The Financial Determinants of Investment Level Based on the Direction of Production of Agricultural Enterprises in the European Union

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Abstract:

Purpose: The article aims to analyze relations between the direction of production of agricultural enterprises in the European Union and the level of investment in the years 2005-2018. As the research hypothesis assumed, the directions of agricultural enterprises' production in the European Union influence their level of investment. The additional aim is to draw attention to the most critical issues reflecting the significance of finances in investment decisions of agricultural enterprises.

Design/Methodology/Approach: The study covers all the European Union member countries. The one-factor analysis of variance ANOVA was used to achieve the research objective.

Findings: The studies prove that agricultural enterprises' directions in the European Union substantially diversify their values of the investment level. The most significant differences in the investment level were observed between the agricultural enterprises specializing in granivores and milk and the plant production agricultural enterprises.

Practical Implications: The investment activities of agricultural enterprises result from their market activity and modernization of their assets. Decisions made by enterprises depend on their financial resources and have a significant impact on their development opportunities. The growth of owned fixed assets or the improvement of their quality may substantially contribute to the increase of the production potential of agricultural enterprises involved in plant production and animal production.

Originality/Value: The existing literature does not present a detailed differentiation of the level of investment in individual types of farms, in line with the FADN methodology.

Keywords: Gross investment, net investment, agriculture, FADN, ANOVA.

JEL codes: E22, O13, Q14.

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1. Introduction

Financing investment in the economy, regardless of a sector, is essential for developing business entities conducting primary production and service activities. In agriculture, the essential elements are agricultural enterprises with the primary function of producing the materials of animal and plant origin and finished products. Their development is determined by the factors constituting them, including investment undertakings. The investment may be considered objects, which are newly produced or purchased, as well as economic expenditures intended to reproduce used fixed assets or create new fixed assets (Zepeda, 2001). There are three types of reproduction of fixed assets: simple - made by the replacement of the investments financed from depreciation fund focused on the replacement of used means of production for new ones of the same kind; extended - implemented by net investment to increase the number, value, and generation capacity of fixed assets in comparison with an initial state, and narrowed reproduction aimed at decreasing the fixed assets when investments do not cover the consumption of these fixed assets (Kowalski and Oczki, 1996). In recent years the issue has been addressed by Demchuk, Khalatur, and Khidiryan (2017), Aleskerowa and Fedorshyna (2018), and Yatsukh (2018).

Additionally, there are several studies, especially in Russian, dealing with the financial factors determining the investment level of agricultural enterprises depending on their direction of production. According to Klepacki (2007), implemented investments facilitate the growth of production and services and improve the economic situation of the rural population. They also foster the modernization of agriculture and reflect its level of modernity. Musiał and Otoliński (2009) emphasize that the level of implemented investments is crucial to maintain the permanent competitive advantage and decrease the distance from the other sections of the economy in terms of modern technological solutions or organization of production. The gradual growth of investment in agriculture has been observed in recent years, contributing to the increase of self-sufficiency of agricultural enterprises and enhancement of competition in food markets (Massot, 2016).

At the same time, it is worth paying attention to factors shaping the investment activity of agricultural enterprises. They may be divided into exogenic and endogenic factors (Byerlee and Halter, 1974; Kowalski and Rembisz, 2003). Exogenic factors include demand for goods and services, supply conditions, domestic and global economic situation, geographical and socio-demographic situation, state policy, inflation level, interest rates level, degree of openness of the economy, and technological progress (Thijssen, 1996; Towarnicka, 2004; Różański, 2006, Henzel, 2016). On the other hand, endogenic factors relate to the production potential of agriculture. They include the level of production of agricultural enterprises, the level of modernity of fixed assets, and a possibility to finance investment from their funds.

