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ECONOMIC VIABILITY OF DAIRY FARMS IN SELECTED EUROPEAN UNION COUNTRIES

Key words: family farm, income, opportunity costs, unpaid labour, own capital, development

ABSTRACT. The aim of the study was to assess the economic viability of farms specializing in dairy cattle breeding in countries with the highest share of milk production in the EU. Viability was measured using two models based on the opportunity cost of unpaid labour and equity. The study used a comparative analysis of farm viability indicators calculated on the basis of data collected in the FADN system in 2008-2017, taking changes in income in the short and long term into account. The research indicates that farms with greater economic potential were characterized by higher economic viability. Italian and Polish farms with an economic size of EUR 100,000-500,000 were considered viable and developing, as well as Italian and German farms from the group of over EUR 500,000. British and French farms were characterized by a lack of viability. The results were largely influenced by differences in the level of average wages in the national economy of the analysed countries, inputs of unpaid labour and the level and volatility of income.

INTRODUCTION

The production of cow's milk in Europe is concentrated in seven countries, which supply the market with more than two-thirds of this raw material (68.5%). These countries include: Germany, France, Great Britain, the Netherlands, Poland and Italy [Eurostat 2018]. However, farms specializing in milk production in their area vary greatly in production scale and production intensity [Poczta et al. 2020] and differ in owned resources [Guth, Smędzik-Ambroży 2020]. The opening of the European dairy sector to world markets as a result of consecutive CAP reforms makes milk prices in the EU more vulnerable to changes in international prices. This exposes farmers to greater competition and makes them more directly dependant on world market movements and the development of trade [Augère-Granier 2018]. The EU internal market may also be a challenge, as production in the EU is expected to grow more slowly than the world average until 2028, as only a small part of production will be exported and the increase in domestic demand will be insignificant [OECD 2019]. Changes taking place on the EU and global milk market directly affect the economic result of farms, their ability to compete and, consequently, also their development. Income resilience and sustainability are key issues for the economic

viability of European dairy farms. It is a condition for the functioning of farms in the long term [Goraj 2006].

The concept of economic viability is defined ambiguously. American and Canadian researchers analyse viability in the context of income needs of a farming family, while in European studies, viability is a measure of the opportunity cost [Spicka et al. 2019, Zorn et al. 2018]some financial ratios (Return on Assets – ROA and assets turnover. Two main views emerge from the large number of different approaches to vitality. In the first, it is defined as the ability for a farm to survive, while in the second, emphasis is placed on its development. In this study, the economic viability of a farm is understood as the ability to survive, live and develop thanks to the use of available resources [Savickiene et al. 2016]. It depends on the level of income, but also on their fluctuations and the level of leverage, i.e. the ability to raise capital for investments [Vrolijk et al. 2010].

The aim of the study was to assess the economic viability of farms specializing in dairy cattle breeding in countries with the highest share in milk production in the EU in selected economic size classes. The research measured viability on the basis of the valuation of opportunity costs of unpaid labour and equity. The applied approach allowed for the assessment of viability in the short and long term.

MATERIAL AND RESEARCH METHODS

The viability assessment was made on the basis of two modified farm viability models used in the study by Cathal O'Donoghue et al. [2016]. The first model was based on the opportunity costs of unpaid farm labour and family farm income. If the farm is unable to cover the wages of the family workforce, then it is recommended that the farmer devotes his time to other activities. In the case of the valuation of unpaid labour, scientific research usually adopts one of the three levels of wages: the minimum wage, the average wage in agriculture or the average wage in the national economy [Ryan et al. 2016, Buckley et al. 2016, Esteves et al. 2017, Lynch et al. 2019]. This has a major impact on the results of the analyses. The viability of farms, determined on the basis of the minimum wage, leads to an overestimation of the number of viable entities in countries where wages are low, because it translates into lower opportunity costs of work [O'Donoghue et al. 2016]. When using the minimum wage, there is also a problem concerning whether or not profitable farms really have a chance for development and whether the minimum wage is sufficient to support the farmer's family [Benidir et al. 2013]. On the other hand, the adoption of the average wage in agriculture in the opportunity cost calculation does not reflect the idea of choosing the best variant in the decision-making process [Spicka et al. 2019]. In the study, to evaluate the opportunity costs of work, the average gross wage in the national economy of a given country, published by the OECD, was used. In the first model, a farm that meets the following condition was considered viable:

$$\frac{FFI}{IUL} > GRE$$

where: *FFI* – family farm income, *IUL* – input of unpaid labour (h/year), *GRE* – gross remuneration in the national economy per hour of work.

