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Do operating subsidies increase labour productivity in Polish farms?

In the agricultural economics literature, there is a lack of consistent results concerning the relationship between operational subsidies and labour productivity. This premise lay behind the research outlined in this paper, which aims to determine the direction and strength of the relationship between several factors influencing labour productivity, including the subsidy rate index and labour productivity in Polish farms. Special attention has been paid to quantitative evaluation of the effects of subsidies on operational activity. The study was carried out at the farm level, divided into quartile groups defined in terms of labour productivity. The panel data regression method was used to analyse data from Farm Accountancy Data Network for the years 2010-2018. It was found that the factors positively influencing labour productivity in agriculture were capital per employee and utilised agricultural area per employee, while labour productivity was negatively affected by the subsidy rate. In smaller farms where low labour productivity is observed, subsidies for operational activity are an important source of income generation and consumption financing. The financial surplus in such farms is not high enough to finance farm development. In such cases, subsidies become a factor slowing down processes of farm structural change because farmers are not interested in occupation change.

Keywords: agriculture, factor productivity, panel regression, subsidies in agriculture, labour efficiency

JEL classification: Q12, Q18

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Introduction

Directing financial support to agriculture causes the emergence of critical voices in society. Some people find that money they receive "for free" does not improve agricultural productivity (including labour productivity). One Polish agricultural economist, Wojciech Józwiak has concluded that subsidies make farmers "lazy". However, research shows that labour productivity in agriculture is much lower than in non-agricultural sectors, and its endogenous growth may be difficult to achieve due to low profitability and difficulties in accumulating capital and financing progress in agriculture (Giannakis and Bruggeman, 2018). These restrictions in the functioning of farms were one of the reasons for supporting European agriculture in the form of the EU Common Agricultural Policy (CAP), to increase both the productivity of factors of production and farmers' income. Subsidies in agriculture have been the subject of research to determine their impact on productivity, taking farm equipment, size, and production direction into consideration. However, the issue of the impact of subsidies on labour productivity in farms is rarely considered and there is a knowledge gap in this regard. McCloud and Kumbhakar (2008) even argue that there has been insufficient empirical assessment of the relationship between subsidies and labour productivity on farms. This is also confirmed by Hloušková and Lekešová (2020), who claim that there are only single studies that investigate direct relationships between subsidy levels and labour productivity. Additionally, most studies consider the nominal level of subsidies in the whole agriculture as a factor influencing income or labour productivity. There are no studies that aim to define how productivity changes, taking into account the relative level of subsidies (e.g. per employee or in relation to the amount of surplus). This means that there is a research gap in this area. We therefore aim to check whether the level of subsidy is related to labour productivity and whether the statement of the quoted W. Józwiak about the low impact of subsidies on the modernisation of agriculture can be regarded as true. Consequently, the aim of this paper is to determine the direction and strength of the relationship between the factors influencing labour productivity mentioned usually in the literature, supplemented with the subsidy rate index (SR) and labour productivity in Polish farms. This research can help to better understand the effects of farm subsidies in terms of their impact on the level of labour productivity. It has been hypothesised that observed higher labour productivity is mainly the result of a higher subsidy rate, which would mean that farmers receive budget funds and use them adequately to achieve better results from their production activities.

This paper is divided into three sections. First, we aim to bring the research on the relationship between subsidies and productivity in agriculture closer to the reader and indicate that the research results so far are varied and that they concerned the overall productivity of the farm, without focusing on labour productivity. The next part presents the methodology of work and the characteristics of the researched groups of farms. In the third part, the obtained results and conclusions are discussed.

Literature review

In global agriculture, there has been a slowdown in the overall rate of productivity growth after 2000, especially in developed countries, but the increase in labour and land productivity continues (Fuglie, 2018). If resource productivity sees little increase, this means agriculture loses competitiveness in relation to other sectors and this can result in

the abandonment of production on farms (Dorward, 2013; Giannakis and Bruggeman, 2018; Kavoosi-Kalashami and Motamed, 2020). Consequently, changes in agriculture that are conducive to an increase in productivity usually win support.

