
PROFITABILITY DETERMINANTS OF AGRICULTURAL ENTERPRISES: EMPIRICAL EVIDENCE FROM RURAL ECONOMIES

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ABSTRACT

This study investigates the profitability determinants of agricultural firms in rural economies and has focused on five Eastern European countries for time period spanning from 2005–2023. The aim of research is to evaluate the key structural, economic and technological factors that influence and effect the performance of agricultural enterprises. The methodology focuses on panel data analysis by employing fixed effects regression, stationarity analysis, examining correlation analysis and performing diagnostic tests for validity. The findings suggest that farm size, agricultural investment, exports and use of fertiliser influence profitability positively and significantly whereas labour employed in agriculture enterprises showcase a negative linkage indicating efficiency concerns. The results suggest that structural development, integration of markets and advancement in technology are crucial for enhancing agricultural performance. The study concludes that policy makers should promote land consolidation, investment support, export facilitation to enhance profitability in rural agricultural economies.

Introduction

Background of the Study

Agriculture has remained a vital component in the economic growth of various economies, especially within rural areas. In these area agriculture acts as a main determinant of livelihood, employment and food security. The food and agriculture organisation

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reported that agriculture constitutes a major portion of rural livelihoods worldwide, with more than 2.5 billion individuals dependent upon this sector. In emerging economies, agriculture sector continues to be a leading force for economic stability and regional progress. Over past few decades, agricultural systems have experienced significant structural changes due to globalisation and bilateral-trade, technological advancement and policy reforms. Economies in Eastern Europe, for instance Croatia, Serbia, Romania, Bulgaria and Hungary, have witnessed significant changes in their agricultural sectors following economic transitions and integration into global markets. These shifts have had an impact over farm structures, investment trends and accessibility to markets, hence influencing agricultural profitability. Despite its significance, profitability in agriculture sector varies between economies over time. Determinants such as size of farm, capital availability, labor availability, technological advancement and integration into global markets significantly affect the economic outcomes of agricultural businesses. Evaluating these components are important for policy makers to frame policies targeted at boosting productivity and livelihood in rural regions.

Importance of Agricultural Profitability

Agricultural profitability acts as indicator of the sustainability and competitiveness of agricultural sectors. It denotes the capacity of agricultural businesses to maximise profits, reinvest in their business and adjust to changing and evolving economic circumstances. The World Bank emphasised that improving agricultural productivity and profitability is crucial for reducing rural poverty and fostering inclusive economic growth. Farmers on achieving higher profitability can now invest in modern technologies, increase production through efficiency and introduce better quality products. This, in return also supports upliftment and development of rural sector by providing more job opportunities and boosting local economies. On the contrary if agriculture sector faces low profitability it may result in low investment, dwindling productivity and more vulnerability for rural households. In economies undergoing transition, profits are shaped not only by the internal characteristics of farms but also influenced by external elements for instance market access, policy support and institutional development. Consequently, a thorough examination of the factors influencing profitability is essential to grasp the economic dynamics of agricultural enterprises.

Challenges in Rural Agricultural Economies

Rural agricultural economies encounter numerous structural and economic hurdles that can hinder profitability. A primary issue is the division of agricultural land into smaller plots, which diminishes production efficiency and hampers the use of modern technologies. In several Eastern European nations, the agricultural sector is predominantly composed of small, fragmented farms, making it challenging to achieve economies of scale. Another major obstacle is the limited access to financial resources. Agricultural investments are often hampered by insufficient credit facilities and high borrowing costs, which limit farmers' capacity to adopt advanced technologies and

enhance productivity. Reports from the European Commission highlight that access to finance remains a crucial concern for small and medium-sized agricultural enterprises in the area. Labor dynamics also significantly influence agricultural performance. Although agriculture has traditionally relied on labor-intensive methods, excessive reliance on labor can reduce efficiency, especially when mechanisation is lacking. Furthermore, fluctuations in agricultural exports and market prices create uncertainty, impacting farm income and profitability.

