

INFLUENCE OF THE PRODUCTION DIRECTION OF EUROPEAN UNION FARMS ON THE LEVEL OF FINANCIAL LIABILITIES

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Purpose: The main purpose of the study was to investigate the relationship between the direction of production of farms in the European Union and the level of their liabilities.

Design/methodology/approach: The study period includes the years 2005-2019. Data relating to eight types of farming identified in the FADN database were used to illustrate the directions of production. The conducted research focuses on the following types of liabilities: total, incurred for a period longer than one year and incurred for a period of less than one year with outstanding cash payments. One-way ANOVA variance was used to achieve the research objective.

Findings: The conducted research showed that the most common differences in the level of liabilities are between the type of granivores and the types of farms focused on plant production and other permanent crops with farms focused on field crops, horticulture and livestock production. Relatively few differences can be observed in the case of farms targeting the same source of food origin (except for other permanent crops).

Originality/value: The obtained results indicate a significant differentiation in the level of liabilities in farms focused on plant and livestock production, which results from the different specificity of their production.

Keywords: agriculture, plant production, livestock production, FADN, analysis of variance.

Category of the paper: Research paper.

1. Introduction

The use of external financing sources by farms is an important factor in the development of production and property security. This is due to the necessity of their functioning in an increasingly competitive agricultural market, including among the constantly changing prices for agricultural raw materials or the necessary resources used during production.

The existing uncertainty of sales as well as relatively long production cycles may make it necessary to use various forms of financial support to an increasing extent.

The access of farms to sources of financing varies, due to the profile of agricultural activity, adopted goals, strategies, economic results, etc. (Stryckova, 2015). The investment decisions made by farms are based primarily on equity. This is due to the limited access to foreign capital. As noted by Barry et al. (2000) financing of agriculture on preferential terms is important due to the relatively high share of small farms and the capital intensity of this sector. The high level of self-financing also results from the high asymmetry of information (Ma and Tian, 2006; Posey and Reichert, 2011), farmers' aversion to debt (Kata, 2010; Gałecka and Pyra, 2016), or high investment risk (Swinnen and Gow, 1999). However, as noted by Azhagaiah and Gavoury (2011), farms should to some extent use both equity and foreign capital, as this is the best choice. Proper use of external sources of financing agricultural activity may contribute to an increase in the production potential, work efficiency, or to the improvement of the achieved competitive position. At the same time, it should be noted that the level of indebtedness of farms is influenced by many internal and external factors. As Daniłowska (2005) notes, the interest of farmers in external financial sources is influenced by the level, structure and terms of loan repayment, which are the result of the impact of these factors.

The diversified structure of financing farms necessitates the examination of the level of their liabilities and the analysis of their diversification in accordance with the adopted criteria. The legitimacy of undertaking this type of research results from the necessity to analyze empirical data from the micro-, meso- or macroeconomic point of view. These tests are possible, among others thanks to the implementation of the FADN database, which allows to select a representative sample according to the criterion of the type of farming, which indicates the production attitude of farms (Goraj et al., 2006). The research carried out on such a sample of farms allows for the formulation of conclusions that relate to the entire population of farms.

Topics related to the level of using external financing sources by farms is a frequently undertaken issue. They dealt with, inter alia, Diederer et al. (2003) and van der Meulen et al. (2016), pointing out that farmers with higher indebtedness can be expected to adapt innovations earlier by using foreign capital, or Ganderton et al. (2000) and Sherrick et al. (2004) presenting that farms with high debt more often adopt a risk management strategy. The available research results also allow to state that farmers are reluctant to use external sources of financing, which is mainly the result of the specificity of their activities, farmers' aversion to risk, and credit limitations (Bierlen et al., 1988; Petrick, 2005; Zinych and Odening, 2009). A significant part of the work also relates to the study of the financial situation of farms, where one of the examined indicators is the level of debt (Burja and Burja, 2010; Grzelak, 2014).

These studies do not show the analysis of the relationships between the type of production of farms and the level of debt. There are also no studies undertaken in this area, which are based on the use of tools for the analysis of variance. Therefore, the main goal of the study was to study the relationship between the production direction of European Union farms and the level

of their debt. In addition, the results achieved are to show how the production direction of European Union farms affects the level of liabilities of farms.