The increase in agricultural labour productivity is a condition for achieving higher income per person. This has a twofold effect: firstly, the standard of living of farmers increases and it is possible to invest surpluses in the development of farms, and secondly, given the constant volume of agricultural production, labour resources are elevated to other sectors of the economy. Hornowski *et al.* (2020) stated that work outside agriculture was the primary source of income in 82% of the Polish farms with an area of up to 15 ha. This is due to the low work efficiency of such farms, but also results in farmers not being interested in the development of their farms.

Higher labour productivity in agriculture is usually achieved by introducing progress embodied in fixed assets, which requires investment outlays or increasing the scale of production. Substitution of labour with capital, where possible, also results from the high share of labour costs in total costs (Ejimakor *et al.,* 2017). For example, in the conditions of highly fragmented agriculture in Poland, an increase in the capital to labour ratio determined as much as 60% of an increase in labour productivity (Gołaś, 2019; Kusz and Misiak, 2017; Niezgoda *et al.,* 2018; Nowak and Kijek, 2016). Unfortunately, the processes of concentration of capital and land are very slow and even over a period of 15 years, they are not clearly visible in the research (Kata, 2018). Increasing the ratio of land to labour is similarly beneficial for other countries like the Baltic states where a rapid increase in labour productivity was observed, resulting from both an increase in the ratio of land and capital to labour (Wicki, 2021), justifying support for expanding the area of farms in countries where small farms dominate (Wójcik and Nowak, 2012).

In the countries of Central and Eastern Europe, the productivity of agriculture is still much lower than in the EU-15 countries and the non-agricultural sectors (Wicki, 2018). Therefore, opportunities are being sought to design subsidies in agriculture to overcome these weaknesses. In Poland, under the second pillar of the CAP, subsidies are granted for the purchase of equipment and construction of buildings. However, such support is not available to everyone. The limitation is the small scale of production and low income, as even 60% of investments should be financed from farmers' own resources. In such cases, support for development processes results from the availability of funds from subsidies for operating activities.

The literature on the relationship between subsidies and on-farm productivity is extensive. It is pointed out that depending on how they are targeted and what their scale is, subsidies may have a positive but sometimes also negative impact on the pace of agricultural modernisation, the volume of agricultural production and the productivity of factors (Ackrill, 2000; Fulginiti and Perris, 1993; Kostlivý and Fuksová, 2019; Rizov *et al.,* 2013). The negative impact of the subsidies is related to the preservation of the agrarian structure and the demotivation of farmers to introduce changes as they had the opportunity to make a living on the received subsidies.

Many authors argue that subsidies have a noticeably positive impact on the development of farms and an increase in the overall productivity of agriculture by increasing investment opportunities, leading to an increase in the scale of production and enabling the replacement of more expensive factors of production with cheaper ones (Blancard *et al.,* 2006; Cechura *et al.,* 2015; Hlavsa *et al.,* 2017; Kirchweger *et al.,* 2015; Zsarnóczai and Zéman, 2018). Such a relationship was also confirmed for Polish farms (Kusz, 2018). The introduction of decoupled subsidies had a positive effect on overall agricultural productivity in the EU (Kazukauskas *et al.,* 2014; Mary, 2013; Rizov *et al.,* 2013), including labour productivity (Garrone *et al.,* 2019). By decoupling support, farmers can individually select production activities with higher added value, and allocation inefficiency is reduced (Dewbre *et al.,* 2001; Guyomard *et al.,* 2004). However, with decoupled subsidies, the goals related to obtaining an increase in the size of farms or the level of income were usually not achieved (Hubbard *et al.,* 2014).

