TRANSPORT INFRASTRUCTURE DEVELOPMENT AND ECONOMIC GROWTH IN THE EUROPEAN UNION

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Abstract: *Transport infrastructure has a strategic importance in the social and economic development of countries. From Antiquity to the present day, transport infrastructure has aimed to facilitate freedom of movement, and access to goods, services, and information. Investments in the development of transport infrastructure led to economic growth, the development of trade, the increase of national and regional competitiveness, as well as the increase of the well-being of the population. The purpose of this article is to analyze the contribution that transport infrastructure manifests to the economic growth of European Union countries. Through this article we aim to explore the correlation between public expenditures on transport infrastructure and economic growth, using the data available in the Eurostat database. The obtained results confirm the hypothesis that, indeed, public spending on transport infrastructure contributes significantly to the economic growth of EU states. The main conclusion of the study carried out in this article supports the need for investments in the modernization and maintenance of the transport infrastructure to enhance sustainable economic growth and the well-being of the population.*

Keywords: *transport infrastructure; economic development; transport policies.*

JEL Classification: *F63; F68; L92.*

1. Introduction

Transport infrastructure is an essential element of economic activities by increasing the movement of goods, training the workforce, encouraging private investment and trade, increasing the mobility of people, and facilitating access to education, jobs, and health services. Investments in the development of transport infrastructure have been a key point in all stages of the socio-economic development of countries, with each government establishing a policy related to the development of the transport sector.
Since the transport system is seen as an essential social and economic asset, investments in the development of transport infrastructure represent an important share of public expenditure. It is thus noted that the transport infrastructure does not only have a macroeconomic, commercial, and competitive impact but has a much wider important contribution, being correlated and influencing multiple economic sectors, from public administration and budget policy to the educational system and the labor market, to the real estate sector and the business environment, to environmental policy and inclusion, even redefining the social role of the population.
The result of investments in the development of transport infrastructure has been economic growth, the development of trade, an increase in national and regional competitiveness, as

well as an increase in the well-being of the population. The purpose of this article is to analyze the contribution that transport infrastructure has made to the economic growth of European Union (EU) countries.
In this article we aim to expand the existing literature on this subject, our objective being to explore the correlation that is established between public spending on transport infrastructure and economic growth in EU states. Using the data available in the Eurostat database, we started with the hypothesis that public expenditures in the transport sector determine the economic growth of EU countries.
The paper is structured as follows. After the introduction of the topic, the paper presents the literature review related to the impact of the transport infrastructure on economic development. The third section presents the data and methodology used in the empirical study. The next section presents the results, and the final part of this paper is dedicated to the conclusions of our research.

2. Literature review

The importance of investments in the transport sector and their influence on the economy has been debated in multiple studies over the years, their conclusions suggesting the existence of a link between the development of transport infrastructure and regional and national economic growth.
Investments in infrastructure represent an important category of national budgets, affecting the distribution of national financial resources. From this point of view, Barro (1990) and Myrdal (1969) evaluate investments in public services as productive government spending and a boost to economic growth. On the other hand, other researchers refer to the crowding-out effect and indicate in their works the idea that increasing government spending could slow down the economy by reducing private sector investment (Mahmoudzadeh, Sadeghi & Sadeghi, 2013; Landau, 1983; Cameron, 1982; Buiter, 1976).
Herranz-Loncan (2007) studies infrastructure in Spain, his results confirming the existence of a positive correlation between transport infrastructure and economic development, and Cascetta et al. (2020) report an Italian GDP growth of 2.6% over 10 years. Similar results were obtained by Saidi, Shahbaz, and Akhtar (2018) for countries in the Middle East and North Africa Region. Also, Alotaibi et al. (2022) observe that the accessibility of transport infrastructure has positive and significant effects on Saudi Arabia's GDP growth.
Several authors have turned their attention to the case of China, which has registered impressive economic development in recent decades (Morrison, 2019), determined by the multiple economic reforms adopted, but also by investments in transport infrastructure (Wang, Kim & Kim, 2021). The results obtained from the research carried out support the hypothesis that the infrastructure in the transport sector is a determining factor of economic development and growth in China (D´emurger, 2001; Zhou et al., 2007; Song & van Geenhuizen, 2014; Li et al., 2018). However, Yu et al. (2012) show that China's transport infrastructure does not independently drive economic growth in underdeveloped regions, thus suggesting the need for collaboration between different economic sectors and the need to adopt congruent policies to ensure economic growth.
The causal relationship between transport infrastructure and economic development has been studied in various specialist works, the results reflecting the fact that transport stimulates economic growth (Pradhan, 2010; Pradhan & Bagchi, 2013; Bahrami, 2012; Sahoo et al., 2012), while other authors have found that economic development promotes the growth of transport (Keho & Echui, 2011; Maparu, & Mazumder, 2017), and other studies conclude that there is a mutual influence, i.e. there is a reciprocal cause-effect interaction between transport and economic development (Njoku, et al., 2015; Saidi & Hammami, 2017).
However, in the literature, some authors contradict the previously mentioned studies through the results they obtained in their research. Kustepeli et al. (2012) observed that

