

Effects of Exports on Regional Economic Development in Croatia

Abstract

The aim of this paper is to analyze the role of exports in the regional development of Croatia. Specifically, the paper employs a panel econometric model to assess the impact of county-level exports on GDP, GDP per capita, and GDP per capita growth during the period 2004-2022. In addition to the main variable of interest, exports by county, several control variables are included, namely investment, employment, human capital (measured through education), and tourism, all of which also influence regional economic performance. Diagnostic tests were conducted to examine the statistical properties and validity of the models used. Based on the results, the fixed effects (FE) model was identified as the most appropriate method. Alongside the econometric analysis, the paper also employs descriptive statistics to outline the main features of Croatian exports at the county level. The findings suggest that exports, investment, employment, and education all have a significant influence on economic growth and income per capita at the regional level. The impact of exports was found to be both statistically significant and positive, indicating that foreign trade plays a crucial role in county-level economic development. Despite these important insights, the analysis also has certain limitations. First, there may be an endogeneity issue within the models. Second, while key macroeconomic variables are included, other potentially important regional development factors such as innovation, EU funding and institutional quality should be considered for future research. Third, the structural heterogeneity among counties (e.g., industrial versus tourism-based regions) could affect the consistency of the model. The main scientific contribution of this paper lies in its empirical confirmation that exports also play a vital role in enhancing economic performance and living standards at the regional level in Croatia.

Keywords: exports, economic growth, Croatian counties, regional development.

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1. INTRODUCTION

The identification of factors that contribute to economic growth is of key importance for designing effective development policies. One such factor is exports. Due to its limited domestic market, Croatia as a small open economy, places an emphasis on exports as a central part of its development strategy. This approach also applies to sub-national units such as regions. While there is broad consensus that exports are a key driver of economic growth at the national level, their contribution to regional economic development remains insufficiently explored. As at the national level, exports should contribute to regional economic growth by increasing output, employment, and the general standard of living.

This paper analyzes the impact of exports on regional economic growth in Croatia during the period from 2004 to 2022. Exports are a crucial component of the economy, particularly in small open economies. Due to the limited size of domestic markets, countries and regions are often compelled to sell their products and services abroad to drive economic growth and development. In this context, the paper employs a panel econometric model, using county-level exports as the independent variable. Three indicators of economic performance are considered as dependent variables:

- GDP p.c. as a measure of standard of living. If exports are a key driver of economic growth, they should also positively influence the average income level within a region. This indicator examines whether counties with higher export levels also with higher GDP p.c., indicating improved living standards;
- GDP p.c. growth as a measure of sustainable economic growth. This indicator assesses whether exports contribute to a continuous rise in living standards over time. In other words, it investigates whether counties with stronger export performance experience higher rates of GDP p.c. growth;
- Total GDP growth as a measure of overall economic activity. This indicator explores whether exports contribute to absolute economic expansion. It aims to determine

whether counties with higher exports also achieve higher overall GDP growth rates.

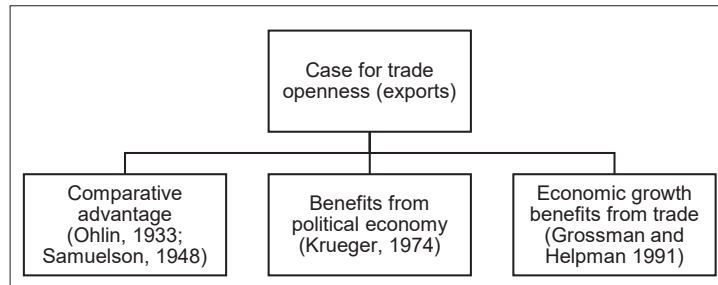
The novelty of this paper lies in the regional focus of the analysis, i.e., the examination of the impact of the exports on economic growth at the county level in Croatia. Furthermore, the paper applies a combination of structural variables such as exports, education, employment, investment and tourism within a fixed-effects panel model. Finally, the analysis covers a long-term period from 2004 to 2023, providing a comprehensive insight into the role of exports in Croatia's regional development.