Research Gap and Contribution

Although a vast body of literature exists on productivity in agricultural sector few studies have focused on the joint effects of structural, economical and technological determinants on profitability of agriculture sector in rural economies. Also most past empirical studies have focused on developed economies, while limited attention has been given to economies undergoing transition in Eastern Europe.

Present study contributes by doing a detailed analysis of the determinants of agricultural profitability. Our study has employed panel data for selected Eastern European countries. Present study has incorporated variables such as size of the farm, agricultural labor, investment in advanced technology, exports of agricultural commodities and use of fertiliser. In this way present study captures multiple dimensions of agricultural performance. Further, the use of panel data allowed us to conduct analysis for both cross-country and time-series variations. This led to providing more robust and valid results.

Statement of the Problem

Agriculture sector plays crucial role in rural economic development but agricultural enterprises in many emerging economies continue to face challenges in achieving stable and sustainable profits. As evident there is lot of difference in profitability across economies suggesting that multiple factors influence agricultural performance, yet the relative importance of these factors remains unclear.

Present study highlights there is a dire need to evaluate how structural factors such as size of the farm, economic factors in form of investment and exports, technological advanced inputs like use of fertiliser, jointly affect agricultural profitability. Also it has been observed that the role of labor in advanced and modern agricultural systems remains ambiguous, especially in the context of increasing mechanisation and technological advancement.

Therefore present study will try to address the following questions: Which variables will serve as key determinants of agricultural profitability in rural economies ?

- To examine whether structural, economic and technological factors have any influence on performance of agricultural enterprises?

The history of agricultural profitability for countries in Eastern Europe has been essentially a narrative of reform and convergence. After the end of socialist systems, economies like Croatia, Serbia, Romania, Bulgaria and Hungary started facing the daunting task of modernising fragmented sectors so that they could compete within the international markets and European Union (Csáki & Jámbo, 2019). A central theme in this evolution was the impact of size of firm. For instance in Romania and Bulgaria, the implementation of land reforms led to a “polarisation” of the sector, where a large number of small and marginal, fragmented holdings existed alongside some large and highly efficient enterprises (Burja & Burja, 2016). While some other studies in Hungary suggested that the average size of farm remained below the European average, which hindered efficiency, results also indicated that increasing the average area per holding had a direct and positive linkage with total agricultural output (Florea et al., 2021; Ivanović et al., 2020). Interestingly, this association between size and profitability is not always direct or linear; larger farms get benefited due to economies of scale but some previous studies from Serbia and Romania suggested that very large agricultural companies also sometimes face negative profitability impacts due to managerial inefficiencies (Mijić & Jakšić, 2017; Milošev, 2023).

This profitability is heavily dependent upon agricultural labor productivity. If we assess emerging Eastern European economies, labor productivity has always been relatively lower than in Western Europe (Onegina et al., 2020). However, reforms and changes in economic system shows that productivity of labour is growing at an increasing rate averaging approximately 12% annually in some CEE regions but its also evident that some countries have started moving towards capital-intensive techniques (Bilenko, 2022). Further, the type of labor also plays a crucial role, for instance, some farms with large size in the CEE region that rely on skilled hired labor often showcase higher profitability for their own labor input compared to smaller firms that lack mechanisation (Średzińska, 2019; Ženka et al., 2015). This transformation is closely linked with investment in agriculture. Capital accumulation is key determinant for growth, yet academicians have reported over-investment in some regions, without any corresponding rise in productivity of labor (Pawłowski et al., 2021). In Serbia and Croatia, experts have emphasised that reaching a decisive level of technical equipment is important so as to use and implement modern advanced technological solutions that actually enhance financial performance (Kusz et al., 2020; Mihailović et al., 2023). Whether these days investments were successful or not is often indicated through input usage, particularly consumption of fertiliser and manures. As evident from previous studies, the reduction in use of fertiliser led to decline in output and yield in Central and Eastern Europe (Macours & Swinnen, 2000).

In today’s era, fertiliser is used as essential input for maximising output, but due to global shocks and international instability has led to increase in cost of inputs including fertilisers. This has started to become a threat to farm margins (Glauber, J. W., & Laborde Debucquet, D., 2023; Vos et al., 2024).

