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Abstract

The EU's Rural Development Programme is worth €100 billion from 2014-2020 and leverages a further €61 billion of public funding in the Member States. Their possible impacts on farmers' behaviour and on farmers' productivity have long been discussed in the literature which shows a large knowledge gap regarding the role of Pillar 2 subsidies on agricultural productivity and on the methodology to estimate and model these effects.

The workshop organised by the JRC aimed at individuating the needed steps to fill the existing gaps and create the necessary consensus between academia and policy makers to produce policy relevant results.

The workshop highlighted a few key elements, both on estimation and modelling sides that will be useful to JRC to adopt the necessary steps to fill the above mentioned gaps.

1 Introduction

Since 2005, the European Commission's Joint Research Centre (JRC), commissioned by the Directorate-General for Agriculture and Rural Development (DG AGRI), maintains and applies the integrated Modelling Platform for Agro-economic Commodity and Policy Analysis (iMAP) (M'barek, Britz, Burrell, & Delince, 2012) (M'barek & Delincé, 2015), whose aim is to deliver in-house policy support to the European Commission. The platform is the backbone of operational data- and model-based support to agricultural and related policy analysis composed of databases and large-scale agro-economic models. In stand-alone or combined mode, the tools assess policy options with its impacts on markets (production, demand, trade and prices), land use, environment and farmers' income from a global to a farm level. The platform is centred on the challenges of the European agricultural sector to ensure jobs & growth in highly competitive globalised markets and an environmentally sustainable production.

The analysis mainly focusses on the current and future Common Agricultural Policy (CAP). The CAP has come a long way since its inception in 1962. The reforms at the end of 1990s under the auspices of 'Agenda 2000' introduced for the first time notions of rural livelihoods, environmental responsibility and sustainability. As a result, the system of agricultural payments was delineated into market support Pillar 1 and Rural Development (RD) programs (Pillar 2), which would form the basis for administering payments to the present day. The future design of the CAP post-2020 is again under consultation following the European Commission President's commitment "to modernise & simplify the CAP" as a guiding principle. Ongoing policy discussions and recommendations are contributing to the debate, which resulted in a Communication on the future of the CAP after 2020 at the end of 2017. The stakeholder consultation and the Inception Impact Assessment on the "Communication on Modernising and Simplifying the Common Agricultural Policy" are the most recent steps in this important endeavour.

To support DG AGRI in this debate, the JRC prepared a series of studies among which the so-called Scenar 2030 (M'Barek, et al., 2017) contributes to the analysis of selected scenarios and provides a framework for further exploration along the process of designing the future CAP and aims at identifying major future trends and driving factors for European agriculture and rural regions and the perspectives and challenges resulting from them employing a set of economic simulation models (MAGNET, CAPRI and IFM-CAP) included into iMAP.

The Scenar2030 preparatory work began in 2015; more than a year in advance of the policy options announced in the Inception Impact Assessment (IIA). One of the most relevant efforts in preparing the report was the enhancement of the modelling of Pillar 2 payments. Indeed, the impact of agricultural subsidies on productivity has long been discussed in the literature without any clear conclusions. Depending on the model specification, statistical method and data source, mixed results are reported. The empirical evidence shows that there is still a large gap in the literature regarding the understanding of the role of CAP Pillar 2 subsidies on agricultural productivity.

Most of existing studies look at the effects on total factor productivity, whereas in reality, different types of CAP subsidies might provoke a factor-biased technical change (for instance, human capital subsidies are expected to stimulate labour productivity more than land productivity). None of the studies so far can provide reliable inputs for parametrization of economy-wide models (e.g. partial or general equilibrium models such as MAGNET or CAPRI) due to different use of functional forms and due to the prevalence of micro-level studies which causes a difficulty of generalization of the results on the sector level.

This lack of understanding is both a constraining factor for policy makers that are interested in *ex-post* and/or *ex-ante* evaluation of the effectiveness of public investments and for modellers who need a reliable quantification of subsidies impact on productivity in their *ex-ante* exercises such as Scenar 2020 (Nowicki, Weeger, & H.v. Meijl, 2007) and (Nowicki, Goba, Knierim, Meijl, & M. Banse, 2009).

Latest published research by (Dudu & Smeets Kristkova, 2017) contributes to bridge this gap by providing a comprehensive empirical assessment of the role of CAP subsidies on productivity across EU-27 countries. More specifically, the contribution of this work is three-fold:

i. the study uses regional (NUTS-2) level data which allows us to capture sector- rather than farm-level behaviour,
ii. the effects of the four major types of Pillar 2 subsidies on factor-augmenting technical change can be compared in a systematic way,
iii. The adopted methodological framework enables to simultaneously estimate both Constant Elasticity of Substitution (CES) and productivity parameters, which can be readily used in impact-assessment models.

Nevertheless, combining available research with expert opinions helps to better qualify some of the results coming from pure econometric estimation.

The econometric estimations and the application of different productivity rates clearly showed the need for more research related to key parameters used for CAP analysis, which then reveals to be extremely relevant in steering the final simulation results (Matthews, Salvatici, & Scoppola, 2017). Based on these considerations, the JRC organised a workshop in Seville on the 14th September 2017. The general objective of the workshop was to discuss, with European academics and modellers, current approaches to estimate impacts of different Rural Development measures on the agricultural sector and ways to model these impacts within economic simulation models (partial and computable general equilibrium models).The specific objectives of the workshop were to:

- Discuss the current literature in terms of estimation and modelling of Pillar 2 payments.
- Discuss the linkages between empirical evidence and modelling techniques.
- Discuss the methods currently applied at JRC in sight of possible enhancements.

This report presents a synthesis of the workshop, summarising the presentations and discussions in the different sessions. The report is organized following the structure of the workshop. The first session of the workshop sets the scene and introduces the main topic at stake. The second session aims at providing current studies estimating the impacts of Pillar 2 measures on agricultural productivity and other main factors (e.g., growth, employment). The third session provides an overview of existing modelling approaches, general and partial equilibrium, to simulate effects of shocks in Pillar 2 payments on the EU agricultural sector. Finally, the fourth session concludes and draws some key messages on how the JRC shall proceed in future efforts on the topic.

2 Background

The workshop started with an introduction by Giampiero Genovese, Head of the Economics of Agriculture Unit with the Sustainable Resources Directorate of the JRC in which all participants were warmly thanked for their participation and the key topics of the workshops highlighted.

The Economics of Agriculture unit of the he Joint Research Centre (JRC) prepared a study, which started at the end of 2015 and was published at the end of 2017 (M'Barek, et al., 2017), aiming to analyse the impact on the agricultural sector of stylised scenarios, reflecting the main drivers of policy debate and thus providing a framework for further exploration of the process of designing the future CAP. In the frame of this study, three main economic models, from the iMAP platform (M'barek & Delincé, 2015) were employed, the global multisector Computable General Equilibrium (CGE) model MAGNET (Woltjer & Kuiper, 2014) and the partial equilibrium (PE) models CAPRI and IFM-CAP.

The JRC has improved the representation of the CAP in these models and in particularly the MAGNET model has been enhanced to capture the allocation of all CAP expenditures, the level of coupling of Single Farm Payments and the modelling of Rural Development payments (Boulanger & Philippidis, 2014) and (Boulanger & Philippidis, 2015). The Rural Development (or Pillar 2) payments in particular might have impacts on productivity of the farmers which have long been discussed in the literature without any clear conclusions. Given that the EU's Rural Development Programme is worth €100 billion from 2014-2020 and leverage a further €61 billion of public funding in the Member States, understanding their impacts on farmers' behaviour remains a crucial task for agricultural economists.

The empirical evidence shows that there is still a large knowledge gap in the literature regarding the understanding of the role of CAP Pillar 2 subsidies on agricultural productivity. The analysis of the growing literature on the topic shows no clear conclusion: results are typically dependent on crop, farm type, region, time, aggregation level etc. so that no clear policy message can be deducted. So far, there is no comprehensive study at NUTS II level for the EU, and in many cases subsidies are generally treated ad-hoc and mostly as a uniform category. Additionally, there is no consensus on the methodology: form of production function, estimation approach, parametrization etc.

The importance of producing reliable results has been underlined by Koen Mondelaers (DG AGRI). The credibility of the results produced by scientists and applied researchers is crucial. All policy DGs, and DG AGRI in particular, need evidence to analyse different policy options and model results to quantify these options in the frame of the upcoming Impact Assessment (IA) of the Common Agricultural Policy (CAP). The results of these models will be even more relevant in the discussion of the next Multiannual Financial Framework (MFF) of the European Commission (EC) which will have to deal with the Brexit case and almost unavoidably with budget cuts. In addition, the shift from Pillar 1 to Pillar 2 is, since some time, one of the possible reforms of the CAP, making modelling of Rural Development always a more important task for agricultural economists and modellers. For the policy makers in DG AGRI, the workshop was relevant to enhance the model credibility and to convince policy makers of the usability of model results. For these reasons, the workshop was relevant to discuss between academics and policy makers about techniques to estimate and model the impact of Rural Development payments in economic models. Additionally, it was a good forum to discuss the importance of having good estimates of the parameters and to explain results which, according to policy makers, looked as counterintuitive in some of the analysed studies.

For all these reasons, the JRC decided to organise a workshop gathering some of the most relevant experts in the topic with the aim of individuating the needed steps to fill the existing gaps and create the necessary consensus between academia and policy makers to produce policy relevant results.

3 Impact of Pillar 2 measures: Estimation procedures

3.1.1 Overview of current literature

The first session of the workshop was dedicated to the approaches used to estimate the impacts of CAP measures on productivity. The session started with the presentation of Hasan Dudu (JRC) on a brief survey of the existing literature. The presentation started with the discussion of the difference between the Technical Efficiency (TE) and Total Factor Productivity (TFP). Total factor productivity explains the change in the production that cannot be attributed to the changes in the production factors. On the other hand, technical efficiency explains ability of a firm (or any economic agent) to produce maximal output by using a given amount of factor (Kumbhakar & Lovell, 2000). TFP explains the deviation of the economic agents from an estimated production function while TE is the distance of firms to the most efficient production function (i.e. the production frontier). In other words, former measures the distance to an average production function while the latter measures the distance to a frontier (i.e. most efficient) production function. These two are not necessarily same, if the average and the frontier production functions are not parallel to each other (Figure 1). Since TFP and TE measures different things, impacts of subsidies on these are not necessarily same. This difference needs to be taken into account while considering the findings in the literature.

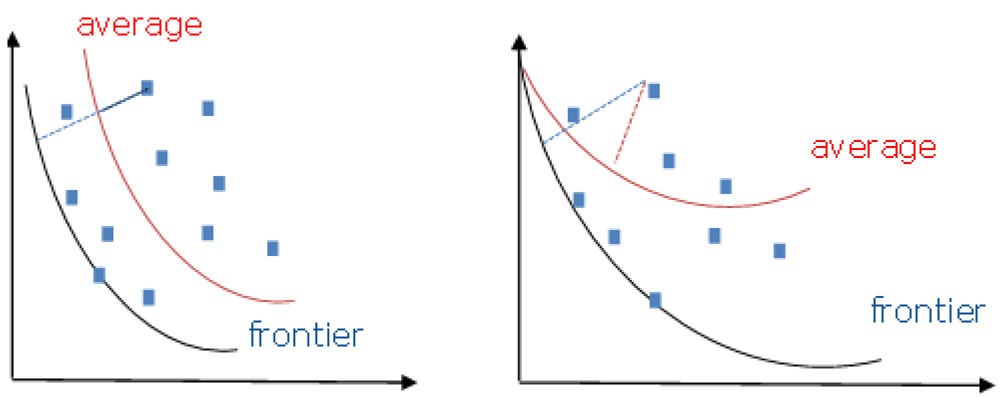

Figure 1: Average production function vs. production frontier

Another way to reflect the differences of TFP and TE is to look at their composition. A change in TFP can be attributed to technical efficiency change, technical change (i.e. change in production technology), scale efficiency change, allocative efficiency change etc… (Key, McBride, & Mosheim, 2008). Hence TFP and TE does not necessarily move in the same direction, as shown by (Key, McBride, & Mosheim, 2008) for US hog production where TE is negative but TFP is positive.

In general, there is a tendency in the literature to link agricultural subsidies to lower technical efficiency or productivity. However empirical findings are contradicting. Some authors report negative findings (Latruffe, Bravo-Ureta, Moreira, Desjeux, & Dupraz, 2011); (Zhu & Lansink, 2012); (Cechura, Grau, Hockmann, Levkovych, & Zdenka, 2016) while others find a positive relationship (Kumbhakar & Lien, 2010); (Latruffe & Desjeux, 2016). There are also studies that find ambiguous relationship: either no impact of subsidies (Pufahl & Weiss, 2009); (Ratinger, Medonos, & Hruška, 2014) or different sign of impacts on TE and TFP (Fogarasi & Latruffe, 2009).

Indeed, only a few studies comprehensively examine the impacts of CAP subsidies at NUTS II level for the EU member states and compare the productivity effects across the different CAP subsidy categories. Furthermore, most studies use farm-level data, mostly from Farm Accountancy Data Network (FADN), whilst capturing private returns, does not consider the public or social returns that are obtained from public investment. Moreover, in most of the studies, agricultural subsidies are treated ad-hoc and as a uniform category. However, when separating the individual subsidy groups, productivity effects of subsidies might change direction.

Examining the relevant literature, a significant proportion of the empirical evidence is based on the use of a parametric Stochastic Frontier Approach (SFA) or a non-parametric Data Envelopment Analysis (DEA) method. The general consensus emerging from these studies is that a negative technical efficiency effect from subsidies is observed. However, as shown in various papers, this negative impact on technical efficiency is not incompatible with positive effect on productivity. Depending on the scope of the study, the results differs: (Mary, 2013) and (Kumbhakar & Lien, 2010) reports negative impacts on TFP (although the latter reports positive impact on TE); (Serra, Zilberman, & Gil, 2008) report ambiguous impact on TFP and (Rizov, Pokrivcak, & Ciaian, 2013) and (Czyżewski, Guth, & Matuszczak, 2018) find mainly negative but improving impacts after decoupling or depending on the type of the support programme.

There is no comprehensive study in the literature that analyse the productivity at NUTS 2 level for the whole Europe. Lastly, no study estimates a CES production frontier or production function to analyse the impact of CAP payments on factor augmenting productivity.

3.1.2 CAP Subsidies and Productivity of EU Farms

The second presentation of the session, by Dr. Smeets-Kristkova, presented the findings of (Dudu & Smeets Kristkova, 2017). The aim of the study was to fill the gap in the literature by taking into account the fact that different CAP subsidies are likely to have different productivity effects. In addition, the study copes with the need for an estimation approach that is consistent with economic simulations models used for impact assessment. To this end, the study uses a novel theoretical approach by linking subsidies to factor-augmenting technical change in the CES framework and employs an econometric model that enables to test explicitly the endogeneity problem i.e., the Generalized Method of Moments (GMM). Further the study relies on a data set that is conceptually in-line with the CGE data following the System of National Accounts (SNA) conventions.

The study relies on several assumptions to be able to estimate the impacts of the CAP subsidies in a consistent way. First of all, the model estimates a CES production function which necessitates the assumption of constant returns to scale[1]. This assumption is also made by the CGE models used for the impact assessment and does not contradict with the general impact assessment framework.

A second set of assumptions are necessitated by the dataset employed. The study mainly relies on at NUTS II level Economic Accounts for Agriculture Rev 1.1 (EAA97) data set which is consistent with SNA definitions and is consistent with the assumptions and definitions used in the CGE modelling. The main assumptions while preparing the dataset are as follows:

- Value added price change is same for all NUTS regions within in a country
- Total area of rented land in a NUTS2 region does not change significantly over the study period (2007-2013).
- Change in the price of capital is same for all NUTS2 regions in a country.

Other minor assumptions and details of the calculations done to estimate the model can be found in (Dudu & Smeets Kristkova, 2017). After the data cleaning process, the resulted dataset was complete only for 10 countries (Austria, Bulgaria, Czech Republic,

[1] CES production function can be generalized by adding a scale parameter to the exponential. However, we did not use this specification as it is not very prevalent in the CGE literature. See (Kmenta, 1967) for the estimation of the generalized CES function.

Denmark, Greece, Finland France, Hungary, Netherlands and Portugal). The CAP data was taken from (Boulanger & Philippidis, 2014) which is also used by JRC to supply GTAP centre with EU agricultural support data.

The results of the study suggested that exogenous productivity growth is zero (statistically insignificant) which is consistent with the finding in the literature. The difference between new and old member states is significant only at 10% level and new member states have a higher exogenous productivity growth. Human capital, physical capital and agro-environmental CAP payments improve the productivity. Rural Development related CAP payments do not affect the agricultural productivity.

The descriptive analysis of the relationship between input and land use growth and ratio of agro-environmental payments to output revealed an important fact: Land use declines with increasing agro-environmental payments while intermediate input use do not change significantly[2]. That is, the higher the share of agro-environmental payments in the output of a region, the more input they use without changing the land use. Thus, the positive impact of agro-environmental payments in productivity can be attributed to the higher intermediate input use by the regions that receive relatively higher agro-environmental subsidies.

The study suffers from several deficiencies: It includes only 10 countries (due to data availability); many variables are missing and substituted by proxies; Pillar 1 is not included; relies on constant returns to scale and CES assumptions; do not take into account different nesting structures (due to missing data on the share of different factors in payments); and lastly excludes intermediate inputs.

3.1.3 Productivity effects of EU domestic support

Professor Marian Rizov presented their study on the impact of CAP subsidies on productivity of EU farms. Rizov et al. (2013) use FADN dataset and modified Olley and Pakes (1996) semi-parametric TFP estimation methodology to directly introduce the effect of subsidies in a model of unobserved productivity. This way they estimate consistent production function coefficients within sectors and countries and obtain unbiased farm-specific TFP measures. Further they verify the impact of subsidies on TFP by the means of correlation analysis and GMM regressions.

After mentioning the mixed findings in the literature and theoretical explanations given by several authors, Professor Rizov introduced the theoretical framework underlying the estimation algorithm. Rizov et al. (2013) estimate a Cobb-Douglas production function with unobserved productivity component applying extensions to the Olley and Pakes (1996) estimation approach suggested by Ackerberg et al. (2007). The estimation methodology deals well with simultaneity and selection biases as well as directly incorporates the impact of subsidies in a model of unobserved productivity utilised in the estimated specifications. The sample consists of farm level production data from FADN data set for EU15 for the period 1995-2008. The sample represents the 90% of land use in EU15.

The findings of the study suggest that most member states exhibit constant or slightly increasing returns to scale. The farm productivity measures aggregated by country and farm type present evidence that productivity level and growth systematically differs between the north and south European countries. The study finds negative correlation between subsidies and farm productivity in the period prior to the decoupling reform; after decoupling, in 2005/2006, the correlation between subsidies and productivity is more nuanced as in several countries it turns positive.

[2] Note that, it was not possible to include the intermediate inputs in the estimations as a factor of production due to limitations in the data set. Hence, the relationship between agro-environmental payments and intermediate input is analysed descriptively.

3.1.4 Assessing CAP impact on growth and jobs

Dr. Garrone presented preliminary results of two joint studies on the impact of CAP on growth jobs and regional GDP growth. Garrone et al., (2017) and Olper et al. (2017) estimate the ex-post impacts of CAP as a treatment by employing panel data econometrics. In the empirical estimation they differentiate between coupled vs. decoupled support and CAP Pillar 1 vs. CAP Pillar 2 payments.. The study uses the Clearance Audit Trail System (CATS) database for 220 NUTS2 regions for EU28 over the period 2004-2014. They disaggregate CAP Pillar 1 payments as coupled and decoupled and CAP Pillar 2 payments.