This paper is structured as follows. After the introduction, the basic concepts of growth theory, with an emphasis on the role of exports in promoting economic growth are presented. This part also includes a literature review of theoretical and empirical studies on the impact of exports on economic growth but also on the regional growth. The third part explains the data and methodology. The fourth part presents the analysis of Croatian exports at county level and the results of panel econometric analysis, while the fifth part provides conclusion and discussion.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Theoretical Background

The argument that exports can be one of the main determinants of economic growth is not new. Classical economic theorists such as Adam Smith and David Ricardo argued that international trade plays a crucial role in economic growth and that each country benefits by specializing in the production of goods in which it is most efficient, engaging in international exchange with those products. Countries with higher export rates tend to have better prospects for employment and output growth. In economic theory, this is also known as the export-led growth (ELG) hypothesis. In principle, there are four main arguments explaining why exports lead to economic growth (Ramos, 2001): First, export growth stimulates production and employment through the foreign trade multi-

Figure 1. Arguments for Trade Openness and Export Promotion Source: Palley (2011)

plier. Second, exports enable the financing of imports of capital goods which in turn increase the economy's productive capacity. Third, higher export volumes and competition in international markets foster economies of scale and technological progress in production. Finally, in light of these arguments, the strong observed correlation between export growth and output can be interpreted as empirical support for the export-led growth hypothesis.

The debate on exports as a driver of economic growth gained significance in the early 1980s when East Asian countries experienced rapid growth driven by strong export performance. This stood in stark contrast to the economic struggles of Latin American countries, which faced debt crises and implemented protectionist policies to shield domestic industries. The consensus on the benefits of trade openness and exports as a source of growth is based on three key theoretical arguments (Figure 1). The first is rooted in the Heckscher-Ohlin-Samuelson theory of comparative advantage, which suggests that trade benefits arise from exchanges between countries with different capital-to-labor ratios. The second argument, from a political economy perspective, criticizes import-substitution strategies for fostering rent-seeking behavior. Free trade and export-oriented policies, by contrast, help reduce corruption and inefficiencies associated with state intervention. The third, more recent argument highlights the advantages of trade openness for economic growth, emphasizing that trade facilitates the diffusion of technology and knowledge spillovers, ultimately accelerating productivity growth.

Contemporary theories of regional development complement the above-mentioned traditional concepts by providing a more multidimensional understanding of the factors shaping regional competitiveness and growth. One of the most influential frameworks is the New Economic Geography which emphasizes the role of spatial concentration and agglomeration economies in the formation of regional disparities. According to this theory, export-oriented firms tend to cluster in economically stronger areas (such as the City of Zagreb, Croatia's largest agglomeration center) thereby intensifying regional development differences. Theories of endogenous growth (Romer, 1990; Lucas, 1988) highlight the role of human capital and innovation in explaining economic performance. A more educated workforce, coupled with incentives for innovation, enables the creation of products with higher added value and greater competitiveness in international markets, thereby fostering conditions for sustainable economic growth. Closely related to endogenous growth theories is the concept of smart specialization, which underscores the importance of knowledge and innovation in driving regional development within European regions and countries. Smart specialization strategies are built upon three core principles that can enhance the export capacity of regions (Foray et al., 2021): first, concentration on specific priorities, given the limited resources and information available for innovation; second, concentration on the transformation rather than the existing structure of the regional economy; and third, promoting a bottom-up and decentralized approach to policymaking. Furthermore, contemporary literature increasingly emphasizes institutional and

place-based approaches to regional development (Rodríguez-Pose, 2013; Barca et al., 2012) which argue that the effectiveness of regional policy depends on the quality of institutions and targeted measures in peripheral regions. Such approaches are particularly relevant for countries like Croatia where institutional capacity remains uneven and should be strengthened to improve the absorption of EU funds, an element that significantly influences the potential of exports as a driver of regional growth.

2.2. Literature Review

The main goal of this paper is to analyze the effects of exports on regional growth in Croatia, based on the assumption that exports have a positive impact on economic growth. While many factors contribute to economic growth, traditional drivers include labor, capital, and technological progress (Blanchard, 2020). Countries that invest in new technologies enhance their competitiveness and have greater growth potential (Solow, 1956; Romer, 1990; Jones, 1995; Acemoglu, 2002). However, beyond these traditional factors, exports stand out as a crucial driver of growth, particularly in small and open economies.

Numerous empirical studies have confirmed that underdeveloped countries with strong export performance tend to experience higher national income growth rates. Since exports are a component of GDP, a positive relationship between exports and economic growth is expected. However, exports contribute to output growth beyond just increasing volume - they enhance capacity utilization, economies of scale, technological advancements, efficient management, and competition (Feder, 1983). The paradigm of exports as a driver of economic growth gained traction in the 1970s when a consensus emerged on the benefits of trade openness. Studies by Michaely (1977), Tyler (1981), Feder (1983) and Thornton (1996) found a positive link between exports and growth in semi-industrialized and developing countries. Similarly, Balassa (1978) confirmed this relationship for economies with an established industrial base. Evidence suggests that policies promoting exports yield stronger growth compared to those

favoring import substitution. Marin (1992) examined the link between export growth and productivity, concluding that an outward-oriented trade regime enhances productivity in both developed and developing nations. Other studies confirming a positive export-growth relationship include Ram (1987), Greenaway et al. (1999), Al-Yousif (1997), Hagemeyer and Mućk (2019), Arteaga et al. (2020) and Hausmann (2024).

