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REGIONAL DIVERSIFICATION OF INVESTMENT OUTLAYS AND LABOUR PROFITABILITY IN AGRICULTURE IN POLAND

Key words: investments, labour, profitability of labour, regional diversification, agricultural

ABSTRACT. The main purpose of the study was to assess changes in labour profitability against changes in the level of investment outlays in Poland in a regional approach. Empirical material consists of statistical data from the Central Statistical Office for the years 2000-2017. The following diagnostic variables were used for the analysis: (1) characterizing the profitability of the labour factor – gross value added in agriculture per one agricultural employee; (2) characterizing the investment activity of farmers – the value of investment outlays in agriculture per one employee in agriculture, the value of investment outlays in agriculture per 1 ha of agricultural land, the value of investment outlays in agriculture in relation to the value of gross fixed assets in agriculture, the value of investment outlays in agriculture in relation to gross value added in agriculture. On the basis of a set of diagnostic features describing the investment activity of farmers, a classification of voivodships was carried out using cluster analysis using Ward's method, and a statistical evaluation of the relationship between the investment activity of farmers and the profitability of labour was performed. There has been a significant diversification of farmers' investment activity and labour profitability in terms of regions. It was found that the level of investment outlays is a crucial factor in the process of improving the efficiency of the use of the labour factor. A level of investments that is loo low does not allow for favourable structural changes and for modernization and restructuring of agriculture to take place.

INTRODUCTION

Tangible investments are of key importance in stimulating the growth and development of economic entities and the national economy. This assumption comes from the fact that the introduction of new, more efficient fixed assets facilitates the implementation of new technological solutions, which is an important source of changes in productivity [De Long, Summers 1991, Kusz 2015, Pawlak 2016].

The literature on the subject highlights investment as a potential factor for economic growth, especially in a long-term perspective. Economic history confirms the close connection between economic growth and tangible investments (for example steam engines increased production efficiency). New technologies require new types of capital and significant investment outlays. Technological change is capital-intensive and efficiency as well as profitability of new business ventures cannot increase without an increase in capital intensity as well. Relationships between economic growth, changes in productivity and efficiency of management, and the level of investment outlays, however, may be varied and dependent on the base level of economic development or the state of technology [De Long, Summers 1991, De Long 1992, Zeira 1998].

A characteristic feature of agriculture in Poland is its regional differentiation in terms of management efficiency [Muszyńska 2010, Miś 2011, Krasowicz 2013]. Observed changes in the relations of production factor prices (especially rising labour costs in relation to other factors of production) [Runowski, Ziętara 2011], but also the need to reduce regional disproportions requires improvement, above all, in the efficiency of labour in agriculture. This requires structural changes, but also the implementation of labour-saving production technologies allowing the substitution of labour with capital, which requires investment outlays [Kusz 2018].

The main purpose of the study was assess changes in labour profitability against changes in the level of investment outlays in agriculture in Poland in a regional approach.

MATERIAL AND METHODS

Empirical material consists of statistical data from the Central Statistical Office for the years 2000-2017. The time scope of the analysis was dictated by data availability. The following diagnostic variables were used for the analysis for the years 2000-2017: (1) characterizing the profitability of the labour factor – gross value added in agriculture per one agricultural employee, (2) characterizing the investment activity of farmers – the value of investment outlays in agriculture per one employee in agriculture, the value of investment outlays in agriculture per 1 ha of agricultural land (AL), the value of investment outlays in agriculture in relation to the value of gross fixed assets in agriculture, the value of investment outlays in agriculture in relation to gross value added in agriculture. In order to maintain the comparability of the values expressed in monetary measures, the fixed prices of 2017 were used, for this purpose the Consumer Price Index (CPI) was used. Based on the set of diagnostic features describing individual voivodships in Poland, their classification was carried out using cluster analysis using Ward's method. This method makes it possible to distinguish clusters of similar objects due to selected statistical features, so that within each cluster there is as little variation as possible, and between clusters as large as possible [Hydzik, Sobolewski 2009]. Analysis of variance was used to estimate the distance between the units [Stanisz 2007]. The analysis was preceded by feature standardization according to the following formula (only stimulants occurred):

$$\dot{x}_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (1)$$

The average annual rate of changes was determined using chain indices:

$$\bar{i_g} = \sqrt[n-1]{i_{n/n-1} \times i_{n-1/n-2} \times \ldots \times i_{2/1} \times i_{1/0}} \quad (2)$$

