# Regional Impacts of Direct Payments on Farm Productivity and Efficiency in the European Union

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## Abstract

This paper analyses the regional impacts of direct payments on the labour and land productivity of European farms. The basic assumption of the research is that direct CAP subsidies have a positive effect on productivity and efficiency. This was tested by quantitative regression-analysis models, which were based on NUTS2-level regional data from 2008-2018. The results show that direct subsidies have a negative effect on labour and productivity in agriculture, a finding that can be attributed to a number of underlying factors. The direction and magnitude of these productivity effects differ markedly between old and new Member States.

## Keywords

## Introduction

The Common Agricultural Policy (CAP) is one of the key policies of the European Union, encouraging the development of the European agricultural economy, the renewal of rural areas and the achievement of certain environmental and climate protection objectives through its diversified support system and market regulation instruments. CAP resources accounted for about 36% of the EU's 2018 budget. The most significant CAP subsidies are the so-called direct payments, which are generally available to farmers based on the size of their land or livestock. Direct payments are income-transfer measures aimed at strengthening agricultural production, stabilising farmers' incomes, contributing to the production of safe food, and compensating farmers for the preservation of certain public goods (such as nature protection and landscape conservation) (European Commission, 2020).

In the 2018 grant year, a total of € 41.74 billion of CAP direct aid was disbursed to 6.38 million beneficiaries across Europe. This clearly illustrates the importance of direct payments in the life of the European agricultural economy (European Commission, 2020).

Because of their magnitude and importance, the economic impacts of direct payments have naturally been the focus of scientific analysis (see e.g, World Bank, 2018; Latruffe, 2017, Ciaian, 2015). Our present research aims to look at the regional impacts of direct payments on the labour and land productivity of European farms, via the quantitative analysis of NUTS2 regional data from 2008 to 2018. Current regional-level data allow for a more detailed level of modelling than the examination of aggregated data by country. This is the main contribution of this paper to the existing literature.

The paper is structured as follows. Section 2 provides a literature review, while Section 3 demonstrates our methodological approach. Section 4 shows the results of our model runs, followed by a discussion. The last section is the conclusion.

### Literature review

The effect of the CAP on the productivity and efficiency of farms is a subject extensively studied in the literature. For instance, Zhu et al. (2012) studied the effects of CAP direct payments on the technical efficiency of German, Dutch and Swedish dairy farms between 1995 and 2004. Their results show that increasing the percentage of direct subsidies within the total agricultural income of farms has led to lower technical efficiency

in all the countries concerned. Furthermore, coupled support had an additional negative effect on technical efficiency in Germany and the Netherlands (but no significant effect in Sweden), compared with decoupled support. This suggests that the motivation of farmers to innovate and work more efficiently is reduced when they become increasingly dependent on subsidies as a source of income. In another article on the same subject (Zhu et al., 2010), the authors found the highest level of efficiency in the Netherlands, followed by Sweden and Germany. In all three countries, farm sizes and degrees of farm specialisation were positive contributors to technical efficiency, while the share of agricultural subsidies in total income was a negative contributor.

Further studies also suggest a negative effect on farm efficiency. Using microeconomic data from the Polish Farm Accountancy Data Network (FADN) on 1212 dairy farms over the period 2004-2011, Marzec and Pisulewski (2017) estimated the translog production function in order to measure the effect of CAP subsidies on technical efficiency of farms. A stochastic frontier analysis revealed that although there was some technical development in the study period among Polish dairy farms, CAP subsidies on the whole had a negative influence on efficiency.

Mary (2013) also arrived at a similar conclusion. FADN data for 1529 French crop farms for the period 1996-2003 were used to assess the impact of the CAP on total factor productivity, by estimating a production function based on the generalized method of moments approach. The calculations showed that CAP measures that were more or less automatically granted to farmers on a per-hectare or per-animal basis had a significant negative effect on the productivity of farms. However, selective measures such as investment or environmental support had no significant effect, while the decoupling of direct payments seems to have had a positive influence on farm efficiency.

