The impact of the CAP and its reforms on the productivity growth in agriculture

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Abstract

This study analyses the effectiveness of the Common Agricultural Policy (CAP) to agricultural productivity development. The analysis is conducted using an econometric model to clarify the policy impact given the general economic and structural development. We measure productivity in terms of value added in agriculture per worker and the policy development is captured using nominal rate of assistance and dummy variables for policy reforms. Our results suggest that the implemented agricultural policy reforms have improved the policy effectiveness in term of its impact on the agriculture value added per worker.

Keywords: Common Agricultural Policy CAP, productivity, agricultural value added per worker

1. Introduction

In this paper, we analyse the effectiveness of the Common Agricultural Policy (CAP) in terms of its ability to respond to the objectives set. We define the policy effectiveness as the ability of agricultural policy to respond to the stated policy objectives, given the general economic and structural conditions under which the policies operate. In order to do this, an empirical analysis on the effects of implemented policies and policy reforms on the objective of the CAP 'to increase agricultural productivity via technological progress and rational use of inputs, especially labour' is conducted. The analysis is conducted at the EU15 level for the time period from 1980 till 2010. This approach follows the framework by Arovuori (2015), where the impact of agricultural policies on stated policy objectives was widely analysed.

There may be multiple ways how agricultural policies affect the use of labour use and, thus, development of productivity in terms of labour use on farms. In general, agricultural policies tend to maintain existing structures. This usually reduces the pace of structural development and leads to slower increase in productivity. Several studies on the effects of agricultural policies on productivity of agriculture have been conducted over the years.

Matthews (2013) summarizes the possible effects of agricultural policy on farm productivity. The positive effects are based on easing the credit constraints as well as affecting the attitudes towards entrepreneurial risks. Subsidies may provide a source of financing directly by increasing the incomes of a farm and, hence, enabling further investments by cash-flow financing. In addition, direct payments may have indirect effects as they may affect the access for formal credit as the risks of the credit institution decrease as a consequence of large share of secured income of the borrower.

In contrast, direct payments have an obvious effect on the production structure. For example a coupled subsidy may keep producers in less or unprofitable business because they will receive the subsidies in any case. In this case the incentives to increase productivity may be somewhat scarce. In addition, subsidies tend to help to keep existing resources in the industry and hinder reallocation of resources to more productive uses provided by new technologies or market conditions. (Matthews 2013.)

In this study we adopt agricultural value added per worker as the target variable for the development of agricultural productivity. Agricultural value added per worker measures the output of the agriculture sector less the value of intermediate inputs. The objective of the CAP is to increase agricultural productivity via technological progress and rational use of inputs,

especially labour. Thus, value added per worker in agriculture is a justified approximation for the policy objective.

Based on the empirical analysis, this study seeks to answer two interrelated research questions.

First**,** *what is the impact of agricultural policies and policy reforms on the development of agricultural productivity in terms of value added in agriculture per worker?*

Second, *what is the role of agricultural policies and policy reforms in the development of agricultural productivity compared to general economic and structural development*?

The impact of agricultural policy is captured using the nominal rate of assistance (NRA) from the updated agricultural distortions database by Anderson and Nelgen (2013). Nominal rate of assistance aggregates all policy instruments which distort agricultural markets. It describes mainly the government-imposed distortions that create a gap between the domestic prices and what they would be under free markets.

The policy variable aim to capture the development of initial policy instruments and the structural changes in the set of policy instruments due to the policy reforms implemented during the 1990s and early 2000s. The impact of policy reforms is emphasized creating dummy variables for the reforms of the CAP, namely MacSharry in 1992, Agenda 2000 and Fischler reform in 2003. The time period analysed ranges from 1980 to 2010.

The scientific added value of this study arises from the fact that in the literature there is a lack of empirical policy analysis especially with this type of research setting. Although a framework for the analysis exists, most policy analyses in the literature have focused on the welfare effects of agricultural policies or on the efficiency of policies in terms of income redistribution. In addition, this study utilises different databases with extensive country-level data on agriculture and economic structures, among other things.