It is also observed that the impact of subsidies on farm productivity depends on the country or region (Minviel and Latruffe, 2017). There differences between the old and the new EU members (countries that joined the EU in 2004 and later) are especially noteworthy. Some studies have shown that subsidies have a positive effect on productivity only on economically large farms (Staniszewski and Borychowski, 2020; Kostlivý and Fuksová, 2019). With an increase in the scale of production, an increase in labour productivity is achieved first, and followed by land and capital growth (Du *et al.,* 2018; Wicki, 2018). Consequently, along with the increase in the size of farms, the impact of the subsidy on their further development may be positive, as the per capita income is higher, which is sufficient not only to support the family, but also to invest. Other conclusions are presented in the study by Gołaś (2019) who found that the main factors leading to an increase in labour productivity in agriculture in the EU were high production intensity and farm size growth, while farm subsidies turned out to be insignificant in this aspect. In this approach, it is assumed that the relationship between subsidies and development may be small, and subsidies only have a social function in maintaining the level of income achieved.

It was also observed that the effects of subsidies are visible only after several years of support (Jitea and Pocol, 2014), implying that research results based on short-term data may yield inconclusive results. For individual countries, it was also found that the first increase was achieved in the size of the activity for which support could be obtained, but no increase in productivity, including labour productivity, was achieved (Skreli *et al.,* 2015), or that this increase was lower than expected (Bajrami *et al.,* 2019). This may be explained by the ineffective use of inputs, so that increasing them does not lead to an increase in production (Jitea and Pocol, 2014). For agricultural subsidies and support to bring the intended results, support should be directed towards overcoming barriers to the development of farms that have been identified in a particular country (Yanwen *et al.,* 2013).

Another issue is the development-oriented investment support of farms. It is shown that in the conditions of low-developed agriculture, the lack of support for investments leads to a slowdown in development and can even worsen the economic results of farms (Hlavsa *et al.,* 2017; Kirchweger *et al.,* 2015), while subsidies themselves contribute to an increase in resource productivity (Hubbard *et al.,* 2014). In this paper, however, we focus on the influence of decoupled subsidies.

Data and Methods

The data used in the paper came from the FADN.PL database. We obtain individual annual data for 3457 farms for the period 2010-2018. The collected data was used to build a balanced data panel, which included 31,113 objects. In the next stage, farms were divided into quartiles according to the criterion of labour efficiency per one employee obtained in 2018 (such a procedure allowed to avoid the migration of objects between quartiles). The year 2010 was taken as the year of the beginning of the analysis, as it was the first year in which the economic size of farms was established, based on the standard production volume.

The EU countries are characterised by a large diversity of agricultural structures and farming conditions, hence the adoption of data on farms from one country for the analysis allows for a more precise explanation of the relationship. Additionally, it was possible to obtain individual data from the same farms for several consecutive years. Such an approach allows to avoid difficulties in creating a credible model resulting from the large diversification of agriculture between countries, and at the same time provides the basis for presenting specific recommendations for a given country.

Panel modelling with fixed-effect estimators (FEM) was used to construct the models. The choice of the fixed effect model (FEM) was preceded by the Hausman test (at $p < 0.05$) and the Breusch-Pagan test. The FEM model is considered more reliable than the random effect model (Hausman, 1978; Hausman and Taylor, 1981; Greene 2008). The general model of panel data is presented in equation 1.

$$y_{it} = m_i + \sum b x_{it} + e_{it}, \quad (1)$$

where b stands for 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} is the rest, meeting the classic assumption $E(e_{it}) = 0$ and $\mathrm{Var}(e_{it}) = S_e^2$. In the fixed effect model (FEM), m_i is decomposed into fixed expressions for individual groups, separately. Therefore, the model looks as follows:

$$\begin{aligned} y_{it} &= a_1 d_{1it} + a_2 d_{2it} + \cdots + a_k d_{kit} + b x_{it} + e_{it} = \\ &= a_i + b x_{it} + e_{it} \end{aligned}, \quad (2)$$

where: a_i stands for specific fixed expressions, while d_i is for zero-one variables, with the value 1 for i-th object and 0 otherwise.