The average annual rate of change was calculated according to the following formula:

$$r = \bar{i_g} - 1 \quad (3)$$

The main purpose was achieved through the implementation of the following research tasks: (1) determining the level and size of changes in labour profitability in agriculture, (2) determining the level and size of changes in the investment activity of farmers. These analyses were carried out for individual voivodships in Poland for the years 2000-2017.

FINDINGS

The value of completed investments reflects the investment effort incurred. The index of investment outlays per one person employed in agriculture has significant cognitive value. The importance of this index results from the processes taking place in the agricultural environment related to changes in the prices of factors of production, and, in particular, rising labour costs. This forces the substitution of labour with capital and improves the efficiency of using the labour factor [Kusz 2011]. The average investment value per person employed in agriculture for the years 2000-2017 was PLN 1,694.2 (Figure 1). At the same time, considerable regional differentiation can be noticed. The differences between the Podkarpackie Voivodship, with the lowest rate of investment per person employed in agriculture, and the Zachodniopomorskie Voivodship with the highest level of this rate, were almost nine times higher (8.99 times). A smaller scale of regional diversification of investment activity concerns the value of investment outlays per 1 ha of AL. The highest level of this indicator was recorded in the Wielkopolskie Voivodship, and the lowest in the Podkarpackie Voivodship – the difference between these two extreme voivodships was only 1.83 (Figure 2). Important information about the level of development and scale of modernization of agriculture is the index of renewal of fixed assets, calculated as the ratio of the value of investment outlays to the value of gross fixed assets. The average value of this indicator in Poland was 2.88% (Figure 3), with the highest degree of renewal of fixed assets recorded in the following voivodships: Lubuskie, Wielkopolskie, Pomorskie and Zachodniopomorskie. While the lowest values in the Małopolskie and Podkarpackie voivodships. Another indicator characterizing the investment activity of farmers in Poland is the share of investment outlays in gross value added (Figure 4). Gross value added is an income category. Relating investment outlays to gross value added, we obtain the investment effort index, which informs about the scale of abandoning current consumption for future uncertain benefits. This indicator illustrates the essence of investments expressed

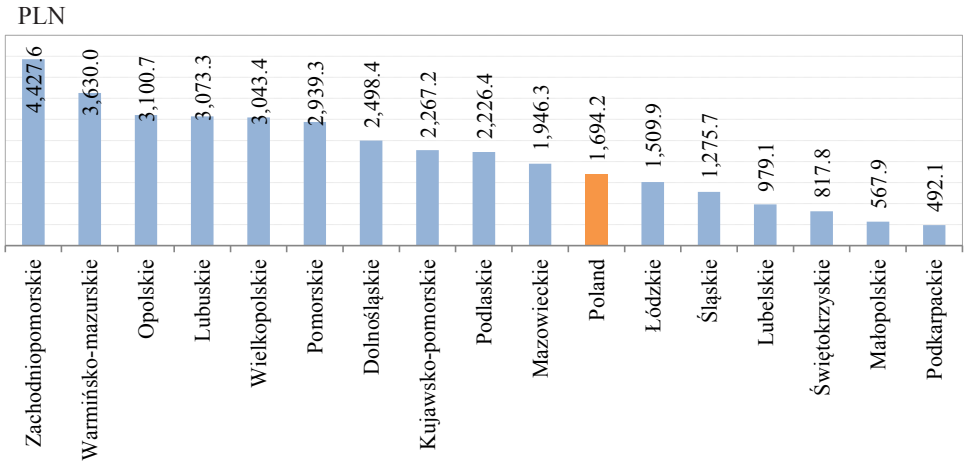

Figure 1. Level of investment outlays per person employed in agriculture – average value for the years 2000-2017, constant prices from 2017