There are few studies in the literature about the impact of CAP on GDP per-capita growth. Esposti (2007) finds a positive CAP effect on regional GDP growth during 1990-2000, but also reports that the share of agriculture in employment has a negative GDP growth effect. On the other hand, (Crescenzi & Giua, 2016) report insignificant impact of CAP on GDP growth, although both Pillar 1 and Pillar 2 payments have a positive effect in areas with high endowments of infrastructure and R&D.

The preliminary findings of (Olper, Emmers, Garrone, & Swinnen, 2017) suggests that for EU28, overall CAP subsidies has no effect on per-worker GDP growth, while similar to Esposti (2007), they find that GDP growth is lower in regions with a higher share of agricultural employment. In addition, they find that decoupled CAP payments are associated positively with agricultural labour productivity growth (see results below). Thus, the last effect seems not strong enough to overcome the productivity gap with other sectors, so the association of a region's share of agricultural employment with regional growth was negative.

The analysis of the relationship between CAP and Agricultural productivity focuses on agricultural value added per work. The preliminary results suggest a positive impact of Pillar I and Pillar II payments. The positive effect comes almost exclusively from decoupled Pillar I and Pillar II subsidies. The CAP seems to be effective in increasing farmers' investments in agricultural productivity. In theory, CAP payments could reduce farmers' credit constraints, allowing them to invest more. This should matter most in the NMS. In addition, CAP support would reduce farmers' exposure to income risk, which, again, would lead them to invest more. The statistical results are consistent with this theory. The shift from "coupled" towards "decoupled" payments and Pillar II is associated with higher agricultural productivity growth. In theory, the coupled CAP payments could lead to a distortion of farmers' resource allocation, which over time would reduce productivity growth[3]. A shift away from these coupled payments would have the opposite effect. This is consistent with what the statistical analysis finds, and with findings of several other studies showing that agricultural productivity in the EU benefited from the shift from "coupled" to "decoupled" subsidies[4]

Lastly the preliminary results for the impact of CAP on the agricultural employment suggest that for EU28 there is a significant negative association between the outflow of labour from agriculture and the decoupled Pillar I and Pillar II payments. Hence, on average, decoupled CAP subsidies maintain employment in EU agriculture. No such association was found for the coupled payments. For EU15, effects of Pillar 1 decoupled and Pillar 2 are both strongly negative while coupled payments have a positive and significant effect. Lastly for EU13 the coupled and decoupled components have negative impact, but barely significant (10% level).

Overall, the results suggest that there may not be a trade-off between employing people in agriculture and supporting increases in agricultural productivity. Decoupled, non-distortionary payments stimulate higher productivity agriculture. They also have a positive association with agricultural employment. In this way productivity growth and employment can go hand in hand.

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[3] Some earlier studies also find that the higher the share of subsidies in total farm income, the more negative the impact, e.g. Zhu and Lansink (2010); Bojnec and Latruffe (2013); and Zhu et al. (2012)

[4] Rizov et al. (2013); Kazukauskas et al (2014)

3.1.5 The Impact of Green Box on Productivity in FADN European Regions

Dr. Guth has presented their joint work, (Czyżewski, Guth, & Matuszczak, 2018) where they test the possible impact of CAP programmes on the 'greening' trend, which have a positive impact on productivity in FADN regions. They use a two stage approach where they first identify the clusters of EU-FADN regions differ significantly in terms of farming models. In the second step they estimate the impact of CAP "green programmes" on productivity.

For the first stage of the study, (Czyżewski, Guth, & Matuszczak, 2018) use agglomerative cluster analysis (Ward's method) classifies the FADN regions according to the criterion of percentage contributions to the different "boxes" of subsidies. In the second stage they analyse the productivity of each cluster with panel data regression.

The cluster analysis identified three clusters of regions with different farming models according to the support structure:

- moderately sustainable,
- Weakly sustainable, where the contribution of single farm and area payments to the political rent was markedly higher than in the others, at close to 80%.
- Strongly sustainable, combining various forms of assistance to farms.

Only models A and C were to a greater or lesser extent aligned with the development priorities of the European agricultural model emphasised in the new financial perspective of 2014–2020.

Panel data analysis shows that three clusters of regions in the EU28 countries differs significantly in terms of the structure of CAP schemes. In the most numerous group, of the EU28 regions, the moderately sustainable model A operated, primarily combining direct support with payments for public goods. The second most numerously represented was the weakly sustainable model B, in which support consisted chiefly of single farm and area payments. The smallest group of regions featured a highly sustainable model, combining various forms of support for farms at similar levels (both through direct and production subsidies, and through payments for the supply of public goods and to a lesser degree the subsidisation of investment). An agricultural support model which reflects structural farming differences is a significant factor in determining the productivity of intermediate consumption over the whole studied period.

The direction of the influence of studied schemes depends on the sustainability level of farming in the respective regions. Hence, the single payments might have a positive influence on productivity only in the old member countries included in the most sustainable model, while the environmental subsidies positively contributed to productivity only in moderately sustainable model of farming.

Although there is evidence for a negative general impact of CAP subsidies on productivity, in each cluster we can observe CAP programmes which positively affected the productivity of intermediate consumption. Cluster A (moderately sustainable model of farming), which encompasses the majority of new member states, was characterised by the highest number of such schemes.

3.1.6 Discussion

Alex Gohin noted that many drivers on the productivity makes identification a difficult task especially if the price volatility is taken into account. He criticized (Dudu & Smeets Kristkova, 2017) for:

- Ignoring the winners and losers from the productivity gains due to CAP payments. He pointed that Constant returns to scale assumptions implies that there are no profits.
- Ignoring the family labour in the study which is an important factor of production and has different characteristics then the paid labour. He defended the fact that without taking into account the ownership of the factors, the study cannot derive conclusions about important policy questions.
- The exclusion of variable inputs
- Importance of the relationship between agri-environmental measures and productivity. He pointed that the mentioned relationship is now only correlation and not causality.
- Ignoring the relative price effects which can play an important role in the production decision of the farmers. The prices of outputs and inputs, excluding land, are likely exogenous but only at the local level.
- Ignoring the value of public goods which are difficult to include in such models. The value added calculations only capture private effects but not public goods.
- Not splitting the agro-environmental payments for contract and non-contract farmers. Since these payments are for a limited period he suggested taking this fact into account?

From the econometric point of view Dr. Gohin raised the following issues:

- The identification of causality: Is CAP causing higher productivity or more productive regions attracting more subsidies?
- A series of instruments for the endogenous prices, different than lagged prices, should be used to account for endogenous prices. A sensitivity analysis needs to be run to check the robustness of the results against the lag selection.
- What about the cross effects? These need to be taken into account.
- The model ignores the benefits of the provision of the public goods. How can we include them?

Koen Mondelaers (DG AGRI) criticised the constant returns to scale assumption and the CES assumption, leading to a constant elasticity of substitution among inputs. He also stressed that differences among Member States' responses to different expenditures are considered only via a dummy variable for all New Member States, while one for each state might be more appropriate. Mr Mondelaers also expressed his concern about considering with marginal methods' differences a big change such as a no-CAP scenario. Finally, he said that also Pillar 1 subsidies should be considered in the analysis.

Dr Dudu clarified that the approach followed is based on the system of national accounts and that family labour is already included in the labour statistics used (from EUROSTAT). In the same way, environmental benefits as public goods, because are not in the system of national accounts, are also ignored in this contribution for the moment. He also mentioned that variable dummies for specific member states have been used without particular change of the results.

The study by Ms Guth sparked a question on the way of clustering the regions in the EU.

4 Modelling Pillar 2 Measures

In this section, after a brief literature review of models dealing with impacts of Pillar 2 payments on the EU agriculture, a selection of available examples drawn from PE, CGE and farm-level model is presented.

4.1.1 Overview of current literature

The session was dedicated to the approaches used to model Rural Development payments in economic simulation models. The session was opened by a presentation of Emanuele Ferrari on a brief survey of the existing modelling approaches.

The first consideration is that in general, RD measures are difficult to be taken into account by these models for several reasons: First of all, due to their complexity and number. There are 118 different Rural Development Programmes (RDP) in the 28 Member States, with 20 single national programmes and 8 Member States opting to have two or more (regional) programmes. Member States and regions draw up their Rural Development programmes based on the needs of their territories and addressing at least four of the six common EU priorities.

Secondly, it is somehow complicated to translate into modelling what policy makers thinks the impact of each policy should be on the economy. First of all, all measures are notified in green-box to WTO so they should likely have very small impacts on production and trade via productivity and other (land, labour use) changes. Ana additional complexity is given by the difficulty to link the reduced and sparse, but growing, empirical evidence to economic modelling to improve the model parametrisation.

The main attempts to take into consideration Pillar 2 Payments in economic modelling are presented below and include the IFM-CAP, CAPRI RD and AMGNET models from the iMAP platform and other regional CGE approaches.

In conclusions, the analysed literature concludes that a CGE approach might be required for a comprehensive ex-ante analysis of Pillar 2 payments as many measures have direct and indirect outside the agriculture sector (factor markets, construction, tourism…).

Secondly, most of the modelling attempts have a regional (NUTS2) dimensions it becomes very complicate to deal with Pillar 2 payments at MS or EU28 averages, given the extreme differences in which the projects are designed and implemented by European regions.

Finally, as a clear link to the first session of the workshop and the estimation of impacts of these policies, the parametrisation of the models (and the way in which different RD measures are mapped into more general categories to be more easily modelled) essentially determines the outcome of any modelling attempts.

4.1.2 Rural Development in Regional CGEs

Katarzyna Zawalińska from the– Institute of Rural and Agricultural Development (IRWiR PAN) of the Polish Academy of Sciences presented the approach of modelling Rural Development in regional CGE models, with focus on Poland.

She first underlined a few concerns about the use of these models.

In the first place they are related to the representation of "rurality" in regional CGE models. When models take into account NUTS3 region, the OECD/Eurostat categorization of rural vs urban regions hold. On the other hand, when models work at NUTS2 level, this distinction is less precise. This spatial distinction is crucial to model correctly households (rural households might have different consumption patterns than urban households), land (e.g., land under LFA can have different parameters than "normal" land).

Secondly, when taking into account RD measures new challenges are merging with reference to technological and environmental impact of these measures.

In more practical terms, when modelling RD measures the first task is to group them according to a chosen approach. Grouping can be made following the design of them measures or the use of the money. For example, analysing a survey on the direction of spending of RDP measures by purpose in Poland it emerges that from most Polish farmers Single Farm Payments (SFP) and LFA payments are equivalent.

Katarzyna Zawalińska presented an example of modelling LFA with the POLTERM model for Poland. POLTERM is an implementation of the TERM model (Horridge, 2012) to the Polish economy (Zawalinska, Giesecke, & Horridge, 2013). The model includes 20 agricultural sectors and 8 processed food commodities, a distinction between LFA and non-LFA land 2 representative households (rural and urban) and 16 NUTS2 regions. The model simulates the introduction of LFA payments modelled as land rental subsidy. The main results report an increase of the Poland GDP by 0.07%. The owner price of LFA land increased by 11.2% and at the same time user price of LFA land declined by 6.06%. Since the price increased the LFA farmers supply more land (by 2.26%). The increase in land supply makes marginal product of labour to raise, this accounts for rise of real wage 0.16%. Notice, however, that real consumption increase is substantially higher than that in GDP. Real consumption increases by 0.2% while GDP by 0.07%. This reflects two things. Firstly, the terms of trade improves (0.06%), secondly and more importantly the LFA funds are financed almost entirely by the rest of the EU. This transfer to Poland follows the Polish real balance of trade to move towards deficit (real exports falls by 0.23% and real imports increases by 0.07%. It is this movement towards the deficit and the resulting decrease in exports that accounts for improvement in terms of trade.

In regional terms, the winners are the most agricultural and rural regions while main losers are the most urban ones. Employment shifts from most urban to more rural regions while the increase in land supply is due to land that would have otherwise been abandoned.

In conclusion regional CGE models, stand alone, has a problem with precise representation of rurality. The results of modelling of RDP measures in regional CGE depend very much on the interpretation of the modellers of the purpose of the measures (what were designed for or how the measures were actually spent by beneficiaries).

In order to overcome some of the limitation listed in the presentation a few proposals are made to move forward modelling RD measures in a regional CGE frame. The measures related to increase in productivity, knowledge-transfer, Research & Development would require an endogenous growth theory behind in order to be implemented in such a model. To grasp the effects on the environment of the measures, environmental aspects should be included and integrated in the CGE database. Lastly, some of the deficiencies in regional CGE approach (e.g. more precise implementation of the measures) could be overcome by linking CGE with more precise and detailed agricultural partial equilibrium models.

As a final remark, Katarzyna Zawalińska, reminded that a good modelling of RD should look at how farmer spend the money they receive and which effects this money have on farmers and in order to improve the quality of modelling asked to make public data on RD expenditure through official EC channels.

4.1.3 Lessons learned from modelling of Pillar 2 in the CAPRI-RD project

Wolfgang Britz from the Bonn University presented Lessons learned from modelling of Pillar 2 in the CAPRI-RD project within the 7th framework program, 2009-2013, focusing on modelling the Pillar 2 of the CAP, not only for agriculture.

The main challenges to model RD measures are due to the wide range of diverse national or even regionalised measures which form Pillar 2. In addition, the measures are of the opt-in type so that farmers are not obliged to adopt them and finally there is no harmonized data base on Pillar 2 programs which is directly suitable for modelling. In terms of data availability, it should also be underlined that available data focus on how the money are spent (planned or actual) while limited information are available on the real use of the money and data are generally classified by political aim rather than by detailed implementation of the expenditures.

The approach of the CAPRI RD project in modelling RD measures was to develop a standardized "impact pathway" matching the classification in the available data bases. In other word, the main idea was to "follow the money" instead of focusing on the logic behind the intervention. As an example, any expenditure linked to "village renewable" measures causes a shift of government demand towards the construction sector. Following this approach, all measures were grouped in to different categories with same expenditure logic.

During the project life time a couple of test were performed with the newly developed model tool: an ex-ante application for Slovenia to assess general options (not details) in terms of RD measures and an ex-post assessment for Germany (Schroeder, Gocht, & Britz, 2015) to compare the evaluation of a few Rd programmes with model results.

The CARPI RD projects produced a functioning set of regional CGE models with matching SAMs (based on 2005 data, by now rather old). The CAPRI code was modified to model selected Pillar 2 instruments in the regional/farm type models of CAPRI. Overall the results was an even more complex CAPRI modelling tool with higher data demands, asking for experts in PE/CGE and bio-physical modelling, the first and second pillar of the CAP.

The main conclusions drawn by Wolfgang Britz are the following:

Modelling Pillar 2 is far more complex compared to Pillar 1 (but recent change in Pillar 1 are challenging as well);

Looking at Pillar 2 the data need is a concrete bottleneck which is slowing down the process of model improvement.

A serious modelling of these measures would require regional expertise to guide the modeller on the implementation logic to associate to each measure/programme.

In addition, one of the main gaps of the current literature is the lack of consideration of administrative costs linked to planning, implementation, controlling, monitoring and ex-post assessment of these programmes. These are potentially very high costs and so far are barely taken into consideration by models.

4.1.4 The RD module in MAGNET

Emanuele Ferrari (JRC) presented the approaches taken by the global CGE MAGNEt to model Rural Development payments. The Modular Agricultural GeNeral Equilibrium Tool (MAGNET) (Woltjer & Kuiper, 2014) is a multi-region CGE model which is a derivative of the well-known Global Trade Analysis Project (GTAP) model. It is developed and applied at Wageningen Economic Research (WECR) at the University of Wageningen and is also employed by the Thünen Institute (TI) and the JRC.

In a first version of the model, Pillar 2 measures were aggregated into five groups according to the similarities in the economic mechanisms which underlie them:

1. Investment in human capital (e.g., vocational training, setting up of young farmers, use of advisory services, etc.);
2. Investment in physical capital (e.g., modernisation of agricultural holdings, infrastructure investments, adding value to agricultural and forestry products, etc.);
3. Agri-environmental payments (e.g., Natura 2000 payments, forest-environment payments, etc.);
4. Least favoured areas (e.g., payments to farmers in mountainous areas);

5. Wider RD schemes (e.g., diversification into non-agricultural activities; encouragement of rural tourism; village renewal and development, etc.).

Payments of classes (i), (ii), (iii), and (v) were then assumed to incur endogenous output or input productivity effects. Investments in physical capital were leading to increases in output productivity only within agricultural sectors. Estimates of vintage effects of investment in physical capital on output productivity suggested a rate of return of 30% (Nowicki et al., 2009). Investments in human capital were modelling as increasing output productivity in agriculture through greater awareness of farming practise, better use of machinery, improved fertiliser, pesticide and feed application, and more efficient land use. The productivity parameter of 0.4 (Nowicki et al., 2009) indicates an internal rate of return of 40% for the OECD countries. Accordingly, an investment of one euro per unit of physical capital stock increases output productivity by 40%. Agri-environmental schemes and LFA were directly tied to the land factor. Payments were modelled as compensation of farmers in return for a more extensive (and consequently less productive) production system. This approach reduced land productivity *indirectly* due to less commercial technologies (i.e., more extensive production techniques, and/or an insurance effect which makes people work less). Due to agri-environmental schemes, labour and capital productivity in agricultural sectors decreases by 5% for every euro of expenditure on agri-environmental schemes. Wider RD payments were modelled as initiatives to reverse the economic and social decline in rural areas such as promoting innovation, creating employment opportunities and thereby output productivity change not only in agriculture but also in the wider rural economy. In this case, the model assumed same rate of return used for physical capital investments (i.e., 30%).

By their nature, ‘agri-environmental schemes’ and ‘least favoured areas’ are almost completely tied to the land factor, whilst remaining Pillar 2 measures are linked (in varying degrees) to land, capital, both labour types and intermediate inputs based on the aims of the policies and discussions with experts.

Output augmenting or factor augmenting technical changes multiply a ‘response parameter’ by the ratio of payments to the specific total cost-price value (based on GTAP data). This yields endogenous augmenting technical change. In the agriculture sectors the total output augmenting effect is the sum of human capital physical capital and wider rural measures. The response parameters reflect the literature estimates (or best guess) of rates of return of these investments. For example, looking at human capital, if the investment in human capital equals 1% of total output value, output productivity increases by 0.40*1%= 0.40% (40% return). In non-agriculture sectors, the total output augmenting effect is the sum of output augmenting due to wider rural measures investments. A factor augmenting change is due to agro-environmental measures which affect non-land agriculture factors (i.e., labour and capital).

An application of this approach to model Rural Development payments showed a limited impacts of CAP cuts on EU agricultural (production neutral behaviour SFP). Changes in output linked to productivity effects arise from changing in Pillar 2 expenditures (Boulanger and Philippidis, 2015). Reductions in Pillar 2 (human and physical capital and wider rural measures) generate productivity losses in agricultural and (to a lesser extent) non-agricultural sectors which are particularly pronounced in Poland. The UK and Austria witness small positive technological gains as 60% of their Pillar 2 expenditure (including co-financed support) is assigned to (productivity reducing) agri-environmental measures.

A new approach has been recently applied with the MAGNET model. In this approach each payment type has a direct relation with the factor to which they correspond and the focus switches from total to single Factor productivity. To parametrise it, a response parameter has to be econometrically estimated. This parameter links the change in the payments to the increase in productivity of a given factor. For instance, it the response parameter is equal to 0.05, a 100% increase in a given payment would be equal to a 5% increase in the productivity of the given factor linked to that payment. Under this new approach, human capital investments are linked to the labour factor productivity; physical capital investments are linked to the capital factor productivity; agro-environmental investments are linked to the land factor productivity while wider rural payments are stilll linked to the total factor productivity parameter.

