

TERRITORIAL RESILIENCE AND EXPORT IN ROMANIA AT COUNTY LEVEL

Daniela Antonescu

Scientific Researcher II,

Institute of National Economy, Romanian Academy, ROMANIA

E-mail: daniela.antonescu25@gmail.com

ORCID: 0000-0003-3758-9022

Ioana Cristina Florescu

Junior Scientific Researcher

Institute of National Economy, Romanian Academy, ROMANIA

E-mail: ioanaflorescu2001@yahoo.com

ORCID: 0000-0002-2582-4140

Abstract: *This article explores the relationship between territorial resilience and export performance at the county level in Romania, aiming to assess how external trade contributes to regional economic stability and adaptive capacity in times of crisis. Territorial resilience is analyzed through the GDP indicator as a key indicator that shows the economic robustness and development, while export performance is evaluated using export volume. The study uses quantitative methods, including correlation and regression analysis, in order to identify patterns and disparities across Romanian counties and the capital over the period 2011–2023. Findings suggest that counties with higher export intensity diversified trade structures and a stronger integration into international markets tend to exhibit stronger resilience to external shocks. Additionally, the research highlights the territorial inequalities, with the resilience being concentrated in a handful of economically advanced and export-oriented counties. These disparities raise important questions about balanced regional development and the long-term sustainability of resilience across all territories. In response, the paper offers a set of policy recommendations aimed at strengthening resilience in underperforming regions. These include the development of tailored export strategies, increased investment in physical and digital infrastructure, and the promotion of small and medium-sized enterprises' (SMEs) internationalization through targeted support programs. The study contributes to the broader discourse on resilience-building in peripheral economies facing systemic vulnerabilities.*

Keywords: *Territorial resilience, county disparities, quantitative analysis, GDP, exports, Romania.*

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Classification JEL: C12, R11, R58.

1. Introduction

In the context of economic changes and successive crises that have affected Europe in the last two decades, the concept of territorial resilience has gained particular importance in the scientific literature. Territorial resilience implies the capacity of a territory – be it national, regional or local – to resist, adapt and reinvent itself in the face of external or internal shocks, maintaining economic and social cohesion. In Romania, the persistent regional imbalances, together with the challenges generated by the economic transition, globalization and recent crises (the financial crisis of 2008-2010 and the health crisis of 2020), have highlighted the significant differences between counties in terms of the capacity for adaptation and economic recovery.

In this situation, the exports play a crucial role in the dynamics of territorial resilience. A region's capacity to integrate into international trade flows, attract foreign investment and sustain a diversified and competitive economic base can determine the speed and sustainability of the post-crisis recovery process. However, in Romania, the

analysis of the correlation between export performance and territorial resilience at county level remains insufficiently explored in the scientific literature.

This paper aims to investigate this relationship through a detailed quantitative analysis of export and Gross Domestic Product (GDP) indicator for the 41 counties of Romania and the municipality of Bucharest over the period 2011-2023. The study makes an important empirical contribution, using statistical methods such as regression analysis, and aims to provide an in-depth understanding of how exports can contribute to strengthening territorial resilience.

2. Literature Review

A critical analysis of existing literature, identifying gaps and positioning the current study within the academic discourse. Discuss theoretical frameworks, prior empirical studies, and relevant methodologies from past research. Ensure proper citation following the journal's referencing style

The concept of territorial resilience has become increasingly common in the scientific literature, being associated with the capacity of regions to cope with and adapt to economic and social shocks. In the context of the European Union, this concept is essential for understanding how regions can achieve economic and social convergence [1]. In Romania, recent research has highlighted the need to develop instruments to measure territorial resilience, adapted to national and regional specificities [2].

In literature, resilience is often conceptualized as a cyclical process, governed by structural and adaptive factors. Bănică and Petrişor highlight three essential forms of regional resilience: resistance at a lower level, recovery from a decline, and creative leap to a higher level [3]. This view emphasizes the dynamic nature of resilience, associated with a continuous development process, likely to be traced along specific evolutionary cycles.