Source: own calculations based on Central Statistical Office data

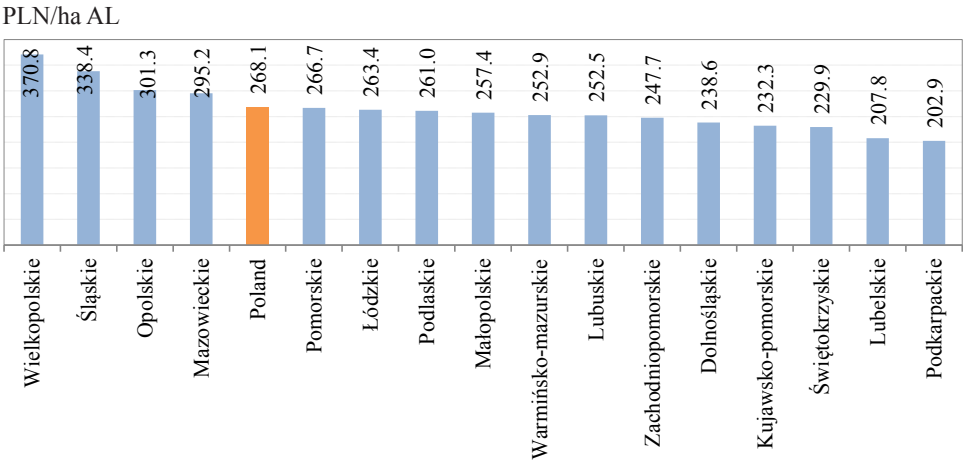

Figure 2. Level of investment outlays per 1 ha of AL – average value for the years 2000-2017, constant prices from 2017

Source: own calculations based on Central Statistical Office data

in the definitions of investments found in the literature on the subject [Hirshleifer 1965, Jajuga, Jajuga 2006]. The average level of such calculated investment effort in Poland was 10.4% (Figure 4). At the same time, in terms of analysis of the investment activity of farmers in individual voivodships, it is worth noting that the Podkarpackie Voivodship, despite being characterised by a low assessment of investment activity expressed with the use of previously discussed indicators, showed a very high rate of investment effort.

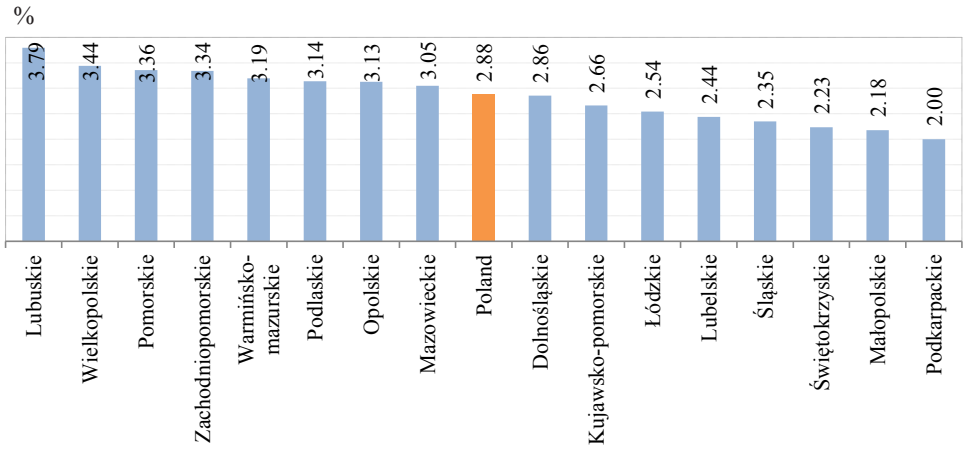

Figure 3. Level of investment outlays in relation to gross fixed assets – average value for the years 2000-2017, constant prices from 2017

