

EU STRUCTURAL FUNDS AND REGIONAL DEVELOPMENT TRAJECTORIES

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Abstract: *The primary agricultural sector must continue to be supported. To this end, the European Union has made the European Agricultural Fund for Rural Development (EAFRD) available to improve the competitiveness of the agricultural and forestry sectors; the environment and the landscape; the quality of life in rural areas; and to encourage the diversification of the rural economy. However, at the NUTS 2 regional level, well-defined policies are needed to distribute the fund as efficiently as possible and in proportion to their needs. This paper will investigate the extent to which the EAFRD influences the growth of gross value added (GVA) in the agricultural sector of 11 countries in Central and Eastern Europe at the regional level, as well as the impact of other factors. The Central and Eastern European region is characterized by the impact of conflicts, economic crises, and successive processes of accession to the European Union, aspects that underscore the relevance of this article. The method used was a fixed-effects panel analysis. Data were collected from official websites administered by the European Union, such as Eurostat and European Data. The results show that the EAFRD and education have a positive and statistically significant effect, while population is not statistically significant. However, the model may also be explained by other indicators that were not included in the present analysis.*

Key words: *EARDF, panel data analysis, Central and Eastern Europe, NUTS2 regions*

JEL: R11, C23, O18, R58

Introduction

While agriculture was traditionally the primary sector from which people earned their livelihood, today the focus is shifting toward other sectors such as industry, services, and even technology. The European Agricultural Fund for Rural Development (EAFRD) aimed to preserve this sector to ensure food security for the population and, at the same time, to serve as a strategy for the national economy. Furthermore, by 2025, the population is projected to grow by 34%, urbanization is expected to accelerate, and the demand for food is expected to at least double (Food and Agriculture Organization of the United Nations, 2009).

Thus, the European Commission has set the following general objectives for the EAFRD: competitiveness in agriculture, management of natural resources, and balanced territorial development. Some say that both agriculture and rural development hold the potential to combat worldwide poverty (Hossain et. al, 2024).

Competitiveness in the EU agricultural sector is driven by investments in research and development, technology, and innovation. This sector is increasingly moving toward smart farming, precision agriculture, digitalization, Agriculture 4.0, and other concepts related to innovation and technology (Șerbănel, 2021).

In this article, we will investigate the extent to which the EAFRD influences the growth of gross value added (GVA) in the agricultural sector of Central and Eastern Europe at the regional level, as well as the impact of other factors. GVA in agriculture measures the net output of this sector. Moreover, GVA is considered one of the most important indicators of agriculture within the economic structure (Užar et. al, 2019).

The rest of the paper is structured as follows: Section 2 presents the existing literature on the subject; Section 3 presents the methodology, describing the model, software, and data used; Section 4 presents the results and discussion; and Section 5 presents the conclusions.

Brief literature review

According to Monsalve et al. (2016), countries that received larger allocations from the EAFRD also experienced a more significant positive economic impact. However, they emphasized the importance of taking into account external demand and the availability of a low-skilled labour force, which leads to lower costs.

Another study demonstrating a significant positive impact on the regional economy, investment, and agricultural production is Insolda et al. (2025). Despite this positive impact, the EAFRD may cause temporary job losses in the agricultural sector due to technological advancements.

Opria (2025) points out that regions employ different mechanisms that lead to varying levels of EAFRD absorption. Thus, analyses at both the local and regional levels are essential for developing policies that boost agricultural performance. Dinu et al. (2020) listed several indicators closely linked to EAFRD absorption, such as GDP, population, agricultural enterprises, roads, etc.

Șerbănel (2021) demonstrates a positive relationship between the amount of EAFRD funds absorbed and the country's agricultural export performance. However, results measured in financial terms, productivity per hectare, and sustainability may become apparent in the medium to long term, and will not be visible in the short term.

According to Manta et al. (2024), EAFRD payments have a significant impact on regional outcomes, but the effects may vary depending on the type of region. In rural areas, benefits can be observed in terms of employment and agricultural income, but they may be less effective in reducing poverty and increasing productivity.

The literature shows a positive relationship between the EAFRD and national performance. However, when analysing the fund, special attention must be given to country or region specific characteristics and factors that may influence outcomes

Methodology

This article uses a fixed-effects panel regression model. The panel consists of the NUTS 2 regions of the 11 countries in Central and Eastern Europe (Bulgaria, the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia, and Slovakia), covering the time period 2000–2022. The analyzed region has undergone significant transformations, ranging from wars and crises to the countries' accession to the EU.

The equation for the fixed-effects panel model is as follows:

$$\ln(GVA_{it}) = \beta_1 \ln(EAFRD_{it}) + \beta_2 \ln(Education_{it}) + \beta_3 \ln(Population_{it}) + \alpha_i + \varepsilon_{it} \quad (1)$$

where GVA stands for Gross Value Added in agriculture; EAFRD refers to payments allocated to regions from the European Agricultural Fund for Rural Development; Education denotes the educational level of the population (aged 25–64) corresponding to ISCED levels 3–8; and Population refers to the total number of people in a region.

