Do Farm Subsidies Improve Labour Efficiency in Farms in EU Countries?

Joanna Bereżnicka[1], Ludwik Wicki[2]

Abstract:

Purpose: *Agricultural support programmes most commonly aim at attaining higher production of raw food materials or supporting processes resulting in agricultural yield. One of the most important challenges is to increase labour productivity, thanks to which working in the agricultural sector may be attractive in comparison with working in the non-agricultural sector. In literature, in the scope of agricultural economy, there is a lack of consistent results concerning the relation between the level of subsidies for operational activity and labour productivity in agriculture. The question arises whether or not subsidies for agriculture help achieve the intended results in the form of an increase in labour productivity. This reasoning gave rise to this study, which aimed at indicating the directions and strength of association between subsidies for operational activity on farms expressed per one employed and the attained labour productivity.*

Design/Methodology/Approach: *The study was carried out for EU countries divided into quartile groups defined according to labour productivity. Data from the Farm Accountancy Data Network for the period 2013-2018 were applied, and for analysis the panel regression method (with random effects) was used.*

Findings: *It was found that together with an increase in labour productivity, the direction and the strength of impact of direct subsidies also altered. On farms of countries with a lower labour productivity, no significant relation was found. However, for the quantile groups Q2 and Q3, an increase in the level of labour productivity resulted in a positive, yet decreasing impact of subsidies. On farms of countries with the lowest labour productivity, a negative impact of subsidies was observed.*

Practical Implications: *The conducted analysis gives reason to state that farms that have attained a high level of development, subsidies do not lead to a further growth of productivity, but only support the maintenance of the same level of farm income.*

Originality/value: *The assessment of whether and under what conditions the subsidies bring the intended effects allows for a change in the directions of support in order to obtain better effects from spending public funds. The research was conducted for a long period of time for a group of all EU countries.*

Keywords: *Labour productivity, panel regression, subsidy per worker, productivity factors.*

JEL Classification: *H21, Q10, Q18.*

Paper type: *Research study.*

[1]Warsaw University of Life Sciences-SGGW, Institute of Economics and Finance, ORCID ID 0000-0002-0316-6693, e-mail: joanna_bereznicka@sggw.edu.pl;
[2]Corresponding author, Warsaw University of Life Sciences-SGGW, Institute of Economics and Finance, ORCID ID: 0000-0002-7602-8902, e-mail: ludwik_wicki@sggw.edu.pl;

1. Introduction

The notion of labour productivity in agriculture is of grave interest to agricultural economists, especially since it is a critical factor for the development of the whole economy (Dorward, 2013), and also due to the fact that productivity is found to be at a much lower level in agriculture than in the non-agricultural sector, while its endogenic increase may be difficult to achieve due to low profitability and difficulties accumulating capital as well as financing progress in agriculture (Wicka and Wicki, 2016). These factors were also why European agriculture gained support in the form of EU CAP to increase productivity of the factors of production and farmer income. Subsidies are also expected to lead to an efficient allocation of resources and a lower consumption of inputs. There have been many analyzes of changes in agricultural productivity, so it may seem that examining mutual dependencies between subsidies and productivity will not bring new knowledge.

However, thus far, studies on such mutual dependencies have focused on the following three areas. The first area is connected with an evaluation of the withdrawal of subsidies concerning production. The second area concerns the type and structure of subsidies, while the third area focuses on the evaluation of aggregated productivity. Most of the analyses concern the influence of subsidies on general farm productivity. The most frequently examined were the impact of subsidies on the overall productivity of a farm, including farm equipment, farm size and production type. A rarely considered issue concerns the impact of subsidies on labour productivity in farms and there is a knowledge gap in this regard. McCloud and Kumbhakar (2008) even claim that not enough empirical assessment has been carried out concerning the relation between subsidies and labour productivity on farms. This is confirmed by Hloušková and Lekešová (2020), who claim that there are only individual studies that examine the direct dependencies between subsidy levels and labour productivity. This means that there is a huge gulf of knowledge in research concerning the identification of dependencies between the level of subsidies for operational activity and labour productivity.

Knowing that both the level of support and labour productivity differ in agriculture of particular countries, and that it changes over time, we aim at examining the dependency of the level of budget support per employed on a farm and the labour productivity in agriculture. In other words, the aim is to establish the conditions in which higher levels of subsidies for operational activity have a positive impact on labour productivity in agriculture. In this way, it will be possible to ascertain how and to what degree subsidies for operational activity contribute to increasing labour productivity. Extensive research was carried out covering all EU-28 countries. Data from the FADN database were used, which come from a representative sample of farms. This research may constitute the basis for identifying the effects of subsidising farms from the perspective of measuring the labour productivity level. The hypothesis was put forward that the higher the level of operational subsidies expressed per one employed, the higher the labour productivity.

