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## **The logistics performance analysis in European Union – EU-15 vs. EU-13**

### **Analiza wydajności logistycznej w Unii Europejskiej – UE-15 vs. UE-13**

**Abstract.** Logistics accounts for 14% of total GDP in the European Union countries, which shows the importance of the logistics service and performance of the European Union countries. Logistics market of EU-15 countries is well developed while most of EU-13 countries need to address poor railway infrastructure and other political issues related to corruption and lack of competitiveness. However, EU-13 economies are growing fast and can benefit even more from the improvements in logistics market. Therefore this paper aims to analyze logistics performance in the European Union, distinguishing between EU-15 and EU-13 countries. For our analysis we use World Bank Logistics Performance Index (LPI) which is a tool that measures the quality, velocity, accuracy and simplicity of the logistics processes. The analysis covers the period from 2010 to 2018. The results of our analysis show that some EU-13 countries are lagging behind EU-15 countries in terms of logistics performance, while countries like Poland, Czech Republic and Hungary are the best logistics performers among all EU-13 countries. Results also show a correlation between logistics performance and economic growth which implies that EU-13 countries must take a step forward in their logistics performance in order to integrate in regional and global supply chain and thus enhance their economic position and competitiveness.

**Key words:** logistics, logistics performance index – LPI, European Union, EU-15, EU-13

**Synopsis.** Logistyka stanowi 14% całkowitego PKB krajów Unii Europejskiej, co wskazuje na duże znaczenie tego sektora dla wyników ekonomicznych krajów członkowskich Unii Europejskiej. Rynek logistyczny krajów UE-15 jest dobrze rozwinięty, podczas gdy większość krajów UE-13 powinno podjąć działania dla rozwoju słabej infrastruktury kolejowej oraz pochylić się nad kwestiami politycznymi związanymi z korupcją, czy brakiem konkurencyjności. Szybko rozwijające się gospodarki UE-13 mogą jednak skorzystać na poprawie rynku usług sektora logistycznego. Celem artykułu było określenie wydajności sektora logistyki w Unii Europejskiej z podziałem na kraje UE-15 i UE-13. W pracy wykorzystano wskaźnik wydajności logistyki według Banku Światowego (Logistics Performance Index

– LPI), który jest narzędziem określającym jakość, szybkość, dokładność i prostotę procesów logistycznych. Analiza objęła okres od 2010 do 2018 roku. Wyniki wskazują, że niektóre kraje UE-13 pozostają w tyle za członkami UE-15 pod względem wyników logistycznych, podczas gdy kraje takie jak Polska, Czechy i Węgry osiągają najlepsze wyniki logistyczne wśród krajów UE-13. Wyniki wskazują również na korelację między wynikami logistyki a wzrostem gospodarczym. To oznacza, że kraje UE-13 muszą zrobić krok naprzód w swoich wynikach logistycznych, aby zintegrować się z regionalnym i globalnym łańcuchem dostaw, a tym samym poprawić swoją pozycję gospodarczą i konkurencyjność.

**Słowa kluczowe:** logistyka, wskaźnik wydajności logistyki – LPI, Unia Europejska, EU-15, EU-13

## Introduction

As trade expands across the border, and the world becomes one market, logistics gains greater importance and logistics industry faces with the number of demanding and complex processes. Logistics is also perceived as a source of competitive advantage. Good foundations for performing logistics at the highest level possible are opening great opportunities for economic growth. The foundations cover quality, coverage and development of infrastructure, and export and import related processes and its velocity. Therefore World Bank has created index which helps countries to identify their logistics position. Logistics performance index helps countries to see where they stand and what should be improved in order to make the most of the logistics potential. “Logistics performance is about how efficiently supply chains connect firms to domestic and international opportunities. The logistics performance tries to capture how logistically accessible and how well connected to the physical internet of global logistics a country is.” [Arvis et al. 2018, p.7].

The aim of this research is to analyse the performance of European Union countries and compare the performances of EU-15 and EU-13, respectively old and new European Union member states. Since the current body of knowledge relates logistics performance with the economic growth, it is important for countries to be aware of their strength and weaknesses in regard to logistics. Our analysis is based on the World Bank Logistics Performance Index (hereinafter LPI) methodology and covers the biennial period from 2010 to 2018.