Based on the data on the results of farms, after creating a division into quartiles reflecting levels of labour productivity on a farm, models were constructed for the entire group of farms as well as for individual quartile groups.

When deciding on the choice of factors for the model, the ones that were most often identified as having an impact on work efficiency were selected. Authors dealing with this subject indicated the following indices: the size of farms (Giannakis and Bruggeman 2018; MacDonald *et al.,* 2020; Parzonko and Bórawski, 2020), land resources per employee (Galluzzo, 2016; Giannakis and Bruggeman, 2018), capital per employee (Kusz and Misiak, 2017) and the intensity of production (Fuglie *et al.,* 2017; Gołaś, 2019; Hayami, 1970; Yamada and Ruttan, 1980). Hence, the presentation of the level of operating subsidies in relation to the value added generated on the farm in the set of analysed factors will – as mentioned in the introduction – complement the knowledge about the mechanisms of increasing labour productivity, and will also allow to verify to what extent operating subsidies are an important factor in achieving higher labour productivity.

The study assumed the measurement of labour productivity (LP) as a relation of net added value (NVA) to labour resources expressed in AWU (SE415/SE010). Following Hloušková and Lekešová (2020), the net value added (NVA) indicator is a synthetic indicator of standard production in EU FADN, expressing general production effects, outlays, and operational subsidies. Thus, per employee, it is one of the most important indicators of labour productivity. It measures productivity with regards to the value input of human capital in relation to external material costs. In this paper, variables with the level of human capital were not included separately due to the lack of relevant data. The subsidy rate (SR) was adopted as a measure of the level of support, which is the ratio of the value of subsidies to operating activities to the NVA. Subsidies are included in the NVA and shape them, and therefore may have an impact on labour productivity.

Additionally, variables that appeared in various studies in the field of labour productivity were taken into account, such as capital value per working person (C_AWU), measured by the value of total assets per one unit of labour; agricultural land area per working person (A_AWU), production intensity (In_A), which was the relation of costs to agricultural land area; livestock density (LU_A) and farm size (SE005), measured by standard output.

Results

Farm characteristics

Farms included in the research were characterised by different potentials resulting from the resources held, affecting labour productivity. Table 1 summarises the data characterising the examined Polish farms, broken down into quartiles, for which separate models have been developed.

The data presented in Table 1 confirm the differentiation of the analysed quartile groups, especially between Q1 and Q4. It is interesting that an average farm in Q4 has an

Table 1: Selected characteristics of Polish farms (averages per farm).

Specification	All farms	Averages for farms by quartile			
		Q1	Q2	Q3	Q4
Land [ha]	40.71	20.52	28.82	39.04	63.31
Annual work unit (AWU)	2.00	1.80	2.00	2.07	2.00
Total assets [thousand PLN]	1,421.77 (761.34)	702.32 (390.71)	986.45 (551.39)	1,372.33 (716.38)	2,232.36 (1,170.89)
Farm income [thousand PLN]	90.61	27.42	53.20	86.78	159.78
Subsidies [thousand PLN]	50.50	26.20	37.70	50.55	76.26

Note: land values are in parentheses.
Source: Own calculations based on FADN.PL data

