction of the CAP has affected this process but not halted it. In this process, the functioning of rural labour markets is extremely important as it will determine the allocation of labour across different economic activities, and as such, affect rural incomes and development.

3.1 Institutional characteristics and modelling of European rural labour markets

Labour markets can contribute significantly to rural household incomes and to the competitiveness of farms and the agricultural sector as a whole. However, studies also show that, in many regions, such markets do not work perfectly and, moreover, that it is crucial to take into account local labour market institutions, variations in household characteristics, etc., in order to get a good understanding of the functioning and the constraints in these rural labour markets.

In Chapter 12, Jason Loughrey, Trevor Donnellan, Kevin Hanrahan and Thia Hennessy give an overview of the functioning of agricultural labour markets in the EU and candidate countries. Based on a survey, they construct an index of labour market flexibility/rigidity and identify criteria that affect the ranking of countries in this index.

A crucial element in studying rural labour markets is how to model the supply of labour. The supply of labour is responsive to changes in the real wage in the medium term as higher wages increase the opportunity cost of being economically inactive and induce people to enter the labour force, while lower wages reduce the opportunity cost and lead to lower participation rates.

In Chapter 13, Lindsay Shutes argues that changes in participation rates are seldom captured in standard computable general equilibrium (CGE) models used for policy analysis. She therefore introduces labour supply curves into the MAGNET CGE model and derives unskilled labour-supply curves for EU member states and Croatia and Turkey. Including the labour supply curves into the MAGNET CGE model affects the estimated impact of CAP reform.

3.2 Determinants of labour reallocation and agricultural employment

Many households in rural areas allocate labour to activities on and off the farm. Most rural economies in the EU are in a dynamic adjustment process involving sectoral re-specialisation and spatial relocation of workers between industries. In addition, in the new member states and candidate countries, the transition and restructuring processes created incentives for workers to relocate their labour supply between sectors. Given that the incidence of off-farm employment by farmers and their families is an important determinant of future structural change within the agricultural sector, future productivity levels and the efficient use of the other factors of production, it is crucial to understand what determines inter-sectoral relocation of workers and off-farm employment and to what extent policies, including the CAP, affect this process.

In Chapter 14, Barbara Tocco, Sophia Davidova, and Alastair Bailey explore the determinants of leaving agriculture. Using Union Labour Force Survey data, they find that younger individuals are more likely to leave farming activities, although the largest outflows of agricultural labour are mainly associated with the retirement of older people. Self-employed and family workers are generally less likely to leave agriculture and low levels of education constrain entry into the non-farm economy. They find that labour market conditions at the regional level matter. Differences among the selected new member states and the EU-15 can be explained by the diverse production structures, suggesting different capacities to release and absorb labour.

In Chapter 15, Alessandro Olper, Valentina Raimondi, Daniele Cavicchioli and Mauro Vigani investigate the impact of CAP subsidies and the reallocation of agricultural labour. Exploiting the properties of a data set covering 150 EU regions during the 1990-2009 period, they find that CAP payments contributed to maintaining jobs in agriculture, but that this effect is small. They also find heterogeneous effects for different CAP payments, with Pillar I subsidies having a larger effect than Pillar II payments.

In Chapter 16, Eleni Kaditi uses data from Greece over the period 1990-2008 to analyse the impact of CAP reforms on farm labour, with a dynamic panel analysis. Family and hired labour are found to be substitutes rather than complements, while agricultural support measures appear to negatively affect both family and hired labour demand. Also, subsidies for rural development do not favour on-farm labour use.

Structural labour adjustments are also affected by farm size and location. Her results are robust to various estimation techniques and specifications.

In Chapter 17, Kristine Van Herck, Ruxanda Berlinschi and Johan Swinnen provide a hypothesis and empirical evidence for why the impact of agricultural subsidies on employment may be small or even negative. They argue that the aggregate effect is the result of two opposing sub-effects: a short-term positive income effect (enhancing employment) and a longer-term positive effect on education (by reducing credit constraints), which leads to a reduction of labour in the longer term.

In Chapter 18, Jason Loughrey, Thia Hennessy, Kevin Hanrahan, Trevor Donnellan, Valentina Raimondi, Daniele Curzi and Alessandro Olper examine the effect of the decoupling of farm direct payments on labour allocation in Ireland and Italy. Using a household model, they derive the hypothesis that the impact of decoupling on off-farm labour supply is dependent on two competing forces: a relative wage effect and a wealth effect. The decline in the farm wage relative to the off-farm wage makes off-farm work more attractive, thus producing the relative wage effect. At the same time, decoupled direct payments provide a new non-labour source of income thereby generating a wealth effect, reducing labour supply. Using data from 2002 to 2009, their empirical analysis indicates that decoupling has not had a significant impact on off-farm labour supply in Ireland but find a negative relationship in Italy.

3.3 *Impact of labour re-allocation on productivity and rural incomes*

The inter-sectoral migration of agricultural labour is a complex but fundamental process of economic development, largely affected by the growth in agriculture and the rest of the economy, and the evolution of the rural-urban relative income gap. Theory and some recent anecdotal evidence suggest that, as an effect of large fixed and sunk costs of out-farm migration, the productivity gap between the agricultural and non-agricultural sectors behaves non-monotonically or follows a U-shaped evolution during economic development.

In Chapter 19, Alessandro Olper, Valentina Raimondi, Danilo Bertoni, Daniele Curzi and Daniele Cavicchioli study the interactions between off-farm labour migration, transfer frictions and the persistency of income gaps. They analyse empirically the interaction across a sample of 38 developing and developed countries and of more than 200 EU regions.

Their results identify a U-shaped relationship between the productivity gap between agriculture and the rest of the economy.

In Chapter 20, Jan Fałkowski, Maciej Jakubowski and Pawel Strawinski use data from Poland to analyse the impact of a diversification of rural household income. They investigate rural households' income using propensity score matching methods with data from 1998 to 2008. Their results suggest that, in the late 1990s, returns from combining farm and off-farm activities were lower than returns from concentrating on farming or on self-employment outside agriculture. Returns from diversification improved after the accession of Poland to the EU.

4. Rural Capital Markets

It is well known that rural capital markets typically work imperfectly, e.g. because of transaction costs and informational imperfections. Capital market imperfections affect both the supply and demand sides of capital markets. A crucial element in the differences between regions is the institutional framework for agricultural credit markets in the EU.

4.1 Institutional characteristics and financial integration of rural capital markets

In Chapter 21, Kristina Hedman Jansson, Ewa Rabinowicz and Carl Johan Lagerkvist provide an overview of the institutions that are essential for the efficient functioning of capital markets. In particular, they make a distinction between formal institutions (rules, regulations, authorities and actors) and informal (norms, values and relations). They compare the institutional situation in several EU countries and make an attempt to develop indicators to measure the performance of the institutions.

In Chapter 22, Sami Myyra argues that the integration of rural capital markets in member states and in the European Union enhances access to capital for farmers and rural entrepreneurs, but it also implies risks coming from financial market shocks. He analyses the financial integration of the EU's rural capital markets by computing financial indicators of rural capital markets. His key indicators measure how rural capital markets are linked to the wider capital markets. He also measures and compares the financial leverage structure in agriculture among member states.

Another key institutional factor is the internal financial structure and management of farms.

In Chapter 23, Jarmila Curtiss, Tomáš Ratinger and Tomáš Medonos study the relationship between capital ownership and investment behaviour using data from Czech corporate farms. Their chapter explores the ownership-investment relationship from 1997 to 2008. They find significant differences in the level of investment activity, responsiveness to market signals, investment lumpiness, as well as investment sensitivity to financial variables among farms with different ownership characteristics. They predict that there will be a decrease in the number of owners and an increase in ownership concentration in the Czech cooperative and corporate farms.

4.2 Impact of CAP on rural finance and investments

An important issue is the interaction between CAP payments, credit constraints and farm investments. Previous studies suggest that farm investment decisions may be affected by the nature of the subsidies: coupled payments stimulate farm investments, but decoupled payments may not affect investment decisions. A key question is whether these results hold if credit constraints are taken into account.

In Chapter 24, Giovanni Guastella, Daniele Moro, Paolo Sckokai and Mario Veneziani analyse the impacts of the 2013 CAP reform on farm investments, using a sample of farms specialised in the production of arable crops in EU member states. They find that investment demand is a function of the type and amount of direct payments. They use the estimated coefficients in the investment models yields to simulate the farms' future and expected investment behaviour with the implementation of the direct payments reform. The investment in machinery and equipment is predicted to improve in several member states following the reduction in support levels induced by the policy scenarios considered.

In Chapter 25, Jan Pokrivcak, Pavel Ciaian and Katarina Szegenyova explain that in addition to the demand effects of subsidies, there may also be a supply effect on the provision of rural finance. For example, farms may use the SFP directly to pay for farm activities and thus substitute for missing credit. Subsidies may also affect bank credit if future subsidies are used as collateral. This is especially important in the new member states and candidate countries, where imperfect competition and unequal distribution of bargaining power within the agri-food supply chain can be observed. Using Farm Accountancy Data for the period 1995-2007, they find that there is a positive effect of subsidies on bank loans, but that the effect depends on the farm structure: large farms use subsidies to increase long-term loans, whereas small farms use subsidies to obtain short-term loans.

5. Factor Markets and Productivity

The explicit incorporation of factor markets and their institutional diversity into theory and empirical analysis should contribute to a better understanding of the changes in farm sizes and farm structures, income distribution and productivity in agriculture.

In Chapter 26, Martin Banse, Andrea Rothe and Lindsay Shutes show how improved modelling of the heterogeneity of factor markets amongst EU member states in CGE models can improve model-based analyses of the CAP and other policy measures affecting agricultural production.

In Chapter 27, Martin Petrick and Mathias Kloss examine the relationship of productivity in EU agriculture and EU factor markets. They estimate production elasticities and shadow prices of factors for a set of eight EU member states for the years 2002-08. They find significant differences between member states. They also find that marginal returns to land, labour and fixed capital are generally low. They conclude that the functioning of factor markets plays a crucial role for productivity growth, but that the impact of factor markets is heterogeneous across the EU.

In Chapter 28, Marian Rizov, Jan Pokrivcak and Pavel Ciaian investigate the impact of CAP subsidies on the total factor productivity of farms in the EU. They use Farm Accountancy Data Network for EU-15 countries and find that subsidies had a negative impact on farm productivity in the period before the decoupling reform was implemented. After decoupling the effect of subsidies on productivity became positive in several countries.

Finally, Chapter 29 summarises some key insights from several papers by Štefan Bojnec and colleagues on the rural factor markets in three candidate countries (Croatia, Macedonia and Turkey). The papers in this chapter provide an extensive review of each of the factor markets for each of these countries. In the final chapter, Štefan Bojnec explains that, although the role of agriculture in the economies of Croatia, the Former Yugoslav Republic (FYR) of Macedonia and Turkey has declined over time, it is still important in absolute and relative terms compared to the EU economies. The prevailing small-scale farm structures provide employment and incomes for a large part of rural population. The substantial outflow of labour to urban areas and to other countries causes an inflow of remittances, which complements the emerging rural capital markets.

PART I
LAND MARKETS

2. WHAT DO WE KNOW ABOUT THE INFLUENCE OF AGRICULTURAL SUPPORT ON AGRICULTURAL LAND PRICES? A SUMMARY OF RESULTS*

PAUL FEICHTINGER AND KLAUS SALHOFER

This chapter gives an overview of the literature on the determinants of agricultural land prices. A particular interest is given to the effects of government support policies. Almost all empirical studies on the determination of land prices either refer to the net present value method or the hedonic pricing approach. While the two approaches have different theoretical bases, they converge in their empirical implementation. Empirical studies use a broad range of variables to explain land values and we systematise these into six categories. In order to investigate the influence of different measures of government support on land prices, a meta-regression analysis is carried out based on 242 observations from 26 articles. Results indicate that a 10% decrease in agricultural support would decrease land prices by 3.3% to 5%. Therefore, a considerable part of farm subsidies is realised by initial owners of land instead of operating farmers. Results in regard to differences in capitalisation for different support measures are ambiguous. Model assumptions, data structure and estimation techniques do have a significant influence on capitalisation estimates.

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1. Introduction

The question of what determines agricultural land values has occupied economists for more than 200 years and has been an important research topic in agricultural economics throughout the last century. Although a few econometric contributions date back as far as the late 1930s, regression analysis of land value determinants took off in the 1960s and has continued since then. The purpose of this chapter is to give an overview of this literature. The study is structured as follows. Section 2 outlines the two most common theoretical frameworks on which empirical studies in this area are based: the net present value method and the hedonic pricing approach. Section 3 reviews and systematises the determinants utilised in empirical work. Based on an extensive literature review and a meta-regression analysis, Section 4 summarises our findings on the extent to which government payments are capitalised into land values. Section 5 gives a short discussion of our results.

2. Net present value and the hedonic pricing approach

Most empirical studies investigating the determinants of agricultural land prices either refer to the net present value (NPV) method or the hedonic pricing approach as a theoretical basis. According to the NPV model, the maximum price a farmer would be willing to pay for a particular piece of agricultural land at a specific time is equal to the summed and discounted expected future stream of earnings from this land. Beside the Ricardian land rent, which is created by the "original and indestructible powers of the soils" (Ricardo, 1817), other returns connected to land may capitalise into land prices. This is true to some extent for almost all agricultural support programmes. If land is necessary to receive this support, people will take expected future earnings from the support programmes into account in their willingness to pay. Different support measures may capitalise into the land value to a different extent. Beside returns to land and government payments, there are other factors which may influence land prices. One is competing demand for land for non-agricultural use, i.e. urban pressure.

Taking these different determinants for land prices into account and making some simplifying assumptions, an estimable empirical model of agricultural land prices (L_i) is outlined in equation (1):

$$L_i = \beta R_i + \sum_{j=1}^{m} \beta_{G,j} G_{j,i} + \sum_{k=1}^{z} \alpha_k X_{k,i} + \varepsilon_i \tag{1}$$

where R is the expected returns to land (Ricardian land rent), G_j is the different types of expected government support payments, X_k includes a constant and different shift variables accounting for example for urban pressure and β, $\beta_{G,j}$ and a_k are $m + z + 1$ parameters to be estimated. The parameters β and $\beta_{G,j}$ reflect the rate at which land rents and government support payments are capitalised into land prices. They ultimately reflect the discount rate as well as a growth rate of the associated variables.

In contrast, the hedonic pricing approach is anchored in consumer theory (Lancaster, 1966), and starts from the assumption that the price of a good (in our case, agricultural land) can be explained by a set of characteristics (e.g. land quality) affecting it (Rosen, 1974). Generally, and as an estimable function, agricultural land price is a function of y factors:

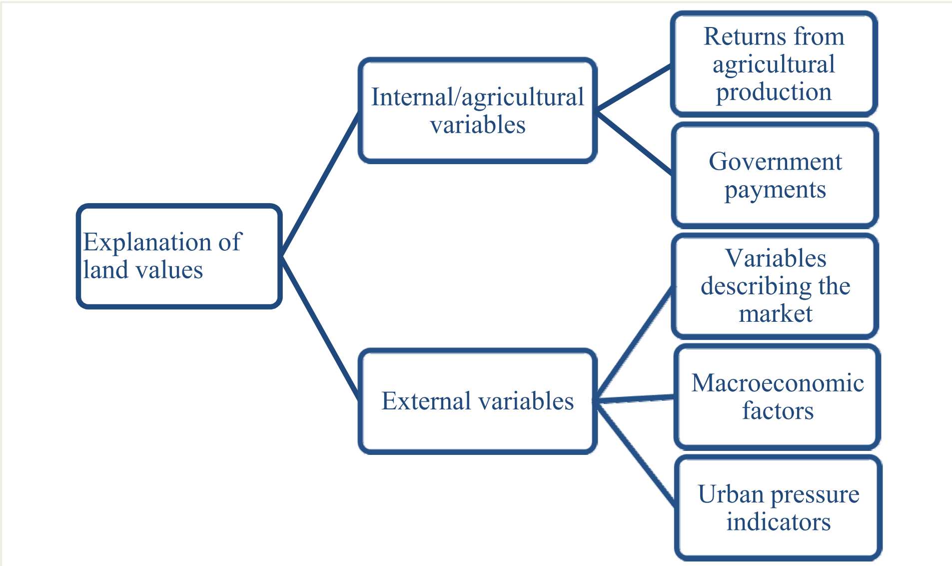
$$L_i = \sum_{l=1}^{y} \delta_l Z_{l,i} + \varepsilon_i \qquad (2)$$

where Z_l is the variables representing characteristics with $Z_1 = 1$ for all i observations. If explanatory variables Z_l include returns from land (or some proxy) R and government payments $G_{j,i}$, the hedonic pricing approach of equation (2) and the empirical implementation of the NPV model of equation (1) converge to the same empirical model, though based on different theoretical considerations.

3. Explanatory variables used in empirical applications

In an effort to explain what determines agricultural land prices as discussed theoretically in the previous section, researchers have utilised numerous different variables. One way to structure these variables is depicted in Figure 2.1, where we define two major groups: internal/agricultural variables and external variables.

Figure 2.1 Variables used in empirical analysis



Agricultural variables are further split into two subgroups. The first is concerned with returns from agricultural production. Hence, variables in this category usually represent the returns from land *R*. Since estimates of *R* are often not available, for example because the shadow price of labour is not known, proxies such as market revenues, net income or the price of the output are used in empirical work (Table 2.1). Beside those variables which try to approximate *R* directly utilising some monetary measure, there are also other non-monetary variables which have a clear influence on returns from land, such as yields or soil quality. As described in Section 2, besides returns from land, returns from government payments influence land prices through capitalisation. As long as government payments are tied to the price of agricultural production, as in the case of a price support policy, returns to land from production *R* and from government payments *G* are hardly separable. While some studies use total government payments as an explanatory variable of land prices, others split them into different categories (e.g. animal payments and area payments).

Table 2.1 Examples for variables used to explain land values

Agricultural returns – monetary variables

- Market revenues (Carlberg, 2002; Barnard et al., 1997; Folland & Hough, 1991; Gardner, 2002; etc.)
- Returns to land (Goodwin et al., 2005 & 2010; Weerahewa et al., 2008)
- Net income (Devadoss and Manchu, 2007)
- Producer price of wheat (Goodwin and Ortalo-Magné, 1992)

Agricultural returns – non-monetary variables

- Yield (Pyykkönen, 2005; Devadoss & Manchu, 2007; Latruffe et al., 2008)
- Soil quality (Barnard et al., 1997; Kilian, 2010)
- Temperature and precipitation (Barnard et al., 1997)
- Dummy for
  - Irrigation (Barnard et al., 1997)
  - Presence of intensive crops (Barnard et al., 1997)
  - Special crops (Pyykkönen, 2005)
- Fraction of cropland (Gardner, 2002)
- Proximity of a port (Folland & Hough, 1991)

Government payments

- Total government payments (Devadoss & Manchu, 2007; Vyn, 2006; Henderson & Gloy, 2008; Shaik et al., 2005)
- One or multiple categories of government support (Goodwin et al., 2003 & 2005; Pyykkönen, 2005)

Variables describing the market

- Manure density (Pyykkönen, 2005)
- Pig density (Duvivier, 2005)
- Farm density (Pyykkönen, 2005)
- Average farm size (Folland and Hough, 1991)
- Size of the agricultural land market (in the case of Duvivier et al., 2005; e.g. the fraction of arable farmland exchanged in a particular district in a particular year)
- Dummy for a specific region

Macroeconomic factors

- Interest rate (Weerahewa et al., 2008; Devadoss & Manchu, 2007)
- Inflation rate (Alston, 1986)
- Property tax rate (Gardner, 2002; Devadoss & Manchu, 2007)
- Multifactor productivity growth (Gardner, 2002)
- Debt to asset ratio (Devadoss & Manchu, 2007)
- Credit availability (Devadoss & Manchu, 2007)
- Unemployment rate (Pyykkönen, 2005)

Urban pressure indicators

- Total population (Devadoss & Manchu, 2007)
- Population density per square kilometre
- Population growth (Gardner, 2002)
- Ratio of population to farm acres (Goodwin et al., 2010)
- Urbanisation categories (Goodwin et al., 2010; 2005, defined through proximity to an urban centre)
- Rurality – fraction of the population living on farms (Gardner, 2002)
- Dummy variables for metropolitan areas (Henderson & Gloy, 2008)
- Proportion of the labour employed in agriculture (Pyykkönen, 2005)

Besides returns to land and government payments, there are other factors which may influence land prices. The influence of some of these factors, in particular interest rates, inflation rates and property tax, can also be explained within the NPV model. Here we systematise these external variables used in the literature into three groups: variables describing the market, macroeconomic factors and urban pressure indicators.

4. Results from a meta-regression analysis

Recently, the discussion of the capitalisation of government support into land prices has gained importance due to the increasing share of rented agricultural area in most parts of the developed world. Here, we apply a meta–regression analysis in order to derive some knowledge about the extent of capitalisation of different measures of support and to reveal some structural differences which may influence the capitalisation ratio.

Our basic model is an extension of Stanley & Jarrell (1989),

$$b_{ik} = \eta_0 + \sum_{j=1}^{m} \eta_j D_{j,ik} + \sum_{l=1}^{y} \gamma_l Z_{l,ik} + \varepsilon_{ik} \quad (i = 1, 2, \ldots, n), (k = 1, 2, \ldots, z) \tag{3}$$

where b_{ik} is one of n effects reported in primary study k, η_0, η_j, and γ_l, are parameters to be estimated, $D_{j,ik}$ are dummy variables representing m different categories of government support, $Z_{l,ik}$ are y variables measuring relevant characteristics of an empirical study and explaining its systematic variation from other results in the literature, and ε_{ik} is an error term representing white noise. In our case, b_{ik} is the elasticity of land prices with respect to government payments. η_0 may be interpreted as the 'true' average value of b_{ik} if we do not distinguish between different government support policies, i.e. use the default category total government payments.

However, theoretically there are differences in the capitalisation ratio of government payments depending on the measure of support. This is derived from the fact that different government payments have a different impact on land rents R. Parameters η_j capture the differences of particular support policies to the average situation. Therefore, equation (3) is used to test for two different things. First, we try to investigate if there are different support categories which reveal significant different capitalisation rates. Second, we try to find out if differences in, for example, estimation techniques, included variables and differences in proxies for land rents lead to a systematic and significant bias in estimated capitalisation elasticities.

As summarised in Table 2.2, 242 estimations from 26 articles have been included in total. Elasticities vary from -0.408 to 1.184 with a mean elasticity of 0.276. In 96% of the cases, the elasticity is between 0.002 and 0.789. The articles report on average 9.3 different estimates, with a minimum of 1 estimate and a maximum of 40 estimates.

Table 2.2 List of articles and the reported capitalisation elasticities included in the meta-regression analysis

Author	Title	Article	Mean	Median	Max	Min.	Std. Dev.	Obs.
Barnard et al., 1997	Evidence of Capitalization of Direct Government Payments in to U.S. Cropland Values	1	0.265	0.215	0.690	0.120	0.180	8
Carlberg, 2002	Effects of Ownership Restrictions on Farmland Values in Saskatchewan	2	0.043	0.030	0.520	-0.408	0.423	4
Devadoss & Manchu, 2007	A comprehensive analysis of farmland value determination: a county-level analysis	3	0.020	0.020	0.020	0.020		1
Duvivier et al., 2005	A Panel Data Analysis of the determinants of farmland price: An application to the effects of the 1992 CAP Reform in Belgium	4	0.299	0.285	0.469	0.121	0.100	28
Folland & Hough, 1991	Nuclear Power Plants and the Value of Agricultural Land	5	0.386	0.384	0.427	0.355	0.033	6
Goodwin & Ortalo-Magné, 1992	The Capitalization of Wheat Subsidies into Agricultural Land Values	6	0.380	0.380	0.380	0.380		1
Goodwin et al., 2003	What's wrong with our models of agricultural land values?	7	0.076	0.061	0.130	0.020	0.049	5
Goodwin et al., 2005	Landowners' Riches: The Distribution of Agricultural Subsidies	8	0.111	0.042	0.233	0.028	0.086	6
Goodwin et al., 2010	The Buck Stops Where? The Distribution of Agricultural Subsidies	9	0.041	0.032	0.134	0.007	0.042	8
Hardie et al., 2001	The Joint Influence of Agricultural and Nonfarm Factors on Real Estate Values: An Application to the Mid-Atlantic Region	10	0.474	0.460	0.605	0.405	0.077	5
Henderson & Gloy, 2008	The Impact of Ethanol Plants on Cropland Values in the Great Plains	11	0.302	0.296	0.372	0.270	0.032	8
Kilian, 2010	Die Kapitalisierung von Direktzahlungen in landwirtschaftlichen Pacht- und Bodenpreisen - Theoretische und empirische Analyse der Fischler-Reform der Gemeinsamen Agrarpolitik	12	0.282	0.093	0.472	0.093	0.268	2

Latruffe et al., 2008	Capitalisation of the government support in agricultural land prices in the Czech Republic	13	0.205	0.070	0.890	0.040	0.296	10
Pyykkönen, 2005	Spatial Analysis of Factors Affecting Finnish Farmland Prices	14	0.412	0.344	0.835	0.166	0.256	8
Runge & Halbach, 1990	Export Demand, U.S. Farm Income and Land Prices: 1949 - 1985	15	0.322	0.253	1.184	0.051	0.208	40
Sandrey et al., 1982	Determinants of Oregon Farmland Values: a Pooled Cross-Sectional, Time Series Analysis	16	0.228	0.228	0.228	0.228		1
Shaik et al., 2005	The Evolution of Farm Programs and their contribution to agricultural land values	17	0.256	0.242	0.397	-0.040	0.136	14
Shaik et al., 2006	Farm programs and agricultural land values	18	0.281	0.274	0.543	0.099	0.119	31
Shaik, 2007	Farm Programs and Land Values in Mountain States: Alternative Panel Estimators	19	0.429	0.441	0.608	0.224	0.125	15
Shaik et al., 2010	Did 1933 New Deal Legislation Contribute to Farm Real Estate: Temporal and Spatial Analysis	20	0.378	0.303	0.875	0.103	0.230	18
Taylor & Brester, 2005	Noncash Income Transfers and Agricultural Land Values	21	0.100	0.100	0.100	0.100		1
Veeman et al., 1993	Price Behaviour of Canadian Farmland	22	0.384	0.380	0.470	0.260	0.083	5
Vyn, 2006	Testing for Changes in the Effects of Government Payments on Farmland Values in Ontario	23	0.130	0.130	0.184	0.075	0.077	2
Weerahewa et al., 2008	The Determinants of Farmland Values in Canada	24	0.060	0.060	0.060	0.060		1
Weersink et al., 1999	The Effect of Agricultural Policy on Farmland Values	25	0.008	0.008	0.013	0.002	0.004	10
Weisensel et al., 1988	Where are Saskatchewan Farmland Prices Headed	26	0.088	0.275	0.284	-0.342	0.295	4
Total			**0.276**	**0.208**	**1.184**	**-0.408**	**0.198**	**242**

About half of the estimates in the investigated studies use total government payments without differentiating between payment categories. Hence, we use this as a base line and introduce dummies if government payments are split into different types. The groups are: market price support (e.g. loan deficiency payments in the US, intervention price in the EU), direct payments (e.g. deficiency payments and crop disaster payments in the US, area and animal payments in the EU) and decoupled direct payments (e.g. counter cyclical payments, production flexibility contract payments and market loss assistance in the US, single farm payments in the EU). These categories are closely related to the PSE classification of the OECD.

To account for correlation between primary studies, a common problem in meta-regression studies, we apply different estimation techniques including pooled ordinary least square, weighted least squares, and a single estimate per primary study. We do not report the estimation results here, but rather summarise our main findings. Average capitalisation elasticities over all types of agricultural support are estimated to be between 0.245 and 0.355. Hence, a 1% change in support implies a change of between 0.245% and 0.355% in land prices. Furthermore, one can observe considerable differences with respect to the three different models. Based on our meta-regression analysis, we can only confirm a significantly higher capitalisation of market price support and direct payments compared to the reference category of total government payments in one of the three models.

With regard to the *Z* variables, results show that taking theoretically consistent land rents (returns to land) to explain land values leads to lower elasticities of capitalisation at a highly significant level in all models. Hence, taking a proxy for land rents (most often revenues or similar measures) tends to overestimate the capitalisation effect. Including non-agricultural variables has a significant negative effect on the estimated capitalisation elasticity in at least one of our models. This seems plausible based on the omitted variable bias. If land rents and potential non-agricultural land use are significant in determining land prices, omitting one of them would increase the estimated coefficient of the other. Significantly higher capitalisation elasticities are observed if primary studies consider only arable land in two of our three models. Moreover, if a study is based on aggregated data, we can expect higher capitalisation elasticities compared with farm-level data. While a multiple equation model had a significant positive influence on the rate of capitalisation in one, the double-log specification does not influence capitalisation elasticities. With regard to estimation procedures, we find significantly higher elasticities if spatial econometric models are utilised. In addition, the lag of the independent variable or the lag of the dependent variable had a negative influence in least in two of the models. Elasticities in published studies are not significantly different from unpublished work.

5. Summary and conclusions

Almost all studies analysing the determinants of farmland prices either refer to the net present value (NPV) method or to the hedonic pricing approach as the basis of their work. The hedonic pricing approach is anchored in consumer utility theory and assumes that the observed prices of a good (in our case, land) are a function of a set of characteristics which define this good. Therefore, empirical models based on the hedonic pricing approach can include a multitude of very different explanatory variables, as long as those refer to characteristics of land. In contrast, the NPV model defines the maximum price somebody (in our case, a farmer) would be willing to pay for a particular asset (in our case, a piece of agricultural land) as the summed and discounted expected future streams of earnings from this asset. While the NPV approach gives a consistent theoretical explanation for the relation between land prices and probably the most important influence factors – land rents and government payments – it also suffers from severe shortcomings if transferred to an estimable empirical model for land price determination. First, since expected future streams of earnings are not observable, one has to either make strong assumptions or lack theoretical consistency. Second, the NPV model does not explain what determines land prices beyond expected future earnings and government payments. We have discussed that in the econometric adoption of the NPV model additional explanatory variables can be introduced as some shifters comparable to Goodwin et al.'s (2003) urban pressure indicators. If those shift variables are included, the empirical model based on the NPV approach and that based on the hedonic pricing approach converge.

Empirical studies used a broad range of variables to explain land prices. We tried to systematise those variables by splitting them into six groups. Three groups reflect earnings from land – variables directly or indirectly measuring land rents and variables measuring government payments. The remaining three groups measure other influence factors – variables describing market structure, variables describing macroeconomic factors and variables describing pressure from non-agricultural land use.

We utilised a meta-regression analysis to investigate if different support policies reveal significantly different degrees of capitalisation. Results show that a decrease in 10% of support would decrease land prices by between 3.3% and 5%. This result indicates that a considerable part of farm subsidies is realised by initial owners of land, rather than operating farmers. Other results of the meta-regression analysis are to some extent ambiguous and depend on applied estimation procedures. We find a significant difference in the capitalisation elasticity for market price support and direct payments compared with average payments using a pooled OLS regression, but not in the other two models, which account for non-independence of estimates. Moreover, we were not able to verify previous theoretical results regarding the capitalisation of decoupled government payments. Although we derive a small positive coefficient for decoupled payments in all three models, they are not statistically significant. A reason for this result is probably the very small number of from only five primary studies.

Results show that model variables, data variables and structural variables have a significant impact on the estimated capitalisation elasticities with respect to government payments.

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3. THE IMPACT OF DECOUPLED PAYMENTS ON LAND PRICES IN THE EU

*PAVEL CIAIAN, D'ARTIS KANCS AND JOHAN SWINNEN**

This chapter analyses the income distributional effects of the Single Payment Scheme (SPS) in the EU. The authors find that the SPS implementation details are highly significant in determining policy rent distribution between farmers and landowners. Farmers' benefits can range from 100% of the SPS value to a negative policy incidence.

1. Introduction

The objective of this chapter is to investigate the impact of decoupled payments – the Single Payment Scheme (SPS) – on land values in the EU. It first summarises the theoretical impacts of the SPS on land values and then presents empirical findings from the literature. Understanding the relationship between the SPS and land values is relevant in the context of the 2013 reform of the Common Agriculture Policy (CAP), which maintains the SPS at least until 2020, although with some modifications. This chapter therefore provides important insights into the potential future implications of the SPS for the EU land markets.

The distributional effects of agricultural policy, which Alston & James (2002) refer to as the "incidence of agricultural policy", have been studied extensively in the literature. Previous studies have analysed how these effects differ among polices (Alston & James, 2002; de Gorter & Meilke, 1989; Dewbreet al., 2001; Gardner, 1983; Guyomard et al., 2004) and how

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* This chapter is based on Ciaian, Kancs & Swinnen, "Income Distributional Effects of Decoupled Payments: Single Payment Scheme in the European Union", Factor Markets Working Paper No. 29, July 2012.

the results change if one includes more agents along the vertical chain (Desquilbet & Guyomard, 2002; Sheldon et al., 2001) or if one takes into account imperfect competition (McCorriston & Sheldon, 1991 and Salhofer & Schmid, 2004), imperfections in factor markets (Ciaian & Swinnen, 2006; 2009), or transaction costs and constraints in the implementation of the polices (OECD, 2007; de Gorter, 1992; Vatn, 2001).[2]

Early studies focused on policies, which were coupled with production decisions, e.g. price intervention or production quotas. After the decoupling of policy support in the late 1990s in the US and 2003 in the EU, more recent studies have analysed the impact of decoupled subsidies (e.g. Chau & de Gorter, 2005; de Gorter, 2007; Goodwin & Mishra, 2006; Hennessy, 1998; 2004; Serra et al., 2005; Sckokai & Moro, 2006). However, few studies have looked at the income distributional effects of the EU Single Payment Scheme (e.g. Ciaian & Swinnen, 2006; 2008; Courleux et al., 2008; Kilian & Salhofer, 2008).

According to Courleux et al. (2008), Ciaian et al. (2008) and Kilian & Salhofer (2008), the impact of the SPS largely depends on the ratio of the eligible area to the total number of entitlements. If the allocated entitlements are in deficit relative to the eligible area of land, then the SPS benefits farms; it is not capitalised into land values. However, if the allocated entitlements are in surplus, then the SPS gets capitalised into land values. These studies also show that the income distributional effects of the SPS depend significantly on the implementation model, i.e. differences in the SPS between farms: the larger the SPS differentiation between farms, the smaller the capitalisation of the SPS.[3] According to Ciaian et al. (2008), a further important determinant of the SPS capitalisation is conditionality on the cross–compliance. Given that cross-compliance imposes additional costs to land use, the net effect of the SPS on land rents will be lower.

The empirical literature tends to confirm that not only farmers but also landowners benefit from agricultural subsidies. According to Goodwin et al. (2003); Weersink et al. (1999); Lence & Mishra (2003); Robertset al. (2003); Kirwan (2009); Ciaian & Kancs (2012); Barnard et al. (1997);

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[2] There are also important empirical studies measuring the impact of agricultural policies on land markets (Goodwin et al., 2003; Lence & Mishra, 2003).

[3] There is a large related literature on the effects of tradability of production quota (Babcock & Foster 1992; Guyomard et al., 1996; Sumner & Wolf, 1996; Boots et al., 1997; Bureau et al., 1997; Bureauet al., 2001).

Michalek et al. (2013), Patton et al. (2008), the capitalisation rate of decoupled subsidies is usually found 6% and 80%. Most of the existing empirical studies focus on North America (the US and Canada), while far fewer papers cover the EU (Patton et al., 2008; Breustedt & Habermann, 2011; Michalek et al., 2013; Ciaian & Kancs, 2012; Johansson & Nilsson, 2012; Kilian et al., 2012).

2. The Single Payment Scheme

Introduced by the 2003 CAP reform, the SPS was implemented in 2005 and it runs until 2013.[4] The SPS replaced coupled subsidies, which included crop area payments and animal payments. Under the SPS, entitlements are allocated as a fixed set of payments per farm. Farms are entitled to yearly payments, depending on the number of the SPS entitlements and the eligible land they possess.

When implementing the SPS, EU member states could choose between three different SPS implementation models: the *historical* model, the *regional* model, and the *hybrid* model. Under the historical model, the SPS is farm-specific and equals the support the farm has received in the 'reference' period. Under the regional model, an equal per hectare payment is granted to all farms in a given region. The hybrid model is a combination of historical and regional models, and has two versions: static and dynamic. The key difference between the three models is in the unit value of entitlements: under the historical and hybrid models, the value of entitlement varies between farms (higher in the former than in the latter), whereas under the regional SPS model, all farms in a region have entitlements with the same unit value. The main source of differentiation is the past (production) coupled subsidies, which determine the SPS value at farm level fully in the historical model and partially in the hybrid model. The most commonly implemented SPS model in the EU is the historical model.[5]

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[4] Member states could choose to introduce the SPS either in 2005 or in 2006.

[5] In 2012 the *historical model* was implemented in Austria, Belgium, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain; the *regional model* in Malta and Slovenia; the *static hybrid* in Luxembourg and Sweden; the *dynamic hybrid* in Denmark, Finland and Germany; and a *mixed system* of historical and hybrid models in the UK. Those member states implementing the dynamic hybrid model move gradually to a fully regional model. In those implementing the static hybrid

In the first year of the SPS implementation (2005 or 2006 depending on the country), each farm was allocated a fixed amount of SPS entitlements. Since then, farms can activate the entitlements and receive the SPS if they are *accompanied* by an equal amount of eligible land.[6] This implies that the SPS is indirectly linked to land because, in the absence of land, farms cannot activate (cash in) the SPS entitlements. However, the SPS is not linked to a specific land area – the SPS entitlements can be activated by any eligible farmland in the region. Furthermore, farms can expand or decrease their stock of entitlements by buying or selling entitlements on the market from other farms.

Farm eligibility in the SPS is subject to cross-compliance. Each farm that receives the SPS must comply with the Statutory Management Requirements (SMR), and maintain the agricultural land in Good Agricultural and Environmental Condition (GAEC). The SMR are based on pre-existing EU directives and regulations in the fields of environment, public, animal and plant health and animal welfare. The aim of the GAEC is to prevent the abandonment or severe under-management of agricultural land.

3. Theoretical findings

A set of recent theoretical studies investigated the efficiency and income distributional impact of the SPS introduced by the 2003 CAP reform. These include Ciaian & Swinnen (2006), Ciaian et al. (2008), Courleux et al. (2008) and Kilian & Salhofer (2008). These studies yield several insights.

The impact of the SPS depends on the ratio of the eligible area to the total number of entitlements. If there are fewer entitlements (deficit) than eligible land, the SPS leads to land price increases (i.e. is capitalised in land prices). However, if there are more entitlements (surplus) than eligible land, then the SPS does not cause increases in land prices (i.e. is not capitalised in land

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model, the regional and the historical shares do not change over time (European Commission, 2007).

[6] This setting makes the SPS a different type of subsidy compared to the coupled area payment implemented prior to the introduction of the SPS. Under the coupled area payment, farms receive payments for the entire area they use for eligible crops, whereas with the SPS only a pre-defined quantity of land (determined by the number of entitlements) may obtain payments. Further, the value of coupled area payment does not vary by farm. All farms receive the same value of payment for a given eligible crop in a given region.

values). The relative scarcity of entitlements is crucial. The intuition is that the more entitlements that are allocated to farms (compared to the eligible land), the more farms will compete for the eligible land to activate the entitlements in order to cash the SPS. Hence, if there are more entitlements than land available (a surplus), the increased demand for land will cause land prices to go up. If there are fewer entitlements (a deficit) than available land, there is no such demand and there will be no pressure on land prices.

Table 3.1 reports the number of activated entitlements relative to the utilised agricultural area (UAA) for 17 member states in 2010. Despite some inherent problems with the data, the table suggests some structural differences. In about half of member states reported in the table (mostly those with the hybrid model), farms activated entitlements that roughly correspond to the UAA (e.g. Denmark, Finland, Germany, Greece, Ireland and Sweden), whereas in other member states (mostly with the historical model) the ratio of activated entitlements to UAA is significantly below one (e.g. France, Italy, Malta, Portugal and Spain). This suggests that there may be important differences in the capitalisation rate of the SPS across member states. Theory predicts that capitalisation should be stronger in the first group of countries than the second.

Table 3.1 UAA and SPS activated areas in 2010

	SPS activated area (1000 ha)			Ratio of activated area to UAA (%)		
	2007	2009	2011	2007	2009	2011
Belgium	1168	1151	1153	0.85	0.84	0.85
Denmark	2679	2643	2627	0.99	1.00	0.98
Germany	16737	16731	16658	0.99	0.99	1.00
Ireland	4606	4164	-	1.08	0.99	-
Greece	5537	5774	-	1.39	1.51	-
Spain	14959	15368	16445	0.60	0.64	0.68
France	24151	26140	25730	0.82	0.74	0.88
Italy	8116	8235	8551	0.56	0.62	0.66
Luxembourg	124	124	124	0.94	0.95	0.95
Malta	7	6	7	0.70	0.62	0.62
Netherlands	1285	1348	1369	0.68	0.70	0.74
Austria	2721	2696	2680	0.84	0.85	0.93
Portugal	2418	2342	2295	0.66	0.63	0.64
Slovenia	428	444	435	0.86	0.95	0.95
Finland	2304	2288	2277	1.02	1.00	0.99
Sweden	3146	3036	2991	1.01	0.99	0.98
UK	15294	14867	15151	0.86	0.86	0.88

Note: This table reports only the number of activated entitlements, which is different from the total allocated entitlements. Farmers may also hold additional entitlements, which they may not be able to use due to the unavailability of eligible land and their sale could be potentially constrained by imperfections in entitlement markets and uncertainties related to future CAP changes (Ciaian et al., 2010). The data on the amount of these unused entitlements are not available. In principle, the SPS activated should not exceed the UAA, whereas the total allocated entitlements may exceed the UAA. Note that the number of activated areas for SPS may exceed the UAA in the case that farmers receive entitlements on common land (e.g. Greece).

The UAA may not exactly correspond to the eligible area. According to the European Commission, "eligible land means any agricultural area of the holding, and any area planted with short rotation coppice, that is used for an agricultural activity or, where the area is used as well for non-agricultural activities, predominantly used for agricultural activities" (European Commission, 2013).

Source: SPS entitlements: European Commission; UAA used to calculate the ratio of activated area to UAA: Eurostat. If data were not available for a given year, the value from the previous year was used.

The share of the payments that is capitalised in land values is larger for smaller payments (endowment values) than for larger. As farms with high value entitlements compete with farms with low value entitlements, farms owning high value entitlements can afford to pay higher rents, but will only bid up the rent to the maximum that the low value entitlements can (no longer) afford. Therefore, the low value entitlements will determine the SPS capitalisation at the margin.

Capitalisation of SPS in land prices will be stronger in the regional SPS model than in the historical SPS model. The different models are reflected in differences in the SPS entitlements between farms. With the regional model, there is no difference in SPS entitlements among farms, while there may be large differences with the historical model. An implication of the previous point is that the larger the differences between farms in SPS entitlements, the smaller the capitalisation of the SPS, because the smallest value will determine the level of capitalisation.

Capitalisation of SPS in land prices will be affected by the tradability of entitlements under some conditions. If the eligible area is larger than the total number of entitlements, then with full tradability of entitlements there is no capitalisation of the SPS into land values.[7] However, the more difficult it is to trade entitlements, the more the SPS becomes capitalised into land

[7] With surplus entitlements, SPS is capitalised anyway so tradability is less important in this case.

values. With low tradability, farms are more likely to keep their entitlements (instead of selling them) and to use them to compete for land, which exerts an upward pressure on land prices. In other words, entitlements indirectly become farm specific or practically attached to the farmer's land if trade is constrained. In contrast, facilitation of entitlement trade may actually play a role in reducing potential SPS capitalisation as it will reduce pressure of the SPS on land markets. In principle, full tradability cuts the link between land use decisions of farmers and their decision to hold or sell (or lease) entitlements.

Ciaian et al. (2010) document differences among the EU-15 member states in the restrictions on trading SPS entitlements. EU regulations allow entitlements to be tradable, but under certain constraints. 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.

Capitalisation of the SPS in land prices is higher when:

- *The supply of land is less elastic (i.e. when it is difficult to use more land)*. In the extreme case, with fixed land supply, the SPS gets fully capitalised in land prices, i.e. all the subsidies go to the landowner because the land rent increase equals the subsidy per hectare. This result holds only if there are sufficient entitlements. In empirical studies, land supply elasticities are usually found to be rather low, mostly owing to natural constraints.[8]
- *The substitution between inputs in the production process is more elastic (i.e. when it is easy to use land instead of other inputs).* 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. Where there is high elasticity of substitution between land and other inputs, the impact of an area subsidy on land values that is induced will be large.[9]

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[8] For example, based on an extensive literature review, Salhofer (2001) concludes that a plausible range of land supply elasticity for the EU is between 0.1 and 0.4. Similarly, Abler (2001) finds a plausible range between 0.2 and 0.6 for the US, Canada and Mexico.

[9] 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

Capitalisation of the SPS in land prices is lower with cross-compliance. Cross-compliance requirements imply additional costs to land users, which reduce the demand for land and thus the (positive) effects of the SPS on land rents will be smaller.

Capitalisation of the SPS in land prices is lower when land prices are regulated. Land market regulations in the EU-27 vary strongly among member states. Of particular importance for the SPS capitalisation are *maximum price regulations*. The potential capitalisation of the SPS into land rents will be reduced in the presence of a rental price ceiling as exists, for example, in Belgium, France and the Netherlands. On the other hand, to overcome the rental price regulation (i.e. the maximum price intervention), farmers will have the incentive to pay unofficial payments (bribes) to landowners to prevent the loss of land to competing farms.[10]

Capitalisation of the SPS in land prices is higher when SPS reduces credit constraints. Many farms, in particular in the poorer rural regions of the EU, face credit market constraints. Access to cash payments (the SPS) may reduce these credit market constraints either directly, or indirectly through easier access to bank loans.[11] This will increase capitalisation of the SPS because it increases the demand for land.

(Changes in) capitalisation of the SPS in land prices is more gradual with long-term rental contracts. The length of the rental contracts can vary strongly – and, often because of regulations, varies strongly among member states.[12] With short-run contracts (as in Ireland), average rental price adjustments can occur quickly; with long-term contracts (as in Belgium and France), average rental price adjustments will occur more slowly.

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and variable inputs of 1.4 for Europe. Similar values are reported in Abler (2001) for the US and Canada.

[10] Anecdotal evidence suggests that this indeed happens in countries with strong rental price regulation (Ciaian et al., 2010).

[11] Ciaian & Swinnen (2009) explain how SAPS payments can be used as collateral for working capital in the new member states.

[12] According to Ciaian et al. (2010), the key determinants of rental contract durations in the EU are social norms (e.g. in Greece), governmental regulations (e.g. there is a minimum of nine years in Belgium and France, six years in the Netherlands, and five in Spain), and market institutions (e.g. Germany, Italy and Sweden). Moreover, in several countries (e.g. France) even the renewal of rental contracts is regulated.

4. Empirical findings

Although there is an extensive empirical literature on subsidy capitalisation, to our knowledge only three studies have estimated the effect of the SPS on land values (Kilian et al., 2012; Michalek et al., 2013; Johansson & Nilsson, 2012).

Kilian et al. (2012) analyse capitalisation of the SPS in land rental prices in 2005 in Bavaria, which implements the regional SPS model. They find that 44% to 94% of the direct payments are capitalised into land rental prices. This is similar to pre-2003 direct payments capitalisation rates found in earlier EU studies (around 40%),[13] although Kilian et al. (2012) find that decoupling of support increased the capitalisation ratio by more than 15% in Bavaria. Johansson & Nilsson (2012) use sales price data for the period 2007-08, and find a relatively high SPS capitalisation in Sweden. The elasticity of agricultural land price with respect to the SPS is estimated at 0.62, i.e. a 1% increase in the SPS increases land sale price by 0.62%. Michalek et al. (2013) estimate the capitalisation of the SPS into land rents using farm-level data across the EU-15 for the early period of the SPS implementation (2004-07). They find much lower estimates: the average level of capitalisation is only 6%.

However, Michalek et al. (2013) also show that there is a significant variation in capitalisation in the EU-15, both among regions and among farms. Moreover, the variation is consistent with theoretical predictions with respect to lower a capitalisation rate under the historical compared to the regional model; the hybrid model has a higher capitalisation rate than the historical model.

This is also consistent with the findings of Johansson & Nilsson (2012) for Sweden and Kilian et al. (2012) for Bavaria (Germany). The fact that they find much higher SPS capitalisation rates is consistent with i) the implementation model – Sweden uses the hybrid model and Bavaria the regional model, both of which are expected to have higher capitalisation than historic models; and ii) the fact that in both Sweden and Germany the entitlement/UAA ratio is (almost) one (see Table 3.1), which, according to

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[13] Patton et al. (2008) on Northern Ireland from 1994 to 2002 and Breustedt & Habermann (2011) for 2001 in Germany find strong capitalisation rates for pre-2003 direct payments. They both estimate that around 40% of direct payments were capitalised in land rents.

the underlying theoretical framework, is also expected to cause higher capitalisation.

Michalek et al. (2013) also find that capitalisation is considerably higher for low levels of the SPS than for high levels, which is consistent with theoretical predictions on the historical SPS model: low SPS levels will determine the level of capitalisation (at the margin). The capitalisation rate varies between 11% and 94% for SPS smaller than €200/ha – representing around 43% of land area (and 51% of the farms) in the EU-15. For larger payments (i.e. SPS greater than €200/ha), the capitalisation rate is below 11%.

The estimates also depend on the timing of the effects. As rental contracts are typically for more than one year, the impact on land rents may take some time to materialise. Studies which focus specifically on short-term or new contracts find much higher capitalisation rates. For example, Patton et al. (2008) only include farms with rental contracts of one year in their analysis of Northern Ireland, and exclude all longer-term rental contracts. They find that the capitalisation of land-based subsidies is more than 100%. Kilian et al. (2012) also find that the SPS capitalisation effect is significantly higher for newly signed rental contracts in Bavaria.

For obvious reasons, land regulations may constrain capitalisation. Ciaian et al. (2010) confirm that land regulations in France have lower land prices (and constrain their increase).

The empirical estimation of the impact of cross-compliance costs is complicated, because their direct measurement is difficult. These costs are linked to farms' decisions on input allocation and production choices. They influence farm activities both directly by impacting the intensity of inputs, farm management practices and production, and indirectly through secondary effects on farm productivity.[14] That said, Michalek et al. (2013) provide some indirect evidence that cross-compliance costs may indeed reduce the land rents in the EU-15. Similarly, Johansson & Nilsson (2011) in their study on land values in Sweden and Kilian et al. (2012) in their study on land rents in Germany find that agro-environmental payments are

[14] For example, cross-compliance costs related to environmental requirements are the sum of the direct input use effects (e.g. reduced use of fertilizers) and change in management practices and the indirect productivity effects induced by changes in input use and management practices. For this reason, it is difficult to separate them from regular farm practices and quantify their impact on land rents.

negatively correlated with land prices, which suggests that the SPS is not sufficient to cover the additional costs associated with cultivating plots eligible for this type of payments.

5. Conclusions

The objective of this chapter is to analyse the income distributional effects in the EU decoupled payments – the SPS – implemented under the CAP. We present both theoretical and empirical findings on the impact of SPS on land values.

There is significant capitalisation of the SPS in the EU, but with strong variation among regions and among farms. The impact of the SPS on land prices depends (inter alia) on the ratio of land entitlements to eligible land, (for SPS) the implementation model (historical vs. regional), (for SPS) the tradability of the entitlements, the elasticity of land supply, cross-compliance requirements, land market regulations, credit market constraints, the length of the rental contracts, and so on.

Theoretical findings suggest that the entitlement stock effect, barriers to entitlement trade and credit market imperfections and low land supply elasticity increase the capitalisation rate of the SPS, whereas cross-compliance, the tradability of entitlements, variation in the face value of entitlements, land market institutions and regulations reduce the capitalisation rate of the SPS. These results suggest that the particular details of the SPS have highly important implications: farmers' benefits can range from 100% of the SPS value to a negative policy incidence.

Empirical studies find that between €0.06 and €0.94 per additional euro of SPS is capitalised in land prices in the EU, in other words, each additional euro of SPS leads to an increase in land rents of between €0.06 and €0.94. There is stronger capitalisation under the hybrid model than under the historical model and low value entitlements are capitalised more than high value entitlements.

Understanding the relationship between the SPS and land values is relevant in the context of the 2013 CAP reform. The 2013 CAP reform changes both the implementation of the SPS and its budget. Some measures, such as the shift from an historical to a regional SPS, will induce a harmonisation of payments across member states and across farms, while other reforms, such as the progressive reduction of the SPS per farm, will cause an increased differentiation in per hectare SPS. Other reform issues relate to the linkage of the so-called 'CAP greening', the reference period for entitlement allocation and the definition of farms eligible for SPS. As indicated in this chapter, different implementation of the SPS leads to a variation in its effect on land values, indicating that the changes introduced by the 2013 CAP reform may have important implications for EU land markets.

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4. THE IMPACT OF THE CAP ON LAND RENTS AND LAND ALLOCATION

PAUL FEICHTINGER AND KLAUS SALHOFER[*]

This chapter investigates the impact of different CAP support measures on land rents and land allocation, explicitly taking land heterogeneity into account. Price support before the 1992 MacSharry reform, area payments as implemented in the CAP, and SFPs in the historical model all favour land of higher quality (productivity). This is not true for uniform area payments, but holds true for the way area payments are implemented in the CAP. In contrast, SFPs in the regional model and uniform area payments uniformly distribute support with respect to land quality. With regard to land allocation, the authors were able to show that price support will change land use to a smaller extent than uniform area payments. SFPs do not change land use compared with a situation without support, as long as all land uses are entitled to payments. However, SFPs do change land use compared with the situation before the 2003 reform. Some of the land is idled or converted from crop to grassland.

1. Introduction

The EU has devoted a considerable share of its budget to supporting European agriculture throughout its history. After decades of price support and a decade of coupled direct payments (e.g. area payments and animal payments), the 2003 Fischler reform introduced decoupled direct payments (single farm payments, or SFPs). The aim of this chapter is to investigate the impact of these different governmental support measures of the Common Agricultural Policy (CAP) on land rents and land allocation, explicitly taking into account that land is a production factor of

[*] This chapter is based on Feichtinger & Salhofer, "Influence of the Common Agricultural Policy and Heterogeneous Land Quality on Land Rent and Land Allocation", Factor Markets Working Paper No. 38, March 2013.

heterogeneous quality. While algebraic solutions are provided in Feichtinger & Salhofer (2013), in this short summary we concentrate on a graphical presentation of our results. After introducing the model in Section 2, we present the impacts of different policies in Section 3 before we finish with some conclusions.

2. Ricardian land rent model

Ricardo (1817) defines rent as "that portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of the soil". In other words, Ricardian land rent is the residual returns to land after the costs for all other factors of production are subtracted (Featherstone & Baker, 1988).

Line *R* in Figure 4.1 depicts the Ricardian land rent for different land qualities in a simplified manner. The underlying model by which *R* is derived is based on a Cobb-Douglas production technology with a fixed (land) and a variable (non-land) production factor and constant returns to scale (Feichtinger & Salhofer, 2013). Farmers are assumed to maximise profits and land heterogeneity is considered by a linearly decreasing function following Lichtenberg (1989). While the Ricardian land rent is measured along the vertical axis, the available amount of land (A^{max}) is depicted on the horizontal axis, with the quality of land continuously decreasing from left to right. *R* represents the land rent or the value of marginal product of the input land for heterogeneous land quality and without any government intervention (von Witzke et al., 2007). *R* can also be seen as a demand curve representing the maximum willingness to pay for renting land of a specific quality for one period.

Before the 1992 MacSharry reform of the CAP, price support was the most common instrument. After the McSharry reform, per acreage area payments became prominent. The 2003 Fischler reform introduced decoupled SFPs, which farmers receive by activating their SFP entitlements and farming a corresponding number of hectares of eligible land. Ciaian et al. (2008), Courleux et al. (2008) and Kilian et al. (2012) pointed out that the effect of these payments on land rents and land prices crucially depend on the implemented model (regional, historical, hybrid) and the ratio between entitlements and eligible area. Swinnen et al. (2009) reported that total distributed entitlements exceeded or were close to the eligible area in Finland, Belgium, France, Germany, Northern Ireland and Scotland in 2007. Furthermore, they reported a considerable share of unactivated entitlements, ranging from 0.9% to 6.8% for all studied countries. Salhofer et al. (2009) found a small entitlement surplus for Germany in 2005, the first year under the Fischler reform. Given this, we consider only the case of the number of entitlements being equal to or higher than the eligible area.

Courleux et al. (2008) and Kilian et al. (2012) find that in the case of no entitlement shortage, SFPs are similar to direct payments per acreage. Under the regional model, payments per acreage are uniform and hence coincide with the case of "uniform" area payments. Under the historical model, payments per acreage vary.

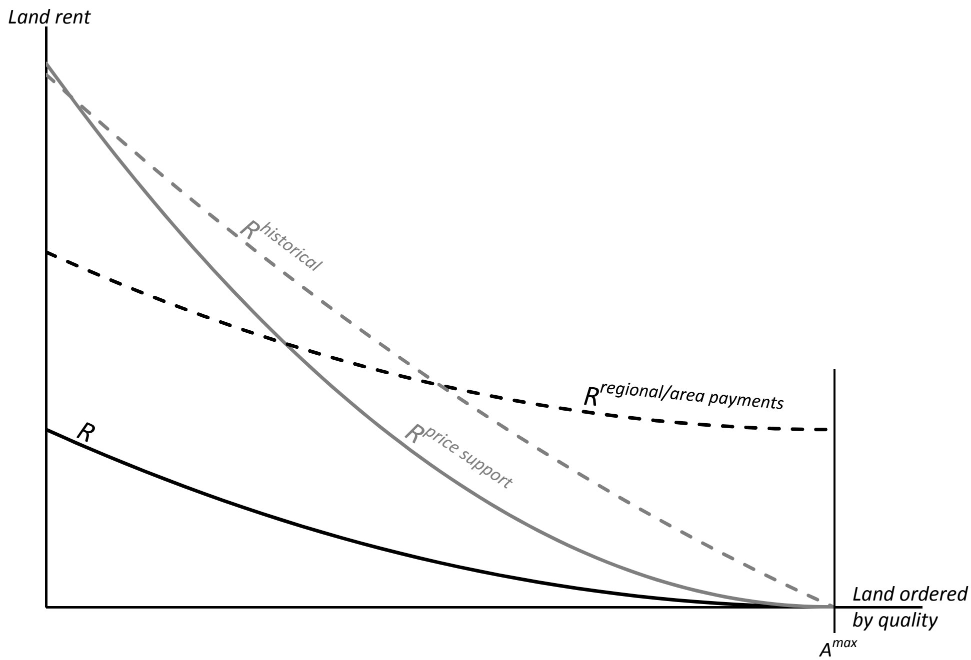
For simplicity we assume here that SFPs depend linearly on land quality. The rational for this assumption is that entitlement values were derived from the payments received in the reference period 2000 to 2002 and at that time, area payments for cereals and corn and slaughter premiums for bull fattening accounted for the largest share of CAP spending (Gay et al., 2005). Arable farming and intensive bull fattening tend to take place on higher quality land. In addition, the area payments as implemented in the CAP after 1992 were based on historical average yields, implying higher payments per acreage for higher quality land. Moreover, as part of the sugar market reform in 2006, compensation payments for price cuts were also included in SFPs and sugar beet production usually takes place on higher quality land. All these arguments support our assumption of a strong positive correlation between land quality and entitlement values under the historical model. This contrasts with the argument that dairy farmers, who use a considerable share of Middle Europe's grassland, received a dairy premium which was fully implemented into SFPs in 2007. However, even for Bavaria, an agricultural region dominated by dairy farming, we find a medium-to-strong positive correlation between soil quality and SFPs.

Based on this, we consider three different stylised policy instruments: (i) a price support policy, where the producer price is set (or subsidised) at a level above the market price; (ii) uniform area payments, implying the same effects as SFPs under the regional model; (iii) SFPs under the historical model.

3. Effects of policies on land rents and land allocation

The effects of these policy measures on land rent are depicted in Figure 4.1. In the case of uniform area payments and SFPs in the regional model, Ricardian land rent increases by the same amount for all acreages, independent of land quality. The rent function R is shifted upwards in a parallel manner to $R^{regional/area\ payments}$. In contrast, a price support policy clearly favours land with higher productivity. Hence, we observe a rotation of the rent function to $R^{price\ support}$ rather than a shift. It is debatable to what extent the area payments policy of the 1992 MacSharry reform and the AGENDA 2000 reform can be represented by our $R^{regional/area\ payment}$ function. Area payments in the CAP were defined by a payment per tonne multiplied by the average historical yield of a region. Hence, one could argue that land quality still played a major role in the amount of payment per acreage and that the reform did not change the distribution of rents among different land qualities. In this case, the distribution of rents between the 1992 MacSharry reform and the 2003 Fischler reform remained close to $R^{price\ support}$ rather than to $R^{regional/area\ payments}$.

Figure 4.1 Land rent function under different policies



As with price support, higher quality land also benefits more per acreage than lower quality land with SFPs in the historical model, as depicted by $R^{historical}$. The difference between $R^{historical}$ and $R^{price\ support}$ depends on the extent to which SFPs in the historical model correlate with land productivity. Given that rents under price support were transferred directly into yield-dependent area payments later on, we can also expect SFPs in the historical model based on these payments to follow a similar distribution with regard to land quality.

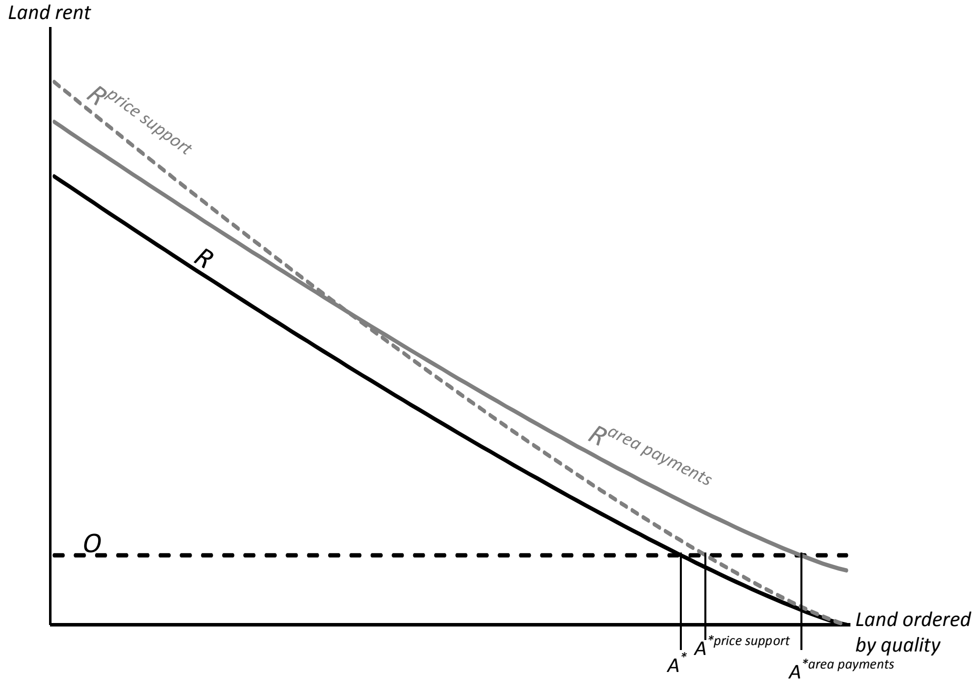
Therefore, what should become clear from the discussion of Figure 4.1 is the difference between the regional model (or uniform area payments) and all the other CAP support measures, which favour high quality land.

While our analysis so far has been concerned with the effects of policy instruments on land rents under a given land use, in most cases farmers face more than one production possibility and therefore have to decide how to allocate their land. To analyse the effects of different policy measures under alternative land uses, we introduce an outside option with a constant per acreage rent independent of land quality. Our model can illustrate, in a very stylised way, the fact that good quality land can be used for crop farming where rents vary considerably with land quality, with extensive grassland use as an outside option where land quality does not play a (considerable) role. It is also a stylised presentation of a situation where the amount of land under production is not fixed, since the outside option could be to take land out of production.

In this extended model, a farmer is assumed to maximise total profits by allocating land between the two different utilisations in an optimal way. We assume the outside option to be eligible to receive SFPs, but not area payments or price support. Figure 4.2 shows the land rent function for producing the "regular" output (R) and the outside option (O). A^* denotes the land quality where the land use changes without any government support.

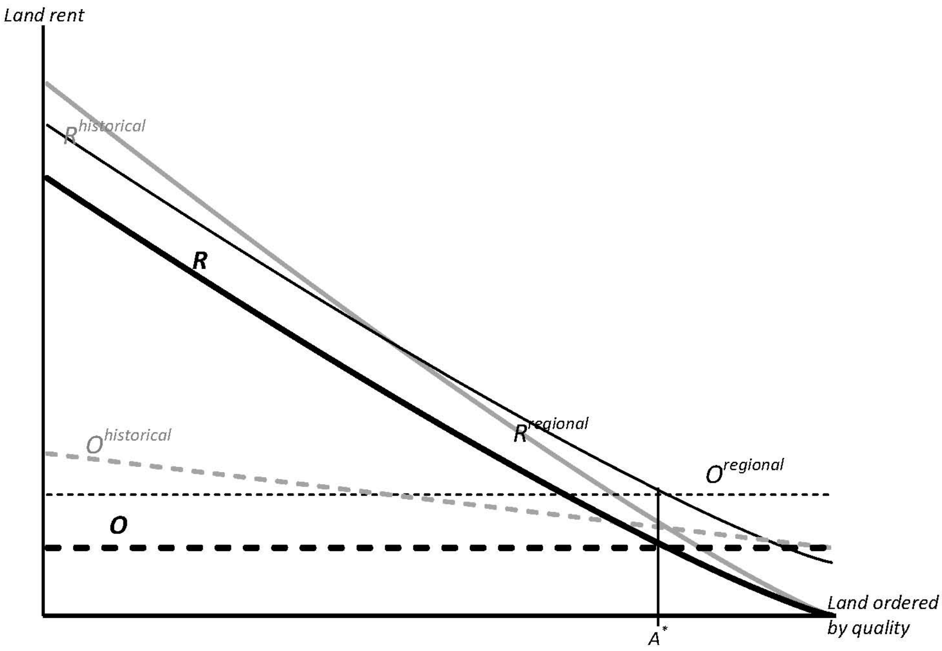
Allocation changes induced by price support ($R^{price\ support}$) and uniform area payments ($R^{area\ payments}$) are also illustrated in Figure 4.2. Both policies shift some land away from the outside option and into production of the regular output. Uniform area payments do this to a greater extent (from A^* to $A^{*area\ payments}$) than price support (from A^* to $A^{*price\ support}$), since the support of low quality land is higher with area payments.

Figure 4.2 Influence of price support and area payments on land allocation



During the implementation of SFPs as the core innovation of the 2003 Fischler reform, countries were generally able to choose between a regional and a historical model. Figure 4.3 shows that with the introduction of the regional or the historical model, both rent functions, producing the "regular" good ($R^{historical}$, $R^{regional}$) and the outside option ($O^{historical}$, $O^{regional}$), are shifted. This shift is parallel with the regional model, but not with a historical model. As both land uses are subsidised, land allocation does not change and remains at A^*. Furthermore, in the historical model both curves are steeper and as with price supports, therefore, higher quality land is subsidised disproportionally higher than land of lower quality.

Figure 4.3 Influence of SFPs in the regional model and the historical model on land allocation



4. Conclusion

Over many decades, government support for EU farmers played a central role in the CAP. Major changes occurred in 1992 – from price support to coupled direct payments – and in 2003 (implemented in 2005) – from coupled to decoupled payments. The objective of this chapter was to investigate the impact of different government support measures on land rents and land allocation, explicitly taking into consideration that land quality is heterogeneous.

Our main findings can be summarised as follows. Price support before the MacSharry reform, area payments as implemented from 1992 onwards and SFPs in the historical model all distribute farm support unequally with respect to land quality. All three support schemes favour land with higher productivity. This is not true for uniform area payments, but holds true for the way area payments were implemented in the CAP. In contrast, SFPs in the regional model (and uniform area payments) uniformly distribute support with respect to land quality. Which support is preferable depends crucially on policy objectives. Lower land quality often correlates with lower farm income. To this extent, policies favouring higher quality land may increase income inequalities in the sector and seem inappropriate, or at least inefficient, to support low income.

With regard to land allocation, we were able to show that price support will change land use to a lesser extent than uniform area payments, since the latter support low quality land more. If one has the goal of keeping as much land as possible in production, then area payments on land, independent of land quality, are favourable. Even more efficient would be a targeted subsidisation of lower quality land (e.g. less-favoured areas payments). SFPs do not change land use in comparison to a situation without support, as long as all land uses are entitled to payments. However, SFPs do change land use in comparison to the situation before the 2003 reform. Some of the land is shifted to the outside option, and hence might be left idle or converted from crop to grassland.

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5. Direct Payments and Land Rents: Evidence from New Member States

*Kristine Van Herck, Johan Swinnen and Liesbet Vranken**

This chapter analyses the impact of direct payments (DPs) on land rents in the new EU member states. Land rents and direct payments increased strongly at the time of EU accession. The authors estimate that up to 25% of DPs is capitalised in land rents. In addition, the results show that capitalisation of DPs is higher in more credit-constrained markets, while capitalisation of DPs is lower in countries where more land is used by corporate farms, reflecting a stronger bargaining position of corporate farms in these countries. These results imply that the functioning of other markets (in particular, rural credit markets) not only affect access to land by farmers and structural change, but also influence the distributional effects of agricultural subsidies.

1. Introduction

The influence of agricultural subsidies on land prices is important for two reasons. First, a general purpose of agricultural subsidies is to increase farmers' incomes. However, the positive income effects can be eroded if subsidies are capitalised in land sales and rental prices. Second, an increase in land sales and rental prices affects land mobility and hence farm restructuring. New farmers face a higher initial investment cost and existing farmers face a higher cost of expansion. Consequently, the transfer of land from less to more efficient users is reduced, which has a negative impact on structural adjustments in the agricultural sector.

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* This chapter is based on Van Herck, Swinnen & Vranken, "Direct Payments and Land Rents: Evidence from New Member States", Factor Markets Working Paper No. 62, August 2013.

Several studies have analysed the impact of subsidies on land sales and rental prices (Floyd, 1965; Goodwin & Ortalo-Magné, 1992; Hennessy, 1998; Lence & Mishra, 2003; Guyomard et al., 2004; Chau & de Gorter, 2005; Ciaian & Swinnen, 2006; 2009; Kirwan, 2009; Latruffe & Mouël, 2009). The vast majority of the empirical studies have dealt with the land market in North America (the US and Canada)[15] and, in recent years, the EU-15 (Patton et al., 2008; Ciaian et al., 2010; Breustedt & Habermann, 2011; Kilian et al., 2012).

In this chapter, we estimate the second order effect of agricultural subsidies on the rural land market in several new EU member states (EU-NMS). These data are particularly interesting for studying the influence of agricultural subsidies on land prices because EU accession resulted in a considerable change in the level of subsidies paid. In the period 2000–08, a strong and persistent increase in land rental prices is observed in all EU-NMS, which was especially strong around the period of EU accession. Figures 5.1 and 5.2 show that there was a strong increase in land rental prices just after accession, which coincides with an increase in direct payments (DPs) in the same period. Hence, EU accession can be considered a quasi-natural experiment to estimate the impact of the increase in DPs on land rental prices.

To our knowledge, there is only one other study that analyses the impact of DPs in the EU-NMS. Ciaian & Kancs (2012) investigate the impact of the Single Area Payment Scheme (SAPS), a system of DPs introduced in the EU-NMS, based on farm-level panel data for the period 2004–05. Our paper complements this study in three ways. First, country-level subsidy data are used in this study, which allows us to exploit variation in the level of agricultural subsidies across countries. This is particularly relevant when estimating the impact of SAPS on land rental prices because, in the case of SAPS, there is no variation in the per hectare subsidy among farms within one country. Second, by covering the period 1994–2009, both the post-accession period and the pre-accession period are included. Third, while Ciaian & Swinnen (2006; 2009) have shown theoretically that credit and land market imperfections may affect capitalisation of agricultural subsidies into land prices, this study is the first to analyse this empirically.

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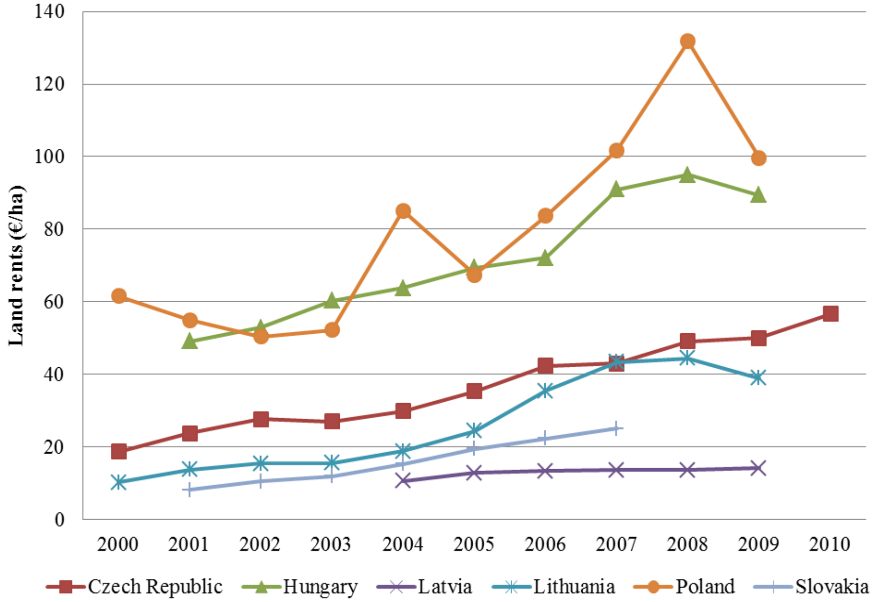
[15] See, for example, Barnard et al. (1997), Lence & Mishra (2003), Goodwin et al. (2003), Goodwin et al. (2005), Kirwan (2009), Goodwin et al. (2011), Kirwan & Roberts (2010), Hendricks et al. (2012), Kropp & Peckham (2012) and Vyn et al. (2012).

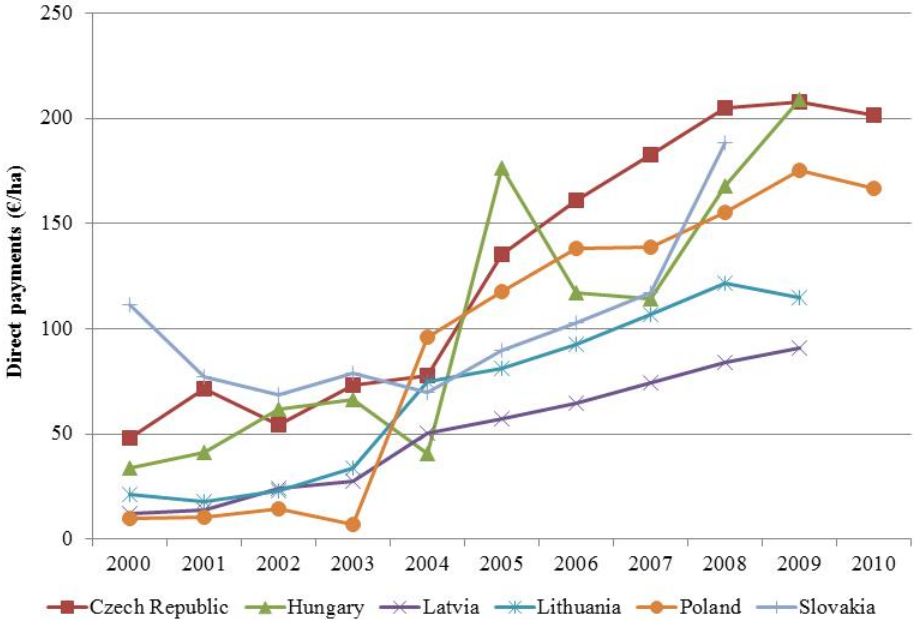
Figure 5.1 Evolution of land rents in the selected NMS (€/ha)



* Rental prices are real 2010 prices.