2. Literature Review

The literature on the research on the relationship between the level of support and the productivity of farms is extensive. It indicates that subsidies, depending on how they are directed and what their scale is, can have a positive or negative influence on the pace of agricultural modernisation, size of farm production and factors of productivity (Ackrill, 2008; Fulginiti and Perris, 1993; Kostlivý and Fuksová, 2019; Rizov *et al.,* 2013). They should, primarily, be directed at farm development reducing main development gaps, which may be different depending on the country (Yanwen *et al.,* 2013). What had positive effects on general farm productivity in the EU was the introduction of subsidies separated from production (Kazukauskas *et al.,* 2014; Mary, 2013; Rizov *et al.,* 2013). Garonne *et al.* (2019) confirmed this also with regard to labour productivity in agriculture. Due to the separation of subsidies, farmers may individually select production activity with added value, while ineffective allocation decreases (Dewbre *et al.,* 2001; Guyomard *et al.,* 2004).

Many researchers indicate that subsidies targeted at farms have a noticeably positive influence on the development and growth of general productivity due to greater opportunities arising in the shape of financing investments, an increase in the scale of production and a substitution of more expensive factors of production (Blancard *et al.,* 2006; Cechura *et al.,* 2015; Ciaian and Swinnen, 2009; Oliynyk, 2012; Pechrova, 2015; Zsarnóczai and Zéman, 2018). It has been observed that with an increase in the scale of production, what takes place first is an increase in labour productivity and, then, in second place land and capital (Wicki, 2016; 2018; Du *et al.,* 2018; Pawlak and Poczta, 2020).

Some research has concluded that the positive impact of farm subsidies on an increase in the factors of production is not always achievable due to overinvestment in fixed assets, which leads to an increase in direct costs, and, as a result, a decrease in Gross Value Added (GVA) (Rogoznicki *et al.,* 2018; Namiotko *et al.,* 2019; Zsarnóczai and Zéman, 2019). It has also been observed that the impact of subsidies on farm productivity depends on the country or region (Minviel and Latruffe, 2017; Nowak and Kubik, 2019), as well as the structure of the subsidy[3]. It has also been found that subsidies only have a positive influence on productivity on economically big farms (Kostlivý and Fuksová, 2019; Staniszewski and Borychowski, 2020).

Among the factors influencing labour productivity, the most frequently indicated were: farm size (Parzonko and Bórawski, 2020; Giannakis and Bruggeman, 2018; MacDonald *et al.,* 2020), land resources per employed person (Galluzzo, 2016; Jaroszewska and Pietrzykowski, 2017; Giannakis and Bruggeman, 2018, Lososová *et*

---

[3]*The results concerning the influence of agro-environmental and investment subsidies are inconsistent. Lakner (2009) stated that their negative influence on the technical effectiveness of ecological dairy farms in Germany, but Sauer and Park (2009), for ecological dairy farms in Denmark confirmed a positive influence.*

al., 2017), capital per employed person (Czyzewski and Staniszewski, 2016; Kusz and Misiak, 2017, Kurdys-Kujawska and Sompolska-Rzechula, 2020) and more rarely production intensity (Hayami, 1970; Yamada and Ruttan, 1980; Fuglie *et al.,* 2017). This is why the factor regarding the level of operational subsidies with regard to the value added on a farm supplements knowledge on the subject of mechanisms increasing labour productivity.

3. Methodology and Scope of Research

The data used in the study came from database FADN EU. In the scope of the EU database, data concerning 28 EU members from between 2013 and 2018 were used. The collected data served to create data panel. Panel constituted sample of 168 observations (EU-28 panel). EU countries database was split into quartile (Q1-Q4) to distinguish the assessment of factors determining labour productivity within uniform groups as well as to limit the influence of intergroup variability on the results. In order to create a quartile division, labour productivity per one employed person calculated for 2018 was applied. Therefore, it was possible to obtain balanced panels (such procedure facilitated the avoidance of items migrating between quartiles). The items with the lowest level of productivity were in quartile 1, while in quartile 4 - those with the highest[4]. The use of quartile breakdown reduced group variability, but it was not completely eliminated.

