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JOANNA ŚREDZIŃSKA

Poznań University of Life Sciences, Poland

DETERMINANTS OF THE FINANCIAL SITUATION OF FARMS IN EUROPEAN UNION COUNTRIES GROUPED BY ECONOMIC SIZE[1]

Key words: financial situation, farms, economic size, CEE, EU-15, multiple regression, FADN

ABSTRACT. The main purpose of this paper was to identify the determinants of the financial situation of farms of different economic size in CEE and EU-15 countries. The FADN database served as the basic source of data. The study covered farms located in FADN regions in the period 2014-2016. The analyses focused on the determinants of the farms' financial situation measured with a synthetic indicator. The first step of the research procedure was the construction of the synthetic indicator of the financial condition of farms. Following this, the calculated values of the synthetic characteristic were used as explained variables in multiple regression models. The study suggests that the production potential and operating subsidies have a key impact on the financial standing of EU farms. As regards the production potential of CEE farms, it would be beneficial for their financial position to reduce their labor input. In turn, a reduction in the assets-to-land ratio would have a favorable impact on the financial situation of operators based in the EU-15. This could be indicative of overinvestment in these farms. Differences were observed in ratios of productive input and in production intensity between economic size classes; this suggests that it would be reasonable for farms of different classes to implement different farming strategies. The models developed in this study revealed that the use efficiency of productive input (measured with income performance) proved to be of relatively minor importance.

INTRODUCTION

Socioeconomic development and accelerating integration and globalization processes result in an increased number of links between countries and regions and between economic operators (including farms) based there. As a consequence, there are many factors that impact economic phenomena and processes, including the operational efficiency of different entities [Kisielińska, Stańko 2009, p. 63]. Because the surroundings keep evolving, there is a continuous need to repeat the research on certain phenomena. Therefore, although numerous analyses of the financial situation of farms are available, it is reasonable to keep investigating this topic. This paper also fills a gap in this respect by addressing the issue of the financial situation defined synthetically, which is a new approach. The

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determinants of different components of the financial position can generally be divided into exogenous and endogenous factors. This paper mostly takes account of endogenous factors because many authors believe them to be more important as they are controlled by the producer [Rembisz 2006, p. 15, Gołębiewska 2008, p. 91]. Another reason for focusing on endogenous factors was data availability. However, due to the highly important role of Common Agricultural Policy (CAP) instruments, operating subsidies are also covered by this study. While their impact on the financial standing of farms is unquestionable, it is not always clearly positive. Some authors claim that adequate CAP reforms need to be adopted to reduce the importance of subsidies because European Union (EU) agriculture seems to be dominated by excessive capitalization [Petrick, Kloss 2012, p. 13, Guan et al. 2009, p. 765]. The determinants of financial situation components were reviewed in detail in a paper by Joanna Średzińska and Walenty Poczta [2012]. It could be enhanced with other studies in this field[2]. Farm income and its determinants differ in economic size function [Ryś-Jurek 2019, p. 406, Hill, Bradley 2015, p. 353]. Hence, it can be presumed that differences also exist between the determinants of the farms' financial standing. Similarly, differences can be observed between the situation of old and new EU member states [Runowski 2015, s. 235-236, Kryszak and Matuszczak 2019, p. 208], and therefore the study focused separately on the EU-15 and Central and Eastern European (CEE) countries. Thus, the main purpose of this paper was to identify the determinants of the financial situation of farms of different economic size in CEE and EU-15 countries.

MATERIAL AND METHODS OF STUDIES

The FADN (Farm Accountancy Data Network) database served as the basic source of data. The study focused on farms of different economic size[3]. The analysis was carried out for all FADN regions in UE countries (except for Malta and Cyprus, because of the marginal importance of agriculture), taking into account the division into CEE and EU-15 groups. The study period was 2014-2016 (the average level for these years is calculated in Table 1. The concept referred to as object-years was used in the analysis of regression). Data from a three-year period were used purposefully in order to eliminate, at least partially, the impact of random production and price fluctuations (and related income volatility) resulting from agriculture being vulnerable to weather and other exogenous factors. This also allowed to increase the number of cases in the multiple regression models[4]. The analysis focused on the determinants of the financial situation of farms surveyed (expressed synthetically). A similar survey had already been conducted for 2005-2007 (Cf.