Latruffe et al. (2017) also examined the association between CAP subsidies and the technical efficiency of European dairy farms by using FADN data from nine EU countries for the period 1990-2007. On this basis, a stochastic production frontier was estimated with the method of moments, to account for possible endogeneity issues. The analysis produced mixed results: direct payments influenced technical efficiency positively in two study countries and negatively in two other countries, while

no effect was detectable in the others. Furthermore, it was shown that decoupling did not change the direction in which CAP support influences technical efficiency, but it generally reduces its magnitude (when compared with coupled payments).

Based on the above-mentioned articles, one can arrive at the general conclusion that CAP direct payments tend to lower the efficiency of farms. However, it seems that the decoupling of payments can somewhat alleviate this undesirable policy effect. For example, Rizov et al. (2013) estimated the impact of the CAP on total farm productivity using a structural semi-parametric procedure. Data from the FADN for a large sample of farms from the EU-15 countries for the period 1991-2008 served as basis for the calculations. Total productivity was aggregated by country and farm type. The results showed that in the years before the 2003 decoupling of direct payments, the subsidies had a negative effect on the productivity of farms. After decoupling, however, the situation became somewhat mixed; in some countries, the effect on productivity even became positive. These empirical findings are in line with the theoretical background: in general, subsidies distort market conditions and therefore lower the efficiency of farms. On the other hand, decoupled direct support is less distortive and therefore has a more positive (or less negative) effect on farm productivity.

Decoupling was also the focus of a study performed by Kazukauskas et al. (2010), which explored the effect of decoupling on the productivity of Irish dairy farms. Using national farm survey data for the period 2001-2007, a productivity estimation model was set up based on the Olley and Pakes approach as well as on stochastic frontier analysis. The models controlled for the significant capital investment grants in the study period, and for the increased price volatility caused by the uncertainties associated with decoupling. With the exclusion of these effects, the models found a significant and positive relationship between decoupling and total productivity in the dairy sector.

In a similar study on the same subject (Kazukauskas et al., 2014), the authors used Irish, Danish and Dutch farm-level data from national agricultural surveys in the period 2001-2007. Again, they found a positive relationship between decoupling and farm productivity, which was especially significant in the case of Ireland. Moreover, decoupling

seemed to alter farmers' choices on specialisation, in the sense that they moved towards more productive farming activities.

Note has to be taken that while the majority of studies detect a negative relationship between direct payments and efficiency, there are some exceptions. Cillero et al. (2018) performed a stochastic frontier analysis to measure the effect of direct payment on the technical efficiency of Irish beef farms. Their calculations were based on panel farm-level data from the FADN for the period 2000-2013. Their analysis revealed low overall technical efficiency in the Irish beef sector. The situation improved from 2000 to 2007, but from 2008 to 2012 a slight decline was detectable. In contrast to the general findings of other studies, it was shown that the effect of direct payments on technical efficiency was positive. In a similar article, Cillero

et al. (2019) analysed technological heterogeneity in the Irish beef sector and, by applying a latent class stochastic frontier model, they again found that decoupled direct payments had significant positive effects on technologically advanced farms.

The reviewed articles analysing the effects of direct payments on technical efficiency are summarised in Table 1.

Most studies into the subject of technical efficiency established a negative relationship between direct payments and productivity. Being a relatively stable source of income, direct support does not incentivise farmers towards innovation, newer technologies, reorganisation of economic activities or investment. Coupled support seems to be especially disadvantageous in this regard, as it influences and distorts production decisions