In the analyses, model panels were applied using estimators with fixed effects (FEM) and random effects (REM, GLS). The choice between fixed effect (FEM) and random effect (REM, GLS) was carried out using the Hausman test (assuming a significance level of 0.05). If p<0.05 the FEM model is considered to be more reliable than the REM model (Hausman 1978; Hausman and Taylor 1981). Upon conducting the Breusch-Pagan and Hausman test – for the "EU-28 Panel" the estimator with random effects was applied.

The general model of panel data is presented in equation 1.

$$y_{it} = m_i + \Sigma b x_{it} + e_{it} \tag{1}$$

where:
b – the vector of structural parameter expressing the influence of the independent variable x
x_{it} – realisation of the independent variable for the i-th item in t-time
e_{it} – the rest, meeting the classic assumption $E(e_{it}) = 0$ and $Var(e_{it}) = S_e^2$.

---

[4]*In the 1st quartile are: Poland, Romania, Slovenia, Croatia, Lithuania, Latvia and Malta; in quartile 2: Bulgaria, Cyprus, Greece, Estonia, Hungary, Portugal and Slovakia; in quartile 3: the Czech Republic, Spain, Ireland, Italy, Austria, Finland and Sweden; in quartile 4: Belgium, Denmark, Germany, France, Luxemburg, Holland and Great Britain. The research covered the period in which GB still remained an EU member.*

In the random effect model (REM), mi expresses specific random components. This model may be expressed as follows (Greene 2008):

$$y_{it} = a + bx_{it} + e_{it} + u_i \qquad (2)$$

where: $E(u_i) = 0$, $Var(u_i) = Cov(e_{it}, u_i) = 0$.

On the basis of gathered data, upon creating divisions, models were constructed for the whole set as well as for particular quartile groups.

3.1 Variables

The study assumed the measurement of labour productivity (LP) as a relation of net value added (NVA) to labour resources expressed in AWU (SE415/SE010). Such an indicator was applied, the net value added (NVA) indicator is a synthetic indicator of standard production in EU FADN, which expresses general production effects, general outlays and operational subsidies. Thus, per employee, it is one of the most important indicators of labour productivity. It measures productivity with regard to the value input of human capital in relation to external material costs. Due to the study hypothesis, it was decided that NVA be used, since it is clean of the value input by using fixed capital. In literature, it is possible to come across such measurements of labour productivity (Hloušková and Lekešová, 2020).

The dependent variable is labour productivity as measured by the NVA per employee. To measure the level of subsidies, the value of operational subsidies expressed per AWU was applied (Support_AWU). It was decided that in this way it is best to express financial support expressed per one employed on a farm, which, in effect, should result in an increase in labour productivity. Additionally, variables commonly used in research on labour productivity conducted thus far were considered in this study. These were: the capital per annual work unit (C_AWU) variable, measured with the value of total assets per unit of work; area per annual work unit (A_AWU), production intensity (In_A), constituting the relation of costs to the number of units of land, as well as farm size (SE005) measured by standard production. The given variables are classic factors impacting productivity in agriculture.

4. Research Results

Table 1 presents a summary of descriptive characteristics of agricultural farms in the group of EU countries in the scope of variables applied in this analysis.

The data in Table 1 indicate that the most varied group, with regard to labour productivity, were countries characterised by the highest level of labour productivity (Q4). The standard deviation in this group constituted over EUR 14,000 and was a little lower than the deviation for all EU countries. This shows the diversity of labour productivity in agriculture in the countries in this group.

The panel data shows that labour productivity in Q4 was the highest, it should be noted that in subsequent years it showed a downward trend with a simultaneous increase in the value of subsidies per AWU.