Source: own calculations based on Central Statistical Office data

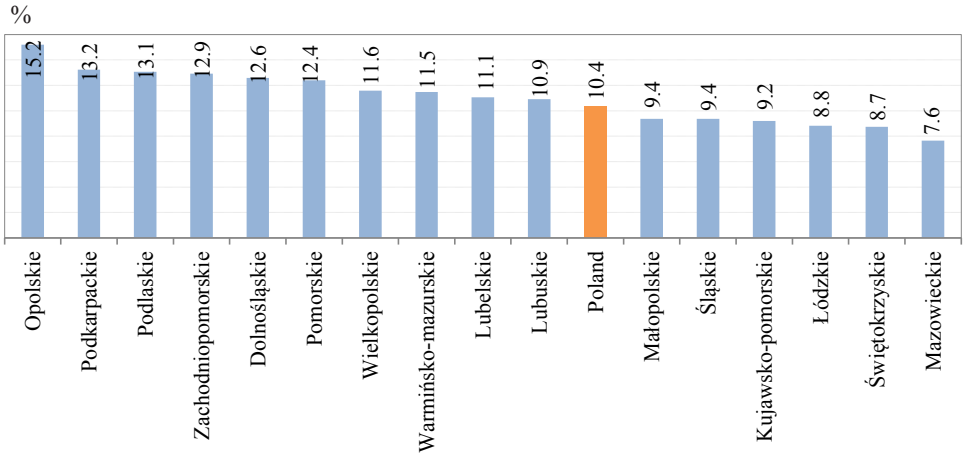

Figure 4. Level of investment outlays in relation to gross value added in agriculture – average value for the years 2000-2017, constant prices from 2017

Source: own calculations based on Central Statistical Office data

Against the presentation of investment activity, the diversification of the effectiveness of the labour factor was also presented. When analysing the differences in work efficiency between voivodships, significant disproportions are observed (Figure 5). The difference between the voivodship with the highest labour efficiency index – the Zachodniopomorskie Voivodship, and the voivodship with the lowest – the Podkarpackie Voivodship, was ninefold. It was a similar case regarding the differences in the level of investment per person working in agriculture (Figure 1).

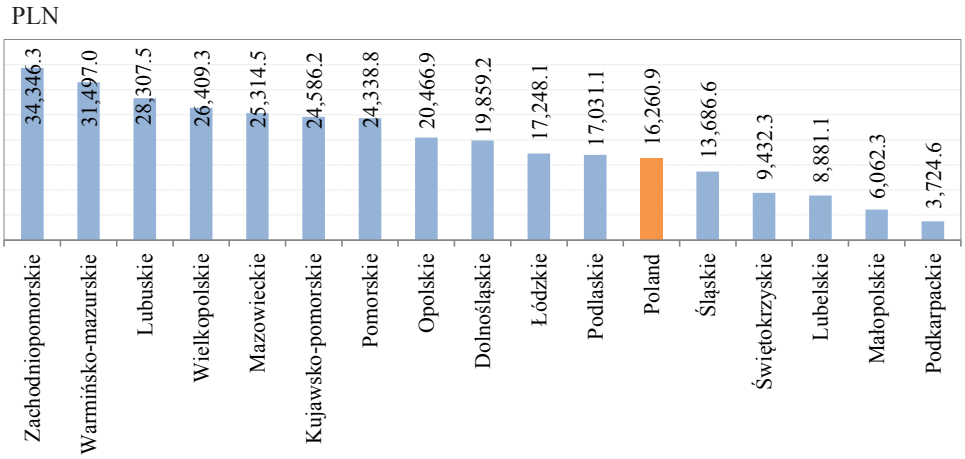

Figure 5. Labour efficiency – average value for the years 2000-2017, constant prices from 2017
Source: own calculations based on Central Statistical Office data