| Author | Topic | Country | Method | Result |
|---|---|---|---|---|
| Zhu et al. (2012) | Effects of CAP direct payments on technical efficiency of farms | Germany Sweden Netherlands | Inefficiency Effects Model | Higher percentage of direct subsidies within total agricultural income of farms leads to lower technical efficiency in all countries concerned. Coupled support had an additional negative effect (compared with decoupled support). |
| Zhu et al. (2010) | Effects of CAP direct payments on technical efficiency of farms | Germany Sweden Netherlands | Inefficiency Effects Model | Positive contributors to technical efficiency are farm size and levels of farm specialization. The share of agricultural subsidies in total income is a negative contributor in all three countries. |
| Marzec and Pisulewski (2017) | Study of technical efficiency of Polish farms | Poland | Stochastic frontier analysis | Although there was some technical development in the study period among Polish dairy farms, CAP subsidies on the whole had a negative influence on efficiency. |
| Mary (2013) | Impact of CAP on total factor productivity | France | Generalized method of moments | CAP measures that are automatically granted to farmers on a per hectare basis had a negative effect on productivity. Decoupling can offset this effect to a certain extent. |
| Latruffe et al. (2017) | Association between CAP subsidies and farm technical efficiency | Several Member States | Stochastic frontier analysis | Direct payments influenced technical efficiency positively in two study countries, negatively in two other countries, while no effect was detectable in others. |
| Rizov et al. (2013) | Effect of decoupling on productivity | Old Member States (EU-15) | Structural semi-parametric estimation procedure | Decoupled direct support is less distortive and therefore has a more positive (or less negative) effect on farm productivity than coupled support. |
| Kazukauskas et al. (2010) | Effect of decoupling on productivity | Ireland | Stochastic frontier analysis | There is a significant and positive relationship between decoupling and total productivity in the dairy sector. |
| Kazukauskas et al. (2014) | Effect of decoupling on productivity | Ireland Denmark Netherlands | Stochastic frontier analysis | Decoupling seems to alter farmers' production choices: a shift towards more productive farming activities was detected. |
| Cillero et al. (2018, 2019) | CAP policy effects on efficiency | Ireland | Stochastic frontier analysis | Decoupled payments decrease production risks and therefore aid farm investments, which can raise technical efficiency levels. |

Source: own composition

Table 1: Effects of direct payments on productivity/efficiency of farms.

to a greater extent. Decoupling, on the other hand, appears to make its best contribution when it comes to tackling issues related to productivity. The reviewed articles unanimously underline that decoupling has a beneficial effect on the technical efficiency of farms. This can alleviate, but not eliminate, negative policy effects.

## Materials and methods

Based on the literature above, the following hypotheses were tested:

H1. Direct payments increase the productivity of agricultural labour at regional level.

H2. Direct payments increase the productivity of agricultural land at regional level.

In order to test these hypotheses, changes in land and labour productivity were measured by using regional agricultural productivity data, proxied as quotients of regional agricultural value added for land as well as labour. A positive link is expected, namely that direct payments will increase agricultural productivity. Data on the volume of direct payments are from the Clearance Audit Trail System (CATS) database. The database is operated by the European Commission and records all payments made under any CAP support on an annual basis and by beneficiary. The data are reported to the Commission by the Member States each year, and form the basis for the financial accounting between the Commission and the Member States. The data on other variables were downloaded from the Annual Regional Database of the European Commission (ARDECO), the EU Statistics on Income and Living Conditions (EU-SILC), and the Eurostat database.

Based on these data, a classic ex-post impact analysis was carried out, in line with the research strategy used by Bojnec and Fertő (2019), Ciaian et al. (2015), Galluzzo (2018), Kilian et al. (2012), Klaiber et al. (2017), Tangermann (1998), and others.

For the different model runs, a number of control variables, in line with the literature (World Bank Group, 2018; Garonne et al., 2019), were also used as evidence in the following equations:

$$\ln LABOURPROD_{it} = \alpha_0 + \alpha_1 \ln DP_{it} \\ + \alpha_2 INCRATIO_{it} + \alpha_3 \ln AGGVA_{it} + \\ + \alpha_4 \ln NONAGGVA_{it} + \alpha_5 \ln SALARIES_{it} + \\ + \alpha_6 \ln POPDENS_{it} + \alpha_7 \ln GFCF_{it} + \\ + \alpha^8 CONVERGENCE + v_{it} + \varepsilon_{it} \qquad (1)$$

$$\ln LANDPROD_{it} = \alpha_0 + \alpha_1 \ln DP_{it} + \\ + \alpha_2 \ln ENTREINCOME_{it} + \alpha_3 \ln GDP_{it} + \\ + \alpha_4 \ln GDPPERHEAD_{it} + \alpha_5 \ln NONAGGVA_{it} + \\ + \alpha_6 \ln AGEMPL_{it} + \alpha_7 \ln HHINCOME_{it} + \\ + \alpha_8 \ln SALARIES_{it} + \alpha_9 \ln POPDENS_{it} + \\ + \alpha_{10} \ln GFCF_{it} + \alpha_{11} CONVERGENCE + \\ + v_{it} + \varepsilon_{it} \qquad (2)$$

To test each hypothesis, random effects panel regression models were used. As shown in the equations above, a logarithmic version of the variables was utilized – where applicable – to show percentage effects. In each case, models were tested for all Member States and then separately for the old and new Member States.

