FACTORS INFLUENCING FARM PROFITABILITY IN THE REPUBLIC OF SERBIA

Veljko Vukoje[1], Aleksandar Miljatović[2], Dragana Tekić[3]

**Corresponding author E-mail: aleksandar.miljatovic@polj.uns.ac.rs*

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ABSTRACT

The paper deals with the production and economic indicators of farms in the Republic of Serbia based on data collected from the FADN sample for 2019. The aim of the research is to analyze and evaluate the influence of important factors on profitability of farms of different economic size. According to their economic size, farms are classified into four groups: very small, small-sized, mid-sized and large-sized farms. Factors influencing profitability are grouped into: production management, financial management, human resources management and subsidies and natural factors. The statistical technique used in the paper is a multiple regression model applied to determine statistically significant influence of certain factors on profitability. The results of the research show that equity turnover is the factor with the greatest positive impact on profitability of farms regardless of their economic size. Paid labour has the greatest negative impact on very small, small-sized and mid-sized farms. Further research should focus on analysis of the financial performance of small and medium farms which, based on the available capacities and income, are the main drivers of development of the entire agricultural sector.

Introduction

Over the following two to three decades, agriculture will be faced with a serious challenge to provide sufficient food for the projected 9.6 billion people on the planet in 2050 (FAO, 2014). Accordingly, there is a need for constant increase in agricultural production in all countries of the world. Increase in production must be accompanied

1 Veljko Vukoje, Ph.D., Full Professor, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Republic of Serbia. Phone: +381 21 48 53 397, E-mail: vukoje@polj.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-0801-9043)

2 Aleksandar Miljatović, MAgrEc, Teaching Assistant, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Republic of Serbia. Phone: +381 21 48 53 239, E-mail: aleksandar.miljatovic@polj.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-3978-5832)

3 Dragana Tekić, MAgrEc, Teaching Assistant, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Republic of Serbia. Phone: +381 21 48 53 380, E-mail: dragana.tekic@polj.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-1924-6196)

by appropriate increase in farm profitability so that farms have an interest to continue producing food for a constantly growing population.

Determining the level of farm profitability is very important also for assessing the economic viability of farms. This is because profitability indicators, together with the indicators of productivity, liquidity and stability, are the most commonly used indicators for assessment of economic viability of farms (Latruffe et al., 2016). In recent years, economic viability of farms has been extensively investigated by researchers across the European Union (EU). The focus of the research has been on small and medium farms, as they are considered to be the "engine of renovation" of the entire agricultural sector in one country (Galluzzo, 2017; Slavickienė & Savickienė, 2014).

Farm profitability can be measured using a number of different indicators, the most commonly used being ROA (Return on Assets) and ROE (Return on Equity). Spicka et al. (2019) recommend using the following indicators: ROE, Return on Invested Capital (ROIC) and Return on Sales (ROS). These authors consider ROA indicator as problematic because large agricultural holdings (AH)[4] in the Czech Republic have more than 80% of hired agricultural land. As this land is not included in the total assets of farms, and ROA is calculated as the ratio of net profit and total assets, the obtained results may significantly deviate from the real situation.

It is not easy to define the benchmark for profitability ratios, which thus also determine economic viability of farms. According to Scott (2001), if ROE indicator is higher than 0.05, and provided that other indicators are acceptable, farms are considered as economically viable. However, O'Donoghue et al. (2016) argue that in agriculture it is necessary to develop "more comprehensive and detailed measurement techniques to provide more clarity on viability and vulnerability levels in the sector". This is because there are a number of factors influencing profitability, which thus also influence economic viability of farms.

Therefore, it is necessary to consider the impact of different factors on farm profitability. DuPont model is a frequently used model, which breaks down ROE into three components – profitability, operating efficiency and financial leverage – so it is used to analyze the impact of profit margin, asset turnover and equity multiplier on ROE (Balezentis & Novickyte, 2018; Nehring et al., 2015). This analysis indicates the economic and financial performance of all economic entities, including AH.

Certainly, these are not the only factors influencing farm profitability. Gloy et al. (2002) group the determinants of profitability into: production management (farm size, efficiency and technology use), financial management (record-keeping practices, debt use, asset structure and rental practices), human resources management (number of operators, education level, age of farm manager). In addition, Kryszak et al. (2021) considered the impact of another group of factors on profitability – subsidies in agricultural policy. Hloušková & Lekešová (2020) and Hloušková et al. (2020) divided

4 Agricultural holding (AH) is used as a synonym for "farm" in the text.

the observed factors into the following groups: production factors (crop yield, livestock yield, etc.), economic factors (labour productivity, direct costs per unit, ROE), financial stability (liquidity ratio, debt to asset ratio, etc.) environmental factors (organic manure use, mineral fertilizers, crop protection, etc.) and social and other factors (gender, age of owner or farm manager, number of employees). Mishra et al. (1999) group the factors affecting profitability into four basic groups: operator characteristics (age of farm manager), farm characteristics (diversification of farm, crop insurance, type of business organization, etc.), management strategies (use of bookkeeping, ratio of variable and fixed costs of production to total value of production, etc.) and other factors.