Source: authors' calculations based on the constructed sample.

Figure 5.2 Evolution of DPs in the selected NMS (€/ha)



* DPs are real 2010 prices.

Source: authors' calculations based on the constructed sample.

2. Empirical approach

The sample used in the empirical analysis includes 6 NMS: the Czech Republic, Hungary, Latvia, Lithuania, Poland and Slovakia. We use yearly data from 1997 to 2009 for the Czech Republic, from 2001 to 2009 for Hungary, 2004 to 2009 for Latvia, from 2000 to 2009 for Lithuania, from 1994 to 2009 for Poland, finally from 2001 to 2007 for Slovakia. This results in an unbalanced panel data set with 61 observations.

To control for time-invariant unobserved heterogeneity, which may lead to an inconsistent estimate of the capitalisation rate, we control for country fixed effects. The fixed effects capture all time-invariant heterogeneity between countries such as soil characteristics, environmental and climatological conditions as well as time-invariant differences in regulations and institutions. Further, we also control for a number of other factors, such as for example agricultural yields, farm income and EU accession.

3. Empirical results

We find that DPs have a positive and significant impact on land rents, indicating that there is rent extraction of government payments by landowners. This impact is not only statistically significant, but is also economically significant. An increase of one additional euro per hectare in DPs increases land rents by 13 to 25 euro cents, corresponding to a capitalisation rate of 13% to 25%. Since renting is widespread in several EU-NMS and most landowners are absentee landowners who live in urban areas or who are no longer active in agriculture, the payments will flow out of the agricultural sector and are, to a large extent, missing their goal of improving the livelihoods of rural inhabitants.

In addition, we find that the level of capitalisation depends on market imperfections. In particular, credit market imperfections are important as well as the country's farm structure, which affects transaction costs and imperfect competition (bargaining position) in the land rental market.

Capitalisation of DPs is higher in more credit-constrained markets, with the level of capitalisation ranging from 40 euro cents (in the case of poorly functioning credit markets) to 16 euro cents per additional euro of DPs (in the case of well-functioning credit markets). DPs may reduce farmers' credit constraints, for example because farmers may use them as collateral for bank loans (Latruffe et al., 2010). As a consequence, the marginal productivity of agricultural land increases which will in turn boost the demand for agricultural land, as theoretically shown by Ciaian & Swinnen (2009).

With respect to farm structure, we find that capitalisation of DPs is lower in countries characterised by a significant share of agricultural land used by corporate farms, reflecting a stronger bargaining position of the farmers. Per additional euro of DPs, the level of capitalisation in the land rental price ranges from 21 euro cents, if all land is used by individual farmers, to 4 euro cents if all land is used by corporate farms. Hence, in the countries where the farm structure is dominated by corporate farms, the level of capitalisation of DPs is found to be lower, suggesting that transaction and stronger bargaining positions of the tenants temper capitalisation.

4. Conclusion

In this chapter, we analyse the impact of increasing DPs on land rents in six new EU member states. In these countries, agricultural subsidies largely increased as a result of their EU accession. We find that up to 25% of DPs is capitalised in land rents. In addition, the results show that capitalisation of DPs is higher in more credit-constrained markets, while capitalisation of DPs is lower in countries where more land is used by corporate farms, reflecting a stronger bargaining position of corporate farms in these countries.

All this clearly illustrates the importance of reforms focused on improving the bargaining position of farms and on improving access to input and output markets, and particularly credit markets, as well as of reforms of sectors 'surrounding agriculture'. Such reforms are not only crucial to improve access to land by farmers and to induce structural change in the sector, but also to ensure that agricultural subsidies are not missing their goal of improving the livelihoods of rural inhabitants in the EU-NMS.

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6. THE IMPACT OF THE 2013 CAP REFORM ON LAND MARKETS IN ITALY

DAVIDE VIAGGI, FABIO BARTOLINI, MARCO PUDDU AND MERI RAGGI[*]

The connection between policy and other context variables and land markets is at the core of the policy debate, including the present reform of the Common Agricultural Policy (CAP). The current proposals for the post-2013 CAP will include the switch of the payment regime from an historical to a regional basis. This component, as well as the greening and other 'micro-provisions' can have an effect on the land markets. The objective of this chapter is to assess the potential impact of the proposed policy reform (in particular concerning the regionalisation of payments) on the land market. Attention will focus on changes in propensity to rent-in and out and in transactions due to the proposed provisions for the post-2013 CAP. To achieve this goal, the authors jointly use: a) a survey of farmers stated intention, and b) a mathematical programming model simulating the land markets in different policy scenarios. Both are applied to a case study at the scale of the province of Bologna, Italy (NUTS 3). The results of the model corroborate the results from the survey, though the model is much more reactive to policy changes, while the survey has a larger share of "no changes". Both hint at a relevant reaction of the land demand and supply to the shift from the historical to the regionalised payments, due to the differentiated and opposite effects that the reform would have on different farm types and sub-regions. The payment would be more capitalised into the land value, at the margin, as long as it is less constrained by the ownership of entitlements. As an effect, the regionalisation would potentially result in increased rental prices and in a tendency to re-allocate land.

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[*] This chapter is based on Viaggi, Bartolini, Puddu, Minarelli & Raggi, "The Impact of the SFP System on Italian Farmland Prices and Tenure Contracts", Factor Markets Working Paper No. 65, August 2013.

1. Introduction

The agricultural economics literature has highlighted the effects of the Common Agricultural Policy (CAP) on factor markets (Ciaian & Swinnen 2006; Bartolini et al., 2011) and, specifically, it has studied the way in which the CAP reforms have changed these effects over time. Many papers show a close relationship between the effects of policy on the production factors prices, which are consequences of supply elasticity as well as of factor substitution possibilities (Floyd, 1965; Bierlen et al., 2000; Goodwin et al., 2003; Ahearn et al., 2005; Latruffe & Le Mouël, 2009). Several works aim to estimate the effect of policy payments in terms of their capitalisation into land value or land rental prices, and to calculate a share of capitalisation depending on type of policy support (Ciaian & Swinnen, 2006; Courleux et al., 2008; Latruffe & Le Mouël, 2009).

The literature also underlines the effect of policy changes on the reallocation of productive factors over time (Bartolini et al., 2011). Several papers in particular analyse the effects of decoupling, introduced in 2003 by the Fischler reform, on the dynamics of the exchange of land. They aim to identify the determinants of capitalisation of payments into land prices, including the distribution of payments between beneficiaries, in connection with the possibility of exchange of entitlements and in relation to the ratio between eligible area and number of entitlements owned (Le Mouël, 2006; Balkhausen et al., 2008; Courleux et al., 2008; Kilian & Salhofer, 2008; Viaggi et al., 2010).

Studies focusing on the effect of different policy scenarios on the changes in land demand or land rented/sold are often derived from or are expressed through changes in the marginal value of land (Viaggi, 2009; Bartolini et al., 2011). Mathematical programming models have been used to simulate the impact of policy reforms considering also changes in farm size under different price, policy, and cost scenarios.[16] This typology of models also has an important use in analysing competition for land allocation between different farms, measuring the effects of drivers of changes through the marginal value of land (Galko & Jayet, 2011). Finally, some studies using these instruments aim to investigate farmers' investment (including land) behaviour and to evaluate the impact of different CAP scenarios, with a special focus on the Single Payment

[16] See Zimmerman et al. (2009) for a review of relevant models applied to structural change

Scheme, to contribute to the understanding of the relation between policy design and farmers' behaviour (Gallerani et al., 2008b; Viaggi et al., 2011b).

Several papers also use econometric models to address the effects of changes in policy mechanisms or property rights systems on the number of land markets transactions (Bierlen et al., 2000; Le Mouël, 2006; Ciaian et al., 2008; Gallerani et al., 2008a; Jin & Jayne, 2011). In some cases, the analysis rests on surveys of intentions, for example to investigate farmers' decisions on land idling in a 2003 CAP reform scenario (Bougherara & Latruffe, 2010), or to identify the determinants of intended changes in farm size under two different CAP scenarios – Health Check and the complete abolition of CAP payments) (Bartolini & Viaggi, 2013). Transaction costs in land exchange and imperfections of the land markets, such as imperfect competition, can be very significant. This has proved to be particularly relevant in developing land markets, such as those of central and eastern European countries (CEECs), where the combination of imperfect competition and transaction costs has a strong impact on land prices (Swinnen, 1999; Ciaian, 2007).

Given the complexity of factors affecting land markets and the impact of policy, ex-ante estimation of the impacts of policy changes always remains difficult. In this respect, survey-based stated intentions and modelling-based simulations may yield different but complementary results (Viaggi et al., 2011a).

The objective of this chapter is to evaluate the impact of the post-2013 CAP policy instruments on the land market in the province of Bologna, Italy. Attention is particularly focused on the regionalisation of the single farm payment regime. To pursue this objective, this chapter combines insights from a survey carried out in Bologna to understand the effect of the reform through stated intentions of the farmers (Raggi et al., 2013) with a modelling simulation exercise carried out in the same province. The modelling component builds on a previous paper (Puddu et al., 2012), and the farm household investment model of the paper has been revised and extended in order to simulate the demand curve for land by individual farms in different policy scenarios.

On the practical side, the chapter aims to contribute an ex-ante understanding of the potential effects of the reform on land values and propensity for transaction. From the methodological point of view, the chapter aims to explore different ways to integrate very detailed farm-level investment model output and survey information in more simplified farm models suitable for providing regional simulations concerning land markets.

In the next section, we first recall the main features of the post-2013 CAP reform. In the subsequent section, we describe the methodology, followed by the main results. After that, we provide a discussion, followed by conclusions and final remarks.

2. The direct payment in the post-2013 CAP reform

At the time this work was carried out, the most up-to-date information about the post-2013 CAP was available from the official proposal published in October 2011 (COM(2011)625/3). In Italy, it will include the switch of the payment regime from an historical to a regional basis. The regionalised payment is a homogenous payment per hectare for farms in the same region, and will be distributed on the basis of the farm area on which some agricultural activity is carried out. This payment will then lose the connection with the per hectare payment in the three-year reference period (2000-02) and the entitlements owned by the farmers. In addition, the farmers can obtain payments on all of their operated land area. The mechanism of payment will be based on disentangling the single farm payment into four separate components: basic payments, a greening component, payments to less-favoured areas, and payments to young and small farms. The basic payments will be assigned to active farmers. These limitations do not apply to farmers that receive less than €5,000 in direct payment. The greening component of the payment is assigned to farmers entitled to a payment under the basic payment scheme and that comply with some ecological prescriptions. The application of greening and the relationship between provision of environmental good in the first and second pillars of the CAP are central to the ongoing scientific debates about greening payments (e.g. Matthews, 2012).

3. Methodology

The methodology follows a framework that represents a combination of two exercises conducted in parallel. We performed a survey of farmers' stated intentions concerning future reforms, in order to provide empirical information on the reaction to the reform. A selection of survey information, together with demand curves for land obtained from an extended farm household investment model developed in previous works, is then used to feed a mathematical programming model for simulation. In the remaining of this section, we first describe the survey and then the modelling framework.

The survey was conducted in the early summer of 2012 on a random sample of 350 farm households out of 7379 beneficiaries of CAP payments located in Bologna province. The questionnaire was been completed through a telephone interview which focused on farmers' intentions about land expansion/reduction conditional on the introduction of some specific measures of the post-2013 CAP reform proposal. More specifically, they were asked to state intentions about renting in/out more/less land and buying/selling more/less land assuming the introduction of the regionalised payments, the greening and the capping measures in comparison to what their would have done under a baseline scenario (the current CAP system). The sample has been proportionally stratified by altimetry location (mountain, hill, Bologna hill, plain) and by the amount of CAP payments received in 2011 (below and above the mean). The questionnaire was divided into different sections: first, information about farm characteristics, labour features and market strategy was requested; then, CAP payments and generic planned future activities were requested; next, questions concerning expansion/reduction intentions under the current CAP and under the post-2013 CAP proposal were asked; and finally, personal and household characteristics were requested.

The farm characteristics relate to farm size, location, legal status, main farm specialisation, typology of crops and animal breeding, intensity of livestock production, surface allocated to agro-environmental or ecological measures, and area invested in photovoltaic or biogas systems. In the same section, information on land rent in and out, on the increase/decrease of land owned or rented in the previous years (from 2002), and on the presence of relatives among owners or tenants of the farm was collected. Concerning labour characteristics, information about the number of household members working full-time or part-time on the farm and the number of full and part-time external workers on the farm was collected. Farm characteristics were investigated through questions about marketing strategies for selling farm production, farm specialisation, production contracts implemented, and use of the internet to buy inputs or sell outputs. Regarding the CAP payments, information on the amount of payments, number of entitlements owned and the amount of other payments received in 2011 was collected. Moreover, the respondents were asked to quantify how the farm revenue is affected by those payments. Generic questions on intentions were also asked about the adoption of new technology and on intentions to remain in activity in the next years. The percentage of total gross family income coming from farming was also investigated in this section. Household information was collected through questions concerning the gender of family members, the number of minors, the number of family members over 65 years old and the number of unemployed. Personal characteristics requested related to farmer age and education level, with the latter divided into eight categories ranging from no title or primary school to PhD. An outlier was excluded from the analysis. The main descriptive statistics about the sampled farms are reported in Table 6.1. More information is available in Viaggi et al. (2013b).

Table 6.1 Descriptive statistics

Category	Variable (code)	Variable (description)	Obs	Mean	Std. Dev.	Min	Max
Geographical characteristics	d_hillBo	1 if farm located in Bologna area	350	0.102857	0.304207	0	1
	d_hill	1 if farm located in hill area	350	0.16	0.367131	0	1
	d_mountain	1 if farm located in mountain area	350	0.102857	0.304207	0	1
	d_plain	1 if farm located in plain area	350	0.634286	0.482319	0	1
	d_disadv	1 if the farm is in a disadvantaged area	350	0.331429	0.471401	0	1
Farm characteristics	d_rentOut	1 if the farmer have land rent out	348	0.051724	0.221788	0	1
	d_rentIn	1 if the farmer have land rent in	349	0.335244	0.472753	0	1
	d_saleCon	1 if have contracts to sell products	348	0.33046	0.471056	0	1
	d_livestock	1 if carries out livestock farming activities	349	0.106017	0.308302	0	1
	d_fruits	1 if main specialization is fruits	349	0.083095	0.276421	0	1
	d_mixedcrop	1 if main specialization is mixedcrop	349	0.272206	0.445735	0	1
	d_cereals	1 if main specialization is cereals	349	0.469914	0.499811	0	1
	HectLanProp	Farm total area in property	349	29.73066	107.5369	0	1870
	d_AATs	1 if is a small farm (AAT <=10 hectares)	349	0.492837	0.500667	0	1
	d_AATms	1 if is a medium small farm (AAT >10 <=50 hectares)	349	0.383954	0.487045	0	1
	d_AATml	1 if is a medium large farm (AAT >50 <=100 hectares)	349	0.083095	0.276421	0	1
	d_AATl	1 if is a large farm (AAT >100 hectares)	349	0.040115	0.19651	0	1
Household characteristics	d_ExPartT	1 if have external worker part time	349	0.091691	0.289003	0	1
	d_ExFullT	1 if have external worker full time	349	0.057307	0.232761	0	1
	d_HPartT	1 if have Household worker part time	349	0.183381	0.387534	0	1
	d_HFullt	1 if haveHousehold worker full time	350	0.871429	0.335204	0	1
	d_Unemployed	1 if presence of unemployed in the household	346	0.054913	0.228141	0	1
	d_Over65	1 if presence of over 65 on household	350	0.537143	0.499332	0	1
Farmer characteristics	d_higheduc	farmer with high school, degree or PHD title	350	0.294286	0.456373	0	1
	d_LowEduc	farmer with no title, primary or middle school title	350	0.705714	0.456373	0	1
	Age	Age of respondent	347	63.29683	13.96263	25	92
	d_livOnFarm	1 if live on farm (alone or with family or only the family)	347	0.85879	0.348741	0	1
	d_Exit	1 if farmer intend to leave farm activity	350	0.145714	0.353325	0	1
	d_Sellpro	1 if sell products to processing firms	350	0.071429	0.257908	0	1
	d_selldea	1 if sell products to wholesale dealer	348	0.321839	0.467854	0	1
	d_sellcoo	1 if sell products to cooperative	347	0.636888	0.481591	0	1
	d_sellcon	1 if sell products to consumers	347	0.198847	0.399709	0	1
	d_sellotfa	1 if sell products to another farm	347	0.083574	0.277147	0	1
CAP payments	importSFP	Amount of Single Farm Payment received	257	7539.428	26404.53	36	350000
	ImpOthPaym	Amount of other CAP payments received	25	27418.4	66675.45	200	310000
	NEntitlem2011	Number of entitlements owned	44	55.29545	188.2768	1	1200
	ImpPayOnRevenue	Average influence of CAP payments on revenue	253	2.217391	1.437927	1	6

The modelling component of the paper is based on mathematical programming applied to the set of individual farms of the sample. Ciaian et al. (2012) and Puddu et al. (2012) developed a theoretical analysis of the impact of regionalisation on land prices in a two-farm setting and a simulation of farm-level demand curves. Puddu et al. also developed a model to simulate the effects of regionalisation (intended as the move from historical payment to fully regionalised) in the province of Bologna. Starting from the regionalised model developed by Ciaian et al., we first apply a simple profit maximisation model to simulate changes in land operated, in which profit is a function of available land, without specifying the way of accessing the land (ownership or rent). An alternative modelling framework is also used, explicitly considering ownership versus renting and including transaction costs, following the model developed by Deininger et al. (2008) and Bartolini & Viaggi (2013).

Using the simulation model, the effect of the post-2013 CAP reform on the land market in the area is calculated as the difference between the current situation and the new situation, assuming a redistribution of the total amount of payments in the area based on a regionalised payment.

In order to calibrate the model using data from the survey, we base the land demand function on information about the demand slope (function) and the amount of land available. In the model, we use the individual farms in the Bologna province assuming that altogether they are representative of the dynamics of the area. We assume that land can only be traded within each sub area of the study area (there are four sub areas: mountain, hill, Bologna hill and plain).

A major issue concerns the reference area for the calculation of the regionalised payment. First, we assume that the regionalised payment will be uniform across the whole area and calculated based on the total SFP/UAA of the area; an alternative hypothesis simulated is that the regionalised payment is uniform within each sub area.

Based on the rationale of the policy instrument, it would be reasonable to assume that entitlements (on the historical basis) do not affect the marginal value of land for most the farmers in the area (see also Bartolini & Viaggi, 2013).

A detailed description of the model and of the calibration procedure is described in Viaggi et al. (2013b).

4. Results

Stated intentions, from the survey, on changes in farmland size as a consequence of the introduction of specific measures of regionalised direct payments, compared to the situation with the present CAP, show a similar trend across the different options tested, with value of change below 13%. The option of "no change" covers the majority of the sample (Table 6.2).

Table 6.2 Pattern of responses to regionalised payments

CAP Measure	Change	Mode	Frequency	Percent
Regionalisation	Expansion	buy	36	12.04
		rent	38	12.71
	Reduction	sell	10	3.34
		rent	23	7.69

The results of the model are illustrated in Table 6.3. The regionalisation of payments causes an increase in total income from €5.119 million to €5.698 million as a result of the fact that with the regionalised payments, land allocation is not driven by entitlements and hence land is allocated reflecting the private optimum without any policy-driven distortion.

Table 6.3 Main results of the model

	Baseline (historical SFP)	Regionalised payment	Regionalised payment per zone
Total gross margin (€ million)	5.991	6.509	6.892
Marginal land value			
Mountain	200	372	251
Hill	350	509	542
Bologna hill	350	506	404
Plain	600	744	789
N. farms	349	160	160
N. farm transaction costs model			
TC=0		122	117
TC=0.1		223	152
TC=0.2		292	211
TC=0.3		320	265

The total income does not differ between the two regionalisation options, due to the fact that land allocation and also the total amount of payments distributed are the same.

There is an increase in marginal land values as revealed by the land constraints in the model (which could hint at an increase in land prices). This may be due to two main effects:

- The regionalised payment directly affects the marginal value, differently from the historical payments, constrained by the mechanism of entitlements.
- There is an increase in the marginal productivity of land due to better re-allocation of land.

The marginal value of land (and supposedly the income) per zone changes between the two regionalised options, as they imply a different re-distribution of payments across areas. In particular, the uniform regionalised payments would yield relevant increases in the marginal value of land in mountain areas.

The results also indicate a major tendency to re-allocate land, which is concentrated in only 160 farms (less than half). This does not differ between the two regionalisation options, due to the fact that land is constrained to being re-allocated within the same zone and the optimal allocation does not change with the level of regionalised payments.

The model including transaction costs corroborates the same ideas, but also emphasises that the actual land re-allocation would depend on the actual transaction costs. The effects of assumptions about transaction costs are twofold. First, there is an effect of model calibration, and second, assuming transaction costs, the differential of marginal value of land across farms is greater and this yields different results (more intense re-allocation) in the option with zero transaction cost (less farms remaining). Increasing transaction costs causes a reduction in land exchanges and hence a higher number of farms remaining. It is expected that there is no difference between the two regionalisation hypotheses.

5. Discussion

This work uses survey and modelling information to assess the impact of post-2013 CAP reforms. Altogether, the results of the model are consistent with the results from the survey. In particular, both hint at the fact that there are farms in the area interested in selling/buying land in opposite directions in the case of regionalisation. However, the high level of "no changes" in the survey (also the consequence of uncertainty in future value of payments under the regionalised regime), which is normal when comparing modelling results with actual intentions, reveal that any change would occur much more gradually than indicated by the model. Both survey and modelling results are generally consistent with the previous literature in terms of stated reactivity to policy reforms and direction of changes. This is also due to the fact that the model design is largely theoretically driven.

This work is affected by several limitations. A key limit is the current uncertainty about the CAP reform (still in a phase of negotiation). This does not allow for realistic hypotheses about the actual details of the allocation mechanisms in each area.

Another set of limitations derives from the characteristics of the model, which uses a very simplified approach not including specific technical constraints, land uses and technologies. In addition, in spite of the use of transaction costs, the model cannot be deemed to fully incorporate obstacles to land transaction, including distance effects, life cycle of the farms and so on, as well as other factors affecting land values and transactions. As a result, the changes due to the reform and the related economic effects are certainly overestimated.

6. Conclusions, policy implications and further research

Modelling and survey information show a reaction in land demand to the shift from historical to regionalised payments. Regionalised payments seem to be capitalised more into the land value, at the margin, as long as they are less connected to entitlements. As a result, regionalisation would cause increased rental prices in the study area. From an economic point of view, however, overall agricultural income would benefit from regionalisation due to a more efficient allocation of land.

The reaction is strongly influenced by the previous historical system of distribution of payments. In fact, the quantity of entitlements owned before the reform and their link with farm area is the key factor affecting the change in land demand resulting from the upcoming reform and how each farm would interact with the market. The difference in historical payments and the hypotheses about how the regionalised payments will be calculated also strongly affect the outcome of the modelling exercise. Hence, the choice of the distribution of the national ceiling, which affects the budget available to the basic payment, and the territorial level at which payments will be uniformly applied will be particularly decisive.

In terms of policy implications, two main messages arise. First, regionalisation is desirable if the objective is efficiency. Second, if there is also a concern over destabilisation of land markets and distribution of income, a cautious (evidence-based) choice of the areas for uniform payments and a gradual move from the historical to the regional system would be advisable.

A straightforward development of this work would be the revision of the model once the reform is approved and the implementation process better clarified. In addition, new instruments could be included and/or better developed in the analysis, such as greening or capping. Another line of investigation is the use of a dynamic model, which could better account for the process of adaptation, or a more realistic specification of spatial interactions, allowing for distance and neighbouring effects.

This work does not necessarily reflect the view of the European Union and in no way anticipates the Commission's future policy in this area.

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7. LAND MARKET REGULATIONS IN THE EU

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In this chapter, the authors develop a set of regulatory indices to assess the importance and stringency of land regulations in the EU. These indices show that there are major differences among EU member states in the regulation of land markets. Some countries, such as France, have a high regulatory index for both rental and sales markets, while others, such as Belgium and the Netherlands, have a high regulation index for rental markets but not sales markets (or vice versa in Poland and Hungary). Then there is a group of countries (including the Czech Republic, Finland, Germany, Greece, Ireland and the UK) with very little regulation in either land rental or sales markets. Interestingly, regulation of land markets and land exchange are not closely aligned with simple regional or institutional macro-clusters. Moreover, the strongest regulations are not in the former communist eastern member states of the EU but in some of the western (long-term capitalist) countries.

1. Introduction

Land markets play a crucial role in EU agriculture and, with the shift to direct payments and SFP/SAPS, an increasingly important role in the CAP as well.

There is a vast literature on the role of land rights and institutions for optimal land exchange (for reviews see, for example, Binswanger et al., 1995; Platteau, 2000; Keefer & Knack, 2002; Deininger, 2003). The creation of

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[*] This chapter draws heavily on the work published under Factor Markets Working Paper No. 14 and Working Paper No. 15. These papers have now been updated and integrated in Swinnen et al. (2013).

optimal land institutions attracted renewed attention in the 1990s because of its central role in the transition process in former communist countries in East Asia, the former Soviet Union and eastern Europe (Lerman et al. 2004, Rozelle & Swinnen, 2004; Swinnen et al., 2006) and more recently because of the large-scale land investments in developing countries (Deininger, 2013).

The optimality of specific land institutions is conditional on the state of the economy and government policies (Sadoulet et al., 2001). Therefore one would expect to observe similar types of land governance (how land is exchanged and what is regulated by the state) in countries which are close in their economic development, geographic location and political institutions. Yet, it is remarkable how much variation one observes empirically in institutions for land exchange and in land regulations among EU countries and among countries within the EU which are relatively close in geographic location and economic development.

In this chapter, we present key findings on differences in the nature and regulation of land markets among EU countries. We refer to Swinnen et al. (2013) for more details and for explanations for the observed differences.

2. Land market regulations in the EU

A central element in the choice between buying and renting land is the trade-off between security of operation (access to land) and liquidity (allocation of capital). Both are affected by the state of the economy but also by government regulations. Land regulations can importantly affect property rights, tenure security and access to land for farmers (Swinnen, 2002). Land regulations also affect the distribution of economic rents and the distribution of policy rents (Ciaian & Swinnen, 2009).

There are major differences among EU member states in regulation of land markets.[17] In some countries, land prices and rental contracts are regulated by the government, in others not. One can identify several categories of land market regulations: (1) measures to protect the tenant, (2) measures to protect the owner-cultivator, (3) measures to protect the owner, and (4) measures to prevent fragmentation.

[17] We refer to Swinnen et al. (2013) where we have developed a series of hypotheses to explain these differences in land markets among countries.

To assess the importance and stringency of land regulations and to indicate the differences between countries, we have collected data on land regulations and have developed a set of regulatory indices to compare countries. We use 15 variables to construct the four indicators.[18] The information on the underlying variables is obtained from interviews with local land experts in each of the countries and from a series of country studies of land markets (Ciaian et al., 2010).

2.1 Measures to protect the tenant

Land market regulations aiming to protect the tenant include regulations that impose a minimum rental contract duration, maximum rental prices, automatic rental contract renewal, conditions for rental contract termination, and a pre-emptive buying right of the tenant.

Maximum rental prices are stipulated in agricultural land legislation in Belgium, France and the Netherlands. Maximum rental prices depend on the agronomic quality (expected marginal productivity) of a plot. In Austria, rental contracts need to be approved by the *Grundverkehrsbehörde*, and this authority can reject the rental transaction when the rental determined in the contract is 50% higher than the average price in the region.

In several countries, the national legislation stipulates a *minimum duration for a rental contract*. This is the case in Austria, Belgium, France, Italy, the Netherlands, Portugal, Spain, Slovakia and Slovenia. In many EU countries, rental contracts are automatically renewed.[19] Moreover, in Belgium, France and the Netherlands, the (automatic) extension of a rental contract can only be prevented by the owner under certain specific conditions (e.g. when the owner or close relative wants to use the land him/herself). Otherwise the rental contract is automatically renewed with the previous tenant.

[18] For a detailed discussion of the variables used to construct the indicators, we refer to Swinnen et al. (2013).

[19] Land rental contracts in Belgium, France, Italy, the Netherlands, Portugal, Spain, Sweden, Slovakia and Slovenia are *automatically renewed* for the length of the initial contract period in case the owner nor the tenant wants to end the contract. In Austria, the Czech Republic, Germany and the UK, rental contracts are extended year-by-year.

Tenants have a *pre-emptive right to buy the land* in Belgium, France, Italy, Portugal, Sweden, Hungary, Latvia, Lithuania, Romania and Slovenia.

2.2 Measures to protect the (local) owner-cultivator

Land market regulations which aim to protect the owner-cultivator include restrictive conditions on the owner (such as nationality), maximum sales prices, pre-emptive buying rights for neighbouring farmers, and maxima on the transacted area.

Restrictions on foreigners to buy (or rent) land are especially important in the new EU member states (NMS) (Swinnen & Vranken, 2009; 2010). These restrictions were introduced at the moment of EU accession to prevent foreign investors, attracted by low land prices due to the large income differences and poor-functioning rural credit markets. Virtually all NMS have some restrictions but the precise nature differs among countries.[20]

Restrictions other than nationality for landowners exist in Austria, Denmark, Hungary and Poland. In Austria, new owners of agricultural land should have their residence relatively close to the plot and have a proof of competence in the agricultural sector (through experience or education). In Poland also, farmers should have a proof of competence in the agricultural sector (through experience or education). In Hungary, there is a legal obligation for the new owner to cultivate the land.

In France, Hungary, Italy, Latvia, Portugal and Slovenia, *neighbouring farmers* have a *pre-emptive right to buy* when a plot of agricultural land is sold.

In none of the countries is there a well-defined *maximum sales price*, but in Austria, France and Poland, the government can interfere in the sales

[20] In Hungary, Latvia and Poland, no company with majority foreign ownership can buy land. In Estonia, Hungary, Latvia, Poland and Slovakia, foreign individuals ("natural persons") are only allowed to buy a plot after renting and farming the plot for at least three years. In Lithuania, foreign natural persons are allowed to buy agricultural land if they have been staying and farming in the country for at least three years or they are married to a national citizen. In Bulgaria and Romania, foreign natural persons are allowed to buy agricultural land if they intend to settle and farm in the country. Interestingly, Finland and Greece also restrict foreigners from renting or buying agricultural land in specific regions.

market of agricultural land if the sales price of agricultural land is considered too high.

Limitations on the amount of land owned or transacted exist in Denmark, France, Hungary and Lithuania. In France, the SAFER can refuse a transaction if it considers the amount of land that is sold to be too high. In Hungary, an individual farmer can own and cultivate up to 300 hectares, while a legal entity (farming company) is not allowed to own any agricultural land and can only cultivate up to 2,500 hectares of (leased) land. In Lithuania, there is an upper limit on the amount of land that can be owned by a natural person or a legal entity (up to 500 hectares).

2.3 Measures to protect the landowner and prevent fragmentation

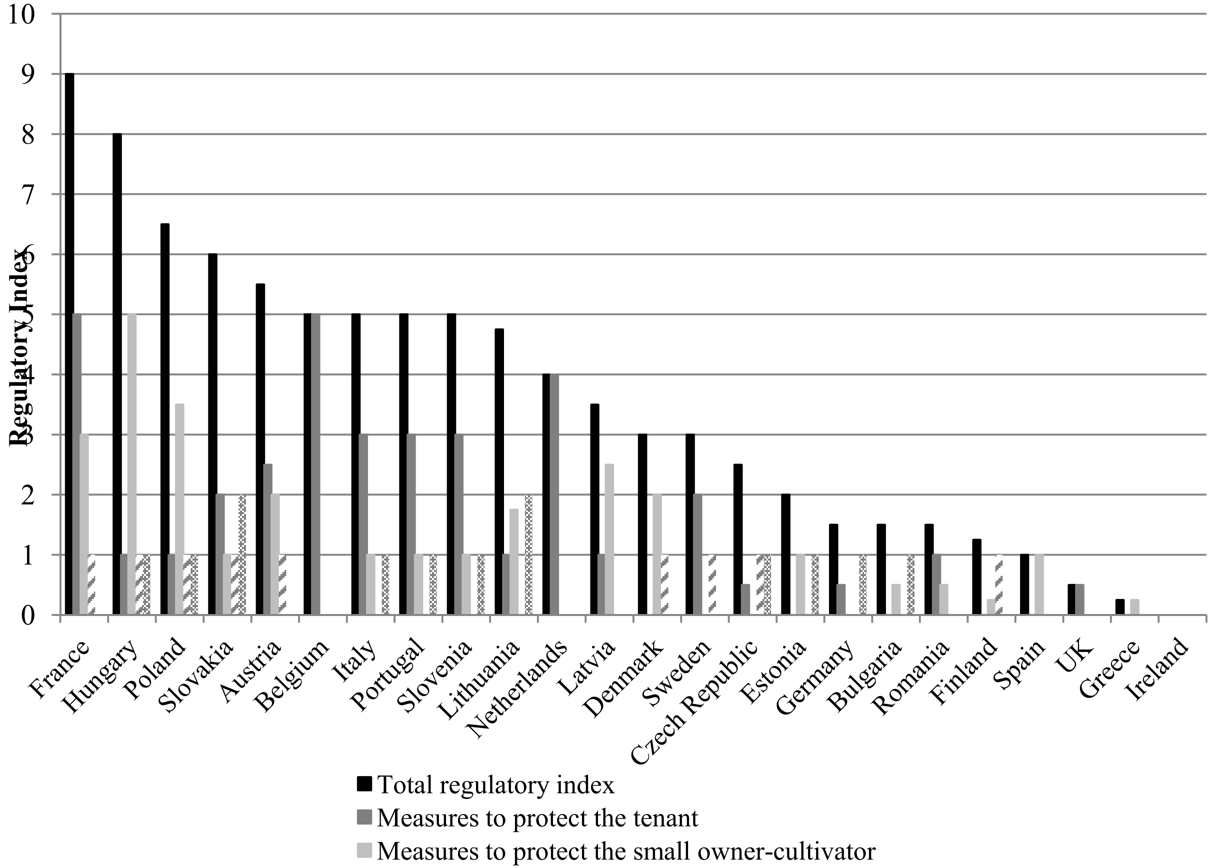
Regulations to protect the landowner include minimum rental prices and maximum durations of contracts. Countries with *a maximum duration on rental contracts* are Denmark, Finland, Hungary, Poland and Sweden. Austria, the Czech Republic and France also regulate the *minimum rental price*.

Regulations to prevent land fragmentation include regulations on minimum plot size and pre-emptive buying rights of the co-owner. *Pre-emptive rights for the co-owner to buy land* exist in the Czech Republic, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia and Slovenia. A *legal minimal plot size* exists in six countries: Bulgaria, Estonia, Germany, Lithuania and Slovakia.

2.4 Indicators of regulation

Figure 7.1 presents the four indicators of regulation as well as an aggregate indicator, the total regulatory index (TRI), which is a measure of the total amount of regulations in the land market. It is clear that there is a large difference among the EU countries in land market regulations, and again the variation in interventions is not a simple East-West divide. Among the new and old member states, there are both strongly regulated and very liberal approaches to land governance.

Figure 7.1 Land regulation indicators



Among the 24 EU countries for which we have data, the most regulated land 'markets' are in France (TRI = 9) and Hungary (TRI=8). In France, regional organisations – the SAFERs – determine a minimum and maximum price bracket within which the tenant and the owner can agree a contract price. These organisations effectively control the local land markets through their powers to buy, sell and rent out agricultural land. Effectively, they ensure that land is only owned by working farmers. The SAFERs also control the level of farm restructuring and growth by requiring farmers to obtain authorisation from them for farm expansion. In Hungary, land can only be owned by individuals or families ("natural persons"), and not by farming companies which operate a large share of the land. Ownership is restricted to Hungarian nationals and owners have an obligation to farm the land. The most liberal regulations exist in Ireland (TRI = 0), Greece (TRI = 0.25), and the UK (TRI = 0.5) among the old member states, and in Romania (TRI = 1.5) and Czech Republic (TRI = 2.5) among the new member states.

The aggregate numbers may bias to some extent the conclusions, in particular for countries with medium levels of the TRI. For example, Belgium has a TRI of 5 but all the regulations are in the rental market, which is very important in Belgium (approximately 70% of the land is rented) and which is highly regulated: the tenant protection indicator (TPI) is 5 which is the highest of all countries (together with France). However, they have no other regulations (the other indices are all 0). The Netherlands is similar to Belgium in that it has quite significant regulations in the rental markets to protect the tenants (TPI = 4) but no other land regulations (other indicators are 0). This contrasts with France, which has extensive regulations both in the rental and in the sales markets.

Another example is Poland with a total regulation index of 6.5, but with a large difference between the sales and rental market regulations. In Poland, where most of the land is owned and operated by (small) family farms (only 20% is rented), there is very little protection for tenants (TPI = 1) but significant regulations protect (family) farms who operate on land they own: their owner protection index (OPI) is 3.5. Together with Hungary, where the OPI = 5, this is the highest of all the countries.

3. Conclusion

In this chapter, we document large variations in land regulation among EU member states. Some countries, such as France, have a high regulatory index for both rental and sales markets. Others, such as Belgium and the

Netherlands, have a high regulation index for rental markets but not sales markets, and Poland and Hungary vice versa. Then there is a group of countries (including the Czech Republic, Finland, Germany, Greece, Ireland and the UK) with very few regulations in either land rental and sales markets. Interestingly, regulation of land markets and land exchange are not closely aligned with simple regional or institutional macro-clusters. Moreover, the strongest regulations are not in the former communist eastern member states of the EU, but in some of the western (long-term capitalist) countries.

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8. The Influence of Agricultural Subsidies and Regulations on Sale Prices of Farmland in France

Laure Latruffe, Laurent Piet, Pierre Dupraz and Chantal Le Mouël[*]

In this chapter, the authors investigate the determinants of agricultural land price in several regions in France over the period 1994-2011 using individual plots transaction data, with a particular emphasis on agricultural subsidies and nitrate zoning regulations. They found evidence that agricultural subsidies capitalised at least to some extent. However, the magnitude of such a capitalisation depends on the region considered, on the type of subsidy considered, and on whether the location of the plot is in a nitrate surplus zone or not.

1. Introduction

The influence of agricultural subsidies on farm land prices has attracted a large body of research in the economic literature. The main issue is whether, and by how much, subsidies increase agricultural land prices. A positive influence on price would reveal that part of the subsidies are capitalised into land prices, indicating that landowners are beneficiaries of public support, generally unintended by governments. While this leakage

[*] The authors are grateful to Sylvain Cariou for his help in preparing the database.

This chapter summarises the key insights on the empirical analysis of the influence of agricultural subsidies on sale prices on French farmland. The full paper with details on methodology and results is available as Latruffe, Piet, Dupraz & Le Mouël, "Influence of Agricultural Support on Sale Prices of French Farmland: A comparison of different subsidies, accounting for the role of environmental and land regulations", Factor Markets Working Paper No. 51, June 2013.

of public funds to potentially non-agricultural or former agricultural stakeholders instead of supporting active farmers' income is problematic, the increase in land prices caused by subsidies is, in addition, detrimental to young farmers willing to settle. The literature is relatively consistent regarding the empirical evidence of the capitalisation of public subsidies into land prices (Latruffe & Le Mouël, 2009): government subsidies are major contributors to agricultural land price increases; they are generally found to account for 15-30% of the price of land.

In this chapter, we investigate the capitalisation of agricultural subsidies into land sale prices in France in 1994-2011. Our contribution to the literature is threefold. First, we provide a recent analysis of this issue, while previous papers on France are largely out-dated (Goodwin & Ortalo-Magné, 1992; Cavailhès & Degoud, 1995). Second, we consider several types of subsidies. It is generally accepted that different subsidies contribute differently to land prices due to their varying objectives and implementation schemes and schedules (Patton et al., 2008; Latruffe et al., 2008). Third, we investigate the issue of public support capitalisation, taking into account that the market for farm land is affected by regulations, related or unrelated to land – such as prohibited land ownership for specific entities, regulated prices, pre-emptive rights for specific buyers and zoning regulations – which may restrict the mobility of land uses.

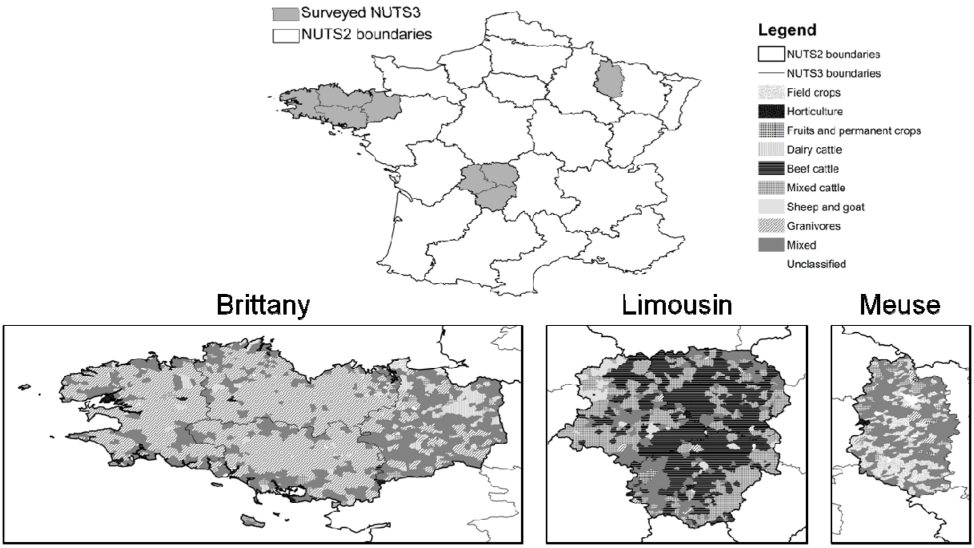
2. The case study regions

We use data from individual land sale transactions in several regions in France. These regions are very different in terms of farm structure and production specialisation and, therefore, in terms of main subsidies received, but also in terms of non-agricultural demand for land. Figure 1 shows the studied regions' locations in France and their main agricultural productions in 2010.

Brittany is a NUTS2 region located in western France consisting of four NUTS3 sub-regions. The region has a strong agricultural nature. The farming structures are characterised by medium-sized farms with respect to the national average, and dairy and granivores as the main types of farming. The urban and agricultural pressures on agricultural land are stronger in Brittany than in the other regions analysed, due to its attractiveness for new inhabitants and for tourism, and due to the significant livestock dejections which urge farmers to find surfaces for manure-spreading. Limousin, a NUTS2 region in central France consisting of three NUTS3 sub-regions, is characterised by a hilly landscape and cattle-raising (beef and sheep). A large part of the region is covered with permanent grass, and farms are medium-sized. Finally, Meuse is a NUTS3 region in eastern France. Farms are on average large. Field crop production – in particular, production of cereals, oilseeds and protein crops – prevails, followed by dairy farming.

France has applied a two-stage zoning based on the European Nitrate Directive. Municipalities are first classified as belonging to a vulnerable zone or not. In such zones, the use of land for specific purposes may be prohibited and farming practices may be restricted. The second stage, the nitrate surplus zoning (*zone d'excédent structurel*, or *ZES*), which includes municipalities where nitrate from livestock source exceeds 170kg per hectare of utilised agricultural area (UAA), imposes stricter regulations. Brittany is affected by livestock pollution, resulting in the whole region being classified as a vulnerable zone, and half of its municipalities come under the nitrate surplus zone. By contrast, NUTS3 Meuse is only partly classified as a vulnerable zone but is not concerned by the nitrate surplus zoning, and NUTS2 Limousin is not classified in either zone.

Figure 8.1 Location and main types of farming of the regions studied



Source: Authors' 2010 SSP agricultural census – ©IGN 2011, Geofla®

3. The land price database

The land price database (the PERVAL database) that we used was obtained from notaries and consists of all transactions of agricultural land that occurred in the regions over the period studied. We considered only arable land and pasture which was non-built and already tenanted by a farmer or not. Because the smallest plots exchanged were sold at very high prices, reflecting the fact that future conversion to development use is anticipated for such plots, we restricted the database to plots with an area equal to or above ten hectares. During the period studied (1994–2011), 2,772 such transactions occurred in NUTS2 Brittany, 774 in NUTS2 Limousin and 739 in NUTS3 Meuse. Taking all regions together, plots sold of 10 hectares or above were, on average, 19.9 hectares in size and priced at €2,795 per hectare.

The occupations of both the seller and the buyer are some of the transaction characteristics which are available in the land sales database. Two thirds of the plots are bought by farmers. In France, specific private bodies have the public mission of regulating the transactions in order to limit price speculation, avoid farm fragmentation and promote the settlement of young farmers. Each transaction is notified to these bodies, called the *SAFER* (*Sociétés d'Aménagement Foncier et d'Etablissement Rural*), which operate at the NUTS3 level. If the SAFER believes that a transaction is a threat to farm consolidation or settlement, or may be governed by price speculation, it can stop the transaction. It then tries to convince the seller and the buyer to change the transaction on an amicable basis and, if this is not possible, it pre-empts the plot and has five years to sell it back at a lower price or to another buyer. In the PERVAL database, the SAFER intervenes (by buying or re-selling a plot) in 16% of transactions.

The municipality in which the plot is located is also available in the PERVAL database, enabling each transaction to be related to agricultural subsidies and revenue as well as to other variables such as the municipality's demographic characteristics and the zones it may come under.

4. Methodology

Because data regarding agricultural revenue and subsidies are not directly available from public statistics at the municipality level, they were estimated in a first stage of the analysis. The second stage of the analysis consists in regressing the transaction price on these proxies and the other variables mentioned above.

The dependent variable used for the second-stage estimation is the deflated price per hectare of agricultural land sold in plots with an area of ten hectares or more. The explanatory variables which were expected *a* *priori* to influence the land price are, first, the basic determinants of land price based on the present value model: on the one hand, revenue from agricultural use, which is separated into a market-based component (*M*) and a government-based component (*G*), and on the other hand, potential revenue from non-agricultural use.

An approximation of the agricultural revenue (*M*) and agricultural subsidies (*G*) at the municipality level was obtained through a first-stage regression. The revenue variable is the pre-tax profit from which we excluded subsidies to avoid double counting. Six types of subsidies could be considered, namely total agricultural subsidies and five different components: CAP first-pillar coupled direct payments to crops and herds; CAP first-pillar land set-aside premiums; CAP first-pillar decoupled single farm payments (SFPs); CAP second-pillar less-favoured area (LFA) payments; and CAP second-pillar agri-environmental payments to extensive grazing livestock. The deflated revenue and subsidies were regressed on crop areas and herd numbers (observed at NUTS3 level) as a system of stacked equations using the seemingly unrelated regression (SUR) estimator. Then, the resulting estimated coefficients were used to generate projections at the municipality level from crop areas and herd numbers observed in the agricultural censuses. To account for the size of the municipality, the revenue and subsidies projections were divided by the municipalities' UAA.

Potential revenue from non-agricultural use was not observed. For this reason, following the literature, we proxied it by two variables: the population density in the municipality where the plot is located, and a dummy indicating whether or not the municipality is part of an urban area.

In addition to these basic determinants suggested by the present value model, we controlled for the size of the plot sold, whether the buyer was a farmer, and the municipality's area. We also included year dummies and NUTS3 region dummies. Finally, we considered regulations that may affect the price of agricultural land. The first regulation variable related to zoning based on the Nitrate Directive; the zoning dummy variable took the value 1 if the municipality was in the nitrate surplus zone, and the value 0 otherwise. The second regulation variable took the value 1 if the seller or buyer was a local *SAFER*, and 0 otherwise.

We performed regressions on a sample consisting of all three regions together, and on the samples of each region separately. In addition, for all four samples, we performed one regression including the total subsidy variable and one regression including the five different types of subsidies instead.

5. Findings

First, we found that agricultural revenue generally has no significant influence on land price, contrary to what can be expected from the present value model. One reason may be that the original variable (i.e. pre-tax profit) used to construct our proxy variable, which is the only one that was available from the statistics, may not be the best representation of income generated by farming activities on land because it is too low in the accounting balance sheet. The gross margin would be a better candidate but was not available in the original database. Another reason may be that the revenue variable was proxied at the municipality level and not at the level of the plot itself.

Second, we found evidence that agricultural subsidies actually capitalised at least to some extent in the price of land in the regions studied over 1994-2011. However, the magnitude of such a capitalisation depends on several factors. One varying factor is the region; for the sample including the three regions together, we found a positive but relatively small capitalisation effect of the total subsidies per hectare. However, this effect is differentiated according to the region in question. In NUTS2 Brittany, the positive effect is significant only for plots located in the nitrate surplus area and is greater than in both other regions. As for these two other regions, the effect is greater in NUTS2 Limousin than in NUTS3 Meuse. Another varying factor is the type of subsidy. When considering all regions together, we found that only land set-aside premiums significantly capitalise into the price of land, whether the plot is located in a surplus zone or not. The capitalisation effect is high, suggesting a scarcity effect due to the requirement to withdraw land from production. In addition, SFP has a significant positive capitalisation impact only for plots located in a surplus zone.

Third, we found a significant influence of regulations on land price. Regarding land transaction regulations, plots purchased or re-sold by *SAFER* were found to be significantly more expensive. This finding is counterintuitive, as *SAFER* are expected to contribute to alleviate speculation on land prices. One reason may be that *SAFER* do not always use their pre-emptive right with a view to keeping land price low; they may also pre-empt land that is up for sale to change the buyer, to limit farm fragmentation, or to support the settlement of young farmers. Another reason may be that *SAFER's* intervention with a view to keeping the price low may occur for specific land, which is more expensive than the average agricultural land. The interactions with the *SAFER* variable and the subsidy variables were not significant. By contrast, we found some significant effect of subsidy variables interacting with the zoning regulation variable: in NUTS2 Brittany, where the nitrate surplus zoning is implemented, the capitalisation of subsidies is significant for plots located inside the zone but not for plots located outside the zone, revealing a restriction on land mobility in the surplus areas. This suggests that public intervention in the form of nitrate zoning regulations may affect land mobility in favour of a specific use of land and may increase the degree of capitalisation of subsidies in agricultural land price, possibly an unintended consequence as it goes against the government objective of supporting farmers' income.

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9. THE IMPACT OF GLOBAL RED AND REDD POLICIES ON EUROPEAN LAND MARKETS

PETER DIXON, HANS VAN MEIJL, MAUREEN RIMMER, LINDSAY SHUTES AND ANDRZEJ TABEAU*

Worldwide biofuel production has expanded rapidly over the past decade, driven by renewable energy directives and high crude oil prices, as well as a growing interest in reducing greenhouse gas emissions. There are increasing concerns, however, that the demand for land for biofuel production may be leading to increased deforestation. The United Nations REDD programme seeks to reduce emissions from deforestation and forest degradation by protecting and managing forests and woodlands. Any effort to limit deforestation is, however, likely to limit the land available for agricultural production, including biofuel production stemming from RED policies. This chapter examines the impact on European agricultural land markets of global renewable energy directives (RED) and the programme to limit deforestation and forest degradation (REDD). The authors adopt a scenario approach using the MAGNET global computable general equilibrium model and find that, in contrast to global trends, both renewable energy and forest protection policies may boost European agriculture. The policies increase the demand for crop land in Europe, partly offsetting the trend towards intensification. Overall, the authors find that Europe appears to experience net gains from global efforts to increase biofuel use and protect forests, experiencing higher agricultural production and trade, with only small increases in land prices and food prices faced by consumers.

* This chapter is an extension of Dixon, van Meijl, Rimmer, Shutes & Tabeau, "RED vs. REDD: Biofuel Policy vs. Forest Conservation", Factor Markets Working Paper No. 41, May 2013.

1. Introduction

A rapid growth in worldwide biofuel production has been observed since 2001, driven by renewable energy directives (REDs) and high crude oil prices, as well as a growing interest in reducing greenhouse gas (GHG) emissions. There are increasing concerns, however, that the demand for land for biofuel production may be leading to increased deforestation (Banse et al., 2008; Banse et al., 2011; Hertel et al., 2010), resulting in biodiversity losses and higher GHG emissions. Deforestation and forest degradation, together with peatland emissions, have been shown to account for between 15% (Van der Werf et al., 2009) and 20–25% of greenhouse gas emissions, a total that is higher than the entire contribution of the transportation sector (Myers, 2007).

The United Nations' REDD programme seeks to reduce emissions from deforestation and forest degradation by protecting and managing forests and woodlands (UN-REDD, 2011). Any effort to limit deforestation is also likely to limit the land available for increasing agricultural production, including biofuel production stemming from RED policies. The restriction of available land by REDD policies is therefore likely to change the pattern of comparative advantage in agricultural production between countries, leading to changes in agricultural prices, trade and food security. However, the effect on European agricultural markets, together with the land use impacts of REDD policies on European land markets, are not well understood and, to date, there have been no studies of the interaction between REDs and REDD and little discussion in the policy arena.

This chapter examines the impact on European agricultural land markets of global REDs and the REDD programme aiming to limit deforestation and forest degradation REDD. We adopt a scenario approach using the MAGNET[21] global computable general equilibrium (CGE) model as outlined in Dixon et al. (2013). The advantage of this modelling approach is that the feedback effects between agricultural, biofuel, energy and other markets are well captured (Rajagopal & Zilberman, 2007).

2. Modelling framework and scenario definitions

Capturing the interaction of RED and REDD policies requires a global multi-sector approach that accounts for both the changes in restrictions on

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[21] The Modular Applied GeNeral Equilibrium Tool (MAGNET) is an applied computable general equilibrium model developed at LEI, The Hague, Netherlands.

land availability arising from the REDD agreements and changes in energy and agricultural markets arising from biofuel directives.

The policy scenarios are implemented in the MAGNET model, a multi-regional, recursive-dynamic, applied general equilibrium model based on neo-classical microeconomic theory (Nowicki et al., 2009; van Meijl et al., 2006). The model is calibrated to version 6 of the GTAP database (Dimaranan, 2006), which contains detailed production, bilateral trade, transport and protection data characterising economic linkages within and among regions. All monetary values of the data are in millions of US dollars and the base year for version 6 is 2001, which is updated to 2010 using macroeconomic and yield data. The 88 regions in the GTAP database are aggregated to 45 regions for simulation purposes, with the results presented here for two groups: Europe and Global. Similarly, the 57 sectors identified in the database are aggregated to 26 sectors that produce 28 products, including land-using agricultural sectors such as rice, grains, wheat, oilseed, sugar, horticulture, other crops, cattle, pork and poultry, and milk; the petrol sector that demands fossil (crude oil, gas and coal) and bioenergy inputs (ethanol and biodiesel); and by-products of biofuels production.

The MAGNET model contains a number of advanced features pertinent to modelling the impact of RED and REDD policies on land and agricultural markets in Europe. These include factor market representations of imperfectly substitutable types of land, a land use allocation structure, segmented labour and capital markets in agriculture and non-agriculture, and a new land supply curve to address large reductions in the amount of available land for agriculture (Dixon et al., 2013). Biofuel production is included by introducing the production and use of ethanol and biodiesel and their by-products. Blending targets are included in the model via an end-user tax on motor-fuels that is used to subsidise biofuel production and stimulate production up to the level implied by the blending target.

We define three scenarios: the 'business-as-usual' scenario projects the development of the global economy to 2030; the RED scenario implements worldwide biofuel blending targets; and the REDD scenario restricts the amount of land available for agriculture through the protection of forests in addition to the worldwide biofuel policy. The assumptions for each of these scenarios are given in Table 9.1. Together, the scenarios show the impact of RED and REDD policies on land use, land prices, agricultural production, food prices and food security in Europe and worldwide up to 2030.

Table 9.1 Scenario assumptions

	Business-as-usual			RED		REDD
	GDP[1]	Population[a]	Yields[b]	Biofuel share 2010	Biofuel share 2020	Land availability[f]
World	100	21	39	0.1 - 20.6[c]	3 - 25[d]	-35
Europe	50	-1	20	1.7[e]	10[e]	-4

[a] Growth over the period 2010-2030 (USDA, 2010).

[b] Average growth over the period 2010-2030, weighted by land area (Bruinsma, 2003).

[c] Ranges from 0.1% in former Soviet Union, China and Indonesia to 20.6% in Brazil (see Dixon et al. 2013 for more details)

[d] Ranges from 3% in Canada and Oceania to 25% in Brazil (see Dixon et al., 2013 for more details)

[e] Percentage of first-generation biofuels in transport fuel (Europe = EU27), simple average over countries in each region. Calculations based on Sorda et al. (2010).

[f] Percentage change in potential land availability due to forest and woodland conversion restrictions. IMAGE model calculations based on Stehfest et al. (2010).

European GDP is projected to increase by 50% between 2010 and 2030, compared to a doubling of world GDP over the same period. Per capita GDP in Europe will increase as the population is projected to fall slightly, in contrast to a 21% increase globally. Yield growth in Europe is below the global average of 39%, at 20% over the same period. The biofuel share needs to increase from 1.7% to 10% to meet the European RED by 2020. Finally, the reduction in land availability implied by the REDD policy is much lower in Europe than in the rest of the world. Globally, land availability is projected to fall by 35%, compared with only 4% in Europe.

Note that the RED scenario introduces the blending targets on top of the business-as-usual scenario assumptions. As such, a comparison of the RED and business-as-usual scenarios shows the impact of the biofuel policy. The REDD scenario introduces the reduction in land availability implied by the REDD policy in addition to the blending targets and business-as-usual scenario assumptions. A comparison of the RED and REDD scenarios therefore captures the effect of the forest protection policy.

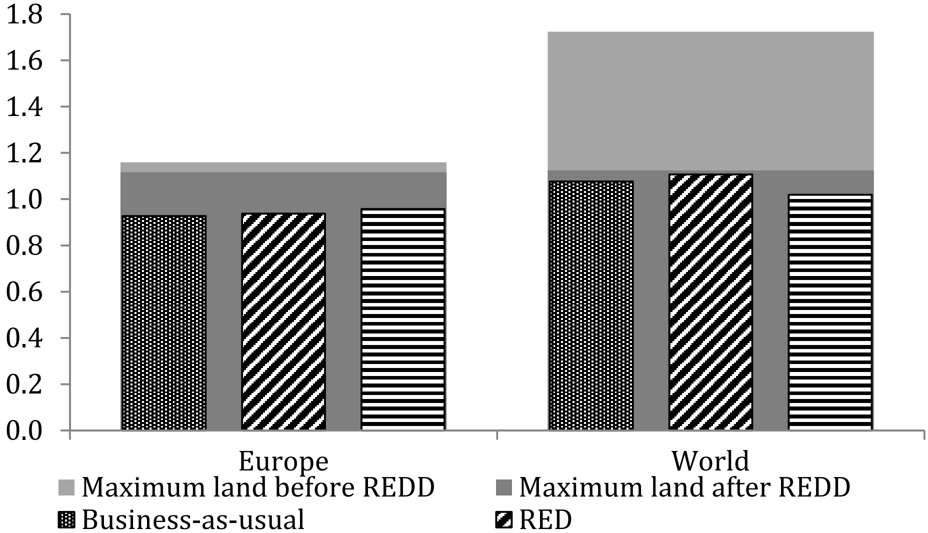
3. The impact of RED and REDD policies on European land and agricultural markets

In assessing the interaction of global REDs and the REDD programme to limit deforestation and forest degradation, we find that economic and population growth, together with biofuel policies, increase the demand for agricultural products and agricultural land use. The increased demand for land is met in part by increased yields and in part by the conversion of forests and woodlands. The introduction of a REDD policy to protect forests and woodlands limits the supply of land suitable for agricultural production worldwide, leading to the intensification of production and higher land prices.

These headline results are shown in more detail for Europe and the world in Figure 9.1. The results for the business-as-usual scenario indicate that the evolution of European land markets differs significantly from the global trend between 2010 and 2030. Land under cultivation in Europe is projected to fall by 7% by 2030, compared to a projected increase of 8% worldwide. These projections are consistent with a European agricultural sector that remains stable but experiences intensification through yield growth, thereby reducing the land required for production. This intensification leads to lower land prices in Europe. Globally however, the increase in agricultural demand outstrips yield growth leading to land extensification and higher land prices.

The introduction of worldwide REDs increases the demand for land both in Europe and worldwide due to the increased demand for agricultural products for biofuel feed-stocks. Although globally the expansion in land area approaches, but does not encroach upon, the area protected under REDD (see dark grey column in Figure 9.1), regional differences mean that the expansion in biofuels following the RED policy may be achieved at the cost of deforestation.

Figure 9.1 Agricultural land use in 2030 (2010=1) and maximum available land relative to 2010 land under cultivation (2010 land under cultivation equals 1)



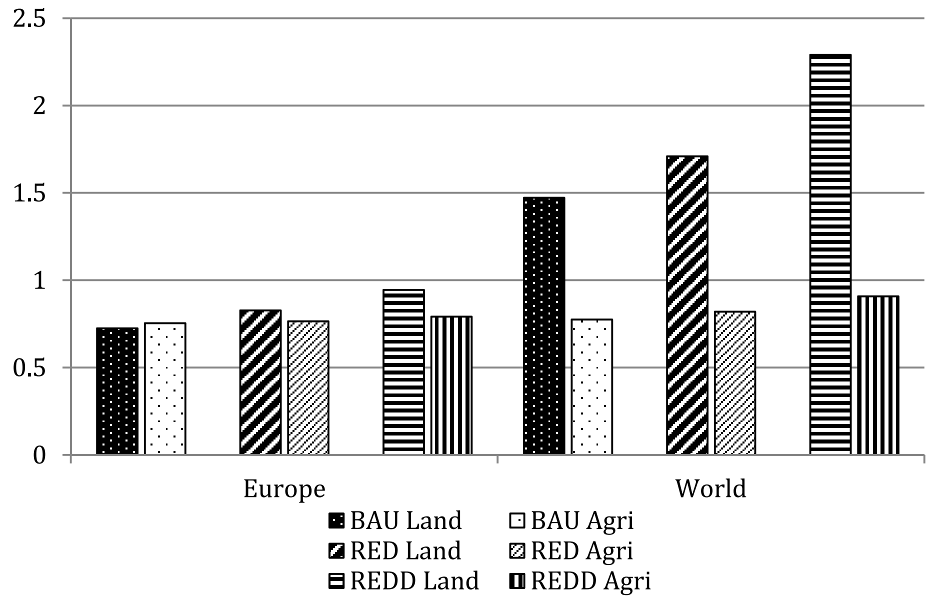
Source: MAGNET model simulations.

The implementation of the REDD policy to protect forests and woodlands leads to significant decreases in agricultural land availability worldwide (as shown by the reduction in the height of the global land-availability column in Figure 9.1). The reduction in land availability reduces worldwide land under cultivation by 8% compared to the RED scenario. The impact of REDD on land use is particularly strong, more than offsetting the increase in land use due to the RED policy and lowering the amount of land under cultivation to below business-as-usual levels.

In contrast to this global trend, the protection of forests worldwide causes the amount of land under cultivation in Europe to increase slightly by 2% compared to the RED scenario. Indeed, Europe is the only region in which agricultural land use increases as a result of the REDD policy. This is due to an improvement in Europe's comparative advantage in agricultural production brought about by the minimal requirements placed on land conservation in the region under the REDD policy and the long-term trend towards land intensification. Greater requirements for forest conservation in other regions increase average global agricultural prices by 17%, compared to only 5% in Europe where land is less scarce. The changing pattern of land scarcity following REDD is clear from Figure 9.1: economic and demographic trends mean that the ratio of land available under REDD to land in use in 2030 is greater in Europe (1.205) than globally (1.045), making land relatively less scarce in Europe. This boosts European agricultural production and agricultural exports. Europe's trade balance in agricultural products improves against a backdrop of slowing worldwide agricultural trade in which the volume of worldwide agricultural exports decreases by 5% following the implementation of the REDD policy.

The impact of RED and REDD policies on real land and agricultural prices are shown in Figure 9.2. Land prices in the business-as-usual scenario are projected to be 27% lower by 2030 in Europe, compared to 47% higher worldwide. Agricultural prices, both within Europe and worldwide, are expected to fall by 2030, by 25% and 23% respectively, due to lower intermediate input prices and technological change that reduces the amount of inputs required to produce a unit of output. The impact of changes in the land price on agricultural prices depends upon the share of land in agricultural production. Regions that favour extensive agriculture, and therefore use a large amount of land to produce agricultural products, experience greater impacts on agricultural prices than regions with intensive agriculture for which land costs are a smaller share of production costs.

Figure 9.2 Real land prices and agricultural producer prices in 2030 (2010=1)



Source: MAGNET model simulations.

Although agricultural prices are generally projected to fall over the period in all scenarios, higher land prices lead to relatively higher agricultural prices after the introduction of the RED policy, and still higher prices after the introduction of the REDD policy. The introduction of biofuels policies pushes up European land prices by 14%, which is slightly below the global average of 16%. That is, instead of falling by 27% as in the business-as-usual scenario, the average real land price falls by only 17%.[22] The higher land prices lead to agricultural prices that are 1.5% higher in Europe and 6% higher worldwide.

The impact of the REDD policy on land prices is particularly pronounced, increasing land prices in all regions including Europe. Land prices increase by a further 14% in Europe and 34% worldwide after the introduction of the REDD policy, which translate into agricultural price rises of a further 3% in Europe and 11% worldwide. The RED and REDD policies therefore lead to higher agricultural prices relative to the business-as-usual values, although even with both policies in place, agricultural prices still remain below their 2010 level in both regions.

Agricultural production is projected to increase by 0.3% in Europe and 28% worldwide by 2030. These increases in agricultural production can be met by increases in land area under cultivation (extensification) or yield growth (intensification) as shown in Figure 9.3. Although European agricultural output is projected to remain stable to 2030, the results indicate that there will be a trend toward intensification, with the same amount of output being produced from a smaller land area due to yield growth. This pattern differs from the global average, where the increase in agricultural production is met by increases in both yields and land area. Within Europe, the small increase in agricultural production of 0.3% is met by a 7% fall in land area and an 8% increase in yields. Globally, the 28% expansion in agricultural production is achieved through an 8% growth in land area and a 19% growth in yields.[23]

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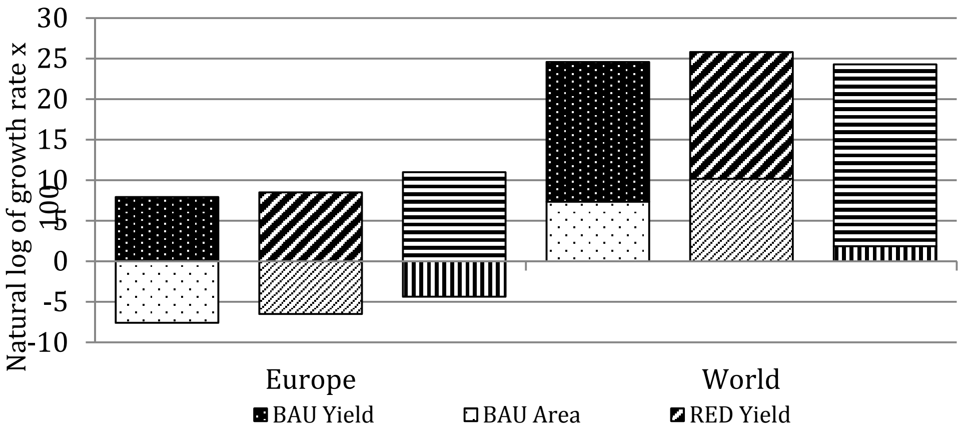
[22] Note: 0.828/0.725 = 1.142.

[23] Figure 9.3 shows changes in logarithms multiplied by 100. Thus a 28% increase is shown as 25% [= 100*ln(1.28)]. Use of logarithms avoids having a residual in the decomposition of output growth into the contributions of area and yields.

Figure 9.3 Decomposition of percentage change in agricultural output by land area and yields, 2010-2030



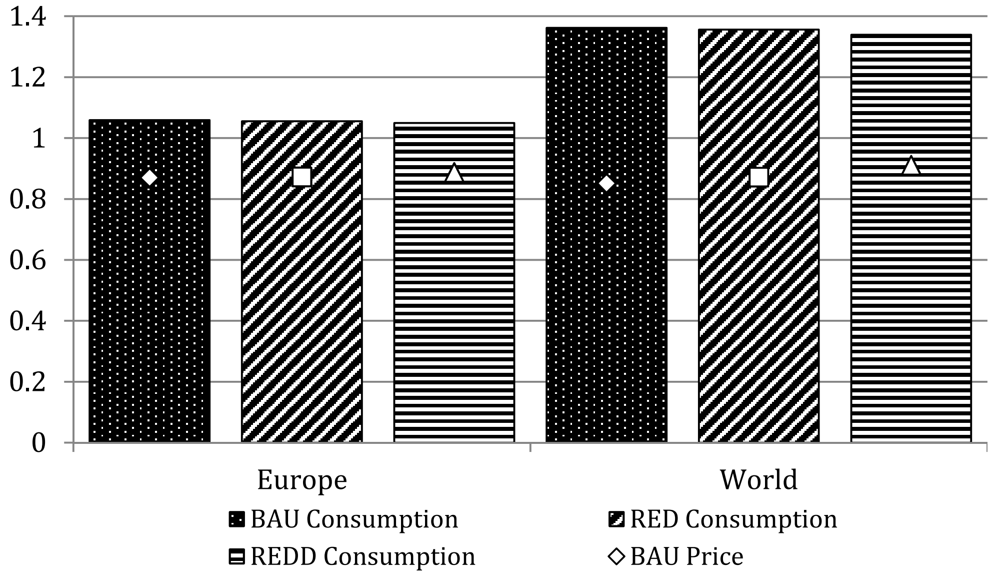
Source: MAGNET model simulations.

The introduction of the RED policy leads to slightly higher agricultural production growth in Europe (1.7% higher) and worldwide (1.5% higher), with the extra production in Europe absorbed by extra demand for biofuel use within the region. The expansion is brought about by greater land use in both regions and a slight improvement in yields in European agriculture.

The extensification that occurs under the RED policy contrasts with greater intensification worldwide under the REDD policy. The protection of forest and woodlands reduces global agricultural production by 1.9%, which more than offsets the increase brought about by the RED policy. Global agriculture intensifies as higher land prices reduce land under cultivation and increase yields by causing more units of capital and labour to be employed per unit of land. In contrast, lower relative land prices improve Europe's comparative advantage and boost production by a further 5%. The expansion is met by both improvements in yields and increased land under cultivation.

The results so far suggest that the introduction of the UN REDD policy to protect forests and woodlands will boost agricultural production in Europe, intensify global agriculture and increase agricultural prices. The implications of these higher agricultural prices for food consumption are shown in Figure 9.4.

Figure 9.4 Consumer food prices and household food consumption in 2030 (2010=1)



Source: MAGNET model simulations.

The impact of the RED and REDD policies on consumer welfare and global food security can be evaluated by considering the impact on food prices and food consumption of households, where higher prices and a reduction in food consumption is taken to mean a worsening of welfare and food security. Overall, the consumption of food in both regions slightly decreases as a result of the RED and REDD policies, due to a small increase in consumer prices, but the impact of the REDD policy is unequally distributed worldwide with some regions experiencing relatively large reductions in food consumption. This result suggests that any growth in income from the expanding agricultural sector in Europe is outweighed by higher consumer prices.

4. Summary

Our findings suggest that in contrast to global trends, both renewable energy and forest protection policies will boost European agriculture. The policies also lead to more demand for land for crop cultivation, partly offsetting the trend towards intensification in Europe. The trend towards intensification in Europe, plus relatively low forest protection requirements, improves Europe's comparative advantage in agricultural production, accounting for the different response in this region. Overall, Europe appears to experience net gains from global efforts to increase biofuel use and protect forests, experiencing higher agricultural production and trade, with only small increases in land prices and food prices faced by consumers.

We also find that RED and REDD are feasible from a worldwide perspective, although there are some regional concerns over food security that need to be addressed. Countries directly affected by forest and woodland protection would be the most economically vulnerable when the REDD policy is implemented. The full REDD policy setting, however, foresees providing compensation to these countries to cover their economic losses. The RED policies are typically achieved through greater extensification, whereas the restriction on available land for agriculture under REDD leads to a greater intensification of agriculture. That said, real food prices are still lower than the 2010 level, even with the RED and REDD policies in place.

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10. ACCESS TO CAPITAL AND AGRICULTURAL LAND DEMAND

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This chapter analyses the consequences of enhanced biofuel production in regions and countries of the world that have announced plans to implement or expand on biofuel policies. The analysis considers biofuel policies implemented as binding blending targets for transportation fuels. The chosen quantitative modelling approach is two-fold: it combines the analysis of biofuel policies in a multi-sectoral economic model (MAGNET) with systematic variation of the functioning of capital and labour markets. The chapter adds to existing research by considering biofuel policies in the EU, the US and various other countries with considerable agricultural production and trade, such as Brazil, India and China. Moreover, the application multi-sectoral modelling system with different assumptions on the mobility of factor markets allows for the observation of changes in economic indicators under different conditions of how factor markets work.

1. Introduction

Since 2001, a rapid growth in biofuel production has been observed, driven by high crude oil prices as well as by growing interest in reducing greenhouse gas (GHG) emissions. High oil prices encouraged innovations to reduce crude oil consumption and triggered governments all over the

[*] This chapter is based on Banse, Rothe, Tabeau, van Meijl & Woltjer, "Will improved access to capital dampen the need for more agricultural land? A CGE analysis of agricultural capital markets and world-wide biofuel policies", Factor Markets Working Paper No. 48, May 2013.

world to stimulate the production and consumption of biofuel. To assure a certain level of reduction of GHG emissions, mandatory targets (e.g. binding blending targets) have been established. These quantitative measures set targets for the share of renewable fuels (biofuel) in fuel consumption (Sorda et al., 2010).

The consequences of biofuel policies on agricultural markets and GHG emissions have been analysed in numerous papers (Rajagopal & Zilberman, 2007; OECD, 2008; Al-Riffai et al., 2010; Banse et al., 2008; Hertel et al., 2010). Apart from the impact on agricultural and food markets, these studies also focus on direct and indirect land-use effects of biofuel mandates. Dehue & Hettinga (2008) report prepared for the Gallagher Review and the Netherlands Environmental Assessment Agency report by Eickhout et al. (2008) provide much higher estimates of the agricultural land requirements of the EU mandate; numbers for the respective studies are about 50, 20–30 and 19–31 million hectares. At the same time, Banse et al. (2008), using the computable general equilibrium (CGE) model LEITAP, projects a similar increase of the biofuel feedstock prices as the OECD (2008). Additionally, a study by Mulligan et al. (2010) shows that changes in crop area from a marginal change in demand for particular biofuels produced by different models differ significantly.

Studies analysing biofuel policies have a strong focus on land-use changes but often do not consider the possibility of intensifying land use by increasing the use of capital. Reducing the pressure on land use is one of the main challenges to guarantee the increase in agricultural production to meet an increasing demand for food, feed, fuel and fibre. Therefore, the analysis presented here shows how improved access to capital affects agricultural production and consequently helps to reduce the pressure on land use arising from obligatory biofuel mandate implementation on a global scale.