According to Cathal O'Donoghue et al. [2016], the farm's ability to cover the opportunity costs of own capital helps to ensure that farmers can continue to invest in their farming activity. Failure to cover this cost may indicate that the farming activity is a way of life, not a profitable activity. In the second model, viable and capable farms were those that achieved an income exceeding the fee for family labour and the opportunity cost of own capital, meeting the following condition:

$$\frac{FFI - COC}{IUL} > GRE$$

where: *FFI* – income from a family farm, *COC* – opportunity cost of own capital, *IUL* – input of unpaid labour (h/year), *GRE* – gross remuneration in the national economy per hour of work.

The opportunity cost of own capital was determined similarly to the research by Hans Vrolijk et al. [2010], for own assets (total assets – total liabilities). Its valuation was based on internet rates on long-term government bonds [ECB 2020] published by the European Central Bank, for euro area Member States and non-euro States.

The viability of farms is related to the possibility of achieving a certain standard of living of the farmer and his family, which is why it is so important to maintain a profitable farm in the long term, i.e. one that is resistant to income fluctuations. Short-term profitability relates to a period of one year, while long-term profitability is determined on the basis of a 3-year moving average of income from a family farm [Barnes et al. 2015, Vrolijk et al. 2010]. The study takes viability in the perspective of an annual and average three-year level of family farm income into account. In the long-term approach, it is assumed that short-term declines in income may be compensated for by their increases in subsequent periods. This enables the stable development of farms.

Research shows that in the assessment of the viability of farms, increasing influence is exerted by unpaid costs of own labour, and the importance of opportunity costs of equity capital involved in agricultural production is decreasing. This is mainly due to an increase in average wages in the economies of the analysed countries and the downward trend in the interest rate on long-term government bonds in the analysed period (Figure 1). Despite the large diversity of the above values in the analysed countries, their change trends were similar. In 2017, the salary level was on average 13% higher than in 2008, and the increase ranged from 7% in Great Britain to 23% in Germany. At the same time, the interest rate on long-term government bonds decreased on average by more than a quarter, with the highest decrease in Germany amounting to 0.32% and the lowest in Poland amounting to 3.4% in 2017.

A comparative analysis of the economic viability of dairy farms was carried out on the basis of data collected in the Farm Accountancy Data Network (FADN) system, published in annual standard reports. Farms were selected for the study according to the SE6 classification of type 45 – dairy cattle. The research period covered the years 2008-2017. The research covered average results for groups of farms from countries with the highest share in milk production in the EU, i.e. Germany (DEU), France (FRA), Italy (ITA), the Netherlands (NED), Poland (POL) and Great Britain (UK). The total purchase of milk in these countries accounted for over 2/3 of the purchase in the EU. The