However, some studies have produced conflicting results, particularly in time-series analyses. Dodaro (1991) argued that export-led growth is not universally strong and that its effectiveness depends on a country's development level and export structure. He found a negative relationship between GDP growth and primary product exports, while manufacturing exports correlated strongly with GDP growth. Yaghmaian (1994) reinforced this by showing that a higher share of manufacturing in exports improves economic performance. Subasat (2002) indicated that the export-growth link is not uniform: while positive for middle-income countries, it is weak or nonexistent for low- and high-income economies. Giles and Williams (2000) conducted an extensive review of the export-led growth literature, while Palley (2011) argued that this paradigm no longer holds in the 21st century, advocating for domestic demand-driven growth strategies instead. Other studies questioning the export-growth connection include Sheehy (1990), who found exports contribute to growth no more than other GDP components, and Jung and Marshall (1985), Ram (1985), and Dollar (1992), who highlighted potential causality issues.

Exports play a crucial role not only in the national economy but also in regional economies. As subnational entities, regions face the constraints of a limited domestic market, making exports essential for driving growth. North (1955) highlighted the importance of exports by critiquing the traditional regional development theory, which suggested that regions progress through primary, secondary, and tertiary transformations. Instead, he argued that regional development is closely tied to exports, introducing the concept of the export base as a foundation for regional growth. Tiebout (1956)

further explored this concept, acknowledging its significance while emphasizing that it is only one of several factors influencing overall economic development. Krugman (1991) and Fujita and Krugman (2004) explore the theoretical aspects of trade in spatial economics. Galindo Martin and Alvarez Herranz (2006) use a panel model to analyze the impact of exports on the growth of Spanish regions, finding that exports play a crucial role in economic growth, particularly in less developed regions. Similarly, González-Pernía and Peña-Legazkue (2015) examine Spanish regions from an entrepreneurial perspective, concluding that regions with a higher share of export-oriented entrepreneurs tend to experience higher growth rates. Psycharis et al. (2020) empirically investigate the role of exports in regional resilience during Greece's 2008–2012 financial crisis. They find that, beyond exports, factors such as initial conditions, sectoral specialization, and regional adaptability also significantly contribute to economic resilience.

Although numerous studies confirm the link between exports and economic development, few have examined the impact of exports on Croatia's regional development. Most research focuses on the national level, and there are no empirical studies that assess the effects of exports on economic disparities across counties. This paper therefore fills an important gap in the literature by providing empirical evidence on regional differences in the impact of exports on economic growth during the period 2004–2022, including the years before and after Croatia's accession to the European Union.

Based on the given literature review, a conceptual framework for the empirical research of this paper was constructed. It is based on the export-led growth hypothesis (Feder, 1983 and Balassa, 1978), which assumes that higher exports contribute to the growth of productivity, employment and production through specialization and access to international markets. In the theories of regional development (North, 1955 and Krugman, 1991), structural and locational factors are key on which exports contribute to the economic development of regions. In this context, the economic growth of the region depends not only on exports but also on other

factors such as investments, employment, human capital and tourism. Capital accumulation in the form of investments positively affects production and thus increases export capacity (Solow, 1956 and Blanchard, 2020). Greater investment in human capital increases innovation and greater absorption of external knowledge (Romer, 1990 and Acemoglu, 2002). Labor (employment) is an important classical growth factor, and tourism can contribute to the economic growth of regions with a developed service sector (Psycharis et al. 2020). Based on the theoretical framework and empirical research from the literature review, the model in this paper assumes that exports and other factors such as employment, tourism and investment directly affect the economic performance of regions, i.e. GDP, GDP p.c. and GDP p.c. growth.