2. Quantitative approach

The quantitative approach is based on Version 6 of the Global Trade Analysis Project (GTAP) data (Dimaranan, 2006). The GTAP database contains detailed bilateral trade, transport and protection data, characterising economic linkages among regions, linked together with individual country input-output databases, which account for intersectoral linkages. All monetary values of the data are in US$ millions and the base year for Version 6 is 2001, which is updated especially for biofuel data including supply, demand and trade as well as policy measures.

The extensions with regard to capital demand have been already outlined in Shutes et al. (2012). The specification of the capital market has been improved through the introduction of capital vintages or sector-specific capital or by allowing for different types of investment good. Here, we implement a sensitivity analysis on the parameters which determine the capital market modelling in MAGNET for the substitution elasticities between capital and other factors, as well as the parameters that govern the movement of capital between agricultural and non-agricultural markets.

2.1 *MAGNET model*

The economic model is the MAGNET (Modular Applied GeNeral Equilibrium Tool) model, which is a multi-regional, multi-sectoral, static, applied general equilibrium model based on neo-classical microeconomic theory (see Woltjer & Kuiper, 2013). It is an extended version of the standard GTAP model, Hertel (1997) and builds on the LEITAP model (Nowicki at al. 2009; van Meijl et al., 2006).

This chapter mainly refers to options to modify the mobility of factors (a) *within* one sector, and (b) *between* different sectors. The first option will affect the degrees of substitutability between different inputs in the sectoral production function, while the second option will model how easily one factor (e.g. capital applied in agriculture) can be transferred to sectors outside agriculture.

Intersectoral factor mobility refers to the speed with which factors move between sectors in response to changes in relative returns. Keeney & Hertel (2005) motivate the introduction of segmented factor markets with four observations: the role of off-farm factor mobility in farm incomes, co-movements in farm and non-farm wages, steady off-farm migration, and persistent rural-urban wage differentials (Keeney & Hertel, 2005, pp. 6–7). The model includes a variant with a constant elasticity of transformation (CET) function that Keeney and Hertel use and a variant where an econometrically estimated dynamic mobility equation of capital and labour between agricultural and non-agricultural markets is modelled. Capturing these features better represents agricultural factor markets in MAGNET and improves long-term projections by accounting for off-farm factor movements such as labour migration with a substitution of agricultural labour by new invested capital.

Two types of factor markets for mobile factors are implemented in MAGNET: un-segmented, and segmented with mobility between the two sectors governed by a CET function. The un-segmented variant follows standard GTAP. The segmented market with CET function variant follows GTAP-AGR as presented by Keeney & Hertel (2005).

The separation of agricultural and non-agricultural markets leads to separate market clearing conditions and different factor prices in the two markets. The segmented factor markets module links to the rest of the model through input or endowment prices and the factor market clearing condition. The endowment price is defined as the market price for the factor endowment plus any taxes on factor use. As there are two markets for factors in the segmented market (agriculture and non-agriculture), the endowment price is defined as the agriculture market price plus taxes in the agricultural market and as the non-agriculture market price plus taxes for the non-agricultural market.

Although there are two distinct markets for mobile factors in the segmented factor markets module, capital can still move between the two markets. Indeed, extra capital needed in the non-agricultural sector must be pulled from the agricultural sector and vice versa. The movement of factors between agricultural and non-agricultural markets is determined by changes in relative prices and an elasticity of transformation (CET function). In the absence of available data on the underlying barriers to factor mobility, Keeney & Hertel (2005) introduce a CET function in GTAP-AGR to 'transform' agricultural capital into non-agricultural capital. This option in MAGNET follows the set up in GTAP-AGR as documented in Keeney & Hertel (2005). The transformation of factors between the two markets is governed by the elasticity of transformation. The transformation elasticity is set at -1 for all factors and regions in the first instance and modified under the systematical sensitivity analysis.

3. Scenario results

3.1 Scenario description

While the main focus of the analysis is on the option to reduce land use changes under improved access for agricultural sectors to capital markets, the main driver in the chapter is the introduction of binding biofuel mandates in different regions and countries. The scenario-setting is built on a reference scenario 'No Biofuel Mandate' (NoBFM) that assumes no mandatory use of biofuel consumption in any part of the world. In addition, we run a single-biofuel policy scenario experiment.

Glob-BFM scenario with mandatory biofuel mandate implemented for the EU and the US together with the following countries: Brazil, Argentina, Canada, Colombia, Ecuador, Paraguay, India, Indonesia, Philippines, South Africa, and Thailand.

Based on this setting, we use the Glob-BFM as the reference to see how (a) improved substitutability of agricultural land with capital, and (b) improved access of agriculture to capital markets ease the pressure on global land-use changes induced by worldwide biofuel policies.

3.2 *Scenario setup*

In the biofuel mandate scenario, we fixed the share of biofuels in fuel used for transportation in 2020. To achieve this policy target, a subsidy on bioenergy inputs in the petrol sector increases endogenously to make bioenergy inputs competitive with crude oil inputs. The following section will present the results for the reference scenario, which does not assume any enforced mandatory blending target. Due to limited space, the impacts of biofuel policies are presented only at the aggregated regional and commodity level.

To show the impact of an improved mobility of capital within and across sectors, we applied the following scenarios:

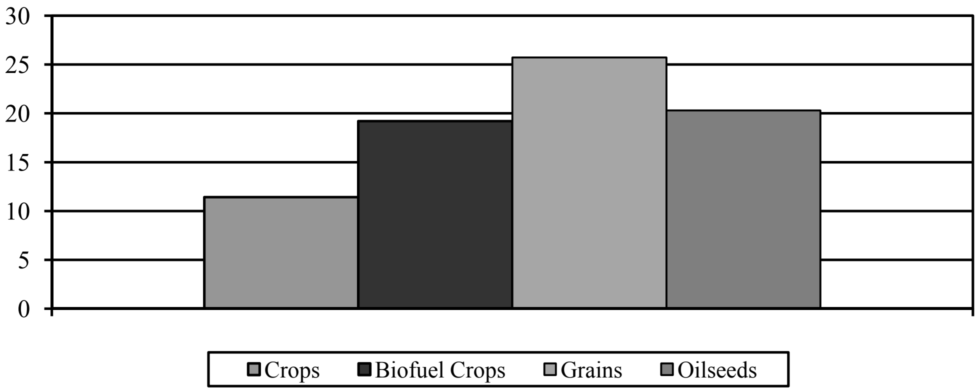
1. CES-CAP: a systematical variation of the **CES elasticity for capital** in the agricultural sectors by -75%, -50%, +50% and +100% relative to the initial level.
2. CET-ALL: a systematical variation of the **CET elasticity for capital and labour** between agricultural and non-agricultural sectors by -75%, -50%, +50% and +100% relative to the initial level.
3. CET-CAP: a systematical variation of the **CET elasticity for capital only** between agricultural and non-agricultural sectors by -75%, -50%, +50% and +100% relative to the initial levels.

The variation of the CET elasticity for all factors (capital and labour) and for capital only should help to identify the impact of improved inter-sectoral mobility of capital relative to improved mobility of both capital and labour together. It should be mentioned that for the scenarios analysing a systematical variation of the CES and CET elasticities, each variant of the model has been run twice, once without binding biofuel targets and a second counter-factual with binding biofuel targets under the same level of CES and CET elasticities.

3.3 Scenario results

As already mentioned, the main goal is to illustrate the impact of changing factor mobility. However, the next two figures show the impact of a worldwide implementation of biofuel policies on world agricultural prices and land use to give a first glance at the underlying 'scenery'.

Figure 10.1 Change in real world prices in 2020 relative to no binding biofuel mandates, %

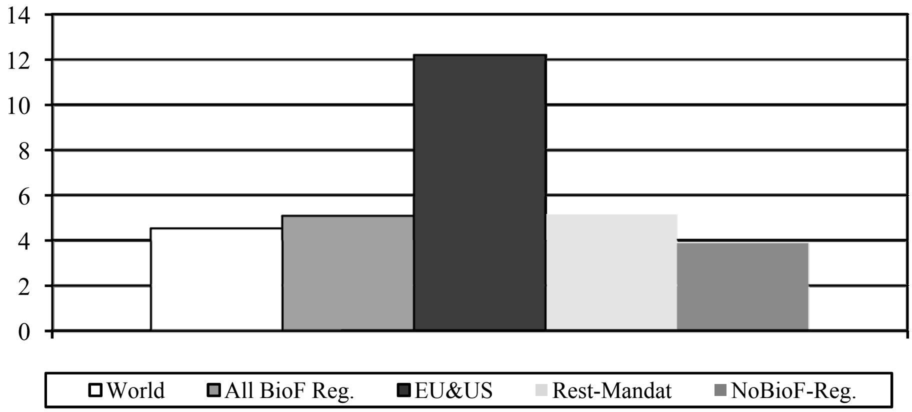


Source: Own calculations.

World prices of agricultural products tend to increase with enhanced biofuel consumption as a consequence of biofuel policies. This is especially the case for those products that are directly used as biofuel crops. Figure 10.1 presents the changes in real agricultural prices relative to a situation without (binding) biofuel policies. Under biofuel mandates international grain and oilseed prices increase by more than 25% relative to the 'no biofuel' scenario.

In all regions, mandatory blending also leads to a moderate increase in total primary agricultural output and consequently higher land demand (Figure 10.2). Land use increases in all regions compared with no binding biofuel mandates. With mandatory biofuel policies implemented on a global scale, agricultural land use increases by around 4.5%.

Figure 10.2 Change in agricultural land use in 2020 relative to no binding biofuel mandates, %



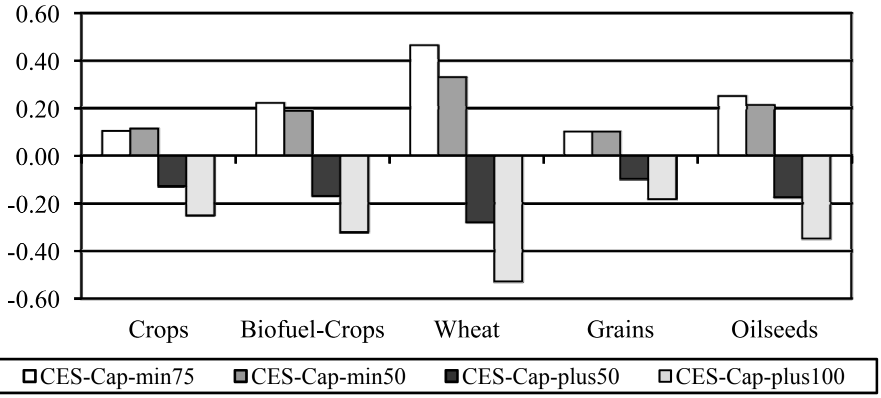
Notes: All BioF Reg covers all regions listed above with the two subsets 'EU&US' and 'Rest-Mandat'. All other regions that do not apply binding biofuel policies are aggregated under 'NoBioF-Reg.'

Source: Own calculations.

These results should illustrate the general tendencies after biofuel mandates have been implemented on a global scale in different countries and regions. The following graphs show how the significant impact on agricultural markets in term of price changes, production and land uses might alter if capital becomes more mobile at the intra-sectoral level (i.e. within the agricultural sector with a higher substitutability between capital and other factors) and at the inter-sectoral level (i.e. between the agricultural and the non-agricultural sectors) with a higher (factor-) price responsiveness to changes in the ratio capital use within the agricultural and the non-agricultural part of the economy.

Similar to the presentation of the general outcome of the implementation of biofuel polices, we show the impact on world agricultural prices.

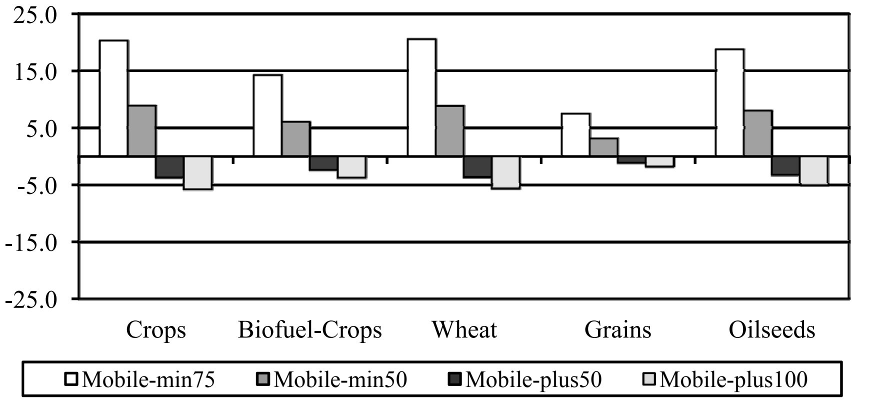
Figure 10.3 CES elasticities: change in real world agricultural prices in 2020 relative to standard CES elasticity values under Glob-BFM scenario, %



Source: Own calculations.

A variation of intra-sectoral mobility of capital due to change in the CES elasticity of capital in the production function has only limited impact on world agricultural prices. With lower CES elasticities, which imply a stickier and 'slower' change in the composition of factor use under changing factor prices, world prices of crops used for biofuel production are slightly higher. With higher CES elasticities, wheat prices will be around 0.5% lower compared with the standard elasticity setting in the Glob-BFM scenario (Figure 10.3).

Figure 10.4 CET elasticities: change in real world agricultural prices in 2020 relative to standard CET elasticity values under Glob-BFM scenario, %



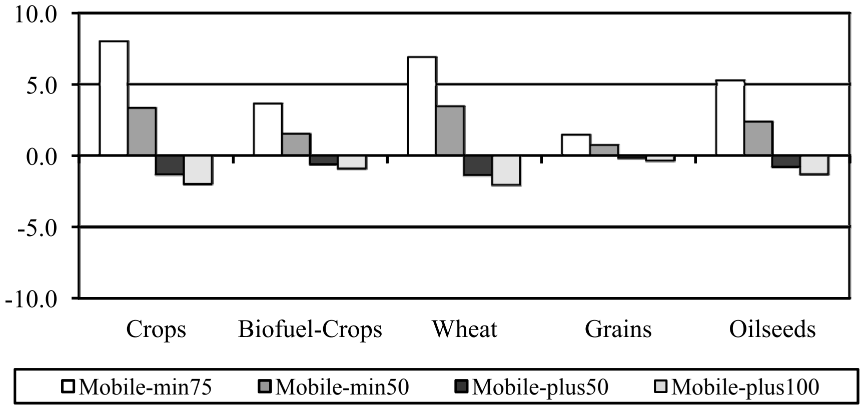
Source: Own calculations.

If we assume an increase in inter-sectoral mobility of factors between agricultural and non-agricultural sectors, the impact of world agricultural prices become more evident. With lower inter-sectoral factor mobility, we see that for all arable crops used for biofuel production world prices are much higher compared with the standard CET elasticity values under the Glob-BFM scenario (Figure 10.4). Under CET elasticities, which are 75% lower compared to the standard assumptions, world prices for wheat are more than 20% higher. Higher inter-sectoral factor mobility will dampen the increase in world prices and with CET elasticities twice as high compared to the standard setting, wheat prices will be more than 5% lower compared to the standard assumptions under the Glob-BFM scenario.

How do these results correspond to the changes in agricultural production? Under lower inter-sectoral factor mobility we observe a higher level of agricultural prices than under the standard assumption. Figure 10.5 shows the impact of a systematical variation in the CET elasticities on the level of agricultural production. The higher level of prices under lower inter-sectoral mobility is mirrored by a higher level of agricultural production, which is at first sight a little bit counter-intuitive. Lower inter-sectoral mobility means lower use of labour and capital compared to the standard scenario outcome. This is, however, only part of the picture! In agriculture, land is sector-specific and acts as the limiting factor to agricultural production. With higher prices, land rents also increase and it becomes profitable to expand land use (see Figure 10.6). Under lower factor mobility, agricultural production becomes more land-intensive and less labour/capital-intensive. Hence land use increases dramatically on the global scale.

The asymmetric figure of price change (i.e. higher increases in prices/production under low factor mobility and relatively lower decreases in prices/production under higher factor mobility) is due to the sector-specificity of land in agriculture where, for most arable crop products, land rents are the largest part of total value added and the mobile part of labour and capital gains make up only a relatively small share of total value added in arable crop production.

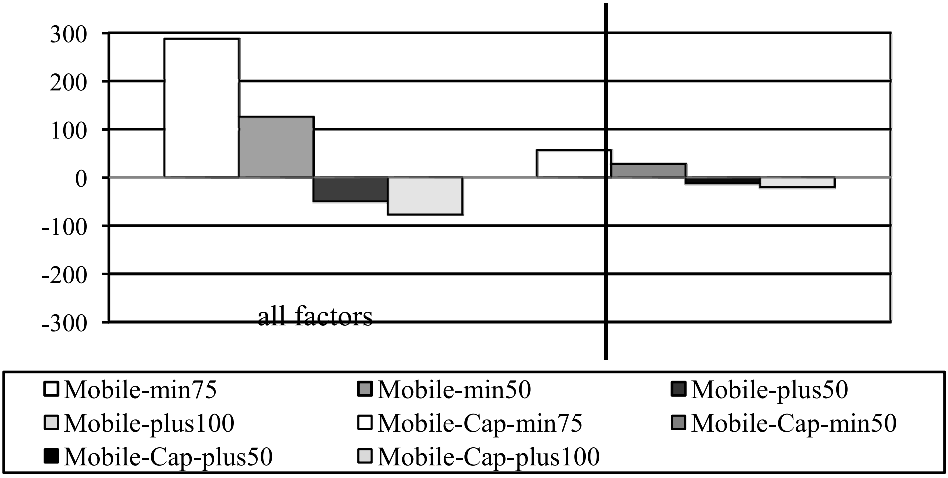
Figure 10.5 CET elasticities: change in world agricultural production in 2020 relative to standard CET elasticity values under Glob-BFM scenario, %



Source: Own calculations.

With lower inter-sectoral factor mobility, agricultural land use expands as a consequence of biofuel mandates implemented on a global scale by almost 290 million hectares, which is equivalent to 5.4% of global agricultural land use. Higher inter-sectoral factor mobility will ease the pressure on expanding agricultural land use and around 80 million hectares less will used compared with the standard assumption of factor mobility. Here, employment and capital use in agricultural increases. If the inter-sectoral factor mobility is altered for capital only, the effects become much smaller (right-hand side of Figure 10.6).

Figure 10.6 CET elasticities: change in agricultural land use in 2020 compared with standard CET elasticity values under Glob-BFM scenario, million ha



Source: Own calculations.

4. Conclusions

This chapter shows the consequences of different degrees of factor mobility in agricultural production under the assumption of enhanced biofuel production in those regions and countries of the world which have implemented biofuel policies in the form of mandatory blending targets of transportation fuels. The chosen quantitative modelling approach is the multi-sectoral economic MAGNET model with a systematical variation of the inter-sectoral and intra-sectoral factor mobility.

The simulation results of the model show that biofuel policies have a pronounced impact on the markets for grains, oilseeds and sugar, but a rather limited impact on the production level of aggregated primary agricultural output. At the global level, the EU and US biofuel policies contribute to the increasing demand for biofuel crops. However, other countries that also introduced mandatory biofuel targets, such as Brazil, Canada, India, Philippines, South Africa and Thailand, contribute to an even greater extent to increasing world prices for agricultural products driven by food use for fuel.

With increasing agricultural output, total agricultural area is projected to increase by 5%, while production of biofuel crops increases by around 19% indicating a more intensive production of biofuel crops at the global level. Even the strong increase in crop production in countries implementing biofuel policies exceeds domestic supply, and the imports of these biofuel crops from other parts of the world which do not implement biofuel policies are projected to increase significantly.

The analysis shows that apart from direct effects of an enhanced demand for bioenergy on production and land use, the indirect effects of biofuel policies dominate. Additional production of biofuel crops within and outside countries with voluntary and mandatory biofuel policies leads to strong indirect land-use changes and associated GHG emissions.

The systematical variation of factor mobility indicates that the 'burden' of global biofuel policies is not equally distributed across different factors within agricultural production. Agricultural land as the predominant and sector-specific factor is, regardless of the degree of inter-sectoral or intra-sectoral factor mobility, the most important factor and limits the expansion of agricultural production. More capital and higher employment in agriculture eases the pressure on additional land use, but only partly. To expand agricultural production on the global scale would require adapting both land and mobile factors to increase total factor productivity in agriculture in the most efficient way.

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11. THE ROLE OF SOCIAL COMPARISONS IN AGRICULTURAL LAND MARKETS: EVIDENCE FROM POLAND

JAN FAŁKOWSKI[*]

While many factors have been studied in relation to the functioning of land markets, the role of land distribution has received relatively little attention. In this chapter, the authors ask to what extent farmers' propensity to buy land is related to the difference between them and their neighbours in terms of land ownership. To this end, they employ the concept of relative deprivation. Drawing on micro-level data from the transition period in Poland and using both OLS and instrumental variables strategy, they find that interpersonal comparisons with others in his or her reference group may have motivated a farmer's behaviour in the land market. In particular, the propensity to purchase land is positively associated with experiencing higher relative deprivation. In addition, this relationship waned over time in a predictable manner: late in the transition period it was weaker than at the beginning of the period.

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This chapter summarises the key insights on the role of social comparisons in shaping farmers' behaviour in land markets in Poland. The full paper with relevant background information, methodology and analysis is available as Fałkowski, "Does it matter how much land your neighbour owns? The functioning of land markets in Poland from a social comparison perspective", Factor Markets Working Paper No. 59, August 2013.

1. Research question and motivation

Many factors have been studied in relation to the functioning of land markets. In fact, the literature on agricultural and development economics offers a number of theoretical as well as empirical studies that aim at explaining both determinants of land market operations and their impact on poverty, efficiency of resource allocation and equity in rural areas (for a comprehensive literature review, see Binswanger et al., 1995; Deininger & Feder, 2001; and Otsuka, 2007). That said, and notwithstanding important contributions that have considerably improved our understanding of factors driving farmers' participation in land transactions, there are still some important questions that largely remain without answers. For instance, relatively little attention has been paid to the way in which farmers' behaviour in land markets is affected by land distribution. In particular, surprisingly little is known to what extent a decision to purchase land could be an effect of social comparisons, i.e. to what extent farmers are motivated to buy more land if others in their reference group have larger land endowments.

This is all the more interesting as this relative lack of studies investigating the role of social comparisons is in a stark contrast to the long-established arguments and interest that economists have placed on the fact that an individual's behaviour is affected by his or her neighbours' behaviour (Markowitz, 1952; Becker, 1974; Clark & Oswald, 1996). This is also in contrast to the existing evidence emphasising the role of social groups in affecting farmers' behaviour or subjective well-being (Burton, 2004; Kuehne, 2013; Van Landeghem et al., 2013).[24] Indeed, based on the existing literature, one may assume that farmers' utility does not depend solely on individual achievements but also on how are they perceived within the local community.

In this chapter, we develop this line of reasoning and ask to what extent farmers' propensity to buy land is related to the difference between them and their neighbours in terms of land ownership. To this end, we employ the concept of relative deprivation (Stark, 1984; Stark & Taylor, 1991). Borrowed from the literature on migration, this concept allows us to relate the behaviour of an individual to the behaviour of other members from the group with which comparisons are made.

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[24] There is also a political economy literature on the role of relative deprivation to induce political actions (e.g. Swinnen, 1994).

As an empirical illustration of these considerations, we use the evidence on the functioning of land markets in Poland during the transition period. The choice to focus on Poland and this particular period can be justified on several grounds, two of which seem to be especially important. First, studying land markets in Poland should be of relevance given the fact that the local agricultural sector has been very fragmented. Therefore, at least some land consolidation seems to be necessary. In this context, a better understanding of the determinants of local land market operations could be of relevant from point of view of the efficiency of resource allocation. Second, looking at the transition period provides a unique opportunity to study the period when land markets had only started to function after being heavily regulated or structurally blocked during communist times (Halamska, 2001; Gorlach, 1989). While one may assume that a shift from a centrally planned economy to a market economy has certainly strengthened the role of economic motives in influencing individuals' behaviour, it is interesting to see to what extent land market participation could have also been driven by non-economic values related to land ownership. To support the idea that these latter values might have indeed played a role, one may recall findings from other studies pointing to the fact that land ownership is often a source of political power (Binswanger et al., 1995; Banerjee & Iyer, 2005; Acemoglu et al., 2008; Baland & Robinson, 2008; Baldwin, 2013) or can be indicative of individuals' socio-economic status and a source of their identity (Platteau, 2000; Burton, 2004; Cheshire et al., 2013; Kuehne, 2013). The importance of land in facilitating access to credit (via acting as a collateral) or providing a social security net, again showing that the role of land may go beyond a mere means of production, should also be recognised. For these reasons, people may want to maintain at least the same level of land endowments as is common in their social group.

That said, it is reasonable to assume that the relative position considerations might have affected farmers' participation in land transactions differently over time. This could be linked to the fact that social relations in rural areas have been a subject to a thorough reorganisation relating to the processes of modernisation and globalisation (Bryant 1999; Johnsen 2004). There is no doubt that during the last two decades, economic aspects of land ownership in Poland have gained importance and this refers not only to the role that land plays as an input to agricultural production. Land has more and more speculative value (as urban demand rises) or serves as a store of wealth (which should also be seen in the context of direct payments introduced in Poland after joining the EU in May 2004). In consequence, with time, land ownership might have lost an important part of its non-economic functions (see Kochanowicz (2008) for a related discussion).

Overall therefore, in this chapter we study whether farmers' participation in land transactions is driven, at least partly, by concerns about their relative position. More specifically, we aim to verify two hypotheses. First, we hypothesise that a farmer's propensity to purchase land would be stronger if he/she has less land endowments than his/her peers from the reference group. Second, we expect the effect of social comparisons to weaken over time and to be stronger at the beginning of the transition period than at the end of this period.

2. Data and empirical methods

2.1 Data

To study the effect of social comparisons on farmers' land market behaviour, we use data from 74 Polish villages. We look at three waves of the survey conducted in 1992, 1996 and 2000. In our econometric modelling, we use roughly between 3300 and 3800 observations, depending on a year and the estimation specification.

Unfortunately, our data are not panel observations. Nevertheless, we are able, to a limited extent, to control for dynamic effects at the household level. This is because each wave that we use provides retrospective information on the events that happened four years earlier. Most importantly, we are able to document some associations between interpersonal comparisons in year t_0 and farmers' behaviour in land markets in the next four years (t_0; t_{0+4}). This is notable as it allows us to assume that what we capture is the effect of relative deprivation on land market behaviour and not *vice versa*. Further, it also enables us to take into account the fact that the decision to buy land and its realisation could be spread over time.

What should be noted is the fact that within the surveyed villages, all farming households were approached. Given our focus, this is a very important characteristic of the dataset that we use. Thanks to this, our sample contains immediate neighbours that are likely to constitute a natural reference group for each other. In effect, even if we assume that some of these households refused to answer the questionnaire, we can be sure that our sample contains a substantial share of relevant peer groups with which farmers compare themselves. This is particularly worth noting since other studies often investigate the phenomenon of social comparisons in larger administrative units and may suffer from measurement error related to the fact that the reference group is defined over entities that are too large. The approach that we adopt allows us to minimise such risk.

Our data provide quite detailed information on farmers' participation in land markets. As we are interested in studying the impact of social comparisons on farmers' propensity to buy land, this feature of our dataset presents an important advantage. However, it also has an important cost. The main problem is that, while offering considerable information on land issues, our dataset has a rather limited coverage of other socio-economic characteristics of the surveyed households. This in turn increases the risk of omitting from the analysis some factors that could be important in shaping farmers' propensity to participate in land purchases. We try to minimise this problem by using various econometric techniques (see below). Nevertheless, this shortcoming should be kept in mind when interpreting our results.

2.2 *Empirical approach*

As our data are not panel observations, information provided in each survey-wave is used in a separate regression. Given the dichotomous nature of our dependent variable (equal to 1 if households bought land in the period (t_0, t_{0+4}) and 0 otherwise), our basic estimates are obtained from a logit model. We test the robustness of these estimates to changing the econometric specification (to a linear probability model) and the estimation sample. Further, to address potential concerns related to the omitted variables bias we also apply an instrumental variables strategy. This is done in order to check whether the findings from logit/OLS (ordinary least squares) models are not driven by an unobserved heterogeneity. This cannot be excluded, especially in the light of data limitations mentioned above. Our instruments include the land Gini coefficient at the village level and the interaction terms between this coefficient and two dummies indicating small and large farms, respectively (defined as farms larger/smaller than the 66th/33rd percentile of farm size distribution). It is assumed therefore that the way in which land is distributed in the village would directly affect a farmer's distaste for relative deprivation in land holdings and otherwise not influence his/her propensity to buy land. The two interaction terms are included as additional instruments in an attempt to account for the fact that the impact of land Gini on the relative deprivation of large-scale farmers would be different from on the relative deprivation of smallholders (negative and positive, respectively).

Our main variable of interest included in the set of covariates is a measure of a potential dismay from having less land resources than other people living in the same village. More specifically, we use a relative deprivation index, calculated as the proportion of those in a farmer's reference group whose land endowments are larger than the farmer's times their mean excess land (Stark & Taylor, 1991).

Other covariates that we add in our models include variables measuring the farmer's access to credit, utilised land holdings, age and education of farm manager and number of household members. We also control for village fixed effects. These variables aim at capturing the main factors/motives mentioned in the literature as being likely to affect farmers' behaviour in land markets. To take account of village-specific variance in the error term, all our models are estimated with robust standard errors.

3. Main findings and conclusions

Before reporting results from econometric models, we start by presenting a general pattern that seems to come out from a descriptive analysis. Interestingly, our data suggest that the relative deprivation index at time t_0 importantly varies across different groups of farms, depending on their activity in land markets in the period (t_0; t_{0+4}). In particular, on average, this index takes the highest values among those farmers that later decided to buy land; medium values among those farmers that in the next four years decided not to participate in land market transactions; and the lowest values among farmers that in the next four years decided to sell at least part of their land. This pattern seems to be consistent over time and can be observed in all survey-waves that we have at our disposal. The differences in average relative deprivation between these different groups of farmers seem to decrease with time, however. The differences in relative deprivation between those that bought and those that sold land were highest for the period 1988-1992, and lowest for the period 1996-2000. What should be noted is that these observations are in line with both hypotheses formulated above. However, they are based on simple averages. Thus, they clearly do not allow for any definite statements. Therefore, in the next step we look at the data in a more rigorous way. Below, we report the main findings that arise from our econometric modelling.

Subject to some caveats, our results consistently show that interpersonal comparisons with people from the relevant reference group may indeed motivate farmers' behaviour in land markets. More specifically, we document a positive association between an index of relative deprivation in land holdings and a farmer's propensity to purchase land. Further, in accordance with expectations, this relationship waned over time and was weaker at the end than at the beginning or in the middle of the 1990s. It should be emphasised that this general picture seems to be consistent across different model specifications and estimation samples. Importantly, estimates from logit/OLS are qualitatively the same as those obtained from an instrumental variables' method. The latter, though, are less precise. We also check if the relationship between relative deprivation and propensity to land purchases exhibits non-linearity. Our results suggest that at the beginning of the transition period, the effect of relative deprivation assumed the form of an inverted U-shape. At the later stages of the transition, though, the coefficient on the square term is statistically indistinguishable from 0, thus suggesting a linear relationship.

As regards the other covariates, their impact on land purchases is in accordance with expectations that could be formulated based on the literature. In particular, we find a positive impact of total utilised area. This clearly shows that farmers' behaviour in land markets is importantly driven not only by relative, but also by absolute land endowments. In fact, the absolute effect seems to be much larger in magnitude than the relative effect. The incidence of buying land is also higher among younger farmers and among households of larger family size. We also document a positive impact of access to bank credit, confirming that external financing could be indispensible for farmers to participate in land purchases.

That said, clearly a question remains as to what extent the relationship that we document reflects causality. As mentioned earlier, our data capture farms' socio-economic characteristics only to a limited extent. In effect, it may be argued that our main variable of interest captures also other unobservable factors. For instance, we do not control for farms' productivity and thus it may be argued that the relative deprivation effect can capture also the effect of economies of scale.[25] Therefore, even though we resort to an instrumental variables method, our findings may still be biased due to an unobserved heterogeneity and this should be kept in mind.

[25] Please note however that we do control for farms' land and labour.

Nevertheless, the correlations that we report are quite robust. In effect, they show that the issues in question should receive more attention. While suggesting that relative considerations may matter for farmers' behaviour in land markets, our findings point to a result that, to the best of our knowledge, has not been investigated elsewhere. In fact, the only paper (of which we are aware) that tries to bring a social comparisons perspective into the debate on land issues is that by Van Landeghem et al. (2013). The focus of this study, however, is different from ours in that it concentrates on the relationship between (relative) land endowments and subjective well-being.

Our findings could be also of relevance to policy-makers. What they seem to suggest, for instance, is that, holding other things constant, state efforts to promote land market operations could be less effective in regions where land holdings, though very fragmented, are more or less equally distributed. This is because in such a case, the relative consideration motive would not provide farmers with incentives to increase their land possession regardless of actions undertaken by the state. The opposite could be expected where the land distribution is more unequal. In this case, however, one could pose the question of whether the stimulus from the government is too big or not needed at all. This is because, again holding other things constant, it could be argued that in this scenario, farmers' propensity to participate in land markets would be high anyway, precisely due to the relative deprivation effect.

Overall, we believe that the association that we document could broaden our understanding of factors determining farmers' behaviour in land markets. Thus, we hope that, even if we are not able to ascertain causality, the analysis which we present here can form a basis for further interesting research. Additional robustness tests of findings reported could be one potential line of research. Providing evidence for other countries also seems promising. Finally, investigating the exact mechanisms through which the importance of relative deprivation may change over time is something that could significantly improve our understanding of the issues in question. Looking at the reorganisation of rural areas in response to the processes of modernisation and globalisation could be a starting point for such an analysis.

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PART II
LABOUR MARKETS

12. AGRICULTURAL LABOUR MARKETS IN THE EU AND CANDIDATE COUNTRIES

JASON LOUGHREY, TREVOR DONNELLAN, KEVIN HANRAHAN AND THIA HENNESSY[*]

The well-functioning of factor markets for capital, land and labour are crucial conditions for the competitiveness and growth of agriculture. In the case of labour, institutions and regulations may give rise to agricultural labour market heterogeneity which could have important effects on the functioning of the labour market and other agricultural factor markets in EU member states. At the same time, the functioning of the labour market and markets for other factors of production are influenced by changes in agriculture and the rural economy and in EU policies.

This chapter first defines the institutional framework for the labour market and identifies the most important elements of the labour market institutional framework to be analysed further. Based on the literature, a survey to characterise the agricultural labour markets was undertaken. This survey was implemented for a selection of EU27 and EU candidate countries, with responses based upon expert opinion. In turn the survey data was used to construct an overall index of labour

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market flexibility/rigidity for the countries examined. The authors present the results for each country in terms of the overall index and the relevant sub-components. In so doing, they are able to rank countries on a labour market flexibility scale and pinpoint specific criteria which affect the ranking of the countries in this index.

1. Introduction

Labour is one of three crucial elements in production that economists refer to as *factors of production.* The economics literature has long recognised that well functioning factor markets are vital conditions for fostering growth and maintaining international competitiveness (Van Bavel et al., 2009). It is important to recognise that the policy, regulatory and legal environment, along with prevailing social norms such as customs and traditions, can affect how well or how poorly these factor markets operate. Within the EU these factor markers are influenced by conditions that exist at either a widespread EU level or at a more localised national level. Therefore, the characteristics of factor markets across the EU member states are not necessarily uniform.

The Factor Markets project was established to explore this factor market heterogeneity in the context of agriculture, with a view to providing policy-makers with a better understanding of the heterogeneity which exists in factor markets across the EU and candidate countries. In so doing, the work aims to identify the constraints which current factor market characteristics present to the facilitation of better functioning markets and better growth opportunities within the EU.

In this chapter, the focus is on the market for labour, specifically labour associated with agriculture. This chapter draws together a number of strands of work so that ultimately an index of labour market flexibility/rigidity is created, which allows the countries under study to be ranked according to a series of criteria associated with the agricultural labour market.

The initial objective of this work was to identify the main criteria of interest in describing the institutional framework of the labour market. These include factors such as ease of engagement and disengagement from employment in the sector, measures of human capital and mechanisms to enhance human capital, wage-setting arrangements, the extent of union power and labour mobility. A survey questionnaire was used to gather data on the institutional framework of the labour market in selected countries in the EU-27 and in Croatia and Macedonia, based on the parameters and associated market characteristics identified in the previous drafts of this chapter. This survey was designed by Teagasc (Irish partner), in conjunction with the University of Kent (UK partner). The survey requested basic data on the structure of the employment market, labour legislation, wage-setting mechanisms, unions, taxation and social benefits, education and training, labour mobility and general features of agriculture.

In this chapter, we present the results from our survey data and develop an index measure to describe the overall characteristics of the labour market for each country under study. In so doing, we are able to rank countries on a labour market flexibility scale and to pinpoint specific criteria which affect the ranking of these countries in this index.

2. Summary statistics from the survey data

In this section, we provide a summary of some statistics based upon the responses to some of the key survey questions. We begin this analysis with the questions relating to the hours of work of legislation.

2.1 *Hours of work legislation*

The survey found that maximum hours of work legislation exists in all of the countries examined. There is some variation in the maximum hours of work across the countries surveyed. The limit in most countries is 40 hours per week, but the survey results indicate that the limit is higher in Croatia, Ireland, the Netherlands and the UK. The lowest limit in terms of working hours was found in Belgium where the maximum is 38 hours per week. Our Belgian expert points out, however, that there can be adjustments depending on the sector and the specific circumstances. Other countries allow for an expansion in working hours over the normal limit, but only for a short number of weeks. In general, it was found that the maximum hours of work legislation applied to the agriculture sector and that the maximum hours limit is broadly similar to that in operation in the rest of the economy. One exception appears to be Croatia, where the maximum limit for agriculture of 52 hours is much higher than that for the rest of the economy of 42 hours per week.

2.2 *Hiring and firing process*

Respondents were asked to consider the hiring and firing process in the countries under study and indicate the ease or difficulty employers faced in hiring and firing of employees. This question was asked in respect of the wider economy and also specifically in the context of the agriculture sector. The hiring of employees in agriculture is described as 'relatively difficult' in most countries with the exceptions of Greece, Ireland, Macedonia and Slovakia, where the hiring process is described as 'relatively easy'. The firing of employees is described as 'relatively difficult' in most countries with the exceptions of Belgium, Ireland, Macedonia and Slovakia, where the description is 'relatively easy'. Some country experts described the hiring or firing processes as 'neither difficult nor easy', but these were a small minority of the overall sample.

2.2.1 Wage-setting

Survey respondents were asked to detail the existence of minimum wage legislation throughout the wider economy and the agricultural sector. It was found that minimum wage legislation is relatively widespread across the survey countries. However, respondents indicated that Finland, Germany, Italy and Sweden do not have minimum wage legislation throughout the wider economy. Some of these countries have industry-level agreements regarding levels of minimum pay rather than national-level minimum wages. For example, in the case of Italy, it was indicated that there are 15 regional agreements in addition to 8 industry-level agreements and 100 agreements at the province level.

Respondents were also asked to indicate the monetary value of the minimum wage in the wider economy and specifically in agriculture. The results for the specific case of agriculture are presented in Figure 12.1. We include the hourly minimum wage in euros but we also adjust for differences in GDP per person (PPP) using Eurostat data. In some instances, the minimum wage applies to monthly incomes. In those circumstances, we have used Eurostat data on average working hours to estimate the minimum wage per hour. The minimum wage applies to monthly income in Belgium, Macedonia, the Netherlands, Poland, Slovenia and Slovakia.

Figure 12.1 Minimum wage in the agriculture sector (adjusted and unadjusted for GDP)

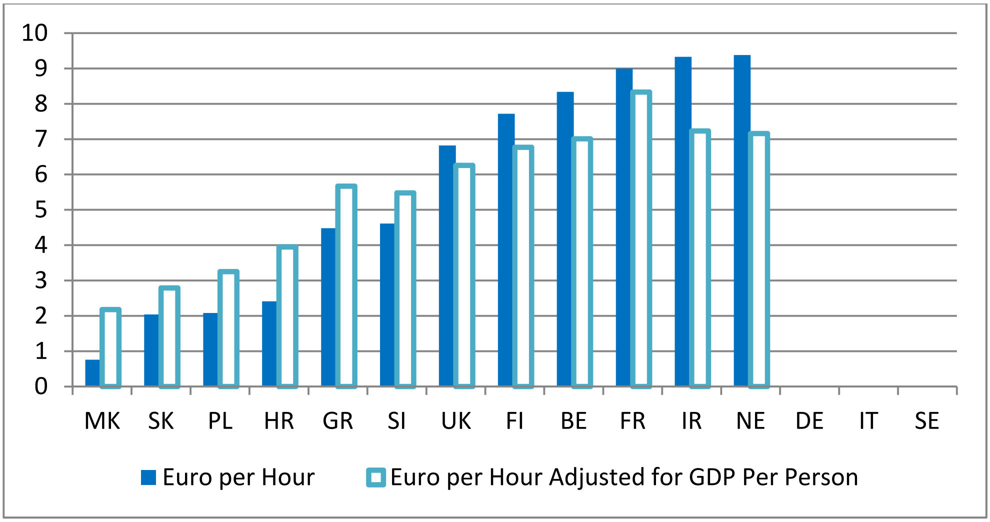


Figure 12.1 shows that the agriculture minimum wage is highest for employees in Ireland, France and the Netherlands. The minimum wage is lowest for employees in Macedonia, Croatia, Poland and Slovakia. Adjusting for differences in GDP per capita does not appear to change the country rankings to any great degree. France has the highest minimum wage after adjusting for GDP, while Macedonia still has the lowest minimum wage. The gap between the countries with the highest minimum wage and those with the lowest minimum wage declines somewhat after the adjustment for differences in GDP per capita, but large differences are still evident. The picture is very similar for the minimum wage in the general economy.

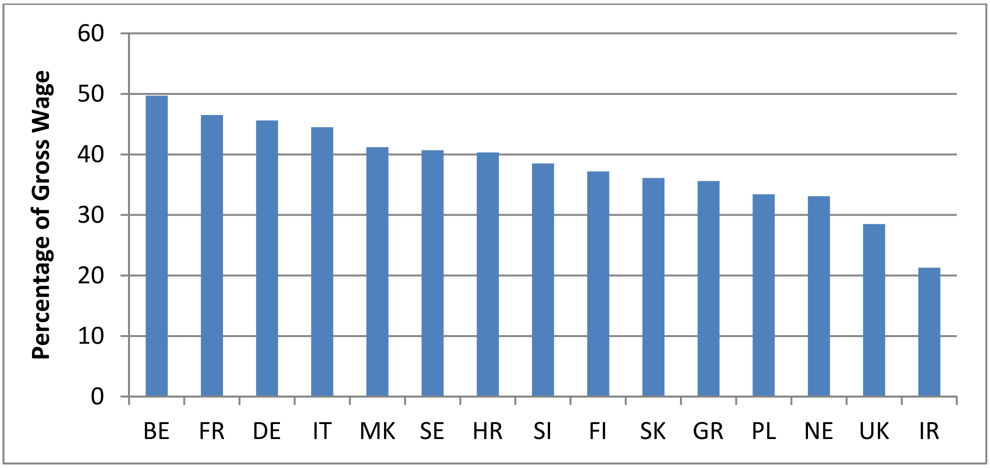
It is notable that in some countries, the minimum wage varies according to the level of job experience, age or education. In the case of Belgium, the minimum wage for uneducated agricultural employees is €8.34 per hour but it is greater for educated workers, at €9.20 per hour. In Greece, the minimum wages varies according to experience. The minimum wages listed here refer to the situation in 2011 and there may have been more recent changes in some countries. Where the minimum wage varies according to age, experience or education, we have applied the minimum wage for those employees with the lowest minimum wage. We include a question in the questionnaire as to whether or not the minimum wage varies according to the above variables and the responses form part of the overall index.

2.2.2 *Taxation and social benefits*

The survey sought information on the design of the unemployment benefit system in the countries under study. It was found that the duration of unemployment payments is generally one year, although there are exceptions where the duration of payments was indicated as indefinite (in Belgium and Ireland, for example). There may have been an issue here with the interpretation of the question and the precise terminology that is used to describe different forms of payments that can be received when an individual is out of work. In any event, the survey indicated that in general farm operators are not entitled to unemployment payments.

In addition to the survey question on benefit duration, we used Eurostat data on the size of the tax wedge for low wage earners in each country. This variable was calculated based upon the tax rate as a percentage of the gross wage which includes both employer and employee social insurance. The results are presented in Figure 12.2 and show that the tax wedge for low wage earners is usually between 30-45% of the gross wage. The tax wedge is highest for Belgium, France and Germany, and lowest in the case of the UK and Ireland.

Figure 12.2 Tax wedge (percentage of gross wage) for low wage earners in 2011



Source: Eurostat (2013).

2.2.3 *Education and training*

The survey sought details on the system of agricultural training qualifications that exist in the countries under study. The results indicated that most countries appear to have a system of agricultural qualifications in place. A further question sought information on whether it was now mandatory for farmers to acquire such qualifications, and it was indicated that this was not the case in the countries under study.

Respondents were asked for information on the typical level of education among farm operators. While the responses indicated that there is some variation in the education level of farmers across the countries examined, there is no regional pattern to this. The UK and Poland were notable outliers from the remaining countries. For the UK, the survey indicated that the level of educational attainment among farm operators is likely to be higher than the average for the wider population, while by contrast in Poland it was indicated that the level of educational attainment among farm operators is likely to be lower than the average for the wider population. For the remaining countries, it was held that there was no discernable difference in the education level of farm operators and the wider population.

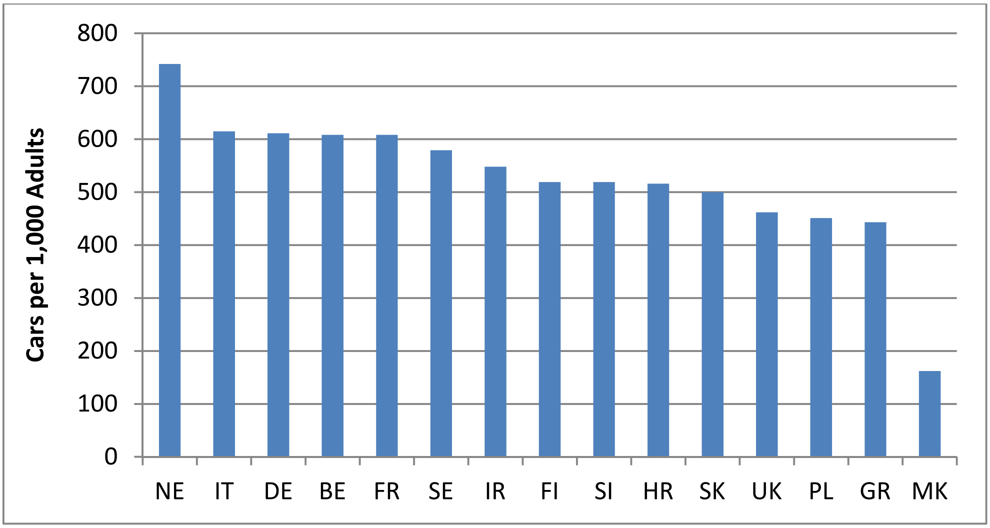
Similarly in the case of agricultural employees, it was found that their education level was above average in the UK. By contrast, the education level of farm employees in Macedonia and Slovakia was considered to be below the average of the wider populations. For most of the remaining countries, it was indicated that the education level of farm employees was broadly similar to that of the wider population.

2.3 *Labour mobility*

The study is concerned with labour mobility, both in terms of the movement of labour between economic sectors and the geographic mobility of labour. Respondents were asked to indicate whether labour market measures exist for farm operators, a mechanism which can facilitate the movement of labour between economic sectors. It was found that labour market measures are not generally targeted to farm operators in most of the countries under study, the exceptions being Greece, Italy, Macedonia, Poland, Slovenia and Sweden. By contrast, active labour market measures are quite widely available for farm employees, with Belgium, Germany, Ireland, the Netherlands and Slovakia as notable exceptions.

Respondents were asked to indicate the level of car ownership per adult as a measure of mobility (it is recognised that this variable is limited in the sense that countries have different population densities and different levels of public transport provision). There was quite a wide spread in the level of car ownership across the surveyed countries. One might expect this to be strongly correlated to the level of GDP per capita, and by and large this was the case. Rates of car ownership are highest in Italy, Germany, Belgium and France, and lowest in Greece, Macedonia and Poland. The number of cars per 1,000 adults exceeds 400 in all countries with the exception of Macedonia. However, there were some outliers, with the UK and Finland reporting lower levels of car ownership than some less affluent EU member states.

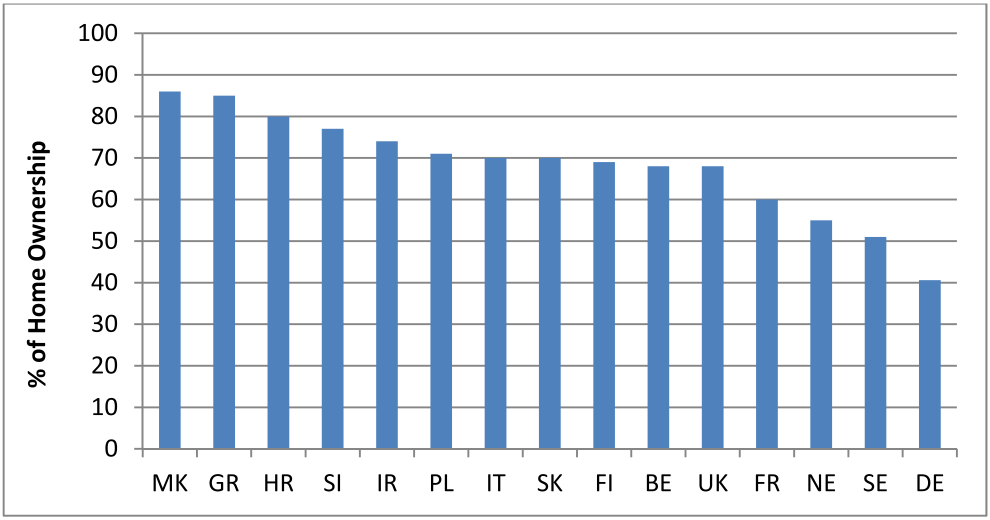
Figure 12.3 Cars per 1,000 members of the adult population



2.3.1 *Home ownership*

Respondents were asked to provide information on the level of home ownership in the countries under study. The level of home ownership could be seen as an indicator of labour mobility, with higher levels of home ownership seen as a limiting factor in terms of the mobility of labour (Oswald, 1996). We find that home ownership is lowest in Germany, Sweden, the Netherlands and France, and highest in Macedonia and Greece.

Figure 12.4 Percentage of home ownership in the countries under study



2.3.2 *Employment of foreign workers in agriculture*

Questions were also asked about the extent to which foreign workers were present in the agriculture sectors of the economies under study, in comparison with other low-skilled sectors in these countries. In general, it was found that foreign workers either from within other EU member states or outside of the EU remain relatively uncommon (exceptions being the labour market in Belgium, Ireland and the Netherlands). However, it was indicated that the prevalence of such workers is generally on the increase, with France and Macedonia notable as exceptions to this trend.

2.3.3 *Unionisation*

Questions relating to the level of union density were included in the questionnaire. Having gathered all of the data on union density, we concluded that it would be best to omit unionisation from the analysis. In making this decision, we took into account some qualitative feedback from the experts regarding the usefulness of farmer union density as a proxy for union power. In addition, it appeared from the results that farmer union density was weakest in countries where there is a reputation for strong farm union power.

3. Construction of an agricultural labour market flexibility/rigidity index

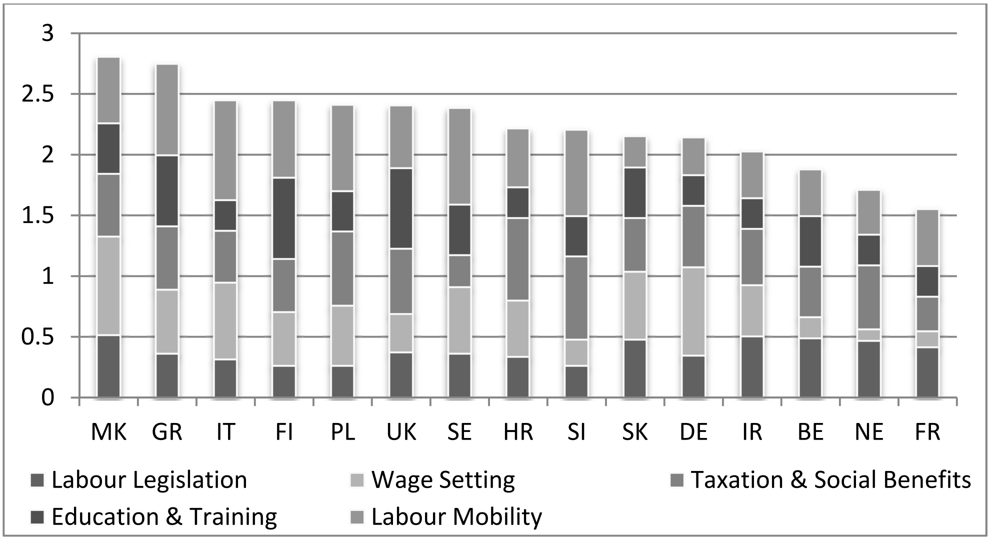
The final step in this work was the development of a labour market rigiditiy/flexibility index. Indices of this kind have been developed in the past for the wider labour market (Nickell & Layard, 1999). Essentially, this involved collating the data from the survey and ascribing a value to the response to each question. These values were then added together to provide an overall index value.

One consideration which immediately arises in the compilation of indices of this kind is whether and how the responses to particular questions should be weighted to provide an overall index measure for each country. The procedure which was followed in this case involved creating a score for each of five separate categories (labour legislation, wage-setting, taxation and social benefits, education and training, and labour mobility). Each of these individual category scores was in turn based on responses to several questions within that category. Questions within a category were weighted in some cases, so that particular questions did not overly influence the score compiled for that category.

For summing the category scores to provide an overall index measure it was decided to go for a simple unweighted approach. It should be noted that alternative approaches can also be used which can involve a consultative process to determine how category scores should be weighted. For example, an expert panel can be assembled in order to achieve consensus on whether specific categories should carry a higher or lower weighting. However, for the purposes of this study, it was decided to allow the category scores to remain unweighted, as we were concerned that consensus on a weighted scheme would not easily be achieved, especially since the work involved a multi-country analysis.

Within each category, the maximum score was 1. Values closer to 1 are an indicator of greater labour market flexibility and values closer to 0 indicate less labour market flexibility. To make the construction of the index as transparent as possible, the individual category scores for each of the countries under study are included in the stack bar chart in Figure 12.5.

Figure 12.5 Overall index of agricultural labour market flexibility/rigidity



In Figure 12.5, we can see that there is some variation in the value of the overall index between countries. The results suggest that Macedonia, Greece and Italy are among the most flexible in terms of agricultural labour markets. By contrast, France, Netherland and Belgium are the least flexible, with each having particularly low scores for the wage-setting category.

This is partly a function of being among the countries with the highest minimum wage levels. In all three countries, wages are typically determined through collective bargaining or through a mixture of collective bargaining and individualised firm level bargaining. Macedonia and Greece score very highly in most categories. Labour mobility is a key driver of flexibility in the case of Greece, while wage-setting appears to have a big impact on the result for Macedonia, partly due to the low minimum wage.

Looking at the country rankings, it is possible to discern some level of inter-regional variation. The three countries with the highest labour market flexibility scores – Macedonia, Greece and Italy – are neighbouring countries. Equally, the three countries with the lowest labour market flexibility scores – Belgium, Netherlands and France – are also neighbouring countries.

It is notable that the category with the biggest variation is wage-setting, where Macedonia and Germany have the highest score. It is also interesting to observe than some of the countries which are categorised as least flexible in terms of the overall index score highly in terms of the labour legislation variable (indicating that labour legislation in these countries is weaker than elsewhere). Just two Mediterranean countries are included in the study and both appear to have more flexible labour markets than northern European countries.

For the vast majority of countries in the study, there was very little difference in the overall labour market flexibility score. However, there were still noticeable differences in the composition of the overall scores, reflecting the existence of some heterogeneity in the category level scores. For this middle range of countries, the contribution of each factor to the overall index scores varies. This emphasises the importance of using a wide variety of criteria to measure labour market flexibility in a country, since individual labour market flexibility component scores for that country may not be a good proxy for overall agricultural labour flexibility in that country. The same observation can be made with respect to inter-country studies of labour market flexibility.

The above point can be illustrated by conducting some sensitivity analysis on the index by removing particular components from the index to see the impact this has on the ranking of individual countries. We present the overall index in Figure 12.6 having omitted the wage-setting component and show how this affects the relative ranking of countries in comparison with Figure 12.5.

Figure 12.6 Overall index without wage-setting component

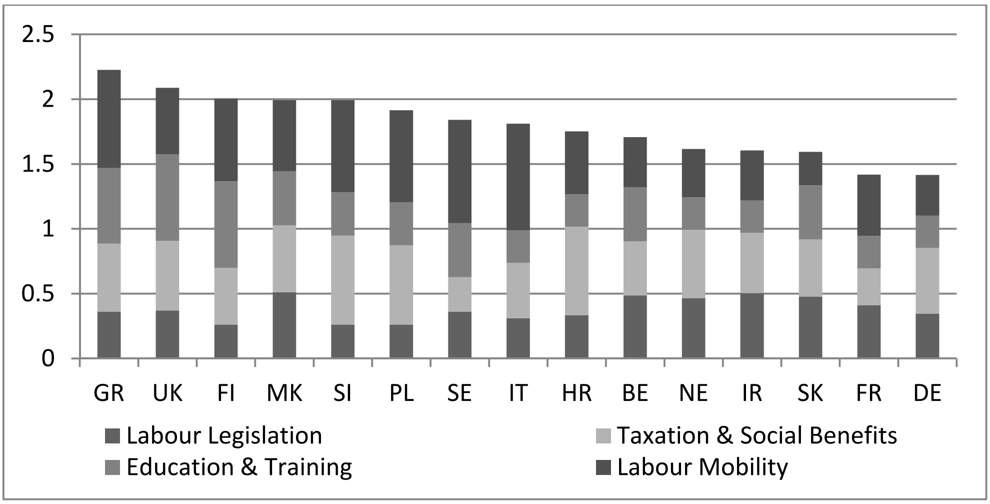
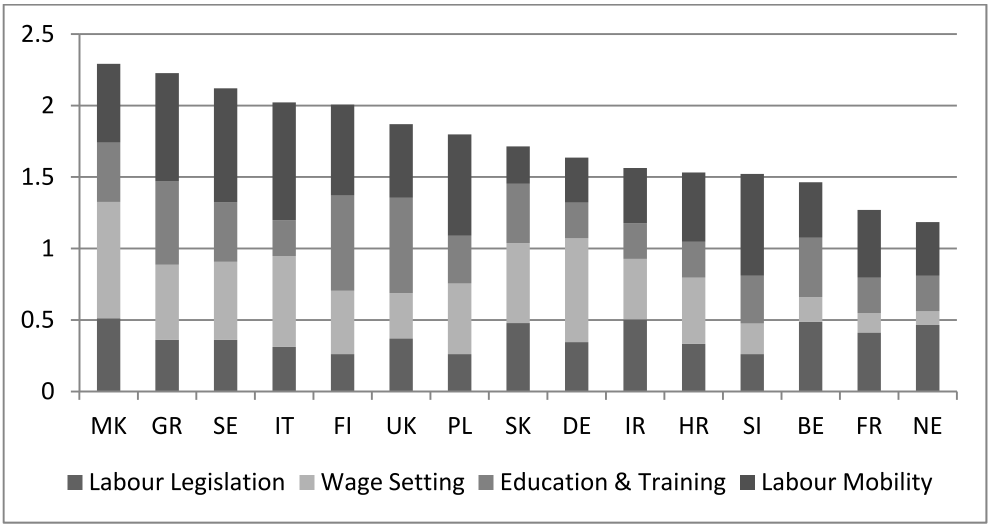


Figure 12.6 shows that the UK moves from fifth to second in terms of overall flexibility with the exclusion of the wage-setting component. Germany has the least flexible index measure if one excludes the wage-setting component, largely driven by low scores for education and training as well as labour mobility. France and the Netherlands remain close to the bottom of the list after the exclusion of wage-setting.

We present the overall index in Figure 12.7, having omitted the tax-benefit component. Sweden has the third most flexible agricultural labour market if one excludes this tax-benefit component. This represents a movement of four places in the overall rankings. The relative ranking for a number of other countries moves by two places but Macedonia and Greece remain the most flexible with Belgium, France and the Netherlands the least flexible.

Figure 12.7 Overall index without tax-benefit component



4. Conclusion

Overall, this survey has found differences between the agricultural labour market characteristics in member states across the EU and in the candidate countries considered. These differences are not particularly extreme when looked at in the aggregate. It was found that the most flexible labour markets exist in Macedonia and Greece, while the least flexible agricultural labour markets were found to be in Belgium, the Netherlands and France.

The two main factors contributing towards low agricultural labour market flexibility in the Netherlands and France are the wage-setting mechanism and relatively low scores in the education and training categories. The low score in the case of Belgium can be attributed to low scores for the wage-setting mechanism and labour mobility. Macedonia and Greece score very highly in most categories. Labour mobility is a key driver of agricultural labour market flexibility in the case of Greece, while wage-setting appears to have a big impact on the result for Macedonia, partly due to the low minimum wage.

Looking for the countries with similar overall labour market flexibility scores, we still find that there is some heterogeneity in the institutional features of these labour markets. This is an important finding for policy-makers since it demonstrates the importance of measuring agricultural labour market flexibility across a wide range of criteria. This is because individual features of a labour market may not be indicative of the extent of overall agricultural labour market flexibility. This point is emphasised by the fact that we found that the labour market flexibility measure was quite sensitive to the criteria included/excluded from that measure. This in turn influenced the relative ranking of countries in terms of their agricultural labour market flexibility/rigidity.

If policy-makers deem it desirable to increase labour market flexibility, the approach required will need to be tailored to the causes of agricultural labour market inflexibility. Our study finds that these causes differ across the countries under study. Ultimately, this implies that a common European approach to enhancing agricultural labour market flexibility may be inappropriate.

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13. LABOUR SUPPLY CURVES FOR EU MEMBER STATES AND CANDIDATE COUNTRIES: AN APPLIED GENERAL EQUILIBRIUM ANALYSIS

LINDSAY SHUTES[*]

The supply of labour is responsive to changes in the real wage in the medium term as higher wages increase the opportunity cost of being economically inactive and induce people to enter the labour force, while lower wages reduce the opportunity cost and lead to lower participation rates. Changes in participation rates are, however, seldom captured in standard computable general equilibrium (CGE) models used for policy analysis. This chapter introduces a more sophisticated modelling of medium-term labour market functioning in European member and candidate states through the introduction of labour supply curves into the MAGNET CGE model. The authors introduce the theoretical foundations of the labour supply curve that define the relationship between the labour supply and the real wage. They then empirically derive unskilled labour-supply curves for all member states along with Croatia and Turkey. The analysis of these supply curves shows that the new member and candidate states have systematically lower average wages than the EU-15 countries and are often less labour-constrained. Integrating the labour supply curves into the MAGNET CGE model and using the extended model to evaluate the impact of CAP reform under different labour-market assumptions, shows that the addition of labour supply curves is a valuable one. The new specification yields results that fall between the two extremes of spare capacity and full employment, capturing the relative flexibility of the labour markets across Europe and producing more nuanced welfare results.

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[*] This chapter is based on Shutes, "Labour Supply Curves for EU Member and Candidate States: An applied general equilibrium analysis", Factor Markets Working Paper No. 26, June 2012.

1. Introduction

The supply of labour endowments is often taken to be exogenous in computable general equilibrium (CGE) models, that is, determined outside the system by such factors as population growth. While this may be true in the longer term, in the shorter term the supply of labour to the market is influenced the real wage. Higher wages increase the opportunity cost of being economically inactive and induce people to enter the labour force, while lower wages reduce the opportunity cost and lead to lower participation rates. Participation rates vary greatly across Europe, ranging from 78% in Denmark to 46% in Turkey in 2007, but this heterogeneity is seldom captured in standard CGE models (Shutes et al., 2012).

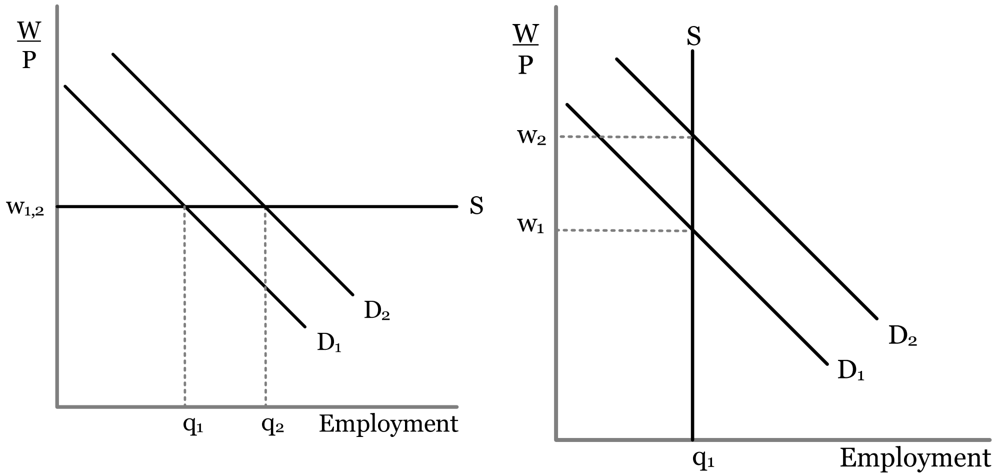
This chapter presents the theoretical and empirical foundations of labour supply curves for the member and candidate states and their introduction to the MAGNET CGE model. Labour supply curves capture the relationship between real wages and employment, allowing for differences between member and candidate states and variable participation rates. The impact of the extended labour market representation economies is shown using a stylised policy experiment in which first pillar support to member states is reduced by 50%.

2. Extending the modelling of the labour supply

2.1 Current specification

Typically, the relationship between the supply of labour and the real wage is modelled in one of two ways in CGE models. The two specifications operate at the extremes of labour market functioning, either by assuming an infinite supply of workers at a fixed wage or a fixed supply of workers with flexible wages. A visual representation of these two labour market specifications is given in Figure 13.1. The left-hand panel reflects an assumption of spare capacity in the labour market. A shift to the right in the demand curve for labour under this assumption is met fully by an increase in the number of workers employed with no impact on the wage rate. The right-hand panel shows the opposite extreme, in which all labour is fully employed and any additional demand is immediately translated into higher wages.

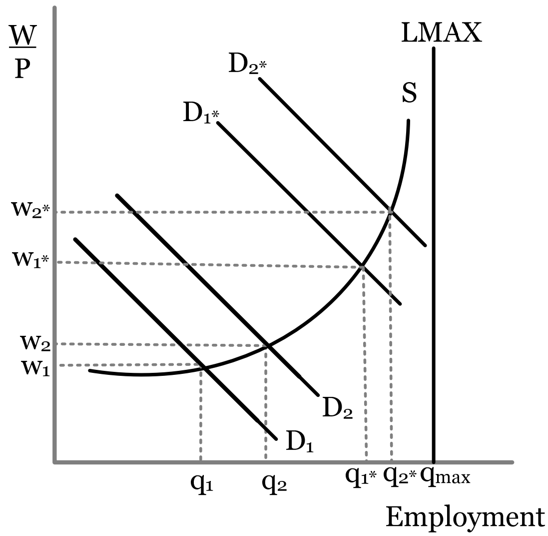
Figure 13.1 Labour market functioning in standard CGE models



2.2 *Labour supply curve*

The labour supply curve offers an intermediate choice in which increases in the demand for labour increase both the real wage and employment. The extent to which increases in demand are translated into wage increases depends upon the proximity of the current employment level to the total amount of available labour, reflecting the scarcity of labour. The functioning of a labour market with an upward-sloping labour supply curve is shown in Figure 13.2. Countries whose current employment levels are relatively far from the maximum available amount of labour (*LMAX*) have labour markets with relatively shallow labour supply curves, while countries with employment levels close to the maximum available amount of labour operate with steeper labour supply curves to reflect the scarcity of labour.

Figure 13.2 Labour market functioning under an upwards-sloping labour supply curve



Defining the relationship between wages and labour supply in this way captures cross-country heterogeneity in the scarcity of labour. This enables the heterogeneous response to the same increase in demand to be captured. As shown in Figure 13.2, the same increase in demand has different effects for countries that are on the shallower part of the supply curve compared with those on the steeper part. For countries with relative spare capacity in labour, the increase in demand is met by an increase in supply with only a small effect on wages, albeit more than under the strict spare capacity assumption shown in Figure 13.1. In contrast, the same increase in demand in countries with relatively scarce labour (nearing full employment) leads to only small increases in employment, with large increases in the wage needed to attract the additional workers into the labour market.

The specification of a labour supply curve for inclusion in the MAGNET CGE model follows that of the land supply curve in Van Meijl et al. (2006) and the labour supply curves for minority groups in Berrittella (2012):

$$LabourSupply = LMAX + \frac{\beta}{wage^{\propto}} \quad (1)$$

where *LabourSupply* is the number of employed workers at the given wage rate, *LMAX* is the total population of working age, β is a negative parameter calibrated on the current level of employment and wages, and α is the power of the function. The equilibrium wage rate and employment determines the vertical position of the curve, while the proximity of the equilibrium employment level to the maximum available number of workers and the power of the function determine the shape of the curve.

2.3 Empirical labour supply curves for the European states

Empirical labour supply curves are derived for the supply of unskilled labour in member states, Croatia and Turkey for 2007 (the starting year of the MAGNET model). The curves are grouped by size of country and presented in Figures 13.3 to 13.5.[26] Each curve is shown for a range of wage rates of between 30% and twice the 2007 equilibrium wage (indicated by the diamond-shaped marker).

Four sets of data are required to derive the labour supply curve for each country: the labour supply by skill type (employment),[27] the total population of working age by skill type, the real wage and the value of the power of the function (α, here assumed to be equal to 1). The value of the β parameter can then be calculated from these values. Employment data for the member and candidate states are extracted from the ILO LabourSta database[28] along with data on the population of working age. Real wages are calculated as the total value of payments to labour divided by the number of employees in each sector.

Among the small European countries, the new member states have systematically lower wages than the EU-15 countries (Figure 13.3). The vast majority of the smaller European countries are constrained in the supply of unskilled labour, as shown by the strong upward slope of the curves. The exceptions to this are Slovakia, Croatia and Lithuania, which are on the flatter part of the curve indicating that only small increases in the wage

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[26] In this context, 'small' countries have a working-age population of fewer than 2.5 million, 'medium' countries have between 2.5 million and 5 million members of working age, and 'large' countries more than 5 million.

[27] The skilled labour category used in the GTAP database corresponds to ILO categories 1-3 and the unskilled category categories 4-9 (Dimaranan & Narayanan, 2007). The armed forces are allocated to the unskilled labour group. The share of known skilled and unskilled labour in total employment is applied to all uncategorised workers and used to group the population of working age.

[28] The download date was 2 May 2012.

would be needed to bring about an increase in the supply of unskilled workers. The clear outlier of this group of small countries is Luxembourg, which has a high equilibrium wage but also near full employment of the working-age population. Very large increases in wages are therefore needed to induce even small increases in the labour supply.

A similar although less pronounced pattern can be observed in the empirical labour supply curves of medium-sized European countries (Figure 4). The new member states had lower wages in 2007 than the medium-sized EU-15 countries, with the exception of Portugal. The curves of the new member states are also slightly shallower that those of the older member states. The equilibrium employment points of both Sweden and Austria are near the vertical portion of the labour supply curve, suggesting that increased demand for unskilled labour in these countries would be mainly translated into higher labour prices. The candidate country of Croatia had one of the lowest average wage rates, but slightly higher than EU member states Slovakia and Lithuania.

The disparity between wage levels among the EU-15 countries and the new and candidate states is even more distinct among the larger European countries. The labour supply curves for the larger countries, as shown in Figure 13.5, are clearly clustered into two groups: the upper group of EU-15 member states with higher wages and steeper labour supply curves, and the lower group of new and candidate member states with lower wage levels and shallower supply curves. This analysis shows a clear difference in the average wage levels of the EU-15 and newer member states, and highlights that the market for unskilled labour in the new and candidate states shows some spare capacity while that of the older member states is more closely approaching full employment. As such, an increase in the demand for unskilled labour in the new member states will have less impact on wage rates than the same increase in the EU-15 countries.

Figure 13.3 Labour supply curves for small European member and candidate states

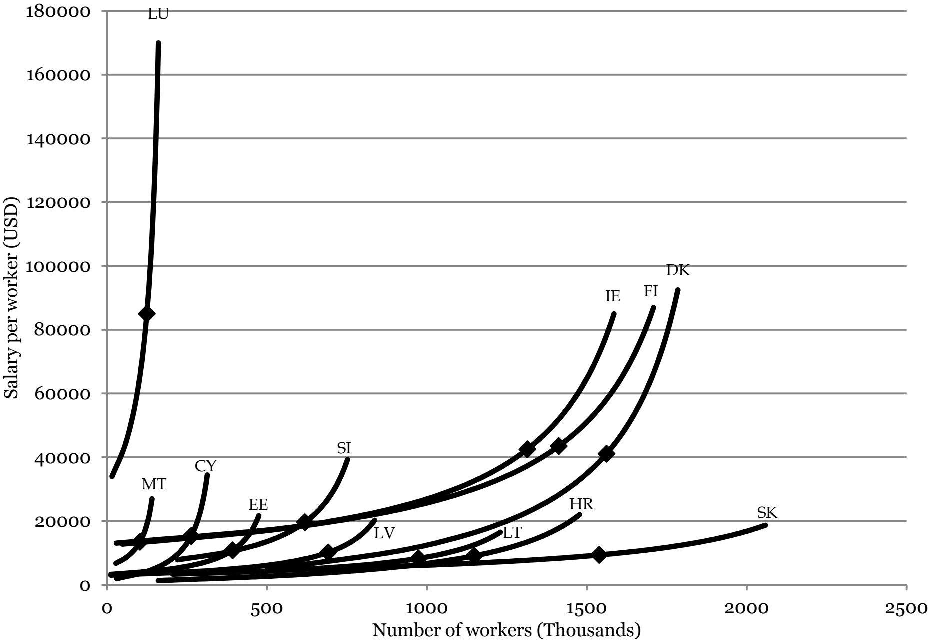


Figure 13.4 Labour supply curves for medium European member and candidate states

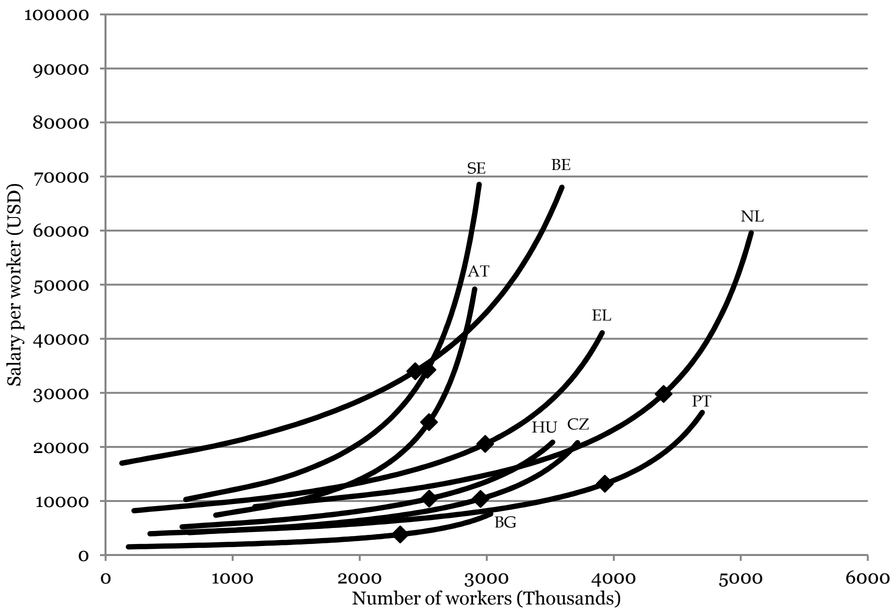
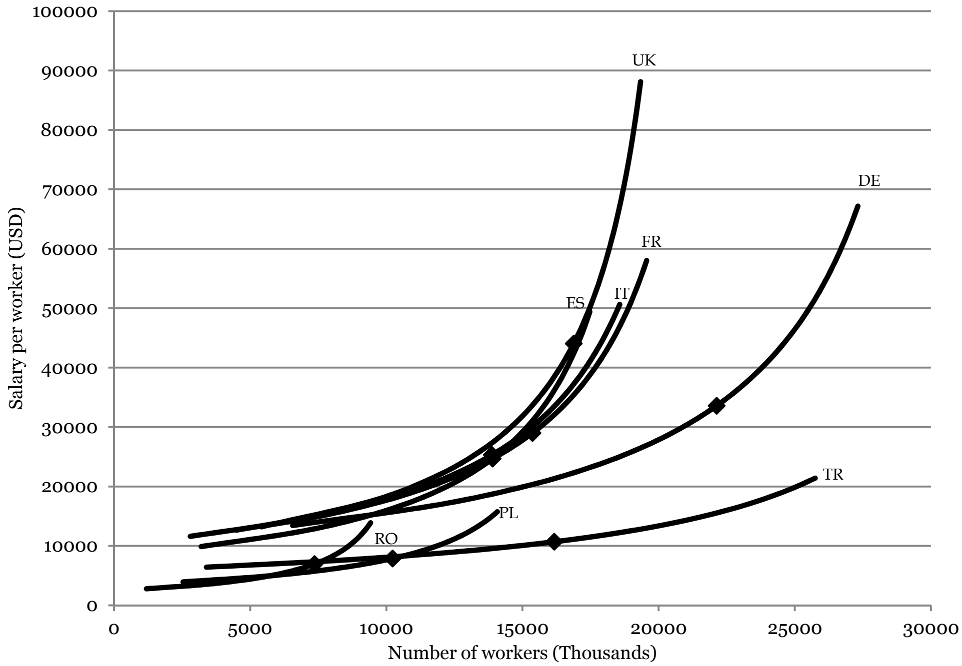


Figure 13.5 Labour supply curves for large European member and candidate states



3. Scenarios and model specification

The empirical labour supply curves are integrated into the MAGNET CGE model to improve the representation of European labour markets. The impact of the extended labour market representation is examined using a stylised policy experiment in which first pillar support to all member states is reduced by 50%. The policy experiment is implemented for three labour market scenarios: (i) unemployed unskilled labour ('spare capacity'); (ii) an upward-sloping labour supply curve for unskilled labour ('labour supply curve'); and (iii) fully employed unskilled labour ('full employment'). Further details of these scenarios can be found in Shutes (2012).