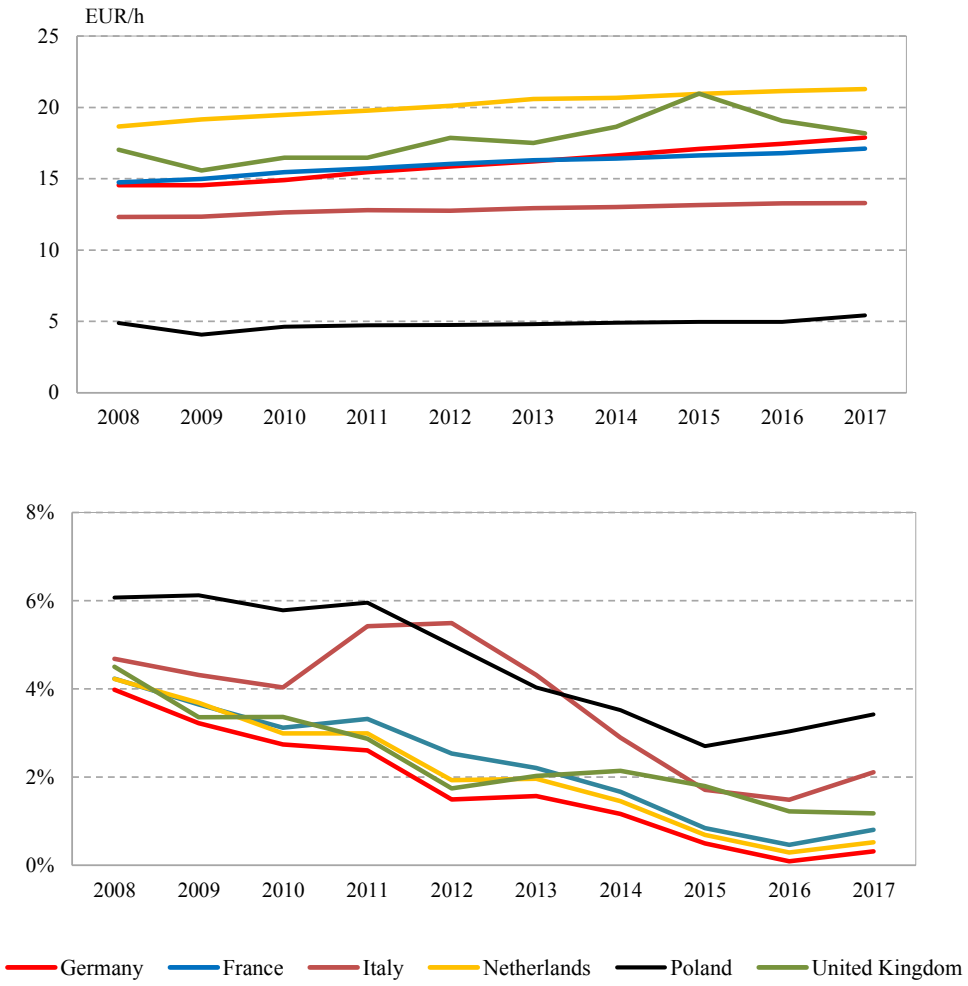

Figure 1. Evolution of the average gross salary in the economy and the interest rate on long-term government bonds

Source: own study based on OECD, ECB

Table 1. Average values of selected components of economic viability of farms in the analysed countries in 2008-2017

Component	Germany	France	Italy	Netherlands	Poland	United Kingdom
FFI [EUR 1,000]	29.0	20.2	53.8	35.6	7.9	42.1
Assets [EUR 1,000]	827.7	423.2	1,010.6	2,753.2	198.1	1,694.6
Total liabilities [EUR 1,000]	171.1	187.9	14.1	887.7	11.3	257.6
Costs of own capital [EUR 1,000]	11.1	5.2	34.8	38.1	8.2	32.7
Unpaid labour input [h]	3,298	2,725	3,562	3,696	3,976	4,360
Share of paid labour in total labour input [%]	25	10	18	10	3	35
Annual average wage [EUR 1,000]	35.3	35.2	28.3	44.4	10.6	39.1

Source: FADN, OECD

comparisons covered farms with a similar production potential measured by economic size. The analysis was performed for those classes that were represented in at least three countries during the period under study. There were four classes of farms: medium-small from EUR 25 to 50 thousand, medium-large from EUR 50 to 100 thousand, large from EUR 100 to 500 thousand and very large above EUR 500 thousand (on a numerical scale of economic size from 3 to 6).

The compilation of the basic components of the economic viability of farms indicates large differences between countries (Table 1). The highest average income among the analysed countries was achieved by Italian farms and was not a result of the highest average total production, but low average total costs in relation to other countries. The lowest average income was achieved by Polish farms, mainly resulting from lower production volumes (Poland was represented in economic size classes from 3 to 5). The average total production of Polish farms was 6 to 12 times lower than in other countries. The costs of equity capital resulted, on the one hand, from the value of capital employed and, on the other hand, from the interest rate adopted for its valuation. The lowest opportunity costs of capital were recorded in the analysed period by French farms (the result of a relatively low value of assets and low interest rates on government bonds) and Polish farms (low value of capital employed, with relatively high bond interest rates). Average own labour inputs on farms were the lowest in France, while on British farms these inputs were the highest, as was the share of contract work in total labour inputs. There are large differences in average annual wages in countries, from EUR 10,600 in Poland up to EUR 44,400 in the Netherlands.