The central aspect of investments implementation is their financing sources. The primary source of financing agricultural enterprises is their equity. The increase of

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income fosters the growth of investment expenditures. Thus, this element is an essential determinant of investment implementation. The external sources of financing speed up structural changes leading, on the one hand, to the improvement of the competitive position of agricultural enterprises, and on the other enabling them to implement new concepts. However, the low creditworthiness of farmers or the preferences of using internal sources of financing cause difficulties in using outside funds (Latruffe, 2005). The structure of financing agricultural enterprises developing in such a way significantly contributes to farmers' investment decisions.

The issues of investments in agriculture have been frequently analyzed in the studies and have a vibrant tradition- the fundamental aspect connected with the investment in finance. Agricultural enterprises display a great tendency to self-financing of investment undertakings. According to the available research findings, it results from the specific nature of their activities, farmers' risk aversion, and credit constraints (Bierlen *et al.,* 1988; Petrick, 2005; Zinych and Odening, 2009). It enhances the importance of savings gathered by agricultural enterprises.

However, it should be emphasized that saving is possible if an agricultural enterprise achieves higher income in the given period than the expenditures it incurs. Swinnen and Gow (1999) drew some interesting conclusions, underlining the role of external financing sources in agricultural enterprises. They claim that larger agricultural enterprises have greater possibilities to use external sources, significantly fostering their development. On the other hand, Barry and others (2000) state that one of the most critical factors determining investment potential is capital procurement costs.

Gallerani *et al.* (2008) analyzed the research findings to indicate factors influencing agricultural enterprises' investment behavior. The authors assumed that the main factors deciding about the implementation of investment include: the characteristics of the agricultural enterprise, the market the enterprise functions on, public policy, and the characteristics of the household. On the other hand, Mikołajczyk (2009) observed that investment expenditures depend on the level of income and the economic size of the enterprise. In the studies conducted by Winters and others (2009), the relations between investment and capital have been shown, indicating that they depend on agriculture support instruments. O'Toole and others (2011) emphasize the significant role of investment in improving agricultural enterprises' competitiveness, productivity, production capacity, and profitability. Equally interesting studies analyzing the determinants of investment intentions of the European Union farmers were performed by Lefebvre and others (2014). The authors claimed that over 60% of the surveyed farmers from the Czech Republic, Germany, Spain, France, Italy, and Poland were planning to invest in 2014-2020.

On the other hand, Wu *et al.* (2014) underlined the significance of demographic issues indicating that older farm enterprises have lower risk acceptance. Therefore, they are more conservative in making the decisions concerning the implementation of the investment. In recent years further studies, substantially contributing to the

investment-related issues, have been published. One of the studies by Firlej indicates that investment expenditures incurred during the production of food products and beverages and in the case of agriculture have similar sizes compared to the other branches of production (Firlej, 2017). At the same time, the author emphasized that their values remained stable in the years 2005-2014. Equally exciting conclusions can be found in the studies by Ferto *et al.* (2020). The authors stated that gross investments are connected with the gross agricultural investments of the previous year, growth in sales, and subsidies to public investment.

Investments implemented in agricultural enterprises are connected with diversified capital requirements in particular types of agricultural production. It results from the need to equip them with appropriate machines and facilities necessary for production in specific conditions. Considering the importance of investment for the growth of agriculture, it is crucial to check the diversification of their level in the individual types of agricultural enterprises. Thus, the study's main aim is to analyze dependencies between the direction of production of the European Union agricultural enterprises and the level of investment in the years 2005-2018. The following hypothesis was assumed: the level of investment of agricultural enterprises is highly diversified depending on their direction of production, which influences them. The additional aim is to draw attention to the most critical issues reflecting the significance of finances in investment decisions in agricultural enterprises.

2. Research Methodology

The study covers all the European Union member countries. The research period was limited to 2005-2018 due to restrictions on access to statistical data. In order to present directions of production, the data relating to eight types of farming listed in the FADN database were used (FADN, 2021). The following types of agricultural enterprises were identified: field crops (1); granivores (2); horticulture (3); milk (4); mixed (5); grazing livestock (6); other permanent crops (7); wine (8).