For the purposes of the analysis, farms in this research are classified according to their economic size, reasonably assuming that there will be certain differences in profitability indicators between farms of different sizes. According to the current FADN regulations, the criterion for defining the economic size of farms is standard output (SO). SO value is obtained by multiplying the standard output coefficient by the area on which the observed crop is cultivated (for crop production), or with the number of heads of the observed livestock (for livestock production) (FADN Europe, 2021).

The main aim of this research is to analyze and evaluate the impact of important factors on profitability of farms of different economic size. The research is based on the FADN data from 2019 for the Republic of Serbia. The paper first provides a detailed description of the variables and the used method, followed by presentation of the obtained results, while the last section presents research conclusions and recommendations.

Materials and methods

The research deals with the general, production and economic indicators of agricultural holdings based on the FADN sample from 2019 for the Republic of Serbia. For the purposes of the analysis, farms are classified according to their economic size, i.e. according to their standard output value. Kryszak et al. (2021) classify farms into six groups of economic size, where farms with standard output value between EUR 2,000 and EUR 8,000 are classified as very small farms, while farms with SO value above EUR 500,000 are classified as very large farms. Miceikiene and Girdžiute (2016) divide farms into four groups: from very small farms (SO value between EUR 4,000 and EUR 8,000) to large-sized farms (SO value above EUR 100,000). Bearing in mind that farms in our country are specific and that there is a small number of very large farms in the population, farms are divided into four groups: very small farms (VS) with standard output value between EUR 4,000 and EUR 8,000; small-sized farms (SS) from EUR 8,001 to EUR 25,000; mid-sized farms (MS) from EUR 25,001 to EUR 100,000; large-sized farms (LS) with SO value above EUR 100,000.

Farm profitability in this paper is measured by ROE, calculated as the ratio of farm net income (SE420) and net worth (SE501). Since a very small percentage of domestic farms in the FADN sample report external liabilities in their balance sheets, ROE as an indicator of profitability relative to its equity has an advantage over ROA which shows

profitability relative to its total assets. Also, since the value of liabilities is not reported, there is correspondence between the values of ROE and ROA indicators in a large number of farms in the sample.

According to previous research conducted by a number of authors (Kryszak et al., 2021; Hloušková & Lekešová, 2020; Hloušková et al., 2020; Balezentis & Novickyte, 2018; Nehring et al., 2015; Gloy et al., 2002 and Mishra et al., 1999), factors that influence profitability of farms include: production factors, economic factors, financial factors, social factors and natural factors. On this basis, we have identified 10 variables that can potentially influence profitability of farms of different economic size. We classified these variables into the following groups: (1) production management, (2) financial management, (3) human resources management and (4) subsidies and natural factors.

The first group includes "production management factors". In this group, the most prominent factor which can significantly affect profitability is type of farming (TF). As a rule, farms with more intensive production are more profitable, which must be taken into account when assessing the impact of various factors on profitability (Miljatović, et al., 2020). We have selected 7 basic types of farming: (1) field crops (FC), (2) horticulture (HC), (3) vineyards and fruits (VF), (4) dairy production (DP), (5) grazing livestock (GL), (6) granivores (GN), (7) mixed crops-livestock (CL). Specialization of agricultural production (SP) can also significantly affect profitability. To express the level of specialization, we used the diversification index (Ir) to determine the share of the value of each individual production line (production of cereals, industrial plants, fruit, milk, pork, eggs, etc.) in the total value of production. This indicator is calculated using the following formula:

$$I_r = \frac{100^2}{p_1^2 + p_2^2 + \cdots + p_i^2 + p_n^2} \quad (1)$$

Where: p_i – the share of the value of the production line "i" in the total value of production (%) i=1(1)n, and n – the number of all production lines. The diversification index is 1 in case of monoculture, and the higher the index, the more diverse the production (Novković & Šomođi, 2016). Equity turnover (ET) can also significantly affect farm profitability. The assumption is that farms with a higher equity turnover ratio are more profitable. ET is calculated as the ratio of total output (SE131) and net worth (SE501).