FINDINGS

SHORT-TERM VIABILITY OF DAIRY FARMS

Economic viability was more frequent in farms with a larger economic size (Table 2). Viability was not achieved in any of the analysed models in the analysed countries in medium-small farms (3). Farmers and their family members could achieve higher incomes by working outside the farm and investing equity in government bonds. In the higher economic classes of farms, Italian and Polish farms stood out as those with the highest vitality. On medium-large (4) and large (5) farms, Polish farms were the most viable. Income per unpaid employee significantly exceeded the average wages in the national economy. However, after taking the opportunity costs of equity in the second model into account, only farms with an economic size of EUR 100,000 to 500,000 were viable. Polish farms incurred the lowest opportunity costs, which resulted from a low level of remuneration in the national economy and the lowest value of equity capital engaged in farms among all analysed countries. Italian farms each year showed the highest viability in the group of farms with the highest production potential (6) and among all analysed economic size classes. In both models, farmer income exceeded the average wages of a given economy of a country several times, and additionally, the equity invested in the farm allowed for higher income than from the interest on long-term government bonds. The high viability of Italian farms resulted from the highest farm incomes and low wages compared to farms from other Western European countries.

The viability rates on German and Dutch farms were definitely lower than those of Polish and Italian entities and only in some periods did they reach a value greater than 1. In model 1, very large Dutch and German farms covered the costs of wages in most of the analysed years. However, covering the costs of equity capital in these farms was possible much less frequently. The Dutch economy offers high wages and a high value of equity capital invested in farms, additionally making it difficult to achieve economic viability.

British and French farms were the least viable among analysed farms. Only in a few analysed years and only in the classes with the largest economic size (large French farms and very large British farms) were they able to cover the average wages of unpaid labour. On British farms, it was a result of high labour inputs of unpaid labour, while French farms had the lowest labour inputs among the analysed countries, but their income was much lower than in other Western European countries. British farms did not reach a viability guaranteeing a higher return on equity of the farm than the interest rate on government bonds, and French farms did not reach viability in only three analysed years.

Table 2. Short-term viability of dairy farms in 2008-2017

Country	Model 1: level of GRE										Model 2: level of COC									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	(3) EUR 25,000 - < 50,000																			
Germany	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.3	0.4	0.5	-0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4
France	0.5	0.3	0.6	0.5	0.4	0.3	0.3	0.5	0.4	0.5	0.5	0.2	0.4	0.3	0.2	0.1	0.2	0.4	0.4	0.4
Italy	0.5	0.5	0.5	0.5	0.5	0.4	0.7	0.6	0.7	0.7	0.2	0.1	0.2	0.0	-0.2	-0.2	0.3	0.3	0.5	0.4
Poland	0.9	0.6	0.8	0.9	0.7	0.7	0.7	0.5	0.6	0.8	0.5	-0.1	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.5
	(4) EUR 50,000 - < 100,000																			
Germany	0.5	0.4	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.7	0.1	0.0	0.3	0.3	0.3	0.5	0.4	0.4	0.5	0.7
France	0.8	0.4	0.7	0.7	0.5	0.5	0.4	0.5	0.4	0.6	0.8	0.1	0.5	0.5	0.3	0.4	0.3	0.4	0.4	0.6
Italy	0.8	0.9	0.9	0.9	0.8	0.8	1.1	1.0	1.2	1.1	0.4	0.4	0.4	0.2	0.0	0.2	0.6	0.7	0.9	0.8
Poland	1.7	1.2	1.6	1.8	1.4	1.4	1.4	1.1	1.2	1.6	0.9	0.0	0.6	0.8	0.6	0.7	0.8	0.7	0.7	1.1
Great Britain	0.4	0.3	0.4	0.4	0.1	0.4	0.4	0.2	0.2	-	-0.1	-0.1	0.0	0.1	0.0	0.1	0.2	0.0	0.0	-
	(5) EUR 100,000 - < 500,000																			
Germany	0.7	0.7	1.1	1.0	0.9	1.2	0.8	0.6	0.8	1.2	0.2	0.3	0.7	0.7	0.7	1.0	0.6	0.5	0.8	1.2
France	1.0	0.4	1.1	1.2	0.9	0.9	0.8	0.7	0.6	1.1	1.0	0.2	0.9	1.0	0.7	0.7	0.7	0.6	0.5	1.0
Italy	2.1	2.1	2.2	2.2	2.0	2.0	2.9	2.4	2.4	2.5	1.2	1.3	1.5	0.9	0.8	1.0	2.2	1.9	2.0	1.8
Netherlands	0.7	0.1	0.8	0.9	0.7	1.0	0.7	0.5	0.3	1.0	-0.2	-0.8	0.0	0.1	0.2	0.5	0.4	0.3	0.3	0.9
Poland	3.2	2.3	3.0	3.5	2.6	3.0	2.9	2.2	2.3	3.4	1.4	0.2	1.3	1.7	1.2	1.8	1.9	1.4	1.5	2.5
Great Britain	0.5	0.4	0.5	0.6	0.4	0.6	0.5	0.2	0.2	0.5	-0.1	-0.1	0.0	0.2	0.1	0.2	0.1	-0.1	0.0	0.3
	(6) ≥ EUR 500,000																			
Germany	1.2	1.6	2.6	2.0	1.9	2.9	1.1	0.5	1.1	2.4	0.1	0.2	1.3	0.7	1.4	2.3	0.8	0.4	1.1	2.3
Italy	7.1	6.7	5.7	7.2	8.1	6.4	7.4	6.6	4.4	5.9	4.7	4.2	3.4	3.5	3.0	3.0	5.5	5.1	3.5	4.5
Netherlands	1.1	0.5	1.7	1.9	1.3	1.9	1.6	0.9	0.6	1.9	-0.3	-0.9	0.5	0.9	0.6	1.2	1.1	0.7	0.5	1.8
Great Britain	0.9	0.8	0.9	1.2	0.7	1.1	0.8	0.5	0.5	1.2	-0.2	0.0	0.1	0.4	0.3	0.6	0.3	0.0	0.2	0.8