Table 2: Descriptive statistics of variables – Polish farms panel

Variable	Statistics	Poland	Q1	Q2	Q3	Q4
LP [thousand PLN]	Avg	57.89	24.75	38.65	59.25	108.85
	Min	0.01	0.01	0.02	0.09	0.31
	Max	490.10	267.41	341.91	473.12	490.10
	SD	53.07	22.53	27.10	36.93	68.01
SR [%]	Avg	50.43	63.02	52.94	45.71	40.05
	Min	0.00	0.00	0.00	0.00	0.00
	Max	100.00	100.00	100.00	100.00	100.00
	SD	30.05	30.85	29.98	28.09	26.08
C_AWU [thousand PLN/AWU]	Avg	316.12	175.71	223.08	326.48	538.97
	Min	5.26	11.34	9.22	5.26	30.03
	Max	2,159.81	1,764.85	2,058.83	2,040.15	2,159.81
	SD	266.06	156.46	173.21	216.55	323.40
A_AWU [ha/AWU]	Avg	20.53	12.03	15.55	20.60	33.94
	Min	0.27	0.40	0.27	0.39	0.54
	Max	280.40	94.94	118.58	280.40	222.58
	SD	17.72	9.46	11.16	14.49	23.71
In_A [thousand PLN/ha]	Avg	7.00	6.14	6.96	7.24	7.68
	Min	0.43	1.09	0.86	0.43	0.68
	Max	220.73	99.76	220.73	188.40	197.70
	SD	8.31	5.48	10.33	7.88	9.29
LU_A [LU/100 ha]	Avg	7.03	9.30	7.99	6.14	4.71
	Min	0.00	0.00	0.00	0.00	0.00
	Max	1,718.00	746.00	324.60	1,718.00	194.70
	SD	18.04	21.40	16.79	30.30	9.98
SE005 [thousand PLN]	Avg	46.40	24.57	35.29	49.83	75.86
	Min	4.01	4.01	4.10	4.09	4.71
	Max	3,433.98	460.97	462.30	3,433.98	467.82
	SD	51.06	25.89	31.90	66.60	53.75

Source: Own calculations based on FADN.PL data

area 3 times larger than that of a farm in Q1, but at the same time the difference in the amount of capital is more than four times. This determines the income achieved (the difference between Q4 and Q1 is almost 6 times to the disadvantage to the latter). It is worth emphasising that despite differences in acreage of utilised agricultural area (UAA) and the value of capital, the amount of employment on farms did not differ between quartiles. This may mean that some farms do not fully use their labour force.

In individual quartiles, the level of received subsidies for agricultural activity also varied. There are almost 3-fold differences in the level of received payments between groups Q1 and Q4, which is not surprising as it is a consequence of the size of the farm. However, there is a clear difference between the value of income and subsidies – in Q1, these values are almost equal, in Q4, there is a clear difference between these amounts. This proves that these smaller farms are very dependent on budget support, but at the same time it is a small amount. Combined with a small amount of capital and land, it limits the possibilities of increasing agricultural production and overall productivity on farms from quartiles 1 and 2.

From Table 2, it can be observed that there are significant and systematic differences in labour, capital, and production intensity as well as in farm size between quartile groups as well as inside these groups, which is visible in the high values of standard deviation. In Q4, labour productivity is almost two-fold higher than the mean for the country and four-fold higher in comparison with Q1. Similarly, other

variables indicate that labour productivity primarily depends on farm size and technical equipment rather than production intensity. The SR level decreases in the successive groups from Q1 to Q4. It can, therefore, be stated that the value of subsidies has a relatively lower significance for the level of income in the Q4 group of farms. In farms from this quartile, a bigger part of NVA was obtained due to agricultural activity, not subsidies, even when NVA in this group was much higher than in other quartiles.

Factors determining the increase in labour productivity

In Table 3, the correlation matrix for variables used in the analysis is presented.

Agricultural land area per working person (A_AWU), capital value per working person (C_AWU) and farm size (SE005) are most significantly and positively correlated with the LP variable. The subsidy rate (SR) is negatively correlated with LP. It is worth noting that SR is also negatively correlated with every other variable, which implies that subsidies are more important in small, low-intensity and less equipped farms. The dependencies presented in Table 3 confirms the results from the farm description according to quartile groups.

Table 4 presents the parameters of the panel regression model for the assessment of the influence of selected factors on labour productivity in groups of Polish farms.