The second group of independent variables in the model includes "financial management factors". The first indicator within this group is current to total assets ratio (CA), which is calculated as the ratio of total current assets (SE465) and total assets (SE436). Another indicator is the share of external costs (EC), which can also have significant impact on profitability. This indicator is calculated as the ratio of total external factors (SE365) and total inputs (SE270). In addition, a very significant indicator of profitability is the share of farming overheads (OVS), which is calculated as the ratio of total farming overheads (SE336) and total inputs (SE270).

In the group "human resources management", the first variable is education level of farm manager (ED), according to which farms are divided into three groups: (1) farmers with practical experience (PE), (2) farmers with basic education (BE), (3) fully educated farmers. Another indicator that belongs to this group is the share of paid labour (PL), which is calculated as the ratio of paid labour input in hours (SE021) and total labour input in hours (SE011).

The last group of indicators include "subsidies and natural factors". Subsidy rate (SR) is the first indicator in this group and it is calculated as the ratio of total subsidies – excluding subsidies on investments (SE605) and total farm incomes (SE131 + SE605). Region (RG) is a variable that can also potentially affect farm profitability. According to NUTS[5] classification, there are four regions: (1) Belgrade (BG), (2) Autonomous Province of Vojvodina (APV), (3) Šumadija and Western Serbia (SWS), Southern and Eastern Serbia (SES) (www.stat.gov.rs).

The data were first processed using the standard methods of descriptive statistics, followed by multiple linear regression applied to determine the impact of the described factors on profitability of the observed farms. Regression analysis was used to estimate the relationship between one or more independent variables (X_1, X_2,..., X_p) and the dependent variable (Y_i) (Kleinbaum et al., 1998). The applied regression model has the following form:

$$\hat{Y} = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_p X_{pi} + \varepsilon_i \quad (2)$$

$\hat{Y}$ is the value of the dependent variable in the model, and X_{1i}, X_{2i},..., X_{Pi} are the values of the observed independent variables, while β_1, β_2,..., β_p are the partial regression coefficients. Partial regression coefficients show the influence of a certain independent variable on the dependent variable, provided that the other variables are held constant. α is a parameter that shows the average initial level of the dependent variable Y, while ε_i is the random error of the model (Novaković, 2019).

The assumptions of the applied multiple linear regression for the described models included: linearity between the dependent and independent variables; the dependent variable is random, while the independent variables are non-random variables; the expected value of the random error is zero; there is no autocorrelation; homoskedasticity; normal residual distribution; there is no problem of multicollinearity (Čavlin, et al., 2021). The presence of multicollinearity was detected using variance inflation factor (VIF) and tolerance (TOL). Multicollinearity occurs when VIF is higher than 5 or 10, and TOL is less than 0.2 (0.1) (Judge et al., 1988). Owing to the presence of multicollinearity, certain variables (e.g. asset turnover) were omitted from the model. Also, variables such as debt to asset ratio and liquidity ratio were not used because only a small number of farms in the sample reported their liabilities, so it was not possible to calculate these variables.

5 NUTS – The Nomenclature of territorial units for statistics.

The influence of outliers on the obtained results was reduced by using the Tukey fence method, according to which all values below Q_1 – 1.5IQR or above Q_3 + 1.5IQR were removed from the series, where Q_1 is the first quartile, Q_3 is the third quartile, and IQR is interquartile difference (Hlavsa et al., 2020; Schwertman & Silva, 2007). After the outliers were removed, the sample comprised 115 VS farms, 736 SS farms, 545 MS farms and 126 LS farms.

After testing the validity of the assumptions of the applied regression analysis, the significance of the model as a whole was determined by applying variance analysis for regression. As an accompanying analysis to regression, correlation analysis was also performed. In order to accurately interpret the results obtained by regression analysis, we used adjusted coefficient of multiple determination, which indicates the proportion of variation in the dependent variable explained by the selected independent variables.

Results

The results of descriptive statistics for the dependent variable and independent variables used in regression analysis are presented in table 1. The results suggest that the highest profitability, i.e. the highest rate of return on equity (ROE) was recorded in large-sized farms (LS). The average coefficient for these farms is 0.367, which means that they make EUR 0.367 net income per euro of invested equity. Very small farms (VS) have the lowest profitability, where the mean value of ROE was 0.144. These results indicate that, when it comes to the economic size of farms in Republic of Serbia, larger farms are more profitable. This pattern determined on the observed sample is not necessarily the rule. Namely, Kryszak et. al. (2021) found that smaller farms have a slightly higher profitability rate in EU countries. However, these authors also point out that, although smaller farms are profitable, they do not generate sufficient "mass" of income, while medium large and large farms (farms with SO value between EUR 50,000 and EUR 500,000) provide optimal rates of return.