[2] Including Brent Gloy et al. [2002], Danuta Zawadzka et al. [2011], Alfred Nzabakenga et al. [2013], Tomasz Felczak [2014], Jayson Beckman and David Schimmelpfennig [2015], Andrzej Czyżewski et al. [2018], Roma Ryś-Jurek [2019], Łukasz Kryszak and Anna Matuszczak [2019].

[3] Small farms: 2,000 ≤ EUR < 25,000; medium farms: 25,000 ≤ EUR < 100,000; large farms: EUR ≥ 100,000.

[4] Another reason why a greater number of cases could be covered is that data were retrieved at a FADN region level rather than at a FADN country level.

Joanna Średzińska and Walenty Poczta [2012]), making it possible to identify changes in the phenomenon covered by this analysis[5].

To meet the objective defined above, the study relied on a synthetic indicator of the farms' financial situation. The synthetic characteristic was built as follows: selecting a set of simple characteristics; normalizing the simple characteristics; and calculating the value of the synthetic characteristic. The set of simple characteristics consisted of selected indicators of: the capacity to pay; financial assistance; debt sustainability; operational efficiency; profitability; and income[6]. The above were selected based on substantive and statistical grounds[7]. The set of simple characteristics was reduced from 19 to 12-13, depending on economic size class. Eventually, the value of the synthetic characteristic was generally determined (depending on the group of farms studied) on the basis of the following simple characteristics: income, quick ratio, share of working capital, debt ratio, structure of debt, lending capacity, asset productivity (or fixed asset productivity), current asset productivity, turnover of liabilities, turnover of stock, profitability (or profitability of sales), profitability of equity. Following this, the impact of simple characteristics was determined; the indicators of liquidity, indebtedness (and its structure), outstanding days payable and days sales of inventory were found to have a neutral effect; other variables were determined to have a stimulating effect. Unitarization was chosen among normalization procedures. The value of the synthetic characteristic was determined without making a reference to an ideal solution [Wysocki, Lira 2005, p. 177-178].

Once calculated, the values of the synthetic characteristic were used as explained variables in multiple regression models (based on the backward stepwise regression method). The following were set as explanatory variables: characteristics of production potential and its use efficiency; production intensity; production scale; marketability of production; costs of external input; and subsidies. The independent variables were verified in substantive and statistical terms. Redundant variables were eliminated based on the value of coefficients of correlation[8]. Outliers were removed from the dataset based on Cook's distance and Mahalanobis' distance. In the case of FADN, average group levels are considered, and therefore the model's parameters were estimated using the weighted least squares method. The resulting models were verified in substantive and statistical terms. The statistical significance of the model was verified with the F test. The t test was used to check the significance of the model's parameters. The distribution of residuals was assessed using the normality plot of residuals and the Shapiro-Wilk normality test. The values of regression coefficients were not interpreted because they differed in measurement units. However,

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5 However, caution should be exercised in this respect because gross margin was replaced by standard output as the basic parameter for farm classification in the FADN.

6 For a detailed set of simple characteristics together with calculation formulas and other methodological information, see [Średzińska, Poczta 2012].

7 The characteristics with a coefficient of variation below 30% and characteristics with corresponding diagonal entries of the inverse matrix greater than 10 were removed [Wysocki, Lira 2005, p. 51, 175].

8 A statistically significant correlation of 0.7 was set as the threshold (cf. Joanna Kisielińska [2008, p. 163]), although, in general, the correlation coefficient was significantly lower than the level adopted. The set of independent variables was admittedly extensive, but, due to the elimination of excess variables, it was eventually limited to less than half of their original number.

β coefficients (normalized parameters of the regression equation) were introduced [Stanisz 2007, p. 43-45, 101-102, Poczta-Wajda 2010, p. 20, 27-28]. The adjusted coefficient of determination was used to assess the model's goodness of fit. This procedure is recommended for use in multiple regression models [Kot et al. 2007, p. 326-327].