Next we will shortly discuss the developments of the Common Agricultural Policy of the European Union. The methodology of the study and model specification are presented in the third chapter. Results are presented in the fourth chapter and conclusions are presented in the final chapter.

2. Development of the CAP

Until 1990s the core element of the CAP was price support, secured with a high level of market protection. As noted by Ackrill et al. (2008) and Silvis and Lapperre (2010), the use of price and market instruments led to major overproduction in the common market. The internal market was cleared with intervention storage and export subsidies. This increased the budgetary expenditure of the CAP and was a significant cause for major distortions on the world agricultural markets.

The starting points for the more fundamental reforms were the internal imbalance within the CAP and the negative multiplier impact of policies, especially on third countries. The pressures for reform arose from the common budget and commitments to cut tariffs and overall support levels under the GATT Uruguay round in 1986–1994. According to Ackrill et al. (2008), budgetary pressures were the pivotal and final push for fundamental policy reform.

However, this was also fuelled by the changed political preferences and changes in the relative importance of different policy objectives. Environmental aspects, animal welfare and food safety started to receive more attention, while less attention started to be given to self-sufficiency and farm income oriented policy objectives.

The MacSharry reform in 1992 brought direct area and animal-related payments to the centre of the policy. For cereals, direct payments were introduced as compensation payments for reductions in administrative prices. In addition to these payments, compulsory set-aside was imposed concerning the whole arable crops sector. Animal-related direct payments were introduced as payments per head of livestock. The total amount of these payments was limited to predetermined maximum eligible livestock numbers. Since then, direct payments have been the dominant policy instrument in the CAP (Jongeneel and Brand 2010, 191). Prior to the MacSharry reform, direct payments were already applied under the less-favoured area scheme (LFA). LFA payments were introduced in 1974. The aim of the payments was to compensate for higher production cost due to less favourable production conditions within the EU.

As part of the MacSharry reform, the implementation of the environmental support scheme started in 1992. The voluntary environmental support scheme introduced conditional direct payments targeted to compensate for the costs and income losses incurred from the implementation of a particular environmentally- oriented production practice or measure. In the Agenda 2000 reform, the administrative prices were further reduced and farmers received a partial compensation for this. In the Fischler reform in 2003, direct payments were transferred to the single farm payment scheme and finally decoupled from the current production. The levels of the single farm payments were based on historical payment entitlements that were decoupled from the level of current production.

Modulation was also introduced (Swinnen 2008, 2). The aim of the modulation is to shift funds from agriculture to rural development by reducing transfers to farms that receive the highest amount of support. More emphasis was also placed on cross compliance introduced in Agenda 2000. Since Agenda 2000 the Member States have been required to take measures to ensure that agricultural activities are compatible with environmental requirements. In 2003 broader cross-compliance requirements were set to ensure that the single farm payment is only paid to farmers who abide by a series of regulations relating to the environment, animal welfare, plant protection and food safety (Jongeneel and Brand 2010, 194).

Several researches have been conducted to clarify the effects of the CAP on the productivity of agriculture. According to Ciaian and Swinnen (2006) single farm payments slow down restructuring of agricultural production if compared to area payments. In addition, reducing farm restructuring restricts productivity gains related to structural development.

McCloud and Kumbhakar (2008) examined the effects of subsidies on the performance of farms in Denmark, Sweden and Finland. Their results suggest that subsidies have a positive effect on productivity as they enhance efficiency and input productivity. However, there are differences in magnitude of these effects between regions. The positive effect is the largest for dairy farms in Denmark and Sweden. In contrast, Kumbhakar and Lien (2010) studied the effects of subsidies on productivity and technical efficiency (TE) in Norwegian grain farms. Their results show that subsidies had a negative effect on productivity. However, payments had a positive influence on TE.

Kazukauskas et al. (2011) examined if decoupled payments have had an effect on productivity growth in agriculture. Furthermore, they investigated what is the influence of switching behaviour and specialization have on improvement of productivity on Irish, Dutch and Danish farms. They find that decoupling subsidies have had significant positive effects on productivity, especially in Ireland. Their results do not suggest that switching behaviour significantly affects productivity. On the other hand, increased specialization in more productive production lines has had positive effects on productivity of agriculture.