Table 1. Descriptive statistics of variables used in regression models

Variable	VS		SS		MS		LS	
	mean	SD	mean	SD	mean	SD	mean	SD
ROE	0.144	0.110	0.146	0.109	0.172	0.128	**0.367**	1.002
SP	2.175	1.010	2.611	1.160	2.416	1.041	1.975	0.834
ET	0.329	0.255	0.303	0.183	0.373	0.225	0.744	1.452
CA	0.111	0.121	0.098	0.097	0.107	0.100	0.111	0.128
EC	0.067	0.124	0.073	0.109	0.128	0.118	0.199	0.127
OVS	0.279	0.118	0.231	0.107	0.202	0.094	0.186	0.100
PL	0.078	0.168	0.087	0.164	0.139	0.209	0.277	0.310
SR	0.071	0.073	0.083	0.075	0.063	0.064	0.029	0.042

Source: Authors' calculations based on FADN data

Small-sized farms have the highest coefficient of production specialization (SP) of 2.611, which indicates relatively high diversification of production in these farms. As a rule, large farms have a lower coefficient, i.e. a higher degree of production specialization. Larger farms have higher equity turnover (ET) compared to smaller farms. Kryszak et al. (2021) attribute this finding to the fact that small farms have considerable value of equity compared to their real production capacity, or because larger farms are more productive as they use better and more modern technology. Considering the current to total assets ratio (CA), it can be observed that there are no large differences in the calculated coefficient between farms regardless of their economic size. Namely, current to total assets ratio for the farms in the sample ranges from 9.8% to 11.1%. Farms are characterized by a higher fixed to total assets ratio owing to the considerable value of land, perennial crops, livestock unit, machinery and facilities. However, such a low current to total assets ratio can negatively affect the liquidity of farms.

Total external factors, i.e. costs for inputs that are not owned by the farm (land, labour, assets), do not have a high share in the cost structure. This is particularly pronounced in small farms where the share of total external costs ranges from 6.7% to 7.3%. VS and SS farms have a higher share of farming overheads (OVS), while they use paid labour (PL) to a very small percentage. These farms base their production primarily on the family labour and other unpaid labour. On the other hand, MS and LS farms have a slightly lower OVS share (20.2% and 18.6%, respectively), while the share of PL is slightly higher. Large-sized farms have the highest share of PL (27.7%), but this percentage is still significantly lower compared to EU countries where the share of paid labour on farms of this economic size is 42.0% (Kryszak et al., 2021). Subsidies (SR) have no significant share in the total income of farms in RS. The results also indicate that larger farms have lower subsidy rate. Namely, SR for very small farms is 7.1%, while for large-sized farms it is 2.9% (tab. 1).

In the following part of the analysis, the validity of the assumptions of the applied regression model was tested for each model separately. After testing all the assumptions, four regression models were formed according to the economic size classes of farms: VS, SS, MS and LS farms (tab. 2). Their significance was tested by applying the variance analysis for regression and it was determined that all models were statistically highly significant ($p < 0.01$). The estimated regression models explain the variation of profitability well, the adjusted coefficient of multiple determination ranges from 45.6% for very small farms to 95.6% for large-sized farms.

Type of farming has no significant impact on farm profitability in the first three economic size classes, while for LS farms type of farming has statistically highly significant and positive impact. This means that large-sized farms with more intensive production can achieve significantly higher rates of return on equity, which is certainly expected.

Specialization of agricultural production proved to be a significant factor of profitability only in very small farms. There is a negative relationship between SP and ROE indicators in VS farms, which means the higher the coefficient, the less profitable the farms. In

other words, when the level of production specialization in very small farms increases, it will result in lower rate of ROE. This poses a problem given that small farms have a lower level of production specialization according to available data. On the other hand, Kopta et al. (2013) state that the level of production specialization has no significant impact on profitability of Czech farms, except in dairy cattle breeding, where a higher level of specialization leads to lower profitability.

Equity turnover is statistically highly significant determinant of farm profitability regardless of the economic size class of farms. This indicator has very positive impact on profitability, so increase in equity turnover is expected to increase profitability of all observed farms.