In M'barek et al., (2017), the MAGNET model has performed the CAP scenario analysis with the following parameters:

- 100% increases in human capital investments produce labour factor productivity improvements of 1.6%.
- 100% increases in physical capital investments produce capital factor productivity improvements of 2.5%.
- 100% increases in agro-environmental investments produce land factor productivity improvements of 0%.
- 100% increases in wider rural payments increase productivity with 0.2%

An additional test with parameter increased by 50 and 100 per cent and Agri-environmental payments equal to 5% was also performed as sensitivity analysis of the parametrisation of the model. The results of the analysis show a negative effect of abolishment of the Pillar 2 payments on agricultural production. The magnitude of the shocks varies according to the parameter used in the scenarios. The bigger is the response parameter, the higher is the loss in terms of production and the bigger is the increase in price. On the other hand, the impact on the employment level has to be better explained as, the bigger the response parameter, the less the job lost in agricultural sector. Pillar 2 payments in human capital causes an increase of labour productivity and consequently a decrease of labour demand, which being more productivity can produce more with less inputs. Removing the subsidies, cause job to become less productive (less paid and of minor qualities too) so that demand for labour is decreasing less compared to the baseline.

As conclusion it should be underlined that parametric uncertainty (i.e., more econometrics definitely needed to take this further) remains a key drawback of any approach to model RD payments. In addition, MAGNET treatment is necessarily very stylized due to this uncertainty, but at very least goes deeper than other global CGE treatments of this issue.

The discussion following the presentation focused on some of the hypotheses (including the functional form behind the labour market and the hypothesis of constant return to scale) behind the model and on the interpretation results presented.

4.1.5 Rural Development in farm models: IFM-CAP

Jeroen Buysse (University of Gent) presented a feasibility study to incorporate Rural Development policy modelling in IFM-CAP.

The approach proposed is based on an adoption modelling, estimated with a two-step econometric Heckman approach. In the first step a probit regression model is performed to to predict adoption of a farm. In the second step, the “level” of adoption is estimated including only adopting farms with the same explanatory variables as in the first step

The results of the econometric estimation are then implemented into the model. The econometric model selects the farms with highest probability of adopting an RD measure. The model then calculates the intensity of adoption (2nd step Heckman). In the following step, subsidies are multiplied by the sampling weight. The steps 1-3 are replicated until the total budget is allocated and exhausted. Finally, coupling coefficients are assigned to farms with new adopting behaviour.

This approach has a few implications for the modelling strategy. First of all, the adoption of RDP is calculated outside the IFM-CAP model. Secondly, budget allocation to different RDP measures will be exactly reflected in the IFM-CAP model. Thirdly, no simulations of behaviour of farms that would strategically change land allocation of livestock production to satisfy with the requirements of certain RD measures are needed. The level of data detail finally will define modelling details.

The main drawback of this approach is that FADN is not representative in terms of RD adoption.

4.1.6 Discussion

Hubertus Gay (OECD) facilitated and chaired the discussion on the modelling. He started his presentation reminding the challenges linked to the modelling of the RDmeasures in any kind of economic simulation model.

The first challenge is due to the diversity of the six common EU priorities which lies behind the RD payments:

- fostering **knowledge transfer and innovation** in agriculture, forestry and rural areas
- enhancing the viability and **competitiveness** of all types of agriculture, and promoting innovative farm technologies and sustainable forest management
- promoting **food chain organisation, animal welfare and risk management** in agriculture
- **restoring, preserving and enhancing ecosystems** related to agriculture and forestry
- promoting **resource efficiency** and supporting the shift toward a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors
- promoting **social inclusion, poverty reduction and economic development** in rural areas.

The second challenge is due to the specificity of these policy measures which worth €100 billion from 2014-2020 and leverage a further €61 billion of public funding in the Member States.

1. All the measures are co-financed by Member States
2. They target specific RD objectives
3. They are based on multi-annual commitments
4. *Plus: opt-in and not mandatory*

The OECD is approaching these challenges collecting as much data as possible to allows researchers and policy makers to compare between countries and over time (Agri-environmental indicators www.oecd.org/tad/sustainable-agriculture/agri-environmentalindicators.htm, Innovation, agricultural productivity and Sustainability www.oecd.org/tad/agricultural-policies/innovation-food-agriculture.htm).

The OECD has also recently published an evaluation of Agricultural Policy Reforms in the European Union: The Common Agricultural Policy 2014-20 (http://dx.doi.org/10.1787/9789264278783-en) paying special attention to risk management instruments and environmental measures.

From the previous presentation a few key messages emerged:

- Pillar 2 modelling is far more complex compared to Pillar 1.
- Modellers need to better understand the logic behind Pillar 2 measures. For instance, why are they notified as green-box measures to the WTO by the EU?
- More specific data are needed; this is often a huge bottleneck.

- “Implementation” logic in models of specific programs needs national / regional expertise
- One of the main gap so far is represented by the lack of modelling of administration costs (planning, implementation, controlling, monitoring, ex-post assessment ..) of Pillar 2 which are rarely included into models but potentially quite high.

A few indications were mentioned as possible way forward. Estimation of parameters has to be consistent with the type of economic model which will be used for performing the simulations. The difference between the micro and macro level has also to be accounted for, the assessment of a single measure has to necessary be a micro impact study while only the assessment of many or all RD measures can be performed with a more macro model. Models have to be able to differentiate between intervention logic and implementation logic (possibly with insights from the behavioural economics) and to account for administration costs to implement the measures..

In the end, multiple approaches will be needed to perform a comprehensive analysis.

5 Conclusions

The workshop concluded with a summarising session where the key inputs from the previous sessions were highlighted.

From the JRC side some key elements were underlined.

On the estimation side, several improvements can be achieved:

- Collection of more detailed, more frequent and spatial disaggregated data
- A few assumptions used by last JRC estimation process can help to improve the estimates. Among them, the inclusion of intermediate inputs, family labour and the possibility to use an improved database to provide MS estimates.

On model:

- The impact of abolishing Pillar 2 measures on the labour market. How can it be better communicated and how the methodology can be improved?
- One of the main gaps highlighted by all presenters in reference to the models is the absence of deadweight losses and administrative costs related to RD measures.
- A thoughtful reflection on why RD measures are notified as green box ones to the WTO and how can this be taken into account when they are implemented in economic models.
- Again in terms of modelling, the approach of following the money (in terms of understanding how money allocated to each measure is spent) should be better analysed.
- IFM-CAP approach looks promising
- CGE different approaches are currently in use. JRC should perform a review of the current approach and highlights pros and cons of the different methodologies.
- The treatment of the labour market is a key part of the rural development payments and models (CGE in particular) should look at improved approach to model this key market.
- Sensitivity analysis is always a very powerful tool to show how much models are sensitive to changes in key parameters.

In addition to these conclusions, from DG- AGRI and policy making side a few statements concluded the workshop:

- The methodology proposed by Dudu & Smeets Kristkova is appreciated for the effort that went into the development of the approach, the data 'manipulation' and the estimations. DG AGRI has full confidence that JRC pursues the best way possible to improve their models and provide sound analyses. However, important drawbacks were highlighted before and during this workshop in relation to the current estimation and modelling techniques. These drawbacks should be addressed in the near future by the JRC..
- The methodology would remain rigorous even when combined with expertise providing specific knowledge of given territories or regions. The combination of expert knowledge and a sound econometric estimation will make results more easily interpretable and credible.
- One of the key to make results more credible is related to how these results are communicated. Scientists should spend more time in improving communication towards policy makers.

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List of abbreviations and definitions

CAP	Common Agricultural Policy
CAPRI	Common Agricultural Policy Regional Impact model
CATS	Clearance Audit Trail System
CES	Constant Elasticity of Substitution
CGE	Computable General Equilibrium
DEA	Data Envelopment Analysis
DG AGRI	Directorate-General for Agriculture and Rural Development
EC	European Commission
FADN	Farm Accountancy Data Network
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GTAP	Global Trade Analysis Project
IFM-CAP	Individual Farm Model for Common Agricultural Policy Analysis
IIA	Inception Impact Assessment
iMAP	integrated Modelling Platform for Agro-economic Commodity and Policy Analysis
JRC	Joint Research Centre
LFA	Least Favoured Area
MAGNET	Modular Applied GeNeral Equilibrium Tool
MFF	Multiannual Financial Framework
PE	Partial Equilibrium
RD	Rural Development
RDP	Rural Development Programmes
SFA	Stochastic Frontier Approach
SNA	System of National Accounts
SFP	Single Farm Payments
TI	Thünen Institute
TE	Technical Efficiency
TFP	Total Factor Productivity
WECR	Wageningen Economic Research at the University of Wageningen

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Figure 1: Average production function vs. production frontier...................................... 7

Annexes

Annex 1. Workshop Agenda

WORKSHOP ON ESTIMATION AND MODELLING IMPACTS OF PILLAR 2 MEASURES ON THE AGRICULTURAL SECTOR

Seville, 14 September 2017

Venue	European Commission – Joint Research Centre (JRC) Edificio Expo, Calle Inca Garcilaso 3, 41092 Seville, Spain - Room A41	
Organisers	Emanuele Ferrari	JRC - scientist
	Hasan Dudu	JRC - scientist
	Koen Mondelaers	DG AGRI
	Sandra Marcolini	JRC - logistics

AGENDA

09:30 – 10:00	Welcome and background	Giampiero Genovese (JRC) Koen Mondelaers (AGRI)
	Session 1: Impact of Pillar 2 measures: Estimation procedures Session 1a - Chair: Simone Pieralli (JRC)	
10.00-10.20	Overview of current literature	Hasan Dudu (JRC)
10.20-10.40	CAP Subsidies and Productivity of EU Farms	Marian Rizov (Lincoln University) (VC)
10.40-11.00	Productivity effects of EU domestic support	Zuzana Smeets Kristkova (WECR)
11.00-11.30	Coffee break	
	Session 1b - Chair: Emanuele Ferrari	
11.30-11.50	Assessing CAP impact on growth and jobs	Maria Garrone (KUL)
11.50-12.10	The Impact Of The CAP Green Box On Productivity In FADN European Regions	Marta Guth (Poznań University of Economics and Business)
12.10.12.30	Discussant	Alex Gohin (INRA)
12.30.13.00	Open Discussion	All participants
13.00-14:00	Networking lunch	
	Session 2a: Modelling Pillar 2 Measures - Chair: Hasan Dudu (JRC)	
14.00-14.20	Overview of current literature	Emanuele Ferrari (JRC)
14.20-14.40	Rural Development in Regional CGEs	Katarzyna Zawalinska (Polish Academy of Sciences) (VC)
14.40-15.00	Lessons learned from modelling of Pillar II in the CAPRI-RD project	Wolfgang Britz (Bonn University) (V
15.00-15.30	Coffee break	
	Session 2b – Chair: Koen Mondelaers (AGRI)	
15.30-15.50	The RD module in MAGNET	Emanuele Ferrari (JRC)
15.50-16.10	Rural Development in farm models: IFM-CAP	Jeroen Buysse (Ghent University)
16.10.16.30	Discussant	Hubertus Gay (OECD)
16.30.17.00	Open Discussion	All participants

	Session 3 - Conclusions	
17.00-17.10	Way forward – estimation point of view	Hasan Dudu (JRC)
17.10-17.20	Way forward – modelling point of view	Emanuele Ferrari (JRC)
17.20-17.30	Way forward and conclusion	Koen Mondelaers (AGRI)
21.00	Dinner	

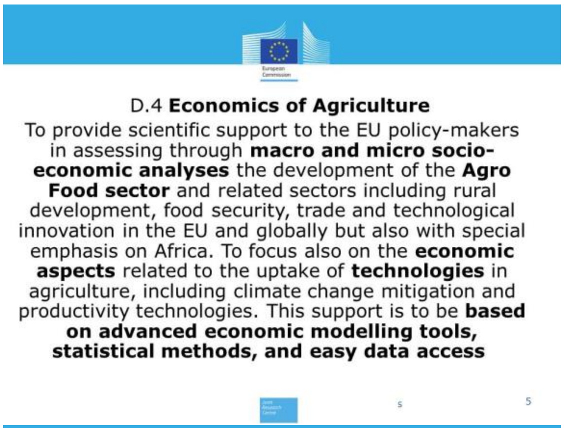
Annex 2. List of participants

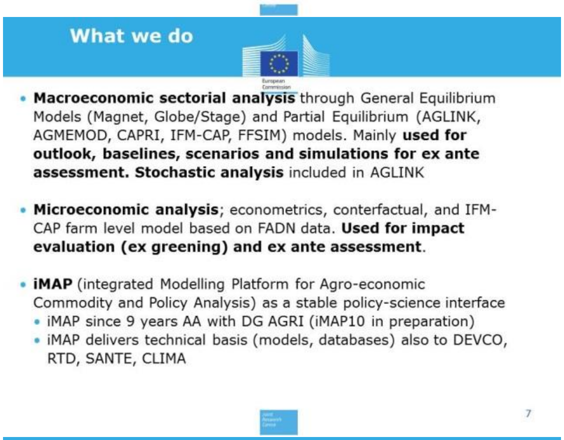
IN SEVILLE	BY VIDEOCONFERENCE
BUYSSE Jeroen Ghent University	BRITZ Wolfgang University of Bonn
GARRONE Maria University of Leuven	RIZOV Marian University of Lincoln
GAY Stephan Hubertus OECD	ZAWALIŃSKA Katarzyna Polish Academy of Sciences
GOHIN Alexandre INRA	
GUTH Marta Poznań University of Economics and Business	
SMEETS KRISTKOVA Zuzana Wageningen University and Research Centre	

IN SEVILLE		BY VIDEOCONFERENCE	
CIAIAN Pavel	JRC	BIELZA Maria	JRC
DUDU Hasan	JRC	CARMONA GARCIA Gema	JRC
FERRARI Emanuele	JRC	HELAINE Sophie	AGRI
GENOVESE Giampiero	JRC	LONDERO Pierluigi	AGRI
HIMICS Mihaly	JRC		
LOUHICHI Kamel	JRC		
MONDELAERS Koen	AGRI		
PIERALLI Simone	JRC		

Annex 3. Presentations

Introduction – Giampiero Genovese (JRC)





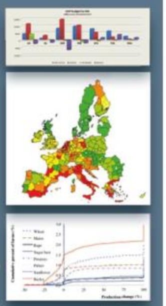
The modelling framework

The figures are for pure illustration purposes

MAGNET (CGE model)
Trade & budget implications

CAPRI (PE model)
EU production & environment

IFM-CAP (Farm level model)
Farm income (average & distribution)



Why three models?
- To capture better the three dimensions of sustainability
- Strengths of different tools
- Spatial disaggregation

Caveats of models
- Simplification of reality
- Assumptions on future developments
- No forecasting models
- Assumption on perfect competition (and others)
- No non-tariff measures
- …

Rural Development Measures

The EU's rural development worth €100 billion from 2014-2020 and leverage a further €61 billion of public funding in the Member States.

1. Investing in rural **jobs and growth.**
2. Ensuring the **sustainable management of natural resources**, and climate action.
3. Achieving **a balanced territorial development** of rural economies and communities

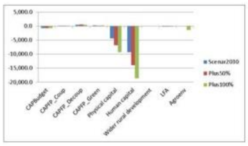
Number of Rural Development Programmes per country and budget


What we know, what we don't

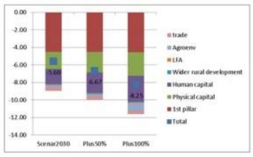
There are many studies in the literature but…
- No clear conclusion: effects depend on crop, farm type, region, time, aggregation level etc…
- No comprehensive study at NUTS II level for the EU, many farm-level studies (i.e FADN).
- Subsidies are treated ad-hoc and mostly as a uniform category.
- No consensus on the methodology: form of production function, estimation approach, parametrization etc…

Why do we need to fill the gap?

Impact of RD measures on Welfare
NoCAP Scenario



Agricultural Production, 2030-2016
No CAP Scenario



Thank you!

Impact of CAP Pillar II Payments on Agricultural Productivity– Hasan Dudu (JRC)

Impact of CAP Pillar II Payments on Agricultural Productivity

Hasan Dudu, Zuzana Smeets Kristkova

www.jrc.ec.europa.eu

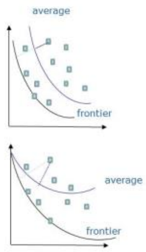
Serving society
Stimulating innovation
Supporting legislation

Overview

- Methods:
  - Production function estimation
    - TFP measures (Malmquist etc…)
    - Technical Efficiency measures (SFA & DEA)
  - Propensity Score Matching
- Data
  - Micro
  - Aggregated
  - Macro

TFP vs TE

- Distance from the frontier and the average prod. func. would be
  - Would be same if they are paralles
  - Would be different if they are not!
- Supporting findings in the literature



Subsidies & (-) Technical Efficiency

- Negative impact on Technical Efficiency
  - Latruffe et al. (2009): SFA, 7 EU Countries,
  - Zhu and Lansink (2010) and Zhu et al. (2012): SFA, selected EU-15,
  - Cechura et al. (2016): SFA, 24 EU, Milk,

Subsidies & (+) Technical Efficiency

- Positive impact on TE
  - Khumbhakar and Lien (2010): SFA, Norway, Grain, (remember negative impact on TFP)
  - Latruffe and Desjeux (2016): DEA, France, Crop – Dairy – Beef
  - Investment & Rural development insignificant
  - production subsidies positive impact on TE & TFP

Subsidies & Ambigious TE Effects

- Fogarasi and Latruffe (2009): DEA, Hungary : in general Negative TE impact; Positive impact on TFP for Crop
- Pufahl and Weiss (2009): PSM : Germany: No effect on land prodcutivity
- Ratinger et al. (2015): Czech Republic : No effect on TFP

CAP Payments & Productivity

- Few studies links CAP payments to **productivity**:
  - Mary (2013): GMM, Cobb-Douglas (CD), France, Crop farms,
    - set-aside, LFA and livestock payments: **Negative** impact on TFP
    - Investment & Agri-env. Payments: Insignificant
  - Rizov et al. (2013): Semi-parametric, FADN, EU15, CD, Total subsidies
    - **Negative** impact on TFP, **improves** after decoupling
  - Serra et al. (2008): SFA, USA, Farm data,
    - **ambiguous** impact on TFP
  - Khumbhakar and Lien (2010): SFA, Norway, Grain, **negative** impact on TFP (remember + TE finding)
  - Czyżewski et al. (2017): (details will be presented today)
    - Generally negative impact but **some programmes** have **positive** impacts

What is missing?

- No comprehensive study at NUTS II level for the EU
- Most studies use farm-level data (i.e FADN).
- In most of the studies, agricultural subsidies are treated ad-hoc and mostly as a uniform category.
  - Minviel and Latruffe (2014) (Meta-analysis of 195 studies)
    - Using total subsidies received increases the probability of a negative effect
- Most empirical evidence relies on Stochastic Frontier Approach or Data Envelopment Analysis but TE≠ TFP
- Further TFP ≠ factor augmenting productivity (e.g. human capital subsidies are likely to stimulate labour productivity more than land productivity).
- None of the studies use CES and cannot be used to parametrize economy-wide models

Do CAP subsidies affect productivity of the EU farm?– Marian Rizov (Lincoln International Business School)

Do CAP subsidies affect productivity of the EU farm?

