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Identification of the Impact of Transport Performance on the Economy of Particular Area

Miloš Poliak[1], Jaroslava Kubáňová[1], Natalia Aleksandrovna Zhuravleva[2], Marek Jaśkiewicz[3] and Natalia Lakhmetkina[4]

[1]*University of Žilina, Univerzitná 8215/1, 01026 Žilina, Slovak Republic; Email: milos.poliak@.uniza.sk , jaroslava.kubanova@uniza.sk*
[2]*St. Petersburg State Transport University, 9 Moskovsky pr., Saint Petersburg, 190031, Russia; Email: zhuravleva_na@mail.ru*
[3]*University of the Kielce University of Technology, Department of Automotive Engineering and Transport, Avenue Tysiąclecia Państwa Polskiego 7, 25-314 Kielce, Poland; Email: m.jaskiewicz@tu.kielce.pl*
[4]*Russian University of Transport, 9b9 Obrazcova Street, Moscow 127994, Russia; Email: naturla@mail.ru*

***Corresponding Author:** Jaroslava Kubáňová

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Abstract: Transport is one of the most important economic sectors in the world. It is a fundamental and important element of a country's GDP. Gross Domestic Product (GDP) is considered one of the most important indicators of economic performance of a country. GDP can be compiled for both a country and a region. Changes in technology and economic structure of the production system of an area are the central issues of long-term economic growth according to the increase in the gross value added of a region. In this paper, the authors focus on finding out how the development of road freight transport performance affects the economy of a region. At the same time, they try to answer the question to what extent transport regulation can influence the economic development of an area. The research is mainly focused on EU policies aimed at regulating road freight transport.

Keywords: Gross domestic product, road freight transport, transport performance, economy

1. Introduction

Transport is one of the most important sectors of the economies of the EU Member States. In the EU, transport and logistics account for a significant share of gross domestic product [1,2]. Within the modes of transport, which include road, rail, air and water transport, transport performance is not evenly distributed [3,4]. In terms of freight transport performance within the European Union, road transport has the largest share [5]. The share of road transport accounts for 79 % of the total volume

of transport performance in the EU [6,7]. In the EU-28 Member States, road freight transport has long seen an increase in the share of transport performance in the transport market. The increase in the transport performance in the period from 1995 to 2015 was 33.7 %, representing a year-on-year increase of 1.5 % [8,9]. In the period from 2000 to 2015, however, the growth of transport performance slowed down. In 2015, the total transport performance of road freight transport amounted to 1.727 mil. tonne-kilometres [10-12].

The road freight transport performance in 2015 accounted for 50.6 % of the total performance of individual modes of transport. When comparing freight transport only in terms of inland freight transport, the share of road freight transport performance would be even higher, accounting for up to 75.3 % of total transport performance [13,14].

Figure 1 shows the total development of road freight transport performance in EU between 2003 and 2019 [15]. Complete data on transport performance data for all countries were only available for these years. The transport performance in the EU grew from 2003 to 2007, when it amounted to € 1.860 million tonne-kilometres. During the period of the Great Recession between 2008 and 2009, the most significant decrease in transport performance in the monitored period was recorded, specifically a decrease by 11.7 % [16]. Subsequently, in 2010, there was again a growth in transport performance by 3.7%. Between 2010 and 2015, transport performance showed another decrease, specifically in 2012 and 2014. From the year 2015, the total EU transport performance grew steadily, although from 2018, there could be seen a slight slowdown in transport performance growth. In 2019, the transport performance amounted to 1.976 mil. tonne-kilometres. However, in the long run, there is an upward trend of total road freight transport performance in the EU in the period under review, with a total increase in the transport performance in the EU of 31.9 % between 2003 and 2019. According to the prediction, road freight transport performance will continue to grow until 2050 [17,18].