RESULTS OF THE STUDY

Table 1 summarizes the average values of characteristics identified as potential determinants of the farms' financial situation and used in the regression models developed in this study. Obviously, the characteristics differ in value depending on the economic size of farms. Certain patterns can be observed in countries grouped as EU-15 and CEE. Note that as regards the availability of land and capital, small farms located in the EU-15 reported higher average ratios. However, when it comes to large farms, CEE countries demonstrated a better performance. In the study period, labor input was higher in new member states irrespective of the economic size of farms. These patterns are the consequence of many factors, including historical events. After World War 2, most CEE countries covered by this study experienced collectivization processes resulting in the emergence of large-scale agricultural holdings. The current condition and structure of agriculture in these countries also largely depend on ownership transformation procedures adopted afterwards [Poczta et al. 2008, p. 42, Zawalińska et al. 2015, p. 347, Janiszewska, Ossowska 2014, p. 44]. The situation is different with regard to relationships between productive input: in the study periods, most ratios were higher in EU-15 countries. For instance, in old member countries, the assets-to-labor ratio was above EUR 200,000 per full-time employee (FTE) in each economic size class. In corresponding groups of CEE farms, that index was several times lower. A similar situation takes place when it comes to the assets-to-land ratio which was in excess of EUR 10,000 per hectare in each class of the first group. Production intensity, measured with fixed and current assets consumption, was considerably higher in the EU-15 than in CEE countries, too. The underlying reason for the above could also be the historical differences between the country groups considered. In the era of centrally planned economies, quantitative objectives prevailed over efficiency goals in CEE countries. These priorities were realigned only after the socioeconomic transformation [Podstawka 1999, p. 5, Baer-Nawrocka, Kiryluk 2006, p. 44-45]. Conversely, the market orientation of Western European agriculture often resulted in concentration processes [Poczta et al. 2008, p. 42]. Operating subsidies are an important co-determinant of the farms' financial situation, and are largely related to the area of agricultural land owned. Note also the differences in costs of external input: due to a high contribution of hired labor in the mix of labor input, a higher share of such costs could be observed in medium and large farms located in CEE countries. In this context, the differences in income performance are another interesting observation. In all farm groups surveyed, labor productivity (measured as net value added per FTE) was higher in old Union farms (from EUR 12,600 to EUR 43,200 per AWU). In turn, CEE countries reported higher profitability levels of own labor input in medium and large farms. This was a consequence of the large contribution of hired labor, as mentioned earlier. This conclusion is corroborated, for instance, by land profitability ratios, which were several times higher in the EU-15 than in CEE countries.

Table 1. Potential determinants of the financial situation of CEE and EU-15 farms in 2014-2016 grouped by economic size (average figures per farm)

Specification	Symbol	CEE			UE-15		
		small	medium	large	small	medium	large
Utilized agricultural area [ha]	X_1	12.7	61.2	674.0	17.6	47.6	144.8
Total labor input [AWU*]	X_2	1.3	2.4	14.9	1.0	1.4	4.5
Total value of assets less the value of land, permanent crops and production quotas [EUR thous.]	X_3	35.8	130.6	1,463.5	80.7	176.1	852.9
Assets-to-labor ratio [EUR thous./AWU]	X_4	45.5	74.7	99.0	204.1	265.8	297.3
Assets-to-land ratio [EUR thousand/ha]	X_5	5.8	4.0	2.6	16.3	10.8	11.4
Utilized agricultural area per FTE [ha/AWU]	X_6	10.3	27.8	52.9	18.9	36.1	38.9
Current assets per hectare [EUR/ha]	X_7	710.2	687.1	918.1	1,183.0	1,434.9	3,456.8
Fixed assets per hectare [EUR/ha]	X_8	206.3	181.3	166.1	384.2	319.5	541.0
Total output [EUR thous.]	X_9	12.5	59.1	887.6	24.6	68.0	512.6
Marketable output [%]	X_{10}	82.9	86.0	92.6	94.6	93.5	95.2
Share of external input in costs [%]	X_{11}	11.4	16.2	22.0	13.2	14.2	19.4
Operating subsidies [EUR thous.]	X_{12}	3.7	17.2	162.9	6.6	17.7	57.4
Net value added per FTE [EUR thous./AWU]	X_{13}	4.8	13.3	26.7	12.6	20.9	43.2
Family farming income per full-time family employee [EUR thous./FWU**]	X_{14}	4.8	19.4	507.3	11.2	18.2	60.4
Land profitability [EUR/ha]	X_{15}	484.2	423.8	312.5	1,157.1	916.9	1381.3
Profitability of current assets used	X_{16}	0.7	0.7	0.4	1.1	0.6	0.4
Profitability of fixed assets used	X_{17}	3.7	4.1	2.7	3.8	3.3	3.5

* AWU (Annual Work Unit) is equivalent to 2120 working hours per year [IERiGŻ-PIB 2016, p. 4, 7]

** FWU (Family Work Unit) is equivalent to 2120 working hours of a family member per year [IERiGŻ-PIB 2016, p. 4, 7]

Source: own study based on [FADN 2018]