Marian Rizov
Lincoln International Business School
United Kingdom

Introduction

- EU spends around 50 billion on CAP
  with the primary aim to support farmers' income and improve the environment
  - Decoupled direct payments (SFP) – Pillar 1
  - Coupled payments (crop and animal activities) – Pillar 1
  - Rural development payments (RDP) – Pillar 2
- The 2003 CAP reform significantly reduced coupled payments
- The impact of subsidies and of the 2003 reform is of high policy and academic interest

Structure of the analysis

- Lack of empirical evidence of subsidies' direct effect on farm productivity (TFP)
- This study fills the gap by using the large FADN dataset and (advanced) semi-parametric TFP estimation technique (Rizov et al., 2013 JAE)
  - We directly introduce the effect of subsidies in a model of unobserved productivity
  - Estimate consistent production functions coefficients within sectors and countries
  - Obtain unbiased farm-specific TFP measures
  - Verify the impact of subsidies on TFP by the means of GMM regressions

Subsidies and productivity

- Theoretically the link is ambiguous and therefore it requires empirical investigating
- *Market failure* justifications for public subsidisation (De Long and Summers, 1991 QJE; Rajan and Zingales, 1998 AER)
- But financing subsidies leads to *deadweight* losses and subsidies themselves lead to *allocative and technical* inefficiencies (Blomstrom et al., 1996 QJE)
- The findings of empirical studies are also mixed; (Lee, 1996 JEG; Beason and Weinstein, 1996 RES; Bergstrom, 2000 SBE; Hyytinen and Toivanen, 2005 RP)

Subsidies and productivity

- Some studies find positive effect of subsidies on investment and output but no or negative effect on productivity
- Productivity is important because of its implications for long-term growth(Nickell, 1996 JPE); thus, analyses of the subsidy effect on productivity are important
- Subsidies may improve productivity if technological development is stimulated or firms can better utilise economies of scale

Subsidies and productivity

- But subsidies may be transferred to less productive firms; or reduce the rate of productive resource reallocation
- Subsidies give incentives for changing the capital/labour ratio which can lead to allocative inefficiency and over-investment
- Subsidies may lead to technical inefficiency if they are captured as higher profits leading to slack, lack of effort and not seeking cost-improving methods (Leibenstein, 1966 AER)
- Subsidisation may give rise to SBC and moral hazard (Kornai, 1986 Kyk) or "subsidy seeking"

TFP estimation

- Semi-parametric estimation methodology based on Olley and Pakes (1996 Econ) and extensions by Ackerberg et al. (2007 HoE)
  - Deals well with simultaneity and selection biases
  - Is flexible in accommodating various economic situations
- Cobb-Douglas production function

$$y_{jt} = \beta_0 + \beta_k k_{jt} + \beta_m m_{jt} + \beta_l l_{jt} + \omega_{jt} + \eta_{jt}$$

- The model of the unobservable, ω is a non-parametric (control) function (extended)

$$\omega_{jt} = h_t(i_{jt}, k_{jt}, s_{jt}, \vec{e}_{jt})$$

- Two stage estimation algorithm:
  - First stage (semi-parametric OLS)

$$y_{jt} = \beta_m m_{jt} + \beta_l l_{jt} + \phi_t(i_{jt}, k_{jt}, s_{jt}, \vec{e}_{jt}) + e_{1,jt}$$

$$\hat{\omega}_{jt}(\beta_0, \beta_k) = \hat{\phi}_{jt} - \beta_0 - \beta_k k_{jt}\,; \quad \omega_{jt} = g'(\omega_{jt-1}, \hat{P}_{jt}) + e_{2,jt}$$

  - Second stage (semi-parametric NLLS)

$$y_{jt} - \widehat{\beta}_m m_{jt} - \widehat{\beta}_l l_{jt} = \beta_k k_{jt} + g'(\hat{\phi}_{jt-1} - \beta_k k_{jt-1}, \widehat{P}_{jt}) + \varepsilon_{jt},$$

- TFP (residual) obtained as

$$TFP_{jt} = \exp(y_{jt} - \hat{\beta}_k k_{jt} - \hat{\beta}_l l_{jt} - \hat{\beta}_m m_{jt})$$

Control function estimators (CFE)

- The standard Olley-Pakes estimator is a CFE
- *Assumption 1:* k_{jt} at time t is predetermined, while l_{jt} (and m_{jt}) is freely adjustable for each t
- *Assumption 2* ("Scalar unobservable"): The investment function i_{jt} is fully determined by the dynamic input k_{jt}, the ω_{jt}, and, possibly, other observable variables z'_{jt}
- Under Assumptions 1 and 2, the firm investment level that solves the dynamic profit maximisation problem can be represented as a function of the *state* variables (k_{jt}; ω_{jt}) and z'_{jt}: $i_{jt} = f(k_{jt}, \omega_{jt}, z'_{jt})$

Control function estimators (CFE)

- *Assumption 3:* The investment function $i_{jt}(.)$ is monotonic in ω_{jt}
- This implies that the CF can be specified by inverting the investment function $i_{jt}(.)$ for ω_{jt}

$$\omega_{jt} = f(k_{jt}, i_{jt}, z'_{jt})$$

- *Assumption 4:* ω_{jt} follows the first-order Markov process: ω_{jt}= E [$\omega_{jt\,|}\,\omega_{jt-1}$] + $e_{2,jt}$, where $e_{2,jt}$ is an innovation term satisfying E [$e_{2,jt\,|}\,\omega_{jt-1}$] = 0
- This implies that the capital coefficient can be correctly estimated in a second stage where k_{jt} is uncorrelated (also A1) with the error term

Control function estimators (CFE)

- Firm productivity only gradually converges to its steady-state level, and this level varies by firm
- CFEs lack controls for firm heterogeneity in TFP which may cause persistent *transmission bias* in the production function estimates
- The Assumptions 1-4 could be violated
  - Labour may follow a dynamic adjustment process (A1)
  - Scalar unobservable assumption (A2) may not hold due to measurement error in the proxy variable
  - The monotonicity assumption (A3) may not be maintained if investment is zero for many observations
  - The first-order Markov assumption (A4) may fail due to omitted variables

Control function estimators (CFE)

- Richer model of the unobservable incorporating additional proxies of productivity could improve the estimating specification (Ackerberg et al., 2007 HoE)
  - E.g., Huang and Hu (2011 Mim) propose the use of another proxy variable that is independent of the original proxy conditional on unobserved productivity (A2, A4)
- In the specific case of the EU farm productivity
  - The use of subsidy information is ideal complementary proxy to farm investment
  - Estimating samples according to type of farm (TF) allows for heterogeneous technology
  - Also using location information (e.g., NUTS3) helps further capture firm market environment heterogeneity

Data and summary stats

- The FADN data of Eurostat for the EU-15
- Period 1990 (1995)-2008
- Data representative of commercial agriculture and 90% of agricultural land used
- Summary stats: North-South divide - assets, investment, output are higher in NE MS (less variation in labour use)
- Pronounced differences in subsidies per farm and per unit of capital showing opposite relationships

TFP estimates

- Consistently estimated production function coefficients – 83 TF-samples (field crops, horticulture, diary, pasture, pig and poultry, mixed farms) for each of the EU-15 MS
- Most MS exhibit constant or slightly increasing RtS
- Some evidence of North-South divide - more SE MS exhibit decreasing RtS
- TFP index (level) and TFP growth (rate)
  - A higher index suggests that relatively more productive farms and farm sectors dominate – NE MS
  - Growth varies across countries – in SE it is the highest; in the small NE MS it is lowest

Production function coefficients and TFP estimates

Country	b_m (s.e.)	b_l (s.e.)	b_k (s.e.)	Adj. R^2 (No. obs.)	*TFP* index (*TFP* growth)
(1)	(2)	(3)	(4)	(5)	(6)
Belgium	0.68	0.24	0.08	0.98	1.10
	(0.03)	(0.04)	(0.02)	(10693)	(-0.63)
Denmark	0.72	0.26	0.08	0.97	1.02
	(0.02)	(0.02)	(0.02)	(10697)	(-0.06)
Germany	0.84	0.17	0.07	0.93	1.05
	(0.01)	(0.01)	(0.01)	(54037)	(+0.63)
Greece	0.59	0.22	0.07	0.99	0.73
	(0.02)	(0.02)	(0.02)	(11957)	(+0.43)
Spain	0.60	0.26	0.07	0.98	1.09
	(0.01)	(0.02)	(0.01)	(32121)	(+1.98)
France	0.74	0.21	0.08	0.97	1.01
	(0.01)	(0.01)	(0.01)	(71274)	(+0.24)
Ireland	0.80	0.07	0.05	0.98	1.23
	(0.02)	(0.02)	(0.02)	(6088)	(-0.59)

Notes: *TFP* index is an aggregate productivity measure in levels; *TFP* growth is the aggregate annual percentage growth. The total number of observations (No. obs.) reported is from the second-step estimated sample.

Production function coefficients and TFP estimates

Country	b_m (s.e.)	b_l (s.e.)	b_k (s.e.)	Adj. R^2 (No. obs.)	*TFP* index (*TFP* growth)
(1)	(2)	(3)	(4)	(5)	(6)
Italy	0.62	0.20	0.07	0.98	1.10
	(0.01)	(0.01)	(0.01)	(56977)	(+2.05)
Luxembourg	0.68	0.24	0.10	0.99	0.99
	(0.03)	(0.03)	(0.02)	(3799)	(+0.63)
Netherlands	0.70	0.27	0.11	0.98	1.04
	(0.01)	(0.02)	(0.01)	(12800)	(-0.61)
Austria	0.62	0.20	0.12	0.99	1.36
	(0.02)	(0.02)	(0.02)	(13228)	(+1.44)
Portugal	0.64	0.20	0.07	0.97	0.96
	(0.02)	(0.03)	(0.01)	(8341)	(+1.89)
Finland	0.68	0.16	0.11	0.93	1.67
	(0.03)	(0.02)	(0.02)	(5364)	(-0.78)
Sweden	0.87	0.11	0.06	0.95	1.20
	(0.03)	(0.02)	(0.01)	(4626)	(-0.47)
UK	0.80	0.22	0.08	0.94	0.99
	(0.01)	(0.02)	(0.01)	(27680)	(+0.18)

Impact of subsidies on TFP

- GMM SYS regressions for each of the EU-15 MS both in levels and in growth rates
- The effect of subsidies before decoupling is negative but magnitude is quite small
  - Except Portugal and Finland for all MS in levels and growth rates
- After decoupling in 2005/2006 the effect is more diverse
  - For ten MS it is positive even though it is statistically significant only for six MS
  - For only two MS effect is negative and small
  - The group of countries for which a switch of effect is observed is mixed – both SE and NE MS

Impact of subsidies on TFP

Country	Specification	b_l (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)

Impact of subsidies on TFP

(1)	(2)	(3)	(4)	(5)	(6)	(7)
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)
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)

Impact of subsidies on TFP

(1)	(2)	(3)	(4)	(5)	(6)	(7)
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)

Conclusion

- We build a structural model of the unobserved productivity incorporating directly the effect of farm subsidies
- Subsidies impact negatively farm productivity in the period before the decoupling; after that the effect is more nuanced as in several MS it turned positive
- Our findings are consistent with the literature on the inefficiencies of subsidisation of production and at the same time lend support to the EU policy for decoupling of CAP subsidies

Impact of CAP Pillar II Payments on Agricultural Productivity– Zuzana Smeets Kristkova (WECR)

Impact of CAP Pillar II Payments on Agricultural Productivity

Hasan Dudu, Zuzana Smeets Kristkova

JRC, Wageningen Economic Research

Estimation and Modelling Impacts of Pillar 2 Measures on the Agricultural Sector
Seville, 14 September 2017

Outline

- Motivation & Aim
- Literature
- Model
- Data
- Results
- Conclusion

Objective of the research

- Contributes to the gap in literature on the lack of comprehensive estimates of CAP subsidies:
  - Different types of CAP subsidies have different productivity affects
  - Consistency with the modelling framework of impact assessment models that use subsidies in scenario analysis
- Goal: To estimate the impact of CAP Pillar II payments on agricultural productivity for EU-27
  - A novel theoretical approach (linking subsidies to factor-augmenting technical change in CES framework)
  - An econometric model that enables to test explicitely the endogeneity problem (i.e. GMM)
  - A data set that is in-line with the CGE data (i.e. SNA) conceptually

Gap in literature

- No comprehensive study at NUTS II level for the EU
- Most studies use farm-level data (i.e FADN).
- In most of the studies, agricultural subsidies are treated ad-hoc and mostly as a uniform category.
  - Minviel and Latruffe (2014) Meta-analysis of 195 studies:
    - Using total subsidies received increases the probability of a negative effect
- Most empirical evidence relies on Stochastic Frontier Approach or Data Envelopment Analysis but TE≠ TFP
- Further TFP ≠ factor augmenting productivity (e.g. human capital subsidies are likely to stimulate labour productivity more than land productivity).
- None of the studies use CES and cannot be used to parametrize economy-wide models

Outline

- Motivation & Aim
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Definition of the model

- CES-production technology:

$$Y = \left[\alpha_k \cdot (A_k \cdot K)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha_L \cdot (A_L \cdot L)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha_D \cdot (A_D \cdot D)^{\left(\frac{\sigma-1}{\sigma}\right)}\right]^{\left(\frac{\sigma}{\sigma-1}\right)}$$

- $Y_{i,t}$ = Value added
- $K_{i,t}$ = Value of capital services or stock
- $L_{i,t}$ = Value of labour services
- $D_{i,t}$ = Value of land
- $\alpha_{k,L,D}$ = Distribution parameter
- σ = elasticity of substitution
- A_{Li} and A_{ki} = Factor-augmenting technology parameters: $\frac{\partial Y}{\partial Af} > 0$

CES function – popular in impact assessment models

- Features of this CES form:
  - Constant returns to scale – assumption important for CGE models with perfect competition (e.g. MAGNET, GTAP, etc.)
  - Constant elasticity of substitution, reduces to Cobb-Douglas if $\sigma \rightarrow 1$
- Popular in:
  - Impact assessment models like CGE (often "guesstimated")
  - Macroeconomics – revival of CES: "*imposing Hicks-neutrality leads to biases towards Cobb-Douglas when the true nature of technical progress is factor-augmenting*"

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But no easy estimation

- Non-linearity
  - Requires adaptation of iterative procedures
  - Convergence difficult
- Identification problem with factor-augmenting TC:
  - Too many parameters
  - Use of trend functions: e.g. exponential for labour-augmenting TC and hyperbolic for capital-augmenting TC (Klump, 2007)
  - Use of latent variables to explain technology: Kalman filter (Jorgenson, 2010)
  - Bayesian approaches (Villacorta, 2014)

8

Methodological approaches to estimate technology parameters in CES function

Estimation of system of FOC
- Either Cost min or Profit Max
- In line with behaviour embedded in the MAGNET

Kmenta linearization
- Does not allow to estimate factor-biased technical change

Non-linear estimation of CES
- Iteration procedure
- Often does not converge

Cost minimization approach

$$\min C_{i,t} = PD_{i,t}D_{i,t} + PK_{i,t}K_{i,t} + PL_{i,t}L_{i,t}$$

$$\text{s.t.} \quad VA_{i,t} = \left[\alpha_D\left(A_D.D_{i,t}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha_K\left(A_K.K_{i,t}\right)^{\left(\frac{\sigma-1}{\sigma}\right)} + \alpha_L\left(A_L.L_{i,t}\right)^{\left(\frac{\sigma-1}{\sigma}\right)}\right]^{\left(\frac{\sigma}{\sigma-1}\right)}$$

- Solving for the first order conditions for K,L,D and expressing in growth rates yields:

$$\left(qd_{i,t} - qva_{i,t}\right) = (\sigma-1)a_D + \sigma.(pva_{i,t} - pd_{i,t})$$
$$\left(qk_{i,t} - qva_{i,t}\right) = (\sigma-1).a_K + \sigma\left(pva_{i,t} - pk_{i,t}\right)$$
$$\left(ql_{i,t} - qva_{i,t}\right) = (\sigma-1).a_L + \sigma\left(pva_{i,t} - pl_{it}\right)$$

Then we assume

Endogenizing factor-augmenting TC

- We explain growth of factor-augmenting TC by the share of CAP II subsidies in Output
- Hypotheses:
  - ↑ share Human Capital subsidies → ↑ labour-augmenting TC
  - ↑ share Physical Capital subsidies → ↑ capital-augmenting TC
  - ↑ share Agri-environmental payments → ↓ ↑ land-augmenting TC ?
  - ↑ share Rural Development Subsidies → no effect on factor productivities

$$a_L = \underbrace{\delta_{EXO} + \delta_{MS}MS}_{\text{Exogenous productivity growth (MS-specific)}} + \underbrace{\delta_{HC}log\frac{HC}{OUT} + \delta_{RD}log\frac{RD}{OUT}}_{\text{Subsidy-driven productivity growth}}$$

$$a_K = \delta_{EXO} + \delta_{MS}MS + \delta_{PC}log\frac{PC}{OUT} + \delta_{RD}log\frac{RD}{OUT}$$

$$a_D = \delta_{EXO} + \delta_{MS}MS + \delta_{AE}log\frac{AE}{OUT} + \delta_{RD}log\frac{RD}{OUT}$$

Final form of the estimated equations

- Substituting expressions for factor-aug. TC into the demand equations yields system of equations:

$$\left(qd_{i,t} - qva_{i,t}\right) = \sigma\left(pva_{i,t} - pd_{i,t}\right) + (\sigma-1)\left(\delta_{EXO} + \delta_{MS}MS + \delta_{AE}log\frac{AE_{i,t}}{OUT_{i,t}} + \delta_{RD}log\frac{RD_{i,t}}{OUT_{i,t}}\right) + u_{i,t}$$
$$\left(qk_{i,t} - qva_{i,t}\right) = \sigma\left(pva_{i,t} - pk_{i,t}\right) + (\sigma-1)\left(\delta_{EXO} + \delta_{MS}MS + \delta_{PC}log\frac{PC_{i,t}}{OUT} + \delta_{RD}log\frac{RD_{i,t}}{OUT_{i,t}}\right) + u_{i,t}$$
$$\left(ql_{i,t} - qva_{i,t}\right) = \sigma\left(pva_{i,t} - pl_{i,t}\right) + (\sigma-1)\left(\delta_{EXO} + \delta_{MS}MS + \delta_{HC}log\frac{HC_{i,t}}{OUT_{i,t}} + \delta_{RD}log\frac{RD_{i,t}}{OUT_{i,t}}\right) + u_{i,t}$$

- Characteristics of this system of equations:
  - Residuals are correlated across the equations
  - Constraint of equal substitution elasticities

Econometric estimation

- Use of GMM for the estimation:
  - Estimating directly the structural form (unlike SUR where reduced form is estimated first)
  - Enables to test the endogeneity of prices and subsidies using Hansen's over-identifying restriction test
  - F-test of the reduced form regression to check strength of the instruments
  - Controls for heteroscedasticity and autocorrelation using Newey-West algorithm
- Other tests possible:
  - Test of the Cobb-Douglas PF (cannot reject $\sigma = 1$)
  - Test for factor neutral TC: exogenous factor productivities are equal across the equation

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Data: EAA97

- "Economic Accounts for Agriculture Rev 1.1." (EAA97)
  - Consistent with SNA definitions = suitable for CGE model
  - NUTS-II level = enough observations
- What we have in the data:
  - *KD* : Operating Surplus/Mixed Income
  - *VA* : Value Added
  - *Y*: Output of Agricultural 'Industry'

$$KD_{i,t} = PD_{i,t}D_{i,t} + PK_{i,t}K_{i,t}$$
$$VA_{i,t} = KD_{i,t} + PL_{i,t}L_{i,t}$$
$$Y_{i,t} = VA_{i,t} + PM_{i,t}M_{i,t}$$

- What we need:

$$qva_{i,t} + pva_{i,t} = \mathrm{gr}\left(VA_{i,t}\right)$$
$$qd_{i,t} + pd_{i,t} = \mathrm{gr}\left(PD_{i,t}D_{i,t}\right)$$
$$qk_{i,t} + pk_{i,t} = \mathrm{gr}\left(PK_{i,t}K_{i,t}\right)$$
$$ql_{i,t} + pl_{i,t} = \mathrm{gr}\left(PL_{i,t}L_{i,t}\right)$$