Table 1. *Descriptive statistics for variables: EU-28 panel*

Variable	Statistics	Q1	Q2	Q3	Q4	UE-28
LP [thousand euro]	Avg	7.38	14.25	26.94	45.83	23.60
	Min	3.59	7.91	19.20	28.72	3.59
	Max	12.39	23.54	39.00	92.27	92.27
	SD	2.17	4.58	5.19	14.33	16.70
Support_AWU [thousand euro]	Avg	5.00	8.63	18.53	17.77	12.48
	Min	1.14	3.26	5.42	5.99	1.14
	Max	10.08	18.72	47.33	44.75	47.33
	SD	2.77	4.44	12.15	8.71	9.78
C_AWU [thousand euro]	Avg	56.40	65.21	192.99	283.55	149.54
	Min	23.38	25.88	79.10	167.13	23.38
	Max	97.03	150.62	356.70	549.17	549.17
	SD	20.15	34.87	78.07	123.65	120.90
A_AWU [ha]	Avg	14.71	27.86	37.44	42.87	30.72
	Min	1.87	6.70	13.19	13.28	1.87
	Max	34.48	77.35	70.12	78.33	78.33
	SD	10.89	21.40	17.27	18.84	20.50
In_A [thousand euro]	Avg	2.83	1.58	1.92	4.31	2.66
	Min	0.75	0.92	1.00	1.44	0.75
	Max	12.80	3.51	2.69	12.53	12.80
	SD	3.78	0.72	0.51	3.37	2.76
SE005 [thousand euro]	Avg	28.85	108.28	115.90	292.91	136.49
	Min	9.30	19.10	49.00	180.50	9.30
	Max	49.90	460.90	281.30	505.90	505.60
	SD	10.59	141.07	71.58	98.18	134.28

Source: *Own calculation based on FADN data.*

The situation in Q3 countries is also noteworthy. In farms of the groups of countries belonging to Q3, the highest mean value of subsidies per employed was observed. Such a result is caused by the fact that in these groups were countries in which there are big area farms (e.g. France, the UK, the Czech Republic and Sweden), while the value of direct subsidies is indirectly connected with the farm area and the historical size of production. At the same time, in these countries, the mean level of employment on farms is low. It is also worth noting that the Q3 group is the most differentiated when it comes to the level of subsidies per AWU, which is indicated by the significant standard deviation. Additionally, in this group the net value added from agricultural activity (without subsidies) was negative.

The countries of Q1 stood out with regard to high production intensity regarding costs per 1 ha. In countries with low labour productivity belonging to Q1, low productivity most likely resulted from low area of land per worker and high production intensity, which may led to a decrease in the value added of agricultural activity produced. There

is also a two-and-a-half-fold difference in the endowment of labour with land between the countries included in Q1 and Q4 and as much as six times the difference in the endowment of labour with capital. Table 2 presents a summary of correlation coefficients of the variables applied.

Table 2. *Variable correlation matrix (at the EU countries level)*

Variable	LP	Support_AWU	C_AWU	A_AWU	In_A	SE005
LP	1					
Support_AWU	0.4516	1				
C_AWU	0.8795	0.6349	1			
A_AWU	0.4764	0.7161	0.5353	1		
In_A	0.3635	-0.1105	0.3128	-0.2698	1	
SE005	0.7450	0.3226	0.6081	0.3984	0.3865	1

Note: The critical value (with a two-sided 5% critical area) = 0.1515 for n = 168
Source: *Own calculation based on FADN data.*

There are significant statistical correlations between the independent variables and the dependent variables (Table 2). The strongest relation can be found between LP to C_AWU and SE005, as the respective coefficients constituted 0.8795 and 0.745. For the remaining variables, the correlation coefficients were lower. It is worth noting that there was no significant correlation between Support_AWU and In_A, (-0.1105). This is confirmation of the fact that the value of direct payments is not closely related to production, which, in turn, results from the level of outlays. It is possible to find a relation with the farm size and level of outlays and also with the fact that in certain countries the system of subsidies was historically related to production size, and, in part, where the SAPS system was applied, however, the size of subsidies was mainly a result of farm area. Table 3 presents the parameters of the regression model for the panel of countries divided into quartile groups.

The model concerning the whole collectivity of country economies (EU-28) failed to ascertain an unequivocal answer as to whether an increase in subsidies per one employed in agriculture has a significant impact on labour productivity. This is pro-bably due to the big differentiation between countries both when it comes to the level of subsidies allocated per farm as well as average employment on a farm. The impact of the variable Support_AWU was not statistically significant, though it carried a minus sign, which may serve as an indication of the impact of higher levels of subsidies not always being beneficial. The obtained results for the panel for all EU countries show that only a high technical capital resources per working person and the economic size of a farm have a significant impact on labour productivity in agriculture. The obtained result confirms that the observed differentiation of agriculture between countries in the EU means that it is necessary to conduct research on smaller groups of countries, yet similar in structure, intensity level and certain other qualities of farms within country group. Such an approach is justified by the fact that the impact of e.g. being equipped in capital may be of various direction, which may lead to the general conclusion concerning the lack of impact of such a variable on productivity.