Based on the cluster analysis using Ward's method (using diagnostic variables – average values for the years 2000-2017: the value of investment outlays in agriculture per one employee in agriculture, the value of investment outlays in agriculture per 1 ha of AL, the value of investment outlays in agriculture in relation to the value of gross fixed assets in agriculture, the value of investment outlays in agriculture in relation to the gross value added in agriculture), typological classes of voivodships with similar investment activity were distinguished (Figure 6). Cluster I includes Dolnośląskie, Podlaskie, Opolskie, Lubuskie, Pomorskie, Warmińsko-mazurskie, Zachodniopomorskie and Wielkopolskie voivodships. Cluster II includes the following voivodships: Kujawsko-pomorskie, Łódzkie, Mazowieckie, Śląskie, Lubelskie, Podkarpackie, Małopolskie, Świętokrzyskie (Figure 6).

The voivodships from the first cluster are characterized by a much higher level of indicators related to investment activity and labour efficiency (Table 1). At the same time, when analysing the changes in the level of investment activity and work efficiency indicators over the years 2000-2017, it is noticed that the average annual rate of change of indicators in the provinces of the second cluster was at a higher level than in the provinces of the first cluster. This proves an attempt to make up the distance between these voivodships. However, the level of investment activity in the provinces of the 2nd cluster is still too low to shorten the distance between these objects in a short time. Moreover, the value of changes in a five-year average characterizing investment activity and labour profitability for the period 2013-2017 compared to a five-year average for the period 2000-2004 in the analysed clusters of voivodships did not differ significantly. This may also indicate that the changes taking place in the voivodships of the 2nd cluster (with lower investment activity) are too slow.

In order to determine the relationship between labour profitability and the factors characterizing investment activity in agriculture in individual voivodships and the rate of

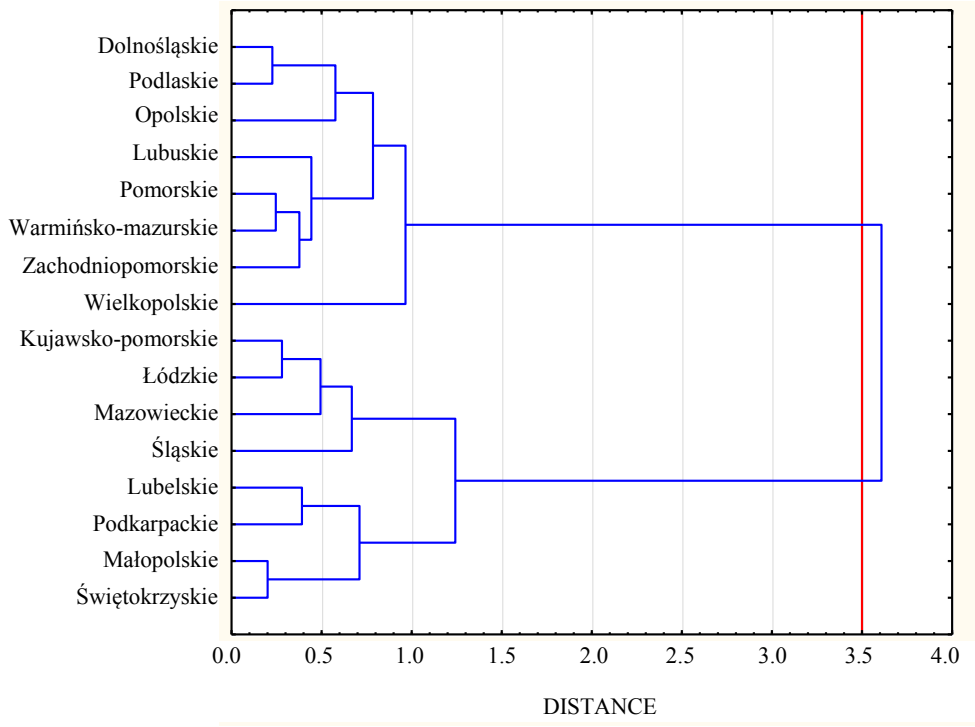

Figure 6. Classification of voivodships using the Ward method according to investment activity in agriculture for 2000-2017