3. DATA AND METHODOLOGY

The paper employs a panel model to examine the impact of exports on regional economic growth in Croatia, integrating both temporal and spatial dimensions. The temporal dimension covers the period from 2004 to 2022, while the spatial dimension encompasses 21 Croatian counties. Unlike classical time-series or cross-sectional regression, panel regression incorporates a double indexing of variables (Baltagi, 2005):

$$y_{it} = \alpha + X_{it}'\beta + u_{it} \quad i=1,2,\dots,N; \quad t=1,2,\dots,T$$

where i represents individuals, households, firms, or countries, and t represents time. The model frequently includes a one-way error component (Baltagi, 2005):

$$u_{it} = \mu_i + v_{it}$$

Here, μ_i represents a fixed individual effect, while v_{it} is a random error. In the context of this paper, y_{it} represents the dependent variable (economic growth), while $i=1, 2, \dots, 21$ denotes the cross-sectional dimension (21 counties). β represents the coefficient of the independent variable or the elasticity coefficient and X_{it} refers to the matrix of independent variables such as exports, investment, education etc. Accordingly, three separate models will be constructed in this paper, depending on the chosen depen-

dent variable. In the first model, the dependent variable is GDP p.c. growth as a measure of living standards. In the second model, the dependent variable is GDP p.c. as an indicator of sustainable economic growth. In the third model, the dependent variable is GDP growth as a measure of overall economic expansion. The independent variable of interest is county-level exports. The objective is to assess the extent to which exports at the county level contribute to GDP p.c., GDP growth p.c. and GDP growth. Additionally, control variables that are not the primary focus of the analysis but influence the dependent variable have been included, namely investment, employment, human capital/education (2009–2022), and tourism. Therefore, the panel models can be expressed as follows:

$$\begin{aligned}
 gdp_pc_g_{it} &= \beta_0 + \beta_1 \ln_Exports_{it} \\
 &+ \beta_2 \ln_Investment_{it} + \beta_3 \ln_Employment_{it} \\
 &+ \beta_4 HumanCapital_{it} + \beta_5 Tourism_{it} + \varepsilon_{it} \\
 \\
 \ln_gdp_pc_{it} &= \beta_0 + \beta_1 \ln_Exports_{it} \\
 &+ \beta_2 \ln_Investment_{it} + \beta_3 \ln_Employment_{it} \\
 &+ \beta_4 HumanCapital_{it} + \beta_5 Tourism_{it} + \varepsilon_{it} \\
 \\
 gdp_g_{it} &= \beta_0 + \beta_1 \ln_Exports_{it} \\
 &+ \beta_2 \ln_Investment_{it} + \beta_3 \ln_Employment_{it} \\
 &+ \beta_4 HumanCapital_{it} + \beta_5 Tourism_{it} + \varepsilon_{it}
 \end{aligned}$$

Due to the characteristics of the data, the variables for exports, investments, employment, and GDP per capita are included in the models in logarithmic form. These variables exhibit significant skewness, meaning their values can vary considerably across counties. Log transformation reduces skewness, and the resulting coefficients can be interpreted as elasticities (Wooldridge, 2002). For the variables GDP p.c. growth and GDP growth, the log-difference method is applied according to the formulas presented in Table 2. The variables for education and tourism are expressed as percentage shares and are not transformed into logarithmic values. The variable education is a proxy for human capital and it is approximated by the share of highly educated workers in the total employment of a county, while the variable tourism is represented by

the share of employees in the accommodation and food service sector within the total county employment. The latter is included in the model because it might play a significant role in regional economic growth, especially in a country like Croatia where its share in GDP is approximately 11.82% in 2019 (Croatian Bureau of Statistics, 2022). A detailed explanation of all variables used in the models is provided in Table 1. All data are retrieved from the Croatian Bureau of Statistics, 2024).

Table 2 provides an overview of the statistical summary, including the number of observations, mean, standard deviation, minimum, and maximum values, to offer insight into the characteristics of the data. Part a) of Table 2 presents descriptive statistics for the variables used in the model. Some variables, such as GDP p.c., exports, investments, and employment, were used in log form, making direct interpretation difficult. Therefore, part b) of Table 2 provides a statistical summary for the same variables in their original numerical form. The average GDP p.c. across all counties is 9,437 EUR. Regarding GDP p.c. growth rates, Croatian counties experienced significant fluctuations over the observed period. The highest growth rate was recorded in Lika-Senj County in 2004, at 27.52%, while the sharpest decline occurred in Dubrovnik-Neretva County in 2020 due to the COVID-19 pandemic, with a drop of -29.47%. The average export value per county is 503.75 million EUR. The average county-level employment stands at 67,939, while the average investment per county is 2.48 million EUR. In terms of human capital, the average share of highly educated workers in total employment is 16.91%, with the City of Zagreb recording the highest share in 2022 (33.27%) and Virovitica-Podravina County the lowest in 2009 (2.18%). Regarding tourism-related employment, the average share of employees in accommodation and food services is 4%. The highest share was observed in Dubrovnik-Neretva County in 2019 (18.29%), while the lowest was recorded in Brod-Posavina County in 2009 (0.6%) (Table 2)