This paper consists of five parts. After the Introduction, the second part reviews the previous literature related to logistics performance. In the third part, data and methodology are explained. The fourth part presents and discusses the results of the analysis and the paper ends with conclusions and policy implications.

## Literature review

As logistics is getting bigger attention, different measurement tools have been developed. This measurement tools evaluate the quality and efficiency of logistics by analysing trade infrastructure, trade regulations, IT development and availability of skilled workers. Logistics performance is measured with different tools, some of which is LPI. Since its

first publication in 2007, LPI became one of the most usable tools in logistics performance and trade facilitation analysis. Puertas, Marti and Garcia [2014] use LPI as a proxy variable for logistics performance in order to estimate the effects of logistics performance on trade in 26 European Union member states. Marti, Puertas and Garcia [2014a, b] followed the same methodology to detect the effects of logistics performance on trade in developing groups of countries, among which are Eastern European countries. Saslavsky and Shepherd [2014] also analyse the effects of logistics performance. The authors investigate the LPI effects on trade within international production networks which are more sensitive to logistics performance. Pupavac and Drašković [2017] analyse the logistics capability in Southeast Europe based on the LPI methodology.

Zekić, Samardžija and Pupavac [2017] use LPI as one of the measures of countries competitiveness. Host, Pavlič Skender and Zaninović [2019] in their gravity framework use LPI as a proxy variable for trade facilitation in order to detect its effects on trade for a group of 150 countries. Bugarčić, Skvarciany and Stanišić [2020] investigate the effect of logistics performance on trade volume in Central and Eastern European and Western Balkan countries. Their results suggest that logistics performance have important effects on trade volume, especially the variables international shipments, logistic quality and competence and tracking and tracing. Zaninović, Zaninović and Pavlič Skender [2020] estimate the impact of logistics performance on the international bilateral trade distinguishing between trade of EU-15 and EU-13 countries with the rest of the world in the period 2010–2018. The authors use differences in LPI values as a main variable of interest and their results show that LPI differences affect bilateral trade differently, namely it depends of the type of goods that partner countries trade. According to Arvis et al. [2018, p. 5] „LPI results have been embraced by the academic community, as evidenced by the widespread use of LPI data in research reports, journal articles, and textbooks“.

In general, scientific and professional literature agree that LPI is a good indicator of logistics performance and therefore we use LPI in our analysis.

## **Data and methodology**

Worlds Bank Logistics Performance Index is a main variable of our interest and we use it in order to analyse the logistics performance in European Union countries. As previously mentioned, LPI is an indicator provided by the World Bank. It measures the logistics performance and the quality of logistics climate in evaluated countries through six indicators. “This index was developed through a joint survey of logistics providers, the World Bank and the scientific community. It covers a broad set of elements that indicate the perceived effectiveness of trade logistics in practice. The index was created as a result of freight forwarders’ ranking of countries according to key logistical issues such as efficiency of customs procedures, quality of infrastructure and ability to track freight“ [Pavlič Skender and Grčić Fabić, 2014, p. 102–103].

Worlds Bank Logistics Performance Index measures logistics performance through six indicators. These indicators are as follows [Arvis et al. 2018, p. 8]:

1. The efficiency of customs and border management clearance.
2. The quality of trade – and transport-related infrastructure.
3. The ease of arranging competitively priced international shipments.

4. The competence and quality of logistics services.
5. The ability to track and trace consignments.
6. The frequency with which shipments reach consignees within the scheduled or expected delivery time.

In order to facilitate trade, customs procedures must be simplified, and its number must be minimized. Usually, customs agencies are better evaluated. Other border agencies include standards, sanitary, phytosanitary, transport, and veterinary agencies. The number of agencies and the number of their physical inspections are in the process of reducing. Countries with higher customs score have faster customs process with less or none delays.

Comprehensive and productive infrastructure is essential for successful running of the economy, as it is a significant factor in deciding the area of economic action and the sorts of exercises or sectors that can evolve in a specific example [Pupavac and Golubović 2015, p. 245]. Comprehensive infrastructure which covers the country (including remote and underdeveloped parts) assists in the development of whole country at a specific pace, not just the centralized and most developed parts. Infrastructure includes both transportation infrastructure and ICT infrastructure. Both are important for the development of logistics. However, ICT infrastructure needs continuous adjustment as communication technology and communication speed changes. Better quality of trade and transport related infrastructure ensures goods to be moved faster, more accurately and more predictable.