2. Research methodology

The study covers all the European Union member countries. The research period was limited to the years 2005-2019. In order to illustrate the production direction of farms, the data relating to eight types of farming identified in the FADN database were used. The following types of farms have been distinguished:

- field crops (A),
- horticulture (B),
- wine (C),
- other permanent crops (D),
- milk (E),
- grazing livestock (F),
- granivores (G),
- mixed (H).

The research undertaken focuses on 3 types of outstanding debts: (1) total liabilities (1) and two variables that it comprises, i.e. liabilities incurred for a period longer than one year (2) and liabilities incurred for a period shorter than one year with any outstanding cash payments (3). In the FADN database, these variables are characterized by the following symbols: SE485, SE490 and SE495.

The one-factor analysis of variance ANOVA has been used to achieve the research objective. According to the definition, the ANOVA is a method that detects the differences between averages in several populations (Aczel and Sounderpandian, 2018). Thus, the ANOVA is used to analyse measurable observations depending on one or several factors, at the same time it explains if they cause differences between group averages. The ANOVA examines the hypothesis of equal averages, i.e.:

$$H_0: m_1 = m_2 = \dots = m_k$$
$$H_1: m_i \neq m_j \text{ for some } i \neq j$$

The test statistics give the answer to the question 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 analysed factor and n is a sample size.

An important aspect of conducting research using the ANOVA method is taking into account a number of assumptions (Stanisz, 2007):

1. the independence of random variables in the analysed populations (groups),
2. the measurability of analysed variables,
3. the normal distribution of variables in each population (group),
4. 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, 1952). The null hypothesis is that the data distribution follows the normal distribution, and the alternative hypothesis is that the data distribution does not follow the normal distribution.

In order to check if there is a reason to reject the zero hypothesis p value is used. When p value is lower than the accepted level of test significance 0,05, there is no reason to reject the zero hypothesis of normal distribution of the analysed characteristics.

The studies of the uniformity of variables in all populations (groups) was conducted by means of the Bartlett test, which compares the weighted arithmetic mean of variance with the geometric mean of variance. It is based on the statistics with asymptotic distribution χ^2 .

If any of these assumptions is not met, the Kruskal-Wallis non-parametric test should be used. The interpretation of the test may be similar to the parametric one-way ANOVA with the difference that the test indicates the equality of average ranks, not average values.

To identify particular dependencies between the production direction of the European Union agricultural enterprises and the particular types of liabilities, the following hypotheses were formulating:

$H_{0(i)}$: the distribution of value of the achieved value i- type of liabilities incurred by farms of the European Union 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- type of liabilities of these enterprises),

$H_{1(i)}$: at least two directions of production of the European Union agricultural enterprises differ in terms of the value of i- type of liabilities of these enterprises from the others (the direction of production of the European Union agricultural enterprises has significant influence on the achieved value of i- type of liabilities of these enterprises).

3. The study results

In the first stage of the research, the basic statistics of the adopted dependent variables were examined. The results are presented in table 1.

Table 1.
Basic data of dependent variables in individual groups

Dependent variable: Total liabilities						
Types of agricultural enterprises	Average	Median	Min	Max	Kurtosis	Skewness
A	45145.33	44154	34548	56525	-0.81	0.26
B	93402.40	94971	78430	103530	-0.74	-0.59
C	44531.20	41965	37534	56184	-1.38	0.53
D	7643.40	8518	4469	10381	-1.73	-0.25
E	103500.27	101217	64055	156365	-0.19	0.62
F	34229.00	32248	29085	43760	-1.03	0.57
G	223982.73	255739	130593	323763	-1.59	-0.15
H	31648.13	31598	20233	47738	-0.35	0.62
Dependent variable: Long & medium-term loans						
Types of agricultural enterprises	Average	Median	Min	Max	Kurtosis	Skewness
A	33165.67	32966	24079	41581	-0.97	-0.08
B	69803.13	70923	58759	78221	-1.01	-0.44
C	24693.07	23154	21252	31611	-1.11	0.75
D	5767.47	6585	3241	7962	-1.70	-0.29
E	87012.47	86329	52525	130754	-0.35	0.50
F	25953.93	24133	22165	33688	-0.90	0.67
G	180787.87	209901	104944	256643	-1.59	-0.26
H	22876.33	22996	14349	33967	-0.24	0.58
Dependent variable: Short-terms loans						
Types of agricultural enterprises	Average	Median	Min	Max	Kurtosis	Skewness
A	11979.40	11628	10469	15204	0.09	1.13
B	23599.13	23300	19670	29397	-0.57	0.62
C	19838.20	19886	15593	25329	-1.52	0.22
D	1876.00	1917	1228	2680	-1.45	0.22
E	16487.67	16093	11530	25611	0.39	1.10
F	8275.27	7928	6920	10072	-1.51	0.34
G	43194.53	45838	24835	69735	-1.47	0.27
H	8771.87	8602	5884	13771	-0.69	0.62