As there are relatively numerous, significant control variables present in the equations, it was presumed that unobserved heterogeneity does not cause correlation between the error term and the explanatory variables. Furthermore, Variance Inflation Factor tests for multicollinearity did not detect a high level of correlation between independent variables.

Table 2 provides a summary of the variables used.

All the data for the variables in Table 2 are available for NUTS2 regions. Data are also broken down by year, covering the period 2008-2018. However, data for some variables are not available for each year.

The names and codes of the regions are included according to the NUTS 2016 nomenclature. Out of a total of 281 NUTS2 regions, 244 regions are included in the database. The other regions were excluded from the scope of the analysis due to lack of data, or due to the fact that the area of the given region changed during the analysis period (through being merged with several regions or split into several regions), so the data for them could not be used validly.

After a uniform alignment of the values of the variables from the different data sources, a strongly balanced panel database was developed. The values of each variable can be characterised by the following descriptive statistics (Table 3).

We are aware of the limitations of our research design. First, it is clear from the structure of the Common Agricultural Policy that not only direct payments but also other forms of support (agri-environment, less-favoured areas, etc.) can have productivity or efficiency impacts. Second, there are other effects (e.g., farm structure, production structure) that are not examined in this article. Third, it is also clear that other methodological approaches (for example, stochastic frontier analysis, data envelopment analysis) may

| Variable name | Description of variable | Unit of measure | Data source |
|---|---|---|---|
| LNLANDPROD | Productivity of agricultural land: agricultural GVA divided by the utilized agricultural area (UAA) | million PPS/hectare | derived statistic |
| LNLABOURPROD | Productivity of agricultural labour: agricultural GVA divided by agricultural employment | million PPS/thousand persons | derived statistic |
| LNDP | The logarithm of the number of direct payments | € | CATS |
| INCRATIO | Rate of agricultural income compared to total household income | ratio (from 0 to 1) | derived statistic |
| LNAGGVA | The logarithm of Gross Value Added in the agricultural sector (GVA), current prices | million PPS | ARDECO |
| LNNONAGGVA | The logarithm of Gross Value Added in all sectors outside agriculture (GVA), current prices | million PPS | ARDECO |
| LNSALARIES | The logarithm of salaries of persons working in agriculture | million PPS | ARDECO |
| LNPOPDENS | The logarithm of population density | persons/square kilometre | Eurostat |
| LNGFCF | The logarithm of Gross Fixed Capital Formation (GFCF) in agriculture, current prices | million € | ARDECO |
| LNENTREINCOME | The logarithm of income of agricultural holdings | million € | Eurostat |
| LNGDP | The logarithm of Gross Domestic Product (GDP), current prices | million PPS | ARDECO |
| LNGDPPERHEAD | The logarithm of GDP/capita | PPS | ARDECO |
| LNAGEMPL | The logarithm of agricultural employment | thousand persons | ARDECO |
| LNHHINCOME | The logarithm of household income (non-agricultural) | million € | Eurostat |
| CONVERGENCE | Regions eligible for financing from the European Regional Development Fund, or the European Social Fund (convergence regions) | 0 – non-convergence region; 1 – convergence region | Implementing decision of the European Commission, 18 February 2014 |
| UAA | Utilized agricultural area | hectares | Eurostat |

Source: own composition

Table 2: provides a summary of the variables used.