If compared in Romania and Bulgaria the usage of fertiliser levels is quite low than the average of EU. This relative comparison partially explains the existing yield gap and lower competitiveness (Burja & Burja, 2016; Ion et al., 2019). Further, the nature of agricultural specialisation also influences these costs for instance there are certain production lines which are more vulnerable to volatility in price of fertiliser than others hence directly having an impact on their net profitability (Kubala, 2024).

Finally, the narrative concludes with the role of agricultural exports. For countries like Serbia and Croatia, raising the portion of agricultural products in there export of is a proven way to diversify rural activities and reduce dependency on domestic primary sectors (Dimitrijević et al., 2023; Birovljev et al., 2017). A positive current account balance in the food sector not only increases the added value of agriculture but also allows these nations to become more resilient (Haller et al., 2025).

Petrović et al. also demonstrated that identifying errors and potential fraud in financial statements can serve as key component for these companies so as to maintain the market credibility needed for expanding agricultural exports (Petrović et al., 2025). Mihajlović et al. argued that Serbian dairy enterprises must optimise their production cycles through rigorous economic analysis to build resilience against global market volatility (Đurić & Njegovan, 2016).

By establishing a balance between these determinants like expanding farm size where required, investing in promoting the efficiency of labour and managing cost of fertiliser in these five countries can lead to improvement in their economic resilience and reduce the performance gap with their Western European counterparts (Bieniek-Majka & Guth, 2021; Mijić & Jakšić, 2017; Vukoje et al., 2022).

Materials and methods

Selection of Countries and Variables

Our empirical analysis will focus on five Eastern European countries namely Croatia, Serbia, Romania, Bulgaria and Hungary. The reason behind selecting these countries is there agricultural sector play a crucial role in rural economies. As this sector contributes significantly towards employment, food production and development of peripheral areas. Further, these countries possess similar agricultural structures and transitional economic characteristics, that will allow us for significant comparative analysis. Furthermore, present study will consider variables that presents main economic conditions that often effect agricultural enterprises in rural economies. Present study has included farm size as it represents the productive capacity and scalability of agricultural enterprises. Agricultural labor is also considered an important factor of production, specifically in rural areas where farming is still dependent on human intensive techniques. We have also considered agricultural exports as an indicator of market integration. Lastly, we have chosen fertiliser consumption as a proxy variable for technological input and production intensity.

Data Sources and Time Period

The empirical investigation relies on secondary data obtained from various recognised databases. The data was collected from the World Bank Open Data and the FAOSTAT database which provided uniform and comparable agricultural and economic indicators across economies. These databases are widely employed in agricultural economics because of their reliability and in depth coverage of macroeconomic and agricultural variables.

Present study employs the period spanning from 2005–2023, allowing for the analysis of long-term trends in determinants of profitability and agricultural performance. This time period was selected to ensure that we have sufficient observations for panel data analysis while also capturing structural changes that took place in agricultural production and economic rural development.

Tools and Techniques

Descriptive Statistical Analysis

Descriptive statistics is used to capture the main characteristics of the dataset. It is used to observe the general trends and behaviour of the selected variables across countries and selected time period. This technique provides information about the central tendency and variance or dispersion of the variables employed in the study (mean values, standard deviation, minimum and maximum values).

This technique will be employed to achieve Objective 1 which targets to identify the main economic factors influencing profitability of agricultural enterprises in rural economies.

Common statistical indicators used in the study include mean, median and standard deviation).

Unit Root Test (Panel Stationarity Test)

In order to avoid spurious regression results, present study tests the stationarity of the panel data series by employing a panel unit root test. Stationarity will ensure that the variance and mean of the variables remain constant and stable over selected time period.

This test will contribute to Objective 1, as it will verify the stability of agricultural economic indicators employed at time of investigation.

The unit root test model can be written as:

$$\Delta Y_{it} = \alpha + \beta Y_{i,t-1} + \sum \gamma_k \Delta Y_{i,t-k} + \varepsilon_{it}$$

where:

ΔY_{it} = represent first difference of the variable

$Y_{i,t-1}$ = denotes lagged level of the variable

ε_{it} = represents the error term

The results will be based on rule of thumb i.e. If $\beta < 0$ and statistically significant, the variable is considered to be stationary with constant mean and variance.