The three scenarios are implemented in a comparative static version of the MAGNET model calibrated to Version 8 of the GTAP database. The focus here on the results of CAP reform under alternative labour market functioning in the EU necessitates a geographical focus on Europe and a commodity focus on agricultural commodities. The 129 regions included in the GTAP database are therefore aggregated to 30 regions comprising the EU-27, Croatia, Turkey and the rest of the world. The 57 commodities in the database are aggregated into six commodities: cereals, vegetables and fruit, animal products, other crops, manufacturing, and services

4. Effects of changes in the labour market specification on the results of a CAP reform scenario

The supply of endowments in an economy and the ability to take on or shed workers in response to economic shocks and policy changes are important determinants of macroeconomic performance. Factors comprise a significant share of production costs for firms and form the major source of income for households. As such, the supply of factors provides a link between the production and consumption sides of an economy and, to the extent that GDP is measured by value added, is the primary determinant of national income. Given the key role of factors in the economy, it is expected that changing the labour market specification will change the outcome of policy simulations.

The results of three simulations in which the same change in CAP policy is analysed with different labour market assumptions are presented in this section. A priori expectations suggest that a 50% reduction in first pillar support in member states will increase production costs, resulting in a contraction of the agricultural sector. This expectation is largely borne out in all countries and agricultural sectors across the EU as shown in Figure 13.6. The large contractions are seen in the Luxembourg cereals and crops sectors (17% and 12% respectively), the Irish vegetables and fruit sector (12%) and the Finnish animal sector (10%). The average contraction across the EU member states is greatest in the crops sector (4.5%) and lowest in the animal products sector (1.6%), with cereals, vegetables and fruit falling between these two extremes.

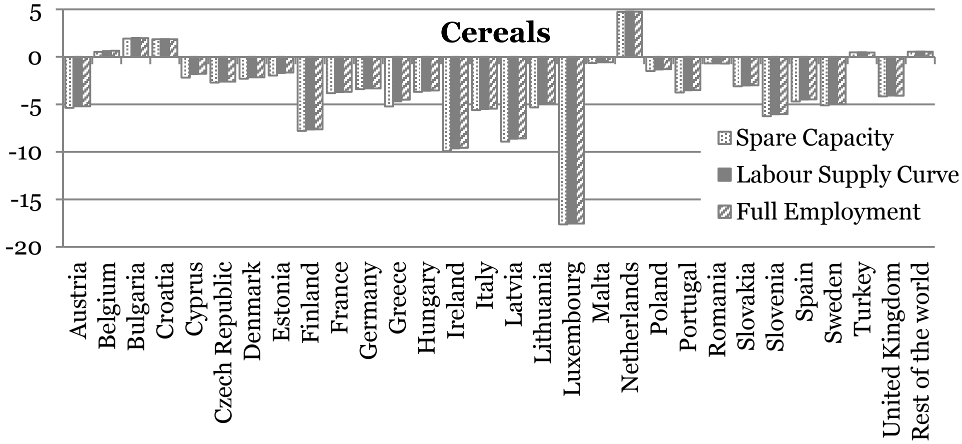
Although the general pattern is one of contraction in the agricultural sectors, the reduction in first pillar support increases production in some sectors in some countries. The agricultural sector in Croatia, Turkey and the rest of world region expands as rising costs in the EU leads to relatively cheaper prices in these regions, boosting demand. A similar effect drives the expansion in agriculture in some of the smaller countries, such as the Netherlands and Malta. The expanding countries, although member states, are recipients of lower levels of initial support from the CAP. Cutting the support to these countries therefore leads to smaller increases in production costs, making their agricultural products relatively cheaper. The expansion by 4.8% of the cereals sector in the Netherlands, for example, is due to export-led growth brought about by relatively cheaper prices compared with other member states.

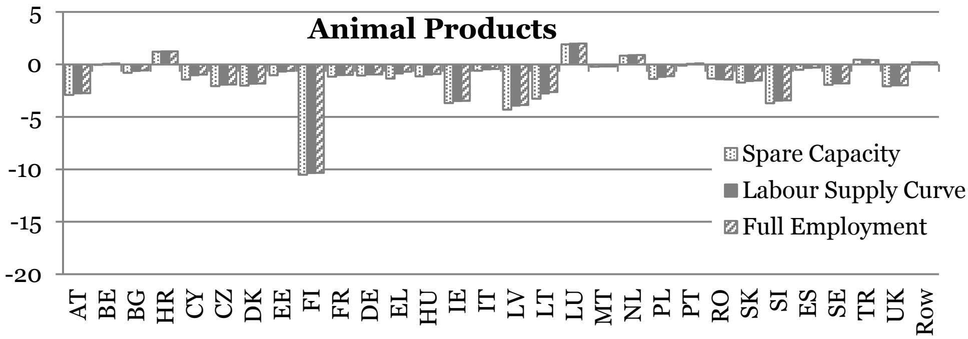
The change in the output of the agricultural sectors from the CAP reform scenario is also shown for each of the labour market specifications in Figure 13.6. While the change in labour market functioning does not alter the overall conclusions from the results, it does lead to different results. An assumption of full employment in unskilled labour leads to smaller contractions in all agricultural sectors in all countries than the assumption of spare capacity. This stems from the assumption of mobile unskilled labour across sectors. Under full employment, the wage rate adjusts to ensure that all labour that is released from the agricultural sector is employed by other sectors. The assumption of mobile labour, however, means that this reduction in wages is equalised across all sectors and it also reduces the wage bill in agriculture. This reduction in wage costs means that production costs and thus output contracts by less than in the case of spare capacity where the released workers return to the inactive pool having no effect on the equilibrium wage rate.

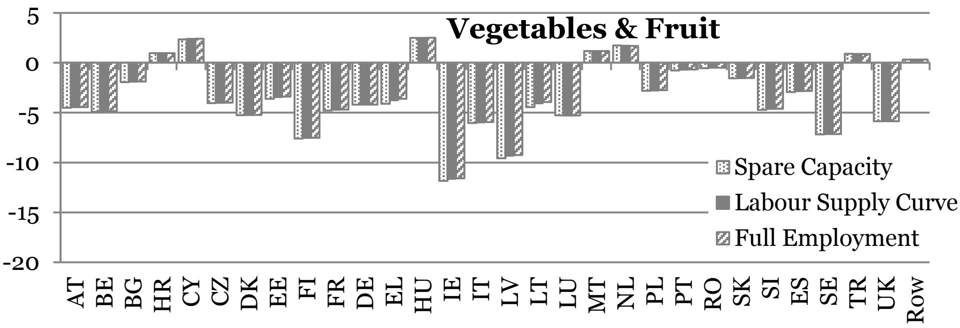
The introduction of a labour supply curve produces results that fall strictly between those of the spare capacity and full employment scenarios, as expected. The proximity of the result under the assumption of an upward-sloping labour supply curve depends upon the shape of the curve: countries with flatter curves and, therefore, more spare capacity in unskilled labour experience changes in the agricultural sector closer to the spare capacity results. Conversely, countries with steeper labour supply curves experience changes in the agricultural sectors that are closer to the full employment results. As such, the introduction of a labour supply curve for unskilled labour slightly dampens the effects of the cut in the budget of the CAP compared with the standard model specification of fully employed unskilled labour.

While the largest difference in the expansion of the agricultural sectors under the various scenarios is still relatively small (0.7% for the cereals sector in Greece), the impact of changing the labour market specification on the supply of labour and wages is more marked. The percentage change in the wages of unskilled labour resulting from a 50% cut in first pillar support to member states is shown in Figure 13.7. The reduction in support to agriculture reduces the demand for unskilled labour and lowers wages in the member states, as more unskilled labour is available for use in other sectors. Wages increase by more under the assumption of full employment as other sectors are enticed to 'mop up' the excess labour. As expected, wages under the labour supply curve assumption also increase, but by less than the full employment scenario to reflect the fact that the economy can also adjust the total number of people in employment. Wages do not alter under the assumption of spare capacity, as all adjustment is made through the number of people employed. Countries near full employment (such as the Netherlands) show changes in wages that are similar under the full employment and labour supply curve assumptions.

Figure 13.6 Percentage change in the output of agricultural sectors







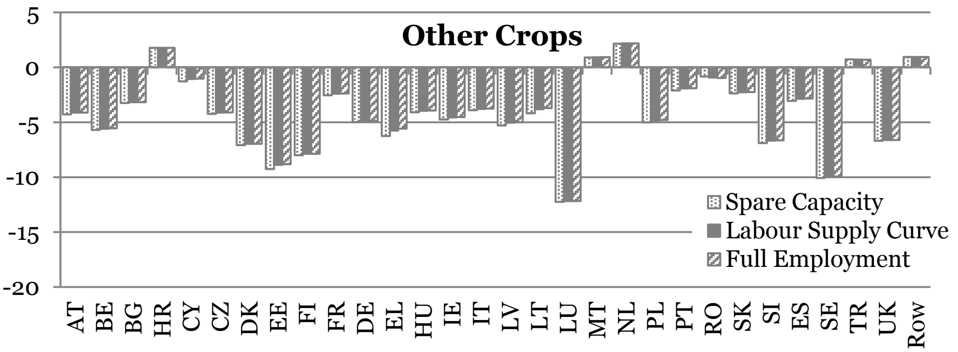
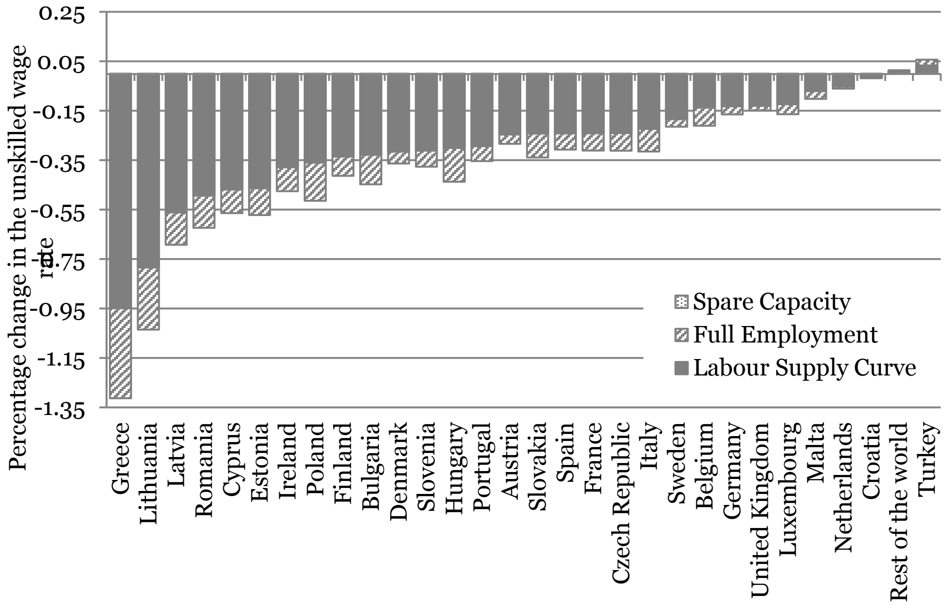
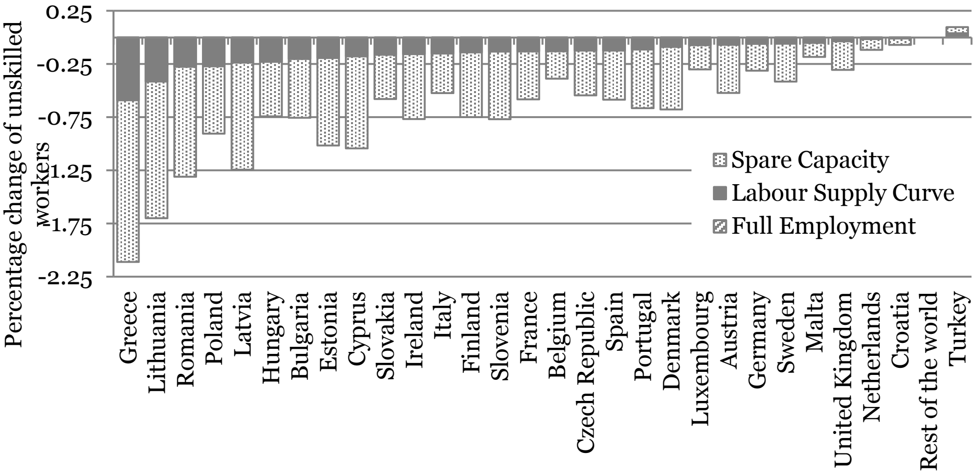


Figure 13.7 Percentage change in the unskilled wage rate



Note: Results are ranked by the size of the labour-supply curve effect and overlaid rather than stacked.

Figure 13.8 Percentage change in the quantity of unskilled labour

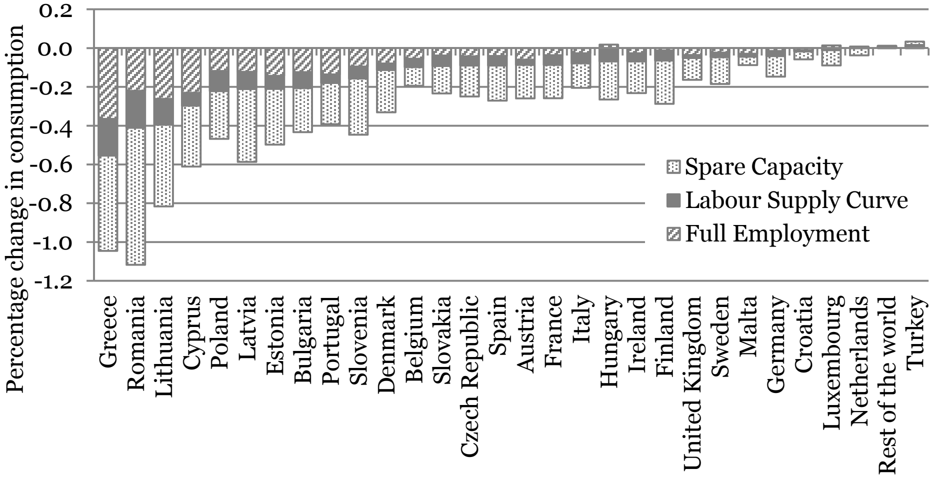


Note: Results are ranked by the size of the labour supply curve effect and overlaid rather than stacked.

The changes in the quantity of the unskilled labour employed tell a similar story, as shown in Figure 13.8. The quantity of labour adjusts most under the spare capacity assumption where all adjustment takes place through the employment level. Some reduction in employment also takes place under the labour supply curve assumption, as expected. There is no change in employment under the full employment assumption, where all adjustment takes place through the wage rate.

These relatively large changes in employment and wages in some countries have important implications for welfare, as shown in Figure 13.9. Consumption by households, considered here as a proxy for welfare, is reduced in all the contracting member states. The reduction in welfare is more pronounced under the assumption of spare capacity, as some workers will have been made unemployed as a result of the CAP reform.

Figure 13.9 Percentage change in consumption by households (welfare)



Note: Results are ranked by the size of the labour supply curve effect and overlaid rather than stacked.

The specification of the labour market therefore has a small effect on the impact in the agricultural sector but a relatively large impact on the welfare effect of a cut in first pillar support. Improving the modelling of factor markets in the member and candidate states is thus important for capturing not only the heterogeneity of labour markets, but also the welfare effects of policy reform.

5. Conclusions

This chapter introduces an extension to the MAGNET CGE model to better capture the heterogeneous nature of labour markets across the member and candidate states. Specifically, the model is extended by introducing a labour supply curve for each country to allow for a more sophisticated relationship between labour supply and the real wage beyond the two extremes of spare capacity and full employment that are normally considered in CGE models.

The chapter introduces the theoretical foundations of the labour supply curve and then empirically derives unskilled labour supply curves for all member states along with Croatia and Turkey. The analysis of these supply curves shows that the new member and candidate states have systematically lower average wages than the EU-15 countries and are often less labour-constrained. Integrating the labour supply curves into the MAGNET CGE model and using the extended model to evaluate the impact of CAP reform under different labour market assumptions shows that the addition of labour supply curves is a valuable one. The new specification produces results that fall between the two extremes of spare capacity and full employment, captures the relative flexibility of the labour markets across Europe and produces more nuanced welfare results.

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14. DETERMINANTS TO LEAVE AGRICULTURE IN THE EU

*BARBARA TOCCO, SOPHIA DAVIDOVA AND ALASTAIR BAILEY**

The aim of this chapter is to shed light on the key issues and constraints affecting EU agricultural labour markets, and to empirically explore the mobility of farm labour and its reallocation across sectors. In the context of an enlarged EU, this work provides valuable insights for policies that aim at improving structural development in the agricultural sector. The authors summarise the key results from their empirical work exploring the labour reallocation from agriculture to the non-farm economy in five selected EU member states. The concluding remarks contain some policy recommendations to ease limitations in both the supply and demand side of rural labour markets. They conclude that market intervention is needed to reduce key distortions and to foster rural development.

1. Background

Well functioning labour markets ensure an efficient allocation of labour and promote the competitiveness and growth of agriculture and the wider rural economy. Since rural development depends on the existence of a

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* This chapter is based on the following Factor Markets Working Papers: Tocco, Davidova & Bailey, "Key Issues in Agricultural Labour Markets: A Review of Major Studies and Project Reports on Agriculture and Rural Labour Markets", Factor Markets Working Paper No. 20, February 2012; Tocco, Davidova & Bailey, "Supply and Demand Side Limitations Affecting the Structure of Agriculture and the Rural Economy", Factor Markets Working Paper No. 21, February 2012 and Tocco, Bailey & Davidova, "Determinants to Leave Agriculture and Change Occupational Sector: Evidence from an Enlarged EU", Factor Markets Working Paper No. 46, May 2013.

competitive multi-sectoral economy, it is fundamental to understand the factors that determine the reallocation of agricultural labour across sectors and the impediments which may hinder its mobility (Dries & Swinnen, 2002). The recent past has seen European agriculture undergo significant structural change. According to the 2009/2010 Eurostat Farm Structure Survey, in the last decade there has been a clear reduction in both the number of agricultural holdings and in the size of the farm labour force in the EU (Eurostat, 2012). As supported by the statistical findings, structural change remains an 'ongoing process'. In particular, the labour market has been subject to several adjustments that have led to an outflow of labour from agriculture, which has also been accompanied by the reallocation of labour by farm residents from farm to off-farm work.

However, agriculture in some member states is still characterised by a surplus of labour and hidden unemployment, implying that farming provides sub-optimal incomes. With the two recent waves of enlargement of the EU, in 2004 and 2007, the spatial heterogeneity of rural areas has been accentuated. This heterogeneity generates quite diverse conditions across member states and it becomes important to examine the differences between labour markets and investigate whether the low mobility of workers is the product of labour market impediments. It is of course possible that preferences for, and pride in, agricultural work may be an alternative explanation for a lack of outward mobility from agriculture, especially in some more advanced economies of the older member states (the EU-15). Nonetheless, structural constraints and market imperfections may instead be the main barriers for entry in non-farm jobs in some other less developed markets, such as the new member states.

2. Main determinants of agricultural labour mobility

Understanding the labour allocation decisions of farm workers has always been of great interest to the academic and policy communities. Before studying the mobility of labour, it becomes important to get a deeper understanding of the determinants of agricultural employment. In particular, the residential choice of individuals and the existence of market imperfections, such as imperfect information, may have a significant impact on the occupational choice. As emphasised by Johnson (1991), individuals are faced with an occupation-residential choice paradigm, whereby their choice to be engaged in farming places a restriction on their residential choice, and likewise their choice of a farm residence reduces their employment opportunities across sectors. Furthermore, the geographical dispersion of the agricultural industry and its rural location imply that there are high costs of obtaining information about off-farm employment, which may lead to a lower probability of moving and switching occupational sector (Huffman, 1977).

The high costs of moving, also due to the distance between rural and urban markets, would suggest that people in rural areas could be 'trapped' in their occupational choices. Moreover, as pointed out by Corsi & Findeis (2000), persistence in a particular state, or state dependence, may explain a certain rigidity in off-farm labour adjustment and the tendency for individuals to remain in the same employment situation. Hence, the decision to work in agriculture may be a 'choice' which is constrained, to varying degrees, by individual and locational variables.

The vast empirical literature has mainly focused on the determinants of labour adjustments in rural areas and on the allocation decisions across activities. The starting point for any empirical investigation has been provided by the two-sector model of rural-urban migration by Todaro (1969) and Harris & Todaro (1970), where individuals are predicted to migrate if the expected urban-rural income differential exceeds migration costs, and the expected income in the urban sector equals the market wage times the probability of finding employment. The choice of occupation is determined by the utility differential from the two sectors (agriculture and non-farm employment) minus the transaction costs, i.e. the inter-sectoral relocation costs: the search costs of finding employment and the costs of the loss of agricultural skills (Kancs et al., 2009; Van Herck, 2009). Moreover, since households' decisions stem from the maximisation of utility derived from income and non-income factors, changes in labour policies and institutional reforms (such as privatisation, liberalisation, restructuring, etc.) also affect the opportunity cost of labour and are therefore included as determinants of labour adjustments. For a comprehensive review of major studies and project reports on agriculture and rural labour markets, see Tocco et al. (2012a).

The main exogenous factors which have been identified as important for the labour allocation decisions of individuals on and off the farm, and their mobility across sectors, include the following:

- Individual characteristics: age, education, experience, gender, marital status, race.
- Household characteristics and life cycle: presence of children, age of children, household size.

- Farm characteristics: farm size, output mix, capital stock, land ownership, technology, farm productivity/efficiency, on-farm diversification.
- Financial characteristics and other benefits: farm income, non-labour (unearned) income, farm subsidies, social benefits, fringe benefits, non-pecuniary benefits linked to the job and residence.
- Locational and labour market characteristics: unemployment rate, wage rate, labour market services/access to job information, distance to urban centre, population density.

Overall, human capital and life-cycle theories are the most influential explanations for understanding the mobility of agricultural labour (Huffman, 1980; Rizov & Swinnen, 2004), although demand-side conditions are also fundamental, so that differences among regions and countries, which reflect level of development, relative importance of agriculture and more generally conditions in the macroeconomic environment, need to be taken into account. Furthermore, the structure of the farm and its production characteristics – in particular, its size, specialisation, and technology – are key determinants of the demand for on-farm labour.

3. Key issues and constraints in agricultural labour markets

The review of the empirical literature has also shed light on a series of market imperfections, as well as structural impediments, which often characterise rural labour markets. The high costs of movement which are associated with rural markets, and which may be exacerbated for farm families if the market for land is underdeveloped or inefficient, and the distance between rural settlements and cities entail limitations in the occupation/residential choice of individuals.

In this context, Tocco et al. (2012b) seek to identify and classify the constraints in rural labour markets from both the supply and demand side. This identification is important as it allows us to highlight the inefficiencies and the failures of labour markets and to understand their potential impact on labour allocation, which becomes essential for policy design.

From the supply point of view, low levels of education, skills, training and experience in agriculture represent an important supply-side limitation which constrains the supply of skilled labour from the agricultural sector and constitutes a barrier for those seeking alternative employment. Not only do poor skills result in low productivity in agriculture, but they also restrict the choice of work that can be undertaken in other sectors, and often lead to lower paid, part-time or seasonal work. Since education has been found to influence entry to the non-farm economy, it follows that low levels of training and transferable skills constrain workers' ability to take up off-farm work. Therefore, general and specific education, vocational training and work experience affect the mobility costs and influence labour allocation decisions (Macours & Swinnen, 2005), constituting a significant impediment to labour mobility and therefore to an efficient allocation of labour (Dries & Swinnen, 2002).

Moreover, as emphasised by the European Commission (2006), demographic ageing in rural areas is an important issue, as it reduces the future labour supply of the working age population, which results in lower productivity growth and may hamper economic development. The agricultural sector often employs the less skilled and the elderly who, being less mobile and flexible, stay and work in farming. Where agriculture represents the main employer of labour in rural areas, this effect can be significant. This also leads to an inefficient labour allocation on agricultural holdings as well as to an impoverishment in terms of human capital in comparison to other sectors (Van Herck, 2009).

Particular state pension schemes can influence this demographic. For instance, Pietola et al. (2003) find that higher retirement benefits in Finland during the early retirement programme have accelerated the rate of exit from the sector, particularly of lower income farmers. In Poland, a special pension provision for agricultural workers may have influenced the present structure of keeping the 'golden' one hectare to qualify as a farmer. However, in many of the new member states, such as Romania, the value of pensions is low and many pensioners engage in agricultural activities to supplement their income (Copus, A. et al., 2006; Tocco et al., 2012c). In other countries, such as Germany, an agricultural holder has to pass on the farm to a successor in order to be eligible for a pension scheme, leading to a small share of holders aged over 65.

Another important supply-side constraint in agriculture concerns the limited access to land and capital, which is worsened by imperfections in the credit market, and thus the inability to access credit. As a consequence, social capital and family links play a key role in agriculture, as they provide access to capital and land needed for farming, hence reducing the probability of unemployment for farm household members (Swinnen et al., 2001). Therefore, the large share of employment in agriculture, often characterised by a surplus of labour and hidden unemployment, implies that agriculture can provide a minimum source of income for those less skilled, older and generally less mobile individuals.

Hidden unemployment and labour immobility can also be a consequence of imperfect information, i.e. poor or incomplete information about the location and availability of jobs or better employment conditions (Kancs et al., 2007). Significant costs of job search may exist in agriculture and the seasonal demand for labour in farm production leads to uncertainty over the obtainment of wage labour (Ellis, 1993). As emphasised by the ILO (2008), information is a vital resource and policy tools therefore need to be in place to ensure that rural workers are aware of job opportunities, in order to promote rural employment and mobility. In this regard, information and communications technologies are fundamental for the facilitation of employment services.

Rural areas, in comparison to urban areas, are usually lagging in terms of GDP per capita and other socio-economic indicators. While this results in lower standards of living, incomes, and a limited access to services and quality products (European Commission, 2006), it also fuels a vicious circle of slow economic growth. Such a situation makes it harder to attract and retain skilled individuals, who are instead pulled into more prosperous regions. Unfavourable labour market conditions, and specifically the lack of jobs opportunities, especially for women and young people, represent one of the main demand-side constraints to rural labour markets and to the mobility of agricultural labour (Juvančič & Erjavec, 2005).

Growth in rural areas and in agriculture depends on investments in physical infrastructure, such as roads and telecommunications, in agricultural research and extension, and in public health and education. Rural areas are often characterised by poor infrastructure, with poorly maintained roads and difficult access to information and communication facilities (Swinnen et al., 2001). This not only constitutes a mobility constraint for non-farm employment, but also increases the uncertainty and restricts market opportunities for farmers (ILO, 2008). As emphasised by de Janvry et al. (1991), poor infrastructure, non-competitive markets and poor information all lead to high transaction costs.

One of the stylised facts of rural areas is the relatively high level of both direct and hidden unemployment (Davis & Pearce, 2001). High unemployment levels in rural areas are often of a structural nature, due to insufficient education and skills of workers. This would imply that there is an imbalance between the supply and the demand for labour, due to a mismatch between the skills that workers are supplying and the skills that firms are demanding. Therefore, due to inadequate specific education and vocational training, individuals are handicapped in their attempts to find alternative employment.

Low mobility of rural households and high levels of on-farm employment despite small farm assets would suggest that there are very few opportunities for alternative income sources and jobs outside agriculture (Juvančič & Erjavec, 2005), which constitute structural impediments for labour adjustments. As suggested by the ILO (2008), rural non-farm activities are often constrained by low market demand, especially in those rural areas with low population density and a high percentage of poverty. On the other hand, smallholders are constrained by a lack of access to inputs and services, as well as low human capital and inappropriate technology, which prevent them from diversifying into higher-value products.

A further limitation concerns the seasonal nature of agricultural activities, which causes fluctuations in both labour demand and supply and results in seasonal employment patterns, seasonal migration, sharp wage variations, widespread unemployment and the dominance of casual over regular employment (ILO, 2008). Seasonality in supply can also be a significant constraint to the development of the non-farm rural sector. Rural people are subject to seasonal migration, as they are pulled into agriculture during the peak season and are released during the slack season, seeking other employment opportunities or becoming unemployed. Furthermore, risks of weather and volatility of prices also tend to reduce the demand for labour.

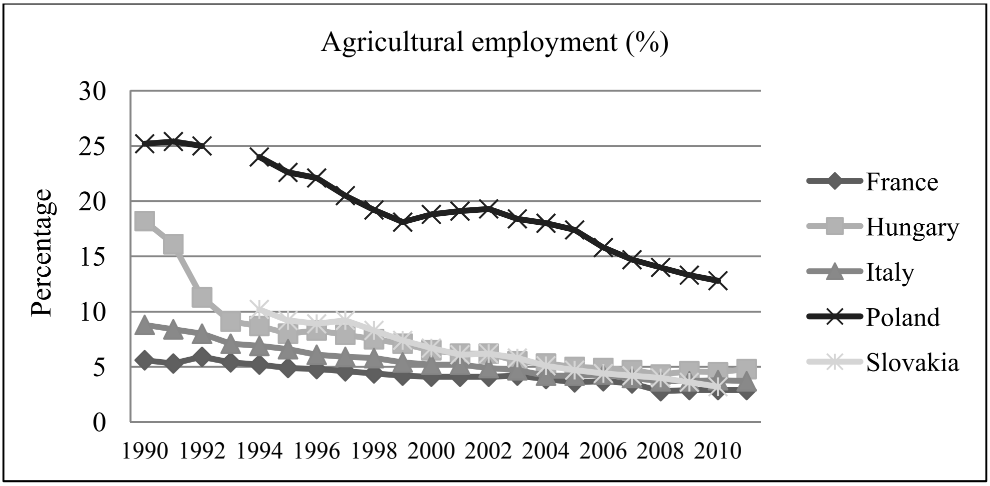
In the EU, within the new member states the disparities between rural and urban areas are accentuated. It is worth stressing here that rural areas in these countries suffer from a less-developed tertiary sector, lower levels of GDP per capita and lower employment rates. Furthermore, despite the high share of people working in the agricultural sector, their specific agricultural training and productivity levels are generally quite low. Therefore, in the context of an enlarged EU where the structure of the agricultural sector presents heterogeneous conditions across member states, it becomes important to examine the differences within labour markets and investigate whether the low mobility of workers reflects the presence of some structural constraints, which prevent entry in non-farm jobs.

4. Trends and differences in agricultural employment in five selected EU member states

The empirical analysis upon which much of the following discussion relies focuses on five selected EU member states, specifically three new member states – Hungary, Slovakia and Poland – and two of the EU-15 – France and Italy – as reference cases. The selection of countries reflects an attempt to compare more mature labour markets with less productive ones and also to capture the substantial differences in the structural organisations of the farms and other labour market conditions. Therefore, we explore to what extent differences in the farm structure and regional labour market conditions matter for structural change in employment patterns.

In the last two decades, the level of agricultural employment in the EU has declined quite quickly, with sharp reductions in the number of people employed in the sector and in the share of agriculture in total employment. The different paths of structural change are depicted in Figure 14.1, comparing the five member states since the 1990s.

Figure 14.1 Trends in structural change, 1990–2010



Source: Tocco et al. (2013).

The largest drops are associated with the first years of transition in the new member states, particularly in Hungary and Poland. Despite the diminishing share in agricultural employment, in 2010 the sector still represented an important source of income and development for the rural community, providing labour for around two million people in Poland, accounting for 12.8% of total employment.[29] The numbers for the other countries are Italy with 867,000 people (3.8%), France with 750,000 (2.9%), Hungary with 169,000 (3.8%), and Slovakia with 75,000 (3.2%)[30].

The dataset used in the analysis in the EU Labour Force Survey (EU-LFS), expanded with additional macro indicators to take into account different economic and labour market conditions as well as farm structures across regions (European NUTS-2 level). These additional variables have been extracted respectively from the Eurostat Online Database and the Farm Structure Survey. The period of analysis is 2003–08. Some key descriptive statistics of the agricultural sample are discussed below (Figure 14.2).

Low levels of formal education and training are evident in the five member states, with trends varying across the countries. In general, most of the agricultural workers have attained medium education (with the exception of Italy), although the share of high education is much lower in comparison to non-farm sectors. Moreover, the majority of workers are above 45 years of age, with almost 20% aged between 55 and 64, suggesting a demographic ageing of the workforce. The diverse conditions of the agricultural sector are also represented by the different types of workers. Employees represent a majority in Slovakia (85%) and in Hungary (68%), whereas self-employment is dominant in Poland (68%) and France (58%). Italy has an equal distribution of these two types of workers (46% respectively). Although family-workers are only a minority, they constitute 22% in Poland.

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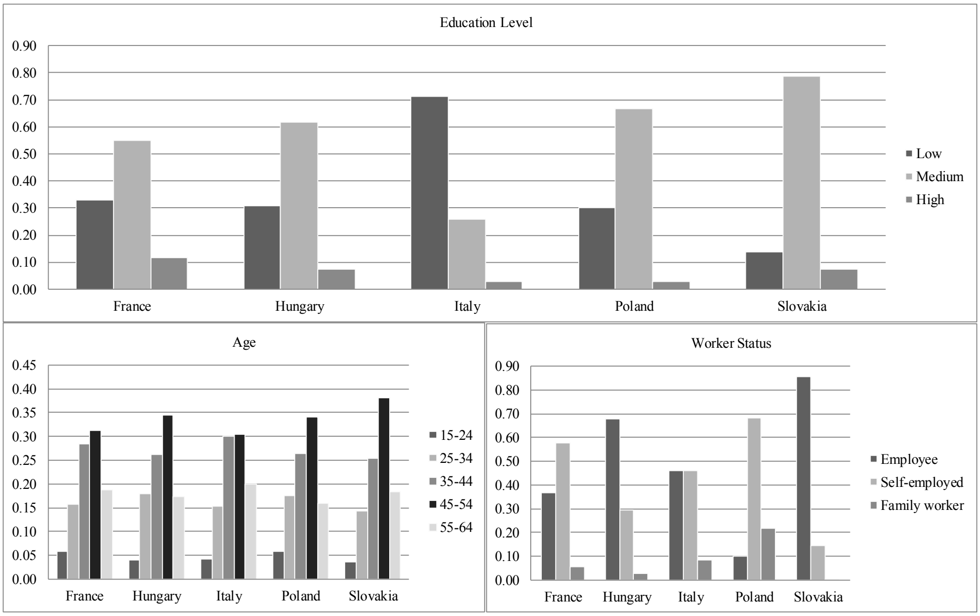
[29] This represents the second largest figure in the EU-27 in absolute and relative numbers following Romania with 2.8 million people, equivalent to 30.1% of the total employment.

[30] In reality, the persons involved in agriculture are much more numerous, since these data only cover those people who are in the 15-64 working age category and work in the primary sector as their main activity. On the other hand, the farm labour force represent all people who, having reached their schooling-leaving age, carry out farm work, thus including the non-regular labour force, i.e. part-time and seasonal workers (measured in annual work units, or AWU).

Figure 14.2 Some descriptive statistics: education, age and worker status



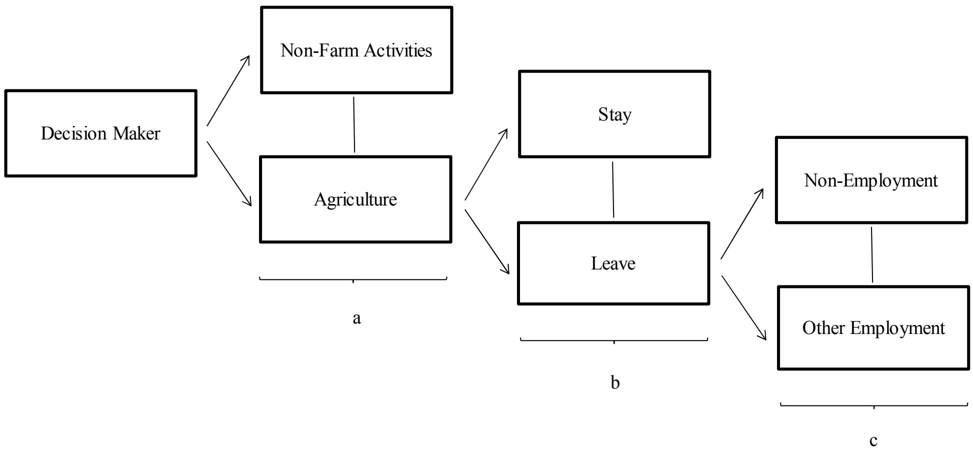
Source: Own figure based on the EU-LFS.

One of the striking differences across countries concerns the structure of agricultural holdings. Small farms of less than 8 ESU (European size units) are predominant in the new member states, with a particularly large share of farms under 2 ESU in Hungary (86%), Poland (65%) and Slovakia (90%). Commercial holdings are instead more common in the EU-15, so that large farms (over 8 ESU) represent the majority in France (73%). Italy is, to some extent, a special case. 70% of its farms are classified as small, with approximately 35% of farms under 2 ESU, a further 35% between 2-8 ESU, and the remaining 30% in the larger class. According to our sample, the type of farming is mainly specialised in crops, whereas mixed crops and livestock systems are generally more important for the new member states. In general, production and specialisation patterns matter for the different labour requirements, as some activities are more labour-intensive and/or have a more seasonal demand for labour. Moreover, their association with credit availability may also have an impact on the demand for labour.

5. Empirical strategy: sequential labour decisions

We draw upon the empirical work of Tocco et al. (2013), which explores the main determinants affecting the decisions of individuals to work in the agricultural sector and subsequently exit agriculture and switch occupational sector. The labour decisions of individuals, across two consecutive periods, can be summarised by the following decision tree (Figure 14.3). The branches of the tree constitute three sequential decisions: a) work in non-farm activities or in agriculture; b) conditional on this, remain in the agricultural sector or leave; c) for those who leave, move to non-employment (retirement or unemployment) or to other sectoral employment (industry/services).

Figure 14.3 Decision tree of labour outcomes



Based on the EU-LFS data sample, Table 14.1 summarises the frequencies of the different labour outcomes in the selected member states. First of all, it is clear that the large majority of agricultural workers remained in the farm sector in the following period. Data shows very large flows towards inactivity as opposed to other sectoral employment, thus it seems that structural change is mainly driven by retirement. Entry in non-farm sectors reaches significant figures only in Italy, followed by Poland and Hungary.

Table 14.1 Frequencies of labour outcomes based on the sample

Labour choice	France	Hungary	Italy	Poland	Slovakia
Non-farm activities	47,188	225,651	499,394	124,492	92,486
Agriculture	1,587	15,099	24,536	27,150	4,565
Stay	1,389	13,394	21,585	25,622	4,149
Leave	198	1,705	2,951	1,528	416
Industry	24	368	511	427	84
Services	72	340	787	289	57
Unemployment	46	350	308	143	136
Inactivity	56	647	1,345	669	139

Source: EU-LFS.

One of the issues in estimating the exit decisions of agricultural workers is that these individuals might not be a random sample from the total population. Some unobserved characteristics which may affect the probability of agricultural employment in the first place would imply that these workers constitute a self-selected sample, and thus their occupational decisions may be different from those in non-farm activities (Heckman, 1979). Therefore, the empirical methodology consists in employing a 3-step multivariate probit where we control for selection bias at two stages – the decision to work in agriculture and then, including only those who work in agriculture, to exit farming. Lastly, the third stage considers those workers who were previously employed in agriculture and left the sector, and examines the probability of a switch to non-farm sectors.[31]

6. Main findings from the empirical analysis

The key findings from the empirical analysis are summarised here. First of all, younger individuals (15–24 years) are generally more mobile and responsive to economic stimulus and may leave the sector for other non-farm jobs or to become temporary unemployed (frictional unemployment). Nonetheless, the main outflows from agriculture are associated with those individuals over 55 years old, who are more likely to exit agriculture and leave the labour force altogether. This would suggest that the largest outflows from the sector are associated with retirement.

[31] The empirical approach, which is an extension of the bivariate probit with selection, is explained in more detail in Tocco et al. (2013). Refer to the paper for the complete output tables, t-statistics and other empirical issues.

Moreover, people with low levels of education are found to be constrained from leaving the farm labour market and entering the non-farm economy, which implies that they do not seem to possess those transferrable skills necessary to move across activities.

Job attributes are quite important for the decision to leave agricultural employment so that in comparison to employees, self-employed individuals and family-workers are less likely to exit agriculture. This supports the assumption that employees are the most flexible category of worker, responsive to the market wage and off-farm opportunities. Self-employed individuals, possibly due to the ownership of specific capital assets or other personal motives, are more reluctant to exit their business, whereas family-workers are usually tied by family responsibilities or may find provisional work and subsistence in the farm household, often contributing to a 'surplus of labour' in agriculture.

Labour market conditions constitute important pull factors for attracting labour out of agriculture. Here, a high population density and, more importantly, a low unemployment rate increase the probability of entering the non-farm economy. Moreover, a high wage differential between the non-farm and farm sectors also increases the likelihood of a sectoral switch, which is consistent with the fact that individuals respond to market incentives and regional labour market conditions. A high ratio of regional non-farm to farm employment, which would capture the absorption capacity of the non-farm economy, has a strong pull effect, particularly in Italy. The opposite result in the case of Poland could be due to a large labour turnover and high competition, which would see agricultural workers flow into frictional unemployment.

Finally, the empirical analysis has also highlighted the impact of heterogeneous farm structures, especially between new member states and the EU-15. Farm characteristics are found to have different impacts on the outflows of labour from agriculture. For instance, the size of the farm at the regional level captures differences in the organisational structure of the business (or farm household) and thus implies different constraints or prospects for farm survival. In Hungary, regions with a large share of very small farms are associated with higher rates of farm exit, suggesting that these farms are the first to disappear in the process of structural change. Conversely, very small farms, and especially subsistence farms, in Italy and Poland appear to play a buffer role and thus prevent major outflows of labour. The mixed evidence in the results reflects the different organisational and production structures, suggesting different capacities to release and absorb labour.

7. Policy implications

Bearing in mind that the inefficiency of the labour market is an important factor behind the lack of competitiveness of rural areas in Europe, the key message from the research summarised here is that locational characteristics, skills mismatch and insufficient information appear to be the most important impediments to inter-sectoral and spatial mobility of labour.

The movement into retirement appears to be an important outflow of labour from the farm workforce. Structural change in agriculture that increases land consolidation and sees agriculture's share of the workforce decline is likely to be highly dependent on the way land is passed from one generation to the next and, importantly, upon how the next generation decides to employ that land. The efficient functioning of land market institutions will likely affect the decisions the next generation makes at this key juncture. If land transfer is costly, then their initial decision to engage or not in agriculture may be constrained. Retirement policies, and associated conditions for pensions and further CAP entitlement access, may also influence the decisions of the next generation at this point.

Since labour markets are central to the determination of the allocation of labour, the efficient functioning of the rural labour market is extremely important for the income and development of people residing in rural areas. Rural regions in Europe are characterised by heterogeneous conditions due to socio-economic and geo-political differences. Some rural areas, especially those which are more remote, depopulated and dependent on agriculture, are the ones more at risk, as they face particular challenges in terms of growth, jobs and sustainability (European Commission, 2006). Despite some large disparities in the economic conditions across individual member states, rural areas in general show a lower degree of economic development than urban areas.

As shown by the empirical analysis, education and training are important determinants of inter-sectoral mobility. Nonetheless, the levels of education, skills and training of farm workers are particularly low. Therefore, rural development policies must focus on the promotion of extensive programmes to support education and vocational training and to invest in human capital in rural areas. Expenditure on education should be targeted towards upgrading managerial and employability skills, with the purpose of improving factor mobility and a more efficient allocation of labour. This might improve labour productivity in, and incomes from, agriculture and other rural non-farm enterprises by shifting those people who are currently under-employed into alternative activities and reducing unemployment. Moreover, investments in human capital and support programmes to enter more productive activities could also facilitate an increased diversification of rural areas. Non-farm activities are extremely important in terms of rural development, as they absorb the excess labour from agriculture and represent a survival strategy for many rural households by providing income and employment. More importantly, emphasis should be placed on the development of rural small and medium-sized enterprises, which tend to be labour-intensive and thus are likely to absorb labour.

Investment in infrastructure remains crucial for improving rural labour markets, for strengthening rural-urban linkages, and thereby facilitating market access and creating better employment opportunities. A further focus point consists in supporting agricultural extension as well as small business development, reducing capital constraints and providing access to credit, markets, technical information and assistance. Adequate transport and communications are necessary in rural areas to stimulate productivity, provide linkages with the wider economy and thus lead to improved and more efficient labour outcomes. In addition to this, the government can play a role in bridging the gap of incomplete information by strengthening market information systems and assisting rural households in finding more and better employment and training opportunities. In this respect, labour market institutions can improve information about markets, such as providing more information on job opportunities to ease the search for a job. Improving factor mobility, and hence the smooth transition across activities, would improve the functioning of labour markets, with important consequences for the income and the development of people in rural areas.

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15. AGRICULTURAL LABOUR AND FARM SUBSIDIES: NEW EVIDENCE FROM THE EU

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This chapter summarises the main results reported in Olper et al. (2013), who investigated the relationship between CAP subsidies and the reallocation of agricultural labour. Exploiting the properties of a large data set covering 150 EU regions during the 1990-2009 period, this study found robust evidence that CAP payments contributed significantly to maintaining jobs in agriculture. However, the economic magnitude of this effect is quite low, and strongly heterogeneous across different CAP payments, i.e. Pillar I subsidies exert an effect more than two times greater than Pillar II payments.

1. Introduction

The creation and maintenance of jobs in agriculture and in rural areas has been a traditional CAP target, and an objective recently re-stated and emphasised by several EU official documents (e.g. European Commission, 2010; European Parliament, 2010).[32] However, the effectiveness of subsidies

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[*] This chapter is based on Olper, Raimondi, Cavicchioli & Vigani, "Does the Common Agricultural Policy Reduce Farm Labour Migration? Panel data analysis across EU regions", Factor Markets Working Paper No. 28, July 2012.

[32] The European Commission reflection on the future of the CAP, "The CAP Towards 2020" (EC, COM(2010) 672), explicitly addressed agricultural and rural labour issues in several sections of the document. Labour and rural areas

in maintaining the labour force in the agricultural sector is unclear and the empirical evidence is still largely inconclusive. Over the last 50 years, EU countries have experienced dramatic adjustments in their agricultural labour markets, showing an impressive off-farm migration. Surprisingly, in the most recent decades, we do not find any substantial reduction of the migration rate, a stylised fact that is at odds with €50 billion per year of income subsidies spent through the Common Agricultural Policy (CAP).

During the 1990–2009 period, the off-farm migration rate across the EU-15 regions was about 2.5% per annum.[33] This average value masks substantial differences both over time and, especially, across countries and regions. The off-farm migration rate was equal to 3.02% over the 1990–99 period, going down to 2.06% in the period 2000–09. However, this lower rate is largely attributable to a value close to zero in 2008 and even slightly negative in 2009, probably as an effect of the 2008 commodities price spike and of the 2009 global crisis. Across EU regions, the net farm migration rate shows great variation (Figure 15.1). Consistent with expectations, there is a negative relationship between the level of development and the rate of off-farm migration, as less developed regions are still in structural transformation. However, this negative relation is weak.

A central question analysed in this chapter is the extent to which farm subsidies played a role in affecting these patterns of off-farm migration. Mainly due to data limitations, existing evidence concerning the effect of CAP subsidies on off-farm labour migration has been quite inconclusive. This evidence is mostly confined to specific countries or regional case studies, only rarely focusing on the European-wide perspective (Shucksmith et al., 2005; Petrick & Zier, 2011; 2012). Thus, although interesting and often rich in detailed interpretations, such studies only measure the CAP effects within a single country or region, an approach that has the advantage of keeping factors such as institutions fixed. However, these studies are difficult to generalise to other countries and regions where there are wide differences in development, labour market institutions and farming structures.

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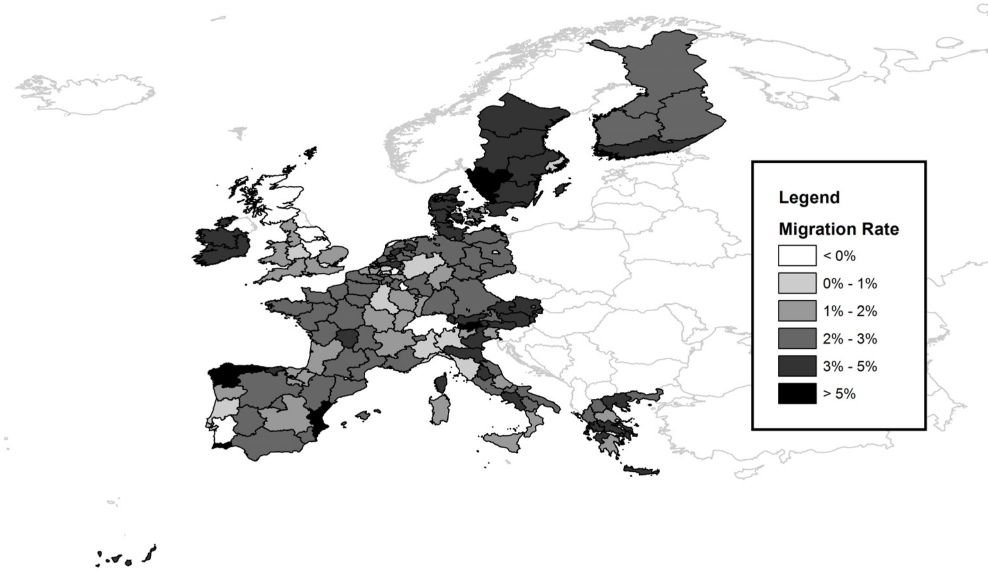
employment issues are also well represented in the recent European Parliament document on CAP reforms, "On the Future of the CAP after 2013" (EP 439.972).

33 Regional off-farm migration rate, m, is estimated as $m = [L_{it-1}(1+n) - L_{it}]/L_{it-1}$, where L_{it} is the stock of agricultural labour in the region i and year t, and $n = (L_t - L_{t-1}/L_{t-1})$ is the growth rate of the total labour force. See Olper et al. (2012) for details.

Figure 15.1 Average annual off-farm migration rate, 1990–2009



Source: Authors computation based on data from Olper et al. (2012).

This chapter summarises the main findings reported in Olper et al. (2012) on the effect of CAP subsidies on off-farm migration across the EU regions. The chapter starts with a short review of the empirical literature to date. In Section 3, after a non-technical discussion of the method, key results are presented in term of the estimated off-farm migration elasticity to CAP payments. Finally, Section 4 concludes.

2. The empirical literature to date

Table 15.1 summarises the empirical literature on the effect of farm subsidies on the agricultural labour market. Theoretically, these studies can be divided into two main approaches: studies based on household models to analyse the impact of subsidies on the allocation of household labour (Lee, 1965; Becker, 1965); and those based on models of occupational choice to investigate the process of entry and exit from the agricultural sector (Todaro, 1969; Harris & Todaro 1970; Mundlak, 1979). The above distinction is also reflected in empirical works, with studies at the farm-household level largely based on micro farm-level data, and studies on the inter-sectoral reallocation of agricultural labour conducted at the aggregate (country or regional) level.

Table 15.1 The labour effect of farm payments: The literature to date

Author	*Country*	*Data level*	*Empirical methods*	*Period*	*Data structure*	*Output variable*	*Type of Subsidy*	*Subsidy net Effect*	*Additional information*
Barkley (1990)	US	Aggregate	OLS	1940-1985	Time series	Out farm labour migration	Direct payments	0	
Goetz and Debertin (1996)	US	Aggregate	OLS	1980-1990	Cross-section	Population out-migration	Federal farm program payments	+	
Mishra and Goodwin (1997)	Kansas	Household	Tobit	1992	Cross-section	Off-farm labour supply	Federal farm program payments	–	
Goetz and Debertin (2001)	US	Household	OLS	1987-1997	Cross-section	Net farm exit rate	Federal farm program payments	–	
Goodwin and Holt (2002)	Bulgary	Household	Probit + others	1995	Cross-section	Off-farm work participation	Social benefit payments	–	
Pietola *et al.* (2003)	Finland	Household	Multinomial Probit	1993-1998	Panel	Out farm labour migration	Per hectar subsidies	0	
El-Osta *et al.* (2004)	US	Household	Tobit	2001	Cross-section	On-farm labour supply	AMTA, loan deficiency, disaster and market loss payments	+ (on-farm) − (off-farm)	Heterogeneity effects across subsidies
Foltz (2004)	Connecticut	Household	Probit	1996-2001	Panel	Farm exit rate	Price support subsidies	–	
Goodwin and Mishra (2004)	US	Household	OLS	2001	Cross-section	Off-farm labour supply	Decoupled payments	–	
Serra *et al.* (2005)	Kansas	Aggregate	Probit	1994-2000	Cross-section	Off-farm labour supply	Decoupled payments	0	
Glauben *et al.* (2006)	Germany	Household	OLS	1991-1999	Cross-section	Out farm labour migration	Sectoral subsidies payments	0	
Benjamin and Kimhi (2006)	France	Household	Multinomial Logit	2000	Cross-section	On-farm work participation	Direct payments for young farmers	–	
Ahearn *et al.* (2006)	US	Household	Probit	1999 vs. 1996	Cross-section	Off-farm work participation	Coupled and decoupled payments	–	
Key *et al.* (2006)	US	Household	OLS	1992 and 1997	Cross-section	Off-farm labour supply	Federal crop insurance subsidies and total government payments	–	
Breustedt and Glauben (2007)	110 EU regions	Aggregate	OLS	1993-1997	Cross-section	Out farm labour migration	Direct payments and price support	–	
Dewbre and Mishra (2007)	US	Household	OLS	1998-2001	Cross-section	On farm work	AMTA, loan deficiency, disaster and market loss	□(AMTA) + (coupled)	AMTA are decoupled, other subsidies coupled
Goodwin *et al.* (2007)	US	Household	Probability-weighted bootstrapping	2003-2004	Cross-section	Off-farm labour supply	Coupled and (decoupled) payments	− (decoupled) + (coupled)	
Hennessy and Rehman (2008)	Ireland	Household	Probit /OLS	2002	Cross-section	Probability (hours) of off-farm participation	Decoupled payments	+	
Gullstrand and Tezic (2008)	Sweden	Household	Logit	1989-2003	Panel	Out farm labour migration of salaried	Objective 1 Structural Funds Programme	0	
Pufahl and Weiss (2009)	Germany	Household	Propensity Score Matching	2000-2005	Panel	On-farm labour supply	Agri-environment programs	+	
Van Herck (2009)	144 EU Regions	Household	Logit	2005-2006	Cross-section	Out farm labour migration	Coupled and decoupled payments	+	
Uchida *et al*. (2009)	China	Household	D-in-D Matching	1999-2004	Panel	Off-farm labour supply	Payment for ecosystem service	+	
Becker *et al.* (2010)	EU NUTS 2	Aggregate	Regression Discontinuity Design	1989–2006	Cross-section	Total Employment growth	Objective 1 Structural Funds Programme	0	
D'Antoni and Mishra (2010)	US	Aggregate	Autoregressive distributed lag	1940-2007	Time series	Out farm labour migration	Direct payments	–	
Petrick and Zier (2011)	3 East-Germany landers	Aggregate	LSDV	1999-2006	Panel	Out farm labour	Coupled, decoupled and rural development CAP payments	+ (0 livestock payments)	Heterogeneity effects across subsidies
Salvioni and Sciulli (2011)	Italy	Household	Propensity Score Matching	2003-2007	Panel	On-farm family labour	Rural development Program	+ (0 LFA)	
Petrick and Zier (2012)	3 East-Germany landers	Aggregate	GMM	1999-2006	Panel	Out farm labour	Coupled, decoupled and rural development CAP payments	0	
Corsi and Salvioni (2012)	Italy	Household	Tobit	2002-2008	Panel	Off-farm labour participation	Decoupled payments	0	

Micro-data allow us to address individual adjustment behaviour in response to changes in factors affecting household utility, such as different revenues sources. For example, Mishra & Goodwin (1997), focusing on farm households in Kansas, found that policy changes that reduce farm income support can increase off-farm employment of the operators and their spouses. Similarly, El-Osta et al. (2004) showed that US Agricultural Market Transition Act (AMTA) payments tend to increase the hours operators work on-farm and *vice versa*. The majority of farm-level studies are based on a cross-sectional approach. However, there are also important examples of micro-data analysis based on panel data (Pietola et al., 2003; Gullstrand & Tezic, 2008). One of the main shortcomings of these studies is the short time period normally involved, an issue that makes it difficult to isolate all the farmer adjustment processes due to the changes in agricultural policy (Glauben et al., 2006).

The analysis at the aggregate level is, in principle, less data constrained, providing results with broader coverage. The process of labour migration from one sector to another is assessed by controlling for structural variables such as country or regional relative income, unemployment, population densities, and institutional and policy variables. The econometric approaches of aggregate studies range from cross-sectional to time-series analyses and, more recently, to panel data methods and also quasi-experimental approaches.

The seminal work of Barkley (1990) used a two-sector occupation choice model on a large time series (from 1940 to 1985) to analyse the labour migration out of agriculture in the US, using government payments as a key variable. Results show that the effect of farm support on agricultural labour is negative but insignificant. D'Antoni & Mishra (2010) extended Barkley's sample to 2007, accounting also for dynamics, through an autoregressive distributed lag model. By taking dynamics into account, the farm support effect on off-farm labour migration becomes significantly negative.

At the EU level, many studies have investigated the effect of CAP payments, as well as of specific national public policies (see Table 15.1). From both household and aggregate level studies, the evidence of the direct (and indirect) effect of CAP subsidies on off-farm labour participation/migration is inconclusive, ranging from negative even to positive. Moreover, results are often confined to specific countries or regions (Pufahl & Weiss, 2009; Hennessy & Rehman, 2008; Gullstrand & Tezic, 2008), mainly as a consequence of data limitation at the EU regional level. Several studies used a cross-sectional approach (e.g. Breusted & Glauben, 2007; Hennessy & Rehman, 2008; Van Herck, 2009), while those which performed a panel data analysis considered only a single country and/or specific policy measures (e.g. Gullstrand & Tezic, 2008; Pufahl & Weiss, 2009; Salvioni & Sciulli, 2011).

Only a few studies have worked at the overall EU level. Breusted & Glauben (2007) investigated the effect of total farm subsidies on off-farm labour migration in 110 EU NUTS 2 regions, finding that CAP payments slowed down structural change in the period 1993–97. Van Herck (2009) used a multinomial logit approach to investigate the main destination of households exiting the agricultural sector. Coupled, decoupled and total subsidies showed a positive effect on off-farm migration for 144 NUTS 2 EU regions, mainly as a consequence of secondary order effects. Finally, within this literature the works of Petrick & Zier (2011; 2012) represent two relevant exceptions. They used difference-in-difference and dynamic panel models, respectively, and exploited the entire portfolio of CAP payments, showing an employment effect on CAP subsidies which goes from weak but positive to zero. However, their results focused on just three East German regions and are hardly extendible to the EU as a whole.

To sum up, actual evidence concerning the effect of CAP payments on off-farm migration is not only quite inconclusive, but also suffers from several drawbacks. First, the evidence often comes from cross-sectional inference, and when panel data are used the time coverage is short. Second, it is largely focused on country or regional case studies whose findings are difficult to generalise to other countries and regions. Third, it rarely takes into account the entire portfolio of CAP payments. Last, but not least, no particular effort has been taken to account for potential problems of endogeneity bias of CAP payments.

3. New evidence on the CAP subsidies effect on agricultural labour

3.1 Theoretical and empirical background

From a theoretical point of view, Olper et al. (2013) rely on the theory of occupational choice and labour migration decision, which has its roots in the Todaro (1969) and Harris & Todaro (1970) two-sector model, subsequently developed by Mundlak (1979) and Barkley (1990). In this model, there is no room for uncertainty, capital market restrictions and adjustment costs (see Breustedt & Glauben, 2007).

The economy is disaggregated into two sectors: agriculture (i) and non-agriculture (j). Individuals choose between working in the agricultural or the non-agricultural sector by comparing their expected discounted lifetime utility in the two sectors. Assuming that the price of the composite consumption good equals one, the utility (V) derived from one occupation is a function of the expected income (Y) and the time spent working (L), plus exogenous shifters (Z). An individual selects one occupation over the other at time t, such that max $\int e^{-rt} V(Y_t, L_t, Z_t)dt$, with r the discount rate, and $\partial V/\partial Y > 0$.

Thus, when the income level in non-farm occupation is higher than that in the farm sector, farmers are expected to move away from agriculture. However, even though non-farm income may be higher than that associated with farming, such a difference may be discounted by the probability, q_{jt}, of finding a job in the industrial sector. The off-farm migration will occur when the expected lifetime utility in the non-farm sector – net of the costs C_t associated with changing job – exceeds the expected lifetime utility in farming. The net migration out from agriculture, m, is then a function of the arguments of the utility functions in the two sectors, and includes the income, the labour force, the probability of finding a job, the costs of migration, the age structure, g, and other personal characteristics of the farm population, namely $m = f\left(Y, L, Z, q_j, C, g\right)$.

Next, defining the relative income between the non-agricultural and agricultural sectors by $ri = Y_j/Y_i$, clearly the theoretical model predicts that $\partial m/\partial ri > 0$. Thus, other things being equal, to the extent to which farm subsidies, s, will contribute to a shrink in relative income, they will negatively affect off-farm migration, namely $\partial m/\partial s < 0$. The empirical identification of this *direct effect* of farm subsidies on off-farm migration, together with other effects on the demand for agricultural labour, represented one of the main objectives of the Olper et al. (2012) study.

The predictions above have been tested econometrically in a sample of 150 EU-15 regions in the period 1990–2009, using both static and dynamic panel estimators, to account for the adjustment nature of the migration process and the possible endogeneity of CAP payments. Empirically, one of the main challenges is how to measure the policy variables at the regional level.[34] To overcome these issues, the study

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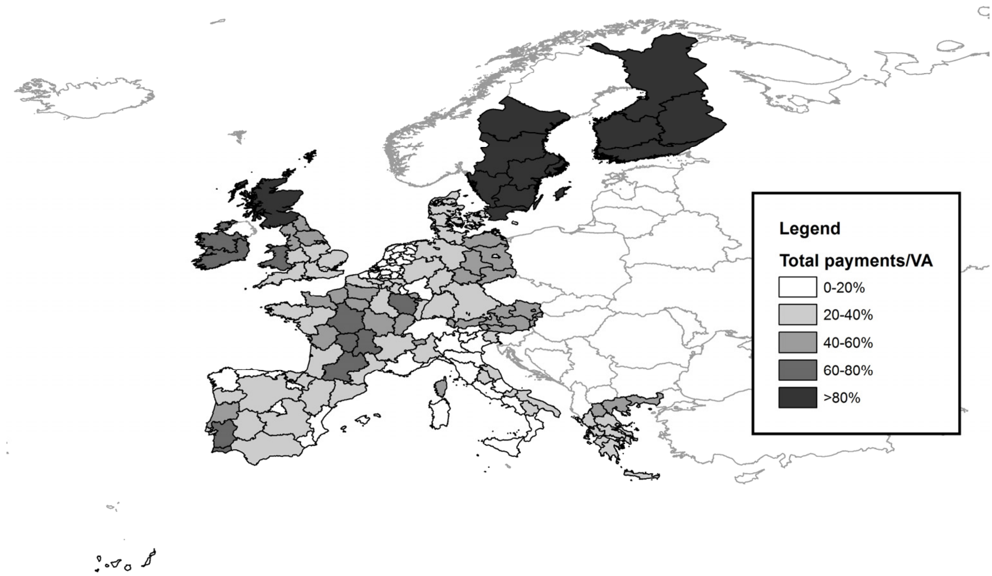
34 Previous studies followed two main approaches: measuring a regionalised producer subsidy equivalent (PSE) as in Anders et al. (2004), Tarditi & Zanias (2001) and Hansen & Herrmann (2012); using FADN data as in Shucksmith et al. (2005), and combining the same source with Eurostat Regio-New Cronos database, assuring to the former also a time variation, as in Esposti (2007). However, as discussed in Olper et al. (2012) both these approaches have some limitations, especially due to the impossibility of investigating the possible differentiated effect

adopted a new strategy, measuring CAP payments over the net farm income using only Farm Accountancy Data Network (FADN) data at the regional level. The key advantage of this approach is the possibility of splitting CAP total payments into their different components: coupled and decoupled payments of Pillar I, as well as agri-environmental payments, less-favoured areas (LFA), investment aids and a residual category called 'other' subsidies of Pillar II.

Figure 15.2 Average CAP payments over farm income, 1990–2009



Source: Authors computation based on data from Olper et al. (2012).

For illustrative purposes, Figure 15.2 reports the 1990–2009 average amount of total CAP payments relative to farm income (payments/VA) received by the considered EU regions. The pattern that emerges is quite close to previous findings (e.g. Shucksmith et al., 2005). In particular, there is strong variability in the amount of farm income due to CAP payments. The average level in the considered period (33%) masks a large variability across regions, which range from close to 0% to above 80%, especially in some central and northern Europe regions. However, the correlation between the distribution of CAP support and the level of development,

between coupled and decoupled payments, as well as the effect of different Pillar II subsidies measured as real GDP per capita, is always very low: –0.084 for total CAP subsidies, –0.152 for Pillar I payments, and 0.05 for Pillar II payments.

3.2 *Main findings*

Overall, the econometric results strongly support the model predictions, namely that CAP subsidies as a whole have played a role in keeping labour forces in agriculture. However, the economic magnitude of the overall effect is not particularly high and, interestingly, strongly heterogeneous across different CAP payments. A simple comparison between the off-farm migration effects of CAP payments is reported in Figures 15.3 and 15.4, using the respective (absolute) elasticities, estimated from the econometric regressions reported in Olper et al. (2012).[35] Several interesting patterns emerge. First, a 10% increase in total CAP payments leads to a decrease in off-farm migration of about 1.72% when the effect is estimated using the static fixed effects model. The value rises to 1.90% and 2.46% when dynamics and endogeneity are accounted for. Considering our preferred estimate coming from the dynamic model, that controls for the endogeneity of CAP payments, meaning that, without subsidies, the EU-15 net off-farm migration rate would be equal to 3.2% per year, instead of the current 2.5%.

This average effect cancels out relevant differences across CAP instruments. The long-run elasticity of Pillar I payments, equal to about 0.274% when dynamics and endogeneity are considered (column 3), is indeed about 2.7 times higher in absolute value than the elasticity of Pillar II policies. Within Pillar I, the coupled payments display higher absolute elasticity than decoupled payments, while across Pillar II instruments, investment aids display the highest absolute elasticity to off-farm migration, and this elasticity is the only one with a positive effect. Thus, considering the value of the above elasticities, one can conclude that, if the labour effect of CAP payments is high on the EU policy agenda, then the

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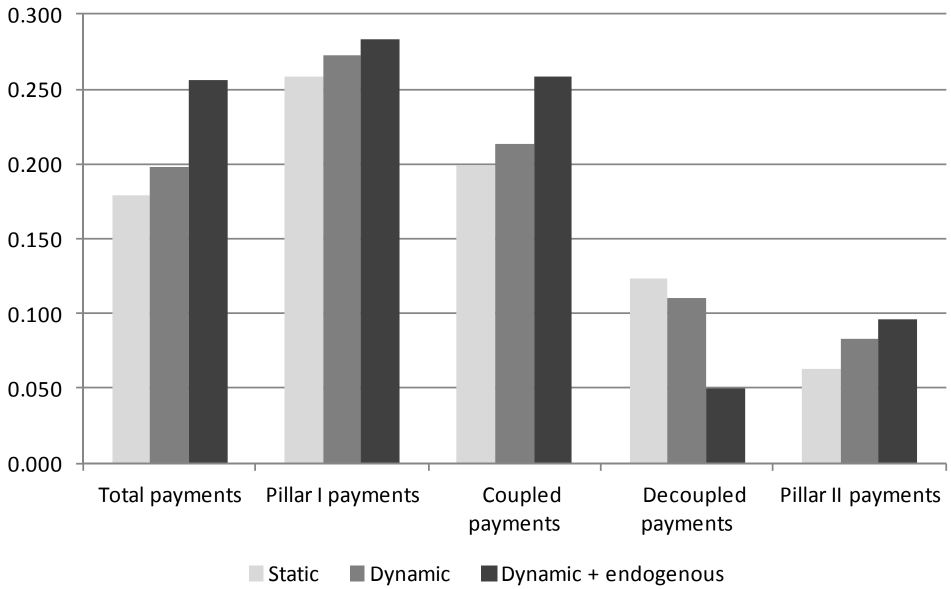
[35] These elasticities are estimated at the sample mean using the following formula: $\frac{\partial \ln m}{\partial \ln s} = \beta \frac{\bar{s}_{it}}{\bar{m}_{it}}$, where $\bar{s}_{it}$ and $\bar{m}_{it}$ are, respectively, the sample mean of the specific CAP subsidy and of off-farm migration, while β is the estimated marginal effect of the CAP subsidy. Note that, to make figure 3 and 4 more readable, we report *absolute* elasticities, although all the estimated elasticities of farm migration to CAP payments are negative, but the elasticity to investment aids is positive and always significant.

most effective policy tools to reach this objective would be coupled payments, followed by decoupled payments, *ceteris paribus*.

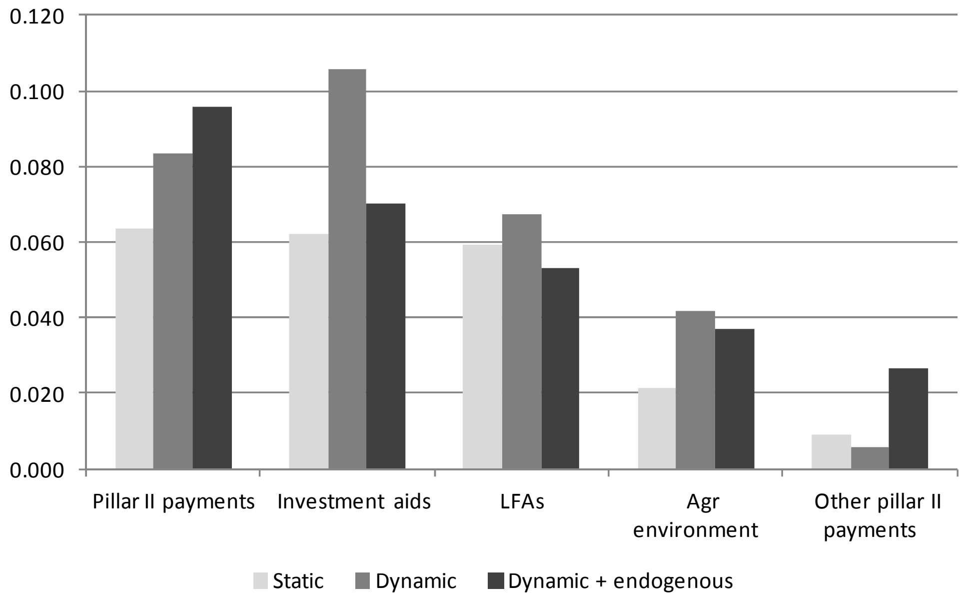
Figure 15.3 Off-farm migration elasticity to CAP payments



Notes: The figure reports the (absolute) elasticity of off-farm migration to CAP payments, namely the percentage reduction in off-farm migration for an increase of the respective CAP subsidies of 1%. This is because the estimated elasticity are always negative. The term Static, Dynamic, and Dynamic+endogenous refer to the econometric approach used to estimate the underline parameters. See Olper *et al.* 2013, for details.

Source: Authors computation based on data from Olper et al. (2012).

Figure 15.4 Off-farm migration elasticity to Pillar II payments



Notes: The figure reports the (absolute) elasticity of off-farm migration to CAP payments, namely the percentage reduction in off-farm migration for an increase of the respective CAP subsidies of 1%. This is because the estimated elasticity are always negative, but the investments aids subsidies. The term Static, Dynamic, and Dynamic+endogenous refer to the econometric approach used to estimate the underline parameters. See Olper et al. 2013, for details.

Source: Authors computation based on data from Olper et al. (2012).

Another way of interpreting the economic magnitude of these findings is through a back-of-the-envelope calculation. Olper et al. (2012), focusing on the off-farm migration effect of total CAP payments, found the following numbers. Every year, CAP payments prevented a flow of off-farm migration of around 27,000 agricultural workers. In percentage terms, this means a reduction in farm labour migration ranging from a minimum of about 6%, in the more conservative estimate, to a maximum of 20%.[36] Therefore, a conservative view is to interpret these numbers as saying that CAP subsidies might generate a reduction in off-farm migration, although the effect can be rather moderate.

[36] This values range is obtained taking into account of the confidence interval of our estimation, namely its uncertainty.