Table 3. *GLS estimation for the labour productivity variable – UE-28 panel*

Variable	UE-28	Q1	Q2	Q3	Q4
constant	2.267 (0.994)	4.612*** (1.813)	10.4032*** (9.042)	7.07 (0.385)	14.0513* (1.873)
Support _AWU	-0.0093 (-0.079)	0.3176 (1.142)	1.54*** (3.088)	0.222* (1.731)	-0.50*** (-3.045)
C_AWU	0.1048*** (5.761)	-0.0599*** (-2.326)	0.1802*** (3.795)	0.0906*** (5.275)	0.0872*** (3.326)
A_AWU	0.0049 (0.054)	0.0672 (1.491)	-0.420*** (-11.47)	-0.2116 (-1.078)	0.059 (0.8759)
In_A	0.469 (0.7252)	0.5406*** (4.283)	-3.4776*** (-4.573)	-0.158 (-0.0738)	-0.4124 (-0.5032)
SE005	0.032** (2.013)	0.0709*** (2.887)	0.0016 (0.5436)	0.055* (1.879)	0.051 (1.231)
Sample size	168	42	42	42	42
Descriptive statistics for model					
Tests	UE-28	Q1	Q2	Q3	Q4
Durbina-Watsona	2.00	1.63	1.96	1.90	2.07
Autocorrelation of residuals	-0.21	-0.05	-0.36	-0.34	-0.20
Breucha-Pagana	Chi^2 = 210 p=1,301e-47	Chi^2 = 1,309 p=0,2536	Chi^2 = 1,127 p=0,2884	Chi^2 = 15,40 p=8,09e-005	Chi^2 = 0,07 p=0,7796
Hausmana	Chi^2 = 12,56 p=0,0278	Chi^2 = 79,25 p=1,20e-15	Chi^2 =171,34 p=3,77e-35	Chi^2 =100,53 p=4,07e-80	Chi^2 =104,13 p=7,12e-21

Note: ***P<0.01; ** P< 0.05; * P< 0.1.
Source: Own calculation.

In the models of particular quantile groups, the set of dependent variables with a significant impact is different. The only variable of statistical significance regarding labour productivity in all models was value of technical capital per worker. It is worth highlighting that this variable in Q1 carried a negative impact on labour productivity, which indicates that capital resources o farms in Q1 were not fully taken advantage of. This may be a result of the big fragmentation of farms in countries in this group, which signifies the incomplete utilisation of fixed assets possessed. In particular, the size of available machinery and equipment may not be tailored to the frequent small size of the activities undertaken. In effect, the capital is not fully utilised (overinvestment), resulting in an increase of capital to labour ratio, which is not conducive to a growth in productivity.

In the remaining groups, a positive impact of the technical capital on labour productivity was observed, however, it is worth noting that the established size of impact decreases together with an increase in the level of labour productivity and also with an increase in farm size in country groups. The greatest value of the coefficient is observed in the model for Q2 and constitutes 0,1802, while the lowest for Q4 – 0,0872. Such a result indicates that a further increase in capital endowments will not have a significant impact on an increase in labour productivity. It is also worth highlighting that the factor having a negative impact on labour productivity in Q2 was

A_AWU. This is most probably a result of big variation of this variable (compare data in Table 1). In some countries with fragmented agriculture belonging to Q2, permanent crop production, which is characterised by bigger added value, is conducted. The dominant direction of production in a particular country may significantly influence attained results. In the scope of the analysis herein, it is impossible to ascertain the root cause of such a dependency, which suggests that the results obtained by us for group Q2 differ from those presented by Zsarnóczai and Zéman (2019), as well as Nawrocka (2017), and Salimowa *et al.* (2019). Outside group Q2, the variable A_AWU did not have a significant impact on labour productivity.

In the case of assessing the impact of Support_AWU on labour productivity, it can be stated that a significant impact on labour productivity was observed, but it differed depending on the group. What is important is that it was negative for the model for all countries, yet this variable was statistically insignificant. Respectively, this variable did not have a significant impact on labour productivity. In groups Q2 and Q3, with a higher mean of labour productivity, the increase of the level of subsidies per employed in agriculture had a positive impact on the observed labour productivity.

However, its impact in group Q3 was lower than in group Q2 (0.22 and 1.54, re-spectively). In the group of farms with the highest labour productivity, an increase in the level of subsidies per employed had a negative impact on labour productivity (the coefficient being -0.50). The obtained results may indicate that on farms with a low level of labour productivity (Q1) the level of subsidies per person is so small that it has a much smaller impact on labour productivity than capital endowment or production intensity. It can also be inferred that the level of subsidies in countries of this group is weakly associated with production size, in other words with the size of the value added. This stems from the fact that in many of these countries, a simplified system of SAPS subsidies based on farm size has been implemented.