Table 2. Significant regression coefficients* for the variable defined as the financial situation of farms in CEE and EU-15 countries in 2014-2016 grouped by economic size

Specification	Symbol	CEE			UE-15		
		small	medium	large	small	medium	large
Utilized agricultural area [ha]	X_1						
Total labor input [AWU]	X_2	-0.0686	-0.0315	-	-	-0.2550	-
Total value of assets less the value of land, permanent crops and production quotas [EUR thous.]	X_3	-	-0.6512	-	-0.5529	-0.4939	-
Assets-to-labor ratio [EUR thousand/AWU]	X_4	-	-	-0.4589	0.0524	0.0164	-0,.391
Assets-to-land ratio [EUR thousand/ha]	X_5	-	-	-	-0.5103	-0.4221	-
Utilized agricultural area per FTE [ha/AWU]	X_6	-	-	0.0796	-	-	0,.030
Current assets per hectare [EUR/ha]	X_7	0.1211	-0.2249	-0.3852	0.8755	0.4480	-0.9314
Fixed assets per hectare [EUR/ha]	X_8	-0.4715	-	-	-	-	1.1050
Total output [EUR thous.]	X_9	-	-	-	-	-	0.2291
Marketable output [%]	X_{10}		0.2872	0.2892	-	0.1734	0.2373
Share of external input in costs [%]	X_{11}	-	-0.1616	-0.3706	-	-0.1667	-
Operating subsidies [EUR thous.]	X_{12}	0.5585	0.0437	0.4851	0.4633	0.2408	-
Net value added per FTE [EUR thous./AWU]	X_{13}	0.0874	-	-	-	-	0.0141
Family farming income per full-time family employee [EUR thous./FWU]	X_{14}	-	-	-	0.0254	-	-
Land profitability [EUR/ha]	X_{15}	-	-	-	-	-	-
Profitability of current assets used	X_{16}	-	-	-	-	-	-
Profitability of fixed assets used	X_{17}	-	-	-	-	-	-
Adjusted coefficient of determination		0.5021	0.5448	0.5242	0.5190	0.3766	0.4593
Number of observations		139	160	139	122	512	477
SW-W and p [normality of the distribution of residuals]		0.9847 0.1319	0.9891 0.2634	0.9837 0.1374	0.9936 0.9123	0.9938 0.0596	0.9980 0.8618

* β coefficients for statistically significant variables at p = 0.05
Source: own study based on [FADN 2018]

The next step of the research procedure consisted of building multiple regression models. The results are presented in Table 2. None of the models built included the area of agricultural land. However, that variable was often correlated with operating subsidies which, in turn, were covered by nearly all of the models built. Moreover, the importance of that variable's impact on the financial situation of farms in the groups surveyed was also reflected by the (usually) relatively high values of β coefficients. Hence, subsidies may be concluded to be among the key determinants of a farm's financial standing[9]. This is corroborated in research by Roma Ryś-Jurek [2019, p. 409] and by Łukasz Kryszak and Anna Matuszczak [2019, p. 208][10] who analyzed the determinants of agricultural income as a major element that reflects the financial standing of farms. Negative β coefficients for labor input suggest that it would be reasonable for small and medium CEE farms (as well as medium EU-15 farms) to reduce the input in order to improve their financial situation. In turn, small and medium EU-15 farms would benefit from reducing the assets-to-land ratio, which is evidenced by negative and relatively high values of β coefficients. This could be indicative of overinvestment in these farms. Conversely, the assets-to-labor ratio was a driver of improvements in the financial standing of these groups. However, in relative terms, this variable seems to be of minor importance as the value of the corresponding β coefficients did not even exceed 0.1. Note that in both groups of countries, it was found that it would be reasonable for large farms to reduce their assets-to-labor ratios. At the same time, the area of agricultural land per FTE had a positive impact on the situation of these farms. The research also revealed the following pattern: generally, the larger the economic size of a farm, the more reasonable it is to reduce the use of current assets per hectare. What also needs to be emphasized is the positive impact of marketable output on the financial condition of medium and large farms in both groups of countries. In turn, the share of external input in costs had a negative effect on the farms' situation, which was particularly noticeable in CEE. Based on these findings, it may be also concluded that production efficiency (measured with income performance) had a relatively minor impact on the farms' financial standing compared to production potential and subsidies. Some of these characteristics were not covered by any of the models built, while the ones included in selected models exhibited low values of β coefficients.