Table 1. Summary of Variables Used in the Panel Data Models

Code	Variable	Unit of measurement
<i>ln_gdp_pc</i>	GDP per capita	Log transformation of GDP p. c. at the county level in EUR at fixed exchange rate, 2004-2022.
<i>gdp_pc_g</i>	GDP per capita growth	Log-difference growth of GDP p. c. at the county level:
<i>ln_gdp</i>	GDP	Log transformation of GDP at the county level in EUR at fixed exchange rate, 2004-2022.
<i>gdp_g</i>	GDP growth	Log-difference growth of GDP at the county level:
<i>ln_exports</i>	Exports	Log transformation of exports by counties in EUR at fixed exchange rate, 2003-2022.
<i>ln_investment</i>	Investment	Log transformation of gross investment in new fixed assets in current HRK at the county level, 2003-2022.
<i>ln_employment</i>	Employment	Log transformation of number of persons in employment at the county level, 2003-2022.
<i>hc</i>	Human capital/ education	Percentage share of employees with university degrees in legal entities at the county level, 2009-2022.
<i>tourism</i>	Accommodation and food service activities (I)	Percentage share of employees in Accommodation and food service activities (Section I) in legal entities at the county level, 2004-2022.

Table 2. Summary Statistics of the Variables

Variables	(1) Obs	(2) Mean	(3) St. dev.	(4) Min	(5) Max
a)					
<i>ln_gdp_pc</i>	399	9.095	0.325	8.452	10.28
<i>gdp_pc_g</i>	399	4.453	7.453	-29.47	27.52
<i>gdp_g</i>	399	3.650	7.201	-28.96	27.47
<i>ln_exports</i>	399	12.46	1.192	8.404	15.89
<i>ln_investment</i>	399	14.20	0.908	12.48	17.26
<i>ln_employment</i>	399	10.78	0.741	9.462	13.02
<i>education</i>	294	16.91	6.410	2.181	33.28
<i>tourism</i>	399	4.015	3.634	0.600	18.29
b)					
<i>gdp_pc</i>	399	9437.521	3580.437	4685	29070
<i>exports</i>	399	503753.2	835996	4464	7999580
<i>investment</i>	399	2481840	3843659	263933	3.14e+07
<i>employment</i>	399	67939.53	82361.17	12860	449598

4. RESULTS OF THE PANEL ECONOMETRIC ANALYSIS

A panel econometric analysis is conducted to examine the impact of exports on regional development in Croatia. The analysis begins with the diagnostic tests that were conducted to assess the statistical properties and validity of the methods used. Table 3 presents diagnostic tests for the models that exclude the *hc/education* variable and cover the period 2004-2022, while Table 4 shows the results for models that include the *hc/education* variable and refer to the period 2009-2022. The first test is the Hausman test, which determines whether a fixed-effects (FE) or random-effects (RE) model is more appropriate. Since the *p*-values in all models are extremely low (0.000), it is concluded that fixed-effects models are the better choice in all models. The main reason for using a fixed-effects model is that it eliminates omitted variable bias by accounting for changes within a group over time, typically by including dummy variables for unobserved or unknown characteristics (Wooldridge, 2002). In other words, at the county level, this model makes it possible to control for time-invariant characteristics that may affect economic growth but are not directly included in the model. These may include geographic features, cultural differences, or institutional quality. At the same time, the model allows the focus to be placed on variables that change over time, such as exports, employment, or investment. This enables a more accurate assessment of the impact of explanatory variables on county-level economic growth, without the influence of region-specific, unchanging characteristics.

Furthermore, the modified Wald test was conducted to check for the presence of heteroscedasticity, or unequal error variances. The results indicate that heteroscedasticity is present in all models (*p*-value = 0.000), meaning that the standard errors are not consistent and should be corrected using robust standard errors, such as the Driscoll-Kraay correction (Tables 3 and 4). Autocorrelation was tested using the Wooldridge test. The results show that in Models 1 (GDP p.c. growth) and 3 (GDP growth), autocorrelation is not a problem (*p*-values are 0.255 and 0.345, respectively). However, in Model 2 (GDP p.c.), autocorrelation is present (*p*-value

= 0.000) (Table 3). This suggests that the error terms in Model 2 are correlated over time, which can lead to underestimated standard errors and potentially misleading statistical significance of the coefficients. The same applies to the models that include the *hc/education* variable and cover the period 2009-2022. In those models as well, autocorrelation is not an issue in models 1 and 3, while it is present in model 2 (Table 4).