there are no long-run relationships between investment in transport infrastructure, economic growth, and international trade in Turkey. The results obtained by Bhunia (2011) reflect an insignificant positive influence on transport infrastructure and economic growth in India.
The study by Park et al. (2019) on the role of transport in the economic development of OECD and non-OECD states shows the increased importance of maritime transport in ensuring economic growth compared to air and land transport, and the fact that air and land transport are often irrelevant or negatively affect economic growth, especially in developing countries. Also, the results obtained by Crescenzi and Rodriguez-Pose (2012) support the existence of a low correlation between transport infrastructure and regional growth in the EU.
Studies by Munnell (1992), Ghosh & Meagher (2004), and Liu & Zhou (2006) conclude that infrastructure significantly influences the economic performance of countries. The influence of transport infrastructure on economic growth is realized in expanding labor productivity, reducing transport costs and increasing efficiency, industrial concentration, and changing aggregate market demand (Pradhan & Bagchi, 2013; Gunasekera et al., 2008; Baldwin & Forslid, 2000). These results are confirmed by Meersman & Nazemzadeh (2017) in the case of Belgium, and Zhang & Cheng (2023) in the case of Great Britain. Agnusdei (2022) argues the importance of transport infrastructure for food security in the agri-food sector in Italy, as well as in improving the economic performance of companies, also emphasizing the importance of regional economic desolation.
At the same time, Serven & Calderon (2004) show that underinvestment in infrastructure is correlated with recession in developed European states, such as Greece, Spain, Portugal, and Ireland, but also with poverty in developing states. However, Virag et al. (2022) studied the relationship between transport infrastructure and well-being in a sample of 172 countries and found that high mobility expressed in terms of distances traveled, and transport infrastructure increases well-being, but only up to a certain point.
Jacobs-Crisioni et al. (2016) analyze the impact of transport infrastructure on the reduction of territorial disparities in Austria, the Czech Republic, Germany, and Poland, the results obtained reflect the influence of urbanization and changes in population numbers and the role of infrastructure in territorial cohesion.
Limani (2018) studies the contribution of transport to GDP growth in developed economies (USA, EU-27, Canada, New Zealand, Russia, China, and Japan), the results obtained reflect the fact that infrastructure investments are not the main cause of economic development. Bottasso & Conti (2010) analyze the impact of transport infrastructure on industrial production and note that regulatory barriers can reduce the productive impact of transport infrastructure, especially in industries that depend on logistics and transport services.
Maciulyte-Sniukiene & Butkus (2022) the impact of different types of infrastructure on the economic growth of EU countries, the results obtained reflecting the positive correlation between transport infrastructure, ICT infrastructure, public utility infrastructure, and economic growth. However, only ICT infrastructure and electricity generation infrastructure have a significant influence on economic growth.
Alvarez-San Jaime et al. (2021) study the effects of cooperation and coordination of rail and air infrastructure in the case of Spain and show that cooperation has positive effects on welfare by reducing transport costs, increasing traffic, reducing congestion and transport time, developing competitiveness, and increasing welfare.
Rehman et al. (2022) investigate the impact of the BRI project and demonstrate that transport infrastructure, along with institutional quality, human capital quality, trade intensity, domestic investment, foreign aid, and GDP per capita, lead to an increase in foreign direct investment in regions from Asia, Europe, Africa, and the Middle East. However, Chen & Li (2021) obtained different results, showing that Central and West Asian countries had a significant increase in GDP, employment, and economic welfare, while the economic impact

of transport infrastructure in the countries of Central and Western Europe was relatively minor.
From the previously mentioned studies, a divergence of the results obtained by the authors can be noted. It is clear that there is a causal relationship between transport infrastructure and economic growth, but the degree of correlation and its intensity differ depending on pre-existing economic conditions. Results identified in the specialized literature suggest the importance of adopting congruent socio-economic policies to ensure sustainable, resilient, and inclusive economic growth, especially in underdeveloped regions (Sehleanu et al., 2021).
Based on the bibliography presented above, our study starts from the idea that in EU countries investments in transport infrastructure influence economic growth. The formulated research hypothesis is presented as follows:
H1: Public spending in the transport sector determines the economic growth of EU countries.