Latruffe et al. (2011) examined the association between agricultural subsidies and productivity. In addition, they investigated differences in effects under different subsidy regimes, over time and in different countries. They included seven countries in their analysis, namely Denmark, France, Germany, Ireland, Spain, the Netherlands and the United Kingdom. Their data covered 18 years from 1990 to 2007. Their results suggest that productivity on farms with higher dependency on subsidies and hired labour has increased in a slower pace in all seven countries. With respect to different policy regimes they find that in five countries TE was on the highest level prior to the reforms and on the lowest level in the most recent years. In addition, introduction of the decoupled SFP decreased the TE in all countries but Denmark.

Zhu el al. (2012) investigated TE and changes in it on Dutch, Swedish and German dairy farms between 1995 and 2004. According to their results output-related as well as input-related subsidies have a negative effect or no effect on TE. In addition, they found that the higher share of subsidies in farm income results a lower level of TE. Also a growing dependency on subsidies decreases the farmers' performance. In general, they conclude that a higher degree of decoupling has a negative effect on farm efficiency. In contrast, composition of subsidies has lesser effect on productivity than the share of subsidies in farm income.

Mary (2013) estimated the effects of CAP Pillar 1 and 2 payments on farm performance. They found that several CAP subsidies in general have a negative effect on total farm productivity (TFP). However, their results suggest that there are significant differences between different subsidies as targeted subsidies have no significant effect on productivity, whereas other subsidies decrease productivity. In contrast to other studies, they find that CAP reforms through Agenda 200 have affected farm performance in a positive manner.

Rizov et al. (2013) evaluated the impact of CAP subsidies on the total factor productivity (TFP) of EU farms in EU-15 countries. Their analysis consisted of six farm types in 15 EU countries. Their results suggest that there are differences in productivity and growth between northern and southern countries. They also found that subsidies before decoupling had a negative effect on productivity. However, after decoupling the effects of subsidies on productivity were more diverse. In several EU-15 countries subsidies have a positive effect on productivity after decoupling. The effects are negative and statistically significant in no more than two countries. In general, they conclude that decoupled subsidies have no or minor effects on productivity in the majority of the EU-15 countries. In contrast, they found coupled subsidies distorting farm behaviour and causing decrease in productivity.

Overall, results of the studies concerning the effects of policies on productivity level are somewhat controversial. Evidence has been found for both decreasing and increasing effect on productivity. Majority of studies have found differences in the effects of different types of subsidies on productivity. However, also these findings are debatable as there is no consensus on the effects of any particular subsidy.

3. Methodology

The ultimate goal of economic analysis is to measure the impacts of different economic phenomena on selected variables. In an econometric model, a causal relationship between two or more variables is established holding other factors constant. For the analysis, the set of control variables x that are explicitly hold fixed when studying the effect of z on the expected value of y is selected. The reason for controlling these variables is that it is assumed z is correlated with other factors that influence y.

In this paper, the setting of the analysis is based on the traditional version of Tinbergen's theory of economic policy, which starts out by classifying the variables of an econometric model into four groups: (a) policy target variables; (b) policy instruments; (c) data or non-controllable variables; and (d) non-target or irrelevant variables (Hughes-Hallet 1989, 195). In this study, the classification is modified to include policy target variables, exogenous variables not controllable by the policy-makers, and policy variables.

Deciding on the list of proper controls is not always straightforward. Using different controls can lead to different conclusions about causal relationship between y and z. Thus, a researcher needs to decide which factors are to be held fixed in the analysis (Woolridge 2010, 3-7). In the empirical analysis, these decisions are usually based on underlying economic theory, research literature, among others.
Vector of control variables $X=(x_1, x_2,...,x_n)$ are assumed to capture the economic and structural development under which the vector of policy variables $Z=(z_1, z_2,...,z_n)$ impact on the selected policy target variable y. In a simple functional presentation the relation between target variable y and policy variable z_i can be written in the form

$$y = f(X, z_i) \tag{1}$$

on which we are able to analyse how y changes when z_i is marginally changed given the development of the vector of control variables X. However, according to Woolridge (2010, 15) in a stochastic setting we cannot assume that $y = f(X, z_i)$ for some known function and observable variables (X, z_i) because there are always unobserved factors affecting y. Thus, including an error term ε with a conditional mean zero to get

$$y = f(X, z_i, \varepsilon) \tag{2}$$

where an error term is expected to capture the unobserved impact in the estimated model. In a linear econometric specification this implies

$$y = X\beta + z_i \alpha + \varepsilon, \tag{3}$$

where β and α are the estimated coefficients and ε is the error term.