Additionally, the Pesaran test was performed to examine the presence of cross-sectional dependence, i.e., the interdependence among units within the panel. Given that the *p*-values for all models are 0.000, it is concluded that there is significant correlation between regions indicating that shocks in one unit may affect others. This result further justifies the application of Driscoll-Kraay standard errors, which are robust to both heteroscedasticity and cross-sectional dependence. Finally, the Variance Inflation Factor (VIF) test was conducted to assess the presence of multicollinearity among the independent variables. The average VIF value is 5.71/5.44 (Table 3/Table 4), which is below the commonly accepted threshold of 10. This indicates that multicollinearity is not a serious concern and is unlikely to distort the stability or reliability of the model estimates. Considering the results of all diagnostic tests, the most appropriate analytical approach is to employ a fixed effects (FE) model with Driscoll-Kraay standard errors, which correct for heteroscedasticity, autocorrelation, and cross-sectional dependence (Hoechle, 2007). This method ensures more precise and robust estimation of the effects of the explanatory variables on economic growth.

The results of the analysis are presented in Table 5. Three models were constructed based on different dependent variables: GDP p.c. growth rate, GDP p.c. level, and overall GDP growth rate. Since data on workforce education levels by county have been available only since 2009, three additional models were developed for the period 2009-2022 that include the variable *hc/education*, which measures the percentage of highly educated individuals in total county employment. In all models, the key variable of interest is exports (*ln_exports*). The analysis aims to determine whether, and to what extent,

Table 3. Diagnostics Test for Models Without Variable hc/education, Period 2004-2022

	(1)	(2)	(3)
	GDP p.c. Growth	GDP p.c.	GDP Growth
Hausman test χ^2 -statistics (p-value)	Fixed 37.42 (0.000)	Fixed 43.54 (0.000)	Fixed 33.53 (0.000)
Modified Wald test χ^2 -statistics (p-value)	Heteroskedasticity present 64.93 (0.000)	Heteroskedasticity present 133.35 (0.000)	Heteroskedasticity present 66.06 (0.000)
Wooldridge test F-statistic (p-value)	No autocorrelation 1.376 (0.255)	Autocorrelation 40.971 (0.000)	No autocorrelation 0.936 (0.345)
Pesaran test CD (p-value)	Cross-sectional dependence present 39.103 (0.000)	Cross-sectional dependence present 22.930 (0.000)	Cross-sectional dependence present 38.934 (0.000)
VIF test (multi- colinearity)	Mean VIF=5.71	Mean VIF=5.71	Mean VIF=5.71

Notes: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; VIF<5 (low multicollinearity), VIF between 5-10 (moderate multicollinearity), VIF>10 (strong multicollinearity)

Table 4. Diagnostics Test for Models that Include Variable hc/education, Period 2009-2022

	(1)	(2)	(3)
	GDP p.c. Growth	GDP p.c.	GDP Growth
Hausman test χ^2 -statistics (p-value)	Fixed 119.65 (0.000)	Fixed 144.66 (0.000)	Fixed 87.89 (0.000)
Modified Wald test χ^2 -statistics (p-value)	Heteroskedasticity present 91.64 (0.000)	Heteroskedasticity present 133.35 (0.000)	Heteroskedasticity present 90.28 (0.000)
Wooldridge test F-statistic (p-value)	No autocorrelation 1.376 (0.255)	Autocorrelation 45.10 (0.002)	No autocorrelation 0.936 (0.345)
Pesaran test CD (p-value)	Cross-sectional dependence present 35.403 (0.000)	Cross-sectional dependence present 18.320 (0.000)	Cross-sectional dependence present 35.053 (0.000)
VIF test (multi- colinearity)	Mean VIF=5.44	Mean VIF=5.44	Mean VIF=5.44

Notes: Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; VIF<5 (low multicollinearity), VIF between 5-10 (moderate multicollinearity), VIF>10 (strong multicollinearity)