Simultaneously, this means that in these countries a critical factor of increase in labour productivity in agriculture is increasing farm size and an increase in production in-tensity. In countries with the highest labour productivity in agriculture (Q4) there is no possibility of further growth in current structures. Subsidies for operational activity per person are huge (over EUR 17 thou.) Similar labour productivity is attained within this group both in countries with a big farm area and relatively low production labour intensity as in countries with a smaller farm area but higher production labour intensity, where subsidies per person are lower. In effect, in group Q4, a higher subsidy level has a negative relation with labour productivity. A key difference here production direction in particular countries. It is necessary to note that the result obtained for Q3, in which the impact of direct payments is significantly positive on labour productivity, despite the value of subsidies being the highest (over EUR 18 thou.). It is, in this case, connected with a small surplus obtained by the business run. It is the only group of country farms in which a positive value added has been achieved only with the help of budget support. Without such support, these farms would have

incurred losses. This is confirmed by data in the FADN, which unequivocally indicate that the costs over the last two years exceeded income.

5. Conclusions and Recommendations

The conducted studies show that taking the subsidies per employed into account as a factor influencing the level of labour productivity is viable as its significant relation with labour productivity has been confirmed. The subsidies greatly impacted labour productivity on farms, but the observed impact was irregular. This signifies that the impact of subsidies on labour productivity is strongly modified by the agricultural structure in particular country groups as well as their economic size and production direction. Despite the fact that the dependency of labour productivity on subsidy level was not visible for the whole collectivity of EU countries, the models constructed for particular groups did show such dependency. This result confirms that the analysis needs to be conducted in a more homogenous group. In groups Q2 and Q3 a positive impact was observed of the variable on labour productivity, yet the negative impact of subsidy per AWU was stronger in groups Q4 characterised by a high level of labour productivity.

The research carried out didn't simultaneously confirmed that the traditionally indicated factors, such as increase in production scale, increase in capital-labour ratio, increase in land per employed person still have a significant positive impact on labour productivity.

This is confirmed by results for Q2, in which an increase in land area per employee had a significant negative impact on labour productivity, while an increase in production intensity in groups Q2-Q4 also failed to have a positive impact on the studied productivity. This means that in EU farms, there is still no common set of factors impacting the labour productivity obtained. Due to country and group differences, a factor positively assessed in one country group may have a negative impact on another group. Unequivocally, the greatest impact was made by technical equipment per employee and production intensity.

The research also showed that subsidies for operational activity stimulated growth in labour productivity in most countries, but such observations were not made in countries with the highest labour productivity in agriculture, where the impact of such subsidies had a negative impact on labour productivity. Not just the direction but also the established root causes of this impact are various depending on country groups. In Q2, a positive relation between subsidies and labour productivity was found. In Q3 this result was also positive but it stems from compensation for very high costs of running agricultural activity (in other words, subsidies serve the purpose for which this mechanism was created). However, in the group with the highest productivity per employed, the impact of direct payments was not beneficial due to the fact that such farms do not have any space for a production increase.

To conclude, on the basis of the research carried out, it can be stated that the hypothesis put down cannot be fully confirmed. This can serve as a foundation for further studies concerning mutual dependencies facilitating the understanding of direct payment utilisation for farmers.

References:

Ackrill, R. 2000. The Common Agricultural Policy. Sheffield: Sheffield Academic Press.

Baer-Nawrocka, A. 2017. Labour productivity in agriculture of European Union countries (dynamic approach). Research Papers of Wrocław University of Economics, (489), 24-33. https://doi.org/10.15611/pn.2017.489.02.

Blancard, S., Boussemart, J., Briec, W., Kerstens, K. 2006. Short- and long-run credit constraints in French agriculture: A directional distance function framework using expenditure - constrained profit functions. American Journal of Agricultural Economics, 88, 351-364.

Cechura, L., Kroupova, Z., Rudinskaya, T. 2015. Factors determining TFP changes in Czech agriculture. Agricultural Economics Czech, 61, 543-551. https://doi.org/10.17221/14/2015-AGRICECON.

Czyzewski, A., Staniszewski, J. 2016. The Use of a Panel Regression for the Assessment of Productivity and Profitability in the Agriculture of the European Union Countries After 2005. Annals of Agricultural Economics and Rural Development, 103(3), 7-21.