The study focuses on two kinds of agricultural enterprises investments:
- gross investments (SE516), that is, the value of purchased and produced fixed assets decreased by the values of sold and disposed of free of charge fixed assets in a financial year + difference in livestock value,
- net investment (SE521) is gross investment decreased by depreciation value calculated for a fiscal year.

Conducting the studies exclusively on gross investments may pose problems, as gross investments include depreciation, so they are not the reliable source of information on changes in the agricultural enterprises' capital. Therefore, the analysis of net investment data is also necessary. At the same time, it is worth emphasizing that net investments are a significant source of knowledge development capability. The relatively high level of this measure remaining on the equal level indicates continued

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implementation of extended reproduction, the systematic increase of productive potential, and possibilities to implement innovations (Sobczyński, 2008).

The one-factor analysis of variance ANOVA has been used to achieve the research objective. The ANOVA is a method that detects the differences between averages in several populations (Aczel and Sounderpandian, 2011). Thus, the ANOVA is used to analyze measurable observations depending on one or several factors; simultaneously, it explains if they cause differences between group averages. The ANOVA examines the hypothesis of equal averages, i.e.:

$$H_0: m_1 = m_2 = \ldots = m_k$$
$$H_1: m_i \neq m_j \; for \; some \; i \neq \text{j.} \qquad (1)$$

The test statistics answer how much results from the acting of the factor and how much from the randomness of phenomena. The statistic has a distribution F with $k-1$ and $n-k$ degrees of freedom, where k is the number of degrees of the analyzed factor and n is a sample size. To verify the hypothesis of equal averages, the variance analysis table should be completed (Table 1).

Table 1. *Variance analysis table (single classification)*

Source of variation	Degrees of freedom	Sum of squares	Mean square	Test statistics
between groups (objects)	k - 1	$SSA = \sum_{i=1}^{k} (\bar{X}_i - \bar{X})^2 \, n_i$	$MSA = \dfrac{SSA}{k-1}$	$F = \dfrac{MSA}{MSE}$
within groups (error)	n - k	$SSE = \sum_{i=1}^{k} \sum_{j=1}^{n_i} (X_{ij} - \bar{X}_i)^2$	$MSE = \dfrac{SSE}{n-k}$	
total	n - 1	$SSA = SSA + SSE$	$MST = \dfrac{SST}{n-1}$	

Source: *Own study based on Górecki, 2011.*

When conducting the study by the ANOVA method, several assumptions should be taken into account (Rabiej, 2012; Baum, 2006; Nirmal Ravi Kumar, 2020):
- the independence of random variables in the analysed populations (groups),
- the measurability of analysed variables,
- the normal distribution of variables in each population (group),
- the uniformity of variables in all populations (groups).

The assumption of normal distribution of variables in each population (group) was conducted by means of the Anderson-Darling test, which proposes two opposing statistical hypotheses (Anderson and Darling, 1962):
H0: the distribution of data is consistent with normal distribution,
H1: the distribution of data is not consistent with normal distribution.

To check if there is a reason to reject the zero-hypothesis p-value is used. When the p-value is lower than the accepted level of test significance 0,05, there is no reason to reject the zero hypotheses of normal distribution of the analyzed characteristics. The studies of the uniformity of variables in all populations (groups) were conducted using the Bartlett test, which compares the weighted arithmetic mean of variance with the geometric mean of variance (Stanisz, 2007; Washington and Karlaftis, 2003). It is based on the statistics with asymptotic distribution χ^2.

If any of these assumptions are not met, the Kruskal-Wallis non-parametric test should be used. The interpretation of the test may be like the parametric one-way ANOVA with the difference that the test indicates the equality of average ranks, not average values. To identify dependencies between the production direction of the European Union agricultural enterprises and the particular types of investment, the following hypotheses were formulating:

H0(i): The distribution of the value of the achieved value i- the type of investment of the European Union agricultural enterprise in every direction of production of these enterprises is the same (the direction of production of the European Union agricultural enterprises has no significant influence on the achieved value of i- a type of investment of these enterprises),

H1(i): At least two directions of production of the European Union agricultural enterprises differ in terms of the value of i- a type of investment of these enterprises from the others (the direction of production of the European Union agricultural enterprises has a significant influence on the achieved value of i- a type of investment of these enterprises).