| Variable name | Number of observations | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| LNLANDPROD | 2 684 | 0.21 | 0.74 | -3.79 | 3.06 |
| LNLABOURPROD | 2 684 | -3.03 | 0.84 | -9.07 | -0.76 |
| LNDP | 2 683 | 18.26 | 1.23 | 12.13 | 21.20 |
| INCRATIO | 1 891 | 0.02 | 0.03 | -0.03 | 0.23 |
| LNAGGVA | 2 684 | 6.22 | 1.11 | 0.81 | 9.27 |
| LNNONAGGVA | 2 684 | 10.28 | 0.93 | 6.70 | 13.30 |
| LNSALARIES | 2 440 | 4.87 | 1.08 | 0.10 | 7.54 |
| LNPOPDENS | 2 637 | 5.02 | 1.13 | 0.99 | 8.92 |
| LNGFCF | 2 439 | 5.18 | 1.04 | 0.80 | 7.77 |
| LNENTREINCOME | 1 661 | 5.24 | 1.22 | 0.00 | 9.12 |
| LNGDP | 2 684 | 10.42 | 0.91 | 6.85 | 13.42 |
| LNGDPPERHEAD | 2 684 | 10.1 | 0.38 | 8.82 | 11.29 |
| LNAGEMPL | 2 684 | 2.97 | 1.26 | -2.3 | 6.72 |
| LNHHINCOME | 2 466 | 9.97 | 1.00 | 6.55 | 12.86 |
| CONVERGENCE | 2 684 | 0.27 | 0.44 | 0.00 | 1.00 |
| UAA | 2 684 | 646.58 | 659.12 | 7.01 | 4 643.46 |

Source: own composition

Table 3: Main descriptive statistics of the model variables.

lead to different results. However, the chosen methodology has been used by a large number of researchers in this subject.

## Results and discussion

According to our hypotheses, direct payments increase regional agricultural productivity in the European Union. The results of the models for agricultural labour productivity are detailed in the Table 4. The model was first run on all Member States' data, and then also on the data of old and new Member States, separately.

(Please note that the number of observations used by the models is smaller than the total number of observations indicated in Table 3. This is due to the fact that the model only runs on observations where the values of all regression variables are jointly present, which is not always the case.)

The results of the model contradict our hypothesis: direct subsidies have a negative effect on labour productivity in agriculture. With a 1% increase in direct payments, the labour productivity indicator will deteriorate by 0.016%, which means a lower agricultural value added (GVA) produced by a thousand people. The result is consistent with Zhu et al. (2010, 2012), Marzec and Pisulewski (2017), Mary (2013) and Latruffe et al. (2017), by examining the technical efficiency of farms in general and showing a negative relationship between productivity and the level of direct subsidies.

The negative effects of direct subsidies on efficiency are due to the following factors (Zhu et al., 2012):

- Direct subsidies are a stable source of income, increasing the income realised from agricultural activity, regardless of how technically efficient the production process is. In this way, farmers may become interested in sub-optimal production activities, thus reducing efficiency.

- Due to their stable nature, direct payments distort farmers' risk perceptions and preferences, which affect their production activities and often encourage them to be less efficient.

- Coupled support is particularly disadvantageous in terms of efficiency, as it can encourage farmers to produce goods that cannot be produced particularly efficiently under the given circumstances.

For all these reasons, direct payments do not encourage farmers to innovate, to develop new technologies, to invest or to restructure economic activities. This way, producers' efficiency efforts decline, and the phenomenon of wastage of factors of production, such as agricultural labour, emerges (Bakucs et al., 2010).

| Dependent variable: labour productivity | all Member States | old Member States | new Member States |
|---|---|---|---|
| Amount of direct payments | -0.016** | 0.012 | -0.663** |
| | (0.008) | (0.009) | (0.028) |
| Agricultural GVA | 0.044*** | 0.008 | 0.208*** |
| | (0.015) | (0.017) | (0.04) |
| Non-agricultural GVA | -0.244*** | -0.180*** | -0.441*** |
| | (0.033) | (0.041) | (0.089) |
| Population density | 0.379*** | 0.316*** | 0.06 |
| | (0.045) | (0.049) | (0.156) |
| Agricultural GFCF | 0.036*** | 0.049*** | 0.024 |
| | (0.011) | (0.012) | (0.029) |
| Agricultural salaries | 0.046*** | 0.110*** | 0.007 |
| | (0.016) | (0.024) | (0.025) |
| Income ratio | -0.655*** | -1.201*** | -0.582 |
| | (0.25) | (0.407) | (0.374) |
| Convergence region | -2.967*** | 0.488*** | -0.660* |
| | (0.324) | (0.16) | (0.35) |
| Constant term | -2.967*** | -3.992*** | 1.74 |
| | (0.324) | (0.374) | (1.079) |
| Number of observations | 1842 | 1539 | 303 |
| Number of regions | 214 | 182 | 32 |
| R squared | 0.211 | 0.232 | 0.061 |

Source: own composition

Table 4: Impacts of direct payments on labour productivity – model results.