Dewbre, J., Antón, J., Thompson, W. 2001. The Transfer Efficiency and Trade Effects of Direct Payments. American Journal of Agricultural Economics, 83, 1204-1214.

Dorward, A. 2013. Agricultural labour productivity, food prices and sustainable development impacts and indicators. Food Policy, 39, 40-50. https://doi.org/10.1016/j.foodpol.2012.12.003.

Du, X., Zhang, X., Jin, X. 2018. Assessing the Effectiveness of Land Consolidation for Improving Agricultural Productivity in China. Land Use Policy, 70, 360-367. https://doi.org/10.1016/j.landusepol.2017.10.051.

Fogarasi, J., Latruffe, L. 2009. Farm performance and support in Central and Western Europe: A comparison of Hungary and France. Paper presented at the 83rd Annual Conference of the Agricultural Economics Society. Dublin, Ireland.

Fuglie, K., Clancy, M., Heisey, P., Macdonald, J. 2017. Research, Productivity, and Output Growth in U.S. Agriculture. Journal of Agricultural and Applied Economics, 49(4), 514-554. https://doi.org/10.1017/aae.2017.13.

Fulginiti, L., Perrin, R. 1993. Prices and Productivity in Agriculture. The Review of Economics and Statistics, 75(3), 471-482. https://doi.org/10.2307/2109461.

Galluzzo, N. 2016. An analysis of the efficiency in a sample of small Italian farms part of the FADN dataset. Agricultural Economics Czech, 62, 62-70. https://doi.org/10.17221/37/2015-AGRICECON.

Garrone, M., Emmers, D., Lee, H., Olper, A., Swinnen, J. 2019. Subsidies and agricultural productivity in the EU. Agricultural Economics, 50(6), 803-817. https://doi.org/10.1111/agec.12526.

Giannakis, E., Bruggeman, A. 2018. Exploring the labour productivity of agricultural systems across European regions: A multilevel approach. Land Use Policy, 77, 94-106. https://doi.org/10.1016/j.landusepol.2018.05.037.

Greene, W. 2008. Econometric Analysis. 6th Edition. Pearson Prentice Hall, Upper Saddle River.

Guyomard, H., Le Mouël, C., Gohin, A. 2004. Impacts of Alternative Agricultural Income Support Schemes on Multiple Policy Goals. European Review of Agricultural Economics, 31(2), 125-148.

Hausman, J. 1978. Specification Tests in Econometrics. Econometrica, 46(6), 1251-1271.

Hausman, J., Taylor, W. 1981. Panel Data and Unobservable Individual Effects. Econometrica, 49(6), 1377-1398. https://doi.org/10.2307/1911406.

Hayami, Y., Ruttan, V. 1970. Agricultural Productivity Differences among Countries. The American Economic Review, 60(5), 895-911.

Hloušková, Z., Lekešová, M. 2020. Farm outcomes based on cluster analysis of compound farm evaluation. Agricultural Economics Czech, 66, 435-443. https://doi.org/10.17221/273/2020-AGRICECON.

Jaroszewska, J., Pietrzykowski, R. 2017. Convergence of the Labour Productivity in European Union Agriculture. Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Światowego, 17(4), 120-129. https://doi.org/10.22630/PRS.2017.17.4.88.

Kazukauskas, A., Newman, C., Sauer, J. 2014. The impact of decoupled subsidies on productivity in agriculture: a cross country analysis using microdata. Agricultural Economics, 45(3), 327-336. https://doi.org/10.1111/agec.12068.

Kostlivý, V., Fuksová, Z. 2019. Technical efficiency and its determinants for Czech livestock farms. Agricultural Economics Czech, 65, 175-184. https://doi.org/10.17221/162/2018-AGRICECON.

Kurdys-Kujawska, A., Sompolska-Rzechula, A. 2020. Subsidization of Entrepreneurship in Rural Areas in Poland: Scale, Effects and Regional Diversity. European Research Studies Journal, 23(2), 246-263. https://doi.org/ 10.35808/ersj/1592.

Kusz, D., Misiak, T. 2017. Influence of Work Technical Equipment and Technical Progress Labour on Efficiency in Agriculture. Annals of PAAAE, 19(2), 145-150. https://doi.org/10.5604/01.3001.0010.1177.

Lakner, S. 2009. Technical efficiency of organic milk-farms in Germany –the role of subsidies and of regional factors. Paper presented at the IAAE 2009 Conference, August 16–22, Beijing, China.