“In the top performers, the ease of arranging shipments tends to lower overall LPI scores, possibly because macroeconomic factors generally make services more expensive there, which may make it hard to arrange shipments perceived as competitively priced elsewhere” [Arvis et al. 2014, p. 11]. However, the prices remain at certain, tolerable price since competition is also bigger. On the other hand, prices are higher in smaller land-locked and island countries since the connectivity and competition in those countries is smaller.

The competence and quality of logistics services can be the main reason for choosing a specific country to trade with or to trade in. There are many critical components of this indicator, such as the transparency of processes and the quality, predictability (especially of the clearance process), and reliability of services. However, we also must take into consideration that other factors like border policy and business environment affect logistics performance [Arvis et al. 2007].

Tracking and tracing are contemporary benefit that can increase the value of logistics service as they enable to track and trace the goods and to estimate the delivery time more precisely, thus facilitating planning and increasing predictability. The ability to track and trace consignments is often better graded than the very quality of logistics services.

Timeliness strongly depends on the quality of logistics services and infrastructure. According to Arvis et al. [2018, p. 28], the interruptions in delivery may be caused by following factors: “unpredictability in clearance, inland transit delays, and low service reliability”. Taken into consideration that the recurrence of postpones usually increases as the logistics performance decreases, it is obvious that the timeliness of clearance and delivery is usually disrupted as country descends the LPI quintiles. Delays and errors in delivering are much less tolerated in high performing countries (such as European Union countries) than in lower and low performing countries.

Furthermore, when LPI data is used in the comparison, one should never use rank only. The rank does not say much about the country, and a big difference in rank does not mean a big difference in score. Furthermore, there should be used longer period for comparison, not just the latest with the previous one. Also, the reliability of respondents must be taken into consideration, since this index is questionnaire-based.

The LPI is based on an international survey of freight forwarders and express carriers. It is a measurement tool introduced by the World Bank that evaluates logistics performance through the whole supply chain within specific country. The observation of the results across 167 countries can help countries to recognize the difficulties and chances and improve their logistics performance. The survey is conducted every two years, with exception between 2007th and 2010th edition [Arvis et al. 2018, p. 70].

As mentioned above, there were 167 observed countries by logistics performance index in 2018th edition. The countries involvement depends on the respondents and where are they coming from. The respondents' rate eight markets they cooperate with based on six indicators listed earlier. Additionally, respondents also rate the market in which they work. Furthermore, the domestic LPI is also made based on data about their own market. In our analysis we distinguish between EU-15 and EU-13 countries. EU-15 is the grouping of the first 15 member states, also called old members. The EU-15 consists of the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom. All the EU-15 countries are high-income level countries. "Germany runs a trade surplus of U.S. \$ 279 billion and imports only 79 percent of what it exports. The Netherlands and Belgium also show a trade surplus with imports representing only 89 and 78 percent of their exports, respectively" [David 2018, p. 13]. EU-13 or the new member states are the following: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia. Since LPI is being published every two years, we use biennial data from 2010 to 2018.

## **The results**

The LPI scores of EU-15 vary from 3.2 to 4.2, and the average is 3.854. When comparing average scores of EU-15 and high-income countries, EU-15 has a higher mean of LPI score as well as all indicators. Nevertheless, some EU-15 countries have lower than average results. The only EU-15 country that has a LPI score lower than average in high-income countries (3.5) is Greece with a score of 3.2. Greece has scores of all of the indicators lower than the average of high-income countries. Tables 1 and 2 presents descriptive statistics of aggregate LPI and its six sub-indices in year 2018 separately for EU-15 and EU-13 countries.

All of the minimum values in the table above are scored by Greece. Portugal has also lower than average scores in customs and infrastructure indicators, and Ireland in timeliness indicator. All of the maximum values are scored by Germany, except for international shipment score of 3.99, which is achieved by Belgium. Germany is the best ranked European country holding first position. However, there are some other countries which have been constantly within top performers. Those are the Netherlands, Sweden and

Table 1. Descriptive statistics of EU-15 countries in 2018

Tabela 1. Statistyk opisowe krajów UE-15 w 2018 roku

Variable	Obs	Mean	SD	Min	Max
Overall LPI	15	3.845	0.261	3.200	4.200
Customs	15	3.635	0.334	2.840	4.090
Infrastructure	15	3.867	0.373	3.170	4.370
International	15	3.660	0.216	3.300	3.990
Logistics	15	3.865	0.297	3.060	4.310
Tracking	15	3.913	0.295	3.180	4.320
Timeliness	15	4.159	0.230	3.660	4.410

Source: own calculation.