4. Concluding remarks

Understanding the effect of CAP policies is important, as a deeper comprehension of their incidence would allow the design of better policies. This chapter has summarised the main findings reported in Olper et al. (2013), who investigated how different CAP subsidies affected off-farm migration across 150 EU regions over the period 1990–2009. Within the standard neo-classical two-sector models, inter-sectoral labour migration is affected by across-sector income differences, *ceteris paribus*. Thus, as far as CAP subsidies have been effective in transferring income to farmers, they should have contributed to a reduction in the rate of off-farm migration. We find strong support for this expectation.

An interesting implication of the study, which comes from the structure of the conceptual model, is related to the 'efficiency' of CAP payments in transferring income to farmers. Although several previous works have documented an overall inefficiency of (coupled) agricultural payments (e.g. OECD, 2001), our results seem to partially contradict this conclusion. This appears in line with most recent evidence showing that farmers gain from 60% to 95% of the value of CAP coupled payments, and only a marginal fraction of such payments is capitalised in land rent (Michalek et al., 2011).

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16. The Impact of CAP Reforms on Farm Labour Structure: Evidence from Greece

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The labour force in the agricultural sector declines over time, and the reallocation of labour from family members to hired workers is observed. Using farm-level data, this chapter analyses the on-farm labour structure in Greece and assesses the factors driving its evolution over the period 1990-2008. The impact of agricultural policies and farm characteristics is examined in a dynamic panel analysis. Family and hired labour are found to be substitutes rather than complements, while agricultural support measures appear to negatively affect both family and hired labour demand. Decoupled payments and subsidies on crops have a significant impact on both labour sources, as well as subsidies for rural development that do not favour on-farm labour use. Structural labour adjustments are also the result of farm characteristics, such as farm size and location. The results are robust to various estimation techniques and specifications.

1. Introduction

The Common Agricultural Policy (CAP) has been reformed on many occasions, evolving into a multifunctional policy aimed at economic efficiency, strengthened competitiveness as well as social and territorial balance, among other things The CAP has effectively moved away from supporting commodity prices to supporting producers' income and rural development in order to ensure sustainable farming, contribute to farms growth or survival, and provide basic public goods realigning with consumer concerns (OECD, 2011). Thus, the CAP plays a significant role in

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fostering prosperity in rural economies, and policy-makers argue that it is of vital importance for maintaining the farm labour force (European Commission, 2005). However, its effectiveness and efficiency in achieving its objectives have been strongly criticised.

For instance, agriculture in Greece is fully regulated by the CAP and remains the most heavily subsidised sector, yet the rural economy has undergone significant changes over the last two decades and the agricultural sector has experienced a sharp decline in its relative size as well as structural labour adjustments. Greek agriculture was traditionally dominated by family farms with a near absence of hired labour. A decline in both the absolute level and the relative importance of farm labour is currently observed, accompanied by the reallocation of labour from family members to off-farm workers (Labrianidis & Sykas, 2010). The continuous CAP reforms have essentially resulted in lower competitiveness, reduced farm income, and greater demand for hired labour (Kasimis & Papadopoulos, 2005).

Along with the gradual implementation of more decoupled payments, four major driving factors have been affecting the Greek farm labour structure as well. First, the restructuring of labour markets has been associated with the expansion of non-farm rural employment sectors (e.g. tourism) that increased the alternative employment opportunities of farmers and endorsed their pluriactivity (Kasimis et al., 2000). Second, a dual labour market was developed leading to the division of the labour force and the segmentation of labour markets into the so-called 'primary' and 'secondary' markets. In the former, workers are well paid and benefit from full-time employment and security, whereas flexibility, seasonality, low wages and uncertainty characterise the 'secondary' market (Labrianidis & Sykas, 2009). Third, the roles of family farm members have been redistributed due to the entrance of women in non-farm employment, and labour deficiencies have been observed owing also to the unwillingness of young natives to work in agriculture and to the retirement of the older farmers (Cavounidis, 2006). Finally, migrant labour complemented family labour by filling seasonal deficits and allowing for a more flexible combination of capital and labour in the production process (Jentch, 2007).

A wide range of approaches and disciplines have been used to examine such structural changes in farm labour markets and the factors that affect labour decisions. Various studies have used the theoretical framework of the farm household model to analyse farmers’ time allocation (off-farm labour participation or part-time labour) (Kimhi, 2000; Corsi &

Findeis, 2000; El-Osta et al., 2008). A few studies have simultaneously examined the demand for hired labour and the supply of family labour (Huffman, 1991; Benjamin & Kihmi, 2006). Job creation and destruction models are employed to explain intra-sectoral job flows (Dries et al., 2010). Considerably fewer studies use these models to assess the impact of agricultural policy reforms on farmers' behaviour and the different labour market participation strategies (Weiss, 1997; Hennessy & Rehman, 2008). It is generally concluded that in developed countries, the share of hired labour in total farm labour has increased over the last decades (e.g. Blanc et al., 2008). The key factors contributing to the reduction of family farming are the agricultural support measures and migrant labour. However, it is evident that their impact on farm labour structure is complex and difficult to predict. For instance, the institution of family farming is competitive because of the lower transaction costs within families compared with hired labour, so that the use of family labour may be preferred (e.g. Schmitt, 1991). In any case, the introduction of decoupled payments is likely to decrease the incentives to produce and therefore may have negative effects on the use of production factors (e.g. Swinnen & Van Herck, 2010).

Using Farm Accountancy Data Network (FADN) data at the farm level, the objective of this chapter is to analyse the on-farm labour structure and to assess the factors driving its evolution in Greece over the period 1990-2008.[37] The factors that influence farms' decisions concerning the use of both family and hired labour will be examined, identifying also the agricultural support measures that have an impact on the different types of on-farm labour.

2. Methodology

2.1 Empirical model

In the present analysis, a neoclassical labour demand model is used, and labour demand of farm i is assumed to be denoted by:

$$L_i^D = L^D(p, w, r, s, T_i, H_i) \tag{1}$$

where p is the vector of output price, w is the wage rate, r is the vector of other input prices, s denotes subsidies, T is for technology and H is for the farm-specific characteristics. The output produced by the farm household, and thus the labour demand, depends on: (i) the production

[37] Source: "EU-FADN – DG AGRI".

technology; (ii) the expected profits from selling the produced output, i.e. output prices; and (iii) the relative prices of the production factors, i.e. input prices (Kancs et al., 2009).

Labour use of farm i at time t can therefore be represented empirically by the following baseline equation:

$$l_{it} = \beta_0 + \beta_1 S_{it-1} + X_{it}^{'}\beta + u_{it} \quad (2)$$

Agricultural payments are assumed to be predetermined instead of strictly exogenous, so that lagged levels are used as independent variables – and as instruments in the estimation methods presented below. To resolve the problem of endogeneity bias due to farm heterogeneity or selection bias, farm- and time- fixed effects are used. That is, the disturbance term is specified as a two-way error component model:

$$u_{it} = \alpha_t + \mu_i + \varepsilon_{it} \quad (3)$$

Farm heterogeneity is denoted by μ_i, which is the unobserved or fixed farm-specific effect; while year-specific dummies, α_t, are included to account for common trends in labour use. Equation (2) is therefore equivalent to a difference-in-differences (DiD) estimation (Olper et al., 2012).

The dependent variable lagged by one period is also introduced as an explanatory variable. The significance of this term will indicate that labour demand at the farm-level is dynamic. The equation to be estimated in this case is given by:

$$l_{it} = \beta_0 + \lambda l_{it-1} + \beta_1 S_{it-1} + X_{it}^{'}\beta + \alpha_t + \mu_i + \varepsilon_{it} \quad (4)$$

Parameters λ and β are to be estimated, and a set of additional explanatory variables are used in a dynamic panel-data analysis to determine the significance of agricultural payments for farm family and hired labour, taking into account important factors related to farm characteristics, such as specialisation and location.

In terms of agricultural support measures, *total subsidies*, *subsidies on crops*, *subsidies on livestock*, *support for rural development*, *coupled payments* and *decoupled payments* are used as instruments for the Common Agricultural Policy. A dummy variable for the Fischler CAP reform is also included to isolate the structural effects of decoupling that cannot be captured by a mere change of transfers measured in monetary values. This is equal to one after 2005, and zero otherwise. The impact of CAP reforms on farm labour markets is not clear *a priori*. Receiving a farm subsidy conditional on farm production encourages farm work by family members and thus reduces the demand for hired labour. Yet, direct payments coupled to certain production activities may induce additional employment if more (hired) workers are required to maintain these activities. If direct payments are fully decoupled, either they will not affect labour use or they may result in farmers reducing family labour, i.e. supply of off-farm labour will increase (Hennessy & Rehman, 2008). The impact of decoupled payments on hired labour is also ambiguous and depends on whether family and hired labour are substitutes or complements. Moreover, rural development payments may increase labour use assuming higher output prices or reduced production costs, making it essentially easier to hire (or fire) workers.

Farm-specific variables likely to be associated with higher labour use are as follows.[38] The *labour cost* is expected to have a negative impact on labour demand, as labour is considered to be a normal good. The impact of the cost for hired labour on family labour is expected to be positive, assuming the two labour inputs are substitutes. The cost of labour is measured by the ratio of wages over the hours of hired workers. The *land cost* is likely to negatively affect labour demand, as this is a main input for farm production. This cost is measured as the rental per hectare of rented land for those farms using external land. The *output cost* may be positively related to labour use, as higher sales revenue could be associated with farm expansion. This variable is the ratio of farms' sales revenue over the production quantity. As larger farms and farms using irrigation are likely to use more labour, *size* indicates each farm's economic size expressed in European Size Units (ESU), and *technology* is proxied by the UAA in hectares under irrigation. *Specialisation* is likely to denote higher seasonal labour needs, as crop farms rely more on seasonal labour and livestock farms hire workers on a permanent basis. The standard groups of farms determined according to their specialisation and provided by FADN are used for this parameter. The localisation variable is a dummy parameter on less-favoured areas (LFA), while *rented land* is the share of rented land in total UAA. Both parameters are likely to be negatively related to labour use. Each farm's operators *age* is also included, as older farmers are expected to be more experienced, but they need more help in operating their farms.

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[38] Cost variables are normalised using output, while agricultural support measures are divided by ESU to avoid capturing size effects.

Equation (2) is estimated using fixed-effects estimators. An *F*-test indicated that fixed-effects were significant in all specifications. To estimate Equation (4), a Generalised Method of Moments (GMM) procedure is used, following Arellano & Bover (1995) and Blundell & Bond (1998). The Windmeijer (2005) biased-corrected two-step robust standard errors are reported.

Finally, the direct implication of heterogeneous farm labour is that the notion of a single demand curve for farm labour should be abandoned. On-farm demand of family and hired labour is therefore considered separately and is measured in annual work units (AWU).

2.2 Data and descriptive statistics

Data for 19 sequential years (1990-2008) were retrieved for Greece from the FADN dataset, which includes physical, structural, economic and financial data for about 5,000 farms. An unbalanced panel data is used for a maximum of 91,357 observations. Descriptive statistics for the variables included in the empirical estimations are shown in Table 16.1.

Table 16.1 Descriptive statistics

	Mean	SD	Min	Max
Family labour, AWU	1.446	0.614	0.040	5.982
Hired labour, AWU	0.212	0.549	0.000	19.273
Utilised agricultural area, ha	10.099	11.726	0.000	235.770
Size, ESU	14.212	11.441	2.002	196.778
Total output, €	19,457	18,327	0.000	584,613
Rented land, Ha	4.744	10.353	0.000	235.770
Total subsidies, €	4,187	5,668	0.000	119,614
Subsidies on crops, €	2,771	4,780	0.000	119,159
Subsidies on livestock, €	557.9	1,658	0.000	31,209
Support for rural development, €	192.1	1,012	0.000	83,129
Decoupled payments, €	620.2	2,449	0.000	101,578
Labour cost, wages/labour$_{Hired}$ (€/hour)	2.732	0.771	0.000	15.045
Land cost, rental/rented land (€/ha)	243.8	319.8	0.000	10,360
Output cost, sales revenue/production (€/ton)	217.4	473.7	0.000	19,815
Technology, UAA under irrigation (ha)	3.954	5.502	0.000	91.700
Age, years	50	13	17	99

Note: All value variables are deflated by the national consumer price indices with base year 1990.

3. Empirical results

The results of the fixed-effects estimations are reported in Table 16.2. It is in general indicated that agricultural support measures are among the variables that have a statistically significant impact on both family and hired farm labour. Agricultural payments negatively affect labour use, especially family farm labour. Hired labour is negatively related to decoupled payments, while there is no statistically significant impact of crops and livestock subsidies on hired labour. In addition, support for rural development increases demand for family labour, while it does not increase the use of hired labour. The dummy used to capture the structural changes due to the Fischler reform indicates that decoupled payments may favour the use of labour as a production input, but the overall impact of subsidies on labour demand is estimated to be negative.

Table 16.2 Empirical estimations, Fixed-effects

	Family labour	**Hired labour**	**Family labour**	**Hired labour**	**Family labour**	**Hired labour**
Total subsidies	-.000028*** (0.000)	-.00002*** (0.000)				
Coupled payments			-.00003*** (0.000)	-.00001 (0.171)		
Decoupled payments			-.000018* (0.098)	-.00012*** (0.000)		
Subsidies on crops					-.00003*** (0.000)	.00002 (0.735)
Subsidies on livestock					-.00001 (0.637)	.00002 (0.452)
Support for rural development					.00019*** (0.000)	-.00014*** (0.005)
Fischler dummy	.1212*** (0.000)	.0173*** (0.003)	.1199*** (0.000)	.0289*** (0.000)	.1158*** (0.000)	.0223*** (0.000)
Labour cost	.0286*** (0.000)	-.1493*** (0.000)	.0286*** (0.000)	-.1492*** (0.000)	.0288*** (0.000)	-.1492*** (0.000)
Land cost	-.1807*** (0.000)	-.1040** (0.045)	-.1792*** (0.000)	-.1176** (0.023)	-.1765*** (0.000)	-.1097** (0.035)
Output cost	-.1466*** (0.000)	-.0092 (0.778)	-.1468*** (0.000)	-.0078 (0.812)	-.1477*** (0.000)	-.0106 (0.746)
Size	.0068*** (0.000)	.0096*** (0.000)	.0068*** (0.000)	.0095*** (0.000)	.0068*** (0.000)	.0097*** (0.000)
Technology	.0021*** (0.000)	.0017** (0.020)	.0021*** (0.000)	.0014** (0.044)	.0023*** (0.000)	.0016** (0.027)

Specialisation	.0054*** (0.000)	.0009 (0.600)	.0054*** (0.000)	.0013 (0.453)	.0052*** (0.000)	.0009 (0.606)
LFA	.0022 (0.738)	-.0057 (0.474)	.0021 (0.743)	-.0053 (0.505)	.0017 (0.791)	-.0055 (0.487)
Rented land	.1058*** (0.000)	-.0547*** (0.000)	.1054*** (0.000)	-.0511*** (0.000)	.1045*** (0.000)	-.0551*** (0.000)
Age	-.0003 (0.296)	.0012*** (0.002)	-.0003 (0.302)	.0012*** (0.003)	-.0003 (0.334)	.0012*** (0.002)

Region and year fixed effects are included in each regression. The P-values are reported. Number of observations: 73,364. Significance levels: 0.01***, 0.05**, 0.1*.

In terms of the farm-specific variables, the cost of hired labour significantly influences the demand for both family and hired workers. The positive effect of the labour cost on family workers indicates that the two types of labour are substitutes rather than complements. This can be considered as an indication of migrant labour used to substitute family labour owing to the unwillingness of farmers' children to succeed their parents and the expansion of non-farm rural employment sectors (e.g. tourism) that increased alternative employment opportunities for farmers.

The costs of both land and output negatively affect labour use, while the estimation for the share of rented land is positive only for the case of family labour. This may be explained by the fact that expansion of a farm's operations is possible when additional unpaid family workers are available, while the option of hiring labour to be used for rented land increases the cost of production in two major inputs simultaneously. Farm size and the proxy for technology are positively correlated to labour use, implying that larger and more efficient farms require more labour sources. Regarding specialisation, it appears that only family labour use is positively affected, while the impact of the localisation dummy is not significant. Finally, the age of the farm operator positively affects hired labour demand, as older farmers are likely to need more help provided by hired workers.

The estimations of equation (4) are included in Table 16.3. The coefficient of the lagged variable for family labour is positive and statistically significant at the 1% level. The coefficients for hired labour are also significant but with a negative sign, indicating that farms which already have hired workers are less likely to further increase this input of production in the future. On the other hand, agricultural support measures appear to negatively affect both family and hired labour demand, as expected, while coupled payments and subsidies on crops have a significant impact on both labour sources. Moreover, subsidies for rural development do not favour on-farm labour, similarly to the other payments that discourage farm labour demand. Family labour is particularly affected by the introduction of decoupled payments, as indicated by the estimated coefficient for this parameter and the dummy variable for the Fischler reform. Regarding the estimations of farm-specific characteristics, the coefficients on *LFA* and *age* appear to be negative and statistical significant in all specifications, while the remaining coefficients are similar to those obtained in the previous estimation case.

4. Conclusion

The prevalence of family-based forms of production and the relatively limited extent of hired labour have long characterised the farm labour structure in Greece. Yet, substitution of unpaid family labour by (migrant) hired labour has occurred and much of the work previously carried out within the framework of the family is now undertaken by workers for wage. Trends show that while farm labour has declined significantly over time, this trend has been coupled with an increasing proportion of the farm labour force that is hired.

In particular, off-farm employment of family members increases, as well as the proportion of the total farm labour force that is hired. Family labour is reduced mainly due to the low profitability of farming, the attractiveness of alternative employment opportunities, the ageing of farm population, and the increasing outflow of young natives from rural areas. At the same time, (migrant) hired workers are willing to undertake unskilled, temporary and low wage tasks in the farm labour market. Changes in farm structure, technological innovation and agricultural policy reforms are likely to have an impact on the trends observed in farm labour force.

This chapter examined a set of explanatory variables used in a dynamic panel data analysis to determine the significance of agricultural payments for farm family and hired labour, taking also into account important factors related to farm characteristics, such as specialisation and location. The analysis showed that in Greece, family and hired labour are substitutes rather than complements, while agricultural support measures appear to negatively affect both family and hired labour demand. Decoupled payments and subsidies on crops have a significant impact on both labour sources, as well as subsidies for rural development that do not favour on-farm labour use. Farm-specific characteristics, such as farm size and age of the farm operator, also appear to have a significant impact on farm labour. The results were robust to various estimation techniques and specifications.

Table 16.3 Empirical estimations, GMM estimations

	Family Labour	Hired Labour	Family Labour	Hired Labour	Family Labour	Hired Labour
Labour	.1821*** (0.000)	-.1186*** (0.000)	.1758*** (0.000)	-.1190*** (0.000)	.1787*** (0.000)	-.1178*** (0.000)
Total subsidies	-.000061*** (0.000)	-.000031*** (0.000)				
Coupled payments			-.000044*** (0.002)	-.000027*** (0.000)		
Decoupled payments			-.000098*** (0.000)	-.000063*** (0.000)		
Subsidies on crops					-.000043*** (0.003)	-.000025*** (0.000)
Subsidies on livestock					.000066 (0.166)	.000044 (0.889)
Support for rural development					-.00038** (0.050)	-.00027** (0.017)
Fischler dummy	-.0414*** (0.000)	.0044 (0.497)	-.0343*** (0.000)	.0061 (0.346)	-.0395*** (0.000)	.0054 (0.413)
Labour cost	.0076** (0.023)	-.0999*** (0.000)	.0076** (0.024)	-.0993*** (0.000)	.0074** (0.028)	-.1005*** (0.000)
Land cost	-.0524 (0.591)	-.0259 (0.631)	-.0733 (0.473)	-.0313 (0.539)	-.0550 (0.579)	-.0213 (0.697)
Output cost	-.1042 (0.111)	-.1341 (0.111)	-.1016 (0.122)	-.1303 (0.124)	-.1029 (0.118)	-.1355 (0.106)
Size	.0136*** (0.000)	.0305*** (0.000)	.0131*** (0.000)	.0307*** (0.000)	.0143*** (0.000)	.0311*** (0.000)
Technology	-.0064 (0.136)	.0036 (0.440)	-.0063 (0.154)	.0031 (0.505)	-.0082* (0.078)	.0028 (0.560)
Specialisation	.2206*** (0.000)	.0654*** (0.008)	.2322*** (0.000)	.0702*** (0.005)	.2232*** (0.000)	.0651*** (0.008)
LFA	-.4017*** (0.000)	-.2295*** (0.010)	-.4008*** (0.000)	-.2288*** (0.010)	-.4129*** (0.000)	-.2299*** (0.010)
Rented land	.7988*** (0.000)	.0686 (0.644)	.8873*** (0.000)	.1199 (0.422)	.7864*** (0.000)	.0510 (0.730)
Age	-.0307*** (0.000)	-.0101** (0.017)	-.0304*** (0.000)	-.0096** (0.022)	-.0307*** (0.000)	-.0098** (0.021)

Values in the parentheses are Windmeijer-corrected Robust Standard Errors. Tests of autocorrelation were computed based on Arellano & Bond (1991). The results presented strong evidence against the null hypotheses that the overidentifying restrictions are valid, and that there is zero autocorrelation in the first-differenced errors at order 1. There is also no significant evidence of serial correlation in the first-differenced errors at order 2. Year fixed effects are included in each regression. Number of observations: 73,364. Significance levels: 0.01***, 0.05**, 0.1*.

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17. How Subsidies may Reduce Agricultural Employment: The Impact on Credit Constraints and Education

Kristine Van Herck, Ruxanda Berlinschi and Johan Swinnen[*]

Agricultural employment is found to be responsive to relative changes in returns to agricultural labour. Given this responsiveness, one would expect that a technological change or a government policy that causes farm incomes to increase, such as an agricultural subsidy programme, would have a positive impact on agricultural employment. However, despite massive subsidies agricultural employment in industrialised countries has been steadily decreasing over the past decades. In this chapter, the authors provide a new explanation for this puzzle, namely the positive impact of increased farm income on the educational level of farmers' children. If farmers are credit constrained, they may underinvest in their children's education. An increase in farm incomes will then allow more farmers to educate their children and if higher educated children are less willing to become farmers, increased farm incomes may in the long run lead to a reduction of labour supply in the agricultural sector. The authors provide both theoretical and empirical evidence supporting this argument.

[*] This chapter is based on Berlinschi, Swinnen & Van Herck, "Trapped in Agriculture: The Impact of Credit Constraints on the Educational and Occupational Choice of Farmers' Children", Factor Markets Working paper No. 39, May 2013.

1. Introduction

One of the objectives of the Common Agricultural Policy is to protect farmers' income to ensure a fair standard of living for the European farm population, and one would expect agricultural subsidies to have a positive impact on agricultural employment (or at least to mitigate the reduction).

This is consistent with basic economic models of labour allocation, which conclude that agricultural employment is responsive to relative changes in returns to agricultural labour. Given this responsiveness, one would expect that a technological change or a government policy that causes farm incomes to increase, such as an agricultural subsidy programme, would have a positive impact on agricultural employment. However, despite massive subsidies agricultural employment in industrialised countries has been steadily decreasing over the past decades.

A striking example of this evolution is a country like Spain, where at the beginning of the 1970s almost 30% of the population was employed in the agricultural sector, while currently the share is barely 5% despite the fact that subsidies have increased substantially over this period.

Cross-country observations suggest the same conclusion: there is no evidence of a positive correlation between agricultural subsidies and agricultural employment. If anything, the relationship is negative. In the OECD, the outflow of labour from the agricultural sector over the 1987–2007 period was strongest in the countries where farmers have been supported most heavily.[39]

Of course this negative correlation does not imply causality. Other factors, such as overall income growth, may have been important determinants. Moreover, the relationship could be due to reverse causality: the political economy of subsidies is such that farmers from countries where the farming population is small are more able to put pressure on politicians to increase agricultural subsidies (see Swinnen, 1994).

Therefore, the relationship which measures the correlation of changes presented in Figure 17.1 is more intriguing. Over the past 20 years, the decline in agricultural employment is lowest in countries with the strongest

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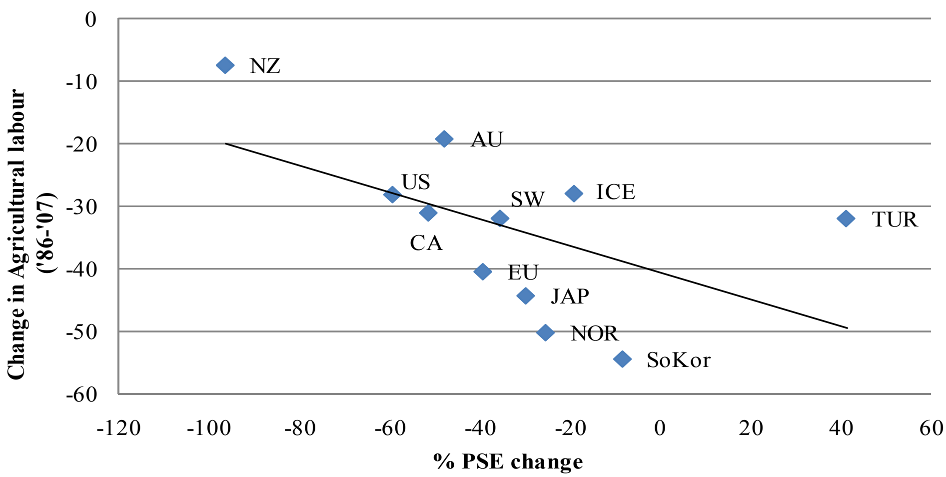
[39] Similar results hold within the agricultural sector in several European countries. For example, data for Belgium, Greece, the Netherlands and Portugal show that in the subsectors where agricultural subsidies were higher, agricultural labour outflow was stronger in the period 1990–2007 (Swinnen & Van Herck, 2010).

subsidy reduction or, vice versa, the decline is strongest where subsidies increased the most.

While these are aggregate figures, more careful and detailed analyses also yield results which do not support the 'simple story' of the impact of subsidies on agricultural employment. Some studies find a positive impact (e.g. Pietola et al., 2003; Foltz, 2004; Key & Roberts, 2006; Breustedt & Glauben, 2007), others find no impact (e.g. Barkley, 1990; Mishra et al., 2004; Glauben, et al., 2006) and yet others find a negative impact (e.g. Goetz & Debertin, 1996; 2001; Hoppe & Korbi, 2006; Petrick & Zier, 2011). Studies in this volume confirm the mixed results. Olper et al. (2013) find evidence that CAP subsidies contributed to maintaining jobs in agriculture but with a small impact. Eleni Kaditi (2013) finds that subsidies have a negative impact on employment in Greek agriculture.

Figure 17.1 Change in agricultural labour and PSE (1987–2007)*



*The Producer Support Estimate (PSE) is "an indicator of the annual monetary value of gross transfers from consumers and taxpayers to support agricultural producers, measured at farm gate level, arising from policy measures, regardless of their nature, objectives or impacts on farm production or income".

Source: OECD, ILO, national statistics.

Explanations in the existing literature are that (an increase in) subsidies may also have an indirect (second-order) negative impact on agricultural employment, which in some circumstances depending on the country and/or time period, may dominate the direct (first-order) positive impact, i.e. the direct income effect. Subsidies may lead for example to capital-labour substitution (Goetz & Debertin, 1996) or to a reduction of the credit constraint hampering farm expansion, enabling farmers that want to expand their farm size to purchase the land of those who want to stop their activities (Goetz & Debertin, 2001).

In this chapter, we provide an alternative explanation looking at longer-term adjustments. This is the effect of an increase in farm income on the educational level of farmers' children and the resulting impact on employment choices in the next generation. In many European countries, as in many other parts of the world, the majority of farmers are self-employed household farmers. As a result, an important share of the long-term decline in agricultural employment is due to farmers' children choosing to work in the industrial or service sectors rather than taking over their parents' farm.[40] For example, in 2008 only 27% of the Dutch farm operators over 50 years' old indicated having a successor (De Bont & Van Everdingen, 2010). The situation is even worse in Flanders (Belgium), where only 13% of the farmers reported having a successor (Vlaamse Overheid, 2009). Where farmers are credit constrained for education, increasing farm incomes may allow farmers to increase their investment in their children's education. If children with higher education levels are less willing to work in the agricultural sector, then one long-term effect of an increase in farm income may be to reduce agricultural employment.

2. Theoretical framework

We develop a theoretical model of two periods with intergenerational investment in education, building on Acemoglu & Pischke (2001). The economy is composed of farmers with heterogeneous incomes. In period one, each farmer decides whether to use his income for consumption and savings or to invest part of it in his child's education. In period two, each child decides to work in the agricultural sector or in the industrial/service sector (non-agricultural sector).

We show that in the presence of credit constraints, agricultural subsidies may have two opposite effects on agricultural employment. The first effect is an increase in farm income, which, for a given education level, induces more children to opt for the agricultural sector, since it improves

[40] There is a large literature analysing intergenerational farm transfers and its determinants (e.g. Kimhi, 1994; Stiglbauer and Weiss, 2000; Kimhi and Nachlieli, 2001; Mishra et al. 2004; Glauben et al., 2006).

the relative (economic) returns in the sector. The second effect is that, in the presence of credit constraints, subsidies allow more farmers to educate their children, increasing the attractiveness of jobs in the non-agricultural sector for those children with returns to education assumed to be higher in the non-agricultural sector. The combined effect of agricultural subsidies on agricultural employment depends on the income distribution in the agricultural sector and the cost of education. When the proportion of credit-constrained farmers and the cost of education are sufficiently high, the long-run impact of an increase in farm income through subsidies is more likely to be negative.

3. Empirical framework

To empirically test the theoretical predictions, we use data from the European Community Household Panel (ECHP). The sampling scheme of the panel survey enables to identify identical individuals and households in different years. This unique feature of the dataset allows us to analyse the educational and occupational decisions taken by parents and children. We use a sample of parents and their children based on information obtained from 1994 (to analyse the educational choice) and 1999 (to analyse the occupational choice). [41] We selected households in which at least one of the parents was self-employed in the agricultural sector in 1994 and at least one of the children was enrolled in an advanced stage of the educational system in 1994 such that the child finished his/her education by 1999.[42,43] This resulted in a dataset of 109 households from Portugal (48), Italy (32), Ireland (21) and Spain (8).

We estimate a recursive simultaneous bivariate probit model as in Hennessey & Rehman (2007). This model consists of two simultaneous

[41] The first time period (1994) was selected because it was the first wave of the ECHP. The second time period (1999) was selected to ensure that there were sufficient years between the two time periods such that most of the children that were enrolled in the educational system in 1994 had finished their studies and made an occupational choice by 1999.

[42] We only consider self-employed farmers because most of the farms in the EU-15 are family farms for which succession usually takes place within the household (Stiglbauer & Weiss, 2000).

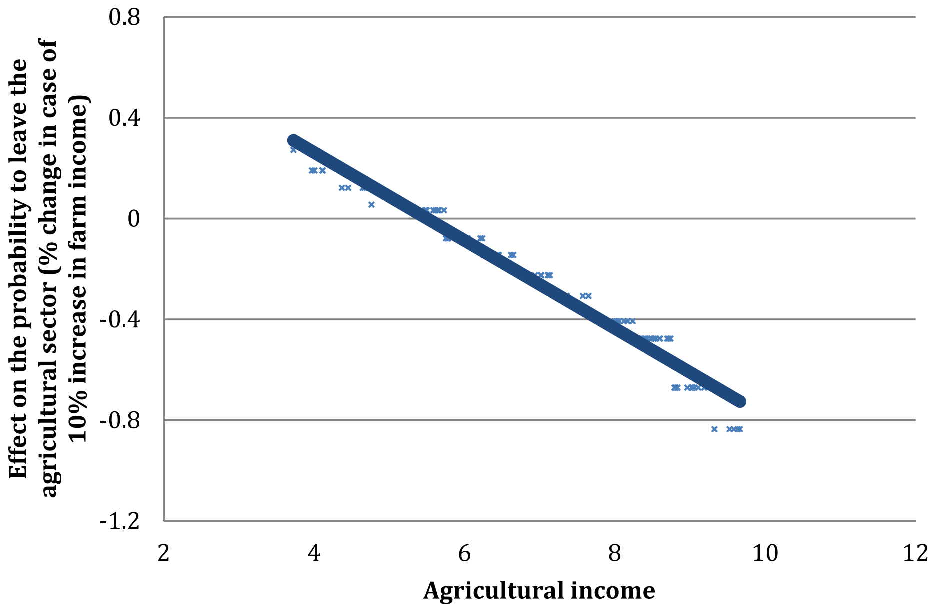
[43] We exclude children that are enrolled in the educational system in 1994 and are still enrolled in the educational system in 1999 to avoid censoring problems as these children have not yet made an occupational decision.

equations: the occupational choice equation, which estimates the direct impact of increased farm income on the decision to leave agriculture, given a certain education level; and the educational choice equation, which estimates the indirect impact of increased farm income on education.

Our results show that an increase in farm income has a positive and significant effect on children's education, which is consistent with the argument that farmers are credit constrained for investing in education. Controlling for education, an increase in farm income has a negative and significant impact on the probability of leaving agriculture.

These results are consistent with the theoretical predictions. An increase in farm income has two effects on the probability to leave agriculture, a direct effect (through the occupational choice) and an indirect effect (through the educational choice). In our sample, the aggregate effect is significant, but small. Moreover, it is dependent on the level of farm income; for farmers with a low income the indirect, positive effect (educational channel) dominates, while for farmers with an intermediate or high income the direct, the negative effect dominates, which is consistent with our theoretical model. This is illustrated in Figure 17.2, which shows the aggregated impact of a 10% increase in farm income on the probability of leaving the agricultural sector at different levels of farm income.

Figure 17.2 Aggregated impact of a 10% increase in agricultural income on the probability to leave the agricultural sector at different levels of agricultural income



* Agricultural income is the natural logarithm of the household farm income.
Source: own calculations based on a subsample of the EHCP survey.

4. Conclusion

Agricultural employment in western countries has been steadily decreasing in the past decades, despite substantial agricultural subsidies which have increased farm incomes. Previous studies on the impact of subsidies on agricultural employment have arrived at contradictory conclusions, suggesting that the direct positive effect on agricultural employment is sometimes counterbalanced by indirect negative effects, such as labour substitution for capital.

In this chapter, we provided an alternative explanation: the indirect negative effect of an increase in farm income on agricultural employment through the education of farmers' children, in the presence of credit constraints. The evolution of agricultural employment largely depends on the willingness of farmers' children to continue their parents' farming activities. An increase in farm income may enable farmers to increase investment in their children's education. Children with higher education levels have access to better paid jobs in the industrial or services sectors. They are therefore less likely to be willing to work in the agricultural sector. We presented a theoretical model and empirical evidence supporting this argument.

Our findings are relevant to explaining the limited impact of agricultural subsidies on agricultural employment observed in several studies on various OECD countries in the last 50 years. However, they may also have important implications for intergenerational farm transfers in transition and developing countries, where a large share of the rural population is still employed in agriculture.

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18. THE IMPACT OF DECOUPLED PAYMENTS ON OFF-FARM LABOUR SUPPLY: EVIDENCE FROM IRELAND AND ITALY

JASON LOUGHREY, THIA HENNESSY, KEVIN HANRAHAN, TREVOR DONNELLAN, VALENTINA RAIMONDI, DANIELE CURZI AND ALESSANDRO OLPER[*]

This chapter examines the effect of the decoupling of farm direct payments on the off-farm labour supply decisions of farmers in Ireland and Italy. The authors use panel data from the Italian Farm Business Survey (REA) and the Irish Teagasc National Farm Survey database covering the period from 2002 to 2009 to model these decisions. The model is the neo-classical agricultural household model described by Donnellan & Hennessy (2012) in Working Paper No. 31 of the Factor Markets project. Both models are developed at a national level. The model holds that the impact of decoupling on off-farm labour supply is dependent upon two competing forces i.e. the relative wage effect and the wealth effect. The decline in the farm wage relative to the off-farm wage makes off-farm work more attractive thus producing the relative wage effect. At the same time, the new decoupled direct payment provides a new non-labour source of income thereby generating a wealth effect. This may in turn have suppressed or eliminated the likelihood of increased off-farm labour supply for some farmers. Our hypothesis is that decoupling led to

[*] This chapter is based on Loughrey, Hennessy, Hanrahan, Donnellan, Raimondi & Olper, "Determinants of Farm Labour Use: A Comparison between Ireland and Italy", Factor Markets Working Paper No. 60, August 2013. The working paper version includes a longer discussion of the conceptual framework and the methodology and includes a more detailed set of results.

an increase in off-farm labour activity which would imply that the relative wage has dominated the wealth effect. We draw from the literature on female labour supply and use a sample selection corrected ordinary least squares model to examine both the decisions of off farm work participation and the decisions regarding the amount of time spent working off-farm. The results indicate that decoupling has not had a significant impact on off-farm labour supply in the case of Ireland but there appears to be a significantly negative relationship in the Italian case.

1. Introduction

Off-farm employment supports the living standards of a large proportion of farm households in Ireland and Italy, in part due to the small-scale nature of many family farm operations. For example, the smallest one quarter of farms in Ireland account for just about 3% of all gross agricultural output, and for about 10% of all gross agricultural output in the case of Italy (Moreddu, 2011). Many farm households therefore cannot rely upon farming as their only income source. This chapter summarises the findings from our work on the determinants of off-farm labour supply among farmers in both countries. We highlight in particular the potential impact of the decoupling of farm direct payments from labour supply decisions, both in terms of the participation decision and the number of hours supplied.

The potential impact of decoupling is highlighted as it is a relatively recent policy development with the potential to have radically altered the incentives for farmers towards the supply of off-farm labour. The 2005 reform of the Common Agricultural Policy ensured that farmers received support independent of their on-farm production decisions, as long as they complied with the "statutory management requirements" and maintained their land in "good agricultural and environmental condition". According to neo-classical economic theory, this reform had the potential to either increase or decrease off-farm employment depending upon the relative strength of two opposing forces, i.e. 'the wealth effect' and 'the substitution effect'. Decoupling provided a wealth effect via the introduction of a new non-labour source of income which incentivised farmers to relax their supply of off-farm work and devote more time to leisure. On the other hand, the introduction of decoupling made the coupled farm wage less rewarding relative to the prevailing off-farm wage. This substitution effect incentivised farmers to increase their off-farm employment.

This chapter uses an agricultural household modelling framework to consider the substitution and wealth effects of decoupled payments and the implications for the farm operators' off-farm labour participation and supply decisions. The chapter provides an ex post assessment, in contrast to the ex ante analysis of Irish farms by Hennessy & Rehman (2008), which relied upon projections at the macro level. The arrival of the economic recession in 2008 substantially changed the macroeconomic picture in both Ireland and Italy, and it would be interesting to identify whether or not the introduction of decoupled payments achieved a significant impact against such a background. Ex post analysis of the effect of decoupling on off-farm employment in Italy has been carried out by Corsi & Salvioni (2012) with respect to a subset of crop farmers. A wider sample of farms is included in this study, stretching over a longer time period, and we have a greater consideration for many small farmers where, at least in theory, the off-farm income source should be more relevant.[44] In addition, we have modelled the determination of off-farm labour hours and we provide a unique ex post cross-country analysis regarding the impact of decoupling on off-farm employment.

In the next section, we provide a brief summary of the policy background. This is followed by the data section with a separate description of the data sources for each country. The next section discusses the results and this is followed finally by the conclusion.

2. Policy background

Ireland and Italy are among ten EU member states that decoupled EU direct payments from agricultural production in 2005 under the introduction of the Single Payment Scheme (SPS). A further seven member states followed this path in subsequent years while ten new member states embarked upon the Single Area Payment Scheme (SAPS). Ireland, in common with Luxembourg, Malta and the UK (excluding Scotland), decoupled all direct payments from production while Italy retained some coupling payments for certain crop production, such as rice and tobacco. These reforms formed part of the Luxembourg Agreement on the reform of the CAP announced in September 2003.

[44] For example, in the Corsi & Salvioni sample the average farm size is equal to 53.37 ha of utilised agricultural area (UAA). Differently in our sample average size is 24.2 ha and 36.7 ha for the Italian and Irish sample, respectively.

On the introduction of the SPS, each member state had the option of choosing between three different implementation models: the historical model, the regional model, and the hybrid model. Ireland and Italy were among the majority of countries that chose to implement the historical model of payments. This meant that the allocation of entitlements became based on a historical reference period from 2000 to 2002.

The adoption of the historical model limited the extent to which the reforms could impact directly on the distribution of farm income between farm households. In contrast to Ireland and Italy, the new member states (excluding Malta and Slovenia) implemented the regional model which set a uniform payment per hectare. A small number of countries (Denmark, England, Finland, Germany, Luxemburg, Northern Ireland and Sweden) embarked upon a hybrid version of the two models.

Access to the SPS came with certain conditions for farmers. In order to access the scheme, farmers must have received direct payments during the reference period 2000-02 and the reference amount is based upon the three-year average of the total direct payments received in this reference period. Farmers were required to maintain the land 'in good agricultural and environmental condition' and furthermore that land under permanent pasture at the date of the area aid application must be maintained under permanent pasture. O'Neill & Hanrahan (2012) explained that these requirements may have incentivised some farmers to keep land in agricultural use and that without such requirements, the land would be left idle or converted to non-agricultural use. These conditions may in turn have some implications for the decision to enter off-farm employment.

3. Data

In this section, we briefly describe the data sources used for the analysis in both countries. Loughrey et al. (2013) describes these data sources in more detail. The Irish analysis utilises the Teagasc National Farm Survey data, which is essentially the Irish Farm Accountancy Data Network (FADN) database but containing richer data on off-farm labour supply. The attrition rate is relatively low and a sizeable proportion of the farms are contained in the dataset for all years concerned. New farmers are introduced during the period to maintain a representative sample and the sample size is usually kept to between 1,000 and 1,100 farms.

The Italian analysis utilises the data from the Farm Business Survey (REA) carried out by the Italian Institute of Statistics (ISTAT). The database surveys yearly a sample of agricultural holdings representative of Italian agriculture, stratified by region, farm type and economic size of holdings. Besides a detailed set of variables on farm structure, the database includes household composition variables as well as extra-farm source of income variables. The study covers an average of 3,573 farms per year, in a balanced panel that includes only farms surveyed for the entire period analysed.

The data for both countries covers the period from 2002 to 2009 and therefore includes the three years prior to the decoupling reform in 2005 and the four years immediately after the reform. We use approximately the same list of variables from both datasets and the mean values for these variables are presented in Table 18.1.[45]

Table 18.1 Mean value statistics for Italian and Irish data

	ITALY		IRELAND	
Main variables	Off-Farm employed	Full sample	Off-farm employed	Full sample
Off-farm job (Head)		23.0		36.3
Off-farm hours per year	466.71	113.19	1572.35	570.65
IndependentaVariables				
Age	53.40	55.78	48.98	54.35
Sex (= 1 male; 2 female)	1.29	1.34	1.03	1.05
Specialist dairy	0.0927	0.1388	0.0540	0.1571
UAA (ha)	15.11	24.18	27.47	36.72
Spouse (= 1 if work off-farm)	0.1146	0.0656	0.4190	0.3167
Married (= 1 if married)	0.3709	0.4114	0.7449	0.6730
Number of young in the family farm	0.0801	0.0465	0.8318	0.6278
Number of family members living in the farm	1.8457	1.9466	3.6214	3.2889
Number of family members working in the farm	0.2409	0.3482	N/A	N/A
Hired (= 1 if presence of hired workers)	0.2099	0.2617	0.1097	0.1827
Number of bovine on UAA	0.7564	0.8798	1.1429	1.3093

45 In the Italian sample, household characteristics such as the 'number of family members living in the farm' and the 'number of young in the family farm', could be seriously underestimated, as the available data mainly include family members working on- or off-farm.

Decoupled payments	2,529	5,441	7,237	9,059
Coupled income	2,517	3,936	2,636	7,780
Other subsidies (investment aids, organic payments, etc.)	442	630	2,676	2,764
Average number of farms each year	825	3,573	330	1,184

Sources: see text.

The mean values provided include both the dependent and independent variables from our analysis. The values are presented separately for the entire sample and for the sub-sample of farm operators engaged in off-farm employment. In terms of the dependent variables, it is clear that off-farm employment is much more common among Irish farm operators than among Italian operators. Among those with off-farm employment, the Irish operators participate in over three times the amount of off-farm labour relative to the Italian farm operators.

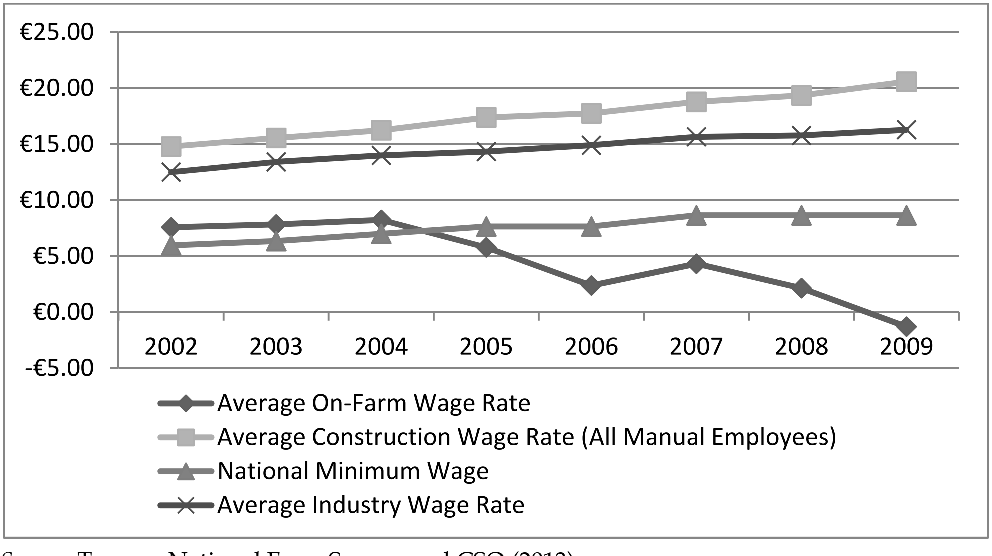
Among the independent variables, the average age is very similar for farm operators in both countries. Italian farm operators have an average age of 55.78 years, compared to 54.35 years for Irish farm operators. The average age of Irish operators with off-farm employment is approximately four years younger than for the Irish sample as a whole. Italian farm operators are much more likely to be female than their Irish counterparts. The proportion of farms classified as specialist in dairy is relatively close in both datasets. We find that Irish farms have much larger farm incomes both in terms of coupled and decoupled incomes along with larger farms. In addition, Irish farm operators receive much greater amounts in the form of other subsidies.

In terms of the remaining farm-level variables, it appears that the presence of hired workers is more common in the case of Italian farms, with 26.2% of farms hiring labour compared to 18.3% in the case of Irish farms. The number of bovine units per UAA hectare is much higher on Irish farms. Average farm size is much greater in Ireland. This finding is supported by Moreddu (2011), who provides results from the 2007 farm structure survey carried out in both countries. The farm structure survey includes farms of all sizes whereas the FADN database excludes farms of less than 4 European Size Units (ESU) in the case of Italian farms and less than 2 ESU in the case of Irish farms.

In terms of household variables, we can see that the average household size is much smaller among the Italian farms than the Irish farms. While Irish farms have on average higher income, the Irish farm household must support on average at least one more person. There are also deep differences in the proportion of farms where a spouse is engaged in off-farm employment. This proportion lies at just 6.6% for the Italian farms compared to 31.7% for the Irish farms. There appears to be some correlation between off-farm employment of the operator and the spouse in both countries. In both cases, the proportion of farms with a spouse employed off-farm is greater among the sub-sample of farms where the operator is employed off-farm than for the sample as a whole. The Irish data does not provide for a variable regarding the number of other family members working on the farm.

Before proceeding to the results section, we first take a look at some of the trends in farm and off-farm wage rates in Ireland both before and after the decoupling of direct payments in 2005. The differences in wage rates between farm and non-farm labour can reflect the size of the incentives faced by farm operators in the allocation of labour. As explained previously, an increase in the off-farm wage rate relative to the farm wage incentivises farm operators to increase their off-farm employment.

Figure 18.1 Off-farm and coupled farm wage rates in Ireland



Source: Teagasc National Farm Survey and CSO (2013).

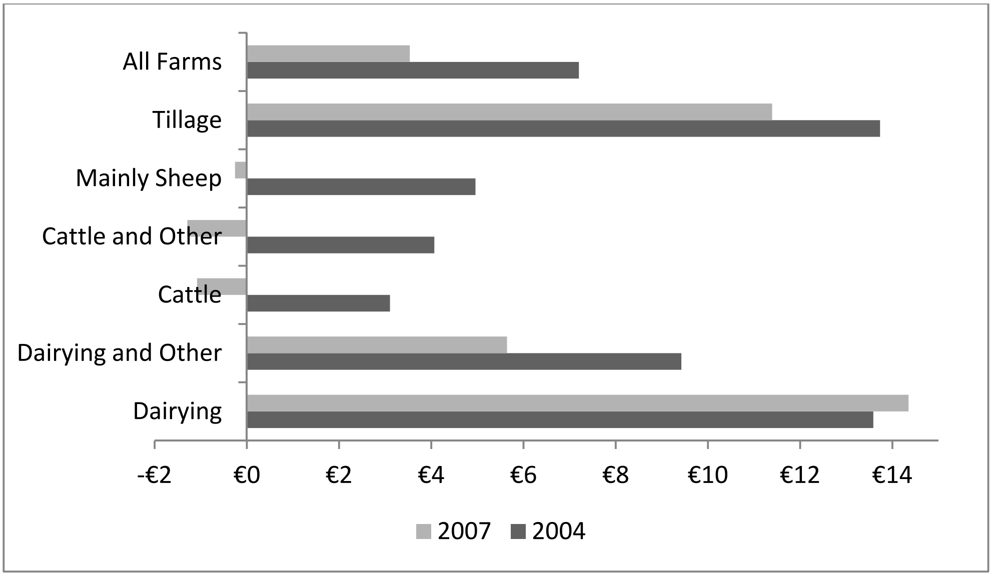
It is evident from Figure 18.1 that the gap between off-farm wages and on-farm wages grew substantially during the period 2002 to 2009. We highlight both the average industrial wage and the average construction wage, as construction provided many farm operators with employment during the economic boom. Wage rates in construction and industry grew continuously during the period, while the coupled farm wage rate declined overall. Some of this decline was concentrated around the time of decoupling in 2005, with the average on-farm wage rate falling from approximately eight euros per hour in 2004 to less than six euros in 2005.

Irish farming experienced some difficult years post-decoupling, with 2009 being a particularly difficult year as the average coupled on-farm wage entered negative territory. The coupled farm wage recovered to approximately five euros per hour in the following two years but remains two or three euros per hour less than the level pre-decoupling.

We can conclude from the above that decoupling produced a shift in relative wages but much of the overall change in relative wages can be attributed to the improvement in off-farm wage rates during the period. The average industry wage was almost double that of the average coupled farm wage rate prior to decoupling. Many farm operators chose, for various reasons, to not enter into off-farm employment despite the incentive of higher off-farm wages in the pre-decoupling era. We should perhaps therefore not expect the decoupling-induced shift in relative wages to cause large increases in off-farm employment participation in the Irish case.

The average coupled farm wage in Ireland varies according to the farm system. In addition, the decoupling-induced change in relative wages appears to have varied according to the system. From Figure 18.2, it appears that the shift in relative wages has been greatest for those farms which can be categorised within either the 'drystock cattle' or 'mainly sheep' categories. The relative wage effect is therefore most pronounced for farms in these systems.

Figure 18.2 Coupled farm wage rates by system in Ireland [post- and pre-decoupling]



Source: Teagasc National Farm Survey.

4. Results

In this section, we present the econometric results for the off-farm participation probit model and the hours of off-farm work model. More detailed results including the size of the coefficients are provided for both countries in Loughrey et al. (2013). For the Irish results, we strongly recommend Donnellan et al. (2013) as this particular paper provides analysis suggesting that the significance of the relationship between decoupled payments and off-farm work participation is quite sensitive to the choice of modelled variables and in addition the paper examines the relationship between off-farm employment and farm exit within an Irish context. In terms of the impact of decoupling on off-farm work participation, it appears from Table 18.2 that there was a significant negative impact in Italy but no significant impact in Ireland. We can imply from this that the wealth effect has dominated the relative wage effect in Italy and that off-farm employment participation has responded negatively as a consequence.

Table 18.2 Results for participation analysis

Independent Variable	Ireland	Italy
Age	Positive***	Positive***
Age squared	Negative***	Negative***
Sex	Negative	Negative***
Specialist dairy	Negative***	Negative***
UAA (ha)	Negative**	Negative***
Spouse working off-farm	Positive	Positive***
Married	Positive***	Negative***
Number of young in HH	Negative***	Negative
Household size	Positive***	Positive***
Number of family members working on the farm	N/A	Negative***
Hired workers (1,0)	Negative	Negative***
Number of bovine Per UAA	Negative***	Negative**
Decoupled payments (in €10,000s)	Negative	Negative**

Level of Significance: *p<0.10, **p<0.05, ***p<0.01

The differentiated impact of decoupled income on off-farm work participation in the two countries is interesting. The difference could perhaps lie in the combined effect of the level of average payments and off-farm wages in the two countries. Indeed, in the Italian sample, the corresponding average amount of decoupled payments per farm is only 59% of the Irish sample, a fraction that goes down to 35% when only the farms with off-farm work are considered.[46] From this perspective, it is not simple to justify the above results. However, in several southern Italian South, the off-farm wage (unemployment rate) is typically lower (higher) than in Ireland, a consideration that can at least partially recompose the above evidence.

For both countries, the presence of a specialist dairy farm reduces the likelihood of participation. We find that age is positively associated with participation in both countries, but in a non-linear fashion as age squared is negative and significant. The off-farm employment participation of the

[46] Note that differences in farm size can only partially explain these numbers, suggesting that the reason could be attributable to differences in the types of farm activities.

spouse is found to have no significant impact upon the participation decision in Ireland, but a significant and positive one in Italy. Mariage status has a totally different effect in the two samples, pointing to a significant positive effect in Ireland but to a significant negative effect in Italy. The number of young in the household is a negative contributor towards off-farm employment participation, although it is statistically significant only in Ireland. Finally, household size and the presence of hired workers are positively and negatively associated, respectively, with off-farm employment participation, but the latter is statistically significant only for the Italian sample.

Table 18.3 Results for hours equation

Independent variables	Ireland	Italy
Age	Positive***	Positive***
Age squared	Negative***	Negative***
Specialist dairy	Negative***	Positive
UAA (ha)	Negative*	Positive
Spouse working off-farm	Negative***	Positive***
Married	Positive	Negative**
Number of young	Negative*	Negative*
Number of family members living in the farm	Positive	Positive**
Number of family members working in the farm		Negative*
Hired workers (1,0)	Negative	Positive
Number of bovine on UAA	Negative**	Negative***
Decoupled payments (x 10,000€)	Negative	Negative***
Mills ratio	Positive**	Positive

Level of Significance: *p<0.10, **p<0.05, ***p<0.01

In the hours equation, and coherently with the Probit result, we find for Italy that decoupled payments have had a significant negative impact on the number of hours supplied off-farm. Decoupled payments are therefore found to have had a significant negative effect on both participation and hours supplied off-farm in Italy. In a neo-classical framework, this suggests a strong wealth effect. No significant impact is found in the Irish case, but the negative sign is also apparent.

As in the case of the participation equation, the age variable is significantly positive and non-linear for both countries. Farm size has a negative and significant impact on hours supplied among Irish farmers but no such relationship appears from the Italian results. The results also show that being a specialist dairy farmer has a significantly negative impact upon hours among Irish farmers but not among Italian farmers, a result that could be attributed to the way we are forced to estimate the dairy specialisation in the Italian sample.

The off-farm work participation of the spouse appears to have a very strong positive effect in Italy, which is perhaps unexpected. The off-farm employment of the spouse has a significant negative effect in Ireland. This would imply some kind of trade-off taking place between the off-farm employment of the spouse and the number of off-farm hours supplied by the farm operator. We find that a being married has a significantly negative effect upon off-farm employment in the Italian data while in the Irish data there is a significant relationship between off-farm employment participation and marriage.

The number of young in the household is a negative contributor towards off-farm employment in both samples, and the effect appears to have greater significance for participation than for hours. The intensity of livestock farming is unlikely to be among the stable covariates and it appears, as expected, to have a significantly negative impact upon hours supplied in both countries.

Finally, in the Irish case, the significance of the inverse Mills ratio in the second stage means that sample selection is present. Farm operators engaging in off-farm employment are therefore found to have unobserved characteristics that make them more likely to engage in off-farm employment relative to the group not participating in off-farm work. This result is quite different from the Italian sample, where instead the Mills ratio is never significant.

5. Conclusion

This chapter summarises our econometric analysis of the determinants of off-farm labour participation in Ireland and Italy with the aim of understanding the role played by decoupled payments in this important adjustment process. To this end, a neo-classical household model based on utility maximisation is used to model farm households' labour allocation decisions. Under this framework, the effect of decoupling on off-farm participation is the result of two contrasting effects, namely, a wage effect that should increase the off-farm labour participation, and a wealth effect that should reduce it. Thus, overall, which of the two effects will prevail is an empirical question that we addressed through an hours off-farm labour supply equation and an off-farm participation equation, to take care of the possible unobserved selection effects.

Overall, many of the determinants of off-farm labour participation and off-farm labour supply suggested by the previous literature have the expected significant effect in both Ireland and Italy, although some notable exceptions are present. With regard to the main policy variable of interest, the results suggest that decoupled payments have a negative effect on the off-farm participation decision and on the hours supplied in the two samples, although this result is significantly different from zero only in the case of Italy. In light of the conceptual model framework, this result points to a wage effect that is dominated by the wealth effect.

The characteristics of farms at the top and bottom of the coupled income distribution can therefore differ between the countries. In addition, farmers in both countries are likely to be affected by different income risks relating to weather, disease and other natural forces. In Ireland, the off-farm job demands on average close to 30 hours of labour per week, whereas the average number of hours is much lower in Italy. Future refinement of the analysis calls for a deeper investigation of the differentiated factors that are at the root of the above findings.

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19. OFF-FARM LABOUR MIGRATION, TRANSFER FRICTIONS AND THE PERSISTENCY OF INCOME GAPS

ALESSANDRO OLPER, VALENTINA RAIMONDI, DANILO BERTONI, DANIELE CURZI AND DANIELE CAVICCHIOLI[*]

The inter-sectoral migration of agricultural labour is a complex but fundamental process of economic development largely affected by the growth of agricultural productivity and the evolution of the agricultural relative income gap. Theory and some recent anecdotal evidence suggest that as an effect of large fixed and sunk costs of off-farm migration, the productivity gap between the agricultural and non-agricultural sectors should behave non-monotonically or follow a U-shaped evolution during economic development. Whether or not this relationship holds true across a sample of 38 developing and developed countries and across more than 200 EU regions was empirically tested. Results strongly confirm this relationship, which also emphasises the role played by national agricultural policy.

1. Introduction

Changes in resource allocation as a result of structural changes such as across-sector labour reallocation represent one of the most important engines driving economic growth and development. The most complex form of resource adjustment during economic development is the migration of labour out of the agricultural sector. Labour is the most

[*] This chapter is based on Olper, Raimondi, Bertoni & Cavicchioli, “Patterns and Determinants of Off-Farm Migration: Transfer frictions and persistency of relative income gaps”, Factor Markets Working Paper No. 36, February 2013.

important factor in determining national income. Therefore, countries that manage to pull themselves out of poverty are those that are able to diversify away from the agricultural sector. This occurs because labour moves from agriculture into the industrial sector, with overall productivity rising and income growing due to sector convergence in labour productivity. However, the speed with which this structural transformation takes place is a fundamental factor that differentiates successful countries and regions from unsuccessful ones (McMillan & Rodrik, 2011).

One of the key variables that both governs and is affected by structural change is the existence of productivity gaps between sectors. Large differences in labour productivity across sectors are traditionally found in developing countries, but also across regions in more developed countries such as member states of the EU. These differences are at the heart of allocative inefficiencies that ultimately reduce overall GDP per capita. Consequently, understanding the magnitude and dynamics of the actual income gap between the agriculture and non-agricultural sector is useful in speculating about the potential gains from off-farm labour migration and the convergence process.

As emphasised by dual-economy models (Lewis, 1954), the productivity gap between the agricultural and non-agricultural parts of the economy behaves non-monotonically during economic growth. It shows a gap that first increases and then falls, and forms a U-shaped pattern during economic development. One of the key reasons behind this pattern is found in the lower rate of agricultural labour reallocation compared to other production factors, as a consequence of the fixed and sunk costs that farmers incur when they move between sectors (Mundlak, 2000; Dennis & Iscan, 2007).[47]

McMillan & Rodrik (2011) documented interesting stylised facts in support of this relationship for a sample of 38 developed and developing countries. Similarly, Hayami (2007) reports evidence of this relationship for high-performing economies in Asia, suggesting that their transition from a low-income to a middle-income stage through industrialisation has generated a widening income gap between farm and non-farm workers,

[47] This 'transfer problem' of agricultural labour out-migration was documented several years ago by Shultz (1964) and Johnson (1951) among others. For a more recent assessment see Mundlak (2000), Timmer (1988), Williamson (1988), and Dennis & Iscan (2007).

corresponding to rapid shifts in comparative advantage from agriculture to manufacturing. The same author makes the point that in order to prevent this income disparity from culminating in serious social and political instability, policies have been reoriented toward supporting the income of farmers.

On the other hand, a variety of evidence has been presented regarding China (see Yang & Zhou, 1999; Yang, 1999) with reports of how urban bias in government policy has been a fundamental determinant of the increase in rural-urban income disparity. Interestingly, these authors have shown that during the economic reforms of the 1970s, China substituted government constraints on rural-urban migration with urban-biased policies. These policies contributed substantially to the increase of income inequality in China during the 1980s and 1990s.[48]

These stylised facts, associated with policies that traditionally tax farmers in low-income countries and support them in developed countries, make it difficult to use *observed* sectoral incomes to document the non-monotonic relationship between the relative agricultural income gap and economic development.

This chapter has two aims. First, we analyse patterns of inter-sectoral agricultural labour migration as well as patterns of sectoral productivity growth and agricultural relative income gaps, across both countries and EU regions. Second, we test empirically whether or not the supposed U-shaped relationship between the relative agricultural productivity gap and the level of development represents a robust regularity, taking into consideration the role played by agricultural policy.

This paper is organised as follows. In Section 2, data and variables used to estimate off-farm labour migration at both the international and EU regional level, as well as data on sectoral productivities and agricultural policy, are presented. Section 3 deals with the analysis of the patterns of off-farm migration and productivity growth. In Section 4, we perform an econometric test to see whether or not the relationship between the

[48] Data on inequality decomposition in Chinese provinces indicates that rural-urban income differentials constitute a large share of total inequality, and the widening sectoral gaps from 1985 to 1995 have caused rising inequality in China. Yang (1999) shows that the rise in sectoral disparity is due to increased urban-biased policies such as subsidies, investments, and credits, which have resulted in higher rates of inflation on rural earnings.

agricultural productivity gap and development is robust to different specifications and country samples, and controlling for agricultural policy. Finally, Section 5 discusses the main implications and draws some conclusions.

2. Data and variables

To study the patterns of off-farm labour migration[49] and the relationship between the relative agricultural income gap[50] and economic development, data was collected at both the international and EU regional level. The dataset assembled by McMillan & Rodrik (2011) was used for international comparison with sectoral data on employment, value added, and labour productivity for 38 countries over the period 1990-2005 (annual data). The original dataset is based on data taken from the Groningen Growth and Development Centre (GGDC) integrated with 11 countries (9 African countries plus China and Turkey). The GGDC database has two sections: the 10-sector database (Timmer & de Vries, 2007) and the EU-KLEM database (Timmer et al., 2007).

The 10-sector database provides sector-level information on employment and value added for 19 countries (10 Asian and 9 Latin American) over the period 1950–2005. The EU-KLEM database has been built with the same methodology and time coverage to integrate the 10-sector database with data on 8 OECD countries (7 European countries plus the US). To take advantage of a wider number of observations, the dataset of McMillan & Rodrik was added to the observations of the 10-sector database and the EU-KLEM Database before 1990. Table A.1 in the

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[49] Using agricultural employment information from country (region) datasets, the off-farm migration rate was computed according to the following equation: $m_{kt}=(Aw_{k(t-1)}- Aw_{kt})/Aw_{k(t-1)}$, where Aw_{kt} refers to 'agricultural workers' in the country/region *k* at the time *t*. This type of computation has positive values in the presence of off-farm migration and negative values with the migration of workers into agricultural sectors from other sectors.

[50] The income gaps between the agricultural and non-agricultural parts of the economy were computed by dividing agricultural by non-agricultural labour productivity. Therefore, a low ratio indicates huge differences in productivity between agricultural and other economic sectors (high productivity gap), and vice versa. Agricultural and non-agricultural productivity was computed by dividing the sectoral value added by the corresponding level of employment.

Appendix reports country and time coverage of the pooled dataset used in the analysis presented in this chapter.

The international dataset is complemented with data of the agricultural nominal rate of assistance (NRA) from the World Bank "Agdistortions Database" (see Anderson & Valenzuela, 2008). The NRA is calculated as $= \frac{(P-P^1)}{P^1}$, where P is the actual domestic price in local currency and P^1 is the estimated domestic price that would hold in the absence of any commodity-market or exchange-rate intervention. Consequently, the *NRA* is like an equivalent tariff measuring the total transfer to agricultural products (sector) as a percentage of the undistorted unit values. The *NRA* is positive when the product is subsidised, negative when it is taxed, and 0 when net transfers are zero.

At the EU regional level, the data for the analysis of off-farm migration within the EU covers 154 regions of the 15 'old' EU countries[51] and 56 regions of the 12 new member states throughout the period 1990–2010.[52] Table A.2 in the Appendix describes the number of regions used for each country according to the Nomenclature of Territorial Units for Statistics (NUTS) and distinguishing between NUTS1 and NUTS2. The decision to use both NUTS1 and NUTS2 is motivated by the need to link data from different sources. Indeed, the Farm Accountancy Data Network (FADN) regional classification that was used to retrieve data about agricultural subsidies from the CAP does not always match the NUTS2 level defined by Eurostat.

The EU regional data are taken from Cambridge Econometrics' Regional Database, which represents an improvement on and rationalisation of the Eurostat Regio series. Specifically, data on total and agricultural gross value added and sectoral employment was collected from this source to measure both off-farm migration and the relative agricultural income gap. Labour productivity is calculated as gross value added (GVA) per worker at constant and basic prices. The difference

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[51] Luxembourg is coded as a NUTS1 (and NUTS2) single region. Information could not be found for the four French overseas departments, the two Portuguese regions of Madeira and Azores, the two Greek regions of Voreio Aigaio and Notio Aigaio, and the Åland region in Finland due to lack of data.

[52] Cyprus, Estonia, Lithuania, Latvia, and Malta are coded as NUTS1 (and NUTS2) single regions.

between total GVA and GVA in agriculture, also for non-agricultural employment, was used for the non-agriculture sector.

Concerning the measurement of CAP payments at the EU regional level, the FADN data was exploited in accordance with Olper et al. (2012). Specifically, the amount of payments received by the 'average farm' in each year over the period 1990–2010 in every region covered by the FADN was obtained. The extent to which the average farm is representative of the farm population,[53] and then the computation of the ratio between this farm CAP payments and the respective farm net income (including subsidies), means it is possible to measure a consistent regional level of farm protection due to different CAP policy measures. Note that in addition to only being based on farm subsidies, this indicator of agricultural protection measured at the regional level is conceptually different from the *NRA* used to estimate agricultural protection in the international dataset. However, this is the only source of data from which it is possible to measure the level of farm subsidies at regional level consistently.

3. Patterns of off-farm labour migration, productivity and income gaps

3.1 Off-farm migration

Tables 19.1 and 19.2 report the mean value of off-farm migration rate, agricultural labour productivity, the relative income gap, and agricultural productivity growth for the 38 countries and 209 European regions, respectively. In order to understand the off-farm migration rate over time more clearly, Figures 19.1 and 19.2 plot migration values for each country and region, respectively. In the figures, the average migration rates of the two subsequent decades are reported on the y and x axis, respectively. As the farm migration can range from negative to positive values, each graph is divided into four quadrants.

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[53] For each region, the FADN sample is stratified according to the type of farming (TF) and the European size unit (ESU) class, while the same stratification is made on the regional farm population. Each stratum in the sample is then weighted to render its data representative of the underlying population. This procedure makes the FADN data representative at the regional level for TF and ESU and, indirectly, for Pillar I payments, while this is not the case for Pillar II payments.

Table 19.1 Migration rate and agricultural labour productivity at country group level (mean value for each decade)

		N. Obs	Migration rate (%)	Agricultural labour productivity (US$)	Productivity Gap	Agricultural Productivity Growth (%)
9 African countries	1990-2000	83	-1.361	3,852	0.28	1.22
	2000-2010	65	-0.743	6,221	0.35	2.67
10 Asian countries + Turkey	1960-1970	30	-0.353	2,164	0.29	3.71
	1970-1980	74	-0.494	5,130	0.34	2.59
	1980-1990	91	1.143	7,980	0.39	2.64
	1990-2000	109	1.850	8,992	0.35	2.01
	2000-2010	72	0.031	10,040	0.32	2.97
9 High-income countries	1950-1960	56	2.163	5,146	0.25	4.57
	1960-1970	89	4.070	8,231	0.32	5.79
	1970-1980	90	2.536	13,252	0.39	4.33
	1980-1990	90	2.584	20,784	0.53	5.23
	1990-2000	90	2.424	32,298	0.71	3.91
	2000-2010	54	2.002	41,830	0.83	2.32
9 Latin American countries	1950-1960	72	-0.606	3,237	0.19	2.43
	1960-1970	89	-0.464	4,087	0.19	2.84
	1970-1980	90	-0.325	5,452	0.23	2.67
	1980-1990	90	-1.667	6,490	0.30	0.90
	1990-2000	90	0.101	8,241	0.39	3.29
	2000-2010	54	-0.361	10,654	0.51	2.65

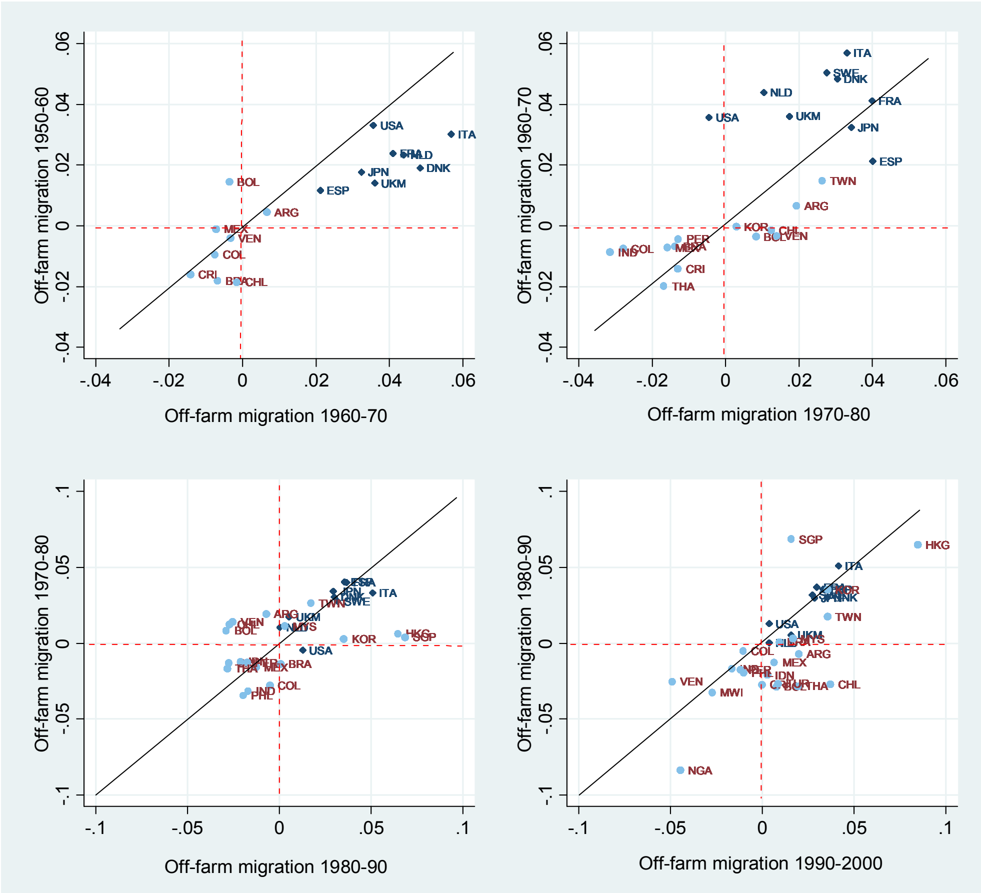
Source: Authors' estimates from McMillan & Rodrik database (see text).

Table 19.2 Migration rate and agricultural labour productivity at European regional level (mean value for each decade)

	N. Obs	Migration rate (%)	Agricultural labour productivity (Euros)	Productivity Gap	Agricultural Productivity Growth (%)
1990-2000	2310	2.53	32,381	0.54	4.47
2000-2010	2100	1.71	37,533	0.65	2.39
EU15 regions					
1990-2000	1694	2.68	41,184	0.56	5.06
2000-2010	1540	1.18	46,946	0.64	1.35
12NMSs regions					
1990-2000	616	2.11	8,245	0.49	2.84
2000-2010	560	3.15	11,649	0.69	5.25

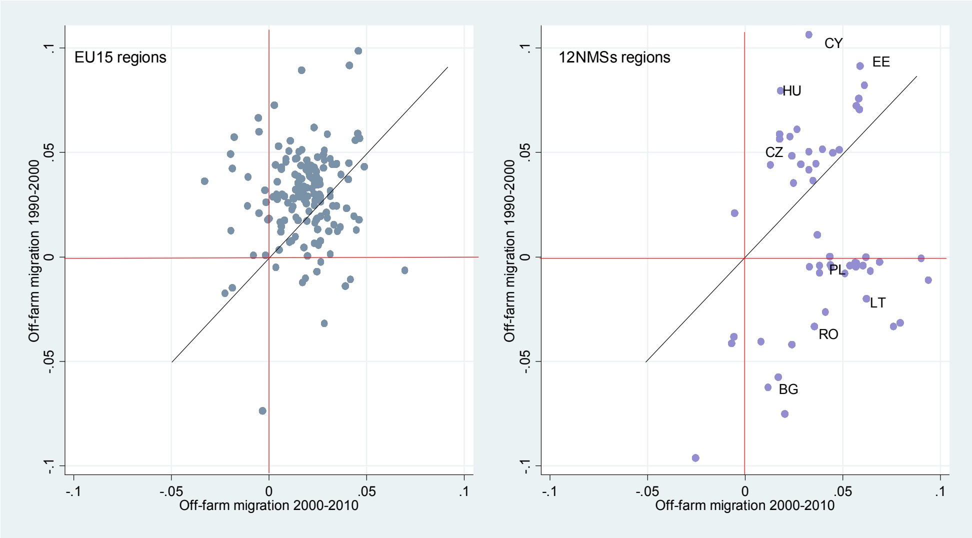
Source: Authors' estimates based on Cambridge Econometrics Regional Database (see text).

Figure 19.1 Global off-farm migration rates during decades (1950s to 2000s)



Source: Authors' estimates based on McMillan & Rodrik database (see text).

Figure 19.2 Off-farm migration rates in EU regions during the 1990s and 2000s



Source: Authors' estimates based on Cambridge Econometrics Regional Database.