Source: own calculations based on Central Statistical Office data

change in this investment activity, a statistical analysis of these relationships was carried out (Table 2). Statistically significant relationships were found between labour profitability and the investment activity of farmers expressed by the value of investments per one person working in agriculture, investments per 1 ha of AL and the value of investments in relation to the value of gross fixed assets. There was no statistically significant relationship between labour profitability and the rate of changes in the investment activity of farmers. This indicates that, in the process of improving the efficiency of the use of the labour factor, not only changes in the level of investment outlays per production factors are important, but the specific investment level here is decisive, beyond which a new state of technical equipment is achieved, enabling the application of new, more efficient technological solutions. Despite the fact that the average annual rate of changes in investment activity in agriculture in the provinces of the 2nd cluster is greater than in the case of cluster I (Table 1), the level of investment in relation to the factors of production is too low, which prevents the application of new solutions on a large scale. Moreover, it also indicates the necessity of structural transformations in the provinces of the 2nd cluster, favouring the improvement of labour efficiency.

Table 1. Statistics of diagnostic variables and their average annual changes for 2000-2017 in selected clusters of voivodships

Specification	I cluster				II cluster			
	$\bar{x}$	min.	max.	V_s	$\bar{x}$	min.	max.	V_s
Investments per one worker in agriculture [PLN]								
Descriptive statistics	3,117.4	1,092.3	6,085.7	33.3	1,232.0	229.2	3,183.5	56.5
Average annual rate of change [%]	3.41	0.25	6.92	66.3	4.22	2.15	6.48	44.0
Change in a five-year average 2013-2017/ 2000-2004*	1.8142				1.8060			
Investments per 1 ha of AL [PLN]								
Descriptive statistics	273.9	112.8	518.8	32.6	253.4	75.2	542.5	34.1
Average annual rate of change [%]	4.12	0.52	8.28	64.7	5.40	2.34	7.77	41.8
Change in a five-year average 2013-2017/ 2000-2004*	1.9857				2.0585			
Investments in relation to gross fixed assets [%]								
Descriptive statistics	3.28	1.46	5.82	28.0	2.43	0.77	4.26	30.2
Average annual rate of change [%]	3.71	1.14	7.69	56.6	4.82	2.54	7.46	44.1
Change in a five-year average 2013-2017/ 2000-2004*	1.8578				1.9250			
Investments in relation to gross value added [%]								
Descriptive statistics	12.52	5.73	24.53	24.6	9.68	4.29	18.80	26.2
Average annual rate of change [%]	0.87	-4.26	4.57	293.7	1.62	-1.46	5.76	181.1
Change in a five-year average 2013-2017/ 2000-2004*	1.3327				1.3208			
Gross value added per one worker in agriculture [thousand PLN]								
Descriptive statistics	25.28	9.54	42.43	28.5	13.62	2.21	38.29	60.2
Average annual rate of change [%]	2.53	0.69	4.72	60.7	2.60	-0.15	4.75	66.7
Change in a five-year average 2013-2017/2000-2004*	1.3598				1.4046			

* calculated as the relation of a five-year average value for the period 2013-2017 to a five-year average value for the period 2000-2004

Source: own calculations based on Central Statistical Office data

Table 2. Correlation indicators between gross value added per one person employed in agriculture and indicators characterizing the investment activity of farmers in individual voivodships