3. Research methodology

In this article, we aimed to empirically investigate the relationship between public spending in the transport sector and the economic growth of EU countries. In this sense, we have collected the data published by Eurostat regarding the public expenditures in the transport sector (CHt) and the Gross Domestic Product per inhabitant (GDPc) for the period 2002-2022. Public expenditure in the transport sector (CHt) was determined by summing it up for each country and is expressed in millions of euros, and the Gross Domestic Product per capita (GDPpc) was considered the average of the 27 countries and is expressed in euros/ resident in current prices.
We aim to analyze the influence that CHt has on EU economic growth, expressed by GDPpc. As a result, we studied the correlation that is established between the two variables by calculating both the Pearson and the Spearman coefficient which is much more relevant in the case of smaller data samples. The econometric analysis was carried out using SPSS software.
In the next step, we set out to see if CHt represents a significant predictor for the evolution of GDPpc. In this sense, we considered GDPpc as the dependent variable and CHt as the independent variable in the following regression equation:

$$GDPpc_t = \alpha + \beta * CH_t \qquad (1)$$

Where:
GDPpc = Gross Domestic Product per capita
α = the intercept
β = coefficient of the independent variable
CH = public expenditures in the transport sector
t=time

4. Empirical results

Descriptive statistics (Table 1) show a homogeneous sample, with each variable having 21 entries for each year considered in the analysis. The median value of GDPpc is 25990.2833 with a standard deviation of 5023.69301 and a normal distribution (the values of skewness and kurtosis are less than ± 1.0). In the case of CHt, the median value is 250354.0095, and the standard deviation is 44339.49075, presenting an approximately normal distribution (the values of Skewness and Kurtosis are less than ± 1.0).

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
GDPpc	21	18071.85	37458.00	25990.2833	5023.69301	.459	.501	-.037	.972
CHt	21	171806.60	353348.50	250354.0095	44339.49075	.466	.501	.723	.972
Valid N (listwise)	21								

Source: authors's own computation by using SPSS software

The results obtained after determining the Person and Spearman coefficient support the existence of a strong and significant correlation (p < 1%) between the two variables (Table 2 and Table 3).

Table 2. Person Correlation

		PIBc	CHt
PIBc	Pearson Correlation	1	.960**
	Sig. (2-tailed)		.000
	N	21	21
CHt	Pearson Correlation	.960**	1
	Sig. (2-tailed)	.000	
	N	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

Source: authors's own computation by using SPSS software

Table 3. Spearman Correlation

			PIBc	CHt
Spearman's rho	PIBc	Correlation Coefficient	1.000	.918**
		Sig. (2-tailed)	.	.000
		N	21	21
	CHt	Correlation Coefficient	.918**	1.000
		Sig. (2-tailed)	.000	.
		N	21	21

**. Correlation is significant at the 0.01 level (2-tailed).

Source: authors's own computation by using SPSS software

The results of the econometric modeling of the hypothesis that CHt represents a significant predictor for the evolution of GDPpc reflect the fact that the model is valid and partially significant, with R Square = 92.10% and adjusted R Square = 91.70% (Table 4). However, CHt are a significant predictor for EU economic growth (p value is less than 1%) (Table 5).

Table 5. Empirical results [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1236.792	1851.958		-.668	.512
	CHt	.109	.007	.960	14.920	.000

a. Dependent Variable: PIBc

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.960[a]	.921	.917	1445.40785

a. Predictors: (Constant), CHt

Source: authors's own computation by using SPSS software

The analysis of the evolution of public expenditures made in the period 2002-2022 by the EU countries reflects their growth, especially in the Eastern European countries and the Baltic countries of the European Union. The upward trend is also noted in the case of the evolution of GDP per capita, with the largest increases also being recorded in the Baltic and Eastern EU countries.

The econometric study carried out to determine how public spending in the transport sector influences economic growth in EU countries reflects the significant correlation between the two variables. It was demonstrated that public expenditures in the transport sector are significant predictors of the Gross Domestic Product per inhabitant in the case of the EU. The results obtained are similar to those presented in the specialized literature and support the importance of transport infrastructure in ensuring economic growth and increasing the well-being of the population.

5. Conclusion

Numerous studies in the literature show that transport infrastructure contributes to economic development and the well-being of the population. Given the liberalization of the market, transport infrastructure plays an important role in stimulating international trade and thereby increasing a country's competitiveness. These results can be a starting point for decision-makers, who need to understand the "big picture" of the importance of transport infrastructure investments.

The increase in transport infrastructure is the result of questionable investments, because the decision to develop infrastructure usually falls under the responsibility of the public administration, and therefore the allocation of public funds is always subject to controversial discussions. Therefore, there will always be debate over the spending of public funds and how they further an economic or social purpose.

The empirical results reflect the importance of transport infrastructure in the economic growth of the EU and the development of transport infrastructure significantly influences the gross domestic product per inhabitant. These results support the importance of investments in the modernization and maintenance of the existing transport infrastructure to support the free movement of goods, services, and people, an aspect that facilitates the development of the business environment and implicitly can also increase the influence and economy of countries.

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