Panel Data Regression Model

To investigate the relationship between agricultural profitability and its determinants present study employed panel data regression analysis. Panel data set combines both cross-sectional and time-series observations that allows the empirical investigation of variations across countries and over the period of time simultaneously. This approach increases the number of observations and strengthen the efficiency of econometric estimation.

Panel data regression will be used to address Objective 2 of our study which aims at analysing the impact of structural and economic factors such as farm size, labor, agricultural investment and exports on agricultural profitability.

Panel regression model can be expressed as follows:

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{FarmSize}_{it} + \beta_2 \text{Labor}_{it} + \beta_3 \text{Investment}_{it} + \beta_4 \text{Exports}_{it} + \beta_5 \text{Fertilizer}_{it} + \varepsilon_{it}$$

where:

$\text{Profitability}_{it}$ = denotes profitability of agricultural enterprises in country i at time t

FarmSize_{it} = represents average land size of agriculture

Labor_{it} = represents employment share provided by agriculture sector

Investment_{it} = denotes agricultural investment level

Exports_{it} = represents agricultural exports share

Fertiliser_{it} = means fertiliser consumption

ε_{it} = error term

Fixed Effects and Random Effects Models

In order to obtain robust results, the study examines both Fixed Effects (FE) and Random Effects (RE) models. The Fixed Effects model is employed to control for country-specific characteristics which are unobserved and they remain constant over time, while the Random Effects model pre-assumes that these individual effects are random in nature and not linked with the independent variables.

The Fixed Effects model can be showcased as: $\text{Profitability}_{it} = \alpha_i + \beta_1 X1_{it} + \beta_2 X2_{it} + \dots + \beta_k Xk_{it} + \varepsilon_{it}$

The Random Effects model is presented as follows:

$$\text{Profitability}_{it} = \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + \dots + \beta_k Xk_{it} + u_i + \varepsilon_{it}$$

where:

α_i = represents country-specific fixed effect

u_i = denotes random individual effect

ε_{it} = showcased the error term

Diagnostic Tests

Multicollinearity Test (Variance Inflation Factor – VIF)

Present study tests for the presence of multicollinearity among selected independent variables as a check of robustness before applying regression. Multicollinearity means when independent variables are highly or perfectly associated with each other, leading to distortion of results and questioning the reliability of regression coefficients.

The diagnostic test helps support Objective 2 of our study as it confirms that the selected determinants of agricultural profitability captures true individual explanatory power of independent variables. The presence or absence of multi-collinearity is given by Variance Inflating Factor which is further calculated as: $VIF_i = 1 / (1 - R_i^2)$

where:

VIF_i = denotes variance inflation factor of variable i

R_i^2 = represents coefficient of determination obtained when variable i is regressed on other independent variables

Presence or absence of MC is given by value of VIF, if greater than 10 indicates serious multicollinearity and value less than 10 presents no multi-collinearity.

Hausman Specification Test

This study employed Hausman test to examine whether the Fixed Effects (FE) is more suitable or Random Effects (RE) model is more appropriate for estimating panel data. The test assess whether the individual effects are correlated with independent variables or not.

This test will be used to examine Objective 2 of our study as it helps in selecting the most appropriate econometric model for examining the determinants of agricultural profitability.

The Hausman test statistic can be defined as follows:

$$H = (\beta_{FE} - \beta_{RE})' [\text{Var}(\beta_{FE}) - \text{Var}(\beta_{RE})]^{-1} (\beta_{FE} - \beta_{RE})$$

where:

β_{FE} = is the coefficient vector from Fixed Effects model

β_{RE} = represents the coefficient vector from Random Effects model

The results are given on basis of p-value, If the p-value is less than 0.05, we will employ the Fixed Effects model as it will give significant results and vice versa.

Heteroskedasticity Test

The term Heteroskedasticity denotes variance of the error terms being not constant across data set. The presence of heteroskedasticity leads to estimators being inefficient and biased standard errors.