The last stage involved identifying if there is an impact of production direction on the investment level. It also tried to answer the fundamental question of how the particular directions of production of agricultural enterprises influence the level of the given type of investment.

3. Results and Discussion

In the first stage of the study, the financial data of particular types of investment were examined. The detailed results are presented in Table 2. Considering the average value of the investment during the analyzed period, the highest level of investment may be observed in the agricultural enterprises specializing in agricultural raw materials of animal origin. Both in the gross and net investments, the highest average level was noted as follows: granivores (27144.43 euros for gross investment and 4849.86 euros for net investment) and milk (18539.79 euros for gross investment and 4594.07 euros for net investment). Additionally, in gross investment, the relatively high average level of investment is in horticulture (13890.79 euros). The lowest values were observed for other permanent crops (2762.29 euros). A slightly different situation is in the case of net investment.

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Negative figures were noted in three agricultural enterprises, horticulture, other permanent crops, and wine. Ivanovic and others made a similar analysis of the net and gross investments (2020). They indicated that in Bulgaria, Croatia, Romania, Serbia, and Hungary, net and gross investment levels are much higher in plant production farms than in mixed farms.

**Table 2.** *Basic data of dependent variables in individual groups*

Dependent variable: Gross Investment						
Types of agricultural enterprises	Average	Median	Min	Max	Kurtosis	Skewness
1	9547.64	9587.0	7532	12302	-0.63	0.42
2	27144.43	26437.0	17054	39604	-1.30	0.28
3	13890.79	12869.5	10518	18606	-1.21	0.51
4	18539.79	18233.5	14002	26205	0.98	0.96
5	6472.14	6584.0	4562	10299	0.71	0.87
6	7808.14	7528.5	6259	11125	0.46	1.25
7	2762.29	2816.5	1716	4411	-1.21	0.36
8	8664.00	7918.5	5238	12498	-1.18	0.35
Dependent variable: Net Investment						
Types of agricultural enterprises	Average	Median	Min	Max	Kurtosis	Skewness
1	401.86	329.0	-1336	3418	0.76	0.83
2	4849.86	4376.5	1914	8654	-1.21	0.54
3	-711.00	-1172.5	-3406	4113	-0.95	0.67
4	4594.07	4642.0	1003	6989	-0.45	-0.32
5	173.14	142.00	-534	1689	0.56	0.97
6	256.71	219.5	-533	2268	2.49	1.54
7	-1616.21	-1682.5	-2173	-783	-0.62	0.54
8	-1132.64	-1594.5	-4662	2113	-1.23	0.01

Source: *Own study.*

It should also be emphasized that the average levels of individual types of investments let us initially reject the zero hypothesis in most cases. Moreover, based on the observations of kurtosis and obliquity, it can be stated that there may be problems with the normality of distribution in some cases of investment. To confirm the initial assumptions, the box-and-whisker plots were created (Figure. 1).

To check the normality of the distribution of the dependent variable in the analyzed groups, the Anderson-Darling test was conducted. In both cases of investments of the European Union agricultural enterprises p-value is lower than the accepted materiality level by 5% (Table 3). Therefore, it should be concluded that normal distribution is not present in any of these groups. For verification of the uniformity of variance, the Bartlett test was performed. The results are presented in Table 4. The obtained p-value is lower than the accepted materiality level (5%). It was thus recognized that the uniformity of variance is not present in any investments of the European Union agricultural enterprises.