Source: own study.

In the case of the total amount of liabilities, the lowest level was characteristic for farms such as: other permanent crops, mixed and grazing livestock. The highest level of liabilities was recorded in the case of: granivores, milk and horticulture. The lowest average values of long-term liabilities – as in the case of the total amount of liabilities – occurred in farms of the type: other permanent crops, grazing livestock and mixed, while the highest were in the type: milk, horticulture and field crops. Slightly different values were observed for short-term liabilities. The lowest level was recorded for farms focused on the production of other permanent crops, granivores and mixed, and the highest: granivores, horticulture and wine.

The obtained results of the average levels of individual variables allow for the initial rejection of the null hypothesis in most cases. Moreover, on the basis of the observations of kurtosis and obliquity it can be stated that in some cases of investment there may be problems with the normality of distribution.

To confirm the initial assumptions the box-and-whisker plots were created (figure 1).

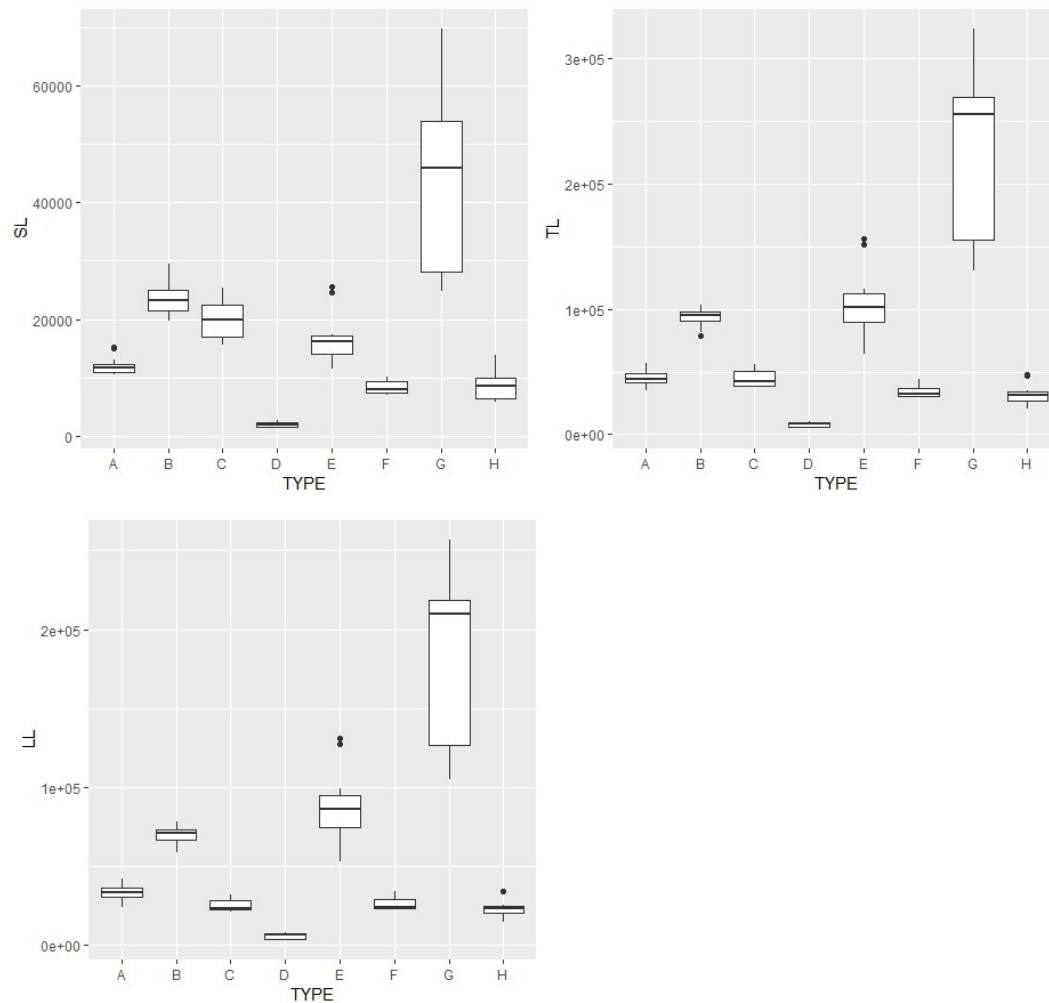


Figure 1. Box-and-whisker plot illustrating the relationship between the direction of production of the European Union agricultural enterprises and individual types of liabilities. Source: own study.

In order to check the normality of distribution of dependent variable in the analysed groups the Anderson-Darling test was conducted. The obtained results indicate that in each of the groups of the analyzed liabilities of European Union farms there is a p-value below 5% (table 2). This means that in each of the studied groups there is no normal distribution.

Table 2.

Results of the Anderson-Darling test for individual dependent variables

Types of agricultural enterprises	Dependent variable: Total liabilities		Dependent variable: Long & medium-term loans		Dependent variable: Short-terms loans	
	Test statistics A	p-value	Test statistics A	p-value	Test statistics A	p-value
A	0.210	0.827	0.179	0.900	0.928	0.014
B	0.329	0.475	0.380	0.357	0.349	0.426
C	0.721	0.047	1.145	0.004	0.371	0.376
D	0.723	0.046	0.766	0.036	0.334	0.464
E	0.503	0.172	0.419	0.285	0.974	0.010
F	0.536	0.141	0.636	0.078	0.522	0.154