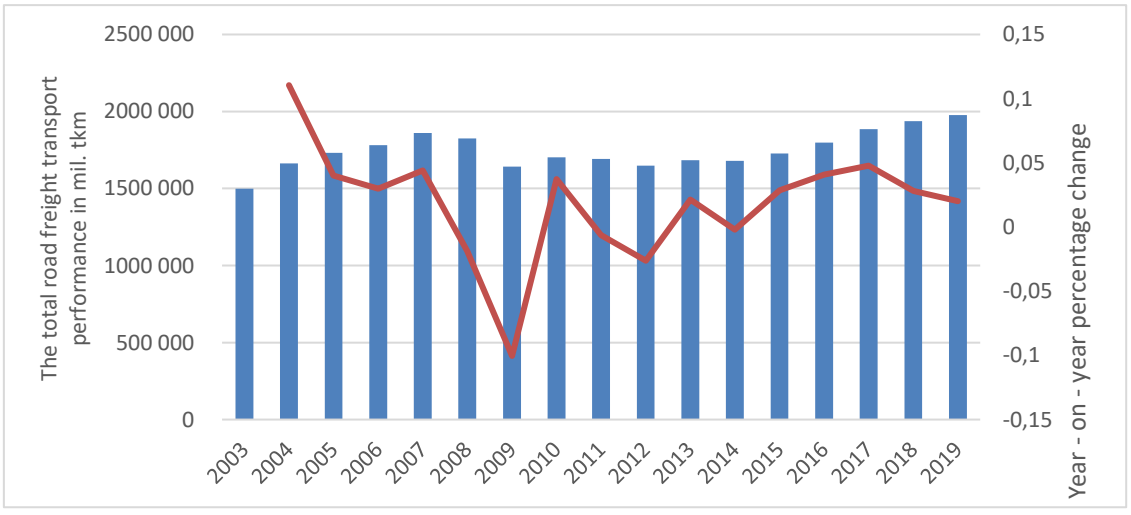


Fig. 1 The total development of road freight transport performance in EU in mil. tonne-kilometres.

Source: [19]

The goal of this paper is to determine how the development of road freight transport performance affects the economy of a given region [20,21]. The research in mainly concerned with EU policies aimed at regulating road freight transport. Within the EU, there are several elements of regulation which can include direct regulation of transport performance (e.g., ban on driving for a certain period and territory) [22] as well as also indirect regulations (e.g., limitations on driving time, requirements for emission limits, etc.) [23,24].

This research seeks to answer the question of what the impact of is restricting or reducing road freight transport on the economic development of a given area. When focusing on long-term economic growth, [25,26] argue that the central problem of long-term economic growth according to increasing the gross value added of the region are changes in technologies and economic structure of the production system of a given area. Effective use of available resources and their reorientation to the creation of new types of products that would be competitive on national and international markets is possible only in the conditions of technical and innovative development.

In [27-29], the authors point out that a country´s economic performance can be measured by using various macroeconomic indicators. Gross domestic product (GDP) is considered one of the most important and critical indicators of economic performance [30,31]. GDP is a monetary expression of the total value of goods and services newly created in a given period in a given territory. It is used to determine the performance of an economy. The development of gross domestic product within the EU is shown in Figure 2.

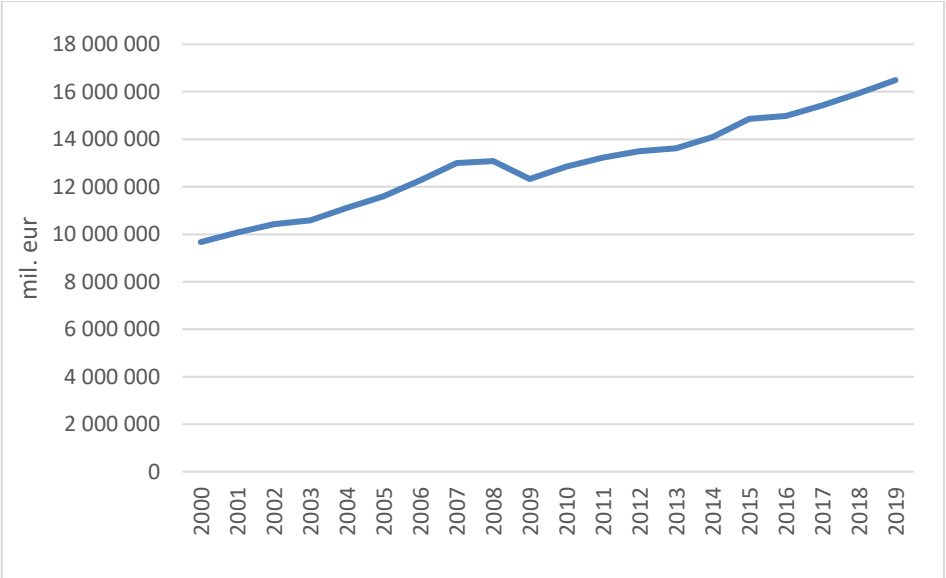


Fig. 2 The development of gross domestic product within the EU in mil. euros. Source: authors, according to [32-34]