Starting from the international country dataset (see Figure 19.1), high-income countries (OECD), which are symbolised in the graph by a square, always fall in the first quadrant and are characterised by a positive migration rate in both decades. In particular, all of these countries show average migration increasing during the 1960s (first graph) from 2.2% to 4%, but in contrast, they experience a general reduction of migration rates during the 1970s (second graph) as highlighted by the observations above the diagonal line. Exceptions are France and Japan, maintaining the same migration rate in this period, and Spain where migration continued to increase. From the 1970s to the 1990s, the high-income countries had an evident and persistent off-farm migration rate as seen in their position very close to the diagonal line and by the average migration value permanently close to 2.5% (Table 19.1, third and fourth quadrants). The behaviour of low-income countries is very different and symbolised on the graph by circles, which generally fill the third quadrant (negative migration in both periods) and present an inflow of labour into the agricultural sector from 1950 to 1990. By contrast, the 2000s saw a marked acceleration in the off-farm migration rate in these countries, which has become a pervasive feature for most of them, showing a reversal of the trend.

Examining the EU-27 regions, the off-farm migration rate presents a slight decrease over the last two decades (1990s and 2000s), falling from 2.53% to 1.71%. However, when the EU-15 regions are considered separately, there is a bigger drop in the average migration rate from 2.68% to 1.18% (Table 19.2). The individual region performance shows that most of the EU-15 regions have a migration rate that slows down between decades, as highlighted in Figure 19.2 by the observations above the diagonal line. Only a few regions had a different pattern, with migration increasing (especially in Spain and Belgium) or migration being reversed (in some UK regions). By contrast, regions in new member states show a strong average increase of migration rate through the two decades from 2.11% to 3.15%, but with two different behaviours. One group of regions (Estonia, Cyprus, Hungary, and the Czech Republic) presents a decrease in off-farm migration, while in the other group of regions, especially Romania, Bulgaria, Poland and Lithuania, off-farm migration reversed, moving from a negative value in the 1990s, to high positive values in the 2000s.

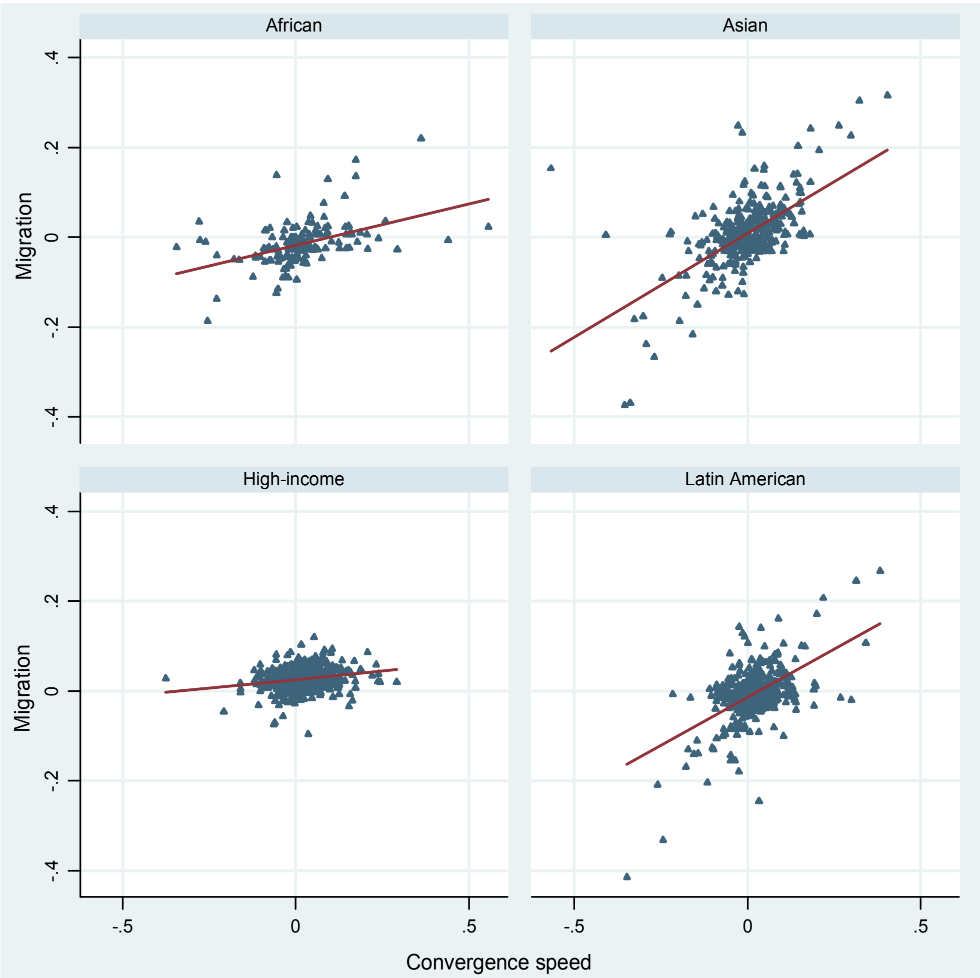
3.2 *Productivity and migration*

The choice to migrate from the agricultural sector is influenced by incentives such as sectoral income. Consequently, the larger the income gap between sectors, the stronger the migration rate (Mundlak, 2000), *ceteris paribus*. At the same time, when labour moves from less to more productive activities, the economy grows even if there is no growth in productivity within sectors. Note moreover that, when off-farm migration contributes to an increase in agricultural labour productivity and this increase is greater than the non-agricultural productivity growth, agricultural relative income brings about convergence in sectoral incomes. This positive relationship between migration and the speed of convergence is shown in Figure 19.3 and Figure 19.4, where these variables are plotted at the country and regional level, respectively.[54] Although this pattern is apparent in all country groups, the value of the average productivity gap over the decades highlights deep differences in the speed of convergence between agricultural versus non-agricultural income (see Tables 19.1 and 19.2). In particular, in developed countries, where the migration rate has always been above 2%, agricultural productivity growth over the last 60 years filled the large gap in labour productivity between the traditional and modern parts of the economy, with the highest productivity difference being in Japan and the lowest in the UK. Conversely, the process of reduction in the gap between sectoral productivity presents a different

[54] Convergence speed is computed as the relative agricultural income gap growth.

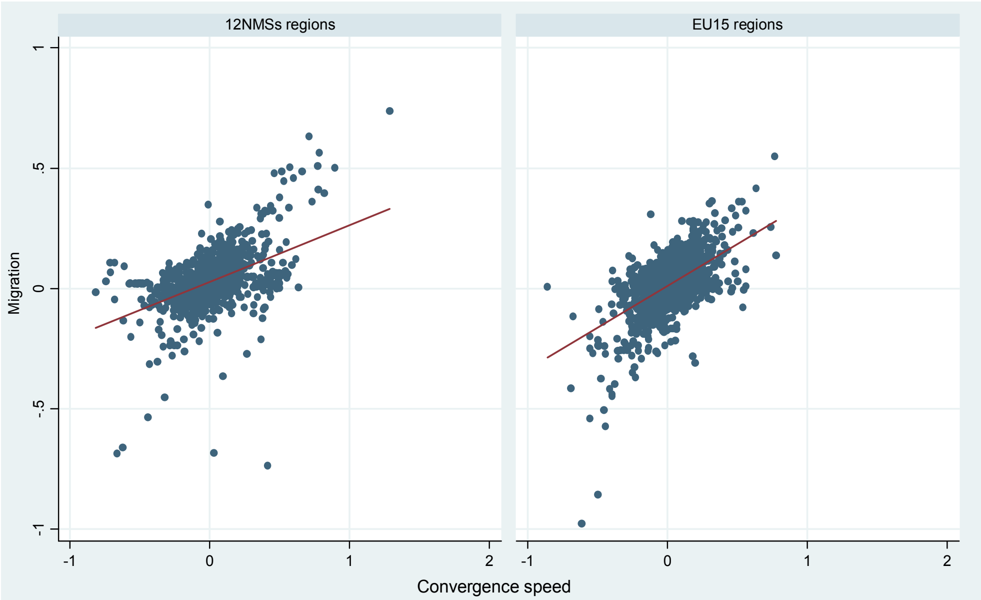
speed in developing countries, where the possibility that displaced workers could finish in even lower-productivity activities cannot be ruled out (McMillan & Rodrik, 2011). This convergence process is more evident in Latin American countries, despite the negative value of the average migration, where the labour force seems to have moved from high- to low-productivity activities. In contrast, the relative income gap in the Asian countries changes slightly and the agricultural labour productivity has continuously remained at one-third that of the non-agricultural sector over the last 50 years.

Figure 19.3 Relationship between migration and labour productivity convergence speed in world countries



Source: Authors' estimates based on the McMillan & Rodrik database (see text).

Figure 19.4 Relationship between migration and labour productivity convergence speed in European regions



Source: Authors' estimates based on Cambridge Econometrics Regional Database (see text).

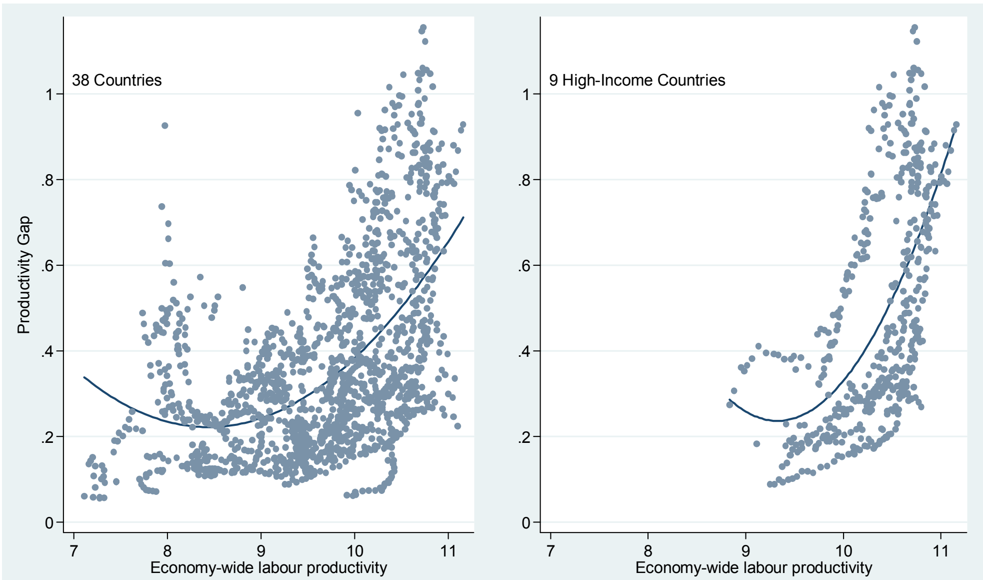
It is easier to see what has happened at the European regional level, where the dynamic reproduces what has already been described for high-income countries in the last two decades. The exception are regions in new member states, where average off-farm migration and agricultural productivity markedly increased over the last decade, reducing the differentials in productivities despite the big differences in labour productivity levels. Indeed, the agricultural labour productivity of European regions during the 2000s ranged from a minimum in the Bulgarian region of Severozapaden, with a productivity of €2,072, to a maximum in the Dutch region of Groningen, where labour productivity is over €90,000, almost 45 times greater (see Table A.4 in the Appendix).

4. The agricultural productivity gap and economic development

Whether or not there is a U-shaped relationship between the relative agricultural income gap and development at both the international and EU regional level is now empirically tested. The economic logic behind this U-shaped relationship is that if economic growth occurs, the modern and 'urban' sectors of the economy expand and the gap between them and the traditional agricultural sectors begins to widen. Therefore, up to a certain point, labour begins to move from traditional agriculture to the modern part of the economy. Beyond this point, productivity levels begin to converge within the economy and productivity diffuses throughout the rest of the economy, thereby reducing the productivity gap.

Figure 19.5 shows the relationship between the country level of development, measured as the (log) of economy-wide labour productivity, and the ratio of agricultural to non-agricultural productivity with reference to all of the 38 countries and to a sub-sample of the nine high-income countries. As highlighted in Figure 19.5, the quadratic curve with its U-shaped pattern fits the data very well, the turning point being at an economy-wide productivity level of around \$7.259 (=exp(8.8)) per worker. This value corresponds to the development level of China and India in the 2000s or Thailand in the mid-1980s, and represents the kind of turning point that most of the African countries included in the dataset are still waiting for. By contrast, all the high-income economies show labour productivity levels that started their convergence process between agricultural and non-agricultural sectors many years ago.

Figure 19.5 Relationship between economy development level and productivity gap



Note: The line refers to the fitted value.

Source: Authors' estimates based on the McMillan & Rodrik database (see text).

Is this relationship a robust pattern of development, or it is just a result of spurious correlation? Answering this question is particularly important because, as discussed by Hayami (2007), the turning point of the relationship often coincides with a marked change in agricultural policy patterns, moving from taxation to subsidisation of the agricultural sector. If this is the case, then clearly problems emerge in empirically testing the relationship because of the role played by agricultural policies. Indeed, because these subsidies or taxes are sometimes very large, these policy transfers can clearly affect the measurement of the agricultural relative income gap. Specifically, with transfers going from the agricultural to the non-agricultural sectors in poor countries (and vice versa in rich countries), the pre-transfer rural-urban income ratio will be lower (higher) than that observed in poor (rich) countries. In medium-income countries, the transfers are comparatively low and so the observed income ratio is closer to the pre-transfer ratio.

Consequently, the most important issue in testing the relationship between the agricultural relative income gap and the level of development is the need to control for the large transfers induced by agricultural policies. However, as clearly shown by Hayami (2007) and the large body of literature on the political economy of agricultural protection, the policy itself is affected by the agricultural rural income gap (see Swinnen, 1994). This raises the issue of the endogeneity of the policy transfer to the agricultural income gap.

So it is important to bear in mind that the inclusion of the agricultural policy variable in the empirical estimation below cannot be interpreted as the effect of policy on the sectoral income gap. In fact, it is included in order to estimate the 'true' relationship between the pre-transfer or pre-tax agricultural income gap and development. Put differently, our main objective is to test if, after controlling for the agricultural policy transfer and tax and other unobserved factors, the U-shaped relationship continues to hold and if so, how it changes with respect to a specification where we do not control for agricultural policy. In fact, the particular direction of the changes can offer new insight into the effect of agricultural policy on the process of convergence in sectoral productivity.

4.1 *Empirical evidence*

In order to verify the robustness of these relationships, the productivity gap is regressed on economy-wide labour productivity and country-fixed effects to control for any other omitted factors. The results of this exercise are reported in column 1 of Table 19.3.

Table 19.3 Relationship between agricultural relative productivity gap and economic development at the international level

Dependent variable: Productivity gap	All Countries		African		Asian		High income		Latin American	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log(labour productivity)	-3.33***	-3.29***	-1.71***	-1.97***	-0.93***	-0.76***	-11.17***	-10.78***	-4.36***	-4.68***
	(0.16)	(0.15)	(0.54)	(0.54)	(0.15)	(0.15)	(0.58)	(0.58)	(0.85)	(0.83)
Log(labour productivity)sq	0.18***	0.18***	0.10***	0.11***	0.05***	0.04***	0.57***	0.55***	0.25***	0.27***
	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)	(0.03)	(0.04)	(0.04)
NRA		-0.06***		0.10*		0.11***		-0.09***		0.25***
		(0.02)		(0.06)		(0.01)		(0.02)		(0.04)
Constant	14.93***	14.68***	7.63***	8.81***	4.38***	4.09***	55.12***	53.09***	18.86***	20.51***
	(0.72)	(0.70)	(2.46)	(2.48)	(0.70)	(0.68)	(2.94)	(2.96)	(4.04)	(3.89)
No.of Obs.	1030	1030	126	126	301	301	398	398	205	205
R-Sq	0.74	0.74	0.79	0.80	0.85	0.88	0.81	0.81	0.73	0.76
Turning point [= exp (a/2b]	10,405	9,310	5,167	7,743	10,938	13,360	18,002	18,034	6,124	5,806

Notes: country-fixed effects included in each regression. Robust standard errors in parentheses. *, ** and *** indicate statistically significant at 10%, 5%, and 1% level, respectively.

The estimated coefficients of the linear productivity level and its square are negatively and positively related to the income gap, respectively, and both are very significant. Therefore, results strongly point toward the existence of a U-shaped relationship between the productivity gap and the development level. The relationship estimated shows that agricultural relative income is negatively related to the level of economy-wide labour productivity until it reaches a level of $10,405. This level represents the turning point of the relationship.[55] A process of convergence in sectoral productivity starts after this point, with a rapid increase in the agricultural relative income gap. Moreover, note that given the inclusion of country-fixed effects in the specification, the results suggest that the relationship between the agricultural income gap and economic development holds true within countries.

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[55] The estimated turning point is a little higher than that obtained from Figure 5, simply because country-fixed effects are always controlled for in the specifications of Table 3.

Column (2) adds the level of protection to the relationship, which is measured as *NRA*. Its estimated coefficient is significant and negative, confirming that agricultural policy affects relative income. However, what is important is that the U-shaped relationship is only marginally affected. Due to endogeneity issues discussed above, it does not make much sense to give a structural interpretation to the *NRA* coefficient. However, it should be noted that the inclusion of *NRA* purges the income gap-development relationship of the effect of policy. Therefore, by comparing the change in the turning point on passing from regression (1) to regression (2), the extent to which agricultural policies have accelerated or retarded the process of convergence in relative productivity can be evaluated. Controlling for policy, the turning point of the relationship falls slightly to $9,310. A literal interpretation of this result would be that agricultural policy has slightly retarded the process of convergence in productivity level between agricultural and non-agricultural sectors in the overall sample, *ceteris paribus*.

Columns (3), (5), (7), and (9) of Table 19.3 test the relationship by respectively considering the sub-sample of African, Asian, high-income, and Latin American countries. The relationship is very robust for all the country groups considered. Unsurprisingly, the turning point of the relationship is very sensitive to the level of development, tending to increase on moving from poor African countries ($5,167) to Latin American countries ($6,124) and Asian countries ($10,938), to high-income countries ($18,002). Controlling for policy as in columns (4), (6), (8), and (10), the estimated turning point moves to the right for African and Asian countries, but slightly to the left for Latin American ones, and remains the same for high-income countries. Therefore, the effects of taxation and/or subsidisation of the agricultural sector do not display a clear pattern. There is some evidence that agricultural policy in African and Asian countries worked in favour of the process of convergence in relative income as the process of labour adjustment was probably accelerated. However, this effect is less apparent for the high-income country group, and appears to have had the opposite effect in Latin American countries.

Table 19.4 reports the results of estimating the income gap-development relationship for the EU regions (columns 1 and 2), with the old EU-15 regions (columns 3 and 4) and the 12 new member state regions (columns 5 and 6) being considered separately. Results at the EU regional level are impressively similar to those obtained across countries, once again confirming that the relationship between the dynamic of the relative income gap and economic development represents an important and robust regularity in the development process. Within the EU regions, controlling for policy induces a relevant shift of the turning point to the right, from €9,094 to €15,783, an effect largely driven by the EU-15 regions (compare results in columns 3 and 4). This is not surprising as the agricultural subsidies for the new member state regions are of several orders of magnitude lower than in the EU-15 regions, and appeared only in the second part of the period considered here. Note that after controlling for agricultural policy transfers, the shifting of the turning point in the EU-15 regions is consistent with the idea that government policies have accelerated the process of convergence in relative productivity.

Table 19.4 Relationship between agricultural relative productivity gap and economic development at the EU regional level

Dependent variable: Productivity gap						
	All EU regions		EU15 regions		12NMSs regions	
	(1)	(2)	(3)	(4)	(5)	(6)
Log(economy-wide labour productivity)	-2.37***	-2.32***	-3.26***	-3.17***	-2.09***	-1.95***
	(0.62)	(0.62)	(0.82)	(0.82)	(0.29)	(0.27)
Log(economy-wide labour productivity)sq	0.13***	0.12***	0.17***	0.16***	0.14***	0.13***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)
Total payments		0.03***		0.04***		0.05***
		(0.01)		(0.01)		(0.01)
Constant	11.47***	11.29***	15.88***	15.56***	8.11***	7.61***
	(3.24)	(3.23)	(4.36)	(4.34)	(1.21)	(1.14)
No.of Obs.	2943	2943	2706	2706	1176	1176
R-Sq	0.84	0.85	0.81	0.81	0.65	0.65
Turning point [= exp (a/2b]	9,094	15,783	14,592	20,055	1,745	1,808

Notes: Columns (1) to (4) only include observations with existing 'Total payments' values; columns (5) and (6) include all new member state observations, replacing not reported payment with zero value in the years before accession. Country-fixed effects are included in each regression. Robust standard errors in parentheses. *, ** and *** indicate statistically significant at 10%, 5%, and 1% level, respectively.

5. Conclusions

This chapter reviews the key mechanisms that affect the process of off-farm labour reallocation during the process of economic development and its relationship with the evolution of the relative income gap. The variation in off-farm migration obtained from two different datasets was analysed, one relating to 38 countries from all continents, the other relating to 210 EU regions. This data was used to study the patterns of off-farm migration over the last 50 years. The analysis has documented interesting and robust correlations between the rate of labour reallocation, convergence in the relative income gap, and economic development. First, it was found that there is a strong positive correlation between the rate of off-farm migration and the convergence process in across-sector per capita productivity growth. Second, whether or not the supposed U-shaped relationship between the relative income gap and economic development is a robust stylised fact was empirically tested. Strong support for this relationship was found across both samples and also within countries and regions. Third, the role played by agricultural policy has also been highlighted, giving broad confirmation to the idea that the pattern of taxation and subsidisation of agriculture policy affects, and is affected by, the turning point of the relationship. Starting from the robust stylised facts established in this chapter, future research should analyse how fixed labour relocation costs or other potential mechanisms are responsible for the long-term trend in the observed agricultural income gap.

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Appendix

Table A.1 Number of countries and time coverage of the dataset

Groups of countries	***N. countries***	***Time coverage***	***Database***
Asia	9	1950-2005	GGDC - 10 sector
Latin America	9	1950-2005	GGDC - 10 sector
High Income	9	1950-2005	GGDC - Eu-Klem
Africa + 2 Asia (China +Turkey)	11	1990-2005	McMillan and Rodrik
TOTAL	**38**		

Table A.2 Sample of European country regions considered

EU15 Countries	**NUTS**	**Number of regions**	**12 NMSs Countries**	**NUTS**	**Number of regions**
Belgium	(2)	10	Latvia	(1)	1
Denmark	(2)	5	Lithuania	(1)	1
Greece	(2)	11	Estonia	(1)	1
France	(2)	22	Malta	(1)	1
Germany	(1)	14	Cyprus	(1)	1
Ireland	(2)	2	Bulgaria	(2)	6
Italy	(2)	21	Czech Republic	(2)	8
Luxembourg	(2)	1	Hungary	(2)	7
The Nederland	(2)	12	Poland	(2)	16
Austria	(2)	9	Romania	(2)	8
Portogal	(2)	5	Slovenia	(2)	2
Finland	(2)	4	Slovakia	(2)	4
Sweden	(2)	8			
Spain	(2)	17			
United Kingdom	(1)	12			
EU15 regions		153	NMSs regions		56

Table A.3 Agricultural labour productivity: summary statistics (US$)

		Agricultural labour productivity				
		Mean	Min		Max	
9 African countries	1980-1990	nd				
	1990-2000	3,852	355	Malawi	22,198	Mauritius
	2000-2010	6,221	521	Malawi	25,878	Mauritius
10 Asian countries + Turkey	1960-1970	2,164	1,102	Thailand	3,866	Korea
	1970-1980	5,130	1,526	Thailand	21,733	Honk Kong
	1980-1990	7,980	1,735	India	25,729	Honk Kong
	1990-2000	8,992	1,311	China	29,285	Honk Kong
	2000-2010	10,040	1,943	China	24,639	Singapore
9 High-income countries	1950-1960	5,146	1,627	Italy	13,364	United States
	1960-1970	8,231	2,685	Italy	19,334	United States
	1970-1980	13,252	5,545	Spain	24,067	United Kingdom
	1980-1990	20,784	8,667	Japan	36,946	United States
	1990-2000	32,298	12,818	Japan	49,300	United States
	2000-2010	41,830	13,308	Japan	65,306	United States
9 Latin American countries	1950-1960	3,237	1,021	Brazil	7,424	Argentina
	1960-1970	4,087	1,326	Brazil	10,242	Argentina
	1970-1980	5,452	1,674	Brazil	14,299	Argentina
	1980-1990	6,490	2,247	Bolivia	14,617	Argentina
	1990-2000	8,241	2,362	Bolivia	23,023	Argentina
	2000-2010	10,654	3,424	Bolivia	28,003	Argentina

Source: estimates based on McMillan & Rodrik database.

Table A.4 Agricultural labour productivity in European regions (€)

	Agricultural labour productivity				
	Mean	**Min**		**Max**	
1990-2000	32,381	138	Latvia	74,331	Luxenbourg
2000-2010	37,533	2,072	Severozapaden (BG)	92,049	Groningen (NL)
EU15 regions					
1990-2000	41,184	9,852	Centro (PT)	74,331	Luxembourg
2000-2010	46,946	16,777	Centro (PT)	92,049	Groningen (NL)
12NMSs regions					
1990-2000	8,245	138	Latvia	29,613	Cyprus
2000-2010	11,649	2,072	Severozapaden (BG)	31,327	Cyprus

Source: estimates based on Cambridge Econometrics Regional Database.

20. Returns from Income Strategies in Rural Poland

Jan Fałkowski, Maciej Jakubowski and Paweł Strawiński[*]

In order to stabilise and improve their income situation, rural households are strongly encouraged to diversify their activities both in and outside the agricultural sector. Often, however, this phenomenon takes on only moderate proportions. This chapter addresses issues of rural households' income diversification in the case of Poland. It investigates returns from rural households' income strategies using propensity score matching methods and extensive datasets spanning 1998-2008. Results suggest that returns from combining farm and off-farm activities were lower than returns from concentrating on farming or on self-employment outside agriculture. This differential is stable over time although returns from diversification have improved relatively since the accession of Poland to the EU. This is also visible in the fact that since 2006, returns from combining farm and off-farm activities have evened with returns from relying solely on hired off-farm labour, thus smoothing away the difference observed before the accession. Further, over the analysed period households pursuing a diversification strategy performed better than those relying solely on unearned income. Finally, in general, incomes in households combining farm and off-farm activities were higher than in those combining two off-farm income sources.

[*] This chapter summarises the key insights on returns from various income strategies used by rural households in Poland in the period 1998-2008. The full paper with relevant background information, methodology and analysis is available as Fałkowski, Jakubowski & Strawiński, "Returns from Income Strategies in Rural Poland", Factor Markets Working Paper No. 64, August 2013.

1. Research question and motivation

Rural areas in Poland face significant challenges. The average income per capita of rural households is close to 70% of the average income in urban areas (CSO, 2007), while the service sector is less developed. The dependence on agriculture is one of the highest in the EU. Most remote areas are being depopulated due to a lack of economic and social opportunities and the unfavourable demographic situation is likely to limit their growth opportunities and sustainability.

In response to this, one of the main objectives of the Polish rural development policy is to improve the quality of life in rural areas by encouraging diversification of the rural economy. It is believed that promoting diversification of economic activities in rural areas may indirectly contribute to a decrease in hidden unemployment, reduce fragmentation of land holdings, and stimulate their modernisation and improve their competitiveness and commercialisation (RDP, 2010). Thus, advocating diversification often rests on two premises. First, it is likely to improve efficiency of resource allocation. Second, it should help reduce poverty (for a background discussion, see Reardon et al., 2000; Lanjouw & Lanjouw, 2001). In the case of transition countries, diversification has been additionally advocated since farms in these countries have been expected to achieve a post-EU-accession increase in productivity with a net decline in agricultural employment (Chaplin et al., 2004). In this context, diversification has been promoted as a measure to absorb some of the surplus of farm labour. The policy measures aimed at achieving this include support for diversification into non-agricultural activities, support for the creation and development of micro-enterprises, provision of basic services for the economy and rural population, and support for village renewal and development. These measures have been implemented both during the pre-accession period as well as after Poland joined the EU and was embraced by the Common Agricultural Policy.

While support for income diversification in rural areas has gained remarkable popularity, especially within political circles, these programmes are of only moderate proportion (Wilkin, 2003; Błąd, 2006). For example, in the period 2002–06 income diversification measures implemented within the pre-accession SAPARD programme and post-accession SPO programme provided funds for roughly 5,600 applicants (SAPARD, 2007; SPO, 2008). For comparison, it was expected that the number of beneficiaries from these two programmes would be 13,000. While this relatively low participation rate (42%) was mainly explained by problems with administrative implementation (SAPARD, 2007; SPO, 2008), there is also evidence that some households are resistant to diversification strategies due to a preference for agriculture (Chaplin et al., 2004).

Moreover, the benefits of programmes encouraging farms to undertake non-agricultural activities are often questioned. Some experts argue that rural inhabitants are rational profit-maximisers and nudging them to diversify outside agriculture will distort rural and agricultural markets away from their optimal levels. Furthermore, it may lead to overdependence of rural inhabitants on government support. Last but not least, it should also be noted that according to official statistics, starting from 2005, farmers' income is constantly above the average observed in rural areas. This again questions the legitimacy of encouraging farmers to look for income outside agriculture from a profit-maximisation perspective.

Given that the Poland's rural areas contain over 38% of its population (roughly 14 million), it seems important to gain a better understanding of the returns to various income strategies and to evaluate these two contrasting views using evidence from the data. Interestingly, while there has been some work investigating the barriers to diversification in rural Poland (e.g. Wilkin, 2003; Chaplin et al., 2004), there have been hardly any attempts to compare returns to income strategies of rural households. In this chapter, we attempt to at least partly fill this gap and provide a comparison of returns to various income strategies adopted by Polish rural households during transition. More specifically, we examine returns from various ways of combining farm and off-farm income sources (i.e. relying on diversified income) and four single-source strategies: relying solely on farm income, relying solely on hired off-farm labour, relying solely on self-employment outside agriculture, and relying solely on unearned income except pensions. Such information is needed to evaluate the rationale of government programmes aimed at encouraging farmers to diversify outside agriculture. It should also help in explaining labour adjustments in rural areas that were observed in Poland during transition period (Dries & Swinnen, 2002; Swinnen et al., 2005). Finally, by highlighting the most profitable rural income sources, we aim to contribute to the ongoing discussion about the design of new rural development policy, both in Poland and at the broader EU level.

2. Data and empirical method

2.1 Data

Our analysis uses data from Household Budget Surveys (HBS) conducted annually by the Central Statistical Office (CSO) in Poland. This extensive survey includes information on household characteristics as well as details of their income, expenditure and assets. The HBS is a cross-sectional sample with around 32,000 households interviewed each year. For the purposes of our study, only rural households were taken into account. Moreover, to reduce selection based on labour force participation we consider only households without people eligible for pensions (that is also why one of our single-source strategies is relying solely on unearned income without pensions). Finally, to simplify the analysis and to reduce the number of potential comparison groups, we consider only households pursuing either a single income source strategy or combining two income sources. Overall, we have roughly between 5,300 and 8,400 observations, depending on the year, with data covering the period from 1998 to 2008. Given that Poland accessed to the EU in May 2004, our dataset spans both the pre-accession as well as the post-accession period. It thus allows us to trace the relative positions of diversified-income strategy both before and after Polish rural areas were embraced by the Common Agricultural Policy.

To ensure that our diversified households (i.e. those combining two income sources) have more or less balanced contributions from each income source (to avoid treating as diversified those households with two income sources but with one contributing, say, just 5% to the total budget), we do the following. For each household that has two income sources, we calculate the Herfindahl Index (HHI), which is the sum of squared shares of each income source in a total budget. We classify households with HHI smaller than or equal to 0.58, which corresponds to the situation where the less important income source contributes at least 30% to the total, as diversified. Where it is possible and we have enough observations, we test the robustness of our findings to alternative definitions where we take more restrictive values for HHI (smaller than or equal to 0.545 or 0.52). The former (latter) threshold corresponds to a situation where the less important income source contributes at least 35% (40%) to the total. As we are focusing on households that are involved in agricultural activities, we concentrate on diversified households where one of the two sources of income is farming.

2.2 *Empirical approach*

Our aim is to quantify the average impact of a given income strategy on rural household income. A decision to follow an income strategy is possibly non-random. One should rather assume that selection of a given strategy depends on household characteristics. Thus, the unadjusted difference in average income across various groups will give a biased estimate of the returns to income strategies. To make meaningful comparisons, characteristics should be balanced across groups for which financial returns are compared (e.g. Lee, 2005). Building on the microeconometric evaluation literature and given the nature of our data, we estimate income differentials across rural households using a propensity score-matching method, which adjusts for observable differences in household characteristics and endowments (e.g. Blundell & Costa-Dias, 2008). The basic idea is to mimic a randomised experiment. In our context, receiving the 'treatment' is equal to pursuing a given income strategy. A counterfactual control group would consist of otherwise similar households pursuing a different income strategy. To our knowledge, this is the first study concerned with rural areas in Central and Eastern Europe that uses such an approach to balance background characteristics before comparing incomes.

It should be noted that this procedure assumes that after conditioning for observable characteristics, there are no systematic differences between households pursuing different income strategies. However, as noted by Heckman et al. (1997), this might not be true and treated and untreated households may differ in unobserved covariates. A potential solution is a difference-in-difference matching estimator. In our case, however, this strategy is not feasible since longitudinal information on households is not available in our data. Nevertheless, our set of covariates includes crucial characteristics that are decisive for income strategies. Therefore, we assume that by balancing these characteristics across income groups we control for selection in the majority of cases.

Our applied empirical strategy consists of two steps. First, using a probit regression, we calculate the propensity scores. Second, we use these propensity scores to find good matches for treated subjects in the pool of untreated. From several different matching algorithms used in applied research, we employ two that are commonly used by economists: nearest neighbour one-to-one matching and local linear regression matching (Heckman et al., 1997). Comparing results from both methods serves as a robustness check. The latter matching estimator is also more consistent when using a bootstrap to calculate standard errors, which is our case. To improve matching quality and ensure that we compare similar households, we use a calliper with a rather restrictive value of 0.005.

Our dependent variable is a monthly disposable equivalent income per capita deflated to 2005 prices. To assure the representativeness of our calculations, differences in incomes between treated and untreated households were adjusted by household probability survey weights. Our set of covariates used when calculating the propensity score (i.e. in the first-stage probit model) includes variables capturing the level of education, age and gender of the head of the household; we also control for the level of education of other household members, household size (distinguishing between people below and above 15 years of age), gender ratio of household members, and a set of dummies denoting each of the six Polish macro-regions (NUTS 1). To test the robustness of our analysis, in some specifications, we also control for interaction terms between the independent variables mentioned above.

3. Main findings and conclusions

We start by reporting the results for comparisons where we do not distinguish between various diversification strategies but instead pool all diversified households into one group. As mentioned earlier, we focus on households earning income from two sources with one being farming. This group is subsequently compared to households relying solely on one of the single income source strategies mentioned above (i.e. farming, hired off-farm labour, self-employment outside agriculture and unearned income excluding pensions). Several points are worth noting based on these comparisons. First, our results suggest that if we pool all diversified households together, the strategy based on combining two income sources (one of which is farming) performed better only when compared to households relying solely on unearned income (excluding pensions). In contrast, households relying solely on farming or households relying solely on self-employment outside agriculture fare better than diversified ones. What is important is that these patterns seem to be consistent over time and could have been observed in practice during the whole period under study. As regards the comparison with households relying solely on hired off-farm labour, on the other hand, diversified households seemed to fare worse until 2005–06. Since then, we do not find statistically significant differences between these two strategies. A possible explanation for this pattern is related to Poland's accession to the EU and the benefits brought by the CAP. According to this argument, the farmers in rural areas benefited the most relatively from joining the EU. In effect, farming's contribution to total budgets might have improved the relative position of diversified households as compared to their counterparts relying solely on hired off-farm labour. This explanation gains some credence when combined with more detailed analysis of earning differentials between diversification and self-employment. Here again, with the accession to the EU we observe a relative improvement in returns to the former strategy. In specifications where we define diversified households as those with HHI smaller than or equal to 0.58, however, this improvement was insufficient to fully equate remuneration from these two strategies. In specifications where we use more a restrictive definition, though, the difference between returns from these two strategies since 2006 was statistically indistinguishable from zero. Importantly, the abovementioned patterns are consistent across different matching estimators and robust to bootstraping standard errors.

In the next step, we investigate the diversification strategy in more detail and distinguish between a strategy based on combining farming and hired off-farm labour and a strategy based on combining farming and unearned income. We compare these two strategies with strategies based on specialising in hired off-farm labour and unearned income, respectively. Accounting for a more detailed study of the third strategy, i.e. that based on combining farming and self-employment outside agriculture, is not possible due to an insufficient number of observations. These new results complement the picture sketched above. In particular, we observe that combining farming with unearned income appears to be a more profitable strategy than relying solely on the latter source. This conclusion appears to hold for the period 2001-08 (for the previous three years, the difference, although still positive, is small in magnitude and statistically indistinguishable from zero). As regards the comparison between combining farming and off-farm labour with specialising in off-farm labour, we have slightly different results from those reported before. The difference is in two key points. First, this time we do not find that specialising in hired off-farm labour performed better than combining two income sources before the accession to the EU. Our results tend to show that the two strategies brought similar remuneration. If anything, households using the latter strategy performed somewhat better. Second, our results tend to suggest that a diversification strategy outperforms specialising in hired off-farm labour since 2006. This pattern comes out also from specifications where we define diversified households as those with HHI threshold smaller than or equal to 0.545. These results, combined with those shown earlier, point to an important observation that analysing the diversification strategy may lead to different conclusions depending on whether we adopt a more general or a more detailed perspective with regard to what really contributes to a diversified household budget.

In a final step, we report the main findings regarding comparisons between strategies based on combining two income sources including farming with strategies based on combining two income sources but without relying on farming. Within the former group, we distinguish two strategies as before (farming plus off-farm labour and farming plus unearned income). For the control group, we pool all households combining two non-farming income sources. Two key points arise from this analysis. First, households combining farming and hired off-farm labour appear to perform better than those combining two non-farming income sources. This pattern could be observed in practice over the whole analysed period. In contrast, and this is the second main point that we want to make here, relying on two non-farm incomes seem to be more profitable than combining farming and unearned income. Again, this result holds over the whole period under investigation.

To conclude, it is generally believed that economic diversification of rural areas may contribute to more efficient resource allocation and help reduce poverty. In this chapter, we presented results that are only partly in line with this view. Based on the micro-level data from rural Poland over the period 1998–2008, we show that households combining farm and off-farm income performed better than households relying solely on unearned income. We also report some evidence that the former strategy, especially after Poland joined the EU, seems to present an alternative to specialising in hired off-farm labour. However, the remuneration from diversification appears to be consistently lower than that from relying solely on self-employment or farming. This latter result is particularly interesting as a diversification strategy is often advocated for farm households. Our findings in turn tend to suggest that, holding other things constant, households relying solely on farming have higher returns than those combining agricultural activities with off-farm income. Following this result, one could argue that without additional incentives from the state, farm households may not be willing to diversify outside agriculture. On the other hand, this finding prompts the question of whether stimulating diversification with financial support is a viable strategy in the long run. This is because it has to be assumed that state support would be only temporary. If the patterns depicted above and the environment within which rural households operate would not change, then diversified households may be motivated to return to relying solely on farming once the support is removed.

Our results also suggest that joining the EU in May 2004 may have been particularly beneficial to people leaving farming. The exact transmission mechanism through which this effect might have happened is an interesting area for future research. Other potential extensions of our approach include, for instance, more careful examination of where the non-agricultural activities take place (whether in domicile/towns/abroad). Similarly, a closer look at wage employment could allow the inclusion of a distinction between agricultural and non-farm wage employment.

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PART III
CAPITAL MARKETS

21. THE INSTITUTIONAL FRAMEWORK FOR AGRICULTURAL CREDIT MARKETS IN THE EU

KRISTINA HEDMAN JANSSON, EWA RABINOWICZ AND CARL JOHAN LAGERKVIST[*]

Functioning institutions are crucial for an efficient credit market. The institutions can be both formal (rules, regulations, authorities and actors) and informal (norms, values and relations). They also interact and in a situation where the formal institutions are weak, the informal ones increase in importance. In this chapter, the authors compare the institutional situation in selected European countries and attempt to develop indicators to measure the performance of the institutions. The study is based on a questionnaire sent to agricultural financial experts in selected countries and on FADN data.

If farmers cannot borrow as much as they would wish to finance sound investments, their growth possibilities are impaired. Well-functioning credit markets are, accordingly, essential for the growth and prosperity of the agricultural sector and institutions play a major role in this context. Agency problems (asymmetric information, moral hazard and adverse selection), uncertainty and credit constraints are typical in an inefficient (malfunctioning) credit market. Agency problems might be more prevalent in closely held agricultural firms compared with closely held firms in other

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[*] This chapter is based on Jansson, Huisman, Lagerkvist & Rabinowicz, "Agricultural Credit Market Institutions: A Comparison of Selected European Countries", Factor Markets Working Paper No. 33, January 2013 and Jansson & Lagerkvist, "Performance indicators in Agricultural Financial Markets", Factor Markets Working Paper No. 43, June 2013.

sectors of the economy, mainly due to the legal form of the organisation. A proprietary farm is generally not obliged to publicly disclose its financial situation, except its annual tax statement, and this might increase the risk of especially adverse selection and moral hazard. Hence, it is crucial for the bank to either trust the farm seeking a loan in light of a long-term relationship or to be able to accurately assess its financial status through a credit rating, business rating or a sufficient amount of collateral.

In this chapter, we review credit market institutions in 13 countries. Formal institutions are, for instance, rules and regulations, including monitoring by the state and law enforcement. Examples of informal institutions are behaviours, norms and relations. Formal and informal institutions are connected. A key issue is the possible prevalence of credit constraints – a low level of loan-to-value (LTV), as well as the active involvement of governments in the credit market, are used as possible indicators of credit rationing.

The analysis is based on expert knowledge gathered through a questionnaire completed by national experts concerning important creditors, local regulations, risk assessment practices, and so on (Jansson et al., 2013).[56] The expert assessments are complemented with calculations of economic indicators, LTV and economic sustainability based on data from the Farm Accountancy Data Network (FADN) (Jansson & Lagerkvist, 2013).

Based on Lagerkvist (2001), we build an indicator of economic sustainability showing what the farmer has left for private consumption and taxes after all costs have been covered. LTV is the ratio of total liabilities/total assets, also called the debt-to-asset ratio, which shows the financial risk of a company by measuring how much of the assets have been financed through debt. This enables us to investigate whether expert opinions coincide with the results of the calculations and whether there is any relation between economic sustainability indicators and the performance of the financial institutions.

The regulation of financial markets is mostly general; only a few countries have specific regulations for the agricultural sector, and even then they are regarding particular subsidies for agriculture. Government involvement varies widely among the countries – in Ireland and the UK,

[56] The case study countries were: Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Poland, Slovakia, Sweden, the UK and the Former Yugoslav Republic of Macedonia (FYROM).

there is no involvement at all by governmental credit institutions, whereas in Germany and FYROM, for example, there are several different types of governmental institutions involved in the agricultural credit market. This indicates that the agricultural credit markets are not perceived as requiring specific regulations. On the other hand, many governments – in fact, all but four[57] – give some sort of credit support to agriculture, implying a belief that the capital market for agriculture is not functioning efficiently. This seemingly contradictory situation might be caused by the fact that there are different ministries and authorities dealing with the financial sector and the agricultural sector; finance ministries do not consider that there is a need for special regulations for agriculture, but agricultural ministries introduce various types of support.

The dominant loan providers for farmers are commercial banks and farmers' cooperative banks. However, in two countries – Slovakia and FYROM – suppliers have a relatively high share of the market, though this is decreasing. In Greece, on the other hand, suppliers seem to be increasing in importance. It is a more efficient strategy for the farmer to have traditional bank loans rather than debts to suppliers because a farmer has no way of reallocating resources and if he or she is unable to pay, suppliers can reclaim machinery at a short notice. Another positive effect of long-term loans is that they build a long-term relationship, which according to the questionnaire is an important factor when it comes to extending loans. Long-term relations tend to reduce the effects of asymmetric information, as the bank's knowledge of a firm increases over time. A long-term relationship will also reduce the risk of moral hazard, since it is easier for the bank to trust someone after a longer relationship.

In asset-based lending, the credit decision is based on the availability and quality of collateral of the firm. At the other end of the scale, a credit decision can be based on the investment itself: will it provide enough cash flow to pay the interest and repay the full amount? A majority of the case studies show a tendency towards cash-flow-based lending. In Greece, Italy and the UK, asset- and cash-flow-based lending have equal weight and in Poland, asset-based lending is more important than expected cash flow. In the UK, while the 'estimated farm business profit' (cash flow) has a high weight in risk assessments relating to a first-time credit evaluation, in

[57] These are Ireland, Slovakia and the UK plus Sweden; the only involvement in Sweden is that the state is a shareholder in one of the biggest banks, NORDEA.

applications for extending an existing loan the asset (collateral) and cash flow are given the same weight. Results for the Netherlands show the opposite: cash flow is more important when extending a loan.

Cash flow is, according to the experts, assigned the highest weight when performing a risk assessment. This is particularly true for Finland, Sweden, the UK and FYROM. In the Netherlands, the estimated business profit is not given as high a weight as 'available household income'. In Greece, there seems to be little difference between the characteristics; business aspects and personal characteristics are all important. In Italy, 'appropriate farming or management experience' is emphasised. Slovakia also shows a generally even distribution of weight for all characteristics except 'available business collateral' and 'available household income', which are assigned no weight at all.

When it comes to reasons for rejecting credit applications, personal factors, such as education, experience and previous relations with the creditor, carry less weight than lack of collateral, insufficient farm business income and poor credit history.

LTV can be an indicator of how different operators perceive the risks of investing in agriculture. According to the experts, the typical LTV varies between the countries and asset types, from 30% for equipment and machinery in Slovakia to 100% for any assets in the Netherlands. Fixed assets show similar levels of LTV across all countries, whereas equipment, machinery and operating capital varies more between countries and sometimes also between creditors. However, LTV calculated using the FADN data are lower than the experts estimated. This could be explained by differences in accounting standards in agriculture and non-agriculture, but also by the characteristics of the assets making them harder to liquidise.

Belgium, France and Greece obtained the best results from the economic sustainability (ES) indicator. Accordingly one could expect, based on the results from the questionnaire, that it should be easier for farmers in these countries to borrow, resulting in high LTV. Greece, however, has very low levels of LTV, while Belgium and France have rather high levels of LTV. All three countries have specific government support to the agricultural credit market and some level of investment support (through Greece has very low levels), which may reduce the need to borrow for investments.

Ireland, Finland, the Netherlands, Poland, Slovakia, Sweden and the UK all have negative results on the ES indicator for a majority of the years.[58] Here, one might expect low LTV, indicating the possibility of credit rationing. But that is only partly true; Ireland, Poland, Slovakia and the UK all have rather low LTV, whereas Finland, the Netherlands and Sweden have rather high LTV. In this group, we also find all countries with no or low levels of support to the agricultural credit market – Ireland, Slovakia, Sweden and the UK. Accordingly, no clear pattern emerges and one can conclude that there does not seem to be a clear relation between the prevalence of credit rationing, as measured by LTV, and economic sustainability.

As pointed out above, the calculated LTV values appear to be much lower than the levels estimated by the experts in the questionnaire. Therefore, actual lending is lower than the financial experts in the individual countries would expect in general for the sector. This implies that credit levels could be higher. Curtiss (2012) sees low LTV as an indicator of credit constraints. Extremely low values are found in Poland and Slovakia; does this imply that farms in these two countries are severely under-capitalised? Credit rationing has been shown to exist in Poland (Petrick, 2004), so it is not far-fetched to conclude that a low LTV ratio also implies that agriculture is under-capitalised. An interesting, and surprising, outcome of the survey is that firms in the agricultural sector are believed to be more likely to obtain credit than other small rural firms. Thus, agricultural firms should be better off and probably less credit-rationed than other firms. However, this may also imply that credit rationing applies on a wider scale to other small proprietary firms.

Requirements for collateral can reduce the risk of the investment and hence reduce uncertainty effects. Assets, however, are not considered as important as the expected cash flow of the planned investment when extending an existing loan. Only in Poland is asset-based lending more widespread than lending based on cash flow (this is in line with the findings of Petrick & Latruffe, 2006). When undertaking a risk assessment for a first-time loan application, the situation is slightly different; in most countries, a higher weight is given to cash flow, except in the Netherlands, where the emphasis is on collateral. In the Netherlands, assets are the most

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[58] The years referred to are based on the time series available for the individual countries in FADN. The available years are: for Ireland and the Netherlands 1990-2009, for Sweden and Finland 1995-2009 and for Poland and Slovakia 2005-2009.

significant factor at the beginning of a creditor–debtor relationship, while later on the investment itself is more decisive. The survey also shows that (for most countries) the financial situation of the firm or the economic potential of the investment are more influential factors in risk assessments than personal characteristics.

To summarise, this study has attempted to link the performance of financial institutions to the performance of the credit markets and to the performance of the agricultural sector, focusing, in particular, on the possible prevalence of credit rationing. Low levels of LTV indicate that agricultural firms in a particular country may be credit constrained. However, national experts believed that agricultural firms do not face more severe credit constrains than other small firms. This may imply that credit rationing applies on a wider scale. Low levels of LTV for economically viable farms may be deemed particularly worrisome, especially as the national experts have reported that estimated business profit is assigned a higher weight when banks are assessing credit worthiness. However, no clear relation emerges between economic sustainability and LTV. Hence, it is difficult to draw firm conclusions on the relation between economic sustainability of farms and the performance of financial institutions.

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22. AGRICULTURAL CREDIT IN THE EU

SAMI MYYRÄ[*]

On average, the sum of debts on EU farms was €50,022 in 2008. At the same time, equity totalled €229,046. The financial leverage varies considerably between countries. However, the distribution of the financial leverage of agriculture across countries does not reflect the distribution of country-specific risk premiums in the manner they are observed in government bond yields. This will provide, as such, some hedge for the European agricultural sectors against the financial problems in the public sector. The agri premium (the difference between the agricultural loan rate and the rate paid for household loans) ranges between -4.9% and +4.4%. The highest agri premiums must be related to excessive risks or a strong demand for loans in agriculture compared to other industrial sectors. A negative agri premium might indicate some sort of public intervention on financial markets.

1. Introduction

Because money moves fast, modern capital markets should be better integrated across different market regimes than labour and commodity markets. Thus, local, rural capital markets should be closely linked not only to the domestic financial market within the country but increasingly to the EU and even to global financial markets. Recently, it has become evident that under the modern financial systems, information, large economic shocks and instability observed in the international market are inevitably

[*] This chapter is based on two Factor Markets Working Papers. The full papers with details on data, methodology, analysis and conclusions are available as Pietola, Myyrä & Heikkilä, "The Penetration of Financial Instability in Agricultural Credit and Leveraging", Factor Markets Working Paper No. 2, September 2011 and Myyrä, Pietola & Heikkilä, "Farm Level Capital: Capital positions, structures, the dynamics of farm level investments, capital accumulation and leverage positions", Factor Markets Working Paper No. 7, October 2011.

transmitted to the local capital markets. The sector- and country-specific financial risks are additionally reflected by international investors, and these risks quickly transmit to the price of money that each country and entrepreneur has to pay.

This chapter attempts to fill the gap in descriptive statistics by computing certain indicators of rural capital markets from public data sources. The key indicators of financial market data are provided to highlight how rural capital markets are linked to country-specific capital markets. Also, the financial leverage structure in EU agriculture is described to give weights for country-specific comparisons.

2. The price of money for EU farmers

In describing the price of money, indicators of the supply and demand sides of the market are constructed. The benchmark data on the aggregate supply side are measured by two types of interest rate. The first is the short-term interbank offered rate. For the Eurozone, these Euribor rates were accessed from the Statistical Data Warehouse of the ECB. The second supply-side indicator is a selection of 10-year government bond rates paid in the secondary market. These data were also collected from the ECB websites and the countries' own central bank websites. The government bond rates describe the country-specific price of money, including the country-specific risk premiums, while excluding borrower-specific effects, such as the funded sector.

On the borrower and demand sides, two distinct indicators are presented. The first is the interest paid by households on new loans for housing purchases. The maturity of these loans varies between five and ten years. Nevertheless, these data do not represent the rural capital market alone. To the best of our knowledge, no separate data on public financial data sources are available that are specific to the rural capital market. The second set of demand-side data is specific to the rural capital market and imputed from the Farm Accountancy Data Network (FADN). These data represent the effective interest rates paid on all outstanding loans, both short- and long-term, in agriculture and farming households as recorded in the FADN. However, taking into account the distribution of loans between those with a short and long duration, these data actually represent quite well the other long-term indicators, as described above. About 82% of all agricultural debts are classified as long- or medium-term loans in the FADN, and these loans by definition have a duration of at least one year.

The effective interest rates are computed from the amount of outstanding loans and the total amount of interest paid within each calendar year.

For each country, the difference between the household loan rate and the interest paid by farmers is computed. The difference is later on referred to as the 'agri premium'. In these comparisons, only the December 2008 data are used, since this was the last available year in the FADN at the time of performing this part of the factor markets study.

The FADN is a survey carried out by the member states of the EU. It collects accountancy data from about 80,000 agricultural holdings every year. The FADN is the only source of microeconomic data that is harmonised so that the bookkeeping principles are the same in all EU member states. Only commercial agricultural holdings, defined by economic size (RI/CC 882 Rev.8.1), are included in the FADN, and the data therefore cover not more than 39% of all agricultural holdings. However, these farms account for more than 90% of all commercial agricultural production in the EU.[59] The empirical data were collected from a database maintained by MTT Economic Research, Finland (www.mtt.fi/eufadn). The original data source is FADN-EC-DG AGRI/L3. In the FADN, the debts are presented in two variables: 1) long- and medium-term loans, and 2) short-term loans. The loans sum up to the total debt. Total external factors reduced from farm net value added to produce the farm net income are divided into three items: wages paid, rent paid and interest paid. Our interest focused on interest paid.

Our first indicator on the borrowing side is the household rate paid in lending for house purchases, excluding revolving loans and overdrafts, convenience and extended credit card debt. These loans are classed as having a maturity of over 5 and up to 10 years. These interest rates suggest that the current capital market, or at least the risk premiums included in the borrowing rates, substantially differ between European countries. The Eurozone does not seem to define a homogeneous market regime or draw a line between euro countries and countries outside the Eurozone. The rates display large variation across the countries within the Eurozone, and most of the borrowing rates in national currencies closely follow the euro average. Thus, the deviations seem to be country-specific rather than currency-market-specific.

[59] http://ec.europa.eu/agriculture/analysis/fadn/index_en.htm

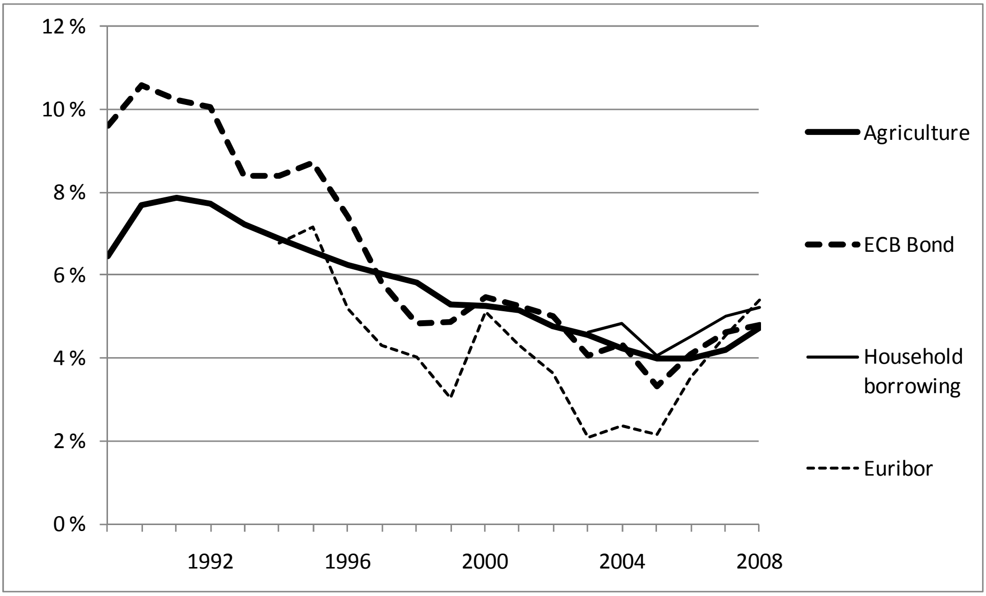
As mentioned above, the public domains do not have, at least to our knowledge, consistent statistics amongst the European countries on interest rates that have been paid in agriculture and in rural capital markets. Therefore, we imputed an approximation for these interest rates using the financial accounts in the FADN. The interest rate paid for agricultural loans is computed by dividing the total annual interest payments by the total amount of outstanding loans at the end of the year. The resulting approximation of the interest rate does not distinguish between short- and long-duration credits, but it roughly corresponds to the duration of the above-reported long-term household borrowing rates, since most agricultural loans are long-term loans. On top of the interbank-offered rates, these rates should involve country-specific risk premiums, comparable to those of bond yields and household borrowing rates. In addition, they account for the sector-specific characteristics of local agricultural capital markets in rural areas. These characteristics include risk premiums on agricultural funding, the implications of potential credit constraints, and in some countries also interest rate supports paid through their structural adjustment and investment programmes in agriculture. The standard is that EU accession has resulted in extensive structural adjustment programmes in agriculture in new member countries.

The average interest rate paid on all EU agricultural loans over the 20-year period from 1989–2008, as recorded in the FADN, was 5.6%. This rate has been as low as 4.0% in 2005 and 2006 and as high as 7.9% in 1991.

The data further suggest that the interest rates paid for agricultural loans have followed quite closely the general financial patterns and other interest rates in Europe (Figure 22.1). There have, nevertheless, been a few deviations. First, agricultural loan rates were substantially below the government bond rates in the late 1980s and early 1990s. The discrepancy then gradually shrank until 1997, when agricultural loan rates and bond rates coincided. Thereafter, agricultural rates have been at the same level as bond rates. One reason may be that increasing liquidity and decreasing market rates have not only transmitted to the agricultural loan rates, but they have also reduced the efficient interest rate supports involved in agricultural loans. Second, agricultural interest rates seem to exhibit smoother patterns than the other interest rates for long-maturity bonds and loans. However, this seemingly significant difference may result from computational differences. In agricultural loans, the borrowing rate represents the stock of all outstanding loans, whereas the other indicators are based on new household loans and current interest rate quotations for government bonds. The rates for new loans and quotations in the secondary market probably reflect the changing market environment more rapidly than the corresponding rates for old loans. If financial institutions change their margins, for example, the new margins will transmit faster to new loans than to the outstanding stock of all loans.

Similarly to government bond and household borrowing rates, the rates for agricultural loans already turned to an upward-sloping trend in 2007, even though the interbank rates continued to decrease. These data suggest that the first signals of the systemic government risks in overall European economies emerged in 2007. These risks also started to embed in the agricultural credit market and interest rates. Thus, even though the agricultural and food sector could at least potentially exhibit counter-cyclical characteristics when compared to other economic sectors, the counter-cyclicality is not reflected in the agricultural credit market and interest rates.

*Figure 22.1 The interest rates for agricultural loans in the EU, the ECB 10-year bond yield, the lending rate for household purchases (2003–2008), and one-year Euribor (1994–2008). The latter three rates are based on July quotations for each year.**



* We also computed geometric averages for each year from the monthly quotations. These averages give a similar picture of interest rate movements to the July quotations.

The data on agricultural loan rates and bond rates only overlap for the three years from 2006–08. These overlapping years nevertheless suggest that agricultural loan rates have varied substantially more across countries than bond rates. Thus, either the distribution of risks embedded in the agricultural capital market has been larger than in the market for government bonds or, alternatively, the local credit constraints or policy interventions have varied between countries, implying large country-specific deviations in agricultural loan rates. It is notable that the new member states joining the EU in 1995 and 2004 have not had a large impact on the standard errors of agricultural loan rates across countries. It remains to be seen how the recent developments in the European financial market will finally transmit to the agricultural credit market. It is likely that the increasing variation in government bond rates between countries will also transmit to the agricultural credit market, which initially already had substantially larger variation across countries than, for instance, the household borrowing rates.

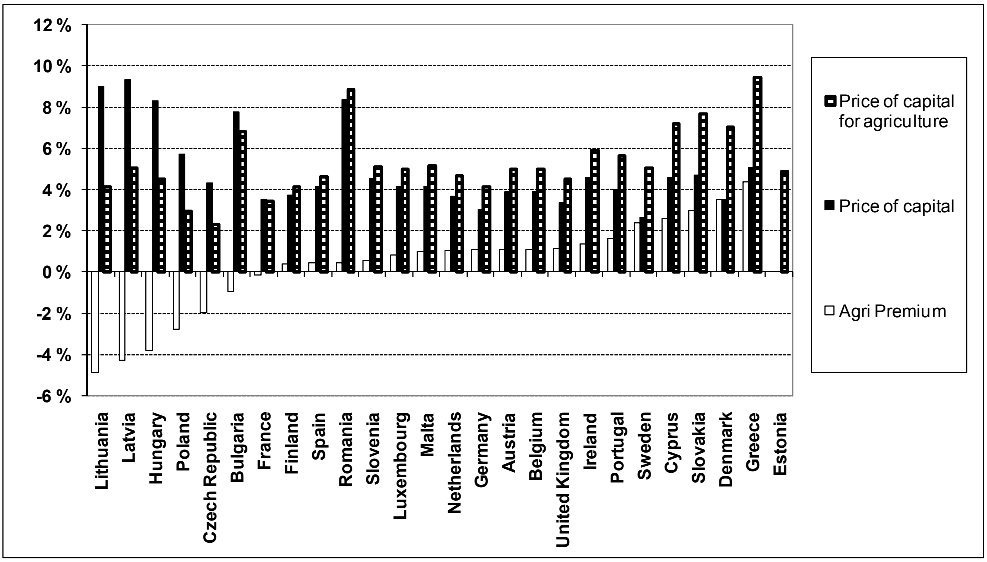
For country comparisons, geometric means of agricultural loan rates for each member country were computed over the years 2004–08. For this period, the average rate paid for the total EU agricultural loan stock was estimated at 4.2%. Even though most of the country-specific rates were close to the average of 4.2%, the spread of the rates was large at the tails. The rate has been highest in Greece (11%) and lowest in the Czech Republic (2.0%). Thus, the highest rate is more than twice the average and the lowest remains at less than half of the average.

Since general loan rates and bond rates vary between countries, the absolute country-specific differences do not, as such, reveal the agriculture-specific deviations from the general credit markets in different countries. Therefore, we further computed an interest rate premium that had been paid in agricultural loans in each country in 2008. This agricultural premium, the agri premium, is defined as the difference between the agricultural loan rate and the rate paid for household loans (Figure 22.2).

The agri premium ranges between -4.9% and +4.4% and is negative in seven countries. The lowest agri premiums are observed in Lithuania (-4.9%), Latvia (-4.3%), Hungary (-3.8%) and Poland (-2.8%). In the Czech Republic, the agri premium is also negative (-2%) and since the country's general loan rates are also low, the negative agri premium has reduced the agricultural interest rates to the lowest level among EU countries. These figures clearly evidence investment aid programmes based on loan rate subsidies for agriculture. This aid is not necessarily transparent and reachable in either the income statement or the balance sheets.

The agri premiums are highest in Greece (+4.4%), Denmark (+3.5%), Slovakia (+3.0%), Cyprus (+2.6%) and Sweden (+2.4%). However, even though the agri premiums are lower in Ireland and Portugal, for instance, than in Sweden, their agricultural loan rates are substantially higher than in Sweden, since the overall loan rates in these countries are high. Such high agri premiums must be related to excessive risks or a strong demand for loans in agriculture compared to other industrial sectors. In Denmark and Slovakia, the size of farms has increased very rapidly. Thus, banks might feel uncertainty when financing this growth. On the other hand, farms in Greece and Cyprus are operating almost solely based on their own capital. This might indicate that farms are credit-rationed by some institutional setting.

Figure 22.2 The interest rates for agricultural loans across the EU in 2008



Sources: ECB; long-term interest rates for assessing convergence among the EU Member States and FADN-EC-DG AGRI/L3 (http://ec.europa.eu/agriculture/rica/). 21.3.2011.

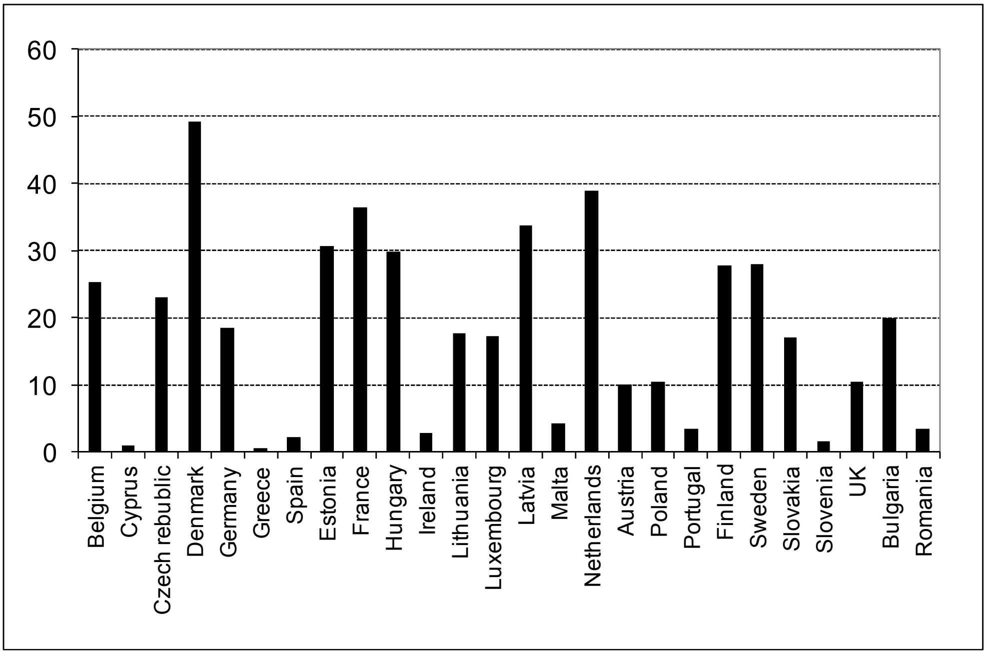
To further extend the analysis, the production-line-specific interest rates are also studied. In 1980s and early 1990s, Irish arable crop farms clearly paid the highest price for their loans, but the interest rates came down from above 15% and by 2008 reached the same rate of about 5% as arable crop farms in most other countries. The recent financial crisis does not yet show in these loan rates, except possibly in Denmark where the interest rates turned to an upward-sloping trend in 2006. In the Danish case, the increased sector-specific risks due to high leverage rates may also have been the key factor that turned the rates to an increasing trend. A similar but milder upturn is also observed on arable farms in some other countries, such as the Netherlands, Italy and Finland. The lowest and the most stable loan rates on arable farms are observed in Germany and France. The loan rates of dairy farms have followed similar patterns to those for arable crop farms, described above. The rates converge close to each other over time, the upturn observed in Denmark being the exception to this development. In the granivore sector, the loan rates again follow the same patterns as above with other production lines. Here, however, the rates in Italy peaked in the mid-1990s to an extent not observed in other production lines or in other countries. The main finding from the production-line-specific study is that there are no major differences between production lines within member states. Apart from a few exceptions the loan rates faced by EU farmers are thus mostly the result of country- and industry-specific risks and not production-line-specific risks. However, it is also shown in a Finnish case study that farm- and farmer-specific conditions have an influence on price of money faced by farmer.

3. Amount and structure of loan money on EU farms

The geometric average of financial leverage (gearing[60]) for EU agriculture was 14.6% from 1989–2008. It rose by more than 2 percentage points during the 1980–90 recession. Thereafter, it decreased to a low of 13% and started to increase again in 1999. In 2008, the financial leverage soared from 14.1% to 17.9%. The jump of almost 4 percentage points within a year was the largest during our sampling period and twice the size of the jump in the 1980–90 recession. The jump was due to significantly increased debts. On average, debts on EU farms increased from €39,118 in 2007 to €50,022 in 2008. At the same time, equity decreased slightly from €235,574 to €229,046. These results may provide the first signals of how the recent financial crisis also hit the agricultural sector in the EU. The financial leverage varies considerably between countries (Figure 22.3). In 2008, it was lowest in Greece (0.6%) and highest in Denmark (49%).

[60] Gearing is calculated as the debts divided by the sum of debts and equity.

Figure 22.3 Financial leverage (gearing) of agriculture in EU countries in 2008, %



Most of the debts in EU agriculture are concentrated in a very small number of countries, and in some cases also in a small geographical area. Farmers operating in France, the Netherlands and Denmark carry 60.3% of all liabilities, but the collateral value[61] of their farm enterprises covers only 19.4% all agricultural capital owned by farmers in the EU. In Denmark, where the debts per farm are the highest, the average farmer pays annual interest payments of €82,233 on his/her average total debts of €1,174,426. At the other end of the scale are farmers operating in Spain, Ireland and Greece; they account for 34.5% of all capital owned by farmers in the EU but carry only 3.5% of all debts. The proportions of debts and capital are almost equal in the Baltic countries of Lithuania, Estonia and Latvia. In Luxemburg, Slovakia, Malta and Bulgaria, these shares are also in balance. Spain differs clearly from other EU countries. Spanish farmers account for 20.2% of all agricultural capital, but only 2.1% of all agricultural debts (Figure 22.4).

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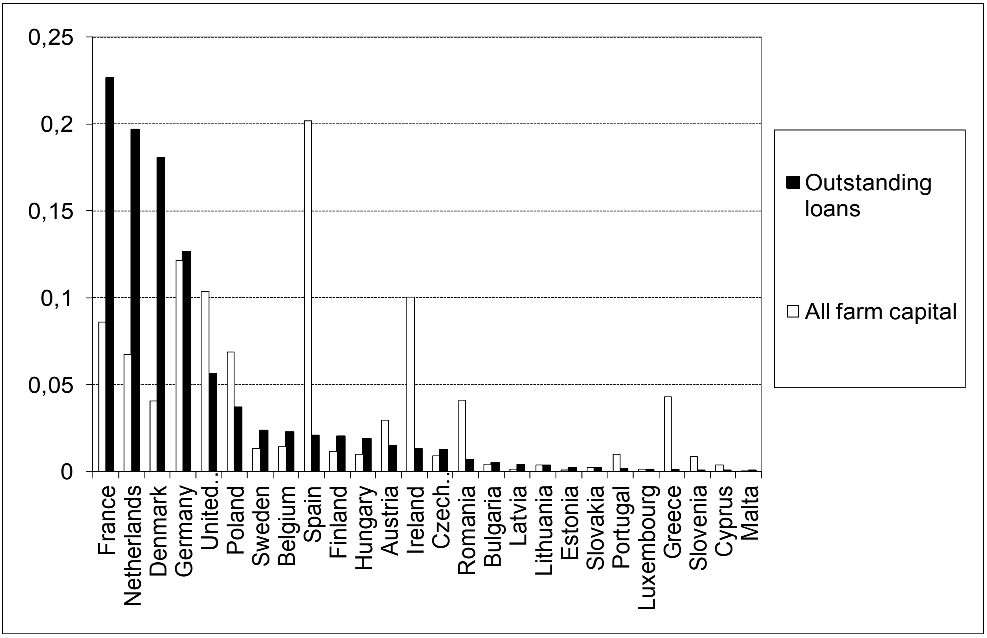
[61] Based on FADN valuation methods.

Figure 22.4 The distribution of outstanding loans and the total farmer capital in EU agriculture between the member states in 2008



There are considerable differences in agricultural debt structures among the EU member states. These structures could be represented by the ratio of short- to long-term debts. In new member states such as Romania, Hungary, Slovakia and Lithuania, a major proportion of total debts consist of short-term loans and credits. These credits are needed for the day-to-day operating of farms. The share of short-term loans is also sizable in the UK because the total debt compared to the turnover of UK farms is small. Belgium represents those member states in which all loans are long- or medium-term loans and are thus probably used for funding agricultural investments. Long- or medium-term loans also predominate in Finland, Denmark and Slovenia.

On the sampled arable crop farms, the equity ratio[62] has been 79% on average. It has been lowest in Denmark (49%) and highest in Italy (99%). The equity ratio is also low on French arable crop farms, but the low equity ratios in Denmark and France have completely different underlying reasons in the accounting systems. In Denmark, the arable farms have total assets per ESU that are 8.5 times higher than the corresponding ESU-

[62] Equity ratio = (total assets – liabilities) / total assets.

normalised assets of arable farms in France. The asset values have increased faster compared to debts in Denmark than in France. Based on this, the observed equity ratio trends are favourable to Denmark. Naturally, the turnover-to-assets ratio is in favour of France. Italian arable farms, having an average equity ratio close to 100%, in practice operate fully on their own capital, and their economic resilience does not directly depend on the performance of the financial market. Liabilities recorded for Italian farms are just a few thousand euros per farm (e.g. €4,485 in 2007). The high equity ratio may, however, signal that the access of farmers to credit and agricultural production assets may have been more constrained in Italy than in other countries. The equity ratios are also high on Irish arable crop farms, but these farms differ from their Italian counterparts since they have average liabilities of €40,000 per farm. The asset values in Ireland have been high and have increased faster than debts, and the equity ratio reached 98.6% in 2007. In the UK, the trend in the equity ratio has been very similar to that in Ireland, but the level of the equity ratio has remained somewhat lower. The trend has been mixed on arable farms in Germany. First, the ratio increased in the early 1990s, reaching the highest level in 1995. From the late 1990s onwards, the debts have increased faster than asset values. In the more or less recently joined member states (Finland and Hungary), membership has not induced any significant trend in the equity ratio of arable farms.

The equity ratio on the sampled dairy farms is estimated at 76%, which is slightly lower than on the arable crop farms. As with the arable crop farms, the ratio has been lowest in Denmark (39%) and highest in Italy (97%). Equity ratios do not exhibit clear trends, but they appear to display one-off jumps and drops in some countries. The most striking changes have been recorded in Hungary, where large investments by dairy farms have almost tripled the total liabilities within four years, but the asset values have not increased with the same pace. The liabilities on Hungarian dairy farms currently equal those in Germany, France, Ireland, Finland and the UK. If the current trend continues, the aggregate equity ratio of Hungarian dairy farms will soon reach levels equally low to those on Danish dairy farms. The largest liabilities on dairy farms are €2,159,726 in Denmark and €666,167 in the Netherlands. Only Denmark still clearly differs from the rest of the countries as measured by the equity ratio, since on Danish dairy farms the majority of the financing comes from financial institutions and not from the farmer. The equity ratio on Danish dairy farms has varied between 32.7% and 44.7%. Italian dairy farms operate almost solely based on their own capital, the equity ratio being as high as 98%.

Farms with granivores have lower financial buffers compared to arable and dairy farms – their average equity ratio is estimated at 61%, which is 15 percentage points lower than on dairy farms. In Denmark, France and the Netherlands, these farms mostly operate based on loaned capital and their equity ratios have decreased to less than 50%. A decreasing trend in the equity ratio is also present in Germany and the UK. As above, Italy is an exception, since Italian farms operate almost solely based on their own capital.

4. Conclusions

The emerging financial crisis was not yet reflected in increasing variance in agricultural borrowing rates across countries for two reasons. First, the country-specific variation in agricultural borrowing rates has also been large in the past. Second, in a large number of countries, agricultural loan rates did not yet increase much and the rates remained close to the EU average. Dramatic changes were only observed in the tails of the distribution, where the interest rate discrepancies were the largest. At the uppermost end of the tail the agricultural loan rate increased to about 11% (Greece), while at the lowest end of the distribution the corresponding rate remained at 2.3% (Czech Republic).