Hence, failing to satisfy BLUE properties. Therefore, the study employs the Breusch–Pagan test to ensure the validity of our regression results.

The test statistic can be expressed as follows: $BP = n \times R^2$

where:

n = represents the number of observations

R^2 = denotes goodness of fit and coefficient of determination

If p-values comes out to be significant meaning less than 0.05 it indicates the presence of heteroskedasticity.

Results and Discussion

This section deals with presenting the empirical results obtained from the empirical investigation of the selected variables. The results and findings are further discussed in order to understand the key factors influencing agricultural profitability in the selected rural economies within the given time period.

Table 1 below highlights the description of variables considered in the study for analysis. The selected variables are used to capture key structural, economic and technological aspects of agricultural production, that serves as key factors for evaluating the profitability in rural economies.

Table 1. Description of Variables Used in the Study

Variable	Type	Description
Country	Categorical	Selected country
Year	Time variable	2005–2023
Profitability	Dependent	Agricultural value added / profitability index
Farm_Size	Independent	Agricultural land area
Labor	Independent	Agricultural employment (%)
Agri_Investment	Independent	Agricultural investment index
Agri_Exports	Independent	Agricultural exports (%)
Fertilizer	Independent	Fertilizer consumption

Source: World Bank and FAOSTAT

Table 2 below will help capture the descriptive statistics of the selected variables for time period spanning from 2005–2023. The table provides a summary of the central tendencies and variance in agricultural profitability and its key determinants.

Table 2. Descriptive Statistics of Selected Variables (2005–2023)

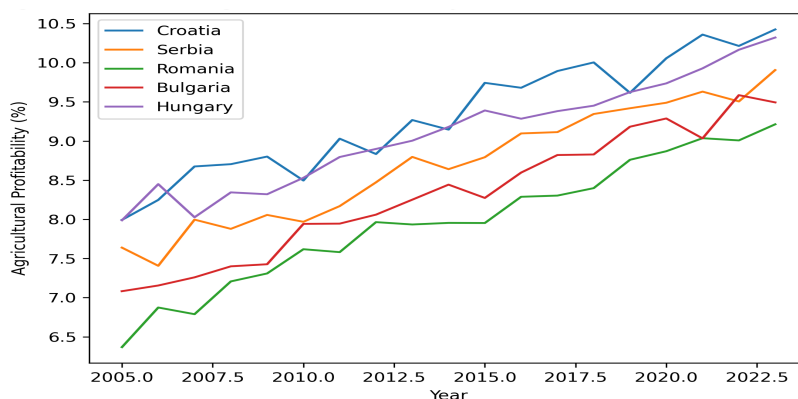
Variable	Mean	Median	Maximum	Minimum	Std. Dev.
Profitability (%)	9.42	9.30	14.10	6.10	1.85
Farm Size (ha)	7.86	7.70	11.90	5.20	1.63
Agricultural Labor (%)	14.52	13.90	22.30	5.80	4.91
Agricultural Investment (Index)	108.74	107.20	139.60	82.10	15.87
Agricultural Exports (%)	7.64	7.50	11.90	4.10	1.94
Fertilizer Use (kg/ha)	123.58	121.40	158.70	92.30	18.62

Source: Author's calculation

Results and findings under Table 2 showcase that the average profitability of agricultural enterprises across the selected countries during the given time period was 9.42%, with minimum value standing at 6.10% and maximum ranging upto 14.10%. The average farm size came out to be 7.86 hectares, indicating that the level of agricultural land available in the selected rural economies is moderate.

The values of dispersion concluded that Agricultural labor exhibited the highest variability among all the considered variables, indicating structural differences in labor dependency across countries. On the other hand, agricultural investment and use of fertiliser showed relatively more stable values, suggesting increase in technological advancement and increased financial support for agriculture enterprises during the study time period.

After showcasing the results of the descriptive statistics present study examines the stationarity properties of the panel data series. This is crucial as Non-stationary variables can lead to misleading regression results and estimations that are not reliable. Therefore, we have applied panel unit root tests to check for stationarity of the variables. Figure 1 below presents the changing trends and patterns in productivity of agriculture across different countries in given time period (2005-2023).