GDP and its development over time is influenced by many factors. Despite this fact, the authors will try to achieve the goal of this paper and identify the relationship between transport performance and the economic success of the country. It is also necessary to realize that transport performance is significantly limited by transport infrastructure [35].

It should be noted that in order to better illustrate the development of road infrastructure, it is necessary not compare only the overall development in terms of its length, because the length of road infrastructure is different in different countries have different sizes. Therefore, it was necessary to divide the total length in each year for each country. This provides the information about the density of the road network in a given country, and thus how many km of superior infrastructure belongs to one km^2 of the area of a given state.

The result is shown in Figure 3 presenting the development of the density of the superior road network in selected EU countries. The density of road infrastructure has increased significantly in recent years, especially in Hungary [36]. From the analysis of the selected countries, it can be concluded that Germany has the most developed superior road network. In the long run, the density of the superior road network is growing in all these selected countries, but its development is very slow.

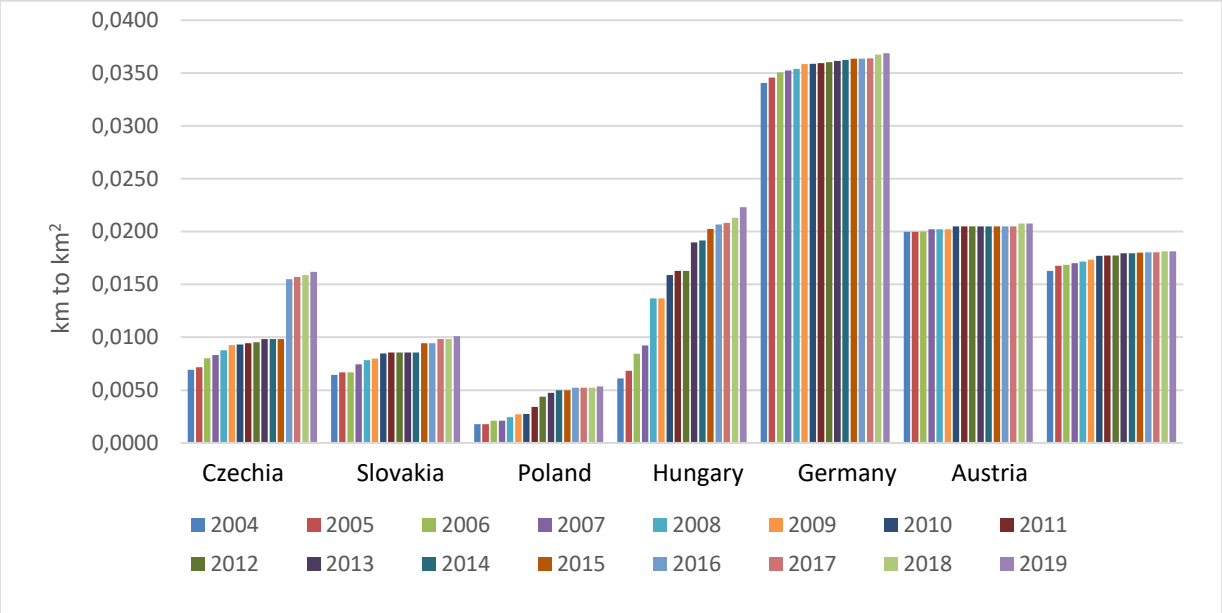


Fig. 3 The development of the density of the superior road network in selected EU countries. Source: authors, according to [32,33]