Lososová, J., Zdeněk, R., Kopta, D. 2017. Development of the main production and economic indicators of Czech farms. Custos e @gronegócio on line, 13(2), 88-109.

MacDonald, J., Law, J., Mosheim, R. 2020. Consolidation in U.S. Dairy Farming. Economic Research Report, (274), 1-61.

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.

McCloud, N., Kumbhakar, S. 2008. Do subsidies drive productivity? A cross-country analysis of Nordic dairy farms. In: Chib, S., Griffiths, W., Koop, G., Terrell, D. (Eds.) Bayesian Econometrics (Advances in Econometrics, 23). Bingley: Emerald Group Publishing Limited, 245-274. https://doi.org/10.1016/S0731-9053(08)23008-2.

Minviel, J., Latruffe, L. 2017. Effect of public subsidies on farm technical efficiency: A meta-analysis of empirical results. Applied Economics, 49(2), 213-226.

Namiotko, V., Galnaitytė, A., Baležentis, T., Wang, P. 2019. The impact of investment support on labour productivity in Lithuanian family farms: A propensity score matching approach. Economics and Sociology, 12(1), 342-352. https://doi.org/10.14254/2071-789X.2019/12-1/21.

Nowak, A., Kubik, R. 2019. Changes in Agricultural Productivity in New and Old Member States of the European Union. European Research Studies Journal, 22(4), 101-114. https://doi.org/ 10.35808/ersj/1500.

Oliynyk, O. 2012. An international comparison of the effect of government support on agricultural productivity. Annals of Agricultural Economics and Rural Development, 99(3), 70-76.

Parzonko, A., Bórawski, P. 2020. Competitiveness of Polish dairy farms in the European Union. Agricultural Economics Czech, 66, 168-174. https://doi.org/10.17221/254/2019-AGRICECON.

Pawlak, K., Poczta, W. 2020. Agricultural Resources and their Productivity: A Transatlantic Perspective. European Research Studies Journal, 23(S1), 18-49. https://doi.org/10.35808/ersj/1743.

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

Rogoznicki, D., Baranowska, A., Kondracki, S. 2018. Common Agricultural Policy as a Determinant of Transformation in Polish Agriculture. Economic Sciences for Agribusiness and Rural Economy, (1), 168-174. https://doi.org/10.22630/ESARE.2018.1.23.

Salimova, G., Ableeva, A., Khabirov, G., Zalilova, Z., Lubova, T., Kabashova, E., Sharafutdinov, A., Valieva, G., Saifutdinova, L. 2019. Labour productivity in agricultural production system: the case of Russia. Bulgarian Journal of Agricultural Science, 25(Suppl. 2), 206-216.

Sauer, J., Park, T. 2009. Organic farming in Scandinavia - Productivity and market exit. Ecological Economics, (68), 2243-2254. https://doi.org/10.1016/j.ecolecon.2009.02.013.

Staniszewski, J., Borychowski, M. 2020. The impact of the subsidies on efficiency of different sized farms. Case study of the Common Agricultural Policy of the European Union. Agricultural Economics Czech, 66, 373-380. https://doi.org/10.17221/151/2020-AGRICECON.

Wicka, A., Wicki, L. 2016. Bio-economy sector in Poland and its importance in the economy. Economic Science for Rural Development, 41, 219-228.

Wicki, L. 2016. Zmiany produktywnosci czynnikow wytworczych w polskim rolnictwie. Zeszyty Naukowe SGGW - Ekonomika i Organizacja Gospodarki Zywnosciowej, (116), 149-160. https://doi.org/10.22630/EIOGZ.2016.116.52.

Wicki, L. 2018. The role of productivity growth in agricultural production development in the Central and Eastern Europe countries after 1991. Economic Science for Rural Development, 47, 514-523. https://doi.org/10.22616/ESRD.2018.060.

Yamada, S., Ruttan, V. 1980. International Comparisons of Productivity in Agriculture. In: Kendrick, K., Vaccara, B. (eds), New Developments in Productivity Measurement. University of Chicago Press, Chicago, 507-594.

Yanwen, T., Jianbo, G., Karimi, H. 2013. The impact of the subsidy policy on Total Factor Productivity: an empirical analysis of China's cotton production. Mathematical Problems in Engineering, 1-8. https://doi.org/10.1155/2013/248537.

Zsarnóczai, J., Zéman, Z. 2019. Output value and productivity of agricultural industry in Central-East Europe, Agricultural Economics Czech 65, 185-193. https://doi.org/10.17221/128/2018-AGRICECON.