In the Romanian context, the applicability of the concept of territorial resilience is highlighted in recent studies analyzing the impact of the COVID-19 pandemic on territorial disparities. Muntele, Bănică and Ursache highlight the manifestation of strong spatial differentiations between January 2020 and June 2022, highlighting the need for adapted public policies in order to strengthen territorial resilience [4].

Also, multidisciplinary approaches in the study of resilience, such as those presented in the work coordinated by Nijkamp et al., integrate economic, social, institutional and geopolitical dimensions [5], providing a comprehensive framework for the analysis of territorial resilience in the European Union and, implicitly, in Romania.

Exports are a key pillar in stimulating economic growth and reducing regional disparities [6]. In Romania, the export performance has been influenced by factors such as foreign direct investment (FDI), infrastructure, human capital and local policies supporting exporters. Zaman and Simion highlighted that, during the period 2001–2017, international trade had a significant impact on Romania's regional economic development, highlighting the efficiency of exports and imports by product and geographical orientation [7]. They applied a modern analytical toolkit to identify trends and processes generated by Romania's integration into the European Union.

Also, the comparative analysis of Romania's position in the region from the perspective of exports and foreign investments shows that, although in 2020 Romania had a higher share of imports used in the production of exports compared to the European Union average, regionally it has been placed in more favorable positions compared to neighboring countries over the last 10 years [8].

In the context of territorial resilience, exports represent an essential pillar of the ability of counties to adapt and recover from economic shocks, due to their openness and

orientation towards international markets. Regions with a strong and diversified export sector benefit not only from external capital flows, but also from increased opportunities for innovation, technology transfer and economic efficiency [9].

Exports allow firms to reduce their dependence on domestic demand, which can be severely affected during crises, and to access global demand, thus maintaining higher levels of production and employment. Geographical diversification of sales markets also helps to mitigate regional or sectoral risks, which gives counties increased resilience [10].

Furthermore, a strong export sector is often associated with higher productivity, investment in research and development (R&D) and a higher level of integration into global value chains, all of which are factors conducive to structural adaptability [11]. These counties are better prepared for post-crisis recovery, as they can capitalize on external trade relations and the rapid response capacity of exporting companies.

In the case of Romania, counties with high-performance logistics infrastructure, well-connected transport networks and export-oriented industrial clusters – such as Timiș, Argeș, Sibiu or Brașov – have shown superior economic resilience compared to those dependent mainly on domestic consumption [6]. The export performance directly influences regional development, and public policies must aim to strengthen the export capacity of regions, especially by supporting SMEs, improving infrastructure and attracting foreign direct investment.

The relationship between territorial resilience and export performance is complex and bidirectional. On the one hand, a resilient regional economy can support and diversify exports; on the other hand, a strong export base can contribute to increasing the region's economic resilience. Economic analyses highlight that regions with a specialization in exports of high value-added products and advanced technology tend to be more resilient to external economic shocks. In Romania, however, exports are dominated by products with a low technological level, which may limit the capacity for adaptation and territorial resilience [12].

In addition, European cohesion policies emphasize the importance of developing a competitive and export-oriented economy to strengthen territorial resilience. Thus, the European funds allocated to Romania in the period 2021-2027 aim to support smart and innovative economic transformation, with a focus on increasing the competitiveness of small and medium-sized enterprises and supporting research and innovation [13].

In conclusion, the interdependence between territorial resilience and export performance suggests the need for integrated policies that support both the diversification and sophistication of exports and the strengthening of regions' capacity to face economic challenges.

3. Methodology

The methodology used is quantitative and consists of analyzing a panel data set. The data used refer to the 41 counties of Romania, plus the municipality of Bucharest, for the period 2011-2023. The main source of data for GDP (the dependent variable expressed in millions of euros) is Eurostat, and for the value of exports (the independent variable measured in thousands of euros) is the National Institute of Statistics (NIS).