The data for the variables mentioned were collected from official websites managed by the European Union, such as Eurostat (ec.europa.eu), which provides regional-level data, and the European Data website (data.europa.eu), which provides data on EAFRD payments at the regional level.

The software used to perform the panel regression analysis is Stata.

Results and discussion

The question of whether structural funds support regional economic development has become increasingly relevant in the literature. The European Agricultural Fund for Rural Development (EAFRD) is part of the structural funds, contributing to the support of rural development. However,

empirical findings regarding the impact of these funds are mixed. In this article, we will analyse the impact of the EAFRD on GVA and determine whether it has a positive or negative effect.

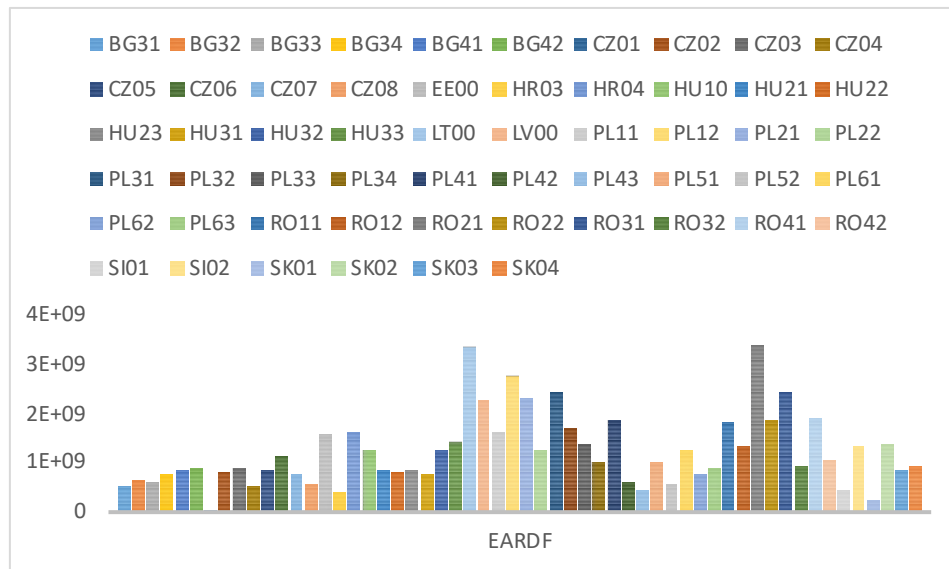


Figure 1. EAFRD payments by NUTS 2 region
 Source: European Data (data.europa.eu); data processed by the author

Figure 1 shows EAFRD payments for NUTS 2 regions across the 11 countries of Central and Eastern Europe. The EAFRD data is taken from the European Data website. The regions that received the most funding are located in the following countries: Romania (RO21, RO31), Lithuania (LT00), Poland (PL12, PL31, PL21), and Latvia (LV00). In contrast, the regions that received the least EAFRD payments are in the following countries: the Czech Republic (CZ01), Slovakia (SK01), Croatia (HR03), and Slovenia (SI01). Thus, the figure shows a significant contrast both between regions receiving funding and between countries.

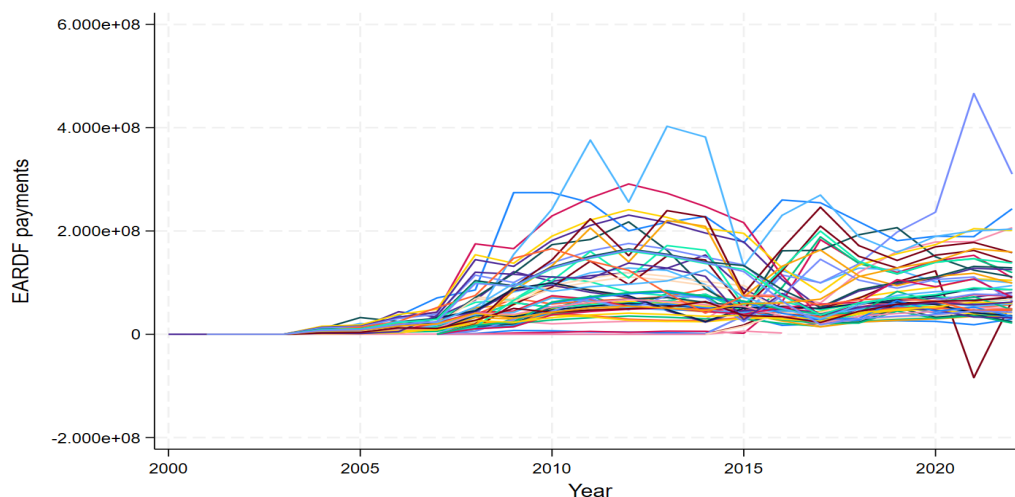


Figure 2 EAFRD payments by year
 Source: European Data (data.europa.eu); data processed by the author in Stata

Figure 2 shows EAFRD payments by region and year. A substantial increase can be observed after 2007, reflecting the expansion of rural development in the EU and the integration of new member states from Central and Eastern Europe into the EAFRD funding system. Therefore, the increase in

EAFRD payments indicates that the European Union is placing greater emphasis on the agricultural sector in its agenda.