In this study, econometric panel data analysis is applied to conduct the empirical part of the study, where the economic phenomenon analysed is agricultural policy and its impact on the selected dependent variable is analysed. In the analysis the effects of a vector of policy variables $Z=(z_1, z_2,...,z_n)$ on a particular policy target variable y holding the vector of control variables $X=(x_1, x_2,...,x_n)$ fixed over time and individuals. In an applied panel data setting, all variables are observed for a number of selected individual countries i in a given time t, while the level and pace of development of the variables differs between countries over time. Both

between country and over-time differences are incorporated in to the analysis. The linear econometric specification for panel data analysis is

$$y_{it} = X'_{it}\beta + z_i\alpha + \varepsilon_{it}. \tag{4}$$

In the empirical analysis, an econometric model utilising panel data for the EU15 countries is built. In the model, the development of the defined policy target variable is explained with policy variables and a set of economic and structural control variables. The target variables are selected to quantify the selected stated policy objective of the CAP. The selected control variables aim to capture the general economic and structural development outside agriculture.

The policy variables aim to capture both the development of initial policy instruments already in force at the beginning of the research period and the structural changes in the set of policy instruments due to the policy reforms implemented during the 1990s and 2000s.

The data for the analysis in this study are obtained from several large databases. From the original data sources, a panel for EU15 countries is compiled following the enlargement of the European Union during the research period from 1980 to 2010. Due to the chosen approach to follow the development of the EU, the structure of the panel is heterogeneous. From 1980 to 1994 the panel is unbalanced, since the number of countries evolves throughout the period. From 1995 onwards the panel is balanced.

3.1. Model specification

Due to the lack of direct theoretical basis, the initial selection of model variables is based on the reviewed literature and deduction. The final selection was made based on the overall statistical significance of the variables. The independent variables were selected based on deduction and statistical efficiency in the final estimations. The utilised variables were selected to fulfil the requirements for a structural and economic variable that has an exogenous role in agricultural policies. In the final model, the control variables included were net food exports in the form of export-import ratio, GDP per capita, net indirect taxes as a share of GDP, and the share of rural population on total population. Model variables are described in table 1.

In a multi-country analysis the inclusion of individual policy instruments as such to the analysis is extremely difficult due to the lack of data. In this study, instead of specific policy instrument variables, the aggregate impact of agricultural policies is measured using nominal rate of assistance (NRA). Moreover, to emphasize the structural changes in the CAP, dummy variables for MacSharry reform, Agenda 2000 and Fischler reform 2003 were included in the model.

The estimated model speciation is:

$$y = \alpha + \beta_1 exim\_r + \beta_2 logGDPperCapita + \beta_3 logNetTax\_r + \beta_4 logRurPop\_r + \beta_5 logNRA + \beta_6 DMacSharry + \beta_7 DAgenda2000 + \beta_8 Fischler + \varepsilon \tag{5}$$

In total, four models were estimated using stepwise regression. First a model with only NRA as a policy instrument variable and the control variables was estimated. Next, a dummy variable for MacSharry reform was included followed by dummy variable for Agenda 2000 and Fischler reform respectively.