G	0.585	0.107	0.684	0.059	0.473	0.207
H	0.487	0.190	0.553	0.127	0.495	0.181

Source: own study.

For the purpose of verification the uniformity of variance, the Bartlett test was performed (table 3). The obtained results allow to conclude that there is no homogeneity of variance in any of the groups of the level of liabilities of European Union farms. This is evidenced by the obtained p-value, where each of them is less than 5%.

Table 3.
Bartlett test results for individual dependent variables

Dependent variable: Total liabilities	
K-squared	p-value
236.240	< 2.2e-16
Dependent variable: Long & medium-term loans	
K-squared	p-value
245.920	< 2.2e-16
Dependent variable: Short-terms loans	
K-squared	p-value
201.080	< 2.2e-16

Source: own study.

On the basis of the conducted Anderson-Darling and Bartlett tests it should be stated that in the case of each dependent variable the assumptions of the ANOVA tests were not fulfilled. Consequently, the non-parametric Kruskal-Wallis test was used in further research on dependencies between the direction of production of the European Union agricultural enterprises and individual dependent variables. The results of the Kruskal-Wallis rank ANOVA test for individual dependent variables are presented in table 4.

The values obtained in the Kruskal-Wallis test allow for the conclusion that at the significance level of 5%, individual null hypotheses should be rejected, which indicate that the distribution of the level of liabilities of farms in each production direction of these farms is the same in favor of the alternative hypothesis, according to which at least two lines of production differ in terms of the level of liabilities from the others. This makes it possible to conclude that the production directions of farms in the European Union countries significantly differentiate the level of liabilities.

Table 4.
Results of the Kruskal-Wallis rank ANOVA test for individual dependent variables

Dependent variable: Total liabilities	
Chi-squared	p-value
109.44	< 2.2e-16
Dependent variable: Long & medium-term loans	
Chi-squared	p-value
108.27	< 2.2e-16
Dependent variable: Short-terms loans	
Chi-squared	p-value
110.46	< 2.2e-16

Source: own study.

In order to identify the reasons of 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 5).