The figure highlights significant heterogeneity in EAFRD allocation trajectories at the NUTS 2 regional level. This shows a difference in absorption capacity and an uneven territorial distribution. Furthermore, the graph reflects temporal fluctuations that may be caused by the EU's multiannual frameworks, delayed absorption, and even administrative changes.

In 2021, a year marked by the COVID-19 pandemic, there was a sharp decline in EAFRD allocations, suggesting a challenge in managing them. Furthermore, due to restrictions, businesses faced major difficulties, and economic support efforts were extremely complex.

The overall objective of the EAFRD is to improve the competitiveness of the agricultural and forestry sectors; the environment and the landscape; the quality of life in rural areas; and to encourage the diversification of the rural economy. The variables for the panel regression analysis were selected based on this objective. Thus, the dependent variable is Gross Value Added at basic prices for the agricultural sector, and the independent variables are: EAFRD payments at the regional level, education, and population.

Table 1 Descriptive statistics of the analyzed variables

Variable	Obs	Mean	Std. Dev.	Min	Max
ln_GVA	918	5.732	.938	2.108	7.884
ln_EAFRD	1102	15.38	5.927	0	19.96
ln_Education	1101	4.445	.084	4.185	4.583
ln_Population	1094	14.327	.467	13.291	15.517

Source: Eurostat and Cohesion Data; data processed by the author in Stata.

Table 1 presents the descriptive statistics for the variables included in the analysis. The dependent variable, GVA, has a mean of 5.73 and a standard deviation of 0.94. The EAFRD variable has a mean of 15.38 and a relatively high standard deviation of 5.93. At the same time, the minimum value of 0 indicates that in certain years, some regions received no funding. The education variable has a mean of 4.45 and a low standard deviation of 0.084, suggesting a relatively uniform distribution across regions. As for the population variable, it has a mean of 14.33 and a standard deviation of 0.47, with moderate differences in population size among the analyzed regions.

Table 2 Hausman test
Hausman (1978) specification test

	Coef.
Chi-square test value	63.235
P-value	0

To determine the most appropriate model for panel data, between the fixed-effects (FE) model and the random-effects (RE) model, we conducted the Hausman test (Table 2). In this test, p (0.00) was less than 0.05, which led us to choose the fixed-effects model.

Table 3 Fixed-effects panel analysis

ln_GVA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ln_FEADR	.011	.004	2.66	.01	.003	.019	**
ln_Education	3.306	.52	6.36	0	2.263	4.348	***
ln_Population	-.192	.519	-0.37	.712	-1.234	.849	
Constant	-6.364	8.84	-0.72	.475	-24.103	11.374	
Mean dependent var		5.732	SD dependent var		0.938		
R-squared		0.213	Number of obs		918		
F-test		21.460	Prob > F		0.000		
Akaike crit. (AIC)		404.366	Bayesian crit. (BIC)		418.833		

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Eurostat and Cohesion Data; data processed by the author in Stata.

Table 3 presents the results of the fixed-effects panel model estimation. The results indicate that the EAFRD has a positive and statistically significant effect on the dependent variable GVA. The estimated coefficient for the EAFRD is 0.01 ($p < 0.05$), indicating that a 1% increase in EAFRD funds is associated with an increase of approximately 0.01% in GVA.

On a similarly positive note, education exhibits a positive and highly significant effect. The estimated coefficient for education is 0.00 ($p < 0.01$), suggesting that the level of education contributes significantly to increased regional economic performance.

Unlike the other two variables, population is not statistically significant. The estimated coefficient for population is 0.71, indicating that population size does not have a significant effect on GVA within the analyzed model.

The model is globally significant ($\text{Prob} > F = 0.000$), and the coefficient of determination ($R^2 = 0.213$) suggests that approximately 21.3% of the variation in the dependent variable is explained by the variables included in the model.

Conclusions

The overall objective of the EAFRD is to improve the competitiveness of agriculture, the environment, and the quality of life in rural areas, as well as to encourage the diversification of the rural economy. The variables used were closely linked to this objective. The data used at the NUTS 2 regional level provided a more detailed picture of the variation in the effectiveness of the EAFRD. The results of the fixed-effects panel analysis indicated that the EAFRD and education have a positive and statistically significant effect on the dependent variable GVA. The estimated coefficients were 0.01 for the EAFRD ($p < 0.05$), indicating that a 1% increase in EAFRD funds is associated with an increase of approximately 0.01% in GVA, and 0.00 ($p < 0.01$), suggesting that the level of education contributes significantly to increased regional economic performance.

Unlike the other two variables, population is not statistically significant. The estimated coefficient for population is 0.71, indicating that population size does not have a significant effect on GVA within the analysed model.

Thus, the results demonstrated the EAFRD's contribution to the development of NUTS 2 regions in the 11 countries of Central and Eastern Europe in terms of GVA in the agricultural sector. The study is limited by the fact that the effects of the funds may be delayed over time and cannot be fully captured by the model used. As suggestions for future studies, we propose that the panel analysis include more variables to better explain the variation in the dependent variable.

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