Belgium. On the other hand, the worst EU-15 performers through the years were: Greece, Portugal, Spain and Ireland. Standard deviations are higher in case of EU-15 for all LPI sub-indices meaning that there is larger disproportion in logistics performance within EU-15 group of countries than within EU-13 group of countries.

Table 2. Descriptive statistics of EU-13 countries

Tabela 2. Statistyk opisowe krajów UE-13

Variable	Obs	Mean	SD	Min	Max
Overall LPI	13	3.179	0.262	2.810	3.680
Customs	13	3.025	0.277	2.580	3.420
Infrastructure	13	3.037	0.214	2.730	3.460
International	13	3.148	0.319	2.700	3.750
Logistics	13	3.104	0.284	2.690	3.720
Tracking	13	3.192	0.292	2.790	3.700
Timeliness	13	3.558	0.369	2.880	4.130

Source: own calculation.

The highest scores of EU-13 countries are achieved in timeliness indicator. This shows that the deliveries almost always arrive as planned. On the other hand, the lowest mean of EU-13 is achieved from customs and infrastructure scores. Compared to the EU-15, these scores are much lower, again showing that less developed countries have lower scores in logistics performance.

Following Figure 1 shows the difference in cumulative LPI score between EU-15 countries and EU-13 countries in observed period from 2010 to 2018. It is noticeable that not just there is a large score gap between two groups of countries, but also EU-15 countries are growing faster than EU-13, in terms of logistics performance.

When we analyse each sub-index separately, in Figure 2, the gap is even larger. For example, sub-indices Customs and Infrastructure, which are in “public domain” show lower scores, meaning there is a slow move forward in the better performance of infrastructure or customs regulations while sub-indices International, Logistics, Timeliness and Tracking which are in the “business domain” were performing better from 2010 to 2014 and then, in 2016 and 2018 decline their performance, particularly in case of EU-13 countries.

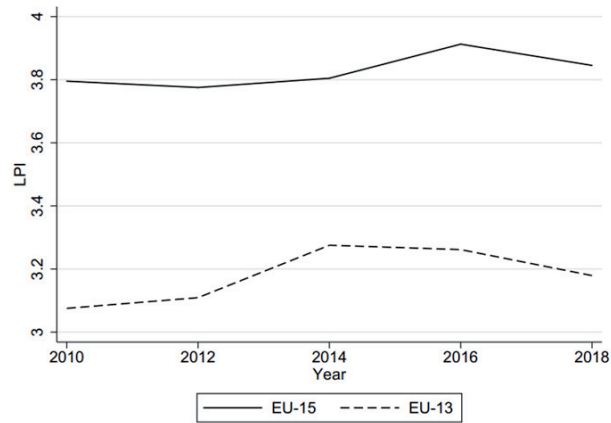


Figure 1. Cumulative distribution of EU-15 vs. EU-13 overall LPI scores in 2010–2018  
 Rysunek 1. Skumulowany rozkład ogólnych wyników LPI w UE-15 względem UE-13 w latach 2010-2018

Source: own calculation.