Figure 1. *Box-and-Whisker plot illustrating the relationship between the direction of production of the European Union agricultural enterprises and individual dependent variables.*
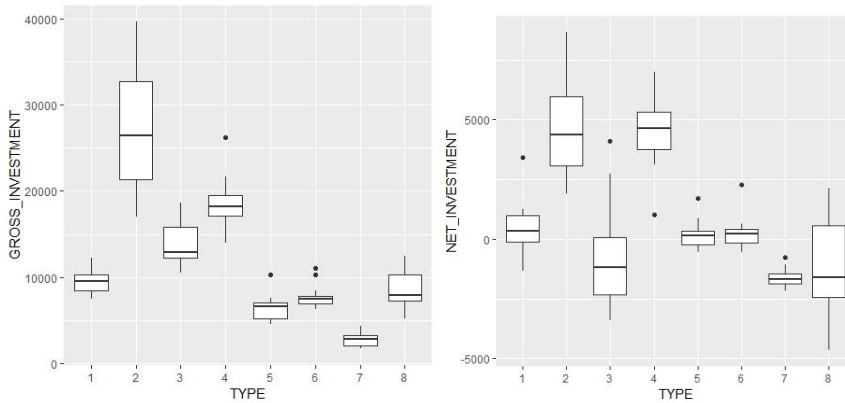
Source: Own study.

Table 3. *Results of the Anderson-Darling test for individual dependent variables*

Types of agricultural enterprises	Dependent variable: Gross Investment		Dependent variable: Net Investment	
	Test statistics A	p-value	Test statistics A	p-value
1	0.246	0.703	0.411	0.296
2	0.364	0.387	0.548	0.129
3	0.487	0.188	0.576	0.111
4	0.608	0.091	0.257	0.664
5	0.522	0.151	0.452	0.232
6	1.001	0.008	0.796	0.029
7	0.398	0.319	0.278	0.594
8	0.376	0.361	0.234	0.748

Source: Own study.

Table 4. *Bartlett test results for individual dependent variables*

Dependent variable: Gross Investment	
K-squared	p-value
82.816	3.667e-15
Dependent variable: Net Investment	
K-squared	p-value
61.671	6.995e-11

Source: Own study.

Based on the conducted Anderson-Darling and Bartlett tests, it should be stated that in each dependent variable's case, the ANOVA tests' assumptions were not fulfilled. Consequently, the non-parametric Kruskal-Wallis test was used to further research dependencies between the direction of production of the European Union agricultural

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enterprises and individual dependent variables. The results of the Kruskal-Wallis rank ANOVA test for individual dependent variables are presented in Table 5.

Table 5. *Results of the Kruskal-Wallis rank ANOVA test for individual dependent variables*

Dependent variable: Gross Investment	
Chi-squared	p-value
99.755	< 2.2e-16
Dependent variable: Net Investment	
Chi-squared	p-value
73.800	2.512e-13

Source: *Own study.*

The achieved values indicate that at the materiality level of 5% individual zero hypotheses, which indicate that the distribution of investment level of the European Union agricultural enterprises in every direction of their production is the same, should be rejected for the alternative hypothesis. According to the alternative hypothesis, at least two production directions differ in terms of the investment level from the others.

The obtained results allow us to conclude that the directions of production of the European Union agricultural enterprises cause significant differences in the values of investment level of these enterprises, thus gross investment, and net investment. The achieved results are consistent with the studies by Gallerani *et al.* (2008), Viaggio *et al.* (2011) and Mustafakulov (2017), which emphasize the importance of the direction of production of farms in the investment decisions made. However, the existing literature does not present a detailed differentiation of the level of investment in individual types of farms, in line with the FADN methodology.

To identify the reasons for significant differences in the direction of production of the European Union agricultural enterprises and the values of individual explanatory variables, a multiple comparison test was used (Table 6).