Table 5.
Dunn test results with Bonferroni correction

		Dependent variable: Total liabilities						
Types of agricultural enterprises	A	B	C	D	E	F	G	
B	0.292	-	-	-	-	-	-	
C	1.000	0.205	-	-	-	-	-	
D	0.001* ¹	0.000*	0.002*	-	-	-	-	
E	0.088	1.000	0.058	0.000*	-	-	-	
F	0.884	0.000*	1.000	0.457	0.000*	-	-	
G	0.000*	0.766	0.000*	0.000*	1.000	0.000*	-	
H	0.412	0.000*	0.569	0.971	0.000*	1.000	0.000*	
		Dependent variable: Long & medium-term loans						
Types of agricultural enterprises	A	B	C	D	E	F	G	
B	1.000	-	-	-	-	-	-	
C	0.630	0.002*	-	-	-	-	-	
D	0.000*	0.000*	0.241	-	-	-	-	
E	0.177	1.000	0.000*	0.000*	-	-	-	
F	1.000	0.018*	1.000	0.046	0.001*	-	-	
G	0.002*	0.534	0.000*	0.000*	1.000	0.000*	-	
H	0.310	0.001*	1.000	0.501	0.000*	1.000	0.000*	
		Dependent variable: Short-terms loans						
Types of agricultural enterprises	A	B	C	D	E	F	G	
B	0.015*	-	-	-	-	-	-	
C	0.242	1.000	-	-	-	-	-	
D	0.006*	0.000*	0.000*	-	-	-	-	
E	1.000	1.000	1.000	0.000*	-	-	-	
F	1.000	0.000*	0.001*	1.000	0.017*	-	-	
G	0.000*	1.000	0.287	0.000*	0.018*	0.000*	-	
H	1.000	0.000*	0.001*	0.682	0.036	1.000	0.000*	

*¹ - statistically significant differences

Source: own study.

The obtained results of Dunn's test with Bonferroni's correction indicate that significant differences in all types of liabilities occur in the case of farms focused on other permanent crops with farms such as: field crops, horticulture and milk, granivores with farms focused on field crops, other permanent crops, grazing livestock and mixed, the type of horticulture with the type granivores and mixed, as well as farms with the production direction of grazing livestock with the milk type. Significant differences also occur in individual cases of the analyzed variables. This is the case between wine farms with farms focused on other permanent crops, horticulture, milk, grazing livestock, granivores and mixed, such as milk with the granivores and mixed type, and field crops with the horticulture type. The obtained results are consistent with the research by Bratek and Praulins (2009), who showed that farms in Poland and Latvia use differently from foreign capital in various types of activity conducted by these farms.

At the same time, it should be emphasized that significant differences are not observable in every type of agricultural production. Such a situation occurs in the case of farms dedicated to field crops with the type of wine, milk, grazing livestock and mixed, farms oriented towards horticulture with the type of milk and granivores, the type of other permanent crops with the type of grazing livestock and mixed, as well as the type of grazing livestock with mixed type.

4. The final conclusions

The conducted research showed that the most common differences in the level of liabilities are between the type of granivores and the types of farms focused on plant production and permanent crops with farms focused on field crops, horticulture and livestock production. Relatively few differences can be observed in the case of farms targeting the same source of food origin (except for other permanent crops).

In the generic structure of the level of liabilities, their highest level (total, short-term and long-term) was recorded for farms such as granivores, milk and horticulture. On the other hand, the lowest values are found mainly in mixed farms and farms characterized by other permanent crops. At the same time, a great similarity is observed in the structure of the level of total liabilities and liabilities with a long maturity period. Thus, the obtained results indicate a significant differentiation in the level of liabilities in farms focused on plant and animal production, which results from the different specificity of their production.

At the same time, it should be noted that the research in this topic should be additionally extended. It is recommended to indicate the reasons for the differentiation in the level of liabilities of individual farms, as well as to conduct a comprehensive financial analysis of the level of indebtedness of farms. This would allow to show even more the role of obligations in the functioning of farms in the European Union.

Acknowledgements

The publication was financed from the subsidy granted to the University of Economics in Krakow. The POTENCJAŁ programme No. 13/EER/2020/POT.

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