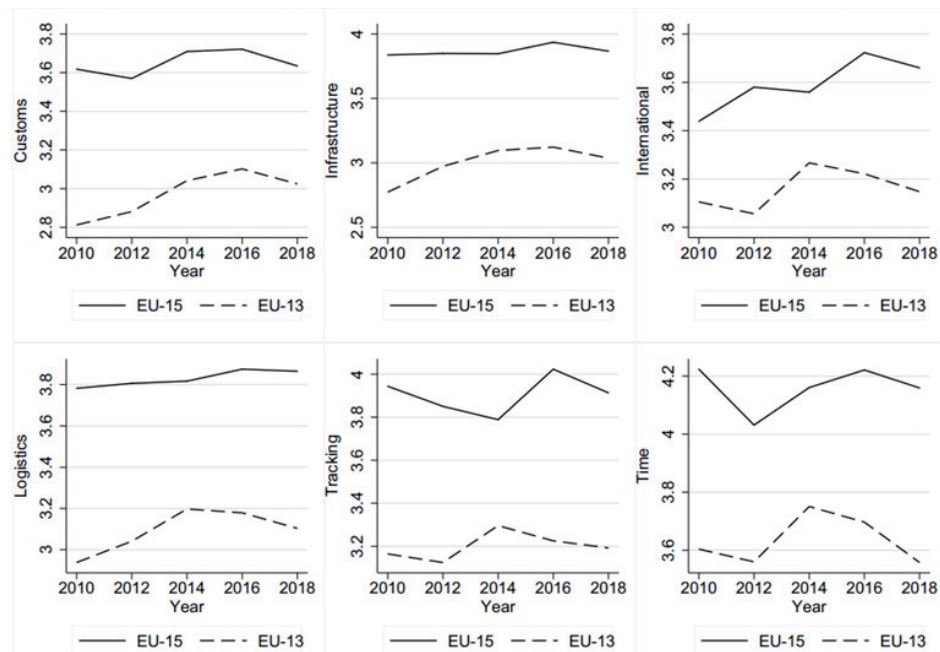


Figure 2. Cumulative distribution of EU-15 vs. EU-13 sub-LPI scores in 2010–2018  
 Rysunek 2. Skumulowany rozkład wyników UE-15 w porównaniu z wynikami sub-LPI w UE-13 w latach 2010–2018

Source: own calculation.

The highest scores of EU-15 countries are achieved in timeliness indicator. This shows that the deliveries almost always arrive as planned. The highest timeliness score of 4.4, achieved by Germany and Belgium, is the highest score in timeliness score overall, not just within scores of European Union countries. On the other end, the lowest mean of EU-15 countries is from international shipments indicator. Based on the results of EU-15 countries, there can be concluded that more developed countries, high-income level countries have higher results in logistics. The quality of logistics services, reliability and predictability is higher. Greece, on the other hand, as a country with unstable economic and political situation, has also worse logistics performance.

All of the EU-13 indicators scores are higher than the overall average of 167 countries, except for Bulgaria's infrastructure score, which is just below the average, 2.71 (overall average is 2.73). However, the results of EU-13 are lower than the average of high-income countries. More specifically, only Poland and the Czech Republic have higher than the average LPI score, international shipments, logistics competence and timeliness score. Further, the Czech Republic is the only country that has customs and tracking and tracing score higher than the average of high-income countries, while infrastructure is the only indicator in which all of the EU-13 countries have lower than the average score. The Czech Republic is by far the best EU-13 country, proved by the fact that all of the maximum values are achieved by Czechia. Four out of seven minimum values are achieved by Malta, two by Bulgaria and one by Romania. Countries that are top performers of EU-13 countries through the years are Hungary, Slovenia, the Czech Republic and Poland. On the other hand, countries with the lowest result through the years are Lithuania, Latvia, and Malta.

In order to analyse the relationship between economic development and LPI score, we run simple linear regression. Our model has the following form:

$$LPI_i = \beta_0 + \beta_1 GDPpc_i + \varepsilon_i,$$

where:  $LPI_i$  – the logistics performance index,  
 $GDPpc_i$  – the gross domestic product per capita,  
 $\varepsilon_i$  – error term.

Our data consist of EU member states grouped in two groups (EU-15 and EU-13) in year 2018. The results of the regression are presented on the scatter plot (Figure 3).

Figure . shows us a noticeable gap between high- and lower-income countries, hence between EU-15 and EU13. However, it also shows that in the case of EU-15. Greece, Ireland and Luxemburg are underperforming countries when we look at the LPI score and economic development, while the rest of EU-15 countries are above regression line. In the case of EU-13, Czech Republic, Poland and Hungary are the best performing countries, while the rest of the countries are lagging behind them. If Croatia is compared with the Czech Republic, which was together with Croatia and Slovenia one of the most developed Central European transition economies, there can be seen large difference in their logistics performance (and economy in general) today. Today, according to LPI, Croatia is lagging behind the Czech Republic substantially. Actually, all EU-13 economies which