The obtained results indicate that three independent variables (regardless of whether the model concerns the whole set or quartile groups) have an impact on the level of labour productivity. These variables are: C_AWU, A_AWU and SR. In the models, SE005 has a significant positive impact on three groups. This means that the primary factor influencing the increase in labour productivity on Polish farms is farm size and better equipment of labour with capital. The obtained result indicates that, from the perspective of labour productivity, land and capital concentration and investment in labour substitution by capital can be a developmental path for Polish farms in the future.

Similar results, indicating the main role of capital in achieving higher productivity, were established for Poland for the period before 2010 by Wójcik and Nowak (2012) and for other countries by Zsarnóczai and Zéman (2019) and Salimova *et al.* (2019). The results of our research are also consistent with the findings of Niezgoda *et al.* (2018), who stated that on larger farms, the effectiveness of the substitution of labour with capital is much higher, implying that the small scale of production is still a strong limitation. With

Table 3: Variable correlation matrix – Polish farms panel.

Variable	LP	SR	C_AWU	A_AWU	In_A	LU_A	SE005
LP	1						
SR	-0.299	1					
C_AWU	0.651	-0.082	1				
A_AWU	0.649	-0.128	0.631	1			
In_A	0.042	-0.252	0.099	-0.188	1		
LU_A	-0.126	-0.029	-0.111	-0.194	0.005	1	
SE005	0.496	-0.173	0.557	0.379	0.213	-0.055	1

Note: Critical value (for two-sided 5% critical area) = 0.0111, for n = 31,113.
Source: Own calculations based on FADN.PL

Table 4: Estimation of fixed effects for the LP variable – Polish farms panel and quartile groups.

Variable	Poland	Q1	Q2	Q3	Q4
Constant	28.17***	24.40***	21.897***	34.384***	36.621***
	(11.780)	(4.77)	(6.246)	(10.54)	(7.557)
SR	-0.419***	-0.243***	-0.305***	-0.406***	-0.831***
	(-36.57)	(-19.36)	(-17.28)	(-19.90)	(-22.81)
C_AWU	0.070***	0.030***	0.046***	0.065***	0.082***
	(14.66)	(2.799)	(3.591)	(7.470)	(12.51)
A_AWU	1.254***	0.776***	1.150***	1.236***	1.270***
	(14.11)	(3.456)	(6.289)	(7.300)	(10.46)
In_A	-0.222**	-0.520	-0.188	-0.538***	-0.165
	(-2.34)	(-1.130)	(-1.040)	(-4.662)	(-1.254)
LU_A	-0.020**	0.008	0.03*	-0.011***	-0.142*
	(-2.247)	(0.876)	(1.693)	(-2.638)	(-1.916)
SE005		0.171***	0.161***		0.264***
		(2.781)	(2.953)		(5.752)
R^2 (within R^2)	0.761	0.619	0.593	0.602	0.665
	(0.731)	(0.571)	(0.541)	(0.552)	(0.623)
Durbin-Watson test	1.75	1.96	1.96	1.89	1.74
Sample size	31,113	7,777	7,778	7,778	7,777

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$
Source: Own calculations based on FADN.PL

a small scale of production, the significance of operating subsidies for inducing productivity growth is small. However, Gołaś (2019) stated that the most important factor in increasing labour productivity was the increase in UAA per employee. Both our research and that of others indicate that operating subsidies are not the main driver of labour productivity growth in agriculture.

In research on agriculture across the whole EU, the most important factor leading to an increase in labour productivity was the increase in the capital-labour relationship, while the increase in farm size and production scale did not have a significant influence on labour productivity. Subsidies per worker had negative impact on labour productivity (Bereżnicka and Wicki, 2021). The situation is different in Poland, our research shows that even in the group of farms with the highest labour productivity, there is still a significant positive relationship between labour productivity and the size of farms. This means that in Polish agriculture, compared to EU agriculture, the main limiting factors are small land and capital resources on farms. In Polish farms, which are still highly scattered, subsidies are not a key factor in increasing labour productivity. As the size of farms grows, the increase in land and capital resources is more important, and the importance of subsidies in creating added value decreases.