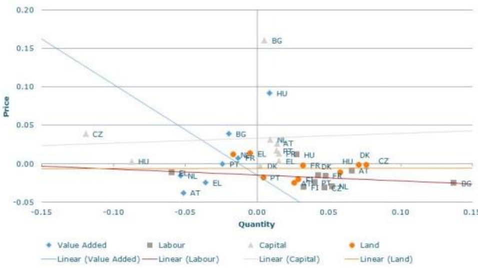
Data: EAA97 - transformations

- Some assumptions to extract info. in the required format
  - *pva*: growth of "**ratio of value added at current prices to value added at constant prices**" (EAA97 reports values in current and constant prices at the country level)
    - => VA price change is same within a country
  - *qva*: difference from growth of VA reported in EEA97
  - *ql* : growth of "**agricultural employment**" at NUTSII level from EuroSTAT
  - *pl* : difference from growth of "**Compensation of Emploees**" reported in EEA97
  - *qd*: growth of "**Total Utilized Area** " from EuroStat at NUTSII level
  - *pd*: growth rate of "**Rents and Other Real Estate Rental Charges to be Paid**" from EAA97
    - => We assume that area of rented land do not change significantly overtime
  - *qk*: growth of **"Fixed Capital Consumption**" from EEA97 by using country level amortization rates
  - *pk*: growth of "**ratio of FCC at current prices to FCC at constant prices**«
    - => Capital price change is same within a country

Data: EAA97 - transformations

- Data cleaning
  - For regions with missing observations
    - Left with 10 countries: Austria, Bulgaria, Czech Republic, Denmark, Greece, Finland France, Hungary, Netherlands and Portugal
  - Outliers: Mostly from Finland (20 observations)

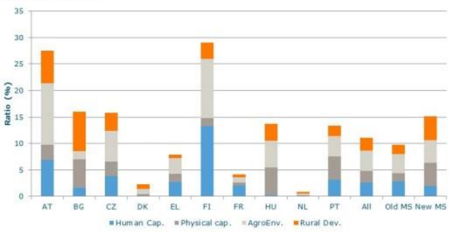
Data: EAA97 – Descriptives



Data: CATS

- "Clearance Audit Trail System (CATS)" data (Boulanger and Philipidis, 2016)
- Project level administrative data on CAP II payments.
- Aggregated to NUTS II level for 2007-2013 & 4 CAP II payment categories
- Complete data set, no outliers, no missing observations

Data: CATS



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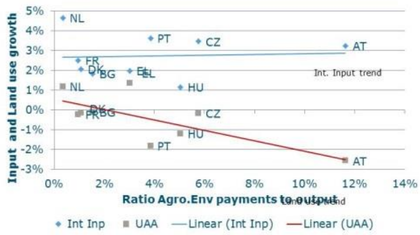
Results

GMM estimation				
Number of parameters=	7			
Number of moments=	15			
Initial weight matrix:	Unadjusted			
Number of obs =	408			
GMM weight matrix:	HAC Bartlett 27			
	(lags chosen by Newey-West)			
	Coef.	Std. Err.	P>z	
Sigma(σ)	0.28	0.09	0.00	***
Delta (δ_{EXO})	0.17	0.12	0.15	
MS Dummy(δ_{MS})	0.10	0.06	0.11	
Human Capital (δ_{HC})	0.03	0.01	0.01	***
Rural development (δ_{RD})	-0.02	0.02	0.28	
Physical Capital (δ_{PC})	0.05	0.02	0.01	***
Agroenvironmental (δ_{AE})	0.05	0.02	0.01	***

- σ significant and very close to the value in MAGNET
- δ_{EXO} insignificant: Payments explain all variation?
- δ_{MS} insignificant: Old and new MS are not different?
- δ_{HC} , δ_{PC} and δ_{AE} significant & positive: They increase productivity of respective factors
- δ_{RD} : insignificant

Results



Conclusion

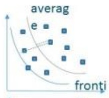
- CAP-II payments related to Human capital, physical capital and agro-environment are **increasing factor productivity.**
- Impacts are small (-er than what is assumed in general): You need to double the share in production to get 3-5% change.
- At the regional level intermediate input use did not change while land use declined

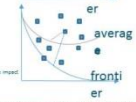
Caveats and Future (on-going) research

- Data is available only for 10 countries: Find a way to include more countries (imputation methods?)
- Many variables are proxy
- No CAP Pillar – I: (is it needed???)
- Restrictive assumptions: CRS, CES
- Different nesting structures (shares???)
- Include intermediate inputs (Price???)

Literature

- Few studies links CAP payments to **productivity**:
  - Mary (2013): GMM, Cobb-Douglas (CD), France, Crop farms.
    - set-aside, LFA and livestock payments: **Negative** impact on TFP
    - Investment & Agri-env. Payments: insignificant
  - Rizov et al. (2013): Semi-parametric, FADN, EU15, CD, Total subsidies
    - **Negative** impact on TFP, **improves** after decoupling
  - Serra et al. (2008): SFA, USA, Farm data,
    - **ambiguous** impact on TFP
- Negative impact on **Technical Efficiency**
  - Latruffe et al. (2009): SFA, 7 EU Countries,
  - Zhu and Lansink (2010) and Zhu et al. (2012): SFA, selected EU-15,
  - Cechura et al. (2016): SFA, 24 EU, Milk,
- Positive impact on **TE**
  - Khumbhakar and Lien (2010): SFA, Norway, Grain,
    - negative impact on TFP
  - Latruffe and Desjeux (2016): DEA, France, Crop – Dairy – Beef
    - Investment & Rural development insignificant
    - production subsidies positive impact on TE & TFP
- Ambigious impact on **TE**
  - Fogarasi and Latruffe (2009): DEA, Hungary : in general Negative TE impact; Positive impact on TFP for Crop
  - Pufahl and Weiss (2009): PSM : Germany: No effect on land productivity
  - Ratinger et al. (2015): Czech Republic : No effect on TFP
- Minviel and Latruffe (2014) point out, when separating the individual subsidy groups, productivity effects of subsidies might turn positive.





Thank you for your attention

CAP Impact on Growth and Jobs– Maria Garrone

CAP and Inclusive Growth:

CAP Impact on Growth and Jobs

[Preliminary Results]

Maria Garrone
based on joint work with Jo Swinnen, Alessandro Olper & Dorien Emmers

Workshop "Estimation and Modelling Impacts of Pillar 2 Measures on the Agricultural Sector"
14 September 2017
JRC, Sevilla

Outline

- Methodology and Empirical Estimation
- Conceptual and Empirical Estimation Issues
- Data
- CAP and regional GDP growth
- CAP and agricultural productivity
- CAP and agricultural employment
- Conclusions

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Methodology and Empirical Estimation

- Methodology :
  - Estimating ex post impacts using CAP as a "treatment" and exploiting panel data econometrics
  - In contrast to ex ante impact using simulation models
- Empirical estimation:
  - Integrates the CAP reform effects in the analysis
    - Coupled vs decoupled support
    - 1st Pillar vs 2nd Pillar etc.

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Conceptual and Empirical Estimation Issues

- Conceptual issue :
  - Some key outcome variables (for instance, agricultural output) were explicitly designed not to be influenced by the 1992/2003 "decoupling reforms" of the CAP
- Empirical estimation issue:
  - Some key indicators are only available since countries joined the EU/CAP or limited period (e.g. FADN and CATS)
    - Some EU-15 countries have been part of the EU from the beginning; so no accession;
    - The impact of the "shock of accession" in EU-13 cannot be measured precisely.

Outline

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Data

- Unique dataset :
  - DG AGRI's **Clearance Audit Trail System (CATS)** regional database covering **all payments paid to farmers;**
  - Cambridge Econometric's Regional database and FADN for other covariates.
- Regional coverage: 220 (NUTS 1 or NUTS 2) regions in EU-15 MS and EU-13 MS;
- Period: 2004 – 2014;
- Analysis more details on type of payments:
  - 1st Pillar coupled and decoupled payments;
  - 2nd Pillar payments;
    - Further disaggregation of its components : agri-environmental measures, investments, LFA payments, and other payments.

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CAP and Regional GDP Growth

- Literature : limited coverage

- Esposti (2007) uses data
  - From the Newcronos Regio database (Eurostat) and Farm Accountant Data Network (FADN);
  - Period: 1989-2000;
  - Only coupled payments;
  - Only EU-15 at NUTS 2 level;
  - 2nd Pillar payments are excluded.
- Findings :
  - **CAP has positive effect on regional GDP growth**
  - **The share of agriculture in employment has a negative effect on regional GDP growth**

CAP and Regional GDP Growth

- Crescenzi & Giua (2016) use data
  - FADN, Eurostat and structural fund data from DG REGIO;
  - Period: 1994-2013;
  - Distinguish between 1st Pillar and 2nd Pillar Payments;
  - 139 (NUTS 1 or NUTS 2) regions in 12 EU-15 MS.
- Findings:
  - Overall 1st Pillar and 2nd Pillar Payments have no systematic impact on GDP growth, but:
    - 1st Pillar and 2nd Pillar payments have a positive effect in areas with high endowments of infrastructure and R&D.

CAP and Regional GDP Growth

Our analysis uses Esposti's model:

- Unique dataset :
  - **CATS** data combining with Cambridge Econometric's Regional and FADN data for other covariates
- Regional coverage: 220 (NUTS 1 or NUTS 2) regions in EU-15 MS and EU-13 MS;
- From 2004 to 2014
- Analysis more details on type of payments:
  - 1st Pillar coupled and decoupled payments;
  - 2nd Pillar payments;
    - Further disaggregation of 2nd Pillar components

CAP and Regional GDP Growth

Table 1: Regional GDP per-capita growth and CAP payments

Dependent variable: ΔGDP per worker	-----EU 28-----			-----EU 15-----			-----EU 13-----		
Estimator: System-GMM	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP per worker (t-1)	-0.033***	-0.033***	-0.032***	-0.041***	-0.039***	-0.039***	-0.028**	-0.022	-0.029**
	(5.58)	(5.46)	(5.22)	(5.23)	(5.07)	(5.17)	(2.12)	(1.60)	(2.01)
Labour force growth (t-1)	0.003	0.003	0.003	0.000	0.000	0.000	0.009**	0.008**	0.009**
	(1.41)	(1.43)	(1.46)	(0.08)	(0.00)	(0.07)	(2.66)	(2.45)	(2.26)
Agricultural labour share (t-1)	-0.096***	-0.096***	-0.094***	-0.169***	-0.168***	-0.166***	-0.032	-0.021	-0.038
	(3.77)	(3.66)	(3.52)	(4.01)	(3.96)	(3.98)	(0.84)	(0.49)	(0.86)
Convergence regions (1, 0)	-0.011***	-0.011***	-0.010***	-0.003	-0.003	-0.002	-0.004	-0.005	-0.006
	(2.69)	(2.74)	(2.68)	(1.01)	(1.04)	(0.88)	(0.49)	(0.72)	(0.85)
Total CAP subsidies (t-1)	0.003			0.005			0.011		
	(0.90)			(1.23)			(1.46)		
Pillar 1 coupled (t-1)		0.016**			0.024***			-0.010	
		(2.26)			(3.84)			(0.35)	
Pillar 1 decoupled (t-1)		-0.002			0.000			0.024	
		(0.38)			(0.06)			(0.98)	
Pillar 2 subsidies (t-1)			-0.003			0.004			0.016**
			(0.24)			(0.36)			(2.45)
Observations	1981	1981	1981	1525	1525	1525	456	456	456
AR (1) p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR (2) p-value	0.330	0.362	0.340	0.086	0.106	0.090	0.091	0.069	0.083
Hansen (Test overid.) p-value	0.265	0.404	0.252	0.990	0.993	0.992	0.637	0.869	0.620

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Regional GDP Growth

2nd Pillar components

Dependent variable: ΔGDP per worker	-----EU 28-----	-----EU 15-----	-----EU 13-----
Estimator: System-GMM	(1)	(2)	(3)
GDP per worker (t-1)	-0.050***	-0.044***	-0.053**
	(4.9)	(3.44)	(2.31)
Labour force growth (t-1)	0.003	0.000	0.010***
	(1.43)	(0.02)	(2.80)
Agricultural labour share (t-1)	-0.089***	-0.195***	-0.054
	(3.36)	(4.3)	(1.03)
Convergence regions (1, 0)	-0.009**	-0.002	-0.011
	(2.46)	(0.65)	(1.31)
Agro-environmental	-0.039	0.037	-0.192*
	(1.17)	(1.26)	(1.79)
LFA paymements	0.069	0.053	0.442***
	(1.41)	(1.26)	(3.24)
Investments	0.006	-0.084***	0.025***
	(0.58)	(3.1)	(3.64)
Pillar 2 other	0.02	0.036	0.193**
	(0.44)	(1.26)	(2.02)
Obs.	1981	1525	456
ar1p	0.000	0.000	0.000
ar2p	0.340	0.094	0.052
hansenp	0.257	0.991	0.893

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Regional GDP Growth

Our preliminary findings :

- **EU-28**:
  - CAP expenditures are not correlated with regional GDP growth
  - Lower regional GDP growth is lower in regions with a high share of agricultural employment
- **EU-15**:
  - The effect is positive for 1st Pillar coupled payments
  - The effect is negative on 2nd Pillar Investment
- **EU-13**:
  - The effect is positive for 2nd Pillar payments
  - Mainly driven by LFA, investment and other 2nd Pillar

CAP and Regional GDP Growth

Problems/issues with the interpretation/ implications of these findings:

- we present findings which measure "gross effects":
  - **ignores taxation costs** – hence CAP expenditures "by definition" imply higher growth
  - we do not assess the opportunity costs of expenditures on the CAP.

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CAP and Agricultural Productivity
– Theoretical predictions

- CAP effect on productivity – potential mechanisms :
  - If payments cause **distortions of factor allocations**, thus reduce productivity (-)
  - Payments may **reduce credit constraints** (Ciaian and Swinnen, 2009) and thus increase productivity (+)
  - Payments may **mitigate risk** (as portfolio of revenues) and thus increase productivity (+)

- Net effect: **UNCERTAIN**

CAP and Agricultural Productivity
– Empirical studies

- Rizov, Pokrivcak, Ciaian (2013) study productivity impact
  - for 1990-2008
  - for EU-15
  - using FADN data
- Results:
  - **Coupled support (before 2005) has negative impact on productivity**
  - **Decoupled support (after 2005) has zero or positive impact on productivity**

CAP and Agricultural Productivity
– Empirical studies

- Kazukauskas, Newman and Sauer (2014) study CAP (Reform) Impact on productivity
  - for 2001-2007
  - for IE, DK, NL
  - using local farm survey data
- Results:
  - **Decoupled support has a positive impact on productivity by increasing specialization in more productive farming activities**

CAP and Agricultural Productivity
– Empirical studies

- Dudu and Kristkova (2017) study impact of 2nd Pillar payments on productivity
  - for 2007-2013
  - 84 NUTS 2 regions
  - using 4 categories of Pillar II payments (i.e. human capital, physical capital, agro-environmental and rural development)
  - using CATS data
- Results:
  - **2nd Pillar payments for physical capital investments, human capital development or agro-environmental have a positive impact on productivity.**
  - **On the other hand, payments related to rural development do not have significant impact on productivity.**

CAP and Agricultural Productivity

- Our analysis:
  - Focuses on **agricultural value added per worker**
- Unique dataset :
  - **CATS** data combining with Cambridge Econometric's Regional and FADN data for other covariates
- Regional coverage: 220 (NUTS 1 or NUTS 2) regions in EU-15 MS and EU-13 MS;
- From 2004 to 2014
- Analysis more details on type of payments:
  - 1st Pillar coupled and decoupled payments;
  - 2nd Pillar payments;
    - Further disaggregation of 2nd Pillar components

CAP and Agricultural Productivity

Table 2: Regional VA per-worker growth in agriculture and CAP payments

Dependent variable: ΔVA-agr per worker	EU 28			EU 15			EU 13		
Estimator: System-GMM	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Agr VA per worker (t-1)	-0.119***	-0.097***	-0.125***	-0.138***	-0.106***	-0.176**	-0.146**	-0.144**	-0.130**
	(4.98)	(5.49)	(5.71)	(5.72)	(4.13)	(1.99)	(2.65)	(2.25)	(2.25)
Labour force growth (t-1)	0.007	0.006	0.008	-0.008	-0.01	-0.004	-0.038	-0.039	-0.037
	(0.75)	(0.61)	(0.92)	(0.75)	(0.91)	(0.40)	(1.57)	(1.65)	(1.66)
Population density (t-1)	-0.001	0.002	-0.001	0.001	0.005	0.002	0.012	0.014	0.012
	(0.20)	(0.37)	(0.25)	(0.14)	(0.78)	(0.31)	(0.35)	(0.39)	(0.39)
Convergence regions (1, 0)	-0.144***	-0.113***	-0.146***	-0.100***	-0.086***	-0.108**	-0.199***	-0.193**	-0.154**
	(4.28)	(4.49)	(3.36)	(3.14)	(3.46)	(1.99)	(2.84)	(2.51)	(2.21)
Total CAP subsidies (t-1)	0.075***			0.073***			0.370***		
	(3.59)			(3.25)			(3.26)		
Pillar 1 coupled (t-1)		0.010			-0.003			0.496**	
		(0.32)			(0.12)			(2.14)	
Pillar 1 decoupled (t-1)		0.110***			0.115***			0.761**	
		(16.53)			(13.45)			(2.04)	
Pillar 2 subsidies (t-1)			0.116*			0.112**			0.368**
			(1.82)			(2.48)			(2.51)
Observations	2000	2001	2000	1544	1545	1544	456	456	456
AR (1) p-value	0.000	0.000	0.001	0.001	0.000	0.011	0.000	0.000	0.000
AR (2) p-value	0.661	0.518	0.358	0.998	0.840	0.710	0.299	0.206	0.453
Hansen (Test overid.) p-value	0.268	0.265	0.288	0.351	0.381	0.336	0.900	0.882	0.851

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Agricultural Productivity
2nd Pillar components

Dependent variable: ΔVA-agr per worker	EU 28	EU 15	EU 13
Estimator: System-GMM	(1)	(2)	(3)
Agr VA per worker (t-1)	-0.099***	-0.154***	-0.176***
	(5.36)	(3.58)	(3.16)
Labour force growth (t-1)	0.004	-0.011	-0.034
	(0.45)	(0.97)	(1.52)
Population density (t-1)	0.004	0.002	0.041
	(0.64)	(0.26)	(1.33)
Convergence regions (1, 0)	-0.118***	-0.101***	-0.190**
	(4.29)	(5.02)	(2.18)
Agro-environmental	0.737	0.78	1.510*
	(0.97)	(0.93)	(1.85)
LFA payements	-0.034	-0.676	2.319*
	(0.05)	(1.04)	(1.93)
Investments	0.108	0.397***	-0.018
	(0.88)	(6.54)	(0.52)
Pillar 2 other	-0.347	-0.532	-1.737
	(0.97)	(1.27)	(1.55)
Obs.	2000	1544	456
ar1p	0.000	0.008	0.000
ar2p	0.270	0.477	0.291
hansenp	0.250	0.345	0.237

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Agricultural Productivity

Our preliminary findings :

- Positive impact of decoupled 1st Pillar payments;
- Positive impact of 2nd Pillar payments, driven by investments in EU-15 and by agri-environmental measures and LFA payments in EU-13;
- Results are largely consistent with the above-mentioned predictions; and
- Results are consistent with findings of other studies (e.g. Rizov et al., 2013 ; Minviel and Latruffe, 2016)

Outline

- Methodology and Empirical Estimation
- Conceptual and Empirical Estimation Issues
- Data
- CAP and regional GDP growth
- CAP and agricultural productivity
- CAP and agricultural employment
- Conclusions

CAP and Agricultural Employment

- Data required:
  - Agricultural employment
  - Rural employment
  - Regional employment
- However, there are only good data on agricultural employment and regional employment, not on rural employment

CAP and Agricultural Employment

–Empirical studies

- Earlier studies provided contradictory findings with respect to the CAP's impact on agricultural employment:
  - Some studies find that the outflow of labor from agriculture was highest in countries which supported agriculture the most: Berlinschi et al. (2011)
  - Some find the opposite: Peerligs et al. (2014) and Olper et al. (2014); and
  - Others find mixed effects: Kristkova and Ratinger (2012); Petrick and Zier (2011).