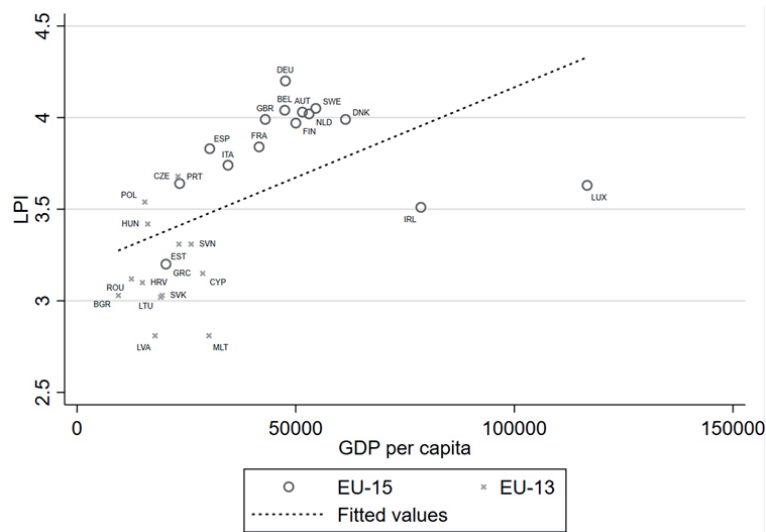


Figure 3. Regression LPI 2018 and GDP per capita (current USD, 2018)

Rysunek 3. Regresja LPI 2018 i PKB per capita (bieżące USD, 2018)

Source: own calculation.

are the best performers in logistics are among the fastest growing economies in European Union [Mordor Intelligence, 2018]. Better logistics performance enables to integrate in regional and global supply chains, and Czech and Poland are well integrated in European supply chains.

## Conclusion

The aim of our research was to analyse logistics performance in the European Union, distinguishing between EU-15 and EU-13 countries. For our analysis we used LPI as it is a benchmark tool in logistics performance analysis and provide us better insights into the logistics performance and its position within increasingly complex regional and global supply chains. The logistics performance in European Union countries, measured by LPI, differs in size and scores. The difference occurs for reasons such as economic size, geographical size and position, and development of the country in general. However, European Union members compared to the rest of the world are well ranked. According to aggregated international logistics performance index results across five editions (2010, 2012, 2014, 2016, and 2018), 15 out of 28 European Union countries are in top 30, six of which are in the top 10. The worst-ranked European Union country is Malta, holding 61st position out of 167 countries evaluated, showing the development of European Union countries. The results show us a significant gap in their performance between EU-15 and EU-13 countries, however there is also present a large gap within each group of

countries. European Union countries like Germany, Netherlands and Belgium that traditionally dominate the supply chain industry are among best performing on the world scale. Czech Republic, Poland and Hungary are converging to the EU-15 logistics performance, while the rest of EU-13 countries must take step forward in order to perform better. Those “outperforming” countries must work on the developed of national logistics strategies in order to improve the functioning domestic and international logistics which is a precondition of national and European Union competitiveness.

Moreover, LPI covers six areas and it allow us to analyse each of them separately and detect strength and weaknesses in the logistics performance. The highest scores of EU-13 countries are achieved in timeliness indicator meaning that the deliveries almost always arrive as planned. On the other hand, the lowest mean of EU-13 is achieved from customs and infrastructure scores. This show us that businesses in EU-13 are working better and faster on enhancement of their logistics performance while the government must take step forward to enable better business climate, easier and faster customs procedures and better infrastructure.

The results shows us that EU-13 countries are better performing in logistics parts which are in the domain of the private sectors, in order to achieve better overall logistics performance, governments and institutions must take step forward and improve the parts which represents logistics performance bottlenecks, such as transport infrastructure. Improvements in infrastructure will help private sector to enhance their part of logistics performance since logistics performance overall is a multiway relationship and each part of logistics depends on others part parts of logistics. For example, improvements in infrastructure will lead to improvements in timeliness etc.

Logistics is a priority for many European Union member countries because trade and transport facilitation stimulate economic development. Logistics performance is significant for economic growth and competitiveness. EU-13 countries must constantly work on improvement of logistics-related policies, ICT, clearance processes, usage of multimodality, and encouragement of specialized logistics. The results of this research can help countries to frame their logistics policies and strategies and to work on the interventions and reforms at the national and European Union level. This research might be broadened to incorporate logistics performance index in macroeconomic growth model to estimate the contribution of logistics performance to an economy.

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