Source: own compilation

Table 3. Long-term viability of dairy farms in 2008-2017

Country	Model 1: level of GRE								Model 2: level of COC							
	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017
	(3) EUR 25,000 - < 50,000															
Germany	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.3
France	0.4	0.5	0.5	0.4	0.2	0.4	0.5	0.4	0.3	0.3	0.3	0.3	0.1	0.3	0.4	0.4
Italy	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.2	0.0	-0.3	-0.1	0.1	0.3	0.4	0.3
Poland	0.8	0.7	0.8	0.8	0.7	0.6	0.6	0.6	0.2	0.1	0.4	0.4	0.3	0.4	0.3	0.3
	(4) EUR 50,000 - < 100,000															
Germany	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.2	0.2	0.4	0.4	0.4	0.5	0.5	0.5
France	0.6	0.6	0.6	0.6	0.3	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.5	0.5	0.5
Italy	0.9	0.8	0.9	0.9	1.0	0.9	1.0	1.1	0.4	0.2	0.0	0.2	0.5	0.6	0.8	0.7
Poland	1.4	1.4	1.6	1.5	1.4	1.3	1.2	1.2	0.4	0.4	0.8	0.9	0.8	0.9	0.7	0.7
Great Britain	0.4	0.4	0.3	0.3	0.3	0.3	0.2	-	0.0	0.0	0.1	0.0	0.1	0.1	0.1	-
	(5) EUR 100,000 - < 500,000															
Germany	0.8	1.0	1.0	1.0	0.9	0.8	0.7	0.9	0.5	0.6	0.8	0.8	0.7	0.7	0.7	0.8
France	0.8	0.9	1.0	1.0	0.8	0.9	0.8	0.8	0.6	0.7	0.8	0.8	0.7	0.8	0.7	0.8
Italy	2.0	2.0	2.1	2.1	2.4	2.6	2.7	2.3	1.2	0.7	0.9	1.1	1.7	2.1	2.3	1.7
Netherlands	0.5	0.6	0.7	0.8	0.8	0.7	0.5	0.6	-0.3	-0.2	0.3	0.3	0.5	0.6	0.4	0.5
Poland	2.5	2.7	3.1	3.0	2.8	2.7	2.5	2.5	0.8	0.9	1.7	1.9	1.8	1.9	1.7	1.6
Great Britain	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.0	0.0	0.2	0.2	0.0	0.1	0.1	0.1
	(6) ≥ EUR 500,000															
Germany	1.9	2.1	1.9	2.2	1.7	1.3	0.9	1.3	0.6	0.8	1.4	1.6	1.4	1.1	0.9	1,2
Italy	5.5	6.2	7.7	7.0	6.5	7.5	5.6	5.0	3.1	2.5	2.6	3.7	4.7	5.9	4.6	3,7
Netherlands	1.1	1.3	1.6	1.7	1.6	1.5	1.0	1.1	0.0	0.3	1.0	1.0	1.1	1.3	0.9	1,0
Great Britain	0.9	0.9	0.9	1.0	0.9	0.7	0.6	0.8	0.0	0.1	0.4	0.4	0.3	0.3	0.3	0,4