4. Results and Discussion

The model proposed in this research aims to estimate the influence of exports on the evolution of Gross Domestic Product (GDP) at county level. Starting from the premise that exports can represent an important engine of economic growth, we first conducted an OLS analysis (table 1). This method serves as a point of comparison and validation of the trends identified in the panel analysis. The estimated model has the following functional form:

$$\text{GDP}_t = c + a_1 \cdot \text{Exports}_t + \varepsilon_t \quad (1)$$

where:

a_1 - the independent variable coefficient;

ε_t - the residual value;

c - the regression equation constant;

t - 2011, ..., 2023

Table 1. The OLS model

| Variable | Coefficient | Std. Error | t-statistic | Prob |
|--------------------|-------------|------------------------|-------------|----------|
| Exports | 0.041558 | 0.001016 | 40.90528 | 0.0000 |
| C | 242.5078 | 198.7762 | 1.220004 | 0.2230 |
| R-squared | 0.754650 | Mean dependent var | | 4732.729 |
| Adjusted R-squared | 0.754199 | S.D. dependent var | | 7810.394 |
| S.E. of regression | 3872.261 | Akaike info criterion | | 19.36472 |
| Sum squared resid | 8.16E+09 | Schwarz criterion | | 19.38048 |
| F-statistic | 1673.242 | Hannan-Quinn criterion | | 19.37088 |
| Prob(F-statistic) | 0.000000 | Durbin-Watson stat | | 0.129697 |

Source: own computations based on the Eurostat and NIS databases

For comparison, a regression model was also estimated on level (non-stationary) data, using the ordinary least squares (OLS) method, without controlling for fixed or random effects. The coefficient associated with exports was positive and significant ($a_1 = 0.0415$, $p < 0.001$), apparently indicating a robust relationship between exports and GDP.

However, the result should be interpreted with caution. The extremely low value of the Durbin-Watson statistic (0.129697) suggests the presence of autocorrelation in the model errors, which significantly reduces confidence in the validity of the statistical inferences. Moreover, the non-stationarity of the GDP and exports series raises the risk of a spurious relationship, making it possible that the detected dependence is just a consequence of the common trend in the two series.

Table 2. The Unit Root test

| | Level | First difference |
|-----------------------------|-----------|------------------|
| GDP | | |
| Levin, Lin & Chu t | 21.3404 | -6.39019 |
| Prob. | (1.0000) | (0.0000) |
| Im, Pesaran and Shin W-Stat | 23.4331 | -3.46183 |
| Prob. | (1.0000) | (0.0003) |
| ADF-Fisher Chi-Square | 0.17901 | 126.043 |
| Prob. | (1.0000) | 0.0021 |
| PP-Fisher Chi-Square | 0.19435 | 111.233 |
| Prob. | (1.0000) | (0.0250) |
| Exports | | |
| Levin, Lin & Chu t | -4.51851 | |
| Prob. | (0.0000) | |
| Im, Pesaran and Shin W-Stat | -1.98683 | |
| Prob. | (0.00235) | |
| ADF-Fisher Chi-Square | 124.048 | |
| Prob. | 0.0030 | |
| PP-Fisher Chi-Square | 123.959 | |
| Prob. | 0.0030 | |

Source: own computations based on the Eurostat and NIS databases

Estimation of this OLS model in level, to demonstrate potential crude correlations between GDP and exports. However, due to the likely non-stationary nature of the variables, it is necessary to test and, if necessary, transform them before panel modeling.

It can be seen that all tests performed on GDP indicate the presence of a unit root, which suggests that the data series isn't stationary at the level but is stationary in the first difference. Exports are stationary at level (table 2).

The first-order differentiation of GDP was a necessary step in order to obtain a stationary series, thus preparing the data for the application of econometric techniques such as OLS regressions or other panel modeling methods. The test results confirm that the differentiated GDP does not contain unit roots, which means that we can continue the analysis on stationary data (table 3).

Table 3. The OLS model with differentiated GDP in I(1)

| <i>Variable</i> | <i>Coefficient</i> | <i>Std. Error</i> | <i>t-statistic</i> | <i>Prob.</i> |
|--------------------|--------------------|------------------------|--------------------|--------------|
| Exports | 0.004242 | 0.000186 | 22.75305 | 0.0000 |
| C | -97.10979 | 37.21659 | -2.609315 | 0.0093 |
| R-squared | 0.508197 | Mean dependent var | | 369.8637 |
| Adjusted R-squared | 0.507216 | S.D. dependent var | | 991.8870 |
| S.E. of regression | 696.2907 | Akaike info criterion | | 15.93338 |
| Sum squared resid | 2.43E+08 | Schwarz criterion | | 15.95016 |
| F-statistic | 517.7014 | Hannan-Quinn criterion | | 15.93996 |
| Prob(F-statistic) | 0.000000 | Durbin-Watson stat | | 0.978348 |

