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Article

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Verslas: Teorija ir praktika / Business: Theory and Practice

Provided in Cooperation with:

Vilnius Gediminas Technical University

Suggested Citation: Bugarčić, Filip Ž.; Skvarciany, Viktorija; Stanišić, Nenad (2020) : Logistics performance index in international trade: Case of Central and Eastern European and Western Balkans countries, Verslas: Teorija ir praktika / Business: Theory and Practice, ISSN 1822-4202, Vilnius Gediminas Technical University, Vilnius, Vol. 21, Iss. 2, pp. 452-459, <https://doi.org/10.3846/btp.2020.12802>

This Version is available at:

<https://hdl.handle.net/10419/248045>

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LOGISTICS PERFORMANCE INDEX IN INTERNATIONAL TRADE: CASE OF CENTRAL AND EASTERN EUROPEAN AND WESTERN BALKANS COUNTRIES

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Received 23 May 2020; accepted 01 June 2020

Abstract. The volume of international trade heavily depends on factors facilitating trade and contributing to reducing its costs. The importance of international logistics as trade facilitator is increasingly emphasised in the literature. The aim of the paper is to assess the level of the impact of logistics performance on trade volume in the Central and Eastern European countries (CEECs) and Western Balkans. In order to achieve the aim, the impact of Logistic Performance Index (LPI) on international trade in 2007 and 2018 is investigated. This relationship is examined using the gravity model approach with a focus on overall LPI and its components. The research results show that there is a positive statistical significance and impact of logistics on bilateral trade between CEECs, and logistics justifies the role of a trade facilitator. Besides, the importance of LPI components in intensifying international trade was emphasised. Research implications indicate that improving logistics performance and logistics services lead to a positive impact on the volume of international trade. Better logistics performance in trading countries will lead to increased bilateral trade and reduced trade costs. The limitation of the research is that only two years have been taken into account. This is done in order to highlight the differences between the year the LPI was introduced, and the last year the LPI was calculated.

Keywords: logistics performance index (LPI), international trade, logistics, Gravity model, trade facilitation, Central and Eastern European Countries (CEECs), Western Balkans.

JEL Classification: C5, F1, H54.

Introduction

The logistics sector has a significant role in facilitating trade, reducing transport costs and stimulating economic growth. Logistics can be defined as part of a supply chain that plans, implements and controls the efficiency of the flow of goods, services and information from a place of origin to an area of consumption (Martí, Puertas, & García, 2014). Logistics services can be essential for continued growth and trade efficiency. High-quality trade logistics, combined with the liberalisation of the economic environment, contributes to an increase in trade volume (Hausman, Lee, & Subramanian, 2013). Moreover, it could have a positive impact on economies of scale, as well as on the amount of distribution, production activities and influence on economic growth (D'Aleo & Sergi, 2017).

On the other hand, poor logistics infrastructure and underdeveloped operational processes can be a significant obstacle to global trade interaction (Devlin & Yee,

2005). The main motive of market players is to ensure efficient transport of goods to final consumers in the most cost-efficient and cost-effective way possible, with the efficiency of the logistics system playing an important role, especially when it comes to international interaction. An efficient transport and logistics sector contribute to the facilitation of international trade and enables economic operators to efficiently carry out the import and export business of goods and services. The steady increase in international trade, as well as the desire of many countries to accelerate the process of integration into the global trading system, depends not only on maintaining the openness of the global trading system but also on improving the quantity and efficiency of support structures such as logistics services (Gani, 2017).

Logistics can be observed as integrated information, packaging, warehousing and transportation system that meets the requirements regarding time, quality, quantity

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and cost, actually, all performances that are crucial for competitiveness (Puertas et al., 2014) and as a result of the continuous enlargement processes it has undergone, the European Union (EU). Logistics thus stands out as one of the essential elements of the competitiveness of an economy (Arvis et al., 2007). International trade requires the organisation and synchronisation of trade flows through logistics centres and strategically critical international routes. In this way, a more efficient supply chain system and better performance enable better business conditions, accuracy and efficiency in the circulation of goods and services at competitive prices, as well as a better market environment for an economy (Puertas et al., 2014) and as a result of the continuous enlargement processes it has undergone, the European Union (EU). In developing countries, underdevelopment of logistics can cause an increase in trade costs and impede the efficient movement of goods due to poor infrastructure, underdeveloped logistics and transport sectors, as well as complex bureaucratic procedures and excessive bureaucracy of state institutions (Martí et al., 2014). The effects of improving logistics as a trade facilitation factor can have different levels of contribution depending on the level of economic development (Çelebi, 2019). By enhancing its performance, logistics unequivocally leads to varying degrees of increase in both exports and imports of countries of all levels of development.