Table 2. Results of regression analysis of farms' profitability by economic size

Variable	VS	SS	MS	LS
TF	0.007	0.001	-0.001	0.057***
	(0.004)	(0.001)	(0.002)	(0.012)
SP	-0.020**	0.001	0.004	0.004
	(0.010)	(0.003)	(0.004)	(0.029)
ET	0.325***	0.472***	0.445***	0.597***
	(0.045)	(0.015)	(0.018)	(0.015)
CA	0.102	0.052*	0.010	0.076
	(0.070)	(0.029)	(0.039)	(0.164)
EC	0.208*	0.044	-0.050	0.079
	(0.123)	(0.038)	(0.042)	(0.189)
OVS	-0.005	0.108***	0.078*	2.494***
	(0.077)	(0.027)	(0.043)	(0.227)
ED	0.022	0.001	0.003	-0.047
	(0.013)	(0.004)	(0.005)	(0.030)
PL	-0.290***	-0.054**	-0.062***	-0.034
	(0.105)	(0.024)	(0.019)	(0.068)
SR	0.214*	0.136***	0.071	-0.312
	(0.118)	(0.039)	(0.071)	(0.673)
RG	0.003	0.006*	0.002	0.052*
	(0.009)	(0.003)	(0.004)	(0.031)
Observations	115	736	545	126
Adjusted R-squared	0.456	0.607	0.580	0.956

***, **, * means $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively

Source: Authors' calculations based on FADN data

Current to total assets proved to be a significant factor of profitability only for small-sized farms. For these farms, any increase in current to total assets ratio may have positive impact on profitability. However, the structure of assets does not significantly determine farm profitability, so the impact of this determinant can be considered as marginal. Share of external costs has statistically significant and positive impact on profitability of very small farms, while for other groups of farms this indicator did not prove to be

significant. This means that increase in the share of hired land and borrowed capital could be justified for this group of farms. Share of farming overheads is an important determinant of profitability for farms of all economic sizes, except for very small farms. Increasing the share of farming overheads in these farms can increase their profitability, except for very small farms, which generally have highly diversified production.

Education level of farm manager is not a significant factor of profitability in any of the evaluated models. This is in line with Gloy et al. (2002) who point out that the age of operators and the maximum age difference have no significant impact on profitability of dairy cattle farms. On the other hand, paid labour has statistically significant impact on profitability of very small, small-sized and mid-sized farms. The sign before the regression coefficient of this variable, in all evaluated models, indicates the negative impact of the share of paid labour on profitability, i.e. increase in the share of paid labour may result in lower farm profitability. Accordingly, these groups of farms should rely primarily on family labour if possible, while in large-sized farms additionally hired paid labour has no significant negative impact on profitability (tab. 2).

Subsidy rate has statistically significant and positive impact on very small and small-sized farms, which indicates that these farms are more dependent on subsidies compared to mid-sized and large sized farms. In large farms, increase in the share of subsidies in total farm income may often result in reduced profitability (Kryszak et al., 2021). Region can be a factor of influence in small-sized and large-sized farms, but with very small probability.

Conclusion

Considering the crucial importance of agriculture, economic viability of farms has been extensively investigated in recent years by researchers across Europe. In order to further develop this extremely important industry, it is very important to reach an appropriate level of economic viability of farms. Farm profitability is one of the indicators that can be used to reliably assess the level of economic viability of farms. This paper calculates ROE as an valid and reliable indicator of profitability.

Growth of profitability is influenced by various factors including production, economic, financial, social and natural factors. In this paper, the factors influencing profitability are grouped as: production management, financial management, human resources management and subsidies and natural factors. Within each of these groups of factors, we identified two or more variables that could potentially affect profitability. The influence of these factors on the dependent variable (ROE) was assessed using a multiple regression model. For the purposes of the analysis, farms were divided into four groups according to their economic size: very small, small-sized, mid-sized and large-sized farms.

Based on the obtained results, it can be concluded that equity turnover is the factor with the greatest impact on profitability in farms of all economic sizes. This means that if equity turnover ratio increases, farm profitability will increase significantly. This is especially important for small farms, which on average have lower profitability rates.

On the other hand, the factor that has the greatest negative impact on farm profitability is paid labour. Increasing the share of paid labour will significantly lower profitability of very small, small-sized and mid-sized farms. According to the obtained results, large-sized farms have adequate funds for hiring additional paid labour, while the incurred additional labour costs do not greatly affect their profitability.

The research presented in this paper can provide valuable guidance to researchers from our country and abroad. Certainly, the model can be extended by including additional variables, primarily those related to financial stability and liquidity of farms. Further research should certainly focus on small and mid-sized farms, which are the basis for agricultural development, both in Serbia and in EU countries. Growth of profitability, i.e. achieving a higher level of economic viability in these farms, will have positive impact on development of the whole agricultural sector in Serbia.

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Conflict of interests

The authors declare no conflict of interest.

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