In each of the separate quartile, the subsidy ratio had a negative relationship with labour productivity. This means that the higher level of subsidies was not conducive to the growth of labour productivity, and seems to perpetuate its relatively low level, resulting from the fact that the negative impact of this variable is three times higher in the Q4 group compared to the Q1 group. It also means that achieving higher labour productivity does not depend on the level of operating subsidies in Poland, but on other factors included in the model like the capital-labour, land-labour relations, and in some groups also the economic size. Giannakis and Brugemann (2018) suggest that farmers' pluriactivity and low level of new technology familiarity may also be the cause of low productivity. It can be pointed out that increasing the size of farms and their equipment allows them to become more independent from operating subsidies. Similar results were obtained by Jitea and Pocol (2014) for agriculture in Romania. Hornowski *et al.* (2020) indicates that operating subsidies in small farms in Poland make it possible to maintain the level of personal income of farmers at an acceptable level, and to a lesser extent have a pro-development function. To stimulate development, the use of subsidies that directly support investment is needed. Galuzzo (2016) reached similar conclusions on small farms in Italy. However, such subsidies are mainly used by large farms, as in smaller ones it is not possible to generate a surplus for co-financing investments (Kostlivý and Fuksová, 2019). The obtained results may also be the basis for confirming that the high level of subsidies to operating activities leads to a slowdown in farm structural change and an increase in labour productivity in agriculture (which indicates an ineffective allocation of budget support). However, it was also confirmed that regardless of the level of labour productivity and the size of farms, increasing the area and accumulation of capital supporting work contribute to achieving higher and higher productivity.

Conclusions

The paper analysed the relationship between subsidies and farm level labour productivity in Poland and showed a significant negative dependency between the subsidy rate and labour productivity in Polish farms. This was proven not only for the general whole model, but also for models of quartile groups distinguished in terms of labour productivity. The negative correlation between subsidy rate and labour productivity was stronger in groups characterised by a high level of labour productivity. However, the conducted research confirmed that the factors traditionally taken into consideration, such as an increase in the scale of production, an increase in the capital-labour ratio, and an increase in land per worker, still have a significant positive impact on labour productivity. The significance of these factors is greater in farm quartiles with an observed high level of productivity, a finding which provides a justification for productivity development, even where more productive and bigger farms are concerned. This would mean that the current progress of farms relating to labour productivity and income level per person will continue, and diversification in this scope will continue to grow. The process may end in a small percentage of farms with high productivity and economic independence, and a high percentage of small farms that will not constitute the basis of the farmers' livelihood. Results also suggest that in Polish agriculture, it is the case that the factors limiting the growth of labour productivity are small resources of land and capital on farms, and that these barriers to growth should therefore be removed.

The income of farms with the lowest labour productivity is more strongly dependent on subsidies than in farms with high productivity, where the increase in labour productivity was dependent on the subsidy level for operational activity to a lesser extent. This may mean that in farms where low labour productivity is observed, subsidies for operational activity are an important source of income generation and form of consumption financing, which may not be enough to generate a surplus that could be allotted to financing the development of the farm. In such cases, subsidies become a bottleneck for farm structure change that would lead to an increase in labour productivity. The hypothesis set in the study that a higher subsidy rate is associated with higher labour productivity on farms was negatively verified.

The limitation in the conducted research is the inability to eliminate the influence of factors not included in the model, which may strongly modify the efficiency (for example the production direction and its structure). The extent to which other objectives, such as environmental protection, emission levels or animal welfare, are achieved, have also not been taken into consideration. The implementation of such goals on farms may lead to a reduction in productivity. The new challenges facing agriculture justify further research on the productivity of factors of production, including labour, with a view to modifying the principles of agricultural support.

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