Table 1. *Summary of independent variables*

Control variables	Specification	Source
Export-import ratio (Food trade balance)	Net food exports (export-import ratio > 1) indicate that a country is competitive in agricultural markets and agriculture has a significant role in the economy. Agriculture gains income from a broader market. Net food imports (export-import ratio < 1) indicate that a country has the ability to buy food from the markets and agriculture has a less significant role in the economy. Net food imports increase competition in the domestic markets. The role of policies with respect to policy objectives may differ depending on whether a country is a net food importer or exporter.	FAOSTAT
GDP per capita (constant 2000 USD)	In general, the source of GDP growth in the EU has been in sectors other than agriculture. General economic growth leads to more efficient use of resources and an increase in the added value. It also increases the other employment opportunities for people engaged in agriculture, and thus has a push effect on structural change in agriculture. Technological development is the main source of economic growth.	World Bank
Net indirect taxes ratio (as a share of GDP, constant 2000 €)	Structural variable. Net taxes on products (net indirect taxes) are the sum of product taxes less subsidies. When proportioned to GDP allows controlling the magnitude of taxation relative to general economic development. A change in the share of net indirect taxes of GDP captures both the effect of policy-oriented changes on taxation levels and the relative changes in overall economic activity, especially in production.	World Bank
Rural population (as a share of total population)	The share of rural population on total population indicates the structure of a country and the importance of rural economy in the overall economy.	World Bank
Policy variable		
Nominal rate of assistance (%)	Aggregated variable for all price distorting agricultural policy instruments. Higher (lower) NRA indicates higher (lower) distortions. Includes all national support measures. If policies are effective, variables should have significant impact on all objectives.	Database of Agricultural Distortions
Dummy for MacSharry reform 1992	Captures the policy reform shock and shift towards less market distorting agricultural policies. Price support policies were abolished and farmers received full compensation for price reductions through direct hectare-based payments.	
Dummy for Agenda 2000 reform	Captures the policy reform shock and shift towards less market distorting agricultural policies. Price support policies were abolished and farmers received partial compensation for price reductions through direct hectare-based payments.	
Dummy for Fischler Reform (SFPS) 2007	Captures the policy reform shock and shift from hectare based decoupled support to single farm payments. Decisions on Single farm payment schemes were made in the Fischler reform in 2003, but they were fully enforced from 2007 onwards.	

3.2. Development of the dependent variable

The dependent variable, the agricultural value added per worker, has increased rapidly in all countries during the research period, with Portugal as an exception (Figure 1). Variation between the countries has increased towards the end to the period, indicating different agricultural structures and their developments within the countries. The agricultural value added per worker has approximately tripled in most countries, except in Portugal, where the increase has been very small. In general, the observed development is due to both the increased value of production and declining use of labour input in agriculture.

Figure 1. *Development of the agricultural valued added per worker in the EU-15 countries (USD constant) (World Bank 2015).*

3.3. Development of the policy instrument variable

Nominal rate of assistance aggregates all policy instruments which distort agricultural markets. It describes mainly the government-imposed distortions that create a gap between the domestic prices and what they would be under free markets. According to Anderson et al. (2010, 31), 'the NRA is computed as the percentage by which government policies have raised gross returns to farmers above what they would be without government intervention. Included are any product specific input subsidies'. In this study, a weighted average NRA is used. The weighted average NRA for all the products covered is derived using the value of production at undistorted prices as product weights, which are expressed as percentage of the distorted price.

The NRA for each farm product is 'computed as the percentage by which government policies have raised gross returns to farmers above what they would be without the government intervention' and defined as (Anderson et al. 2010, 30-31)

$$\text{NRA} \equiv \frac{P_d - P_f}{P_f}, \tag{6}$$

where P_d is the observed domestic price in local currency for a given product, country and year, and P_f is the estimated domestic price that would hold in the absence of commodity market or exchange rate interventions. By definition, NRA is zero in a competitive free-trade regime and positive where producers are subsidised by taxpayers or consumers.

The nominal rate of assistance (NRA) has developed in the same direction in all the EU countries (Figure 2). Until mid-1980s, the NRAs were going upwards and since then the trend has been downwards. National policies as well as producer price levels explain the difference

in the actual level of NRAs between countries. The differences between country-level NRAs have decreased towards the end of the research period. This development indicates that the policy reforms and EU enlargements have led to more harmonized policies in terms of NRA within the EU15. Some national policies are still implemented, but their relative role in market distortions has declined.