The distribution of the financial leverage of agriculture across countries does not reflect the distribution of country-specific risk premiums in the manner that they are observed in government bond yields. Therefore, in those countries that have the weakest financial situation in the public sector and in which the local interest rates are embedded with high country-specific risk premiums, the agricultural sector is not directly exposed to a very large risk of increasing interest rates, since it is not so highly leveraged. An example of these countries is Spain, where the financial leverage (gearing) is only 2.2%, while the average gearing among all EU countries is 18% and the highest country averages reach 50%. The different distributions of government and agriculture leverages will thus provide some hedge for the European agricultural sectors against the financial problems in the public sector. Nevertheless, the dynamic financial spillover effects and economic implications through revised budget policies will also expose agricultural sectors to large risks in these countries.

References

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23. CAPITAL OWNERSHIP AND INVESTMENT BEHAVIOUR: AN EMPIRICAL ANALYSIS OF CZECH CORPORATE FARMS

JARMILA CURTISS, TOMÁŠ RATINGER AND TOMÁŠ MEDONOS[*]

Cooperatives and corporate farms have retained an important role in agricultural production in several central and eastern European countries. Despite their importance, these farms' ownership structures and particularly the ownership's effect on their investment activity, which is vital for efficient restructuring and the sector's future development, are still not well understood. This chapter explores the ownership-investment relationship using data on Czech farms from 1997 to 2008. The authors allow for ownership-specific variability in farm investment behaviour, which is analysed using an error-correction accelerator model. Empirical results suggest significant differences in the level of investment activity, responsiveness to market signals, and investment sensitivity to financial variables among farms with different ownership characteristics. These differences imply farm-internal financial constraints related to high agency costs of dispersed and external ownership. The results suggest that competitive pressures will force Czech cooperatives and corporate farms to improve corporate governance mechanisms and adjust ownership structures towards internal ownership and higher ownership concentration.

[*] This chapter is an excerpt from Curtiss, Ratinger & Medonos, "Ownership and Investment Behaviour in Transition Countries: A Case Study of Collective and Corporate Farms in the Czech Republic", Factor Markets Working Paper No. 17, February 2012. See this publication for more detailed deliberation of theoretical predictions, and description of the methodology, estimation results and their interpretation.

1. Introduction

Cooperative and corporate farms have retained an important role for agricultural production in several of the new EU member states, including the Czech Republic. Transformation policies have provided a wide scope for ownership and organisational adjustments that have resulted in a unique diversity of corporate farms ownership structures and governance constellations. Despite the importance of corporate farms in agricultural production, their ownership structure and particularly its effect on the farms' investment activities, which is vital for efficient restructuring and the sector's future development, have received insufficient attention from the academic community.

Compared to corporate firms in mature economies, corporate farm governance in post-communist countries was formed under conditions of weak legal protection of renewed property rights and minority shareholders' interests (Mueller & Peev, 2007), as well as strong bargaining positions of former collective farms' management (Schlüter, 2001). These conditions hindered many claimants of historic ownership (restituents) in withdrawing their property shares from agriculture (Schlüter, 2001). As a direct consequence, the property rights reforms initially led to highly dispersed ownership of cooperatives and corporate farms with a great representation of insider (employee and managerial) as well as external ownership. Successive ownership development has been further cramped by only slowly emerging internal corporate environments and underdeveloped markets for agricultural ownership shares. This environment indicates a high probability of inefficient property rights allocation and high agency costs, which could be partially lowered by efficient firm governance instruments such as management bonding and monitoring mechanisms. The 'new' owners, however, generally possess no knowledge of corporate bonding and control mechanisms, or their knowledge is limited to only the brief experience accumulated post-privatisation. Each of these aspects amplifies the agency problems of corporate governance in transition agriculture. The separation of ownership and control over the corporate farms and underdeveloped corporate mechanisms suggest that the most distinguishing characteristic of corporate governance in transition agriculture is the large scope for managerial discretion. The area in which the scope for managerial discretion comes into greatest effect is in firm performance and investment decisions, including generated internal fund use and distribution. The latter represents an issue often referred to as agency costs of free cash flow, which affect firm-productive investment and restructuring. This relationship between the structure of large farm ownership and investment decisions lies at the heart of this study.

This chapter aims to assess the differential investment effect and long-run viability of various ownership characteristics using data from Czech cooperative[63] and corporate farms. For this purpose, we apply unique survey data on ownership structure collected in 2004 and data from the Farm Accountancy Data Network from 1997–2008.

2. Theoretical background

Conceptualising the ownership-investment relationship necessitates surpassing the boundaries of the neoclassical theory of firm investment behaviour (Modigliani & Miller, 1958; Jorgenson, 1963) and acknowledging the existence of financial constraints. Financial constraints are discussed in the literature as having two main origins: (i) asymmetric information between the firm and the providers of external finance (e.g. Stiglitz & Weiss, 1981; Myers & Majluf, 1984); and (ii) agency costs borne by the firm, which arise from the divergent goals of managers and owners of the firm (e.g. Grabowski & Mueller, 1972; Jensen & Meckling, 1976). It is widely accepted among financial economists that financial constraints which originate in either of the two theoretical issues – information asymmetries and incentive conflicts between (i) the firm and financiers or (ii) the owners and managers – result in investment sensitivity to changes in firm internal funds. The latter issue is of main interest to our study.

Why is separation of ownership and control of a firm thought to lead to non-optimal investment decisions and why should this be reflected in higher investment sensitivity to internally generated funds (cash flow)? Agency theory and corporate governance literature posit that information asymmetries between owners and managers give managers a scope for discretion that can be utilised for pursuing goals and interests that deviate from the goals and interests of the owners (Williamson, 1963; Grabowski &

[63] In this study, cooperatives are treated as farms with corporate governance, since neither the obligation of connecting cooperative membership to work in the cooperative, nor the one member-one vote voting rule are included in the actual commercial law of the Czech Republic (Law nr. 513/1991 of the Code of Law, Commercial Code). Most Czech agricultural cooperatives do not choose the rules traditionally defining producer cooperatives in academic literature (Curtissová et al., 2006).

Mueller, 1972; Jensen & Meckling, 1976). Managerial discretion can thus lead to non-optimal decisions from the owners' perspective and to agency costs borne by corporate owners. One reason that managers behave less optimally than owners is that their personal wealth is not at stake (Jensen, 1986; Ang et al., 2000). Also, seeking higher appraisal, managers tend to present their work, and thus the firm's performance and its market standing, positively, and follow a strategy of growth independent of the real returns on capital and investment (Grabowski & Mueller, 1972). In contrast to information asymmetries in the capital market that result in under-investment, the internal information asymmetries in firms provide incentives to over-investment (Mueller & Peev, 2007). Moreover, managers are assumed to prefer financing the less optimal projects from internally generated funds (bargaining with owners over free cash flow) to avoid external scrutiny (for example, by banks) of less optimal investment projects, and to show a tendency to waste some of these funds on perquisites (Jensen & Meckling, 1976). Therefore, analogically to information asymmetries in the capital market, agency costs should result in investment sensitivity to generated internal funds.

The effects of managerial discretion on the use of funds and resource allocation can be assumed to be partially modified by the conditions that are characteristic to post-communist economies. The effect of credit constraints can be expected to be amplified by lower liquidity of capital markets, and agency costs to be higher due to the weak protection of property rights and the legal framework for corporate governance. Predictions of the managerial discretion effect can also be altered by the cramped internal fund generation in agriculture during transition (e.g. Doucha et al., 2002). The lower liquidity of capital markets and insufficient free cash flow can be perceived to limit the tendencies of managers to over-invest, even when a large scope of discretion is available, such as in the case of weak governance. Furthermore, the lower liquidity and high transaction costs of an unsuccessful credit application could increase managers' positions over owners in bargaining over free cash flow. The investment effect of agency costs of joint ownership and delegated control can be assumed to be higher in transition, as managers are expected to address low-productivity problems through investments (modernisation) rather than internal restructuring to avoid conflicts with employed owners.

Despite any well-founded rationale for the expectation of a significant effect of agency costs on the investment behaviour of large farms in transition, their empirical investigation is challenged by many other factors that are possibly captured in the investment sensitivity to cash flow or other financial variables. The investment sensitivity to financial variables (cash flow) can simultaneously depict the effect of financial constraints from information asymmetries between the firm and suppliers of external finance, as well as constraints of less liquid capital markets. Furthermore, Kaplan & Zingales (1997) argued that the investment sensitivity to financial variables can also be justified purely by the fact that external funds are more costly than internal funds for all firms, as long as some transaction costs are involved. Similar to Poterba (1988), they also argued that since current investment depends on both current and expected future changes in the desired capital stock, information on cash flow can help to forecast future profitability and investment opportunities. This, again, would result in higher investment sensitivity to cash flow. Because of the various sources of investment sensitivity to financial variables, the interpretation of empirical findings remains ambiguous. Only sufficiently detailed empirical data underpinning the firm ownership variability investigated within a relevant investment model and a comprehensive theoretical discussion can help to shed more light on the determinants of corporate farm investment behaviour and to capture the ownership (agency) effects.

3. Methodology and data

Following the Mairesse et al. (1999) deliberation on the development of investment models and the Bokusheva et al. (2009) discussion on investment models' suitability for the case of modelling investment behaviour in transition agriculture, we chose to apply the error-correction accelerator model. The advantage of the error-correction specification of the accelerator model is that it allows for a separation of the long-run investment determinants from the short-run investment adjustments. The error-correction specification of the investment accelerator model nests the demand for capital equation (Jorgenson, 1963) with the dynamic (accelerator) investment equation with autoregressive-distributed lags. Similarly to numerous investment studies, we add to the basic error-correction investment model the current and lagged cash flow scaled by the previous period's value of fixed capital to test the investment sensitivity to internally generated funds. To analyse the ownership effect on farm investment behaviour, we further allow the effect of investment determinants (short-run as well as long-run adjustments) to vary across three ownership variables – ownership concentration, external ownership, and number of owners.

To address the econometric issues resulting from the model specification, we apply the fully efficient generalised method of moments (GMM). For the estimation of empirical models with autocorrelation and other possible endogeneities in explanatory variables, Arellano & Bover (1995) and Blundell & Bond (1998) suggest using the system GMM, which allows a combination of two equations and two samples of instrumental variables on transformed and untransformed data. Because of the relatively large number of instruments compared to the number of observations, we estimate a one-step system GMM.

Data used in this study originate from the official balance sheets, income statements and supplementary forms of the Farm Accountancy Data Network of the Czech Republic (FADN CZ) survey for the years 1997-2008. Data on farm ownership structure comes from a structured data collection in the Czech Republic in 2004. This data survey was organised and funded by the Institute for Agricultural Development in Central and Eastern Europe (IAMO) in Halle, Germany, together with the Institute of Agricultural Economics and Information (UZEI) in Prague. The sample contains 117 agricultural companies with a combined crop and animal production of a legal entity status (cooperatives, joint stock companies (JSC) and limited liability companies (LLC)) for a minimum of seven years of consecutive annual data between 1997–2008. From these, data on 41 farms are available for the entire 11-year period. The complete model estimations are carried out on a sample of 529 observations.

4. Results

Farm ownership group comparison and results from estimation of the error-correction accelerator model suggest that ownership structure has a significant effect on farms' economic performance as well as investment behaviour.

Joint farm ownership by a large number of shareholders, which contributed to preserving large-scale production, is not found to be motivated by economies of scale, but rather reflects managers' transformation strategies. Besides preserving production size,[64] this strategy also secured continuity of employment for former management and many employees, and prevented an immediate loss of value of

[64] See significantly higher sale volume, S_t, in the group of farms with higher number of owners in Table 23.1.

restitution claims (shares) (see Curtissová et al., 2004). The significantly lower investment activity, I_t/K_{t-1}, observed for the farms with a larger number of owners could be a rational response to lower returns to capital and an indication of a need for restructuring. Without effective restructuring, farms with such ownership dispersion cannot be expected to successfully compete in the sector in the long run.

Table 23.1 Mean statistics and two-group mean comparison t-test for farm ownership groups

	Owners' number			Ownership concentration[1)]			External ownership[2)]		
	< median	≥ median	*p*-value*	< median	≥ median	*p*-value*	< median	≥ median	*p*-value*
I_t/K_{t-1}	0.137	0.119	0.059	0.121	0.135	0.143	0.128	0.128	0.947
S_t/K_t	1.021	0.896	0.000	0.991	0.935	0.035	0.980	0.906	0.012
I_t/S_{t-1}	0.126	0.130	0.754	0.112	0.142	0.024	0.131	0.127	0.825
CF_t/K_{t-1}	0.180	0.133	0.000	0.143	0.171	0.001	0.168	0.136	0.001
$\Delta S_t/K_{t-1}$	0.004	0.006	0.829	-0.004	0.012	0.091	0.003	0.009	0.595
K_t [3)]	36.431	80.237	0.000	49.775	63.592	0.000	56.490	62.674	0.023
S_t [3)]	30.828	69.628	0.000	43.678	53.434	0.000	48.493	52.912	0.077
Nr. of owners	85	555	-	402	234	0.000	188	501	0.000
Ext. own. [2)]	0.652	0.839	0.000	0.794	0.705	0.000	0.605	0.894	-
Transf. debt[4)]	0.439	0.142	0.000	0.385	0.203	0.000	0.378	0.179	0.000
Cap. con. I[1)]	0.753	0.149	0.000	-0.017	0.900	-	0.606	0.113	0.000
Cap. con. II[5)]	0.111	0.126	0.001	0.076	0.166	0.000	0.134	0.116	0.000

Note: *I* = investment, *K* = capital, *S* = sales, *CF* = cash flow, *t* = time period; * *p*-value for a two-group mean comparison t-test; [1)] per owner share in equity (in millions of CZK); [2)] share of the number of external owners in total number of owners; [3)] in millions of CZK; [4)] indebtedness rate from ownership transformation (debts toward eligible persons from transformation in value of total assets); [5)] per owner share in legal capital (in millions of CZK).

Table 23.2 Parameters of the error-correction accelerator model

	Parameters with respect to:			
Dependent variable I_t/K_{t-1} x	x	x * Owners' number (1 = owners' number ≥ median, 0 = otherwise)	x * Ownership concentration[1)] (1 = ownership concentration ≥ median, 0 = otherwise)	x * External ownership[2)] (1 = external ownership ≥ median, 0 = otherwise)
I_{t-1}/K_{t-2}	-***	+**	0	0
I_{t-2}/K_{t-3}	0	+*	-*	0
ΔS_t	+*	-*	0	0
ΔS_{t-1}	0	0	-**	0
ΔS_{t-2}	+**	0	-**	-**
S_{t-3}	0	-**	0	0
$k_{t-3}-s_{t-3}$	-***	0	+**	0
CF_t/K_{t-1}	+**	0	-**	+*
CF_{t-1}/K_{t-2}	0	0	+***	0

Note: *I* = investment, *K* = capital, *S* = sales, *CF* = cash flow, *t* = time period, *k* = logarithm of *K*, *s* = logarithm of *S*; *, **, *** indicate significance at 10%, 5% and 1% significance level, respectively; "0", "+" and "-" represent no, positive and negative significant effect of a given variable on farm investment activity.

Table 23.1 further illustrates that farms with a higher share of external owners are less productive and less profitable than farms owned to a greater degree by insiders. The estimates of the error-correction investment model presented in Table 23.2 show significantly higher investment sensitivity to the ratio of cash flow to capital for the group of farms with higher share external ownership. This suggests external ownership-specific financial constraints. Since lower productivity of farms with more owners was found not to result in greater financial constraints, the higher investment sensitivity to internal funds in the case of farms with a higher share of external ownership can be interpreted in relation to the ownership characteristic rather than to productivity differences and external financial constraints. The higher sensitivity to generated cash flow thus suggests a greater scope for financial decisions given to farm management in farms with a higher share of external ownership. In other words, external owners are more constrained in their control over management than employed owners, which leads to managers having greater discretion over the use of generated profit. The empirical results are thus in line with the theoretical expectation that a higher share of external ownership provides more scope for managerial discretion, which can lead to less optimal investment decisions, overall lower economic performance, and thus higher agency costs borne by the owners. Employee ownership, which is found to contribute to the performance of the farms, is, however, not warranted in the future, as employee ownership was mainly a result of the transformation law. The share of employed owners can be expected to rather decrease with the retirement of currently employed owners, since retirees are mostly interested in the financial settlement of their ownership shares.

Results for ownership concentration (equity per owner) imply a significant effect of ownership concentration on farms' economic performance as well as on investment decisions. Concretely, farms with more shares in farm equity per owner display far higher profitability among considered groups of farms (see Table 23.1). Results in Table 23.2 indicate that investment activity of farms with more concentrated ownership is significantly more cyclical, which could be explained by larger lump investments. Moreover, the investment activity of farms with more concentrated ownership is significantly less dependent on current internal funds, which suggests that these farms rely to a higher degree on credit financing. Past profitability is, on the other hand, found to stimulate current investment activity in this group of farms. These observations support the theoretical expectation that higher ownership concentration provides incentives for more effective corporate governance, better performance and more optimal investment decisions.

5. Conclusions

The study of the ownership-investment relationship in corporate farms delivered valuable insights into internal governance challenges of the corporate farm type and indicated possible future developments of Czech farm ownership structures. Empirical results suggest significant systematic differences in the level of investment activity, responsiveness to market signals, investment lumpiness, and investment sensitivity to financial variables among farms with different ownership characteristics. Farms with highly dispersed ownership (a large number of owners and simultaneously smaller equity shares) display significantly lower investment activity. Farms with a higher share of external ownership and lower values of shares per owner are found to have a higher investment sensitivity to internal funds, which points to the existence of internal financial constraints related to less efficient governance structures and managerial discretion. Farms with a large number of owners, a high share of external ownership or predominantly small ownership shares will require marked restructuring to improve lagging economic performance and investment decisions. This might require gradual buy-outs of small shares that would lead to higher ownership concentration. External owners will be required to implement tools of more efficient corporate governance, which is also more likely to be realised with incentives of higher shares at stake. All these results point to high agency costs of the current ownership structure and future development towards higher ownership concentration (i.e. a decreasing number of owners and increasing equity size) in today's cooperative and corporate farms. Developing institutions that would support an organised agricultural equity share market could contribute to the speed and effectiveness of the farm ownership restructuring process, and increasing legal protection of small shareholders could bolster its fairness.

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24. THE IMPACT OF THE 2013 CAP REFORM ON FARM INVESTMENTS

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This chapter aims to analyse the investment behaviour in the quasi-fixed inputs farm buildings and machinery and equipment for a sample of farms specialised in the production of arable crops from selected EU states. It models investment demand as a function of, inter alia, the type and amount of Pillar I direct payments received under the Common Agricultural Policy of the European Union. The preferred modelling technique accounts for the possibility of zero net investment being a separate equilibrium achieved while dynamically maximising farmer's utility. Results suggest that that the range of zero investment is clearly and consistently identified for Germany for both investment types and Common Agricultural Policy support schemes and for Hungary for both investment types under the sole relevant type of direct payments received. Three regimes also appear to characterise machinery and equipment investment in France, irrespective of the type of support received. Moreover, the estimation of the investment models provides the necessary data to simulate the farms' future and expected investment behaviour arising because of the implementation of the direct payments reform proposals recently discussed and aiming at a more fair

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distribution of Pillar I direct payments across member states. Only a few pieces of evidence contrast the anticipated worsening of investment prospects following a cut in the Common Agricultural Policy support levels. In fact, the investment prospects in machinery and equipment in France and Italy appear to improve following the widespread reduction in support levels induced by the policy scenarios considered. Likewise, an improvement in investment levels occurs in the UK which, under one of the possible implementations of the reform of the Pillar I direct payments of the Common Agricultural Policy, is expected to receive a more substantial amount of funds.

1. Introduction

Farmers' decisions to invest in physical capital (i.e. farm buildings (FB) or machinery and equipment (ME)) might be the result of economic considerations regarding the likely difference between the purchase and resale price of an asset (Johnson, 1956) as well as the uncertain nature of farm output price and government support (i.e. CAP provisions in the EU) (Serra et al., 2009; Boetel et al., 2007). The latter might influence the fluctuations in relative prices through coupled support and/or increase the contribution of non-output related income to total farm income through decoupled subsidies. Both types of subsidies might relax existing budget or credit constraints (Sckokai, 2005) and/or diminish price/revenue uncertainty resulting in higher physical investment. Nonetheless, the decision to avoid investing may still be optimal if irregularities in the adjustment cost function arise.

In Guastella et al. (2013a), drawing on Serra et al. (2009), we estimate a reduced form investment demand function for FB and ME allowing for threshold-type behaviours compatible with several types of capital market imperfections – i.e. differences between assets' purchase and resale prices (Johnson, 1956); asymmetries in fixed capital adjustment costs (Abel & Eberly, 1994); real options (Huttel et al., 2010) – in an attempt to explain the frequent occurrence in farm-level data of zero and negative gross investment levels. We do so by carefully implementing the threshold regression model developed by Hansen (1996, 1999, 2000) to endogenously and consistently determine and test whether the investment model is characterised by multiple regimes, specifically a positive investment regime, a zero-investment regime or a negative investment regime. In turn, this would highlight the optimal nature of the recorded investment values rather than an occurrence strictly dependent on the presence of imperfections in a number of connected markets. Since conditions and constraints are likely to vary significantly across the EU, also due to the different implementation of decoupled subsidies between old and new member states, a comparative analysis of the dependence of agricultural investment on CAP payments in France, Germany, Hungary, Italy and the UK might unveil interesting peculiarities calling for a country-level tuning of more general policy provisions. This exercise constitutes an innovative contribution to an existing literature which, adopting these theoretical and empirical tools, has previously focused mainly on only one geographic region at a time (Boetel et al., 2007; Serra et al., 2009). Moreover, relying on the long time span covered by the Farm Accountancy Data Network (FADN) dataset, the different effects of coupled and decoupled subsidies on agricultural investment are highlighted.

In Guastella et al. (2013b), building on the estimates carried out in Guastella et al. (2013a) and employing some of the methodology in Hansen (1999), we calculate the expected percentage changes in agricultural investments due to the reductions in CAP Direct Payments (DPs) currently discussed in the negotiations defining the features of the CAP in the 2014-2020 budget period (European Commission, 2011). The "CAP towards 2020" policy reform proposal is built upon three main scenarios for DP disbursement levels: the *adjustment*, the *integration* and the *refocus* scenarios. In turn, the *adjustment* scenario comprises three different implementations: the *EU flat rate*, the *min 80%* and the *min 90% and objective criteria*. The *EU flat rate* envisages an EU-wide flat rate per hectare payment on the whole potential eligible area. In the *min 80%* scenario, each member state would obtain a flat rate payment equal to at least 80% of the current EU average. In the *min 90% and objective criteria* implementation, the minimum payment would reach 90% of the EU average, but farmers would face additional environmental and economic criteria to be eligible for the payments. In the *integration* scenario, each member state receiving less than 90% of the EU-27 average DPs would experience a one-third reduction in their gap over the 2014–2020 period. Lastly, the *refocus* scenario would imply a radical shift in the CAP support policies, since the funds allocated to Pillar-II measures would be doubled. In this chapter, attention is focused on the effects of a change in Pillar I DPs only, thus excluding this last scenario. The level of DPs associated to each policy scenario is evaluated in European Commission (2011) with respect to a 2020 status quo scenario implying a full phasing-in (i.e. 100%) of DPs in the EU-12 paid to both small and large farms. Moreover, the percentage changes in DPs are determined as if a regional model at the member state level were applied and considering a limited provision of coupled payments (mainly for livestock production and cotton). Table 24.1 presents the relevant percentage change in DPs under the different policy scenarios.

Table 24.1 Percentage change in DPs under different CAP policy reform scenarios

	EU flat rate (1)	**Min 80% (2)**	**Min 90% and objective criteria (3)**	**Integration (4)**
FR	-17	-12	-13	-2
DE	-23	-13	-16	-4
HU	-10	-7	-8	0
IT	-37	-10	-22	-6
UK	6	-10	-5	-2

Source: Authors' compilation based on European Commission (2011).

Having laid out the scope of this chapter and referring the reader interested in exploring the data and methodology further to Guastella et al. (2013a, 2013b), in what follows the estimates from the econometric models are summarised alongside the presentation of the changes in investment levels due to the above CAP reform scenarios. The last section presents a final summary of the main results.

2. Results

2.1 Models' estimates

Table 24.2 presents the main econometric evidence for the countries of interest from Guastella et al. (2013a).

Table 24.2 Synoptic table of the models' results

			Regimes	k_{-1}	*expoutpi*	**Subsidies**	*varoutpi*
FR	Coup.	FB	**D**-I	- (***)	+ (¥/**)	-	- (***)
		ME	D-**Z**-I	- (***)	+ (***)	+	+
	Decoup.	FB	**D**-I	- (***)	- (***)	+ (*)	+
		ME	*D*-**Z**-*I*	- (***)	- (¥/*/¥)	-	-
DE	Coup.	FB	**D**-Z-I	- (***)	+ (***)	+ (***)	-
		ME	*D*-**Z**-*I*	- (***)	-	+ (***)	- (**)
	Decoup.	FB	D-**Z**-I	- (**/***/¥)	+ (*/¥/¥)	+ (***)	- (***)
		ME	**D**-Z-I	- (***)	+ (¥/*/¥)	+ (**)	+ (*)

HU	Coup.	FB	D-***Z***-***I***	- (***)	-	+	§
	Decoup.					+ (***)	
	Coup.	ME	D-***Z***-***I***	- (¥/***/***)	- (***/**/***)	+	§
	Decoup.					+	
IT	Coup.	FB	D-**I**	- (***)	-	- (***)	-
		ME	***D-I***	- (¥/***)	-	+	-
	Decoup.	FB	**D**-Z-*I*	- (¥/**/**)	- (¥/***/***)	+	-
		ME	§	- (***)	- (*)	-	- (**)
UK	Coup.	FB	**D**-*I*	- (***)	-	+ (**)	-
		ME	§	- (***)	+	+	+
	Decoup.	FB	D-**I**	- (***)	+	+	-
		ME	§	- (***)	+	+ (*)	+

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level based on two tailed tests; ¥ denotes Not Significant in estimation; § denotes Not Applicable in estimation; k_{-1} is the lagged quantity of capital stock, *expoutpi* and *varoutpi* are the expected value and variance of the output price index, respectively, calculated according to Chavas & Holt (1990); **bold** typeface denotes the regime which concentrates the largest number of farms for the majority of the years considered, ***bold and italicised*** typeface identifies the two regimes which concentrate the largest number of farms for two years each, *italicised* typeface identifies the regime which concentrates the largest number of farms in one sole year; regime dependent coefficients (k_{-1} and *expoutpi*) are presented with the sign which occurs more often while significance (their superscript) is presented multiple times if it differs across the Disinvestment (D), Zero-investment (Z) and Investment (I) regimes.

Source: Authors' elaboration on models' estimates from Guastella et al. (2013a).

The "Regimes" column suggests that investment demand is clearly characterised by three regimes only in Germany and Hungary, irrespective of the actual type of investment and agricultural support under which it occurs. In France, only ME investment appears to feature zero investment as a separate and optimal equilibrium, under both types of agricultural support. Moreover, it appears that the zero-investment regime is also concentrating the largest number of farms for several years, suggesting an economic – above and beyond statistical – significance of this equilibrium.[65]

[65] See the notes to Table 24.2 for the estimation variables' definitions.

The coefficient for k_{-1} is expected to range in the [-1; 1] interval determining the rate of adjustment of current capital stock to its long-run equilibrium. In turn, negative values would suggest that farms disinvest to reach a lower long-run stock of capital (Sckokai & Moro, 2009) while positive ones should suggest that farms are under-capitalised and are required to invest in capital assets to reach their long-run equilibrium. The relevant column in Table 24.2 provides the (somewhat surprising and statistically precise) testimony that the farms analysed in this study are over-capitalised both in FB and ME, as well as over the implementation of both types of subsidies and across all the possible regimes. This finding appears to be confirmed by other recent studies employing different methodologies also (Petrick & Kloss, 2012; Sckokai & Moro, 2009).

The model allows for short-run adjustments in the stock of capital following fluctuations in *expoutpi*. Contrary to the consistent sign and significance occurring for k_{-1}, the dependence of investment on *expoutpi* is largely statistically insignificant, negative – over the period 2005–08 after the introduction of decoupled support – in France and Hungary while it also achieves statistical significance in Italy under the same type of support. Germany and the UK feature a largely positive short-run relationship between investment and *expoutpi*, although significant only in the former.

While k_{-1} and *expoutpi* express a behavioural and a market-based reaction of farm investment, respectively, the remaining columns in Table 2 highlight the relationship between investment and variables which might be affected by public policy. Among them, *subsidies*, differentiated between their coupled and decoupled implementation, constitute one of the most relevant sources of financial resources for the investing farm, while the dependence of investment on *varoutpi* is of interest since it traces the impact of risk on farmers' decisions to invest in the assets concerned. The effect of CAP subsidies on investment in both asset types is almost exclusively positive and statistically significant in about half of the cases. Nonetheless, decoupled subsidies appear to have a more significant impact on capital investment since their estimated coefficients achieve statistical significance – at conventional levels – in half of the models, with a 25% increase compared to the coupled case. Agricultural support of both types has a consistently positive and statistically significant effect on investment only in Germany. The transition to a decoupled system of agricultural support does not seem to have induced any dramatic change in farmers' attitudes towards capital investment, suggesting that the two different implementations of CAP subsidies are perceived as being *de facto* very similar. Exceptions may include the effect of support becoming positive and significant for FB investment in France and Hungary, and for ME investment in the UK. On the contrary, significance is lost for FB in the UK. While remaining insignificant, the effect of CAP support turns from positive to negative for ME in France and Italy.

The last column in Table 24.2 presents the estimates of the effect of output price variability on the level of investment in FB and ME. Roughly 70% (11 out of 16) of the estimated models are characterised by a negative coefficient for the effect of risk on both types of investment and across the two types of support scheme. Nonetheless, only in roughly a third of these cases (4 out of 11) is the effect statistically significant at conventional levels. ME investment under decoupled payments in Germany is the only type of investment to be positively and statistically significantly (although at 10%) affected by a rise in the *varoutpi*. France and the UK appear to be evenly characterised by positive and negative relationships between risk and investment. In turn, in the UK the signs of this relationship vary by investment type with FB displaying a negative and ME a positive sign, respectively.

2.2 *Expected investment changes*

Table 24.3 presents the percentage changes in average yearly and regime-specific levels of investment ($\Delta\overline{inv_j}(\#)$) in FB and ME, applying the methodology described in Guastella et al. (2013b) to the expected percentage changes in DPs recorded in the corresponding (#) column in Table 24.1.

To facilitate the interpretation of the results in Table 24.3, expected changes are presented alongside the ancillary columns for the sign of the coefficient tracing the effect of decoupled payments on investment (β^d) as well as the values for the associated 2008 j-regime specific elasticity ($\xi^{sub}_{2008,j}$) and the average value of investment ($\overline{inv_j}$). Except for the UK under the *EU flat rate* and Hungary under the *integration* scenarios of DPs reform, all the remaining expected policy changes are characterised by a percentage decline in the level of DPs. In turn, the resulting sign for the $\Delta\overline{inv_j}$ (#) is opposite to that of the calculated elasticity $\xi^{sub}_{2008,j}$. To define the qualitative effect of the impact of $\Delta\overline{inv_j}$ (#) on the regime-specific average investment level $\overline{inv_j}$, the column "Dir. effect" reports whether $\overline{inv_j}$ should decline or rise because of the related policy change. A negative sign for the "Dir. effect" in each regime, suggesting a worsening of the investment prospects of the farms, is the result of a positive calculated percentage change in average net investment when the latter is negative (namely, negative investment becoming even more negative) or of a negative percentage change in the presence of positive average investment levels. A positive sign for the "Dir. effect" in each regime, suggesting an improvement in the investment prospects of a farm in a given regime, is the result of a negative percentage change in average net investment when the latter is negative (namely, negative investment becoming less negative) or of a positive percentage change in the presence of positive average investment levels. Note that no sign is associated with the zero percentage change in net investment levels expected in Hungary if the *integration* scenario were implemented. The switch in the "Dir. effect" for investment in both asset classes in the UK, from positive to negative, is due to the UK expecting an increase in DPs under the *EU flat rate* policy reform scenario. Every other country appears to be subject to a consistent "Dir. effect" across the reform scenarios. The generalised reduction in support levels induced by the scenarios in Table 24.1 leads to the expected worsening, across countries and asset classes, of the prospects for the average net investment levels. This expectation is met in all cases under all policy scenarios, except for ME in France and Italy.

Table 24.3 Expected changes in average net investment levels due to proposed CAP policy reform scenarios

			Sign of $\boldsymbol{\beta^d}$	$\xi^d_{2008,j}$	$\overline{inv_j}$	$\Delta\overline{inv_j}$ (1)	Dir. effect	$\Delta\overline{inv_j}$ (2)	Dir. effect	$\Delta\overline{inv_j}$ (3)	Dir. effect	$\Delta\overline{inv_j}$ (4)	Dir. effect
FR	**FB**	D	+	-32.3828*	-3.9044	550.51	-	388.59	-	420.98	-	64.77	-
		I	+	-0.7822*	-129.1957	13.30	-	9.39	-	10.17	-	1.56	-
	ME	D	-	0.4684	-229.9723	-7.96	+	-5.62	+	-6.09	+	-0.94	+
		Z	-	-2.0199	73.8329	34.34	+	24.24	+	26.26	+	4.04	+
		I	-	-0.5037	232.8085	8.56	+	6.04	+	6.55	+	1.01	+
DE	**FB**	D	+	0.9286***	3500.7560	-21.36	-	-12.07	-	-14.86	-	-3.71	-
		Z	+	6.6697***	510.9320	-153.40	-	-86.71	-	-106.72	-	-26.68	-
		I	+	1.9740***	1320.0380	-45.40	-	-25.66	-	-31.58	-	-7.90	-
	ME	D	+	-6.9760**	-232.6132	160.45	-	90.69	-	111.62	-	27.90	-
		Z	+	4.8517**	319.2914	-111.59	-	-63.07	-	-77.63	-	-19.41	-
		I	+	-99.7007**	-9.6516	2293.12	-	1296.11	-	1595.21	-	398.80	-
HU	**FB**	D	+	-3.9729***	-332.7315	39.73	-	27.81	-	31.78	-	0.00	§
		Z	+	-78.7439***	-33.5046	787.44	-	551.21	-	629.95	-	0.00	§
		I	+	4.1002***	470.7855	-41.00	-	-28.70	-	-32.80	-	0.00	§
	ME	D	+	0.5359	332.2688	-5.36	-	-3.75	-	-4.29	-	0.00	§
		Z	+	-1.7400	-202.1463	17.40	-	12.18	-	13.92	-	0.00	§
		I	+	-2.2612	-99.5305	22.61	-	15.83	-	18.09	-	0.00	§

IT	FB	D	+	-0.1385	-366.8578	5.12	-	1.39	-	3.05	-	0.83	-
		Z	+	-0.1873	-365.0720	6.93	-	1.87	-	4.12	-	1.12	-
		I	+	-0.1148	-550.8514	4.25	-	1.15	-	2.53	-	0.69	-
	ME	D											
		Z	-	0.0389	-374.5699	-1.44	+	-0.39	+	-0.86	+	-0.23	+
		I											
UK	FB	D	+	-0.3717	-327.1312	-2.23	+	3.72	-	1.86	-	0.74	-
		I	+	3.4698	44.6537	20.82	+	-34.70	-	-17.35	-	-6.94	-
	ME	D											
		Z	+	4.2798*	428.3541	25.68	+	-42.80	-	-21.40	-	-8.56	-
		I											

Note: $\overline{inv_j}$ expressed in real euros, (1) denotes the *EU flat rate* scenario of CAP DPs reform, (2) denotes the *min 80%* scenario of CAP DPs reform, (3) denotes the *min 90% and objective criteria* scenario of CAP DPs reform, (4) denotes the *integration* scenario of CAP DPs reform; § denotes Not Applicable since no sign can be clearly associated to a zero percentage change variation.

Source: authors' compilation based on Guastella et al. (2013b).

3. Conclusions

The peculiar characteristics of the agricultural sector across the EU member states and over time call for a comparative analysis of the developmental effects of agricultural policies. Among the domains affected by agricultural policies, farmers' investment decisions are targeted at combating the often rapid obsolescence of capital assets as well as at advancing the technological dimension of the production process, whenever a major innovative breakthrough is embodied in commercial capital goods. In turn, adaptation of the capital stock to varying economic and policy conditions is likely to increase further the profitability of the agricultural sector, enhancing countries' economic prospects.

The work carried out as part of the Factor Markets project has investigated the role of coupled and decoupled CAP subsidies in determining the investment demand for farm buildings and machinery and equipment of farms specialised in arable crops. Applying a theoretical model of investment choice featuring irregularities in the adjustment cost function and an econometric technique capable of identifying the existence of separating equilibria, the estimated model has assessed whether zero investment in both asset classes is an optimal choice in the presence of a precise range – rather than point value – of the shadow asset prices. The policy evaluation exercise has calculated the expected changes in farm building and machinery and equipment investment levels due to the envisaged reductions in the levels of the CAP Direct Payments.

Empirical estimates suggest that the range of zero investment is clearly and consistently identified for Germany across asset classes and CAP support schemes and across asset classes only for Hungary. Three regimes appear to characterise machinery and equipment investment in France, irrespectively of the type of support received. This evidence might help in devising new regime-specific policy interventions. Since evidence suggests that specialised arable crop farms are disinvesting towards lower levels of long-run capital endowments, the frequent anecdotal evidence that agriculture is undercapitalised is not supported by the data. Nonetheless, except for the UK and Germany, these trajectories may lead towards non-stationary long-run equilibria, implying the possibility of further and different future dynamics. While the trajectories towards the long-run equilibria appear precisely determined, short-run adjustments in capital stocks due to changes in output prices appear largely insignificant and, at times, aiming in opposite directions. The association between both types of investment and both types of CAP subsidy is mostly positive, with the dependence on decoupled support barely more significant. The expectation of a negative association between the variance of the expected output price index – accounting for some of the uncertainty farmers face in commercialising their outputs – is largely met, although rarely in a statistically significant manner.

The analysis of the expected changes in the regime-dependent investment levels due to the implementation of some of the debated reform scenarios of CAP Pillar I payments reveals that only few pieces of evidence contrast the anticipated reduction in investment levels following a cut in the CAP support levels. In fact, investment in machinery and equipment in France and Italy appears to respond positively to the widespread reduction in support levels induced by the policy scenarios considered. Likewise, an increase in investment levels following the reform scenarios occurs for the UK which, under the *EU flat rate* reform of Pillar I payments, is expected to receive higher payments. This evidence is, in turn, consistent with the estimation results implying that the expected policy changes should drive investment along its long-run adjustment paths towards the respective equilibrium.

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25. THE IMPACT OF CAP SUBSIDIES ON BANK LOANS

JAN POKRIVCAK, PAVEL CIAIAN AND KATARINA SZEGENYOVA[*]

In this chapter, the authors estimate the impact of agricultural subsidies granted under the European Union's Common Agricultural Policy (CAP) on bank loans extended to farms. According to their theoretical analysis, subsidies may either stimulate or crowd out bank loans depending on the timing of subsidies, severity of credit constraint, type of subsidies and bank loans, and the relative cost of internal and external financing. In empirical analysis the authors use the Farm Accountancy Data Network (FADN) farm level panel data for the period 1995-2007. They employ the fixed effects and generalised method of moment (GMM) models. The estimated results suggest that i) big farms tend to use subsidies to increase long-term loans, whereas small farms tend to use subsidies to obtain short-term loans; ii) subsidies tend to crowd out short-term loans for big farms and long-term loans for small farms; iii) when controlling for the endogeneity, the crowding out effect becomes smaller, but the positive causal effect of subsidies on bank loans remains significant.

1. Introduction

Annually, the EU spends around €50 billion on the Common Agricultural Policy with the aim of supporting farmers' income and the production of

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[*] The chapter draws heavily on the research published by Ciaian et al. (2012). The authors are grateful to the European Commission for granting access to the FADN data.

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agricultural public goods such as the landscape and a clean environment. The majority of CAP subsidies are disbursed in the form of decoupled direct payments from the EU budget to farms, which are not linked to current and future quantities of agricultural production but are related only to past production levels. Within the CAP, there are also subsidies which are coupled to the production of specific crop or animal commodities. For example, higher production or use of inputs leads to more subsidies for farms. Finally, financial support is also provided for rural development projects.

Agricultural subsidies have important impacts on agricultural markets. Besides affecting farmers' income, studies have shown that agricultural subsidies affect input and output markets and thus, among others, alter rents of other agents active in the agricultural sector (Alston & James, 2002; Ciaian & Pokrivcak, 2004; Ciaian & Swinnen, 2009; de Gorter & Meilke, 1989; Gardner, 1983; Guyomard et al., 2004; Salhofer, 1996), impact environmental performance of farms (Beers Van Cees & Van Den Bergh, 2001; Khanna et al., 2002) and induce productivity changes and market distortions (e.g. Chau & de Gorter, 2005; Goodwin & Mishra, 2006; Rizov et al., 2013; Sckokai & Moro, 2006).

With few exceptions (e.g. Ciaian & Swinnen, 2009), most of the previous studies investigate only the direct impacts of agricultural subsidies (on prices, quantities, income, environment, etc.) by assuming that subsidies do not alter the structure of agricultural markets and do not interact with market institutions. In reality, government policies may have various indirect effects. They can change market structure or crowd out some market institutions. An analysis of such effects goes beyond the focus of the current policy analysis literature. In other contexts, however, the 'crowding-out effect' of government programmes has been extensively analysed. For example, the interaction between private transfers and public welfare programmes has attracted considerable attention among academic writers (Barro, 1974; Cox et al., 2004; Galuscak & Pavel, 2012; Lampman & Smeeding, 1983; Maitra & Ray, 2003; Roberts, 1984).

The objective of this chapter is to assess the impact of the current EU CAP on bank loans extended to the agricultural sector. First, we theoretically analyse how agricultural subsidies affect bank loans. Then, employing unique farm-level Farm Accountancy Data Network (FADN) panel data for the period 1995–2007, we empirically estimate the interaction between CAP subsidies and farm loans.

A better understanding of the dynamic interaction between CAP subsidies and credit market institutions can provide important insights for policy-making. One of the key priorities of the EU agricultural policy, as outlined in the European Commission's strategic document for the future Common Agricultural Policy, is to promote competitiveness and innovation, and to maintain viable rural communities. These policy objectives in the EU's CAP stem from increased international competition, higher uncertainty on global commodity markets, economic crisis, and structural problems persistent in rural EU areas (European Commission, 2010). Farmers' access to credit, especially during a financial crisis, plays a prominent role in achieving some of these policy objectives. For policy-makers, understanding the interaction between subsidies and credit markets is of upmost importance; whether the CAP stimulates or crowds out credit markets. It is well documented that the agricultural sector faces significant credit constraint problems, mainly due to the nature of production and the risk specific to agriculture that is present to a lesser extent in other sectors of the economy (Barry & Robison, 2001). Studies have shown that this is also the case in developed countries such as in the EU and the US (Blancard et al., 2006; Fałkowski et al., 2012; Färe et al., 1990; Lee & Chambers, 1986). Agricultural subsidies may improve farms' credit position and thus may partially address market imperfections.

2. The impact of decoupled subsidies on short-term bank loans

In this study, we use the theoretical framework of Feder (1985), Carter & Wiebe (1990) and Ciaian & Swinnen (2009) to analyse how subsidies affect short-term bank loans extended to farms. The theoretical framework relies on profit-maximising behaviour of farms with the possibility of constrained access to short-term credit (bank loans) used for financing variable inputs of farms.

An important issue for analysing bank loans is the timing of costs and revenues. In general, variable costs are incurred at the beginning of the production season when the farm has to pay for seeds, fertilizer and other variable inputs. Meanwhile, revenues are realised at the end of the season when output is sold. Because of the time lag between the payment for variable inputs and obtaining revenues from the sale of output, the farm has a demand for short-term credit. The demand for credit can be satisfied either internally (e.g. cash flow, savings or subsidy) or externally (e.g. bank loans or trade credit). The demand for credit might not be fully satisfied, which means that the farm can be credit constrained in the short run. Short-term credit constraint implies that the farm might be limited with respect to the use of variable inputs such as fertilizer, that is, the credit constraint may prevent the farm from using the optimal amount of variable inputs. We assume that variable inputs are financed exclusively through bank loans.

The expected impacts of decoupled subsidies on short-term bank loans are summarised in the following three hypotheses.

Hypothesis 1: *If farms are not credit constrained, (a) decoupled subsidies paid at the beginning of the season may reduce farms' bank loans, whereas (b) decoupled subsidies paid at the end of the season have no effect on bank loans.*

Subsidies may reduce bank loans if the opportunity cost of subsidies for the farm is lower than the cost of the loan and when subsidies are paid at the beginning of the production season. In such a case, farms will substitute the more expensive bank loan with a cheaper subsidy. The equilibrium variable input use is not affected by relatively small subsidies. Only if subsidies crowd out all bank loans, which occurs for sufficiently high subsidies, will the equilibrium variable input use increase.

If the subsidies are paid at the end of the season, they have no impact on the use of variable inputs. With perfect markets, farms can also obtain sufficient credit without subsides.

Hypothesis 2: *If farms are credit constrained and if decoupled subsidies are paid at the beginning of the season, (a) farms will use the same amount of loans with or without subsidies if subsidies are sufficiently small, whereas (b) farms reduce bank loans if subsidies are sufficiently large.*

If subsidies are paid at the beginning of the season, farms can use them directly to finance the purchase of variable inputs. With small subsidies, farms still remain credit constrained and the amount of bank loans remains unaffected. However, if the subsidies are sufficiently high, farms will reduce the amount of bank loans because some bank loans will be replaced by cheaper subsidies. Sufficiently high subsidies will also relax the credit constraint of the farm.

Hypothesis 3: *If farms are credit constrained and if decoupled subsidies are paid at the end of the season, farm bank loans increase.*

Farms may use the subsidy paid at the end of the season as collateral for obtaining a bank loan for the purchase of variable inputs at the beginning of the season. Sufficiently high subsidies can increase the collateral to the level that the farm becomes credit unconstrained.

3. Decoupled versus coupled subsidies and bank loans

The impact of coupled subsidies on bank loans relative to the impact of decoupled ones is ambiguous. Coupled subsidies lead to increased input prices and decreased output prices to a greater extent than decoupled subsidies. These leakages reduce the value of coupled subsidies relative to decoupled ones and, therefore, the possibility of subsidy use for credit is also reduced. Furthermore, coupled subsidies involve more risk as they are attached to the production of specific commodities and also require more monitoring on the side of banks to insure the farm has a production structure and levels that give rise to the payment of planned subsidy amounts at the end of the season. These features of coupled subsidies (leakages, higher risk and cost of monitoring) reduce bank loans relative to decoupled subsidies. On the other hand, coupled subsidies are paid at the end of the season after the production of subsidised commodities is realised, which means that they can be used as collateral for obtaining bank loans. Decoupled subsidies do not need to be paid at the end of the season as they are not linked to current and future production. This feature of coupled subsidies leads to increased bank loans. Overall, the impact of coupled subsidies relative to decoupled ones shown in Hypotheses 1-3 is therefore ambiguous.

4. Long-term loans and subsidies

The expectation of markets regarding a multi-annual flow of subsidies is important for long-term loans because such loans tend to be repaid by farms over period of longer than just one year. Market expectations about the continuation of CAP subsidies affect the ability of farmers to obtain long-term loans. If lenders perceive CAP subsidies as uncertain and subject to change, this may reduce their incentive to provide long-term loans collateralised by subsidies. Over its history, the CAP has been reformed several times. Some reforms involved the change of subsidy levels while others altered subsidy types (Kay, 2000; Pokrivcak et al., 2006; Swinnen, 2008). Changing subsidy levels affects the value of collateral for obtaining loans, which increases the risk for farmers and banks. On the other hand, altering the types of subsidy affects administration and monitoring costs for banks and increases the risk because different activities might be subsidised in the future from those that were in the past.

Furthermore, the value of long-term investment tends to be substantially larger than the annual value of subsidies, i.e. annual subsidies may not be sufficient to cover the full value of investment. Instead, expected future subsidies may be used indirectly to enhance the value of collateral for long-term loans. Following Hypotheses 1-3, subsidies increase long-term loans to a larger extent than they increase short-term loans. Since subsidies are not sufficiently high to be used for long-term investments, the potential crowding-out effect on long-term loans is reduced (Hypotheses 1 and 2). Therefore, subsidies might be used as collateral for long-term loans (Hypothesis 3).

In summary, the impact of subsidies on long-term loans relative to short-term loans shown in Hypotheses 1-3 is ambiguous. Due to the uncertainties associated with the future CAP, one may expect a lower impact of subsidies on long-term loans compared to short-run loans. On the other hand, due to the fact that the value of long-term investment tends to be substantially larger than the annual value of subsidies, the reverse may hold (i.e. long-term loans may be more stimulated by subsidies than short-term loans).

5. Econometric specification

Theoretically, the impact of decoupled subsidies on agricultural loans is ambiguous. The relationship between subsidies and bank loans is therefore an empirical question.

Following our theoretical analysis, the amount of farm loan depends on the farm's subsidy, profitability, and assets:

$$loan_{jt} = \beta_0 + b_j + \beta_s S_{jt} + \beta_a assets + \beta_\pi \Pi_{jt} + \beta_x X_{jt} + \varepsilon_{jt} \tag{1}$$

where subscripts j and t represent farm and time, respectively, $\beta_0, \beta_s, \beta_a, \beta_\pi, \beta_x$ are coefficients to be estimated, *loan* stands for farm bank loans, S_{jt} are subsidies received by farm, *assets* are farm assets, Π_{jt} is farm income and X_{jt} is a vector of observable covariates such as farm characteristics, regional, and time variables. Coefficient b_j is the fixed effect for farm j, which captures time-unvarying farm-specific characteristics. As usual, ε_{jt} is the residual term.

We are especially interested in estimating the parameter β_s, which measures the impact of subsidies on bank loans. A statistically significant negative value of the coefficient confirms either Hypothesis 1a or Hypothesis 2b. A statistically significant positive coefficient confirms Hypothesis 3. Finally, if the coefficient is statistically insignificant, then either Hypothesis 1b or 2a holds. However, a statistically insignificant coefficient may also imply that there is no relationship between subsidies and farm credit behaviour.

We expect that the data will confirm either Hypothesis 2 or 3 because there is overwhelming evidence that farms are credit constrained (Blancard et al., 2006; Carter, 1988; Färe et al., 1990; Lee & Chambers, 1986). Further, anecdotal evidence indicates that (at least a share of) subsidies are paid at the end of the season, which implies that Hypothesis 3 should hold.

The estimation of equation (1) is subject to the omitted variable bias and particularly to the endogeneity problem of CAP subsidies. We use panel data and estimate the fixed effects model which helps us to control for the unobserved heterogeneity component that remains fixed over time, thus reducing considerably the omitted variable bias problem. In order to control for endogeneity, we also estimate the generalised method of moment (GMM) model (Arellano & Bond, 1991).

6. Data and variable construction

The main source of the data used in the empirical analysis is the Farm Accountancy Data Network (FADN), which is compiled and maintained by the European Commission. The FADN is a European system of sample surveys that take place each year and collect structural and accountancy data on farms. The FADN data is a panel dataset. In this study, we use panel data for 1995-2007 covering all EU member states except Romania and Bulgaria.

7. Results and conclusions

The empirical estimates are reported in Tables 25.1-25.3 and the main findings are summarised in Table 25.4. They suggest the following impacts of subsidies on farm loan use: (i) Subsidies influence farm loans and the effects tend to be non-linear and heterogeneous among farms. (ii) Large farms tend to use subsidies to increase long-term loans, whereas small farms use subsidies to increase short-term loans. A crowding-out effect may occur in the reverse situation – subsidies tend to reduce short-term loans for large farms and long-term loans for small farms. (iii) Coupled subsidies tend to affect loans differently from decoupled subsidies. Both coupled and decoupled subsidies may reduce long-term loans to small farms (crowding-out effect), whereas they may stimulate long-term loans to large farms. Short-term loans are affected only by decoupled subsidies. They increase the short-term loans of small farms more than those of large farms. For large farms, the effect of decoupled subsidies may even result in a crowding-out effect. (iv) When controlling for endogeneity, the crowding-out effect tends to be reduced in favour of a positive effect of subsidies on loans. (v) In general, our empirical results indicate that Hypothesis 3 (positive impact) may hold although the crowding-out effect cannot be completely excluded.

Our results suggest that the impact of the EU's CAP on agricultural credit markets is complex and varies by credit type and size of farm as well as by type of subsidy. Overall, our estimates indicate that CAP subsidies offset the credit tightening accompanying the financial crisis and, in a time of increasing global market volatility, they stabilise agricultural production by correcting credit market imperfections. However, one should be careful in drawing general policy implications from this, since a complete analysis should include the deadweight cost of taxation as well as the comparison of agricultural subsidies with other policy instruments that address the credit market imperfections directly.

A second important finding of this study is that we cannot completely exclude the crowding-out effect of agricultural subsidies on bank loans. The crowding out tends to be stronger for small farms and for short-term loans. Therefore, different policy measures have varying impacts depending on the structure of farms and the type of financial instruments used. Based on these results, agricultural policies can be better targeted. Subsidies can be designed in such a way that the crowding-out effect is reduced to minimum and only credit-constrained farms are supported. This would result in a more efficient use of public money.

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Table 25.1 Fixed effects estimates for bank loans (total subsidies)

	Total loans			*Long-term loans*			*Short-term loans*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Total subsidies per ha	0.0656	-0.995**	-1.075***	0.0762	-1.943***	-1.662***	0.00813	-0.142	-0.142
Total subsidies per ha squared			0.000143**			0.000164**			-7.02e-07
Total subsidies * Farm size		0.142*	0.0967		0.255**	0.158**		0.0204	0.0206
Observations	237372	237372	237372	195496	195496	195496	206108	206108	206108
R-squared	0.489	0.489	0.490	0.484	0.484	0.485	0.106	0.106	0.106
Number of individual farms	60904	60904	60904	51360	51360	51360	54382	54382	54382

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: coefficients for the rest of explanatory variables are not reported but are included in the estimated equations.

Table 25.2 Fixed effects estimates for bank loans (disaggregated subsidies)

	Total loans			*Long-term loans*			*Short-term loans*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Decoupled subsidies per ha	-0.0325	-2.712***	-2.182**	0.131	-6.451***	-5.383***	-0.164***	1.120***	1.183***
Decoupled subsidies per ha squared			-0.000383			-0.000878*			-8.10e-05
Decoupled subsidies per ha * Farm size		0.339**	0.260		0.801***	0.676***		-0.153***	-0.155***
Coupled subsidies per ha	0.0696	-0.945**	-1.046***	0.0740	-1.731**	-1.450***	0.0139	-0.196	-0.198
Coupled subsidies per ha squared			0.000142**			0.000162**			-2.63e-06
Coupled subsidies per ha * Farm size		0.136*	0.0960		0.229**	0.136**		0.0282	0.0297
Observations	237372	237372	237372	195496	195496	195496	206108	206108	206108
R-squared	0.489	0.489	0.490	0.484	0.484	0.485	0.106	0.107	0.107
Number of individual farms	60904	60904	60904	51360	51360	51360	54382	54382	54382

*** p<0.01, ** p<0.05, * p<0.1

Note: coefficients for the rest of explanatory variables are not reported but are included in the estimated equations.

Table 25.3 Arellano and Bond estimates for bank loans (disaggregated subsidies)

	Long-term loans			*Short-term loans*		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Decoupled subsidies per ha	2.434***	-4.792	0.294	0.328	-0.677	-0.415
Coupled subsidies per ha	2.471***	-1.644	-0.214	0.279	-0.101	-0.189
Decoupled subsidies per ha * Farm size		0.861**			0.118	
Coupled subsidies per ha * Farm size		0.482			0.0449	
Decoupled subsidies per ha squared			-0.000630			0.000792
Coupled subsidies per ha squared			0.000317***			0.000185***
Observations	92328	92328	92328	95448	95448	95448
Number of individual farms	26792	26792	26792	28380	28380	28380

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: coefficients for the rest of explanatory variables are not reported but are included in the estimated equations.

Table 25.4 Summary of empirical results: impact of subsidies on bank loans

	Fixed effect estimates		GMM estimates	
	Long-term	Short-term	Long-term	Short-term
Decoupled subsidies				
Small farms	Negative	Positive	Positive	Zero
Large farms	Positive	Negative	Positive	Zero
Coupled subsidies				
Small farms	Negative	Zero	Non-linear positive	Non-linear positive
Large farms	Positive	Zero		

PART IV
FACTOR MARKETS AND PRODUCTIVITY

26. FACTOR MARKETS IN APPLIED CGE MODELS

MARTIN BANSE, ANDREA ROTHE AND LINDSAY SHUTES[*]

This chapter gives an overview of the implementation of factor markets in computable general equilibrium (CGE) models. Given the heavy data requirements needed, many global CGE models use the Global Trade Analysis Project (GTAP) database and are descendants of the GTAP global CGE model (see Hertel, 1997). Therefore the implementation of labour, land and capital markets in GTAP is briefly described here as a starting point for further developments of factor market modelling in the CGE model MAGNET, which uses the GTAP database. A description of the MAGNET model and extensions to the modelling of factor markets are components of other chapters in this volume. This chapter is based on publications by Dervis et al. (1982), Lofgren et al. (2002) and Burfisher (2011), which provide a comprehensive description of the structure of a standard CGE and factor market modelling.

1. The circular flow in the economy

A CGE model is a system of equations that describes the whole economy and the interactions between markets and institutions. A conceptual starting point for understanding CGE models and the integration of factor markets within them is an understanding of the circular flow in the economy. The circular flow represents the flow of goods and services in one direction through an economy and the flow of funds in the other, i.e.

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[*] This chapter is based on Banse, Shutes, Dixon, van Meijl, Rimmer, Tabeau, Woltjer & Rothe, "Factor Markets in General Computable Equilibrium Models", Factor Markets Working Paper No. 47, May 2013.

the payment for the goods and services, where services also include factors services (Hertel & Tsigas, 2000).

In an economy, industries are responsible for the production of goods and services. In the product markets, the industries sell intermediate goods and services to other industries and goods for final consumption to institutions. Institutions comprise households, corporations and the government. Final goods can be used during the accounting period, or can be accumulated as stocks for future use. Production, consumption, accumulation and distribution are the basic forms of economic activity in a closed economy. In an open economy, imports and exports are also considered. Transactions can take place with the rest of the world through product and factor markets. In the case of products, these transactions include imports and exports. Factor markets are represented through institutions, which sell factor services to industries, which act as purchasers. Factor services typically include labour, capital and land. Payments to labour, capital and land constitute salaries and wages, returns to capital and returns to land, respectively.

2. Factor markets in the database

One central element of a CGE model is the database. The GTAP database records the annual flows of goods and services for the whole world in a defined year. It contains bilateral trade, transport and protection data. It shows all the economic activities among regions and individual national input-output data. The GTAP database is updated regularly; Version 8 is currently available. It contains 57 commodities and 129 regions. The different factor markets are recorded as skilled and unskilled labour, capital and natural resources (Narayanan et al., 2012).

3. The model and behavioural assumptions of factor market modelling

While the database only provides all transactions of the agents of an economy that have taken place, a CGE model includes all the payments recorded in the database. The model itself consists of a set of simultaneous equations, of which many are non-linear. The equations also include constraints that can cover markets or macroeconomic aggregates. The behavioral relationships of the model determine how the agents will react to exogenous changes in the parameters of the model.

Factor markets in GTAP are characterised through the following behavioural assumptions. Producers maximise profits using technology characterised by nested production functions, which combine constant elasticity of substitution (CES) and Leontief production functions. As part of the profit maximisation, each producer uses a set of factors, depending on the industry structure and the factor price. The producer will increase the factor input up to the point at which the marginal revenue product of each factor is equal to its wage. This is also called factor price or rent. Factor wages can be different between producers because of segmented markets or factor mobility.

Factors of production are divided into two groups. The first group includes the mobile factors, which are perfectly mobile across industries in each region. The second group contents the sluggish factors, which are imperfectly mobile or immobile. In the GTAP standard database, labour and capital are mobile, while land and natural resources are declared as sluggish factors.

Factor markets can also be modelled through alternative factor market closures. With these closures a modeller can decide which variables are exogenous or endogenous. Relevant variables for factor market modelling are the demand and supply of factors or economy-wide and specific factor prices to model full employment or unemployment of factors, industry-specific factor markets or factor mobility (Lofgren et al., 2002).

The way labour, capital and land are implemented in the GTAP standard database is described below.

3.1 Labour

Labour is classified as a mobile factor in the standard GTAP model. As such, labour is free to move between sectors in a country or region in response to changes in relative prices, which leads to an equalisation of the increase or decrease in the wage rate across all sectors. Two types of labour are included in the standard GTAP model: skilled labour and unskilled labour. Each type of labour has its own wage rate determined by the interaction of the supply of labour (usually exogenous) and the demand for labour as a factor of production. Skilled and unskilled labour are substitutable both for the other type of labour and the other factors of production, capital and natural resources, in the formation of the value-added composite which, in turn, is substitutable with composite (domestic and imported) intermediate goods in the production of the output of each sector.

3.2 *Capital*

In the standard GTAP model, capital can move between industries within a region, but not between regions. The capital flow is immobile in the short run and mobile in the long run. In the standard GTAP-model, investors are represented by a single agent – the global bank. The global bank receives savings from the households and invests these savings. Investments are represented by the purchase of a commodity named capital goods. Capital goods are not tradable. Because GTAP is a comparative static model, savings are incorporated as a fixed share of the representative households' utility function. All income is split between private household consumption, government consumption and savings. At the global level, investments and savings are equal. Because there is no mechanism from capital markets to savings, the amount of investments is the sum of savings in each region. Time preferences for investments or influences on the decision of saving levels are not captured.

3.3 *Land*

The standard assumption of land markets in the GTAP database is one of sluggish, sector-specific land. Land, together with the 'natural resources' factor, which is also included in the database, is assumed to be imperfectly mobile across alternative uses. The agricultural sectors are the only land-using sectors in the database.[66] With the assumption of land as sluggish, land prices differ across the land-using sectors in agriculture. As with the standard presentation of land and capital, land use is presented in value terms in the GTAP database as a part of sectoral value added. Land use presented in physical units is not modelled in the standard version of GTAP.

4. Summary

There are different ways to model specific factor markets characteristics in a CGE model. Important factor market concepts in CGE models are factor mobility assumptions, factor endowment and productivity growth, complementary and substitution of factors, and also the model closures like full-employment versus unemployment of factors. But factors supply, the structure of the industry and the relations between industry structure and

[66] Land use in forestry is covered under the factor 'natural resource'.

factor prices are also important in analysing the impact of changes in factor markets on the economy (Burfisher, 2011).

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27. FACTOR MARKET IMPERFECTIONS AND PRODUCTIVITY IN EU AGRICULTURE

MARTIN PETRICK AND MATHIAS KLOSS[*]

This chapter examines the drivers of productivity in EU agriculture from a factor markets perspective. Based on a farm model with a constrained factor market, the authors present estimates of production elasticities and shadow prices of factors for a set of eight EU member states. They focus on field crop farms represented in the FADN database for the years 2002-08. As it turns out that output reacts most elastically to materials input, they investigate this factor further and find different rationing regimes represented in different member states. Marginal return on materials is low in Denmark and West Germany, but significantly above typical market interest rates in East Germany, Italy and Spain. In the latter countries and in Denmark, it also increased towards the end of the observed period. This finding is consistent with a perception of tightening funding access, possibly induced or reinforced by the unfolding financial crisis. Marginal returns to land, labour and fixed capital are generally low. We conclude that the functioning of factor markets plays a crucial role for productivity growth, but that factor market operations display considerable heterogeneity across EU member states.

1. Introduction

In recent years, exploding food prices on world markets have conspicuously signalled that global resources for agricultural production are indeed scarce (FAO, 2009). How farm productivity could be raised has recaptured the attention of the global media (e.g. Parker, 2011) and food

[*] The authors are grateful to comments made by participants of the June 2013 IATRC symposium in Seville.

This chapter is based on Petrick & Kloss, "Synthesis Report on the Impact of Capital Use", Factor Markets Working Paper No. 57, August 2013.

riots have been reported in several developing countries. Compared to other world regions, agricultural productivity growth has been stagnating in Europe and especially the EU (Coelli & Rao, 2005; Piesse & Thirtle, 2010). In this contribution, we take on a factor market perspective on productivity and structural change and ask: Which factors are the bottlenecks for productivity growth? What does micro-data tell us about the efficiency of factor markets in EU agriculture?

In order to tackle these questions we empirically estimated production elasticities and shadow prices of factors, based on individual farm data from eight EU member states. As detailed in Petrick & Kloss (2013a), we incorporate recent innovations in the estimation of production functions. We focus on field crop farms represented in the FADN database for the years 2002-08. Our empirical estimates suggest that the output elasticity of materials is quite high, above 0.6, while labour, land and fixed capital display much lower output elasticities (Petrick & Kloss, 2013a; 2013b). The assumption of constant returns to scale is widely supported empirically. The shadow price analysis reveals considerable heterogeneity across EU countries. In France, Spain, Italy and East Germany, we observe marginal returns on materials much above typical market interest rates, especially towards the end of the observed period. This is consistent with a perception of constrained access to funding, possibly induced by the unfolding financial crisis (Petrick & Kloss, 2013c). For Denmark, West Germany and Poland, returns on materials are low, which suggests an over-utilisation of inputs. In general, the remuneration of labour, land, and fixed capital is quite low, except for in Denmark.

In Section 2, we present a conceptual framework as a motivation for the further analysis. Section 3 describes the dataset. Section 4 presents the empirical results. Section 5 concludes.

2. Factor allocation under a generalised input constraint

A simple model of farm production that is subject to a generalised input constraint can usefully illustrate our factor market perspective on agricultural productivity. Assume a farmer maximises profit by producing one output with one input. Profit is then defined as revenue minus the costs of the input:

$$\max_x \pi = f(x) - px, \text{ subject to} \tag{1}$$

$$\bar{x} - x \geq 0, \tag{2}$$

where π is profit, f the production function, x input use, p the input price observed in the market and $\bar{x}$ the generalised input constraint. This input constraint captures the general observation that most agricultural production factors cannot be adjusted instantaneously but are rather subject to more or less pronounced adjustment costs. For example, land is often available in limited quantities only and subject to long-term rental agreements. Agricultural credit markets suffer from informational asymmetries and may be characterised by rationing and high transaction costs (see, for example, Benjamin & Phimister, 2002; Petrick & Latruffe, 2006; Curtiss, 2012).

We assume that f is monotonically increasing and concave in x. Solving this optimisation problem through the Lagrangean L yields $L = f(x) - px + \lambda(\bar{x} - x)$, where λ is the Lagrange multiplier. Assuming that (2) is binding, we obtain the first-order condition $\frac{\partial L}{\partial x} = \frac{\partial f}{\partial x} - (p + \lambda) = 0$. Rearranging leads to

$$\frac{\partial f}{\partial x} = p^* > p, \text{ with } p^* \equiv p + \lambda. \tag{3}$$

We define p^* as the shadow price of the production factor on the farm; it represents the willingness to pay for it. With a more severe input constraint, the decision price for input use is increasing and use of that factor is reduced.

The above model serves as a useful motivation for the empirical measurement of factor productivity and factor market imperfections in agriculture. The practical implementation involves the use of an estimate of the shadow price to study drivers and impacts of factor use. It requires a consistent estimate of the production function as well as reliable data on input use and factor prices. The empirical relation $p^* > p$ is a measure of on-farm input productivity and the severity of supply rationing.

By similar reasoning, a release constraint could be also modelled. $p^* < p$ would then be evidence of a resource over-utilisation. This may, for example, be due to non-pecuniary benefits of input use (e.g. tractors as prestige objects) or the wish to provide safeguards against production risk (use of insurance contracts, precautionary investment in powerful machinery to mitigate production peaks; Witzke, 1993, p. 157). Aurbacher et al. (2011) have recently shown that farmers trapped in small agricultural structures may be unable to coordinate on machinery sharing and thus may hold inefficiently high stocks of machinery. Furthermore, agriculture in Europe is typically organised in family farms on which labour is often highly immobile (Tocco et al., 2012) and may be influenced significantly by life-cycle considerations of the farm family (Glauben et al., 2009).

3. Data

In this study, we employ data from the EU's Farm Accountancy Data Network (FADN). We only use field crop farms (TF1), to justify the assumption of a homogenous state of technology across farms. We show separate results for the following countries:

- Denmark (DK)
- France (FR)
- Germany East (DEE)
- Germany West (DEW)
- Italy (IT)
- Poland (PL)
- Slovakia (SK)
- Spain (ES)
- United Kingdom (UK)

For every country and sector in the study, we created a panel data set covering the years from 2001 to 2008. For Poland and Slovakia, we use only data for 2006–08 for the estimation, although shadow prices are also computed for 2005.[67] A small number of duplicates in the data were dropped. In total, 27,639 observations were included in the EU-wide sample. Table 27.1 summarises the variable definitions and gives the actual FADN codes.

Table 27.1 Selection of variables

FADN code	Variable description
Outputs	
SE131	Total output (EUR)
Inputs	
SE011	Labour input (hours)
SE025	Total utilised agricultural area (ha) = land
SE275	Total intermediate consumption (EUR) = materials
L.SE450 + L.SE455	Opening valuation of machinery and buildings (EUR) = fixed capital

Note: L. denotes the one-year lag.

Source: Authors, FADN data.

[67] This was done to maintain data consistency with the dynamic panel data models analysed in Petrick & Kloss (2013a).

All monetary values are deflated to real values in 2005 prices using price indices by Eurostat. Output was deflated by the agricultural output price index. Fixed capital and investment were deflated by the agricultural input price index for goods and services contributing to agricultural investment, and materials by the agricultural input price index for goods and services currently consumed in agriculture.

Outliers were identified on the basis of the fixed capital productivity per farm: real SE131/(real (L.SE450 + L.SE455)). Observations were dropped for the production function estimation if their value was beyond the median ± 1.5 the interquartile range (IQR). Furthermore, we only included farms which had some minimum panel representation in the data. Farms had to be present in the data for at least four consecutive years, for Poland and Slovakia for at least three consecutive years. Descriptive statistics including the data patterns of the panels are given in Petrick & Kloss (2013a; 2013b).

4. Results

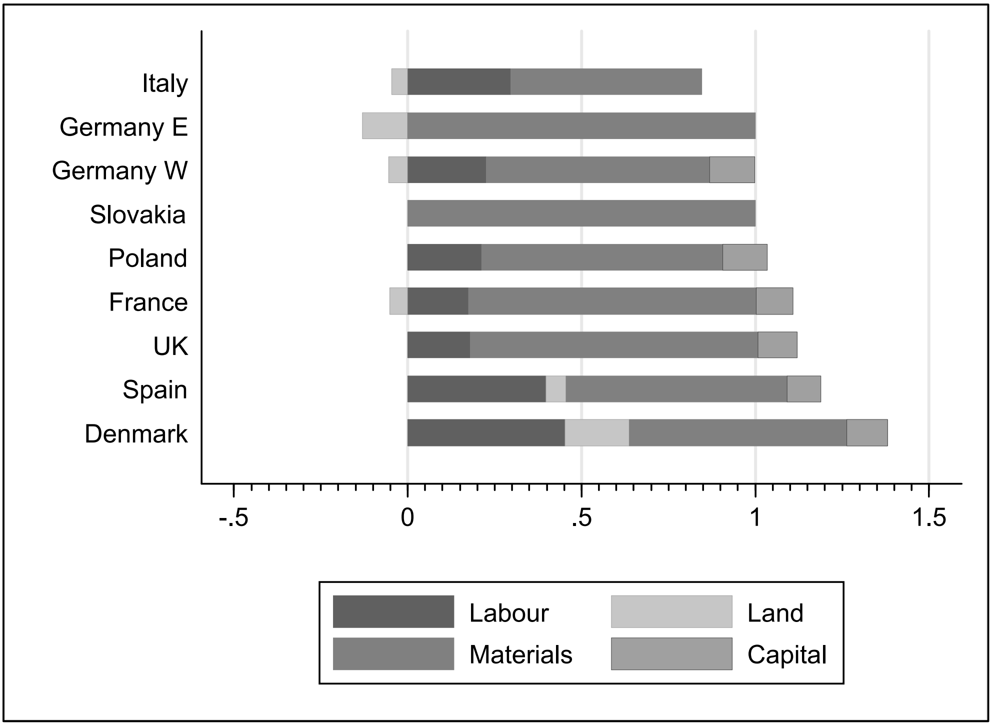
For the present study, we estimated five models per country (Petrick & Kloss, 2013a, b): OLS Cobb-Douglas, OLS 'within', Translog Cobb-Douglas, Translog 'within', and a Cobb-Douglas estimator taken from Levinsohn & Petrin (2003). Generally, the aim was to detect systematic differences across estimators and countries, and to assess their practical implementation. Detailed results tables are presented in the accompanying working papers, which include detailed tables for each country containing the results for the five models. All estimations were performed with Stata 12. For the Levinsohn-Petrin estimators we employed the user-written routine levpet (Petrin et al., 2004).

The 'within' Translog was obtained by interacting the groupwise demeaned logs of factors and using an appropriate degree of freedom correction. Other than by simply calling a panel estimation command with the interacted variables in logs, this procedure ensures that levels are effectively eliminated from the regression. Our estimates displayed remarkably uniform features across countries. The OLS Translog produced unreasonable results throughout, e.g. reflected in the coexistence of negative production elasticities for some factors and elasticities bigger than one for others (at sample means). The 'within' Translog elasticities, on the other hand, were typically close to the 'within' Cobb-Douglas at sample means, and the interaction terms of the Translog were often not jointly different from zero.

4.1 Comparison of estimators

As a general tendency, factor elasticities were found to be low for labour, land and capital, and high for materials (Figure 27.1). Estimates for the first three of these factors are in the range of 0.2 and lower, sometimes not significantly different from zero or even significantly negative. The production elasticity of materials ranges from 0.55 to 1.0 (Figure 27.2).

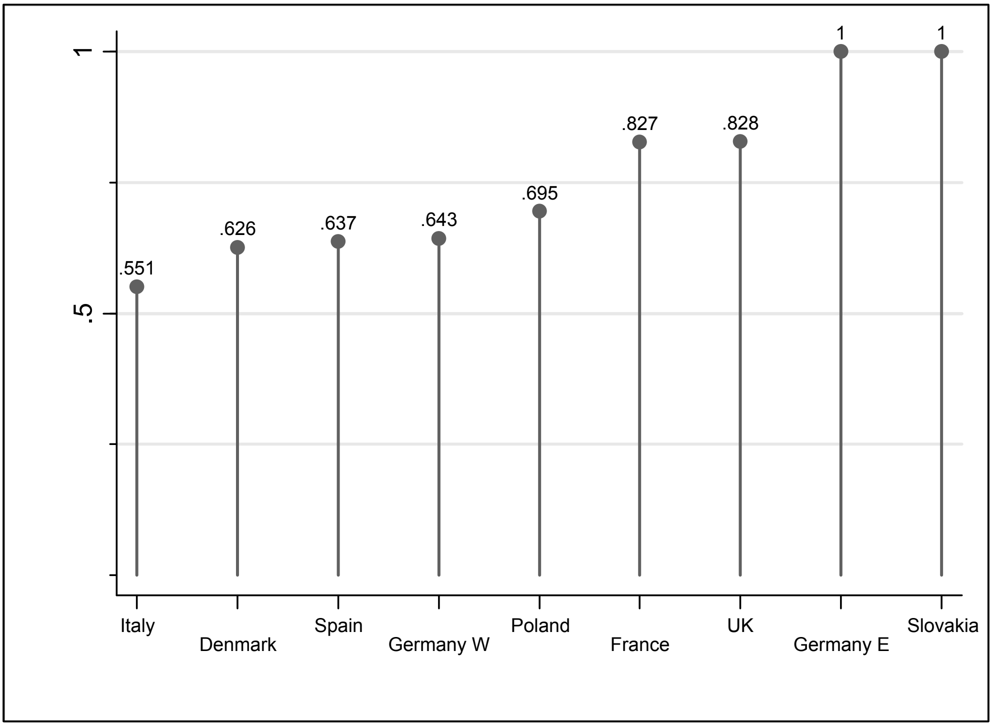
Figure 27.1 Cobb-Douglas production elasticities in comparison



Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.