Figure 1. Trends in Agricultural Profitability across Selected Countries (2005–2023)

Source: Author's calculations based on World Bank and FAOSTAT data.

Figure 1 illustrated the changing trends in agricultural profitability by showcasing a gradual rise in profitability in most countries. This reflects improvements in investment in agriculture sector, rise in agricultural productivity and market integration in the rural economies. Next we have applied unit root test in table 3 to check for stationarity of selected series.

Table 3. Panel Unit Root Test Results: Levin–Lin–Chu (LLC) aur Im–Pesaran–Shin (IPS)

Variable	LLC (Level)	p-value	IPS (Level)	p-value	LLC (1st Diff.)	p-value	IPS (1st Diff.)	p-value
Profitability	-1.42	0.078	-1.31	0.095	-4.12***	0.000	-3.87***	0.000
Farm Size	-1.18	0.112	-1.05	0.146	-3.76***	0.000	-3.54***	0.000
Agricultural Labor	-2.21**	0.027	-2.05**	0.040	-3.88***	0.000	-3.61***	0.000
Agricultural Investment	-0.94	0.173	-0.88	0.189	-4.45***	0.000	-4.10***	0.000
Agricultural Exports	-1.36	0.086	-1.22	0.101	-3.89***	0.000	-3.61***	0.000
Fertilizer Use	-1.09	0.128	-0.97	0.162	-3.74***	0.000	-3.48***	0.000

Source: Author's calculation

The results and findings of the panel unit root showcased under Table 3 tests suggest that most variables are non-stationary at level but when differenced become stationary. Hence all variables turned out to be stationary at level that is they are integrated of order I(1).

However, one selected variable agricultural labor appeared to be stationary at level only, indicating it is integrated of order I(0).

After analysing the stationarity properties of the variables, next we analysed the association between the selected variables. Hence, a correlation analysis was conducted under table 4 to examine the strength and linkage of the relationships among the variables. This step will also help us assess potential multicollinearity issues.

Table 4. Correlation Matrix

Variable	PROF	FS	LAB	INV	EXP	FERT
Profitability (PROF)	1.000					
Farm Size (FS)	0.46	1.000				
Agricultural Labor (LAB)	-0.31	-0.28	1.000			
Agricultural Investment (INV)	0.58	0.44	-0.21	1.000		
Agricultural Exports (EXP)	0.52	0.39	-0.19	0.47	1.000	
Fertilizer Use (FERT)	0.49	0.41	-0.16	0.45	0.43	1.000

Source: Author's Calculation

The correlation matrix under Table 4 showcases moderate positive relationships among profitability and selected variables as size of farm, investment in agriculture, exports and use of fertiliser. This suggested that large farms, higher levels of investment,

stronger market linkages and the use of advanced technological inputs can contribute towards improved performance in agricultural sector.

Results for Agricultural labor highlighted a negative correlation with profitability, suggesting that greater reliance on labor-intensive production may lower the efficiency in agricultural sector. This type of linkage reflects structural limitations in rural economies where lower levels of mechanisation leads to an increase in production costs and lowering productivity. Further, the results showcased that none of the correlation coefficients exceeded the accepted threshold value of 0.70, suggesting no multicollinearity among the independent variables and confirmed the regression analysis without estimation problems.

After analysing the correlation among selected variables, our study investigated the presence of multicollinearity within the regression framework. Correlation analysis has indicated preliminary insight into the relationships between variables, however it does not capture the problem of multicollinearity completely. Therefore, we have further employed the Variance Inflation Factor (VIF) in Table 5 to examine if independent variables exhibit significant multicollinearity or not.