Source: own computations based on the Eurostat and NIS databases

The coefficient for EXPORTS is positive and statistically significant (p-value is 0.0000). This means that there is a direct relationship between exports and GDP growth at the level of the analyzed counties. In simple terms, for 1,000 euros of export growth, GDP is estimated to increase by 0.004242 million euros. The effect is significant and indicates a positive contribution of exports to the economies of the counties. The constant (C) represents a base value of GDP in the absence of exports. The negative value of the coefficient (-97.10979) suggests that, in the absence of exports, GDP would have a decreasing trend for a typical county in the sample, but this value does not have a very meaningful interpretation from an economic point of view, since the probability is still significant, indicating that county fixed effects or other variables could influence this coefficient.

The model explains about 51% of the variation in GDP based on exports, which is a fairly good result in the context of the regional economy. However, there remains a significant part of the variability of the GDP that is not explained by the model. This suggests that there are other relevant factors (e.g. infrastructure, investments, regional economic policies) that should be taken into account. The high F-statistic (517.7014) and p-value of 0.0000 suggest that the model is globally significant, meaning the variables included in the model explain a significant part of the behavior of GDP. The Durbin-Watson of 0.9783 indicates the possibility of positive autocorrelation in the residuals. This could mean that there are unspecified factors that influence GDP continuously over successive periods (e.g. effects of the financial crisis, regional economic policies or other external shocks).

In order to determine the most appropriate estimation model for the analysis of the impact of exports on GDP in the counties of Romania, the Hausman test will be applied. This test allows for the comparison of two types of models: the fixed-effects model and the random-effects model. The aim is to establish whether the unobserved individual variables affecting each county are correlated with the explanatory variables (exports), which would

justify the use of a fixed-effects model. The Hausman test is based on the null hypothesis that the random-effects model is more appropriate, since it assumes that the individual effects are not correlated with the explanatory variables. If the null hypothesis is rejected (the p-value is significant), this indicates that the fixed-effects model is more appropriate for our analysis, since capturing the unobserved individual variability in each county would improve the accuracy of the estimates.

Table 4. The Hausman test

| Correlated Random Effects - Hausman Test | | | |
|--|-------------------|-------------|--------|
| Test cross-section random effects | | | |
| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f | Prob. |
| Cross-section random | 117.791994 | 1 | 0.0000 |

Source: own computations based on the Eurostat and NIS databases

The result of the Hausman test (table 4) indicates a very small p-value (0.0000), which suggests the rejection of the null hypothesis that the random effects model would be appropriate. Clearly, the correlation of the random effects with the explanatory variables (Exports) is significant, which means that the fixed effects model is more suitable for the analysis (table 5).

Table 5. The fixed effects model

| Variable | Coefficient | Std. Error | t-statistic | Prob. |
|--------------------|-------------|------------------------|-------------|----------|
| Exports | 0.009624 | 0.000439 | 21.93075 | 0.0000 |
| C | -689.6227 | 53.97548 | -12.77659 | 0.0000 |
| R-squared | 0.728538 | Mean dependent var | | 369.8637 |
| Adjusted R-squared | 0.703752 | S.D. dependent var | | 991.8870 |
| S.E. of regression | 539.8709 | Akaike info criterion | | 15.50215 |
| Sum squared resid | 1.34E+08 | Schwarz criterion | | 15.86295 |
| F-statistic | 29.39348 | Hannan-Quinn criterion | | 15.64369 |
| Prob(F-statistic) | 0.000000 | Durbin-Watson stat | | 1.704862 |

Source: own computations based on the Eurostat and NIS databases

The results obtained from the application of the fixed effects model show that almost 73% of the variation in GDP is explained by the model, which is a very good result. The coefficient for Exports in the fixed effects model is 0.009624, which means that, on average, an increase of exports by 1,000 euros is associated with an increase of 0.009624 million euros for the GDP at the county level. The effect is statistically significant (p-value < 0.0001). The constant c (-689.6227) is significant (p=0.0000), but in general, this value does not have a direct economic interpretation, since it represents the estimated GDP in the absence of exports and can also be influenced by variations between counties. The model is statistically significant (Prob(F-statistic)=0.0000, indicating that exports have a significant impact on GDP.