SUMMARY

The study suggests that the production potential and operating subsidies have a key impact on the financial standing of EU farms. Certain patterns can be identified regarding the production potential. It seems that in order to improve their financial position, CEE farms should preferably reduce their labor input. This confirms the general opinion that many new EU members use excessive amounts of labor. In turn, a reduction in the assets-to-land ratio would have a favorable impact on the financial situation of operators

[9] Their presence in most models could also indirectly suggest that the area of agricultural land plays an important role.

[10] In the study by Roma Ryś-Jurek, farms were grouped into classes by economic size, whereas Łukasz Kryszak and Anna Matuszczak divided the countries into old and new EU members.

based in the EU-15. This could be indicative of overinvestment in these farms. Undoubtedly, CAP instruments (represented by operating subsidies in this study) are an important factor in improving the financial position of EU farms. That variable was included in most models, usually with a relatively high β coefficient. Differences were observed in ratios of productive input and in production intensity (measured with the consumption of fixed and current assets per hectare) between economic size classes; this suggests that it would be reasonable for farms of different classes to implement different farming strategies. Interestingly, the models developed in this study revealed that the use efficiency of productive input (measured with income performance) proved to be of relatively minor importance. Usually, it was reflected by variables not included in the models. If covered by the models, they had low values of β coefficients suggesting a relatively minor importance[11]. Note that as regards medium and large farms, the models better explained the variation in the phenomenon considered for the EU-15 than for CEE countries. This was true for all groups surveyed in a similar study carried out for the period 2005-2007. It can be presumed that in the EU-15, factors not included in this analysis have a greater impact on the financial situation. Furthermore, the difference in the coefficients of determination between CEE and EU-15 countries in 2014-2016 is not as large as in the previous study period. This could suggest that other factors have grown in importance in CEE countries after several years of EU membership. The analyses carried out in this study form a part of a broader framework; it is necessary to conduct subsequent analyses in countries grouped by other criteria. While some of these findings need to be interpreted with extreme caution, they provide a starting point for further research.

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[11] However, the interpretation must be careful here – perhaps taking into account other production efficiency indicators would lead to different results.

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DETERMINANTY SYTUACJI FINANSOWEJ GOSPODARSTW ROLNYCH KRAJÓW UNII EUROPEJSKIEJ WEDŁUG WIELKOŚCI EKONOMICZNEJ

Słowa kluczowe: sytuacja finansowa, gospodarstwa rolne, wielkość ekonomiczna, EŚW, UE-15, regresja wieloraka, FADN

ABSTRAKT

Głównym celem pracy jest określenie czynników determinujących sytuację finansową gospodarstw rolnych o różnej wielkości ekonomicznej w krajach Europy Środkowo-Wschodniej i UE-15. Podstawowym źródłem danych była baza FADN. Badaniami objęto gospodarstwa rolne z regionów FADN w latach 2014-2016. Przedmiot analiz stanowiły determinanty syntetycznie mierzonej sytuacji finansowej gospodarstw. W pierwszym etapie badań skonstruowano syntetyczny miernik kondycji finansowej gospodarstw rolnych. Następnie wyznaczone wartości cechy syntetycznej wykorzystano jako zmienne objaśniane w modelach regresji wielorakiej. Przeprowadzone badania wskazują na kluczowe znaczenie potencjału produkcyjnego oraz dopłat do działalności operacyjnej w kształtowaniu kondycji finansowej gospodarstw rolnych w UE. W zakresie potencjału wytwórczego w gospodarstwach krajów EŚW dla poprawy ich pozycji finansowej korzystne byłoby zmniejszenie nakładów pracy. Z kolei na sytuację finansową podmiotów w krajach UE-15 korzystnie mogłoby wpłynąć zmniejszenie uzbrojenia ziemi. Wskazywać to może na problem przeinwestowania w tych gospodarstwach. Zaobserwowano różnice między klasami wielkości ekonomicznej w zakresie relacji między czynnikami produkcji oraz intensywności wytwarzania, co świadczy o zasadności stosowania odmiennych strategii gospodarowania przez gospodarstwa z różnych klas. W skonstruowanych modelach stosunkowo mało ważna okazała się efektywność wykorzystania czynników wytwórczych mierzona wynikami dochodowymi.

AUTHOR

JOANNA ŚREDZIŃSKA, PHD
ORCID: 0000-0002-1189-8456
Poznań University of Life Sciences
Faculty of Economics and Social Sciences
Department of Economics and Economic Policies for the Agribusiness
28 Wojska Polskiego St., 60-637 Poznań, Poland