Table 5. Variance Inflation Factor (VIF) Test

Variable	VIF	Tolerance (1/VIF)
Farm Size	2.31	0.432
Agricultural Labor	2.84	0.352
Agricultural Investment	3.12	0.320
Agricultural Exports	2.57	0.389
Fertilizer Use	2.76	0.362
Mean VIF	2.72	-

Source: Author's calculation

The results of VIF can be observed under Table 6. Values of VIF showcase that all independent variables have VIF values less than 10, indicating the absence of serious multicollinearity in the model. This explains that the selected independent variables do not showcase strong linear relationships with each other. In other words it can be concluded that variables have independent explanatory power in the regression analysis.

After checking for multicollinearity and confirming the absence of MC among the explanatory variables, we determined panel regression model. For this we employed Hausman specification test in Table 7 to decide which model is more suitable for analysis Fixed Effects or Random Effects model.

Table 6. Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.27	5	0.014

Source: Author's calculation

The results of Hausman test under Table 6 concluded that the probability values is less than 0.05 indicating that the null hypothesis is rejected for the Random Effects model. Therefore, our study has considered the Fixed Effects model to be more appropriate for examining the relationship between agricultural profitability and its determinants.

Based on the findings concluded by Hausman specification test, the Fixed Effects model was considered to be the appropriate estimation technique for the panel data analysis. Therefore, present study has employed regression model using the Fixed Effects approach. The findings of the panel regression analysis can be seen in Table 7.

Table 7. Fixed Effects Panel Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Farm Size	0.284***	0.091	3.12	0.002
Agricultural Labor	-0.118**	0.054	-2.19	0.031
Agricultural Investment	0.347***	0.102	3.40	0.001
Agricultural Exports	0.263***	0.087	3.02	0.003
Fertilizer Use	0.149**	0.064	2.33	0.022
Constant	2.417**	0.985	2.45	0.016

Source: Author's Calculation, Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7 (A). Model stats

Statistic	Value
R-squared	0.61
Adjusted R-squared	0.58
F-statistic	19.47
Prob(F-statistic)	0.000
Observations	95
Cross-sections	5
Time period	2005–2023

Source: Author's calculation

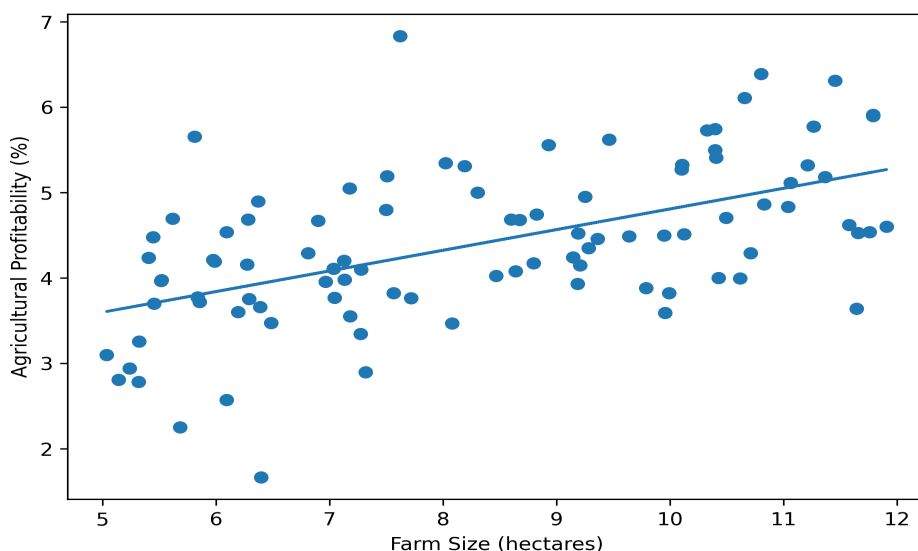
The results of the fixed effects regression model under Table 7 and 7A indicated that several structural and economic factors were significantly influencing agricultural profitability in the selected rural economies. Farm size however showed a positive and statistically significant impact on profitability, conveying that larger farms benefit

more from economies of scale where they get a cost advantage and channelisation of resources also gets improved.

Agricultural investment and exports also exhibited a positive and significant coefficients, suggesting that with an increase in financial support and stronger integration into agricultural markets the profitability levels gets increased. Further, use of Fertiliser demonstrated a positive impact highlighting the relevance of technological advanced inputs in enhancing agricultural productivity.