Furthermore, the introduction of a maximum ceiling for direct payments (a support amount beyond which no payment can be made to a single beneficiary) has led to the splitting up of large farms into smaller, therefore less competitive units. This also acts against technical efficiency (Szerletics, 2018).

The coefficients of certain control variables were as follows:

- The use of gross fixed assets in agriculture (GFCF) has a positive effect on labour productivity. This is because in the model, the degree of fixed asset accumulation reflects productive investments (such as the purchase of agricultural machinery and equipment) that increase the efficiency of production.
- The level of agricultural wages also has a positive effect on labour productivity, presumably because the amount of wages paid suggests not only the quantity but also the quality of the labour used, which increases efficiency.

- Convergence regions are less economically developed regions of the Union, so it is not surprising that the model for such regions has shown overall lower labour productivity.
- As the population density decreases, agricultural labour productivity also decreases. Presumably this is due to the shrinking labour supply in sparsely populated areas of the Union.

There is an interesting difference between the old and new Member States. While the regression model run on data from the old Member States did not find a significant correlation between direct payments and labour productivity, a significant negative effect could be identified in the new Member States. These findings indicate that direct payments do not seem to have affected labour productivity in the old Member States, but they have negatively affected labour productivity in the new ones.

The results of the model for agricultural land productivity are detailed in the Table 5.

| Dependent variable: land productivity | all Member States | old Member States | new Member States |
|---|---|---|---|
| Amount of direct payments | -0.081*** | -0.069** | -0.04 |
| | (0.018) | (0.028) | (0.037) |
| Agricultural employment | 0.098*** | 0.081** | -0.012 |
| | (0.029) | (0.034) | (0.069) |
| Agricultural income | 0.114*** | 0.111*** | 0.099*** |
| | (0.008) | (0.034) | (0.018) |
| GDP | 3.296*** | 3.272*** | 4.033*** |
| | (0.27) | (0.316) | (0.587) |
| GDP/capita | 1.006*** | 0.977*** | 0.902*** |
| | (0.073) | (0.087) | (0.233) |
| Agricultural GFCF | 0.277*** | 0.346*** | 0.009 |
| | (0.018) | (0.02) | (0.039) |
| Non-agricultural income | -0.326*** | -0.344*** | -0.153 |
| | (0.057) | (0.069) | (0.123) |
| Non-agricultural GVA | -3.562*** | -3.613*** | -4.089*** |
| | (0.274) | (0.322) | (0.512) |
| Population density | 0.485*** | 0.537*** | 0.425*** |
| | (0.04) | (0.043) | (0.126) |
| Agricultural salaries | 0.174*** | 0.230*** | 0.103*** |
| | (0.023) | (0.033) | (0.033) |
| Convergence region | -0.248*** | -0.237* | -0.105 |
| | (0.093) | (0.129) | (0.238) |
| Constant term | -8.528*** | -8.297*** | -9.507*** |
| | (0.608) | (0.925) | (1.395) |
| Number of observations | 1562 | 1284 | 278 |
| Number of regions | 193 | 161 | 32 |
| R squared | 0.535 | 0.559 | 0.558 |

Source: own composition

Table 5: Impacts of direct payments on the productivity of land – model results.

The results of the model run counter to our original expectation: direct payments have a negative impact on agricultural productivity of arable land. With a 1% increase in direct payments, the land productivity indicator will deteriorate by 0.08%, i.e., the agricultural value added (GVA) per hectare.