Table 5. Panel Regression Estimates – Driscoll-Kraay SE

	GDP p.c. Growth		GDP p.c.		GDP Growth	
	2004-22	2009-22	2004-22	2009-22	2004-22	2009-22
ln_exports	4.378**	6.034***	0.218***	0.148***	3.687**	5.468***
	(1.682)	(1.185)	(0.032)	(0.021)	(1.611)	(1.218)
ln_investment	6.024**	2.929	0.147***	0.137**	5.753**	2.563
	(2.243)	(2.554)	(0.045)	(0.051)	(2.200)	(2.466)
ln_employment	10.787	16.858	0.270*	1.173***	12.372	15.761
	(8.855)	(13.512)	(0.140)	(0.239)	(8.425)	(11.899)
hc/education		0.481***		0.008***		0.442***
		(0.150)		(0.002)		(0.135)
tourism	-0.086	0.133	0.094***	0.044***	-0.418	0.049
	(1.098)	(0.835)	(0.011)	(0.010)	(1.070)	(0.748)
_cons	-251.54**	-304.02	1.010	-7.588**	-255.62**	-279.93*
	(106.42)	(175.76)	(1.687)	(2.813)	(96.85)	(157.25)
Observations	399	294	399	294	399	294
No. of groups	21	21	21	21	21	21
R ² (Within)	0.161	0.379	0.722	0.789	0.145	0.357
F-statistic (p-value)	5.22 (0.006)	56.97 (0.000)	118.05 (0.000)	46.08 (0.000)	4.78 (0.008)	45.83 (0.000)

Notes: Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

exports influence GDP growth, GDP p.c. levels, and GDP p.c. growth. In both time periods, exports have a positive and statistically significant effect on economic growth (GDP growth) and GDP p.c. (both growth and level). However, the effect of exports is stronger in the 2009-2022 model. Specifically, the coefficient for GDP

p.c. growth increases from 4.378 (2004-2022) to 6.034 (2009-2022), suggesting that exports contributed more significantly to economic growth after 2009. This increase could be attributed to structural changes in the economy, greater integration into international markets or specific economic policies introduced after

the 2008-2009 financial crisis. Regarding investments, during 2004-2022, they had a strong and statistically significant positive effect on both GDP growth and GDP p.c. growth (6.024 for GDP p.c. growth and 5.753 for GDP growth). However, in the 2009-2022 period, their impact significantly decreases and becomes statistically insignificant for GDP p.c. growth and GDP growth, while it remains significant for GDP p.c. level. Employment has a positive effect on all three dependent variables in both models, but it is statistically significant only in the 2009-2022 model. Notably, the impact on GDP p.c. is much larger in this period (1.173 compared to 0.270 in the first model), indicating that post-2009 employment growth may have had a greater influence on improving living standards than in the earlier period.

The *hc/education* variable was not included in the 2004-2022 model but in the 2009-2022 model. It demonstrates a significant and positive effect on all three dependent variables. For example, a 1 percentage point increase in the share of highly educated employees is associated with a 0.481 percentage point increase in GDP p.c. growth. This highlights the importance of education in regional development and its role in enhancing productivity and fostering economic growth. In both periods, the effect of tourism on GDP growth and GDP p.c. growth is not statistically significant. However, in the model for GDP p.c., tourism exhibits a significant and positive effect, particularly in the 2009-2022 period (0.044). This may indicate that tourism contributes to raising income p.c., though it does not necessarily drive overall economic growth. The 2009-2022 model has a considerably higher R^2 (Within) across all specifications, suggesting that the independent variables better explain the variation in the dependent variables during the shorter period. In conclusion, the main differences between the two models are the increased importance of education and employment in the later period (2009-2022), as well as the diminished effect of investment. Additionally, the stronger impact of exports in the 2009-2022 model suggests that foreign trade became a more critical driver of growth in the post-crisis era. Including education in the model underscored its central role in promoting economic growth.

5. CONCLUSION

The novelty of this research lies in its regional focus, longer time frame and integration of multiple growth determinants (exports, investment, education, tourism and employment) within a single empirical framework. These elements distinguish the study from existing national-level analyses of export-led growth in Croatia. The results of the analysis indicate that factors such as exports, investment, employment and education significantly influence economic growth and income p.c. at the county level across the observed periods. The effect of exports was found to be statistically significant and positive, suggesting that foreign trade plays a key role in the economic growth of counties. This finding aligns with expectations, as export-oriented regions tend to experience faster economic growth through increased productivity and deeper integration into the international division of labor. The impact of investment was more pronounced in the earlier period (2004-2022) but diminished in the later period, which may reflect structural shifts in the nature of investments or a decline in capital efficiency following the global financial crisis and Croatia's deeper integration into the European Union. Employment was positively associated with income p.c., with this relationship becoming more evident in the later period. Additionally, education, analyzed only in the models covering 2009-2022, emerged as a significant growth factor, supporting the view that a higher share of highly educated workers contributes to increased income p.c. and overall economic development. On the other hand, tourism did not exhibit a statistically significant effect on economic growth, except in the GDP p.c. model, where a positive relationship was observed. This suggests that while tourism may contribute to higher income levels, it does not necessarily drive broader economic development. This may be due to the seasonal nature of tourism and its limited integration with other sectors of the economy.