In contrast, agricultural labor showed a negative association with profitability, implying that higher dependence on labor may lead to reduction in production efficiency. The model explained approximately 61% of the variation in agricultural profitability, suggesting a comparatively stronger explanatory power of the selected variables. The graphical presentation of relation between Size of Farm and profitability in agriculture is highlighted under figure 2.

Figure 2. Farm Size vs Profitability (Scatter Plot)



Source: Author's calculation

Figure 2 presented above illustrates the association between size of the farm and agricultural profitability in the selected rural economies. The scatter plot indicates a positive relationship between the two variables, suggesting that larger farms tend to achieve higher profitability levels. This finding supports the regression results, which show that farm size has a statistically significant positive impact on agricultural profitability. The empirical results provided important insights into the determinants that influence agricultural profitability.

Conclusion

This study examines the key determinants of agricultural profitability in rural economies by employing panel data from Croatia, Serbia, Romania, Bulgaria and Hungary. The time period of the study ranges from 2005–2023. The investigation employed a fixed effects regression model to assess the impact of structural and economic factors on performance of agricultural enterprises. The results suggest that several variables play a crucial role in shaping agricultural profitability across the selected countries.

The findings showcase that size of farm has a positive and statistically significant effect on profitability. The larger agricultural enterprises are, greater they get benefit of economies of scale and better resource allocation and utilisation. Similarly, agricultural investment and exports were also found to have a positive impact over profitability, demonstrating the significance of financial support, development of infrastructure and market integration in enhancing the economic performance of agricultural enterprises.

The use of fertiliser also had positive effect, which emphasises the role of technological advanced inputs and use of modern production techniques in improving agricultural productivity.

In contrast, agricultural labor showcased a negative relationship with profitability, suggesting that greater reliance on labor-intensive production may lower efficiency in agricultural systems. These findings suggests that limited mechanisation and technological adoption may act as a productivity barrier in some rural economies.

Overall, the results of present study concludes that structural development, technological inputs and market participation are key determinants that influence profitability in agriculture sector.

The empirical findings provide several policy-implications for enhancing agricultural profitability in rural economies. Since size of farm was found to have a significantly positive influence on profitability, policies should be framed that facilitate land consolidation and promote cooperative farming as this may help small-scale farmers achieve economies of scale and benefit from low cost. In many rural areas production efficiency is limited by fragmented land ownership therefore, institutional mechanisms that promote land leasing, cooperative farming or producer organisations could promote optimum utilisation of resources and productivity.

The positive role of investment in agriculture sector showcased the significance of strengthening financial support mechanisms for the agricultural sector. Governments and financial institutions should rely on improving long-term agricultural credit, subsidies and promoting infrastructure development, specifically for small and medium agricultural enterprises. Government should also focus on targeted investment programs in irrigation systems, warehousing facilities and farm machinery that may help reduce production costs and strengthen agricultural competitiveness.

The results also suggested that greater integration into agricultural export markets can significantly lead to improvement in farm profitability. Therefore, policy makers should aim at improving market access, export logistics and quality assessment and certification systems which may enable farmers to demonstrate their products more effectively in international markets. To further improve the export potential of agricultural products, strengthening agricultural value chains and improving transportation and warehousing infrastructure could serve as an important measure.

The positive impact of using fertiliser indicated the relative importance of using advanced technological inputs to improve agricultural productivity. However, policies should aim at promoting efficient and sustainable use of inputs, including training programs for farmers, soil testing services and agriculture techniques that help farmers gain a competitive advantage. Such measures help farmers to make better use of fertiliser application without degrading the environment.

Finally, the negative relationship was observed between agricultural labor and profitability which suggests that over reliance on labor-intensive farming may reduce efficiency and hence reduce productivity. To address this problem policy makers should make efforts to focus on promoting mechanisation, advanced agriculture techniques and modern and environmental friendly farm management practices. Further, regular training programs and easy access to modern tools can help farmers improve productivity and yield while reducing non-productive labor costs.

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Conflict of interests

The authors declare no conflict of interest.

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