The negative link between the productivity of agricultural land and direct payments occurs because farmers receive payments mainly according to the amount of the agricultural land they use. (Although there are some livestock-based direct payments, most payments are calculated on an area basis.) To maximise direct support amounts, farmers are therefore interested in securing as much agricultural land as possible for their own use. There are basically two ways to achieve this:

- more land is bought or leased, and market demand for agricultural land increases accordingly (Constantin et al., 2017);

- previously unused land is also brought into agricultural production. In doing this, farmers may also involve marginal, inferior land in production, merely to establish their entitlement to direct payment. The standard of agricultural production in these areas lags behind that of better-quality land, and consequently productivity decreases.

In addition to the deterioration of the quality of the land, the decrease in productivity may also be exacerbated by the fact that direct subsidies, which can be considered a more or less guaranteed income element, do not contribute to the efficiency and innovation of agricultural production technology (Zhu et al., 2012). It is interesting to note that in extreme cases the increased demand for agricultural land may culminate in the phenomenon of "land grabbing". In this context, investors embark on large-scale land acquisitions, which upset traditional land use conditions and lead to high levels of land concentration, resulting in possible social tensions and environmental problems. "Land grabbing" is a well-known phenomenon in many regions of the world, driven by several market factors. One such factor in Europe is CAP area-based direct support, which contributes to increased pressure in the agricultural land market (Kay, 2016).

Regarding the coefficient of certain control variables, it can be asserted that the use of gross fixed assets in agriculture has a positive effect on the productivity of agricultural land. This is consistent with the results of the labour productivity

model; fixed asset investment generally aids technological advancement and thus increases the efficiency of the use of factors of production. The variable representing convergence regions also had a negative coefficient in this model, in line with preliminary theoretical expectations. The impact on land productivity is negative in the old Member States, while being not significantly different from zero in the new Member States. Interestingly, this is the opposite of what has been shown in terms of labour productivity. On the one hand, this may be due to the fact that the old Member States have higher levels of direct aid per hectare than the new Member States on average. Thus, there is more incentive for farmers to include less productive land in production because the higher amounts of direct support compensate for the possible losses. On the other hand, in the new Member States, there is a larger area of relatively productive land that can be involved in agricultural production (Constantin et al., 2017). Therefore, the inclusion of new land in the new Member States does not lead to the same reduction in productivity as in the old Member States.

At the same time, it is important to stress that the phenomenon of "land grabbing" is much more prevalent in the new Member States overall than in the old ones, because the price of agricultural land is much lower in the new Member States. At the same time, the decline in land productivity related to CAP direct payments is still lower in the new Member States.

## Conclusion

The results of the analysis showed that direct subsidies have a negative effect on labour productivity in agriculture. The result is in line with the findings of previous research, which generally showed a negative relationship between productivity and levels of direct support. The effect is mainly due to the fact that direct payments are a stable source of income, increasing the income realized from agricultural activity, regardless of how technically efficient the production process may be. Direct payments therefore do not encourage farmers to innovate and reorganise their economic activities, so that factors of production, such as agricultural labour, may be used in an irrational, wasteful way.

Likewise, a negative correlation was identified between direct payments and agricultural land productivity. This is due to the fact that farmers receive payments primarily on the basis

of the size of the agricultural land used, which increases the demand for land. Farmers buy or rent more land, or involve marginal, less productive land in production, leading to reduced efficiency.

The direction and magnitude of these productivity effects differ markedly between the old and new Member States. CAP direct payments seem to influence labour productivity in a negative way in new Member States, while no significant effect is detected on land productivity in these countries. This may be due to the fact that in the new Member States, there is a larger area of productive land that can be newly included in agricultural production; therefore, the productivity of agricultural land does not decline as the demand for it increases due to CAP direct support.

The results of the research may have interesting policy implications. In the light of the findings, a shift from direct income support towards insurance premium subsidies and income stabilization instruments could be advisable.

These policy tools could respond to the criticisms of productivity and technological efficiency made against direct subsidies. Direct support is a fixed income supplement for the farmer, regardless of how efficiently they handle resources and production factors, and how much they encourage technological development and innovation. However, in the framework of income stabilization instruments, if the beneficiary was able to operate more efficiently and productively in the previous period, thereby increasing their agricultural income, the increased income reference would be the basis for support in the future. In this way, farmers could become more interested in efficient operation and increasing competitiveness.

Further research may analyse other impacts direct payments may have on regional data, or may use other variables to explain the relationships described above in a deeper way.

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