CAP and Agricultural Employment

Our analysis follows Olper et al. (2014):

- Focuses on **out-farm migration**
- Unique dataset :
  - **CATS** data combining with Cambridge Econometric's Regional and FADN data for other covariates
- Regional coverage: 220 (NUTS 1 or NUTS 2) regions in EU-15 MS and EU-13 MS;
- From 2004 to 2014
- Analysis more details on type of payments:
  - 1st Pillar coupled and decoupled payments;
  - 2nd Pillar payments;
    - Further disaggregation of 2nd Pillar components

CAP and Agricultural Employment

Table 5: Migration of agricultural labour and CAP payments

Dependent variable: Out-farm migration	EU 28			EU 15			EU 13		
Estimator: LSDV	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Relative income (t-1)	0.075***	0.077***	0.069***	0.046***	0.051***	0.047***	0.148***	0.155***	0.133***
	(5.30)	(5.43)	(5.44)	(3.15)	(3.35)	(3.90)	(4.80)	(4.89)	(4.73)
Relative labour (diff)	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	(5.06)	(5.07)	(5.06)	(5.97)	(5.96)	(5.99)	(3.77)	(3.78)	(3.82)
Population density (t-1)	0.509**	0.454*	0.587***	0.266***	0.180*	0.591***	0.712	0.61	0.829
	(2.08)	(1.78)	(2.69)	(2.79)	(1.77)	(3.65)	(0.87)	(0.75)	(1.09)
Unemployment (diff)	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003*	-0.004*	-0.004*
	(3.27)	(3.12)	(3.21)	(3.10)	(2.83)	(3.13)	(1.71)	(1.89)	(1.74)
Family work (t-1)	-0.032***	-0.031**	-0.035***	-0.030*	-0.029*	-0.032*	-0.047**	-0.036	-0.049**
	(2.61)	(2.56)	(2.83)	(1.72)	(1.68)	(1.91)	(2.20)	(1.67)	(2.12)
Convergence regions	0.026**	0.025**	0.024**	0.034***	0.033***	0.031***	-0.009	-0.006	-0.011
	(2.43)	(2.38)	(2.31)	(3.35)	(3.32)	(3.29)	(0.33)	(0.28)	(0.41)
Total CAP subsidies (t-1)	-0.014***			-0.009***			-0.056		
	(4.05)			(5.40)			(1.21)		
Pillar 1 coupled (t-1)		0.017			0.029**			-0.181*	
		(1.30)			(2.00)			(1.71)	
Pillar 1 decoupled (t-1)		-0.017***			-0.013***			-0.144*	
		(4.10)			(3.66)			(1.82)	
Pillar 2 subsidies (t-1)			-0.094***			-0.098***			0.008
			(3.38)			(2.95)			(0.10)
R square (within)	0.435	0.437	0.433	0.445	0.449	0.445	0.482	0.486	0.479
Observations	1739	1739	1739	1551	1551	1551	388	388	388

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also region and time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Agricultural Employment

2nd Pillar components

Dependent variable: Outfarm migration	EU 28	EU 15	EU 13
Estimator: LSDV	(1)	(2)	(3)
Relative income (t-1)	0.080***	0.054***	0.147***
	(6.16)	(4.10)	(5.00)
Relative labour (diff)	0.004***	0.004***	0.004***
	(5.19)	(4.15)	(3.91)
Population density (t-1)	0.316	-0.06	0.711
	(1.12)	(0.22)	(1.05)
Unemployment (diff)	-0.003***	-0.004***	-0.005*
	(3.15)	(3.48)	(1.90)
Family work (t-1)	-0.033***	-0.029*	-0.050**
	(2.71)	(1.82)	(2.07)
Convergence regions	0.025***	0.032***	0.002
	(2.80)	(3.60)	(0.06)
Agro-environmental	-0.15	-0.046	-0.318
	(1.28)	(0.35)	(1.38)
LFA paymements	-0.305	-0.397	-0.183
	(1.21)	(1.55)	(0.68)
Investments	-0.007	-0.035	0.009
	(0.15)	(0.37)	(0.10)
Pillar 2 other	0.164	0.249	0.377*
	(0.73)	-0.9	(1.84)
R square (within)	0.441	0.453	0.489
Observations	1739	1551	388

Notes: Absolute t-statistics based on clustered standard errors at regional level in parentheses; Each regression includes also region and time fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

CAP and Agricultural Employment

Our preliminary results :

- **EU28:**
  - No impact of coupled payments on out-farm migration flows;
  - A significant negative effect of non-distortionary payments: decoupled 1st Pillar and 2nd Pillar payments;
  - No policy trade-off between agricultural employment and efficiency.
- **EU-15:**
  - Effects of decoupled 1st Pillar and 2nd Pillar payments are strongly negative;
  - The coupled component has positive and significant effect.
- **EU-13:**
  - The coupled and decoupled components have negative, but barely significant (10% level) effects;
  - 2nd Pillar payments have no significant effect.

Outline

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Conclusions

- Regional GDP growth:
  - CAP expenditures are not correlated with regional GDP growth;
  - Regional GDP is lower in regions with a high share of agricultural employment, because of lower productivity in agriculture compared to other sectors.
- Agricultural labor productivity:
  - Decoupled payments (under Pillar 1) and Pillar 2 payments raise labor productivity in agriculture.
- Agricultural employment:
  - Coupled payments: no impact;
  - Decoupled payments: positive impact.
- No trade off between efficiency and employment for decoupled payments.

Thank you

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The impact of the CAP green box on productivity in FADN European Regions– Marta Guth (Poznań University of Economics and Business)

POZNAŃ UNIVERSITY OF ECONOMICS AND BUSINESS

The impact of the CAP green box on productivity in FADN European Regions

Bazyli Czyżewski, Marta Guth, Anna Matuszczak
Poznań University of Economics and Business

Introduction and justification of the topic choice

- impossibility of applying one universal model of agricultural support over the whole EU due to the significant structural differences between regions,
- the question of what effect CAP subsidies have on the productivity of farms in the European Union has been studied by many authors, but it has not yet been definitively answered.

The need of slightly different approach

Subsidies for agriculture in the EU should be considered as not so much an econometric problem but as one of political economy.

The productivity of resources in agriculture can be affected not only by the amount of subsidies, but also by their structure, which differs more at regional than national level.

Aim of the study

Facing the opinion about the ambiguous impact of decoupled subsidies on productivity, **the aim of the study was to check whether there are some CAP programmes contributing to the 'greening' trend, which have a positive impact on productivity in FADN regions.**

We shall attempt to fulfill it by means of a two-stage study by:

1. Identifying clusters of EUFADN regions which differ significantly in terms of farming models. For this purpose the structure of acquired CAP funds was used as the proxy for structural differences.
2. Estimation of panel regression models for the clusters identified in the first point, in order to find out which CAP "green programmes" have a significant impact on productivity.

Research methodology (1/2)

1. Agglomerative cluster analysis (Ward's method) covering 131 representative farms for all EUFADN regions, according to the criterion of percentage contributions to the different "boxes" of subsidies, i.e.:
   X1 – value of payments for public goods belonging to the title "green box" (sum of set-aside and agri-environmental subsidies, LFA support and other subsidies under rural support programmes;);
   X2 – value of crop and animal production subsidies;
   X3 – value of single farm payments and area payments (might be classified as the component of "green box");
   X4 – value of subsidies for indirect consumption;
   X5 – values of investment subsidies.
2. Panel regression for each of the clusters A, B and C.

Research methodology (2/2)

A log-linear model was applied.

$$\ln TP_{it} = \gamma' SUB_{it} + \beta'^{X_i} + u \qquad (1)$$

where:
TP_{it} – average technical productivity excluding subsidies: total output (SE131) / total intermediate consumption (SE275) in the region i and year t;
γ – the vector of coefficients for the respective subsidies (the FADN codes include: SE406 SE407 SE612 SE613 SE616 SE617 SE618 SE619 SE621 SE622 SE623 SE699 SE625 SE626 SE631 SE632 SE640 SE650);
β – the vector of coefficients for years dummy variables;
u – random term

- Estimation of fixed or random effects made based on the Breusch–Pagan test
- The evaluation of which of these models (FE or RE) was appropriate was made on the basis of Hausman and Welch tests.
- Beck–Katz robust standard errors (PCSE) for cluster A and Arellano robust standard errors (HAC) for clusters B and C.

Results

Three clusters of regions with different farming models according to the support structure were identified :

A. moderately sustainable,
B. weakly sustainable, where the contribution of single farm and area payments to the political rent was markedly higher than in the others, at close to 80%.
C. strongly sustainable, combining various forms of assistance to farms.

Only models A and C were to a greater or lesser extent aligned with the development priorities of the European agricultural model emphasised in the new financial perspective of 2014–2020.

Panel regression for the cluster A (fixed-effects, using 357 observations, dependent variable: log-productivity, Beck-Katz standard errors)

	Coefficient	Std. Error	p-value	
Const	0.552186	0.0511908	<0.0001	***
Economic size	0.00115674	0.00063528	0.0737	*
Subsidies on investments	−8.97732e-06	5.12817e-06	0.0852	*
Setaside premiums	−0.000848691	0.000401887	0.0390	**
Other crop subsidies	3.48189e-05	7.3805e-06	<0.0001	***
Subsidies other cattle	−2.29505e-05	1.01412e-05	0.0273	**
Subsidies sheep&goats	9.07244e-05	3.80155e-05	0.0202	**
Other livestock subsidies	−4.76956e-05	8.95212e-06	<0.0001	***
Environmental subsidies	2.49441e-05	5.42378e-06	<0.0001	***
LFA subsidies	−3.10549e-05	1.33202e-05	0.0232	**
Other subsidies	−9.69108e-06	5.04416e-06	0.0595	*
Subsidies on intermediate consumption	−2.81006e-05	1.38462e-05	0.0469	**
Single Farm payment	−7.45402e-06	4.57004e-06	0.1082	
Single Area payment	−1.02835e-05	4.7033e-06	0.0328	**
Additional aid	0.00037333	0.000133433	0.0069	***
Support_Art68	3.5304e-05	1.39287e-05	0.0139	**
LSDV R-squared 0.903102; Within R-squared 0.201075				

Source: own study based on EUFADN data

Panel regression for cluster B (Fixed-effects, using 294 observations, Included 49 cross-sectional units, dependent variable: log-productivity, Robust HAC standard errors)

	Coefficient	Std. Error	p-value	
Const	0.931524	0.0839827	<0.0001	***
Payments to dairy outgoers	0.000231715	0.000119086	0.0575	*
Setaside premiums	−0.000676872	0.000120662	<0.0001	***
Other crop subsidies	−4.81729e-05	2.63026e-05	0.0732	*
Subsidies other cattle	−3.68319e-05	1.84421e-05	0.0515	*
LFA subsidies	−1.26174e-05	6.74698e-06	0.0676	*
Single Farm payment	−3.7522e-06	2.37638e-06	0.1209	
Single Area payment	4.80934e-05	1.65638e-05	0.0056	***
Additional aid	−0.000597601	0.000204699	0.0053	***
dt_2 (time dummy variable ref.2007)	−0.0711015	0.014209	<0.0001	***
dt_3	−0.223094	0.0504853	<0.0001	***
dt_4	−0.194809	0.0444979	<0.0001	***
dt_5	−0.221163	0.0442124	<0.0001	***
dt_6	−0.23388	0.042717	<0.0001	***
LSDV R-squared 0.944601; Within R-squared 0.402253				

Source: own study based on EUFADN data

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Panel Regression results for cluster C (Fixed-effects, using 138 observations, included 23 cross-sectional units, time-series length = 6, dependent variable: log_productivity, Robust (HAC) standard errors)

	Coefficient	Std. Error	p-value	
Const	0.438462	0.0783623	<0.0001	***
Subsidies on investments	−3.20247e-05	1.12936e-05	0.0096	***
Set-aside premiums	−0.00414695	0.00195916	0.0458	**
Environmental subsidies	−5.42784e-05	3.44221e-05	0.1291	
LFA subsidies	8.90297e-05	5.13534e-05	0.0970	*
Single Area payment	4.25656e-05	1.96353e-05	0.0413	**
Additional aid	−0.000327124	0.000208785	0.1314	
dt_2 (time dummy variable ref. 2007)	−0.0734276	0.0340674	0.0423	**
dt_3	−0.14195	0.0438113	0.0038	***
dt_4	−0.123363	0.0440283	0.0104	**
dt_5	−0.151302	0.0512326	0.0073	***
dt_6	−0.16012	0.0448902	0.0017	***
LSDV R-squared 0.944276; Within R-squared 0.398523				

Source: own study based on EUFADN data

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Conclusion (1/2)

Three clusters of regions in the EU28 countries were identified, differing significantly in terms of the structure of CAP schemes.

- In the most numerous group, of the EU28 regions, the moderately sustainable model A operated, primarily combining direct support with payments for public goods.
- The second most numerously represented was the weakly sustainable model B, in which support consisted chiefly of single farm and area payments.
- The smallest group of regions featured a highly sustainable model, combining various forms of support for farms at similar levels (both through direct and production subsidies, and through payments for the supply of public goods and to a lesser degree the subsidisation of investment).

An agricultural support model which reflects structural farming differences is a significant factor in determining the productivity of intermediate consumption over the whole studied period.

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Conclusion (2/2)

The direction of the influence of studied schemes depends on the sustainability level of farming in the respective regions. Hence, the single payments might have a positive influence on productivity only in the old member countries included in the most sustainable model, while the environmental subsidies positively contributed to productivity only in moderately sustainable model of farming.

Although there is evidence for a negative general impact of CAP subsidies on productivity, in each cluster we can observe CAP programmes which positively affected the productivity of intermediate consumption. Cluster A (moderately sustainable model of farming), which encompasses the majority of new member states, was characterised by the highest number of such schemes.

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Thank you very much
for your attention

CAP and Productivity: Critical econometric identification before policy simulation– Alexandre Gohin (INRA Rennes)

CAP and Productivity:
Critical econometric identification before policy simulation

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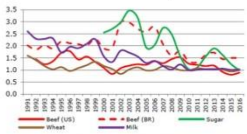
Workshop on « Estimation and modelling impacts of pillar 2 measures on the agricultural sector »
Seville, 14 september 2017

Many drivers complicate the identification

Graph 1: Ratio between EU and world prices



Source: DG Agriculture and Rural Development

Risk is inherent in all economic activities, but due to external factors that influence the yield and price of agricultural output, farmers in particular are exposed to increased uncertainty. Uncertainty about price, and thus income, makes farmers more hesitant in long-term investments that raise productivity.

My main question with Dudu&Kristkova approach:

- Who gains/loses from productivity change ? In other words, where is the farmer (in the equation and the data) ?

- Profit of the farmer = py . y – px. x = pf(fl) .fl

  - With y(py) the output (price), x(px) the input (price), fl the family labor, pf the « residual » return.
  - Is fl included in the hired labor ? Can we assume that pf(fl) is equal to the price of hired labor ?
  - With CRS CES production function, no profit.

How to solve this potential issue ?

- Not sure that the instrumentation of « endogenous » prices with lag prices solve the issue.
  - What about the sensitivity of results to the choice of instrument?
  - Prices of output/input/capital/hired labor are likely « exogenous » at the local level. Land price is more likely endogenous (depending on farmland rental agreement).

- Suggestion : to introduce « exogenous » family labor and also explain the farm income (profit).
  - This way, you may better identify the TFP and biased TC. This is similar to the estimation of the profit function with input demand/output supply (the full system). Look at the literature on « price induced technological change » (Shumway, Surry, …)

Other questions

- Quid of the the endogeneity of 2nd pillar expenditures ?
  - Voluntary adoption of AEM for instance => where are the constraints on these measures ?
  - This leads to the question : why excluding variable inputs ? Are we sure that they do not substitute with labor (pesticides&labor for instance)?
  - The explanation of positive productivity effects of AEM seems to rely on correlation, not causality (figure 4).
  - Quite difficult to understand: « Agroenvironmental payments relate the implementation of more inputs with less land »
  - Suggestion : if data available, to distinguish land with/without AEM contracts. May partially inform on the potential intensification of non-contracted land (and the « leakage story »)
  -
  - Even more difficult : in theory, AEM last for a limited period (5 years). How to acknowledge that in a static approach is not obvious (dynamic estimation raises many other challenges)

Other questions

- What about cross effects (equations 5-7) ?
- Where are the « relative price effects » of some measures ?
- Not clear about the SFP, the « partial » capitalisation in land price and its effects on productivity
- Quite very difficult is the inclusion of the provision of public goods. The value added only captures private effects (recent works by Chambers/Latruffe/Oude Lansink).

Minor questions

- Construction of the series of capital services. After computing land values, independant computation of the capital prices and capital consumption. Are we sure that they reproduce KD (operating surplus)?
- Are we sure that the land quantity is increasing in France ? Figure 2 not clear to me
- Better explain the limited period 2007-2013 for estimation and the exclusion of some countries (econometric methods for unbalanced panel). Why 1000 estimations (table 1)?
- Acknowledge that RD measures may benefit from other channels (transport costs may be lower ; the issue of the existence of fixed costs).

Modelling Pillar 2 Measures Overview of the current Literature– Emanuele Ferrari (JRC)

The European Commission's science and knowledge service

Joint Research Centre

Modelling Pillar 2 Measures

Overview of the current Literature

Emanuele Ferrari

Rural Development Measures

The EU's rural development worth €100 billion from 2014-2020 and leverage a further €61 billion of public funding in the Member States.

1. Co-financed by Member States
2. Target specific rural development objectives
3. Multi-annual commitments

2

Are RD measures difficult to models?

There are 118 different rural development programmes (RDP) in the 28 Member States, with 20 single national programmes and 8 Member States opting to have two or more (regional) programmes.

Member States and regions draw up their rural development programmes based on the needs of their territories and addressing **at least four** of six common **EU priorities**

3

Indicative list of RD measures

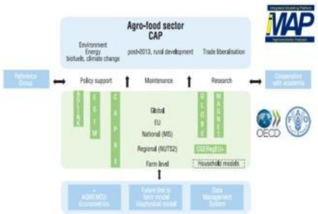
M01 - Knowledge transfer and information actions (Article 14);
M02 - Advisory services, farm management and farm relief services (Article 15);
M03 - Quality schemes for agricultural products and food-stuffs (Article 16);
M04 - Investments in physical assets (Article 17);
M05 - Restoring agricultural production potential damaged by natural disasters and introduction of appropriate prevention (Article 18);
M06 - Farm and business development (Article 19);
M07 - Basic services and village renewal in rural areas (Article 20);
M08 - Investments in forest area development and improvement of the viability of forests (Article 21);
M09 - Setting up of producer groups and organisations (Article 27);
M10 - Agri-environment-climate (AEC) (Article 28);
M11 - Organic farming (Article 29);
M12 - Natura 2000 and Water Framework Directive payments (Article 30);
M13 - Payments to areas facing natural or other specific constraints (Article 31);
M14 - Animal welfare (Article 33);
M15 - Forest-environmental and climate services and forest conservation (Article 34);
M16 - Cooperation (Article 35);
M17 - Risk management (Article 36);
M18 – Financing of complementary national direct payments for Croatia (Article 40);
M19 - Support for Leader local development (CLLD) (Article 35 of Regulation (EU) No 1303/2013);
M20 – Technical Assistance (Articles 51-54).