In order to observe the variations between counties of Romania, a cross-section analysis was applied for the fixed effects model obtained (figure 1).

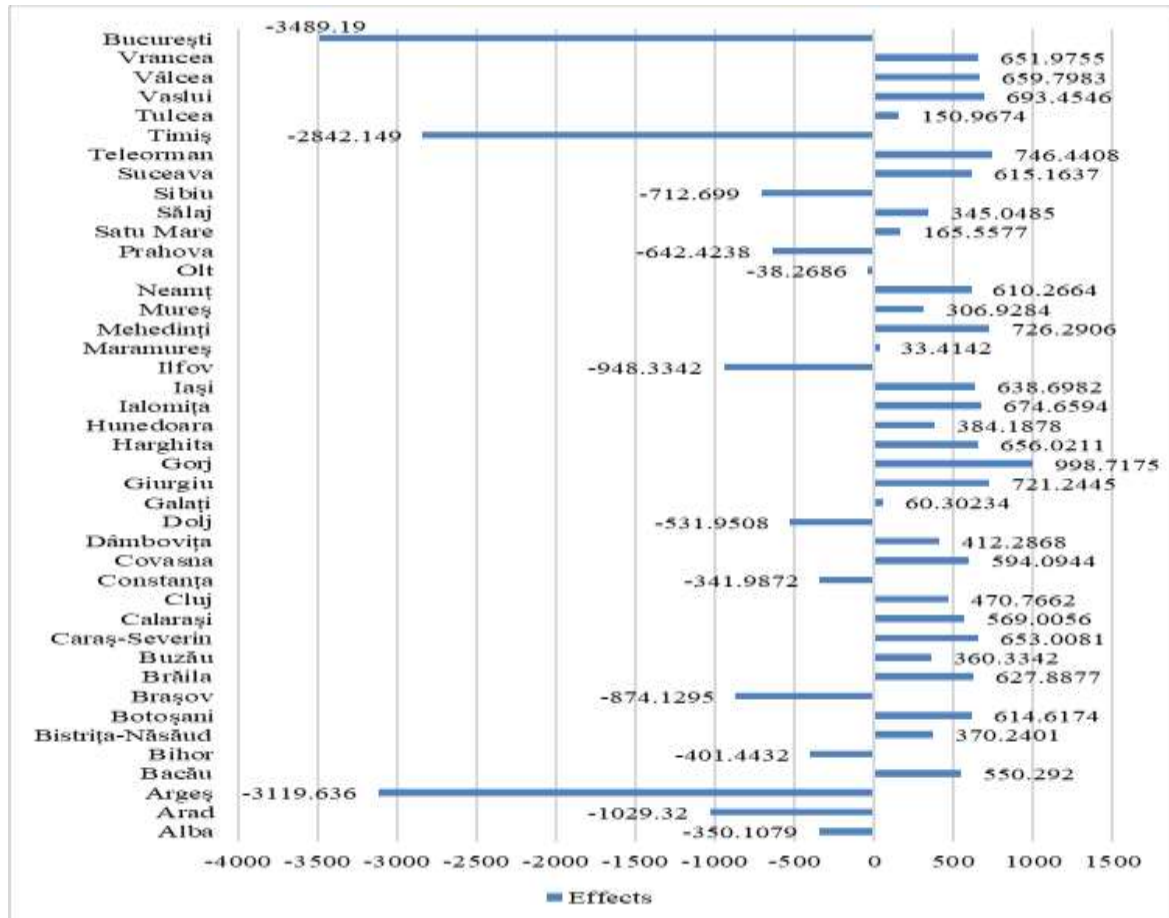


Figure 1. The heterogeneity of the counties of Romania

Source: own computations based on the Eurostat and NIS databases

The analysis of heterogeneity at the level of the 41 counties of Romania together with the municipality of Bucharest revealed the following:

- In Bacău County, an increase in exports is associated with a considerable increase in GDP. This could reflect a more open economy to trade, where exports have a significant impact on economic growth.
- In Bistriţa-Năsăud County, an increase in exports leads to a moderate increase in GDP. This could indicate a local economy benefiting from increased external demand for its products.
- Giurgiu has a high coefficient, which suggests that this county has a strong and positive reaction to export growth. This county probably benefits significantly from exports.
- Mehedinţi, with a high coefficient, suggests a strong link between export growth and GDP growth.
- Vaslui has a significant positive impact on GDP following the increase in exports, which suggests an increasing integration of the county into international trade.
- Arad, with a negative coefficient, indicates that an increase in exports could lead to a decrease in GDP in this county. This result may suggest that exports are not efficient enough or are not directly reflected in the county's GDP.
- Bucharest, with the highest negative coefficient, suggests an inverse relationship between exports and GDP, which is counterintuitive. Bucharest is generally the economic center of Romania and should benefit from exports.

However, this coefficient suggests that, during this period, the exports had a negative impact on GDP.

- Timiș has a negative coefficient, which suggests that, during this period, the increase in exports was associated with a decrease in GDP. Timiș is a county with a fairly diversified economy, but there may be economic complexity that makes exports not have positive effects on GDP.
- Sibiu has also a negative coefficient, suggesting an inverse relationship between exports and GDP. This result is interesting, considering that Sibiu is a county with a well-developed economy.
- Prahova, with a negative coefficient, suggests that exports did not have beneficial effects on GDP. This could be due to the economic structure of the county, which may depend more on domestic sectors than on foreign trade.

Based on the estimated effects of export performance on territorial resilience, Romanian counties were grouped into three categories. This classification enabled the development of a tailored policy matrix, offering targeted strategies to reinforce regional resilience. While some counties benefit from export-driven stability, others require diversification and risk mitigation, especially in highly industrialized regions such as Argeș, Timiș, and Bucharest (table 6).

Table 6. The tailored policy matrix for the counties in Romania and the Bucharest municipality

| Category | Criterion | Counties | Possible economic characteristics | Policy recommendations |
|--|--|--|---|---|
| I. Counties where exports support resilience | Positive estimated effect (over +500) | Bacău, Bistrița-Năsăud, Botoșani, Brăila, Caraș-Severin, Călărași, Covasna, Dâmbovița, Giurgiu, Gorj, Harghita, Hunedoara, Ialomița, Iași, Mehedinți, Neamț, Suceava, Teleorman, Vaslui, Vâlcea, Vrancea | Regional economies where exports, perhaps from traditional sectors, agri-food or light manufacturing, contribute to stability and adaptability. | <ul style="list-style-type: none"> • Strengthening transport and logistics infrastructure • Support for the expansion of SMEs into foreign markets • Certification and quality programs for exports • Regional export support centers |
| II. Counties with moderate or mixed effects | Estimated effect between -500 and +500 | Alba, Bihor, Bistrița-Năsăud, Cluj, Constanța, Dâmbovița, Galați, Maramureș, Mureș, Neamț, Olt, Satu Mare, Sălaj, Tulcea | Counties with a balanced, transitional or diversified economic structure, where exports do not have a clear negative impact on economic resilience. | <ul style="list-style-type: none"> • Creation of industrial clusters and technology transfer • Investment in education and vocational training • Support for innovation and exportable entrepreneurship |
| III. Counties with vulnerability to exports | Estimated negative effect (< -500) | Arad, Argeș, Brașov, București, Dolj, Ilfov, Prahova, Sibiu, Timiș | Counties with concentrated industry, specialized in exports sensitive to external shocks (auto, IT, equipment). Possible lack of diversification or dependence on few partners. | <ul style="list-style-type: none"> • Diversifying the structure of exports • Reducing dependence on a single sector • Developing alternative markets • Digitalization and operational resilience for exporting companies |

Source: own processing based on the results obtained in Figure 1.