 More importantly, individual EU countries do not pose any direct border protection measures that would increase the difference between farm gate and world market prices. Producer prices are not harmonized within the EU. While all the countries face the same undistorted world market price, the levels of NRA differ due to the differences in national producer prices. There have been considerable differences in the producer price levels between countries. These differences are often explained with differences in production costs, transportation costs, unbalanced national supply-demand ratio, and lack of export demand. Thus, the development of the EU policies dominates NRAs in each country. The annual magnitude of changes is to a large extent similar between countries. The interpretation is that national policies have been more stagnant and less relevant compared to the overall development of the CAP.

Besides domestic market protection under national and EU-level policies, NRA is also affected by the changes in the world market prices. These price changes may be due to changes in the supply-demand ratio or heavy use of trade policy measures such as export subsidies and deficiency payments.

During the time period analysed, agricultural product prices have peaked significantly three times, thus reducing the country-level NRAs. These peaks occurred in 1980, 1997 and 2007 and 2010. Correspondingly, NRAs were high in 1986 and 2001, when international agricultural product prices slumped. In addition, the implementation of the CAP reforms in 1992 and 2000 led to decreases in NRA. Moreover, world agricultural product prices were and still are influenced by policies. The changes in the EU-level policies affect the world agricultural prices.

This means that NRA is under the policymakers' control, although not directly. Thus, it needs to be stated that, by construction, NRA violates the assumption of the theory of economic policy that the model should include only variables that are under the direct control of policymakers.

While the NRA covers only price distorting agricultural policies, additional variables are needed to incorporate the shift from distortive price and market support instruments towards less price distorting direct payments. The dummy variables for MacSharry, Agenda 2000 and Fischler reforms are incorporated in the analysis to capture the major policy shifts from price support towards direct and, finally, decoupled payments. Besides a shift in policy structure, these variables aim to capture the initial shock from the policy reform.
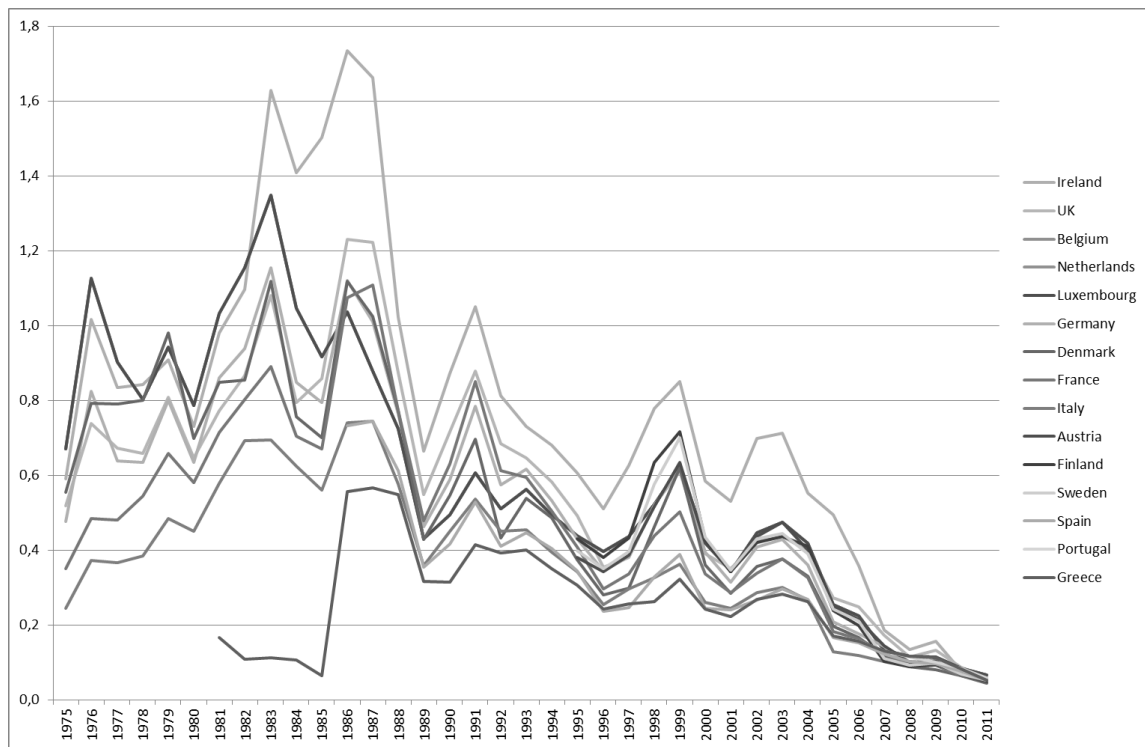
Figure 2. Country-level NRAs 1975-2011 (Source: Anderson & Nelgen 2013)