4

Estimation and Modelling Impacts of Pillar 2 Measures on the Agricultural Sector

From estimation procedures to…

Economic simulation models (iMAP Platform): CGE, PE, farm level



5

Effects of Pillar 2 payments

Increase share of Pillar 2 measures on total CAP

All measures notified in green-box to WTO

Likely (small) impacts on production and trade via productivity and other (land, labour use) changes.

How to link, small and sparse but growing empirical evidence to economic modelling?

6

IFM-CAP

- RD measures are currently only partially modelled (LFA & N2K payments as area payments).
- Feasibility study conducted to implement other RD measures (Agri-environmental schemes, investment support and other RD policies) in form of a productivity change (yields and input costs). Estimation based on FADN on Propensity Score Matching.
- Important is to model adoption of some RD measures at farm level

More will be described by J.Buysse => *"Rural Development in farm models: IFM-CAP"*

7

CAPRI

RD measures that may be represented as support to **particular production** activities in the CAPRI core model (possibly with some influence on technical coefficients).

LFA payments implemented as a payment per ha
Natura 2000 implemented as a payment per ha to the extensive technology of all agricultural activities
Agri-environmental measures

8

LEITAP-MAGNET

Pillar 2 measures aggregated in **groups** according to similarities in the economic **mechanisms.**
Modelled as **output- or input-augmenting technical change** as appropriate.

Parameters coming from literature or own-estimated.

Class	Measures contained
(01) Human Capital	111-115,131-133,141-142
(02) Physical Capital	121-126
(03) LFAs	211-212
(04) Natura 2000	213, 224
(05) Agri-environment	214-216
(06) Forestry	221-223, 225-227
(07) Diversification	311-313
(08) General Rural Development	321-323, 331,341
(09) LEADER	411-413,421,431
(10) Technical Assistance	511

CAPRI-RD

Specific RD instruments are mapped to CGE shocks in the form of increased capital stock, production function shifts, demand shifts or changes in tax Rates.

Type of policy instrument	Linked to the Model through sector/input:	Variables for parametrization*:	Measures contained
1.Investment subsidies in human capital (IS_HC)	1) Total factor productivity in Agriculture	aprim (IND, REG)	111, 114-115,131-133
	2) Total Factor Productivity in Other services sector		341, 411-413, 421, 431, 511
2.Investment subsidies in phisical capital (IS_PC)	3) Construction sector		112, 121, 131, 141, 321-323
	4) Agriculture and Forestry	xinv (COM, REG), xtot(IND, REG)	125-126
	5) Forestry		122, 127
	6) Food processing		123
3. Direct transfers (DT)	7) Income + Total factor productivity in Agriculture	wfacinc(REG), aprim(IND, REG)	113, 142
4. Compensatory aids (CP)	8) Land subsidies in Agricultural sector	delLNDTAXRATE, (IND, REG)	143, 211-216, 222-225
	9) Land subsidies in Forestry sector		221, 226
5. Output subsidies (OS)	10) Other services	delPRDTAXRATE(IND, REG)	311-313

Other CGE modelling attempts

Other CGE tackle individual measures with greater detail.
Zawalińska, et al. (2013) use a regional CGE model to analyse the impact of LFA payments on Polish regions.
Psaltopoulos et al. (2011) Detailed treatment of some RD measures on regional SAMs.

Conclusions

CGE required for ex-ante as many measures outside agriculture.

Most attempt at regional levels. Difficult to deal with MS or EU28 averages.

The way in which this **mapping** is done, and the **parameter** values adopted, essentially determines the outcome of the modelling.

Rural development in regional CGEs - Katarzyna Zawalińska (IRWiR PAN)

IRWIR PAN Polish Academy of Sciences Institute of Rural and Agricultural Development

Workshop on Estimation and Modelling Impacts of Pillar 2 measures on the Agricultural Sector, 14 September Seville

Rural development in regional CGEs

Katarzyna Zawalińska

IRWiR PAN – Institute of Rural and Agricultural Development, Polish Academy of Sciences

Contents

- **Concerns about the MODEL (model design):**

Representation of „rurality" in regional CGE model based on TERM :
  - Rural vs Urban
  - Land types
  - Land use by agricultural vs other sectors

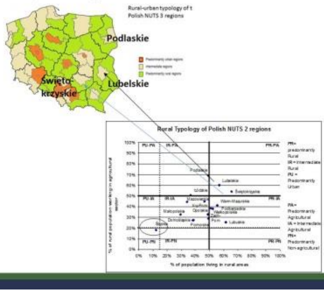
- **Concerns about the POLICY (shock implementation):**

Modelling Rural Development Programe:
  - Tackling the measures – individually vs grouped together
  - Tackling measures linked to transfer of knowledge (productivity)
  - Simulation design (closures)

- **Example of modeling LFA measure in TERM model**
- **Results and Conclusions**

Representation of „rurality" in regional CGE models:

– Distinction between **Rural vs Urban Regions**:
- Regional models at NUTS3 and NUTS2 level.
- For NUTS3 the OECD/EUROSTAT typology holds
- For NUTS2 less precise but analogical definition works (Predominantly Rural are the regions where more than 50% of population lives in rural areas)



Representation of „rurality" in regional CGE models:

– Distinction between **Rural vs Urban Households**:
- Rural households have different consumption patterns than urban hoseholds (demand for cultural goods, services, etc)

– Distinction between **various types of land**:
- Fore example land function under LFA can have different parameters than that for a „normal" land

– **Land is attributed to certain sectors only**:
- Land going to agriculture (**agricultural land**) vs land going to other sectors (mining and quarrying)

Taking account of Rural Development Measures: new challenges

– More advancements in the models in order to grasp:
- Measurement of the measures **concerning the transfer of knowledge (R&D)**, **risk management, cooperation.**
- Full economic measurement of environmental measures may require building integrated I-O tables where natural resources are added to other traditional production inputs →
- **Integrated Economic–Environmental Modeling -** System of Environmental-Economic Accounting (SEEA) in the CGE framework - enabling for the analysis of policy impacts on the economy and the environment in a quantitative, comprehensive, and consistent framework – see Banerjee, O., Cicowiez, M., Horridge, M., & Vargas, R. (2016). A Conceptual Framework for Integrated Economic-Environmental Modeling. *The Journal of Environment & Development*, 25(3), 276–305. http://doi.org/10.1177/1070496516658753

Taking account of Rural Development Measures: grouping

- Grouping according to **OECD /PSE indicators**
- Grouping according to the **economic character**:
  - **Land subsidy** (LFA), **investment subsidies** (young farmers), **direct transfers** (early retirement)
- Grouping by intervention logic
- Grouping proposed by Dwyer (2005)
- **Grouping by the actual spend of the funds**

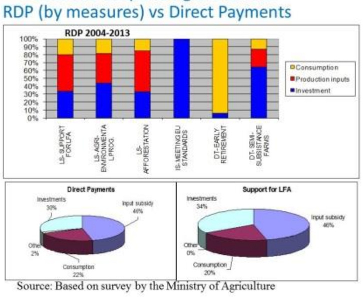
Another grouping of the measures has been presented by Dwyer (2005). She proposed five groups:
a) Compensatory aids (offered as regular annual payments to farmers under multiannual contracts, usually for the provision of environmental management);
b) Investment aids (covering some proportion of the total cost of a one-off or short-term programme of investment activity on a farm or for a farmer, such as training);
c) Other capital-related support (such as low- or no-interest loan facilities to enable farmers to make investments);
d) Collective investments in agricultural infrastructure (such as irrigation or land restructuring, which may bring direct or indirect efficiency gains to individual farm businesses services),
e) Project aids (offered to collective or community projects which are likely to offer only indirect support to farmers).

Directions of spending the funds: RDP (by measures) vs Direct Payments

Shock variables: CONSUMPTION PRODUCTION INPUTS and INVESTMENT

The more detailed distinction which investment (machinery, buildings, etc.) guarantee the more precise **„shock" variable** in the model

Shock value from the actual spend



Source: Based on survey by the Ministry of Agriculture

Data sources required

Source 1: Regional distribution of funding for RDP measures from the Polish Ministry of Agriculture for 2007-2013

Source 2: Survey on the direction of spending of RDP measures by purpose

Source 3: Evaluation of RDP including direction of spend by RDP measures

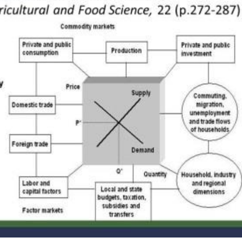
- Modelling RDP measures by:
  - Regional distribution of RDP funds
  - RDP measures grouped by the direction of spent – according to types of measures and declared direction of spend

Example of modeling LFA in TERM model

Regional CGE for Poland – POLTERM

- POLTERM is an implementation of the TERM model (Horridge et al. 2005) to the Polish economy.
- It is described in details in: Zawalińska, Giesecke, Horridge(2013), *Agricultural and Food Science,* 22 (p.272-287)

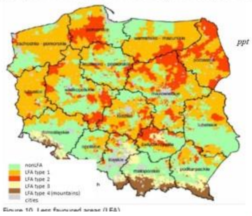
- The in-Poland workforce responds endogenously to movements in the Polish real wage, with **labour supply Elasticity equal to 0.10**
- labour moves between regions in response to regional wage differentials

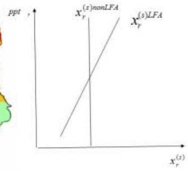


- **20 agricultural activities** (a.o. wheat, rye, barley, potatoes, sugarbeets, fruit and vegetables, etc)
- **8 processed food products** (e.g. beefmeat, porkmeat, poultry, sugar, diary products, etc.)
- **30 industrial sectors** (e.g. textiles, chemicals, paper, etc)
- **24 services** (transport, trade, construction, education, health, public administration, etc)
- **2 representative households**: rural and urban
- **two types of land (LFA and non-LFA)**,
- **Migrations** and regionally mobile labour force
- **16 NUTS2 regions**, among which is **interregional trade**

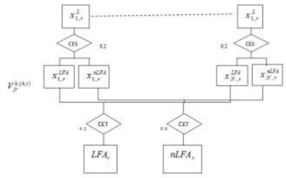
Modelling LFA in Poland

- 56% of land is LFA
- In each region there is LFA and nonLFA land
- Supply of nonLFA is fixed (not affected by policy)
- Supply of LFA is upward sloped (elasticity of land with respect to rent rate is 0.2)





Supply and demand for agricultural land



Where: $X_{1,r}^{L}$ is demand for products by regions, $X_{1,r}^{LFA}$ $X_{1,r}^{nonLFA}$ are quantities demanded for products from LFA and nonLFA land. Then LFAr and nLFAr is supply of products from LFA and nLFA land

Simulation design

- The **shock** is LFA payments which is modeled as land rental subsidy
- The **closure** is similar to a standard LR closure with minor changes:
  - The balance of trade is moved towards the deficit by the value of the EU payments
  - Employment is (weakly) related to real wage
  - Supply of LFA land is (weakly) related to real wage

Annual spend	% of LFA support	milion NAC
1 DOLNOSLASKIE	0.036	43.7
2 KUJPOMORSKIE	0.053	64.4
3 LUBELSKIE	0.067	80.7
4 LUBUSKIE	0.03	36.6
5 LODZKIE	0.075	90.8
6 MALOPOLSKIE	0.04	48.7
7 MAZOWIECKIE	0.185	222.1
8 OPOLSKIE	0.008	10
9 PODKARPACKIE	0.032	39.1
10 PODLASKIE	0.134	160.9
11 POMORSKIE	0.049	58.6
12 SLASKIE	0.015	17.6
13 SWIETOKRZYSK	0.028	33.4
14 WARMMAZURSKI	0.074	88.9
15 WIELKOPOLSKI	0.128	153.9
16 ZACHPOMORSKI	0.045	53.9
Total	**1**	**1203.4**

	shock values
1 DOLNOSLASKIE	16.150
2 KUJPOMORSKIE	28.609
3 LUBELSKIE	17.773
4 LUBUSKIE	14.813
5 LODZKIE	13.152
6 MALOPOLSKIE	23.971
7 MAZOWIECKIE	20.171
8 OPOLSKIE	12.111
9 PODKARPACKIE	19.442
10 PODLASKIE	31.276
11 POMORSKIE	17.046
12 SLASKIE	7.558
13 SWIETOKRZYSK	13.614
14 WARMMAZURSKI	18.533
15 WIELKOPOLSKI	17.229
16 ZACHPOMORSKI	14.459

Results – national level

Impact of land rental subsidy granted to owners of land located at LFA

Table 1: National macroeconomic results

	National macroeconomic indicator:	
1	Real GDP at market prices	0.07
2	Aggregate employment (wagebill weighted)	0.02
3	Aggregate capital stock (rental weighted)	0.07
4	Aggregate land supply - all land (rental weighted)	1.19
5	Aggregate land supply - LFA land (rental weighted)	2.26
6	Aggregate land supply - non-LFA land (rental weighted)	0.00
7	Real consumption (private & public)	0.20
12	Real exports	-0.23
13	Real imports	0.07
14	Terms of trade	0.06
15	Real exchange rate	0.08
23	Real wage	0.16
24	Rental price of capital	0.05
25	Average user price of land - all land (rental weighted)	-2.23
26	Average user price of land - LFA land (rental weighted)	-6.06
27	Average user price of land - non-LFA land (rental weighted)	2.16
28	Average owner price of land - all land (rental weighted)	7.30
29	Average owner price of land - LFA land (rental weighted)	11.77
30	Average owner price of land - non-LFA land (rental weighted)	2.16

Sectoral Results

Winners (green):

Agricultural and food sectors becuase more resources are employed

Loosers (pink):

Export oriented sectors becuase of real appreciation

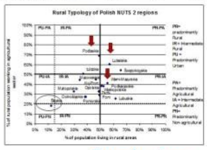
Winners (white):

Services sectors beucase the consumption increased

Sector	Percentage change in output
Wheat	0.33
Rye	0.40
Barley	0.33
Othcer	0.36
Oilseeds	0.31
VegFruit	0.38
Othercrop	0.36
Othanimal	0.45
Pigs	0.34
Poultry	0.33
Catle	0.39
Forest	-0.02
Fish	0.13
CoalOre	-0.02
Beefmeat	0.14
Porkmeat	0.12
DairyPrds	0.12
OthFood	0.14
Beer	0.16
OthBeverage	0.28
Manufac	-0.13
ElecCoalGen	0.06
OthElec	0.07
Constr	0.07
Trade	0.03
Hotres	0.14
Transp	0.01
Finance	0.03
DwelRent	0.11
Educat	0.17
PubAdmin	0.19
Health	0.19
OthServ	0.12

Regional Results

Region	Real GDP	Real consumption	Employment	Capital stock	Land supply LFA Land	Non-LFA Land
1. Dolnoslaskie	0.01	0.12	-0.03	0.01	1.66	0.00
2. Kujpomorskie	0.05	0.19	0.01	0.04	2.96	0.00
3. Lubelskie	0.11	0.30	0.07	0.09	2.00	0.00
4. Lubuskie	0.10	0.24	0.04	0.09	2.08	0.00
5. Lodzkie	0.09	0.23	0.03	0.08	1.70	0.00
6. Malopolskie	0.03	0.15	-0.01	0.03	2.50	0.00
7. Mazowieckie	0.09	0.22	0.03	0.10	2.60	0.00
8. Opolskie	0.01	0.15	-0.01	0.01	1.20	0.00
9. Podkarpackie	0.05	0.19	0.01	0.04	2.10	0.00
10. Podlaskie	0.42	0.64	0.25	0.37	4.33	0.00
11. Pomorskie	0.06	0.19	0.01	0.06	2.15	0.00
12. Slaskie	-0.01	0.07	-0.06	0.00	0.73	0.00
13. Swietokrzysk	0.07	0.22	0.03	0.06	1.60	0.00
14. Warmmazurski	0.19	0.36	0.10	0.16	2.46	0.00
15. Wielkopolski	0.07	0.20	0.02	0.06	2.03	0.00
16. Zachpomorski	0.09	0.23	0.03	0.08	1.87	0.00



Winners: The most agricultural and rural regions Podlaskie, Lubelskie, Warm-mazurskie

Looser:

- Slaskie, the most urban

-Employment shifts from most urban to more rural regions

- The land supply is the land that would have otherwise been abandonded

Conclusions

- Regional CGE, stand alone, has a problem with precise representation of rurality
- Regional CGE can grasp rurality by:
  - rural regions (for shock implementation and results interpretation)
  - Rural households (various types of rural households)
  - land types
- Modelling of RDP measures in regional CGE depend on what we trust in:
  - **the purpose of the measures – what were designed for ? or**
  - **how the measures were actually spent by beneficiaries - where the money went in fact?**

Conclusions

- There is an increasing difficulty in modeling the RDP with new measures such as: **risk management and cooperation**
- The **measures related to increase in productivity**, knowledge-transfer, R&D etc. **require endogenous growth theories** to be implemented and better links between R&D and productivity, etc.
- Grasping the full economic effects of environmental measures would require building up Integrated Economic–Environmental Modeling - **System of Environmental-Economic Accounting (SEEA) in the CGE framework**
- Some of the **deficiencies in regional CGE approach (e.g. more precise implementation of the measures) could be overcome by linking CGE with more precise** partial equilibrium **models.**

Thank you for your attention

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Lessons learned from modelling of Pillar II in the CAPRI-RD project- Wolfgang Britz (Bonn University)

universitätbonn

Lessons learned from modelling of Pillar II in the CAPRI-RD project

Wolfgang Britz
September 2017

Background

- **CAPRI-RD project**, 7th framework program, **2009-2013**, focusing on modeling the second Pillar of the CAP, not only for agriculture
- Based on **EU-wide** application of
  - Coupled supply side / **partial equilibrium** and computable **General Equilibrium modeling** in CAPRI, at **NUTSII** level
  - **Environmental assessment** at **1x1 km** level based on statistical down-scaling and bio-physical modeling/indicators
- Project covered many other aspects (accession countries, modeling of decoupled payments, price transmission in EU market, data and code quality management …)
- Approach here: check final presentations from final meeting and summarize ..