From the data obtained we can see that Argeș, Timiș, Sibiu, Brașov, Arad, Bihor, Cluj, Prahova, Dolj, Alba, Mureș, Galați, Satu Mare, Hunedoara, Bistrița-Năsăud, Sălaj, Ilfov are export based counties and Bucharest, Iași, Constanța, Suceava, Vaslui, Botoșani, Teleorman, Giurgiu, Călărași, Brăila, Vrancea, Bacău, Dâmbovița, Ialomița, Neamț, Vâlcea, Mehedinți,

Harghita, Covasna, Tulcea, Maramureş, Gorj, Olt are mostly services based counties as here they are oriented towards public services, administration, local services.

In order to place the results obtained in the European context, a brief comparison with trends observed in other EU Member States was also made. Recent studies [14], [15] indicate that regions with a diversified export structure and strong integration into international trade networks have shown higher levels of resilience to external shocks, such as the 2008 financial crisis or the COVID-19 pandemic. Similarly, the results from Romania show that counties with high export intensity and diverse trade portfolios have been better prepared to cope with economic disruptions. However, compared to the EU average, Romania shows a stronger concentration of resilience in a few developed counties, suggesting a higher degree of territorial imbalance. This finding highlights the need for tailored regional policies, similar to those applied in other Member States, that aim to expand the export capacity and economic infrastructure also in less developed regions, namely for the country analyzed for the less developed counties.

5. Conclusions

The analysis of the estimated coefficients for each county highlights a significant heterogeneity in terms of the impact of exports on regional GDP. The results obtained suggest that the effect of exports is not uniformly distributed territorially, but is deeply influenced by the local economic structure, the level of industrial specialization, infrastructure and the capacity to capitalize on regional comparative advantages.

On the one hand, counties such as Giurgiu, Mehedinţi, Vaslui and Bacău have recorded significant positive coefficients, indicating a strong correlation between exports and regional economic growth. This suggests that in these counties, exports act as a vector of economic growth, either by consolidating the industrial sector or by capitalizing on local resources with competitive potential on foreign markets. It is also worth noting the potential role of transport infrastructure (e.g. ports, railways, border crossings) in supporting this process.

On the other hand, counties such as Bucharest, Timiş, Arad or Sibiu present negative coefficients, indicating an inverse relationship between exports and regional GDP. This apparently paradoxical result may reflect either a strongly service-oriented economic structure (which is not always reflected in the data on goods exports) or a reduced capacity to convert exports into local value added. In the case of Bucharest, for example, the fact that this is the location of large companies which have as domain of activity in the services sector having a high number of employees may explain this discrepancy.

Thus, the results of the analysis confirm the existence of an asymmetric economic development model at the territorial level, in which export support policies must be calibrated according to the specifics of each county. Not all regions benefit equally from export growth, and the formulation of effective support measures must take into account the local economic context, the existing infrastructure, the degree of diversification of the economy and external trade connections.

This heterogeneity also raises relevant questions for public policies, related to the need for a differentiated approach in promoting exports and identifying the most efficient mechanisms through which exports can become a sustainable factor in regional GDP growth in all counties of the country.

Based on the results of the analysis of the influence of exports on GDP in the 42 counties of Romania, it is evident that export-led economic development does not have a uniform effect at the territorial level. This finding has multiple implications for the formulation and implementation of economic policies, both at the country and regional levels.

In counties where the coefficients are positive and significant (e.g. Vaslui, Mehedinţi, Giurgiu, Caraş-Severin), existing advantages can be consolidated through: investments in transport and logistics infrastructure to facilitate exports, implementation of economic policies that lead to the stimulation of small and medium-sized enterprises aimed at helping them integrate into international value chains and the promotion of smart specializations and sectors with export potential, in line with the Regional Development Strategies.

Whereas, in counties where the coefficients are negative (e.g. Bucharest, Timiş, Sibiu, Arad), a recalibration of policies is necessary, focused not only on increasing the volume of exports, but also on: maximizing the local added value generated by commercial activities, supporting sectors oriented towards high-value services, IT&C, research and development, creating mechanisms to retain economic capital in the territory (e.g. reinvestment of profits, tax incentives for locating new production facilities).

For many counties with untapped export potential, the limitations related to the road, railway and digital infrastructure represent a major obstacle, therefore it is necessary to accelerate the major infrastructure projects (expanding the motorways, creating multimodal hubs), modernizing customs points and logistics facilities and expanding high-speed internet access, especially in rural areas.

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