The research focuses only on road freight transport based on the research results achieved by other authors. According to [32], road freight transport has a different impact on the economy compared to other modes of transport. In researching the development of Danish road freight transport, the authors [37] also identified the causes of the relationship between transport performance and the economy using the Divisia index decomposition method. It was found that the overall growth of road freight transport is a consequence of the often-opposite effects of growth in basic factors, including the economic growth in a given area. Economic growth has traditionally been linked to the demand for road haulage, which leads to a steady increase in social and environmental impacts [23]. The importance of the impact of road freight transport on the economy of a given country is recognized by the European Union as a key means of improving sustainability. Since 2020, Europe

has been affected by a crisis related to the spread of COVID-19. Measures to prevent the spread of the disease have paralyzed not only the economy (closing various stores, curfews, etc.) but also transport (restrictions on crossing borders, complicated route planning), which could have a multiplier effect on the worse economic situation of the area. The impact of the COVID-19 crisis has been addressed by many authors [31,36,38].

Due to the fact that it was not possible to obtain research results focused specifically on the relationship between the impact of transport performance on the country's economy, this specific research was conducted, the results of which are presented in this paper.

The research does not specifically address the impact of the costs of road freight transport performance. The authors are aware of the importance of this influence. The relationship between the cost and the transport performance of the carriers is dealt with by [7,16,39], who examined the relationship on the data from 2005 to 2019.

2. Research Methodology

The authors conducted the research based on available data from selected 20 European Union countries (see Table 1). For the period from 2003 to 2019, the authors examined the development of realized transport performance and gross domestic product for individual countries and identified the dependence between the development of these variables.

Table 1 Transport performance in tonne-kilometres and GDP in mil. in selected countries for 2019.

Source: authors, according to [32,33]

2019	X	Y	2019	X	Y
	Transport performance	GDP absol.		Transport performance	GDP absol.
Czechia	39,059	223,950	**Croatia**	12,477	54,238
Slovakia	33,888	93,865	**Cyprus**	858	22,287
Poland	395,311	532,329	**Latvia**	53,117	48,797
Hungary	36,951	146,062	**Luxemburg**	7,540	63,516
Germany	311,869	3,449,050	**Netherlands**	42,905	810,247
Austria	26,502	397,575	**Portugal**	31,216	213,949
France	181,400	2,425,708	**Rumania**	61,041	222,998
Bulgaria	20,613	61,240	**Slovenia**	2,306	48,393
Estonia	4,795	28,112	**Finland**	28,847	240,261
Ireland	12,403	356,051	**Sweden**	42,601	474,551

During the research, transport performance in tonne-kilometres was selected as an dependent variable X and GDP at market prices in mil. EUR. For the purposes of this analysis, it is possible to link these variables, as there is an assumption that a larger territory will have a higher transport performance and thus a higher GDP. Subsequently, ANOVA testing will be used to determine whether the growth in transport performance affects the growth of GDP in selected countries.

3. Research

The results of ANOVA testing can be seen in the Table 2 below. The calculated correlation coefficient after rounding was 0.67, which indicates a significant dependence between transport performance and GDP growth. The calculated significance of the model as a whole after rounding was 0.001. Even in this case, the value is lower than 0.05; therefore, this dependence will apply equally to other years.

Table 2 Results of testing dependence between road freight transport performance and GDP at market prices in selected EU countries. Source: authors

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.668525795							
R Square	0.446926739							
Adjusted R Square	0.416200447							
Standard Error	669,012.9319							
Observations	20							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	6.51021E+12	6.51021E+12	14.54541716	0.001271546			
Residual	18	8.05641E+12	4.47578E+11					
Total	19	1.45666E+13						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95,0%*	*Upper 95,0%*
Intercept	124,079.6026	178,525.4509	0.695024726	0.4959148	-250,988.4519	499,147.6571	-250,988.4519	499,147.6571
Transport performance	5.522475231	1.448007082	3.813845455	0.001271546	2.480325237	8.564625225	2.480325237	8.564625225

The following Figure 4 shows a graphical processing of this relationship in individual EU countries. It can be seen that in countries such as Germany and France, the ratio between GDP and transport performance is balanced. Specific results were found for Poland, where transport performance is even higher than in Germany, while its GDP is much lower than in Germany. On detailed examination, it was found that Polish carriers perform a large volume of services in international road freight transport.