Despite providing valuable insights, the analysis presented in this paper has several limitations. First, there is the potential issue of endogeneity within the models. Although the use of panel data and fixed effects helps to mitigate unobserved heterogeneity across counties, some

variables may exhibit bidirectional causality. For instance, higher income levels may attract more investment, not just the other way around. Second, while key macroeconomic indicators were included, the analysis would benefit from more comprehensive data on other relevant regional factors, such as innovation, EU funding, institutional quality and capital investment, which could strengthen the robustness of the findings. This limitation stems from the lack of data on these structural determinants. Their inclusion would enhance the explanation of the differences in growth rates between counties. Third, although all counties are within the same national context, there may still be substantial structural differences between more and less developed regions that the models do not fully account for. Future research could expand the regional growth model by incorporating additional variables such as innovation, technological progress, institutional quality and EU structural and cohesion funds. However, the availability and consistency of such data at the county level remain a key limitation.

For economic policymakers, this paper highlights the crucial role of exports in driving regional economic growth. Beyond a descriptive interpretation, the results can also be understood within a broader theoretical framework. The positive relationship between exports and regional growth confirms the export-led growth hypothesis, but it also suggests the possibility of regional divergence as export intensity varies considerably across Croatian counties. At the same time, other factors such as investment, employment, and education, play a key role in fostering sustainable growth in Croatian counties and may partially offset weaker export performance in certain counties. Based on these findings, several specific policy recommendations can be formulated. First, it is necessary to strengthen the export capacities of counties that lag behind in export performance. This can be achieved through programs that support the internationalization of business operations and improve access to foreign markets. Second, given that education has shown a statistically significant and positive effect in all models, it is important to invest in developing educational programs that are aligned with labor market needs and stimulate innovation in high

value-added sectors, particularly in the STEM fields. Third, although tourism has not exhibited a consistent impact on growth, except in the case of GDP per capita, this sector still holds potential if better integrated with local manufacturing and processing industries. Such integration could reduce import dependence, stimulate export activities, and mitigate the seasonality of tourism. Ultimately, efforts should focus on strengthening the manufacturing industry as the main source of goods exports. In terms of future research, an additional recommendation is to enhance the capacity of local institutions and economic actors to utilize EU funds in ways that improve export competitiveness.

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Učinci izvoza na regionalni razvoj Hrvatske

Sažetak

Cilj ovog rada je analizirati ulogu izvoza u regionalnom razvoju Hrvatske. Konkretnije, u radu će se koristiti panel ekonometrijski model kako bi se ocijenio utjecaj izvoza županija na njihov BDP, BDP per capita i rast BDP- per capita u periodu 2004-2022. Osim varijable od interesa, a to je izvoz po županijama, koristit će se i kontrolne varijable koje također utječu na regionalne ekonomske pokazatelje, a to su investicije, zaposlenost, ljudski kapital ili obrazovanje i turizam. U radu su provedeni dijagnostički testovi kako bi se utvrdila statistička svojstva i valjanost korištenih metoda te je utvrđeno da je prikladnije koristiti model s fiksnim efektima (FE). Osim ekonometrijske panel analize, u radu se deskriptivnom statistikom opisuju osnovne karakteristike hrvatskog izvoza po županijama. U konačnici, rezultati analize su pokazali da faktori poput izvoza, investicija, zaposlenosti i obrazovanja utječu na gospodarski rast i dohodak po stanovniku na razini županija. Učinak izvoza se pokazao statistički značajnim i pozitivnim što sugerira da vanjska trgovina igra ključnu ulogu u ekonomskom razvoju županija. Iako rezultati pružaju važne uvide, analiza u ovom radu ima i nekoliko ograničenja. Prvo, u modelima je moguć problem endogenosti. Drugo, potrebno je uključiti ne samo ključne makroekonomske varijable nego i ostale potencijalno bitne čimbenike regionalnog rata poput inovacija, EU fondova ili kvalitete institucija. Treće, u modelima je moguć problem heterogenosti jer se županije strukturno razlikuju među sobom (npr. turističke i industrijske županije). Glavni znanstveni doprinos ovog rada se temelji na empirijskoj potvrdi da izvoz i na regionalnoj razini doprinosi ekonomskom rastu i povećanju životnog standarda u Hrvatskoj.

Ključne riječi: izvoz, ekonomski rast, hrvatske županije, regionalni razvoj.