Challenges

- **Second pillar** programs **diverse**, **national**, even regionalized
- **Opt-in**, not command or control
- Impossible EU wide case by case in a research project
- **No harmonized data base** on pillar II programs directly suitable for modeling
  - Available data focus on money spent (planned or actual), limited information on how and for what
  - Data classified rather by political aim than by detailed implementation

Approach

- Develop a **standardized "impact pathway"** matching the classification in the available data bases
  - Example: "village renewable" is shifting government demand for construction
  - 0/1 decision for each instrument to let either aggregate supply side model (CAPRI) or regional CGE take lead, indirect effect via interaction with other modules
  - Down-scale from NUTS II to 1x1 km grid for environmental assessment (e.g. erosion, bio-diversity)

Approach

Measures ELER-Code	Measure group
214	Agri-environmental measures
321, "322/323"	Increase government demand for construction
"122/123/225", 125, 126	Capital subsidies to agric. & forest.
211, 213/224	Land subsidies to agriculture
121	Increase capital stock in agric.
123	Capital subsidies to food processing
431, 511	Investments in human capital in other sectors
311, 312, 313	Production subsidies to services
221	Land subsidies to forest.
111, 114, 115, 132	Investment in human capital in agric.
112, 113	Income transfers to households

Applications

- Some **test runs** during the project life time
  - **Exante**: application for **Slovenia**: assessed as interesting to compare more general options, not for detailed planning
  - **Expost Germany**: Schroeder, L. A., Gocht, A., Britz, W. (2015): The Impact of Pillar II Funding: Validation from a Modelling and Evaluation Perspective, Journal of Agricultural Economics 66(2): 415–441: next slides

Some results: Pillar II in Germany

Budget for RD DE 2006 in CAPRI-RD [1.9 Mio Euro]

Measure groups

Implementation logic (shocks)		Agri Environment	Governm. Demand for Construction	Capital Subsides Agric. Forest.	Land Subsides Agric.	Increase Capital stock Agric.	Capital Food Process.	Human Capital other Sect.	Production Subsidies Services	Land Subsidies Forest.	Human Capital Agric.	Income Households
Mio Euro	Subsidy to land (CAPRI)	722			263							
	Change of additional government demand										4	
	Change of public investment		355	163		102	50	39				
	Change of Subsidies from local government given to households											2
%	Shift of tax rate for land									-0.01		
	Shift of tax rate for capital			-0.07			-0.01					
	Shift of CES Production Function			0.25		0.06	0.02					
	Shift of the producer tax								< 0.01			

Some results: Pillar II in Germany

CAPRI-RD results	Congruence with ex-post evaluation / experts
Moderate impact of 2nd Pillar in DE	✓
Agric. income ↑	✓ for LFA, but not for AgriEnv
Agric. land use ↑	✓ (but not for AgriEnv)
Substitution from fallow land and set-aside to grassland	✓
Agric. production ↑	Not for AgriEnv
Greenhouse gas emissions & N-surplus ↑	No, reduction
Land price in agri. and forestry ↑	✓
Use of labour in agric. and food processing ↓ in forestry ↑	No, little ↑ for some measures

Project outputs and challenges

- The **regional CGE models** with matching SAMs (by now rather old) with the mapping methodology
- **CAPRI code** to model selected Pillar II instruments in the regional / farm type models of CAPRI
- Operational **statistical downscaling** with **matching indicators**
- Overall: an even more complex CAPRI modeling tool with higher data demands, asking for experts in PE/CGE and bio-physical modeling, the first and second pillar of the CAP

Conclusions

- Pillar II modeling is far more complex compared to Pillar I (but recent change in Pillar I are challenging as well), consequences:
  - More specific data needs – huge bottleneck
  - More resources needed, especially experienced modelers understanding programs
  - "Implementation" logic in models of specific programs needs national / regional expertise
- Gap: administration costs (planning, implementation, controlling, monitoring, ex-post assessment ..) of pillar II not included, but potentially quite high

MAGNET - Pillar 2 payments and productivity effects- Emanuele Ferrari (JRC)

The European Commission's science and knowledge service

Joint Research Centre

MAGNET - Pillar 2 payments and productivity effects

George Philippidis, Pierre Boulanger, Emanuele Ferrari

MAGNET – version 1

Pillar 2 measures aggregated into groups according to the similarities in the economic mechanisms which underlie them.

(i) Investment in human capital (e.g., vocational training, setting up of young farmers, use of advisory services, etc.);
(ii) Investment in physical capital (e.g., modernisation of agricultural holdings, infrastructure investments, adding value to agricultural and forestry products, etc.);
(iii) Agri-environmental payments (e.g., Natura 2000 payments, forest-environment payments, etc.);
(iv) Least favoured areas (e.g., payments to farmers in mountainous areas);
(v) Wider rural development schemes (e.g., diversification into non-agricultural activities; encouragement of rural tourism; village renewal and development, etc.).

Payments of classes (i), (ii), (iii), and (v) are assumed to incur endogenous output or input productivity effects.

Measures

Axes	#	Measure title	investment in physical capital	investment in human capital	wider rural developement schemes	Support to LFAs	Agri-environ. measures
1	111	Vocational training and information actions		X			
	112	Setting up of young farmers		X			
	113	Early retirement		X			
	114	Use of advisory services		X			
	115	Setting up of management, relief and advisory services		X			
	121	Modernisation of agricultural holdings	X				
	122	Improvement of the economic value of forests	X				
	123	Adding value to agricultural and forestry products	X				
	124	Cooperation for development of new products	X				
	125	Infrastructure related to the development and adaptation..	X				
	126	Restoring agricultural production potential	X				
	131	Meeting standards based on Community legislation		X			
	132	Participation of farmers in food quality schemes		X			
	133	Information and promotion activities		X			
	141	Semi-subsistence farming		X			
	142	Producer groups		X			
	143	Provision of farm advisory and extension services in BG and		X			
2	211	Natural handicap payments to farmers in mountain areas				X	
	212	Payments to farmers in areas with h., other than mountain..				X	
	213	Natura 2000 AND Directive 2000/60/EC payments					X
	214	Agri-environment payments					X
	215	Animal welfare payments					X
	216	Non-productive investments					X
	221	First afforestation of agricultural land					X
	222	First establishment of agroforestry systems on..					X
	223	First afforestation of non-agricultural land					X
	224	Natura 2000 payments					X
	225	Forest-environment payments					X
	226	Restoring forestry potential and introducing prevention..					X
	227	Non-productive investments					X
3	311	Diversification into non-agricultural activities			X		
	312	Support for business creation and development			X		
	313	Encouragement of tourism activities			X		
	321	Basic services for the economy and rural population			X		
	322	Village renewal and development			X		
	323	Conservation and upgrading of the rural heritage			X		
	331	Training and information			X		
	341	Skills acquisition, animation and implementation of ..			X		
4	411	Implementing local development strategies. Competitiveness	X				
	412	Implementing local development strategies. Environment/land					X
	413	Implementing local development strategies. Quality of life			X		
	421	Implementing cooperation projects			X		
	431	Running the local action group, acquiring skills and ..			X		
5	511	Technical Assistance			X		

Physical capital

Investments in physical capital lead to **increases in output productivity** in agricultural sectors.

Estimates of vintage effects of investment in physical capital on output productivity suggested a rate of return of 30% (Nowicki et al., 2009), based on research by Wolff (1996) and Gittleman et al. (2006).

Human capital

Investments in human capital increase **output productivity in agriculture** through greater awareness of farming practise, better use of machinery, improved fertiliser, pesticide and feed application, and more efficient land use.

The productivity parameter of 0.4 (based on Evenson (2001)) indicates an internal rate of return of 40% for the OECD countries.

Land payments

Agri-environmental schemes and LFA directly tied to land factor. Payments **compensate farmers in return for a more extensive production system**.

Pufahl and Weiss (2009) show that agri-environmental payments can generate an increase in marginal land use.
Labour and capital productivity in agricultural sectors decreases by 5% for every euro of expenditure on agri-environmental schemes.

Wider rural development

Wider rural development: initiatives to reverse economic and social decline in rural areas such as promoting innovation, creating employment opportunities and thereby **output productivity change not only in agriculture but also in the wider rural economy**.

Assumed same rate of return used for physical capital investments (i.e., 30%).

MAGNET Model

Output augmenting (OA) or factor augmenting (FA) technical change multiply a 'response parameter' by the ratio of payments to the specific total cost-price value (based on GTAP data).
This yields endogenous augmenting technical change.

$$OA_j = \Theta \times \left[\frac{HK}{\sum_{k \in AGRIC} VOA_k} \right] + \Phi \times \left[\frac{PK}{\sum_{k \in AGRIC} VK_k} \right] + \Xi \times \left[\frac{WID}{\sum_{k \in TRAD} VOA_k} \right] \quad j \in AGRIC$$

$$OA_j = \Xi \times \left[\frac{WID}{\sum_{k \in TRAD} VOA_k} \right] \quad j \in NAGRIC$$

$$FA_{f,j} = \Psi \times \left[\frac{AE}{\sum_{i \in NLAND} \sum_{k \in AGRIC} EVFA_{i,k}} \right] \quad f \in NLAND \quad j \in AGRIC$$

MAGNET application

Limited impacts of CAP cuts on EU agricultural (production neutral behaviour SFP).Changes in output linked to **productivity effects arising from changing pillar 2 expenditures** (Boulanger and Philippidis, 2015).

Reductions in pillar 2 (human and physical capital and wider rural measures) generate productivity losses in agricultural and (to a lesser extent) non-agricultural sectors which are **particularly pronounced in Poland.**
The UK and Austria witness small positive technological gains as 60% of their pillar 2 expenditure (including co-financed support) is assigned to (**productivity reducing) agri-environmental measures.**

MAGNET –version 2

From TFP to **Single Factor** productivity.

$\%x = R * [dX / X] * 100$

If R (response parameter) equal 0.05, a 100% increase in a given payment would be equal to a 5% increase in the productivity of the given factor linked to that payment.

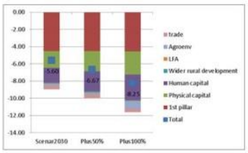
Scenar 2030 - Parameters

100% increases in **human capital** investments produce labour factor productivity improvements of 1.6%.
100% increases in **physical capital** investments produce capital factor productivity improvements of 2.5%.
100% increases in **agro-environmental** investments produce land factor productivity improvements of 0%.
100% increases in **wider rural payments** increase productivity with 0.2%

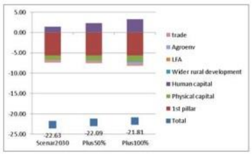
Test with parameter increased by 50 (plus50) and 100 (plus100) per cent and Agri-environmental payments equal to 5%

Scenar 2030

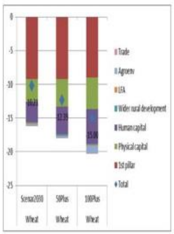
Agricultural Production, 2030-2016
No CAP Scenario

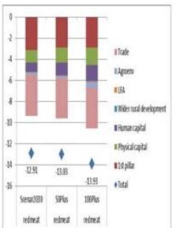


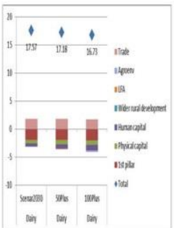
Agricultural Employment , 2030-2016
No CAP Scenario



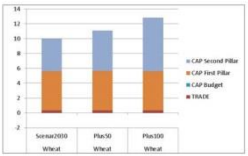
Scenar 2030 – Sectorial Impacts

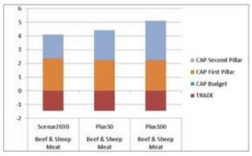






Impacts on Prices – 2030-2016





Conclusions

Key point: **parametric uncertainty** (i.e., more econometrics definitely needed to take this further).

MAGNET treatment is necessarily very stylized due to this uncertainty, but at very least goes deeper than other global CGE treatments of this issue.

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Feasibility study on Rural Development policy modelling in IFM-CAP- Jeroen Buysse (Gent University)

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Feasibility study on Rural Development policy modelling in IFM-CAP

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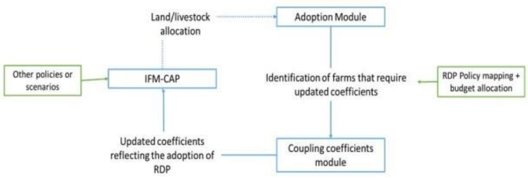
General framework



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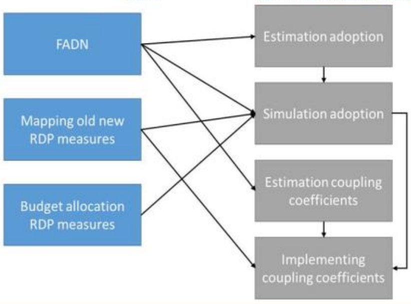

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Adoption modelling: 2 step Heckman approach

- **First step**: probit regression model to predict adoption of a farm
- **Second step**: the “level” of adoption including only adopting farms with the same explanatory variables as in the first step

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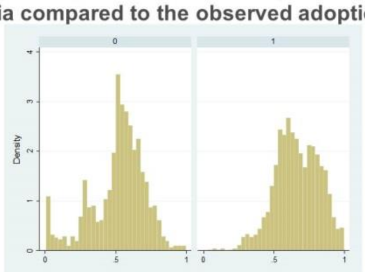
Histogram of probabilities to adopt AES in Bavaria compared to the observed adoption



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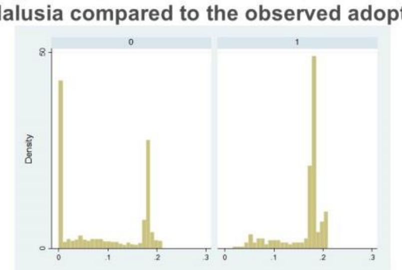
Histogram of probabilities to adopt AES in Andalusia compared to the observed adoption



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Implementing the econometric results

1. Select farm with highest probability of adopting an RDP measure
2. Calculate the intensity of adoption (2nd step Heckman)
3. Multiply subsidies with the sampling weight

- Repeat step 1-3 until the total budget is allocated
- Assign coupling coefficients to farms with new adopting behaviour

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Validation of AES in Bavaria

AES in 2012	FADN	FADN weight	OFFICIAL STATISTICS	predicted	predicted weight
Total # farms	1.750	62.514	97.870	1.750	62.514
# farms with AES (D)	1.080	39.763	61.052	534	22.780
%with AES	62%	64%	62%	31%	36%
SUM of AES subsidy (EUR) (A)	6.202.398	226.104.256	161.219.424	4.031.020	161.219.424
Mean AES per farm (A/D)	5.742	5.686	2.641	7.548	7.077

Validation of LFA in Bavaria

LFA in 2012	FADN	FADN weight	OFFICIAL STATISTICS	predicted	predicted weight
Total # farms	1.750	62.514	97.870[A]	1.750	62.514
# farms with LFA	1.186	46.385	75.371[B]	892	38.270
%with LFA	68%	74%	77%	51%	61%
SUM of LFA subsidy (EUR)	3.426.875	131.430.664	111.291.432	2.864.217	109.929.648
Mean LFA per farm	2.889	2.833	1.476	3.211	2.872

Implications of modelling approach

- Adoption of RDP is outside IFM-CAP
- Budget allocation to different RDP measures will be reflected in the IFM-CAP model
- No simulation of behaviour of farms that would strategically change land allocation of livestock production to satisfy with the requirements of certain RDP measures.
- Data detail defines modelling detail

Conclusion and implication

- FADN is not representative in terms of RDP adoption
- Apply %change of official budget allocation on the budget allocation in FADN
- Increase or decrease the adopting farms based on predicted adoption probability until % budget change is reached

Coupling coefficients/result indicators

The result indicators should change directly parameters and should only indirectly change variables in the final IFM-CAP simulation model. A change in variables is to be simulated by changes in parameters.

Parameters	Description (unit)
w_f	Farm weighting factor
Ψ_f	Farm weight within the NUTS 2 region ($\Psi_f = w_f / \sum_f w_f$)
$y_{f,i}$	Yield of activity i (tonne/ha or tonne/head)
$p_{f,i}$	Farm product prices (euros/tonne)
$p^q_{f,i}$	Farm in-quota prices (euros/tonne)
$s_{f,i}$	Subsidies (coupled and decoupled payments) (euros/ha or euros/head)
$C_{f,i,k}$	Accounting unit costs of input k per hectare of activity i (euros/ha)
$d_{f,i}$ & $Q_{f,i,i'}$	Behavioural functions' parameters (i.e. PMP parameters for activity levels) (euros/ha or euros/head)
$d'_{f,i,j}$ & $Q'_{f,i,i,j}$	PMP parameters for feeding (euros/tonne)
$A_{f,i,m}$	Matrix coefficients for resource and policy constraints (ha/ha or tonne/tonne)
$b_{f,m}$	Resource endowments and policy (quotas and other) rights (ha or tonne)
$R_{f,i,mr}$	Animal requirements (MJ/tonne or tonne or fill unit system)
$u^0_{f,i,j}$	Observed quantity used for animal feeding by animal category (tonne)
$g_{t,i,mr}$	Feed contents (MJ/tonne or tonne or fill unit system)
$\text{MinShr}_{t,i,j}$	Minimum proportion of feed in total feed consumption (in dry matter)
$\text{MaxShr}_{t,i,j}$	Maximum proportion of feed in total feed consumption (in dry matter)

Result indicators

- Quantify change in per crop after adoption of RDP measure
- Quantify change in input use per farm after adoption of RDP measure

How to quantify this change?

- Meta-analysis
  - Little observations
  - Generalisation?
  - Often on other results indicators: variables in IFM-CAP
- Propensity score matching
  - Recommended approach for RDP evaluation

Number of RD beneficiaries vs. non-beneficiaries in Bavaria – FADN panel 2006-2012

Type of RD subsidies	Beneficiaries	Non-beneficiaries
Subsidies on investment	62 (6%)	941 (94%)
Agri-environmental subsidies	768 (77%)	235 (23%)
LFA subsidies	647 (64%)	356 (36%)
Other RD subsidies	89 (9%)	914 (91%)

RD beneficiaries in Andalusia by type of subsidy in the panel for PSM

Type of RD subsidy	Farms (%)	Average payment conditional on receiving the subsidy (€)
Subsidies on investment	1.1%	33055
Agri-environmental subsidy	7.9%	6005
Less Favoured Area	9.3%	2090
Other RD subsidies	0.0%	
Total RD subsides (excl. investment subsidies)	16.4%	4087

Assessment of rural Development – Hubertus Gay (OECD)

ASSESSMENT OF RURAL DEVELOPMENT

Hubertus Gay, OECD

OECD
BETTER POLICIES FOR BETTER LIVES

Ferrari: Effects of Pillar 2 payments

- Increase share of Pillar 2 measures on total CAP
- All measures notified in green-box to WTO
- Likely (small) impacts on production and trade via productivity and other (land, labour use) changes.
- How to link (small but growing) empirical evidence to economic modelling

EU framework for rural development programmes: six common EU priorities

- fostering **knowledge transfer and innovation** in agriculture, forestry and rural areas
- enhancing the viability and **competitiveness** of all types of agriculture, and promoting innovative farm technologies and sustainable forest management
- promoting **food chain organisation, animal welfare and risk management** in agriculture
- **restoring, preserving and enhancing ecosystems** related to agriculture and forestry
- promoting **resource efficiency** and supporting the shift toward a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors
- promoting **social inclusion, poverty reduction and economic development** in rural areas

Britz: Conclusion

- Pillar II modeling is far more complex compared to Pillar I (but recent change in Pillar I are challenging as well), consequences:
  - More specific data needs – huge bottleneck
  - More resources needed, especially experienced modelers understanding programs
  - "Implementation" logic in models of specific programs needs national / regional expertise
- Gap: administration costs (planning, implementation, controlling, monitoring, ex-post assessment ..) of pillar II not included, but potentially quite high

Ferrari: Rural Development Measures

- The EU's rural development worth €100 billion from 2014-2020 and leverage a further €61 billion of public funding in the Member States.

1. Co-financed by Member States
2. Target specific rural development objectives
3. Multi-annual commitments
4. *Plus: opt-in and not mandatory*

Kristkova: Conclusion

- CAP-II payments related to Human capital, physical capital and agro-environment are **increasing factor productivity.**
- Impacts are small (-er than what is assumed in general): You need to double the share in production to get 3-5% change.
- At the regional level intermediate input use did not change while land use declined

OECD: approaches and data

- Agri-environmental indicators (www.oecd.org/tad/sustainable-agriculture/agri-environmentalindicators.htm)
  - Database available to compare between countries and over time
- Innovation, agricultural productivity and Sustainability (www.oecd.org/tad/agricultural-policies/innovation-food-agriculture.htm)
  - Series of country assessments according an agreed framework
- Evaluation of Agricultural Policy Reforms in the European Union: The Common Agricultural Policy 2014-20 (http://dx.doi.org/10.1787/9789264278783-en)
  - Special attention is given to risk management instruments and environmental measures.

What to do?...

- Difference between micro and macro level
- How to link single measure to overall effect?
  - Aggregation of micro observations
  - Assessment of macro level
- Multiple approaches necessary
- Differentiate between aim, primary effect and secondary effect

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