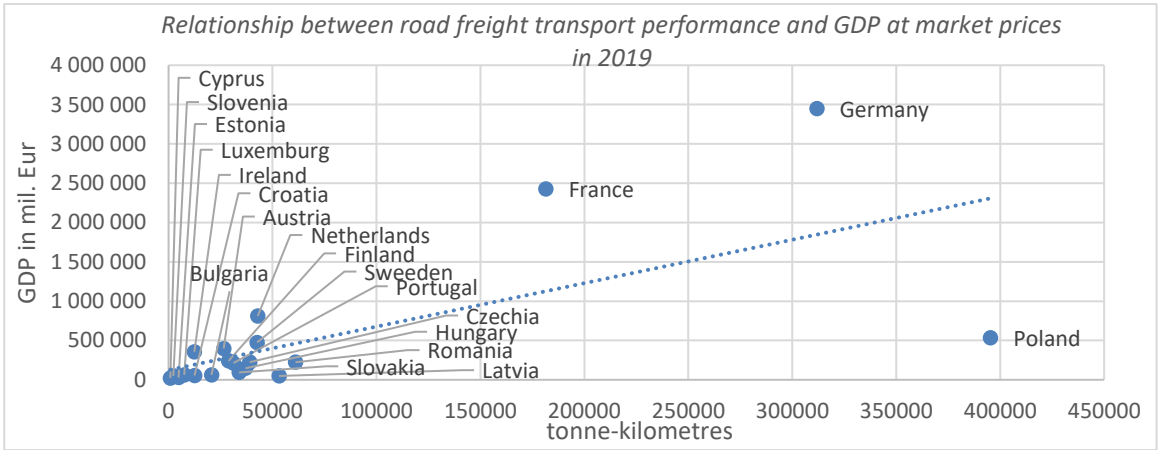


Fig. 4 Relationship between road freight transport performance and GDP at market prices in 2019. Source: authors

Based on the result of this testing, conclusion can be made that the GDP of the selected EU countries is significantly dependent on the volume of transport performance. However, the problem with this test is that some countries do not only carry out domestic or bilateral transport but also transport from third countries, which in turn distorts this dependence. The most pronounced difference can be seen in the ratio of GDP to transport performance in Poland, which has a significantly higher share of transport performance and relatively the same GDP as the other member states. This means that it carries out a significant part of its transport services abroad in the form of transport to third countries. For a different perspective on this issue, it would be appropriate to perform another ANOVA test in the future to specify this dependence by comparing the dependence between transport performance in tonne-kilometres and GDP in mil. for the EU as a whole in the years 2003 to 2019.

Based on the results of this test, it can be confirmed that there is a significant relationship between transport performance and the development of GDP. This relationship also confirms that if individual states want to achieve growth in their economies, they should promote road freight transport.

4. Discussion

Based on the results of research conducted in all analysed EU countries, it can be stated that there is a dependence between the transport performance of road freight transport and gross domestic product. However, as the partial results for individual countries were analysed, the results were biased due to the implementation of transport performance in other countries. This is most evident in the case of Poland, which has a significant share in international road transport. The services are statistically recorded within carriers based in Poland but are performed on the territory of other states.

Another research question focuses on the identification of whether there the growth in gross domestic product can be assumed with the construction of superior road infrastructure.

5. Conclusion

Based on the research, the authors conclude that the economic development of the area depends also on transport performance in road freight transport. From the point of view of emissions and safety, as much of transport performance as possible should be shifted to rail transport, but with regard to the impact on the economy of the territory. Restrictions on road freight transport can hamper the country's economic growth. The EU should take a sensitive restrictive measure in road freight transport. Over the last 15 years, the EU has introduced many regulatory measures in road freight transport, ranging from the introduction of tolls, stricter regulation of drivers' work, the introduction of new, stricter emission limits to the introduction of low-emission zones. These are measures that have the effect of reducing the performance of road freight transport.

Further research should focus on the relationship between the economy of a country and the density of the superior road infrastructure. After joining the EU, the countries of the eastern part of the EU are trying to reach the economic level of the countries of the western part of the EU. Therefore, countries like Slovakia should make special efforts to finish the superior road infrastructure, which is also a prerequisite for the economic growth of the territory.

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