Source: own compilation

LONG-TERM VIABILITY OF FARMS

Long-term viability is essential for farm expansion. Maintaining it at a stable level allows for the implementation of long-term development plans. Medium-small farms (3) in all of the analysed countries (Table 3) did not have such opportunities, just as they did not reach short-term viability.

Farms with a higher production potential were characterized by a resistance to income fluctuations and the ability to cover the costs of family labour. In the group of very large farms (6), such viability was achieved by Italian, Dutch and German farms (excluding 2016). In the group of large farms (5), Polish and Italian farms were viable, and in the group of medium-large farms (4) only Polish farms were.

Covering the opportunity costs of equity in the long term posed a major challenge to farms. Only on very large Italian farms was income higher over the entire period of analysis than the benefits obtainable from the interest rate of equity capital at a level of government bonds. On German farms, the average level of income from the three-year periods did not ensure the long-term viability of farms until 2011 and in the period of 2014-2016.

CONCLUSIONS

Economic viability is an important determinant of farm development. The conducted research shows that, in leading countries in terms of milk production on the EU market, in the analysed period, it was not a parameter commonly characterizing dairy farms. Short-term and long-term viability was achieved more often on farms with greater production potential. Medium-small farms in the analysed countries should be included in the group of non-developing ones.

Italian and Polish farms were viable and able to develop in economic size classes 4-6. Income per employee was much higher than the average salary in the national economy and in classes 5-6 guaranteed meeting the opportunity costs of equity in most of the analysed years. The development of these farms in the perspective of long-term viability was fully achieved in the group of large farms from 2013 and very large Italian farms throughout the analysis period.

Research has shown that British and French farmers can achieve higher incomes by working off farms and investing capital at government bond rates. These farms can be included in the group of non-viable and non-developing farms.

On German and Dutch farms, viability rates were unstable. Income only achieved in very large farms allowed to reach a level of the average wage in the national economy. German farms could count on a higher return on capital than investments in government bonds. For Dutch entities, which had the highest equity invested in farms, viability was not achieved except for a few periods.

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ŻYWOTNOŚĆ EKONOMICZNA GOSPODARSTW MLECZNYCH W WYBRANYCH KRAJACH UNII EUROPEJSKIEJ

Słowa kluczowe: rodzinne gospodarstwo rolne, dochód, koszty alternatywne, nieopłacana siła robocza, kapitał własny, rozwój

ABSTRAKT

Celem badania była ocena żywotności ekonomicznej gospodarstw specjalizujących się w chowie bydła mlecznego w krajach o największym udziale w produkcji mleka, w Unii Euroejskiej. Pomiaru żywotności dokonano za pomocą dwóch modeli opartych na wycenie kosztów alternatywnych nieopłacanej siły roboczej oraz kapitału własnego. W badaniach zastosowano analizę porównawczą wskaźników żywotności gospodarstw, obliczonych na podstawie danych zgromadzonych w systemie FADN w latach 2008-2017, uwzględniając zmiany dochodów w krótkim i długim okresie. Badania wskazują, że wyższą żywotnością ekonomiczną charakteryzowały się gospodarstwa o większym potencjale ekonomicznym. Za żywotne i rozwojowe uznano gospodarstwa włoskie i polskie o wielkości ekonomicznej 100-500 tys. euro oraz bardzo duże gospodarstwa włoskie i niemieckie z grupy powyżej 500 tys. euro. Brakiem żywotności charakteryzowały się gospodarstwa brytyjskie i francuskie. Na uzyskane wyniki duży wpływ miały przede wszystkim różnice w poziomie średniego wynagrodzenia w gospodarce narodowej analizowanych państw, ale również nakłady pracy nieopłacanej siły roboczej oraz poziom i zmienność dochodów.

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