4. Results

Our results show that positive food trade balance and GDP per capita have contributed positively to agricultural value added per worker (Table 2). The coefficients for net indirect taxes, rural population and nominal rate of assistance all receive negative signs. In addition, the estimated coefficients for the first two policy reforms receive a positive sign and are statistically significant, while the third reform lack the statistical efficiency.

The policy impacts are twofold. The sign for nominal rate of assistance is negative. Agricultural policies have, in aggregate, kept the resources, namely labour in the sector and, thus, reduced the pace of increase in the value added per worker. However, the implemented policy reforms have shifted the direction. Two out of three policy reform dummies receive a positive sign. Based on Hausman test statistics, the estimated random effects were statistically more significant in all models compared to fixed effects. This indicates that country level development in agricultural value added per worker is rather homogeneous.

Overall economic growth has contributed towards increasing the value added per worker. Increasing productivity in agriculture, especially due to technological progress, has led to a significant increase in farm output. At the same time the number of farmers and agricultural employment has decreased. The sign for the estimated coefficient for rural population suggests that, the higher the number of rural population, the slower the increase in agricultural value added per worker.

The negative sign of the coefficient for net indirect taxation indicates that increase in indirect taxes in proportion to GDP reduces the growth rate in agricultural value added. The variable implies negative indirect impacts on labour demand outside agriculture, especially if the increase in the share is due to decrease in GDP per capita or increase in indirect taxes.

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Table 2. *Estimation results.*

	N=299	N=299	N=299	N=299
	RE	RE	RE	RE
Intercept	-270.0***	-203.8***	-151.9***	-154.6***
logsEXIM	2.23 .	2.59*	2.30 .	2.29 .
logGDPperc	20.9***	14.2***	9.37**	9.45**
logsNETTAX	-21.7***	-21.7***	-20.8***	-21.2***
logsRURPOP	-14.4***	-14.7***	-14.3***	-14.8***
logNRA	-4.7***	-4.44***	-4.10***	-4.96***
capre		3.76***	4.28***	3.80***
capre2			2.15*	1.97*
capre3				-1.56
R-Squared	0.74	0.75	0.76	0.76
Adj. R-Squared	0.72	0.74	0.74	0.74
F-statistic	165.4***	149.7***	131.3***	115.1***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

5. Conclusions

The implemented agricultural policy reforms have improved the policy effectiveness in term of its impact on the agriculture value added per worker. Based on the analysis it can be argued that a policy shift from coupled price support to direct payments has released resources from agriculture to be utilised in other sectors. Moreover, it can be stated that the impact of agricultural policies is directly linked to structural and economic conditions in a particular country.

The results of this study support the view, that due to the policy impact, more resources are being absorbed into the sector compared to a situation without policies. Often these resources would be used more efficiently in other sectors. Based on this logic, agricultural policies have kept more resources in the agriculture sector compared to a situation without policies, which has reduced the pace of productivity growth in terms of labour use.

References

Ackrill, R., Kay, A. & Morgan, W. 2008. The Common Agricultural Policy and Its Reform: The Problem of Reconciling Budget and Trade Concerns. Canadian Journal of Agricultural Economics 56: 393-411.

Anderson, K., Croser, J., Sandri, D. & Valenzuela, E. 2010. Agricultural Distortion Patterns since the 1950s. What Needs Explaining? In: Anderson, K. (ed.). The Political Economy of Agricultural Price Distortions. pp. 25-77.

Anderson, K. & Nelgen, S. 2013. Updated National and Global Estimates of Distortions to Agricultural Incentives, 1955 to 2011, Washington, D.C., June 2013. Available at: www.worldbank.org/agdistortions

Arovuori, K. & Yrjölä, T. 2015. The impact of the CAP and its reforms on the productivity growth in agriculture.