Table 6. *Dunn test results with Bonferroni correction*

Types of agricultural enterprises	Dependent variable: Gross Investment						
	1	2	3	4	5	6	7
2	0.002*[1]	-	-	-	-	-	-
3	1.000	0.478	-	-	-	-	-
4	0.062	1.000	1.000	-	-	-	-
5	0.256	0.000*	0.001*	0.000*	-	-	-
6	1.000	0.000*	0.030	0.001*	1.000	-	-
7	0.001*	0.000*	0.000*	0.000*	1.000	0.105	-
8	1.000	0.001*	0.180	0.005*	1.000	1.000	0.016*
	Dependent variable: Net Investment						

Types of agricultural enterprises	1	2	3	4	5	6	7
2	0.023*	-	-	-	-	-	-
3	0.870	0.000*	-	-	-	-	-
4	0.019*	1.000	0.000*	-	-	-	-
5	1.000	0.006*	1.000	0.005*	-	-	-
6	1.000	0.010*	1.000	0.008*	1.000	-	-
7	0.028	0.000*	1.000	0.000*	0.093	0.059	-
8	0.788	0.000*	1.000	0.000*	1.000	1.000	1.000
*[1] - statistically significant differences							

Source: *Own study.*

The Dunn test results with Bonferroni correction show that significant differences in both analyzed types of investments of agricultural enterprises were observed in the granivores agricultural enterprises with the enterprises of production direction: field crops, mixed, grazing livestock, other permanent crops, and wine. Additionally, in the case of gross investment, significant differences are present in the agricultural enterprises specializing in field crops with the type of grazing livestock, the other permanent crops enterprises with the production direction: horticulture and wine, and the horticulture enterprises with the mixed type. When considering a net investment, significant differences are visible in the agricultural enterprises specializing in milk with the type of field crops and horticulture and the granivores enterprises with the type of horticulture. At the same time, it should be emphasized that the significant differences of individual types of investments are not observed in every type of agricultural production. This situation occurs in the case of the agricultural enterprises specializing in field crops with the type: horticulture, mixed, grazing livestock and wine, the granivores enterprises with the type of milk, the horticulture enterprises with the grazing livestock and wine as well as the agricultural enterprises specializing in mixed production with the type: grazing livestock, other permanent crops, and wine and grazing livestock with the type of other permanent crops and wine.

The conducted studies reveal the inhomogeneity of the undertaken investment activities by the individual agricultural enterprises. It is a critical issue because the investment support in the agricultural sector enhances development possibilities and is a chance to avoid a slowdown of the undertaken reforms. The intensive investment activities in the enterprises enable further improvements of production, which is closely connected with the use of fixed assets. Simultaneously, it may impact the improvement of competitiveness of the types of agricultural production whose level of development is currently insufficient.

4. Conclusions

Taking into consideration the diagnosis of existing theoretical viewpoints on the financial factors of the investment level depending on the direction of production of

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the European Union agricultural enterprises and the conducted empirical studies, the following conclusions and recommendations should be stated:

- The investment activities of agricultural enterprises result from their market activity and modernization of their assets. Decisions made by enterprises depend on their financial resources and have a significant impact on their development opportunities. The growth of owned fixed assets or the improvement of their quality may substantially contribute to the increase of the production potential of agricultural enterprises involved in plant production and animal production.
- The results of the studies proved that the directions of production of the European Union agricultural enterprises influence their level of investment. The most significant differences in the investment level were observed between the agricultural enterprises of the type of granivores and milk and the enterprises specializing in plant production. Fewer significant differences were observed in the agricultural enterprises specializing in the exact source of food. It should be emphasized that significant differences in gross investments and net investments have similar results.
- The studies also confirmed the different levels of investment depending on the directions of production. It may be considered in the aspect of specific machines and equipment needed to conduct activities. A substantially higher level of investment was noticed in the agricultural enterprises involved in animal production, especially in granivores and milk.
- It is recommended to conduct more studies on the topic, most of all in-depth research of the specific investment directions in individual agricultural enterprises. It would allow a comprehensive comparative study of the different types of investments incurred by the individual types of agricultural enterprises.

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