Source: Authors.

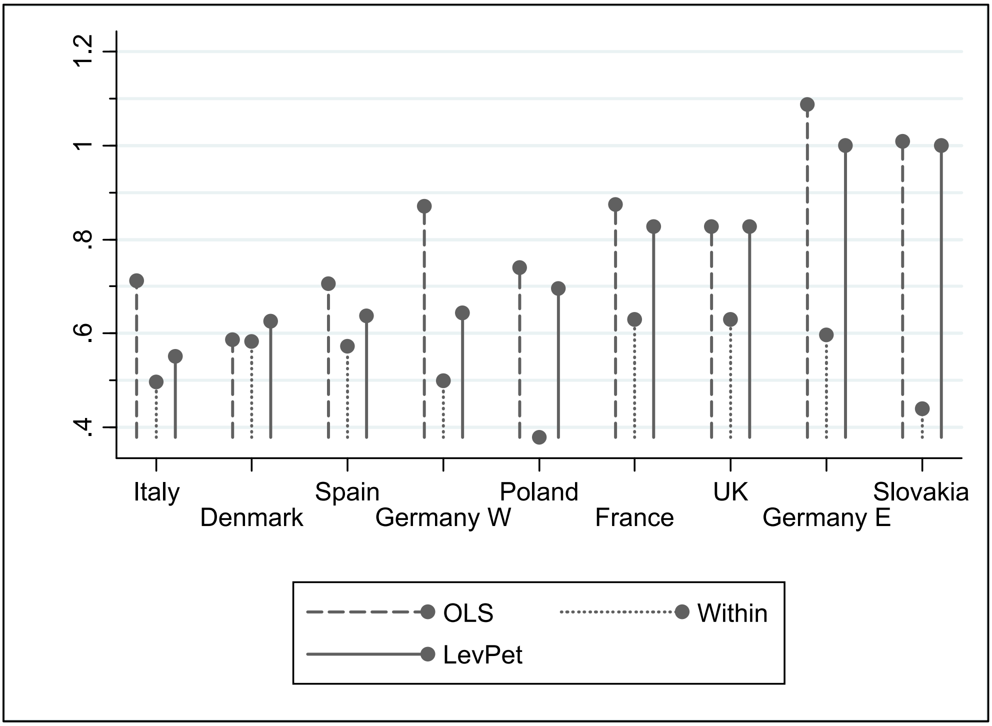
Figure 27.2 Elasticities of materials per country



Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.
Source: Authors.

Since output reacts most elastically to materials, we analysed the bias to this estimate introduced by the choice of estimator. As noted in the literature (Petrick & Kloss, 2013a), OLS estimates of the output elasticity tend to be upward and 'within' downward biased for particularly variable factors. They may thus be considered as an upper and lower boundary for the true value. Figure 27.3 indicates that indeed the Levinsohn-Petrin estimator commonly produces elasticities of materials which are just between OLS and 'within'. The two exceptions are Denmark and the UK. For the UK, the OLS elasticity exceeds the Levinsohn-Petrin elasticity by just 0.01. This result supports the view that the Levinsohn-Petrin estimator may be taken as a plausible alternative to the received estimators.

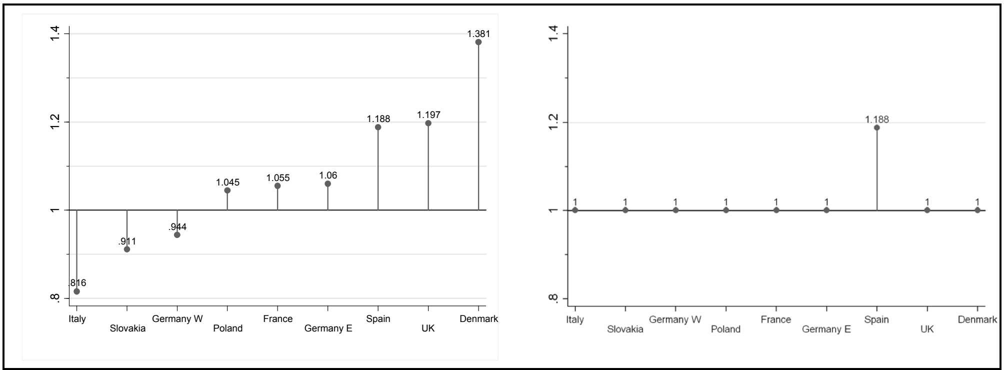
Figure 27.3 Elasticity of materials: comparison of estimators



Source: Authors.

Point estimates for the elasticity of scale (i.e. the sum of the four output elasticities) fluctuate around 1.0, with higher values for Denmark and the UK (Figure 27.4, left panel). However, statistically, only Spain differs significantly from one at the 5 per cent level (Figure 27.4, right panel). Given the previous findings on production elasticities, OLS estimates of scale elasticities tend to be higher than 1.0 while 'within' elasticities tend to be lower. Overall, the scale elasticity in European crop farming appears to be close to one.

Figure 27.4 Returns to scale per country



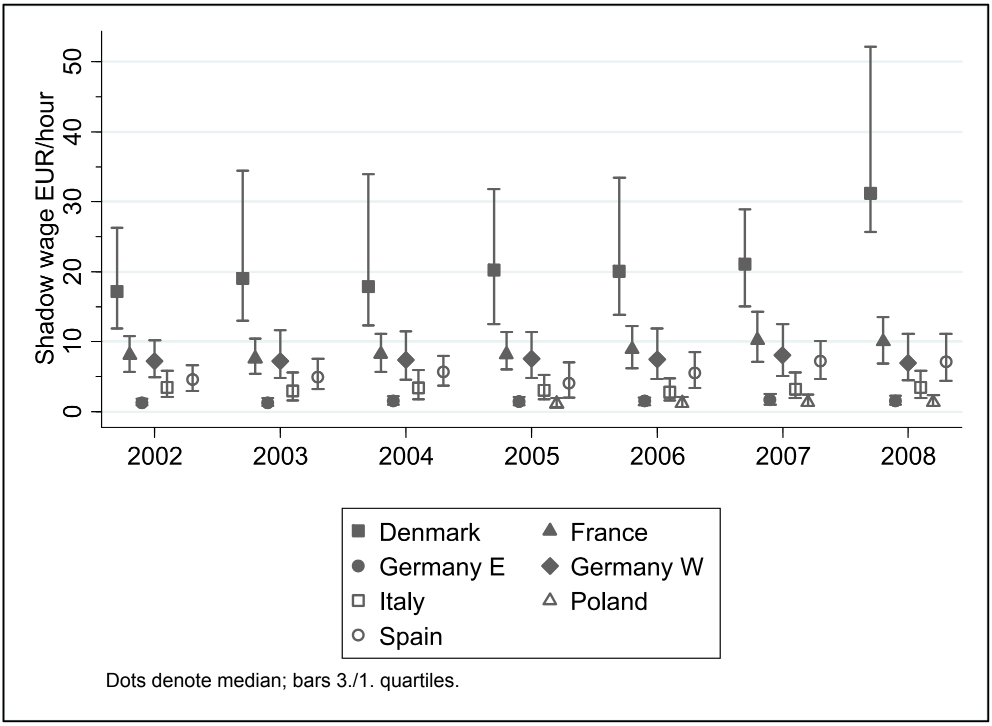
Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator. Left: Point estimates. Right: Not significantly different from 1 displayed as 1.

Source: Authors.

4.2 Distribution of shadow prices

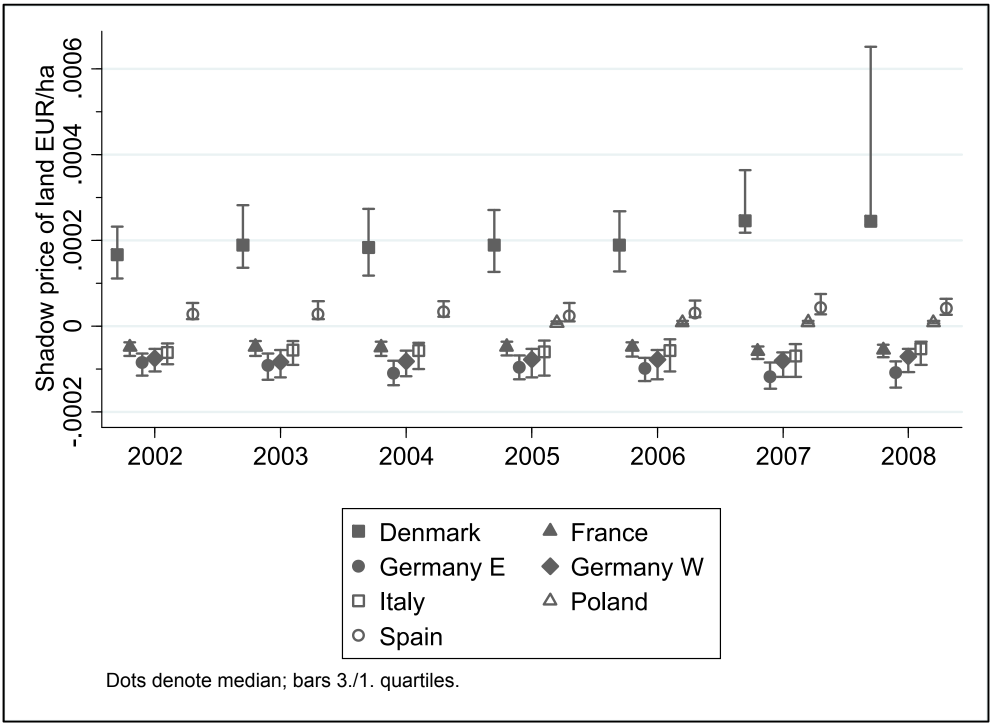
To ease the economic interpretation of the findings, we computed farm-individual shadow prices for all farms used in the estimations. To this end, we multiplied the production elasticities obtained from the Levinsohn-Petrin estimator with the farm-specific average factor productivities. For the two capital variables, net returns equal to the marginal value product minus one were calculated, so that they can be compared with market interest rates for credit (see our theoretical model above and Petrick & Kloss, 2012). The distribution of the shadow prices for the four factors and seven particularly interesting subsamples is illustrated in Figures 27.5–27.8 by using plots displaying the median, first and third quartile of the distribution.

Figure 27.5 Distribution of shadow wages per country and year



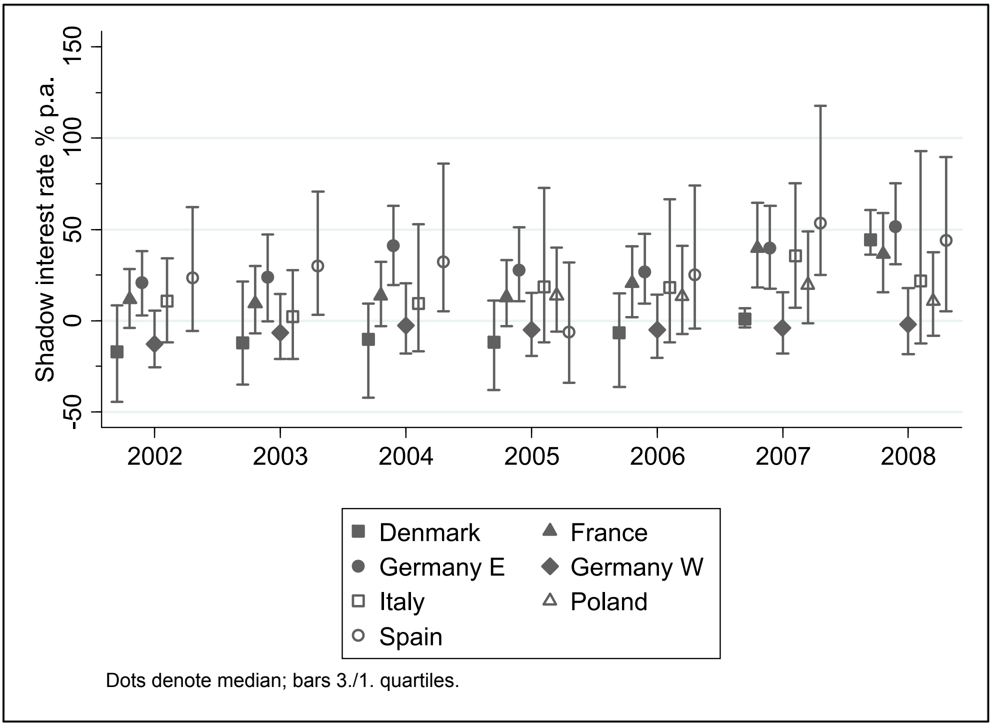
Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.
Source: Authors.

Figure 27.6 Distribution of shadow land rents per country and year



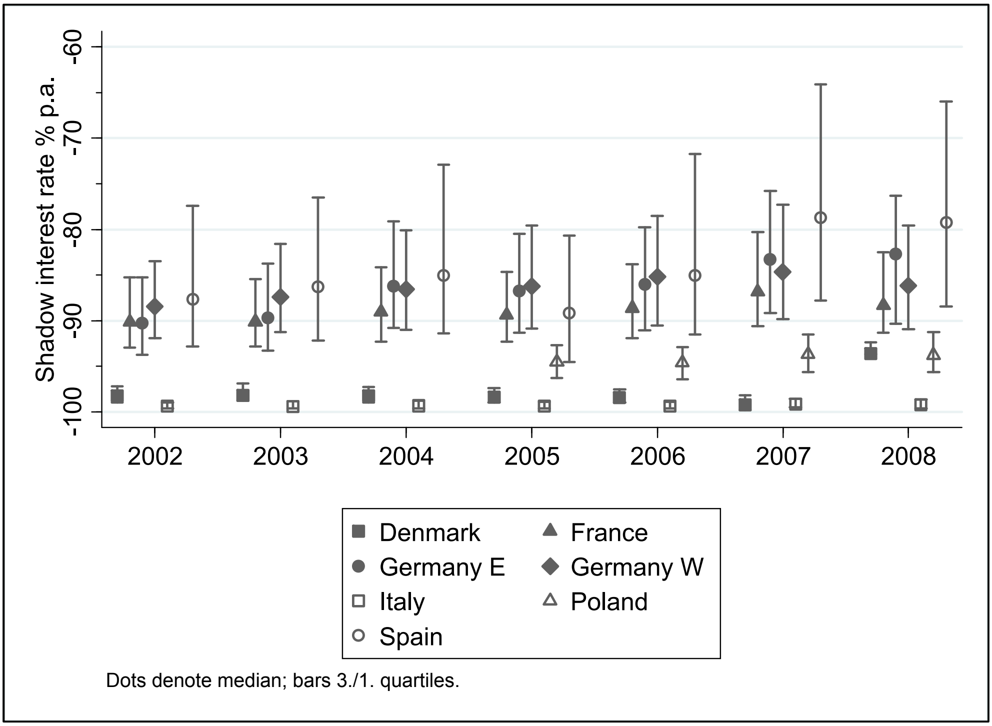
Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.
Source: Authors.

Figure 27.7 Distribution of shadow interest rates of materials per country and year



Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.
Source: Authors.

Figure 27.8 Distribution of shadow interest rates of capital per country and year



Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.
Source: Authors.

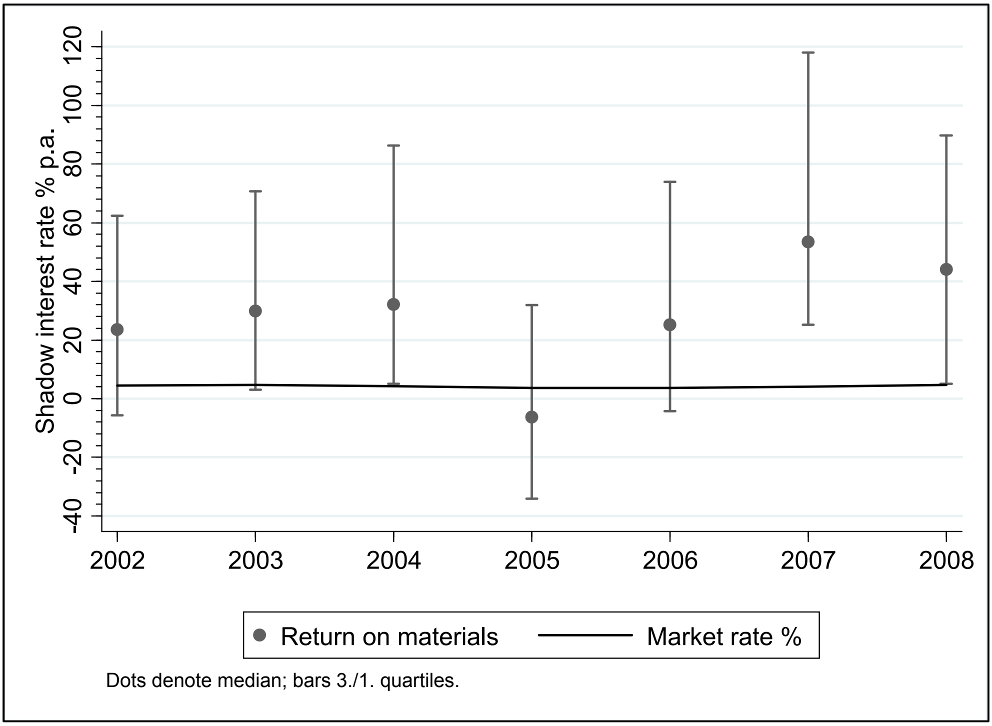
The findings from the plots are not too surprising given the results presented in the previous section. The shadow prices of three of the factors – labour, land and fixed capital – tend to be quite low. The median shadow wage in agriculture is below 9 euros per hour in France and West Germany throughout the years; in Italy and Spain it is below 5 euros per hour for most of the period. East Germany and Poland even exhibit values below 2 euros per hour. Denmark stands out with a value fluctuating at around 20 euros per hour. Shadow land rents are only minimally different from zero throughout. Shadow prices of fixed capital are negative in all subsamples, with medians per country and year in the range of -85 to -100%. Furthermore, there is considerable variation for some of the subsamples.

The distributional plots on the marginal return to materials deserve a closer look (Figure 27.7). As materials use is variable on a short-term basis, it reacts quickly to fluctuations in the economic environment. In the observed study period, the financial crisis was epitomised by the emerging US subprime crisis in 2007 and the collapse of the investment bank Lehman

Brothers in 2008. The shock waves of the crisis hurt the various EU member states quite differently, and there is little analysis available so far of how they affected access to working capital in agriculture. Indeed, both the cross-country as well as the dynamic variation reveals interesting patterns in this regard. Across countries, West Germany is the only region where the median farm exhibited negative marginal returns on working capital throughout the entire period. This is consistent with an excess capital use and the absence of funding constraints, and possibly reflects the strong position of the German agricultural banking sector during the crisis. A similarly strong banking sector based on a mortgage banking model is present in Denmark, where farms also displayed negative shadow prices for materials until 2006. However, Danish farms are typically leveraged much higher than their European counterparts (Petrick & Kloss, 2013c). Danish farms were thus hit harder by the emerging financial crisis, consistent with notably rising shadow rates for the years 2007 and 2008 in Figure 27.7. At the other end of the spectrum, farms in Spain and East Germany show high shadow rates on working capital, with an upward tendency over the observed period. Also, many Italian farms are in the range above 50% interest. Spain and Italy are countries with very low leverage in the agricultural sector, but also with banks suffering from the crisis. Farms may thus have been forced to reduce their use of working capital, particularly after the onset of the crisis. East German agriculture is dominated by corporate farms which are often based on rented land. Capital access is less easy to obtain for them than for West German family farms, and may have become more difficult to obtain during the crisis. France and Poland are somewhere in the middle of the field.

Figure 27.9 plots the marginal return on working capital against the average market interest rate for Spain over the observed period, calculated as the annual interest payments in percentage of outstanding loans. In the two crisis years 2007 and 2008, the shadow price is notably higher than the market rate. This finding supports the view that quantity rationing on the credit market was prevalent in these years.

Figure 27.9 Spanish field crop farms: marginal return on materials vs. market interest rate

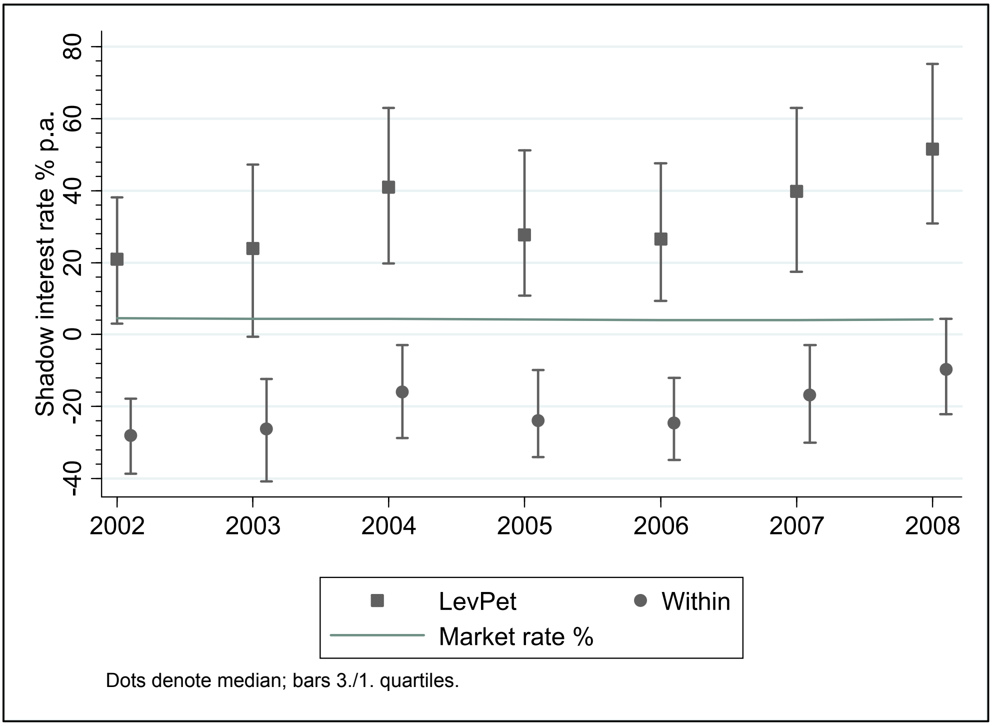


Notes: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator. 'Market rate' is ratio of annual interest payments to all outstanding loans.

Source: Authors.

We conclude this section with another comparison of estimators. Figure 27.10 plots marginal returns on working capital based on the 'within' and Levinsohn-Petrin estimators against the average market interest rate as defined before. The figure indicates that the choice of estimator can lead to completely opposite conclusions: whereas the Levinsohn-Petrin estimator suggests quantity rationing throughout, the supposedly downward biased 'within' estimator is consistent with smooth capital access over the entire period.

Figure 27.10 Comparison of estimators: East German field crop farms – marginal return on materials



Note: Results for field crop farms in EU countries based on Levinsohn-Petrin estimator.

Source: Authors.

5. Conclusions

The aim of this study was to examine the drivers of productivity in EU agriculture from a factor markets perspective. We provide results for OLS Cobb-Douglas and Translog, 'within' Cobb-Douglas and Translog, as well as Levinsohn-Petrin Cobb-Douglas models. Each model was estimated separately for panels of field crop farms in Denmark, France, East and West Germany, Italy, Poland, Slovakia, Spain and the United Kingdom. We also provide shadow price calculations for all four factors per country, based on the Levinsohn-Petrin estimates. From the applied perspective, OLS and 'within' display the biases expected from the literature. OLS typically overestimated the materials coefficient, while 'within' underestimated it. Extending the received Cobb-Douglas specification to a Translog generally did not generate illuminating insights. Either the results were obviously implausible or little different from Cobb-Douglas. Levinsohn-Petrin produced more plausible results and may be taken as an easy-to-implement alternative to the received estimators. However, given the conceptual problems in identifying the supposedly flexible inputs labour and land, which the other estimators share, this is still only a second-best choice (for details, see Petrick & Kloss, 2013a). Additional information, such as that coming from the direct elicitation of input supply constraints, may be used in the future to solve this remaining identification problem.

Our estimates show a consistent picture of very low production elasticities for labour, land and fixed capital, whereas the elasticity of materials is above 0.6 for most of the countries. As a consequence, shadow prices for the three fixed factors are also very low. The median shadow wage in agriculture is below €9 per hour in France and West Germany throughout the years; in Italy and Spain it is below €5 per hour for most of the period. East Germany and Poland even exhibit values below €2 hour. Shadow land rents are typically close to zero. The net return on fixed capital is in the range of -85 to -100%. This finding suggests an excess utilisation of fixed production factors in EU agriculture. Further outflow of factors may be necessary to bring returns up to factor remuneration in other sectors.

The Levinsohn-Petrin estimates used to calculate these figures shed a different light on the shadow price of working capital (materials). The findings suggest that credit rationing is an issue for agricultural finance markets in the EU, particularly with regard to short-term lending in East Germany, Italy, and Spain after the onset of the financial crisis in 2007. In other words, improving the availability of working capital is the most promising way to increase agricultural productivity, whereas land, labour and fixed capital are not among the bottleneck factors of EU arable farming. We conclude that the functioning of factor markets plays a crucial role for productivity growth, but that factor market operations display considerable heterogeneity across EU member states.

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28. THE IMPACT OF CAP REFORM ON THE PRODUCTIVITY OF EU FARMS

*MARIAN RIZOV, JAN POKRIVCAK AND PAVEL CIAIAN**

This chapter investigates the impact of subsidies from the Common Agricultural Policy on the total factor productivity of farms in the EU. The authors employ a structural, semi-parametric estimation algorithm, directly incorporating the effect of subsidies into a model of unobserved productivity. They empirically study the effects using samples from the Farm Accountancy Data Network for EU-15 countries. Our main findings are clear: subsidies had a negative impact on farm productivity in the period before the decoupling reform was implemented; after decoupling the effect of subsidies on productivity was more nuanced, as in several countries it turned positive.

1. Introduction

There are two competing policy-relevant arguments regarding the impact of agricultural subsidies on productivity.[68] On the one hand, in the context of the WTO trade liberalisation agenda, the discussion centres on the

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* The chapter draws heavily on the research published by Rizov et al. (2013). The authors are grateful to the European Commission for granting access to the FADN data. The chapter is also based on Rizov, Pokrivcak & Ciaian, "CAP Subsidies and the Productivity of EU Farms", Factor Markets Working Paper No. 37, March 2013.

[68] Annually, the EU spends around €50 billion on the Common Agricultural Policy (CAP) with the primary goal to support farmers' income and improve the environmental impact of agricultural production. The majority of CAP subsidies are disbursed in the form of decoupled direct payments from the EU budget, which are not linked to current and future quantities of agricultural production. Within the CAP, there are also subsidies which are coupled to the production of specific crop or animal commodities or allocated for rural development projects.

distortionary impact of subsidies on agricultural markets (including on productivity) and how the effects differ between different types of subsidies. Following the WTO agreements, many countries decoupled their agricultural subsidies with the aim of reducing distortionary agricultural support (Meléndez-Ortíz et al., 2009). On the other hand, recent developments in world markets leading to increasing volatility of global food commodity prices and rising food security concerns, especially in developing countries, have led to calls to maintain agricultural support, stimulating farm investment and the adoption of productivity enhancing modern technology (FAO, 2011). The European Commission explicitly mentions in its proposal for the CAP post-2013 revision the challenge of food security and the EU's goal to support long-term food supply potential and meet the growing world food demand (European Commission, 2010; 2011).

The impact of subsidies on agricultural production, input allocation and income distribution is well documented in the literature, but significantly less attention has been devoted to the impacts of subsidies on farm productivity. Theoretical studies suggest that subsidies may have a positive impact on farm production and, at the same time, a negative impact on farm productivity (Hennessy, 1998; Ciaian & Swinnen, 2009). However, these studies are inconclusive in predicting the exact relationship between agricultural subsidies and productivity, while the empirical literature finds mixed effects. The existing empirical studies usually employ a two-stage approach whereby productivity measures are estimated in the first stage without controlling for subsidy effects and then these productivity measures are regressed on subsidies in the second stage (e.g., Giannakas et al., 2001; Latruffe et al., 2009; Lakner, 2009; Sauer & Park, 2009; Zhu & Oude Lansink, 2010; Mary, 2012). The disadvantage of the two-stage approach is that it does not incorporate subsidies explicitly into a structural estimation algorithm and thus cannot capture their full effect on productivity. The two-stage approach therefore may lead to biased estimates of the overall impact of subsidies on productivity.

We aim to fill this gap in the literature by investigating the impact of CAP subsidies on (aggregate) farm productivity using a structural productivity estimation approach based on Olley & Pakes (1996). We explicitly model the unobserved productivity and directly incorporate the effects of subsidies into a structural semi-parametric estimation procedure. We apply the procedure to the Farm Accountancy Data Network (FADN) dataset and estimate total factor productivity (TFP) for large and representative samples of farms in each of the EU-15 countries over the period 1990-2008. Furthermore, special attention is paid to the significant change of regime with the decoupling of subsidies by the 2003 CAP reform. The chapter compares the impact of subsidies on farm productivity before and after decoupling. We find that subsidies are negatively associated with productivity until the implementation of the decoupling reform. After the reform, the link between subsidies and farm productivity became more nuanced as in several EU-15 countries it turned positive.

2. Subsidies and productivity

Theoretical studies show that there are various channels through which subsidies impact (aggregate) productivity (De Long & Summers, 1991; Blomstrom et al., 1996; Rajan & Zingales, 1998). Subsidies may either increase or decrease productivity and thus the net effect may be either positive or negative. The negative impact of subsidies on productivity may result from *allocative and technical efficiency losses* due to distortions in production structure and factor use, soft budget constraints and the shift of subsidies to less productive enterprises. The positive impact of subsidies may be due to *investment-induced productivity gains* caused by interactions of credit and risk attitudes with subsidies (subsidy-induced credit access, lower cost of borrowing, reduction in risk aversion, increase in productive investment).

Subsidies may negatively affect farm productivity because they distort the production structure of recipient farms leading to allocative inefficiency. Recipient farms may modify their behaviour and start investing in subsidy-seeking activities that are relatively less productive (Baumol, 1990; Alston & James, 2002). Allocative inefficiency may also be a result of distortions in input use. Subsidies give recipient farms an incentive to change their input ratios, which can lead to allocative inefficiency, i.e. over-investment in subsidised inputs. Subsidies may also give rise to technical inefficiency if they are captured by the farms as higher profits leading to slack, lack of effort and competitive pressures to seek cost-improving methods (Leibenstein, 1966). Similarly, Kornai (1986) argues that subsidisation might give rise to soft budget constraints which would lead to inefficient use of resources. If the budget constraint is hard, the farm will continuously adjust to (unfavourable) external conditions by behaving in an entrepreneurial manner. If the budget constraint is soft, productive efforts are no longer imperative; the subsidy provider acts like an insurer taking over the moral hazard while the insured (recipient farms) are less careful in protecting their wealth. Finally, subsidies may end up being transferred to less productive farms by policy-makers 'with special interest' or, as Olson (1982) asserts, subsidies may reduce the rate at which resources are reallocated from one activity to another in response to new technologies or market conditions.

The literature on credit constraints and risk behaviour in agriculture (e.g. Blancard et al., 2006; Ciaian & Swinnen, 2009; Kumbhakar & Bokusheva, 2009; Hüttel et al., 2010) asserts a positive relationship between subsidies and productivity. If farms are credit rationed, then subsidies may provide an additional source of finance either directly by increasing farms' financial resources, or indirectly through the improved access to formal credit. In other words, for credit-rationed farms, subsidies may serve as a substitute for credit. Studies find that credit-constrained farms invest less and have lower allocative and technical efficiency which would improve as a result of subsidies (Feder, 1985; Feder et al., 1990; and more recently, Blancard et al., 2006; Kumbhakar & Bokusheva, 2009; Hüttel et al., 2010). Cheaper credit would stimulate investments and input use, thus leading to improved farm performance. Credit-unconstrained farms may also be affected if subsidies present a cheaper source of financing than the credit available from the financial markets. Furthermore, Hennessy (1998) suggests that under uncertainty, subsidies affect markets through a wealth effect; subsidies affect farmers' wealth and thus their risk attitudes. For example, farmers may be more willing to expand production with certain type of activities or employ additional factors which would otherwise be viewed as too risky (Roche & McQuinn, 2004).

The negative effect of subsidies (*allocative and technical efficiency loss*) is likely negatively correlated with decoupling, whilst the positive effect (*investment-induced productivity gain*) is likely positively correlated. Consequently, we expect that coupled subsidies will have a smaller positive or a larger negative impact on productivity relative to decoupled subsidies. First, the efficiency loss is likely to be stronger for coupled subsidies than for decoupled ones because farm eligibility for coupled payments is directly linked to farm factor and production decisions, and thus is likely to lead to distortions in input and/or output allocation. Coupled subsidies may motivate farmers to expand subsidised activities at the expense of otherwise more productive activities. For the decoupled subsidies, the link to farm activities is weaker. Farms receive CAP decoupled subsidies irrespective of their production decisions, so the subsidies are less likely to induce allocative and technical inefficiency effects (Floyd, 1965; Dewbre et al., 2001; Alston & James, 2002; Guyomard et al., 2004; Courleux, et al., 2008). Second, the investment-induced productivity gain through the credit and risk channels is likely smaller for coupled than for decoupled payments (Ciaian & Swinnen, 2009; Hennessy, 1998). The conditionality of coupled subsidies increases the monitoring costs of financial institutions if subsidies are used by credit-constrained farms as collateral for investment loans. Financial institutions have to check what farms produce to learn about their future eligibility for coupled subsidies. For decoupled payments, the certainty of payments is higher due to their link to land assets, which are relatively costless to monitor and less subject to production risk. Thus, decoupled payments are more suitable as collateral to financial institutions (Barry & Robinson, 2001; Ciaian et al., 2012).

3. Estimation strategy, data, and results

Our strategy for estimating productivity is built on the Olley & Pakes (1996) approach, which entails modelling unobserved productivity (TFP) while directly controlling for the effects of subsidies in the estimation algorithm.[69] The strength of the approach lies in its flexibility in accommodating the specificities of the economic problem of interest and its efficiency in dealing with simultaneity and selection biases. Furthermore, we extend the Olley & Pakes (1996) algorithm, in a manner similar to Rizov & Walsh (2011), by explicitly allowing farm decisions and market environment (factor markets and demand conditions) to be affected by the CAP subsidies, which we directly introduce into the underlying structural model of the farm.

We apply our estimation algorithm to the FADN country samples. The panel we employ in the study covers the period 1990–2008 and includes the commercial farms in all EU-15 countries.[70] Our first goal is to estimate unbiased and consistent farm and time specific TFP measures (tfp_{jt}), within six farm-type samples, for each country, and to document the

[69] We do not estimate the effect of any particular channel through which subsidies interact with productivity; we estimate the net effect of allocative and technical efficiency loss and the investment-induced productivity gain caused by subsidies.

[70] For Austria, Finland and Sweden, which joined the EU in 1995, the period of analysis is 1995-2008.

aggregate productivity levels and changes over time and by farm type.[71] We run regressions within the six farm-type samples for each country, which leaves us with 83 farm-type country samples, with a sufficient number of observations to apply our estimation algorithm.

Our ultimate goal in the analysis is to verify the effect of subsidies on farm productivity using the farm TFP measures (tfp_{jt}) estimated by our semi-parametric algorithm. Subsidies are widely used in EU agriculture and the large majority of farms have received subsidies in one way or another, so we do not have an easy way to identify treatment and control groups. Therefore, we verify the relationship by means of a regression analysis using the same FADN country samples that we used to estimate farm productivity. We note that this verification analysis is different from the two-stage analysis in previous productivity studies because in our productivity estimation algorithm we have explicitly accounted for the effects of subsidies and thus, our productivity measures are not biased.

We specify an estimating equation, linking farm productivity and subsidies using as a basis the productivity function (inverted investment demand), formulated in Olley & Pakes (1996). We estimate two specifications where the dependent variable is measured in levels ($\log(tfp_{jt})$) and in growth rates (Δtfp_{jt}) respectively. The explanatory variables are investment (I), capital (K), subsidies (S) and subsidies interacted with a dummy capturing the effect of decoupling (SX); sets of year and farm sector controls are also included in every specification. Given that the main explanatory variables in the estimating equations are not strictly exogenous and likely serially correlated, we treat them as predetermined; considering the regressors as endogenous does not change the results reported.

[71] The six farm types comprise field crop farms, horticultural and vine farms, specialised dairy farms, other grazing livestock farms, poultry and pig meat farms, and mixed farms.

Table 28.1 GMM estimates of the impact of subsidies on productivity

Country	Specification	b_I (s.e.)	b_K (s.e.)	b_S (s.e.)	b_{SX} (s.e.)	AR(2) Hansen J
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Belgium	Level	0.010	0.075	-0.001	0.009	0.121
		(0.005)	(0.045)	(0.002)	(0.011)	(0.324)
	Growth	0.002	0.040	-0.003	0.006	0.178
		(0.001)	(0.024)	(0.002)	(0.011)	(0.461)
Denmark	Level	0.002	-0.314	**-0.012**	**0.010**	0.205
		(0.001)	(0.074)	**(0.002)**	**(0.003)**	(0.194)
	Growth	0.002	-0.180	-0.003	**0.012**	0.183
		(0.001)	(0.056)	(0.002)	**(0.004)**	(0.344)
Germany	Level	0.008	-0.103	**-0.002**	-0.001	0.082
		(0.002)	(0.018)	**(0.001)**	(0.001)	(0.229)
	Growth	0.004	-0.104	**-0.003**	-0.001	0.114
		(0.001)	(0.018)	**(0.001)**	(0.001)	(0.215)
Greece	Level	0.006	-0.105	**-0.037**	**-0.017**	0.181
		(0.002)	(0.055)	**(0.006)**	**(0.007)**	(0.402)
	Growth	0.002	-0.036	**-0.035**	**-0.020**	0.286
		(0.001)	(0.016)	**(0.005)**	**(0.010)**	(0.537)
Spain	Level	0.003	-0.179	-0.003	**0.015**	0.228
		(0.001)	(0.057)	(0.002)	**(0.002)**	(0.198)
	Growth	0.003	-0.130	**-0.008**	**0.007**	0.361
		(0.001)	(0.050)	**(0.002)**	**(0.002)**	(0.399)
France	Level	0.004	0.063	**-0.005**	**0.008**	0.111
		(0.002)	(0.031)	**(0.001)**	**(0.002)**	(0.295)
	Growth	0.004	0.047	**-0.007**	**0.011**	0.115
		(0.002)	(0.026)	**(0.001)**	**(0.002)**	(0.312)
Ireland	Level	0.008	0.067	-0.002	**0.029**	0.221
		(0.004)	(0.036)	(0.002)	**(0.015)**	(0.418)
	Growth	0.008	0.030	**-0.008**	0.019	0.104
		(0.004)	(0.015)	**(0.003)**	(0.012)	(0.372)
Italy	Level	0.002	0.014	-0.003	0.001	0.094
		(0.001)	(0.004)	(0.003)	(0.001)	(0.120)
	Growth	0.005	0.048	-0.002	**0.017**	0.195
		(0.003)	(0.021)	(0.002)	**(0.005)**	(0.210)

Table 28.1 continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Luxembourg	Level	0.003	0.021	**-0.003**	**0.054**	0.225
		(0.001)	(0.011)	**(0.001)**	**(0.016)**	(0.580)
	Growth	0.004	0.030	**-0.005**	**0.042**	0.098
		(0.002)	(0.011)	**(0.002)**	**(0.016)**	(0.321)
Netherlands	Level	0.002	-0.188	-0.001	0.003	0.080
		(0.001)	(0.036)	(0.001)	(0.001)	(0.229)
	Growth	0.002	-0.281	**-0.004**	0.001	0.117
		(0.001)	(0.071)	**(0.002)**	(0.001)	(0.198)
Austria	Level	0.002	-0.084	**-0.009**	-0.009	0.224
		(0.001)	(0.029)	**(0.002)**	(0.010)	(0.154)
	Growth	0.009	-0.062	**-0.012**	-0.005	0.168
		(0.004)	(0.009)	**(0.002)**	(0.012)	(0.188)
Portugal	Level	0.002	0.002	0.004	0.004	0.106
		(0.001)	(0.001)	(0.004)	(0.006)	(0.115)
	Growth	0.015	0.024	0.004	0.008	0.241
		(0.007)	(0.008)	(0.004)	0.008)	(0.298)
Finland	Level	0.007	0.070	0.015	**0.039**	0.221
		(0.003)	(0.028)	(0.017)	**(0.020)**	(0.351)
	Growth	0.008	0.058	0.017	**0.055**	0.102
		(0.004)	(0.022)	(0.012)	**(0.018)**	(0.282)
Sweden	Level	0.009	0.086	-0.003	0.002	0.248
		(0.003)	(0.036)	(0.006)	(0.006)	(0.526)
	Growth	0.006	0.036	**-0.019**	-0.008	0.150
		(0.002)	(0.018)	**(0.008)**	(0.005)	(0.138)
UK	Level	0.013	-0.150	**-0.013**	**-0.005**	0.219
		(0.006)	(0.043)	**(0.002)**	**(0.002)**	(0.438)
	Growth	0.010	-0.153	**-0.009**	-0.003	0.193
		(0.003)	(0.035)	**(0.002)**	(0.002)	(0.278)

Notes: The estimated samples cover the period 1991-2008 (1996-2008 for Austria, Finland and Sweden). Diagnostics reported are the p-values for the AR(2) test and for the Hansen J test (in parentheses). In all estimated equations year and farm type controls are included. Coefficients of the subsidy variables(pre and after decoupling) when significant at 5 percent or better are denoted in **bold**.

We estimate the productivity and subsidies relationship by the Blundell & Bond's (1998) two-step system generalised method of moments (GMM). Table 28.1 reports the regression results for levels and growth rates for each of the EU-15 countries.[72] We find clear evidence that the effect of subsidies before decoupling is negative even though the magnitude of the coefficients is quite small (between zero and a 3.7% decrease in TFP when subsidies double). Overall, for all countries except Portugal and Finland, subsidy coefficients both in the level and in the growth equations have negative signs. In terms of the level of productivity, we find a negative and statistically significant effect for seven of the EU-15 countries. In terms of productivity growth, the effect is negative and statistically significant for ten of the EU-15 countries. Thus, for the period before decoupling of subsidies, no significant negative effect is found in only four of the EU-15 countries, and in no country is a positive effect evident. These results are consistent with findings in previous productivity studies which employ a two-stage approach to identify the CAP subsidy impact on farm efficiency (Latruffe et al., 2009; Lakner, 2009; Zhu & Oude Lansink, 2010).

For the period after decoupled subsidies were introduced, the effect on farm productivity is more diverse.[73] In fact, for ten of the EU-15 countries the subsidy coefficient is positive even though it is statistically significant for only six countries in the level equation as well as in the growth equation. We find a statistically significant negative effect for only two countries – about 2% (when subsidies double) both in the level and in the growth equation for Greece, while for the UK we find a small negative effect of 0.5% (if subsidies doubled) only in the level equation.[74] Interestingly, the group of countries for which a switch of effect, from negative to positive after decoupling is observed is mixed, including both

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[72] For all regressions the diagnostic tests for no second-order autocorrelation, AR(2) and for validity of instruments, Hansen-J are satisfied.

[73] Decoupling of subsidies was formally implemented in 2005-06 across the EU-15 countries. We note that the decoupling is likely to have had effect on the behaviour of farms (and markets) well before the time of formal implementation, i.e. since the details on the policy were made public. Thus, we expect that from 2005-06 tangible effects of decoupling on productivity can be observed.

[74] For the cases where a negative effect of subsidies after decoupling is still observed, this could be due to either insignificant market imperfections (credit problems) in the agricultural sector (e.g. Germany, Sweden, the UK), partial decoupling (e.g. Greece) or the combination of the two factors (e.g. Austria).

northern and southern EU member states. Overall, after decoupling we find that subsidies have either no effect or a small positive effect on productivity in the majority of EU-15 countries. Our findings are consistent with Zhu et al. (2012) and Mary (2012).[75]

4. Summary and conclusions

The focus of this chapter is on evaluating the link between CAP subsidies and total factor productivity of EU commercial farms. We build a structural model of the unobserved productivity incorporating directly the effects of farm subsidies and adapt the semi-parametric estimation algorithm proposed by Olley & Pakes (1996) to estimate the parameters of production functions within the FADN farm-type samples, for each of the EU-15 countries, for the period 1990–2008 (or 1995–2008). We control for differences in the economic environment across narrowly defined spatial units and model productivity as a non-parametric function of investment and state variables, including as additional control farm subsidies, which greatly enhances our ability to obtain consistent estimates of the production function parameters and thus, back out unbiased TFP measures at farm level.

Our farm-level regression analysis for each of the EU-15 countries clearly demonstrates the impact of CAP subsidies on productivity. We find that subsidies impact negatively farm productivity in the period before the decoupling reform was implemented. After decoupling, in 2005-06, the effect of subsidies on productivity is more nuanced as in several countries it turned positive. Theoretically, the impact of subsidies on productivity is a net effect of allocative efficiency losses and the investment-induced productivity gains caused by the interaction of market imperfections with subsidy. We do not identify the two effects separately, we only infer their relative importance from the net effect.

Our findings are consistent with the literature emphasising the inefficiencies of public subsidisation of production and at the same time lend support to the EU policy for decoupling of CAP subsidies. The results suggest that the decoupled payments are less distortive and enhance productivity, which is consistent with the WTO priorities. From the food security perspective, the evidence indicates possible improvement in future

[75] They do not investigate the decoupled payments *per se* but consider the impact of partial decupling (e.g. the introduction of the Agenda 2000).

food availability through increasing the productive capacity of the EU agricultural sector. The CAP reform proposal for the post-2013 period suggests maintaining the decoupled subsidies system after 2013 (European Council, 2013), thus likely ensuring the continued future enhancement of EU farm productivity. However, one should be careful in drawing conclusions regarding general welfare implications from this, since the analysis does not account for distortions of taxation funding the subsidy.

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29. RURAL FACTOR MARKETS IN THREE CANDIDATE COUNTRIES: CROATIA, MACEDONIA AND TURKEY

ŠTEFAN BOJNEC[*]

In a spite of the fact that the role of agriculture in the economies of Croatia, the Former Yugoslav Republic (FYR) of Macedonia and Turkey has declined over time, it is still important in absolute and relative terms compared with the western economies. The prevailing small-scale farm structures provide official and hidden employment and incomes for a large part of rural population. The substantial reduction of rural population is an indication of outflow of labour to urban areas and abroad. Inflows of remittances can only partly mitigate the

[*] This chapter (and the research behind it) was written during Croatia's accession process. Although Croatia has now acceded to the EU, the chapter refers to the country as a candidate for EU membership since the analysis refers to the period leading up to the accession. The analysis remains valid now that Croatia has joined the EU.

This chapter is based on the following Factor Markets Working Papers: Bojnec, "Agricultural and Rural Capital Markets in the EU Candidate Countries of Croatia, the Former Yugoslav Republic of Macedonia and Turkey", Factor Markets Working Paper No. 8, October 2011; Angelova & Bojnec, "Agricultural and Rural Capital Market Developments in the Republic of Macedonia", Factor Markets Working Paper No. 9, October 2011; Bojnec, "Agricultural and Rural Labour Markets in the EU Candidate Countries of Croatia, Former Yugoslav Republic of Macedonia and Turkey", Factor Markets Working Paper No. 6, September 2011; Bojnec, "Land Markets in the EU Candidate Countries of Croatia, Former Yugoslavia Republic of Macedonia and Turkey", Factor Markets Working Paper No. 1, September 2011; Janeska & Bojnec, "Rural Labour Market Developments in the Former Yugoslav Republic of Macedonia", Factor Markets Working Paper No. 5, September 2011; Petroska Angelovska, Ackovska & Bojnec, "Agricultural Land Markets and Land Leasing of the Former Yugoslav Republic of Macedonia", Factor Markets Working Paper No. 11, February 2012.

emerging rural capital markets. A specific situation exists in Turkey with sharecropping arrangements among families and informal land-leasing arrangements based on trust. A relatively large agricultural sector, particularly in Turkey, lower productivity in agriculture than in the rest of the economy, and other developmental gaps between urban and rural areas are expected to have important policy implications.

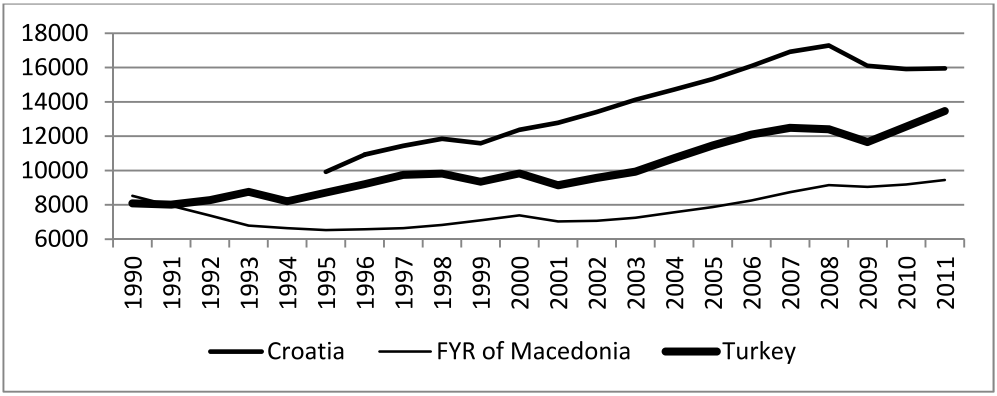
1. Introduction

This chapter reviews and summarises the findings on the empirical facts about and the institutional and policy developments in rural factor markets (land, labour and capital) in three candidates for EU membership – Croatia, the former Yugoslav Republic of Macedonia and Turkey. The chapter is based on Angelova & Bojnec (2012), Bojnec (2012, 2013a, 2013b), Janeska & Bojnec (2012) and Petroska Angelovska et al. (2012), but adds additional, recent empirical facts on the changing role of agriculture in the economies of the three candidate counties and some main empirical facts on land, labour and capital markets with explanations and policy implications.

2. The changing role of agriculture in the economy

The role of agriculture in the economy is one indicator of economic development. A relatively low share of agriculture in the economy indicates a higher level of economic development. The most widely used measure of economic development is GDP per capita. As shown in Figure 29.1, GDP per capita in constant prices in the three candidate countries has increased over the past 20 years. It is the highest in Croatia, followed by Turkey and then the FYR of Macedonia. A decline is seen in 2009 for Croatia and Turkey, but less so for the FYR of Macedonia. Since 2009, Turkey has caught up slightly with Croatia, but the FYR of Macedonia has not.

Figure 29.1 GDP per capita, PPP (constant 2005, international $)



Source: Wold Bank (2013).

The analysed countries differ in the size of their economies (i.e. the size of GDP) and the size of their agricultural sectors. The Turkish economy and agricultural sector are much bigger than those of Croatia and the FYR of Macedonia.

Table 29.1 The role of agriculture in the economy

	1960	1970	1980	1990	1996	2002	2008	2011
				Croatia				
GDP (billion constant 2000 US$)					19.3	23.4	30.1	27.6
Gross value added at factor cost (billion constant 2000 US$)					16.0	19.5	25.2	23.0
Agriculture, value added (billion constant 2000 US$)					1.08	1.24	1.38	1.27
Agriculture, value added (% of GDP)				10.9	7.1	6.4	5.0	5.1
Industry, value added (% of GDP)				35.8	30.8	27.7	27.7	26.5
Services, value added (% of GDP)				53.4	62.2	65.9	67.3	68.4
Manufacturing, value added (% of GDP)				29.3	20.6	18.8	15.8	16.2
Food, beverages and tobacco (% of value added in manufacturing)				21.9				

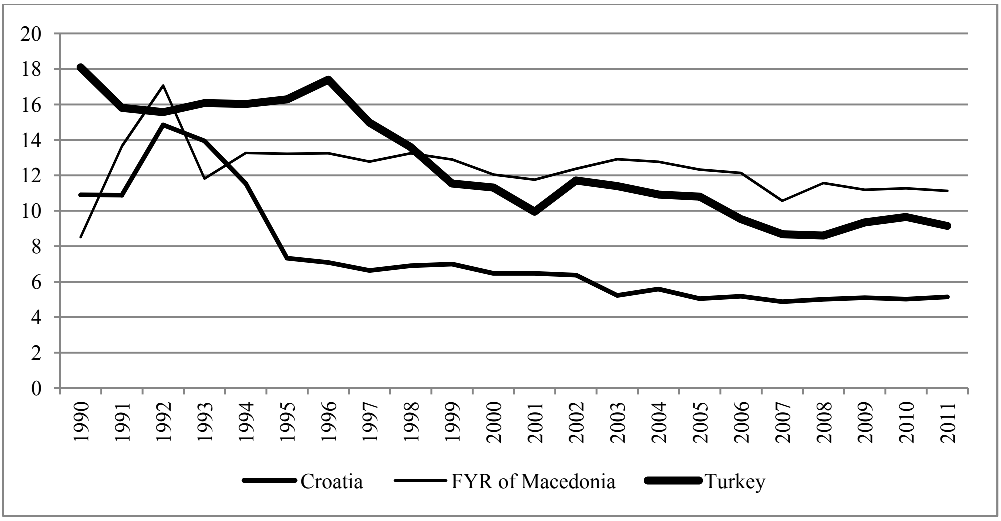
				FYR of Macedonia				
GDP (billion constant 2000 US$)				3.9	3.1	3.5	4.5	4.7
Gross value added at factor cost (billion constant 2000 US$)				3.2	2.6	2.9	3.8	4.0
Agriculture, value added (billion constant 2000 US$)				0.32	0.33	0.32	0.38	0.41
Agriculture, value added (% of GDP)				8.5	13.2	12.4	11.6	11.1
Industry, value added (% of GDP)				44.5	29.6	30.2	29.8	27.5
Services, value added (% of GDP)				47.0	57.2	57.5	58.7	60.9
Manufacturing, value added (% of GDP)				35.7	23.0	19.1	19.8	17.7
Food, beverages and tobacco (% of value added in manufacturing)				20.1	32.0			
				Turkey				
GDP (billion constant 2000 US$)	44.6	75.2	112.0	186.6	234.7	266.9	375.1	422.8
Gross value added at factor cost (billion constant 2000 US$)		67.9	103.3	166.7	208.2	237.8	333.2	375.0
Agriculture, value added (billion constant 2000 US$)		17.7	20.8	23.3	25.2	26.9	28.7	32.1
Agriculture, value added (% of GDP)	55.9	40.2	26.5	18.1	17.4	11.7	8.6	9.1
Industry, value added (% of GDP)	17.6	22.5	23.8	32.2	31.6	28.7	27.7	27.9
Services, value added (% of GDP)	26.4	37.3	49.7	49.8	51.0	59.6	63.7	63.0
Manufacturing, value added (% of GDP)	13.0	16.5	17.3	22.7	21.8	20.2	18.3	18.6
Food, beverages and tobacco (% of value added in manufacturing)				16.0	16.1	17.3		

Source: World Bank (2013).

The relative share of agricultural value added as a percentage of GDP has tended to decline in each of the three analysed countries, but differences can be seen in the dynamics of this decline and in cyclical variations for each of the countries (Table 29.1 and Figure 29.2). The declining relative role of agricultural value added in GDP suggests a higher level of economic development. Since 2008, the economic recession with an accompanying decline in GDP size in constant prices can been seen for Croatia.

In the initial stage of transition to a market economy in the FYR of Macedonia and in Croatia, agricultural value added as a percentage of GDP increased. This share then declined in Croatia, which is consistent with a declining relative role of agriculture in the economy during economic growth as an indicator of a higher level of economic development. This decline is also seen for Turkey and the FYR of Macedonia. In the latter, agricultural value added represents more than 11% of GDP. The lowest share is in Croatia, though the share in both Croatia and Turkey has increased slightly during the recent economic recession.

Figure 29.2 Agriculture, value added (% of GDP)



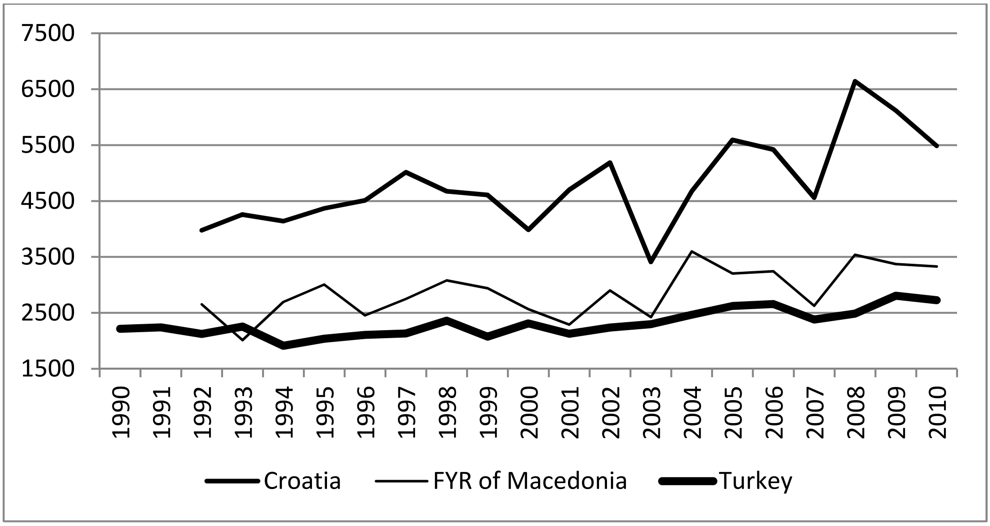
Source: Wold Bank (2013).

With regard to the structure of their economies, the relative importance of the service sector has increased in each of the countries. The role of the industrial sector varies between the three: it has declined in Croatia and most recently in the FYR of Macedonia, and to a lesser extent in Turkey. In addition, within the industrial sector, the role of the manufacturing sector has tended to decline. Food, beverages and tobacco activities seem to be important in the manufacturing sector in each of the three countries, but evidence for this is not available for the most recent years.

3. Land market issues

There are substantial differences in the geographic size of the three countries, and differences in the structure of land use for agricultural production and yields both between the countries (Bojnec, 2013a) and within them (Petroska Angelovska et al., 2012). Turkey is much larger than Croatia and the FYR of Macedonia. Albeit with some differences, crop production is the most important in terms of land use in each of the analysed countries. Cereals yields are highest in Croatia (Figure 29.3) due to a higher use of chemical inputs. At the same time, Croatia has experienced higher cyclical volatility in cereals yield development, with some similarities in cereals yields volatility for the FYR of Macedonia. Cereals yields in Turkey are lower, but have tended to increase slightly without substantial volatility. Cereal yield volatility can be related to adverse (particularly dry) weather conditions.

Figure 29.3 Cereal yields (kg per hectare)



Source: Wold Bank (2013).

Agricultural land structures are the result of historical evolution in land markets and of land-leasing developments, with additional differing institutional environments and agrarian and land reforms. However, from the conceptual relevance, the countries are different: Croatia and the FYR of Macedonia are post-socialist countries, but Turkey is not. Some similarities existed between the territories of the FYR of Macedonia and Turkey during the Ottoman Empire, but not with Croatia.

In each of the three candidate countries, the share of crop production is at least twice as high as that of livestock production. The share of livestock production is highest in Croatia, while the share of crop production is highest in the FYR of Macedonia, which had the lowest share of cereals in crop production. In the FYR of Macedonia and Turkey, other crops (vegetables and long-term plantings of fruit and vineyards) represent an important share of production. Turkey is the richest country by hectares of arable land per person.

Turkey is a substantial wheat producer. Wheat yields in Croatia are slightly lower than in the enlarged EU-27, but more than twice those of Turkey and slightly less than twice those of the FYR of Macedonia.

Maize production in Turkey is around twice that of Croatia, while maize production in the FYR of Macedonia is a few times smaller than in Croatia. Maize yields in Turkey and particularly in Croatia have increased rapidly and are at, or even above, the levels for the enlarged EU-27.

Fragmented farm structures and small plots are one of the major obstacles to the modernisation of agricultural production. Family household subsistence farming takes an important role. There is a need for farm restructuring, which can be supported by the creation of opportunities for off-farm employment with off-farm incomes opportunities.

There is no a minimum or a maximum price for land sale transactions in the three countries. Agricultural land sale prices vary between the countries and within the countries by location within regions and by quality of the land. In Croatia, the sale of agricultural land needs to be approved by a government agency and the tenant has pre-emption rights. In the FYR of Macedonia, co-owners have a priority right and neighbours have a priority purchase right. In Turkey, there are restrictions regarding the subdivision and sale of a plot below a certain minimum size, and the sale of agricultural land needs to be approved by the government. The tenant in Turkey has pre-emption rights and co-owners have priority rights. There are also restrictions for land sale transactions in border areas and in specific protected areas. Some additional restrictions regarding the acquisition of agricultural land apply to foreign legal entities in each of the three countries.

Except for state-owned land in the FYR of Macedonia, land rental transactions in the three countries are not constrained by the government setting minimum or maximum rental prices. Former state land has been transformed into state management and largely continues to be operated by privatised agricultural enterprises.

In Turkey, rental prices are not regulated and land renting is often agreed orally between owner and tenant without defining monetary rental prices. The owner and tenant usually agree on how to share the products. An oral rental agreement is possible due to a high level of trust between the owner and tenant, who are often relatives, neighbours or similarly trusted persons.

4. Labour market issues

Similarly to the size of the land market, the Turkish labour market is much larger than that of Croatia or the FYR of Macedonia. However, there are differences in the patterns of development, with a substantial absolute increase in the labour force in Turkey, a slight absolute increase in the FYR of Macedonia, and a slight absolute decline in Croatia (Table 29.2). These patterns are associated with past fertility rates and, to a lesser extent, are mitigated by outward migration.

Table 29.2 Labour market development and the role of employment in agriculture

	1990	1996	2002	2008	2010
			Croatia		
Labour force (million)	2.17	2.02	1.94	2.00	1.97
% of employment in agriculture		19.9	15.2	13.4	14.9
% of employment in industry		29.1	29.7	30.7	27.3
% of employment in services		50.9	55.1	55.6	57.6
			FYR of Macedonia		
Labour force (million)	0.77	0.82	0.85	0.92	0.95
% of employment in agriculture			23.9	19.7	
% of employment in industry			33.3	31.3	
% of employment in services			42.8	49.1	
			Turkey		
Labour force (million)	19.95	21.66	22.67	24.59	26.52
% of employment in agriculture	46.9	42.8	34.9	23.7	23.7
% of employment in industry	20.7	22.9	23.0	26.8	26.2
% of employment in services	32.4	34.3	42.1	49.5	50.1

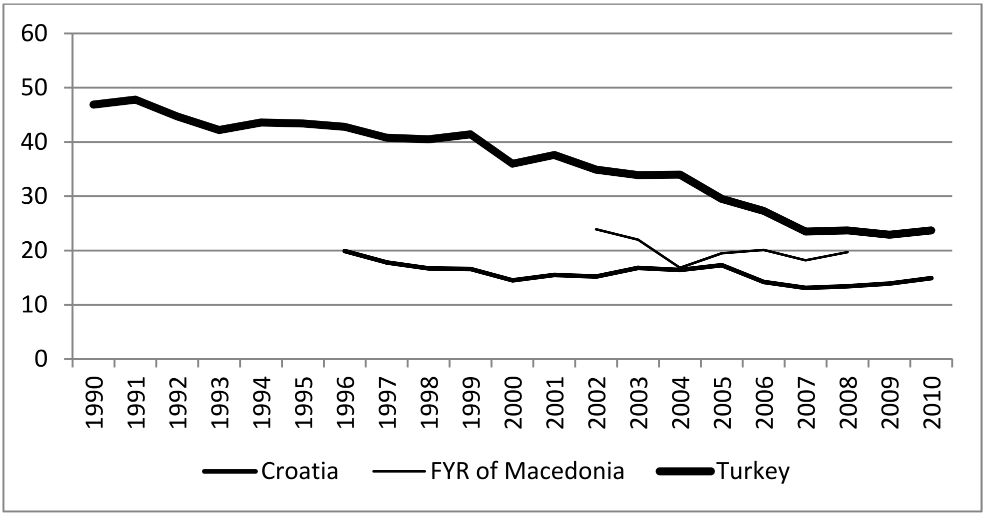
Source: Wold Bank (2013).

In each of the three analysed countries, the relative share of employment in agriculture is higher than the relative share of GDP from agriculture (Tables 29.1 and 29.2). This suggests that labour productivity in agriculture is lower than in the rest of the economy in all three countries. The share of employment in agriculture has declined, particularly from higher relative levels in the FYR of Macedonia and Turkey, and has increased slightly during the recent years of economic recession.

It is interesting to note that the share of agriculture in economy-wide employment declined up to 2007 (Figure 29.4). With the economic and financial recession, it has stabilised or even slightly increased, suggesting difficulties in finding employment outside of agriculture.

The share of employment in industry is volatile across individual years, but has tended to decline, more so recently. The share of employment in services has increased, but is lower than the share of GDP in services. This suggests that labour productivity in services is higher than in the rest of the economy. One of the sources of labour productivity increases can be the reallocation of labour to the service sector.

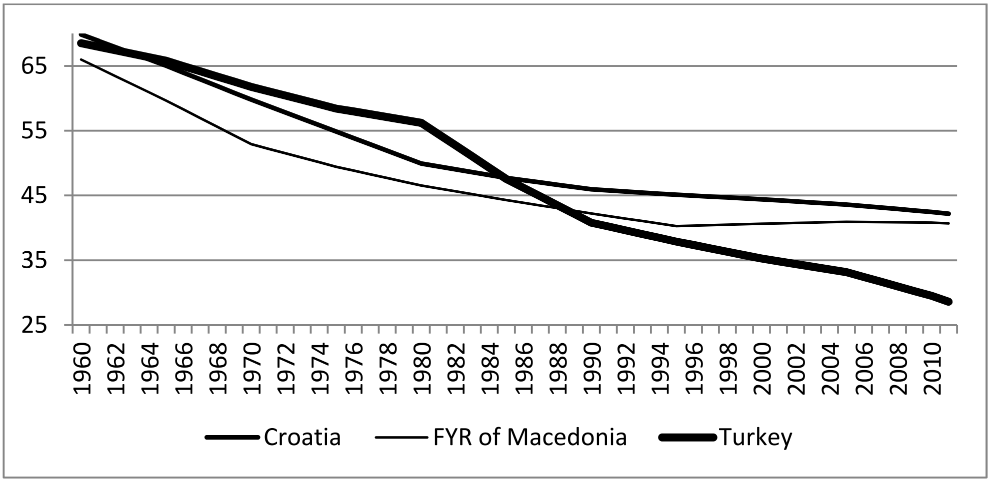
Figure 29.4 Share of employment in agriculture (% of total employment)



Source: Wold Bank (2013).

A substantial decline can be seen in the rural population in Turkey (Figure 29.5). Since the mid-1990s, the percentage of rural population has stabilised in the FYR of Macedonia. Interestingly, since the mid-1980s Croatia – the most economically developed of the three countries – has had the highest percentage of rural population, but there has been some recent convergence with the FYR of Macedonia. The more balanced rural-urban development in Croatia can be explained by a relatively developed transportation infrastructure, networks of local and regional towns, and an important role for the non-agricultural rural economy, including tourism.

Figure 29.5 Rural population (% of total population)



Source: Wold Bank (2013).

The rural labour market continues to be less attractive to the younger and educated population (Janeska & Bojnec 2012; Bojnec, 2013b). Each of the three countries has made efforts to improve both the literacy levels and educational attainments of their populations. The skills and educational levels of agricultural employees are lower than those of non-agricultural workers.

The three countries have been adjusting their labour legislation and labour market policies to those of the EU. This particularly holds for Croatia, as the first due to become an EU member state.

Living conditions in villages and rural areas (except in tourist areas) are seen as less attractive than in urban areas. This is an additional factor pushing young and educated people not only away from agriculture, but also from rural areas.

5. Capital market issues

Capital markets differ between the three countries in terms of interest rates for loans by the commercial banks and subsidy schemes (Bojnec, 2012). In Croatia, all commercial banks are owned by foreign banks. In the FYR of

Macedonia, special subsidy schemes have been introduced to support certain productions (Angelova & Bojnec, 2012). In Turkey, loans by commercial banks at market conditions are also important for agriculture. In addition, sharecropping arrangements between landowners and tenants are also important in the Turkish agricultural sector.

There is no substantial difference between the functioning of the banking sector for agriculture and the rural economy and its general functioning and operation. Agriculture and the rural economy may face more severe capital market imperfections and credit constraints with rent differentiation due to asset and production specificities, which limit access to credit for restructuring and further development.

Each of the three countries experienced very high rates of inflation or even hyperinflation during the 1990s. In recent years, inflation rates as measured by consumer prices have reduced substantially, to close to the EU-27 level in Croatia and above the EU-27 level in Turkey.

Lending interest rates, interest-rate spreads and real interest rates in the three countries are relatively high, which could be explained by higher investment risks and less competitive banking and finance sectors.

The three countries first experienced foreign direct investment (FDI) inflows during the 1970s and 1980s. Most often, these were in the form of joint ventures. During the last two decades, they have experienced greater net inflows than net outflows of FDI, but with substantial variations over time, particularly in FDI net inflows.

An inflow of workers' remittances to each of the three candidate countries associated with the outflow of labour from rural areas to countries abroad, particularly to Germany and some other western European countries, took place during the 1960s and the 1970s. Of the three, the FYR of Macedonia is more dependent on workers' remittance inflows.

Donations from different funds have been granted to each of the three countries. Among these donations, development agencies have supported agricultural and farm-sector restructuring and modernisation. During the 1960s, 1970s and 1980s, development assistance was important for Turkey, but in more recent years the country has also become an important driver of economic development and other assistance abroad. For Croatia, the inflows of development assistance increased during the first half of the 1990s, after the end of the war in Croatia. Development assistance recovered as the Croatian economy has adjusted in anticipation of EU membership. Development assistance has been particularly important for the FYR of Macedonia, and has been targeted towards agricultural and rural areas.

There is no agricultural bank present in Croatia to provide specialised credit for agriculture. Apart from one Croatian-owned and operated bank, all banks in the country are foreign-owned and operated. They provide credit for agriculture and rural development under the same, market-driven interest rates as for the rest of the Croatian economy.

In Turkey, there are both domestic and foreign-owned and operated banks, which provide commercial credit to agriculture and other rural economic activities. A special agricultural bank provides credit for agriculture and rural areas under slightly more favourable conditions than those of commercial banks. Sharecropping plays a significant role in agricultural investment activities and business between landowners and tenants in Turkey, and is also important for the agricultural and rural credit and loan markets.

Commercial banks and sellers of input supplies are among the main active providers of credit to farms' primary production operations in the FYR of Macedonia are. Credit to agriculture was largely allocated to agricultural enterprises, and less often to individual small-scale family farms, which are predominant among farming structures in the country. Individual family farms in the FYR of Macedonia face credit constraints, due to the unsettled legal ownership of assets and thus collateral problems, a lack of appropriate farming or management education, insufficient household income and a weak previous relationship with the creditor.

The EU's Instrument for Pre-Accession Assistance (IPA) funds have been important in each of three candidate countries. EU and donors' funds have assisted in agriculture and in rural areas by allowing greater use of capital equipment and more capital-intensive technologies, as well as in adjustments to international agro-food and other development standards, EU policies and practices.

6. Conclusion

This chapter reveals a number of differences in the countries under study. The absolute size of the countries is different; in terms of land and labour markets, the Turkish agricultural sector is much bigger than that of Croatia or the FYR of Macedonia. There are also differences in the relative importance of agriculture and rural areas for the economy as a whole. Apart from with regards to the percentage of rural population, the relative importance of agriculture is lowest in the more economically developed

Croatia, and highest in the less economically developed Turkey. The changing role of agriculture and rural areas has been important in each of the three countries analysed. Apart from rural tourist resorts, which of varying importance in each of the countries, rural areas are less attractive due to less developed infrastructure and fewer employment and income opportunities.

Farms are small (in terms of land) with prevailing fragmented land pieces. The evolution of farms has been based on the traditions of family farm households. In Croatia and the FYR of Macedonia, the communist family farm and land collectivisation failed up to a certain land maxima, while other land, such as that of bigger landowners, was nationalised. This land has now either been restored to the original owners, rented and cultivated largely by corporate farms, partly rented and cultivated by other farmers, or has even been left uncultivated. In Croatia, some land is also under mines. Different historical developments and land reforms can explain the similarities and differences in inheritance practices, land markets and land-leasing transactions. Demand factors with land location have been important in determining land prices and land rental values. Agricultural land prices per hectare of similar soil qualities are the highest in Turkey, which can largely be explained by demand factors in areas with smaller farms, smaller pieces of land and more labour-intensive agriculture.

Farm restructuring can make important contributions to improving the efficiency of agriculture. This process can be particularly important now, with the recovery in the rest of the economy being followed by increasing employment opportunities in non-agricultural activities.

Improving the quality of labour is an ongoing process that takes place through generational changes. Small and fragmented farms, a lower quality of labour in agriculture and lower technological intensity can explain lower labour productivity in agriculture than in the rest of the economy.

Investments in agriculture are less attractive for banks due to lower profitability of investments, collateral problems, and so on. Substantial changes in rural capital markets are less likely during economic recession and financial constraints.

The EU pre-enlargement support can partly overcome some financial constraints in rural areas for profitable businesses. The Croatian EU membership on 1st July 2013 will also provide opportunities for EU structural and cohesion funds as well as access to other common policy measures in agriculture and rural areas.

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LIST OF ABBREVIATIONS

AMTA	US Agricultural Market Transition Act
AWU	annual work units
CAP	Common Agriculture Policy
CEECs	central and eastern European countries
CES	constant elasticity of substitution
CET	constant elasticity of transformation
CGE	computable general equilibrium
CSO	Central Statistical Office
DiD	difference-in-differences
DP	direct payment
ECHP	European Community Household Panel
ES	economic sustainability
ESU	European size units
EU-LFS	EU Labour Force Survey
FADN	Farm Accountancy Data Network
FB	farm buildings
GAEC	Good Agricultural and Environmental Condition
GHG	greenhouse gas
GMM	generalised method of moment
GTAP	Global Trade Analysis Project
GVA	gross value added
HBS	Household Budget Surveys
HHI	Herfindahl Index
IPA	Instrument for Pre-Accession Assistance
IQR	interquartile range
ISTAT	Italian Institute of Statistics
JSC	joint stock companies

LFA	less-favoured areas
LLC	limited liability companies
LTV	loan-to-value
MAGNET	Modular Applied GeNeral Equilibrium Tool
ME	machinery and equipment
NoBFM	No Biofuel Mandate
NPV	net present value
NRA	rate of assistance
NUTS	Nomenclature of Territorial Units for Statistics
OLS	ordinary least squares
PSE	producer subsidy equivalent
PSE	Producer Support Estimate
REA	Farm Business Survey
RED	renewable energy directive
SAFER	Sociétés d'Aménagement Foncier et d'Etablissement Rural
SAPS	Single Area Payment Scheme
SFP	single farm payment
SMR	Statutory Management Requirements
SPS	Single Payment Scheme
SUR	seemingly unrelated regression
TPI	tenant protection indicator
TRI	total regulatory index
UAA	utilised agricultural area
ZES	zone d'excédent structurel

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