Arovuori, K. 2015. Political effectiveness of agricultural policies – An empirical analysis. *PTT Publications* 23. 125 p. Available: https://helda.helsinki.fi/handle/10138/155644. Referred: September 15, 2015.

Ciaian, p. & Swinnen, J. F. M. 2005. Land market imperfections and agricultural policy impacts in the new EU member states: A partial equilibrium analysis. *American Journal of Agricultural Economics* 8, 799-815.

FAOSTAT. 2015. Statistics division. Food and Agriculture Organization of the United Nations. Available: http://faostat.fao.org/

Hughes-Hallet, A. J. 1989. Econometrics and Theory of Economic Policy: The Tinbergen-Theil Contributions 40 Years On. *Oxford Economic Papers* 41: 189-214.

Jongeneel, R. & Brand. H. 2010. Direct income support and cross-compliance. In: Oskam, A., Meester, G. & Silvis, H. (eds.). 2010. *EU policy for agriculture, food and rural areas*. Wageningen Acedemic Publishers. p. 191-205.

Kazukauskas, A., Newman, C. & Sauer, J. 2011. CAP Reform and Its Impact on Structural Change and Productivity Growth: A Cross Country Analysis. *Trinity Economics Papers* tep0411, Trinity College Dublin, Department of Economics.

Kumbhakar, S. C. & Lien, G. Impact of Subsidies on Farm Productivity and Efficiency. In Ball, V. E, Fanfani, R. & Gutierrez, L. (eds.) *The Economic Impact of Public Support to Agriculture. An international Perspective (Studies in Productivity and Efficiency, Volume 7)*. Springer New York, 109-124.

Latruffe, L., Bravo-Ureta, B. E., Moreira, V. H., Desjeux, Y., & Dupraz, P. (2011, August). Productivity and subsidies in European Union countries: An analysis for dairy farms using input distance frontiers. In *presentation at the EAAE 2011 Congress Change and Uncertainty*. Zürich, Switzerland.

Mary, S. 2013. Assessing the impacts of pillar 1 and 2 subsidies on TFP in French crop farms. *Journal of Agricultural Economics*, *64*(1), 133-144.

Matthews, A. 2013. Impact of CAP subsidies on productivity. *CAP Reform.eu* April 1, 2013. Available: http://capreform.eu/impact-of-cap-subsidies-on-productivity/ Referred: September 15, 2015.

McCloud, N. & Kumbhakar, S. C. 2008. Do subsidies drive productivity? A cross-country analysis of Nordic dairy farms. In Chib, S., Griffiths, W., Koop, G. & Terrell, D. (ed.) *Bayesian Econometrics (Advances in Econometrics, Volume 23)*. Emerald Group Publishing Limited, 245 – 274.

Rizov, M., Pokrivcak, J., & Ciaian, P. 2013. CAP subsidies and productivity of the EU farms. *Journal of Agricultural Economics*, *64*(3), 537-557.

Silvis, H. & Lapperre, R. 2010. Market, price and quota policy: half a century of CAP experience. In: Oskam, A., Meester, G. & Silvis, H. (eds.). *EU policy for agriculture, food and rural areas*. Wageningen Acedemic Publishers. pp. 165-182.

Swinnen, J. 2008. *The Perfect Storm. The political Economy of the Fischler Reforms of the Common Agricultural Policy*. Center for European Policy Studies. Brussels. 182 p.

Arovuori, K. & Yrjölä, T. 2015. The impact of the CAP and its reforms on the productivity growth in agriculture.

Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data*. 2nd. edition. The MIT Press. 752 p.

World Bank. 2015. *World dataBank*. Available: http://databank.worldbank.org.

Zhu, X., Demeter, R. M., & Lansink, A. O. (2012). Technical efficiency and productivity differentials of dairy farms in three EU countries: the role of CAP subsidies. *Agricultural Economics Review* 13, 66-92.

Arovuori, K. & Yrjölä, T. 2015. The impact of the CAP and its reforms on the productivity growth in agriculture.