Variables	R – Spearman	*p- value**
Investments per one worker in agriculture [PLN]	0.8640	0.000*
Investments per 1 ha of AL [PLN]	0.3305	0.000*
Investments in relation to gross fixed assets [%]	0.6419	0.000*
Investments in relation to gross value added [%]	0.0543	0.359
The average annual rate of change in investment per person employed in agriculture	-0.2947	0.251
Average annual rate of changes in investments per 1 ha of AL	-0.3475	0.172
Average annual rate of change in investments in relation to the value of gross fixed assets	-0.3580	0.158
Average annual rate of change in investments in relation to gross value added	-0.2714	0.292

* significant at $p < 0.05$
Source: own calculations based on Central Statistical Office data

SUMMARY

Agriculture in Poland is characterized by high regional differentiation in terms of production potential and management efficiency. These disproportions should be eliminated, but this would require taking action in many areas. One of the factors influencing changes in agriculture are productive investments. The research carried out found significant diversification of the investment activity of farmers and profitability of labour in terms of regions. Two clusters of voivodships were distinguished with different levels of investment activity. In voivodships with lower investment activity, it was noticed that the average annual rate of changes in indicators concerning the level of completed investments and labour profitability was at a higher level than in the voivodships with higher investment activity. It proves that there is an attempt to eliminate losses between these voivodships. Statistically significant relationships between the investment activity of farmers and the level of labour profitability were also found. On the other hand, no statistically significant relationships were found between labour profitability and the rate of changes in investment activity. This analysis shows that the level of investment outlays is crucial in the process of improving the efficiency of the use of the labour factor. A level of investments that is too low does not allow for favourable structural changes and for the modernization and restructuring of agriculture to take place.

On this basis, a more general conclusion can be drawn, which points to the need to conduct agricultural policy in the scope of supporting the investment activity of farmers, taking the needs of individual regions into account.

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ZRÓŻNICOWANIE REGIONALNE NAKŁADÓW INWESTYCYJNYCH I DOCHODOWOŚCI PRACY W POLSKIM ROLNICTWIE

Słowa kluczowe: inwestycje, praca, dochodowość pracy, zróżnicowanie regionalne, rolnictwo

ABSTRAKT

Celem artykułu jest ocena zmian dochodowości pracy na tle zmian poziomu nakładów inwestycyjnych w polskim rolnictwie w ujęciu regionalnym. Materiał empiryczny stanowiły dane statystyczne GUS za lata 2000-2017. Do analizy wykorzystano zmienne diagnostyczne: (1) charakteryzujące dochodowość czynnika pracy – wartość dodana brutto w rolnictwie w przeliczeniu na jednego zatrudnionego w rolnictwie; (2) charakteryzujące aktywność inwestycyjną rolników – wartość nakładów inwestycyjnych w rolnictwie na jednego zatrudnionego w rolnictwie, wartość nakładów inwestycyjnych w rolnictwie przypadająca na 1 ha użytków rolnych, wartość nakładów inwestycyjnych w rolnictwie w odniesieniu do wartości środków trwałych brutto w rolnictwie, wartość nakładów inwestycyjnych w rolnictwie w odniesieniu do wartości dodanej brutto w rolnictwie. Na podstawie zestawu cech diagnostycznych opisujących aktywność inwestycyjną rolników przeprowadzono klasyfikację województw z wykorzystaniem analizy skupień metodą Warda oraz dokonano statystycznej oceny związków między aktywnością inwestycyjną rolników a dochodowością pracy. Odnotowano znaczne zróżnicowanie aktywności inwestycyjnej rolników i dochodowości pracy w ujęciu regionalnym. Stwierdzono, że w procesie poprawy efektywności wykorzystania czynnika pracy decydujące znaczenie miał poziom nakładów inwestycyjnych. Zbyt mały poziom inwestycji nie pozwala dokonać korzystnych zmian strukturalnych i przeprowadzić procesu modernizacji oraz restrukturyzacji rolnictwa.

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