To this end, an important empirical question is whether the level of logistics services could enable more significant international trade and to what extent? Since empirical studies on this topic are rare, especially when it comes to CEECs and the countries of the Western Balkans, this issue deserves attention. The scientific gap is reflected in the lack of research with particular emphasis on these groups of countries. The aim of the paper is to assess the level of the impact of logistics performance on trade volume in the Central and Eastern European countries (CEECs) and Western Balkans. One of the quantitative measures of logistics support and its development is the LPI. The World Bank developed this index in order to assess and monitor the logistical performance of countries and to help them to identify the challenges and opportunities they face in trade logistics. The LPI is based on a global survey. Logistics operators provide feedback on the logistics performances in countries in which they operate and also, in countries with which they trade (World Bank, 2020). This assessment provides an insight into the development of logistics in a particular country. The analysis also covers the importance of individual sub-indicators of the LPI to identify the unique effect of each sub-indicator on the volume of bilateral trade. Regarding methodology, the gravity model of trade will be used for the analysis with the application of multiple linear regression in separate equations, for overall LPI score and its components. According to the aim of the research, the following hypotheses are tested:

H₁: LPIs of trade partners have a significant impact on the volume of bilateral trade of CEECs.

H₂: Distance between trade partners became a less important factor for international trade among CEECs.

The article consists of the following parts: i) introduction ii) an overview of the relevant literature in the field is given; iii) methodology, where the gravity model is discussed; iv) empirical findings; and v) conclusions.

1. Theoretical background

The existing literature has repeatedly demonstrated the positive impact of logistics performance on the volume of international trade. Logistics thus stood out as one of the crucial factors for facilitating trade and removing barriers to stimulating the country's economic development. The importance of the logistics sector itself has been recognised by Shepherd (2011), whose analysis of logistics data for 45 countries concluded that this sector contributes on average 5% to the GDP of countries, with a range of 2% to 12%. As the level of international trade in the world is continuously increasing, the contribution of the logistics sector to national economies is likely to grow with the increase of liberalisation and openness of national economies, thereby achieving broader trade integration and reaping the benefits of the global market (Gani, 2017).

A positive effect on exports and trade facilitation can be achieved by improving logistics performance (Shepherd, 2017; Vlahinić Lenz et al., 2018; Wilson et al., 2005). These authors point out that trade facilitation can first be achieved by increasing the efficiency of trade in goods and by more efficiently processing the necessary documentation accompanying trade. Trade facilitation also includes all measures that reduce trade costs, such as customs efficiency, regulatory and institutional environment, simplicity of procedures, and use of digital technology solutions. Wilson et al. (2005), as well as Mejia, Soloaga, and Wilson (2006) in their work, define trade facilitation using four dimensions: efficiency of ports, customs, regulations and the use of e-commerce, analysing and validating their statistical significance using a gravity model on a sample of 75 countries.

The increasing complexity of international business has enabled logistics to play a vital role in determining the international trading performance of countries (Martí et al., 2014). A focus on improving logistics performance would significantly enhance international trade (Korinek & Sourdin, 2011; Martí et al., 2014; Saslavsky & Shepherd, 2012). Among countries with similar levels of income, it has been shown that those with better logistics performance record additional GDP growth of 1% and trade growth of 2% (Arvis et al., 2016). Consequently, improving logistics performances such as the development of transport infrastructure, logistics services, port and logistics centre efficiency, as well as the continuous improvement of information systems, is crucial for improving countries' performance in terms of trade (Arvis et al., 2007). Bensassi et al. (2015) also proved the positive correlation between logistics performances and trade and pointed out that the quality of logistics facilities positively influences export flows.

Engman (2005) points out that logistics costs are between 2% and 15% of total goods turnover so that their reduction can have a positive effect on international competitiveness. Subsequent OECD studies in 2013 reaffirm the importance of logistics quality for international trade, especially when it comes to exports (Moisé & Sorescu, 2013). Contributing to the increase in imports, on the other hand, as the authors say, will be offset by greater participation in regional and global supply chains and intensification of international economic relations. The study also emphasises the importance of the customs procedure, the quality of infrastructure, logistics services and the ability to track and locate shipments, which have a more significant impact on trade than transportation costs and distance. According to Behar and Nelson (2009) and Wang and Choi (2018), the effects of logistics performance will have a more prominent and significant impact in large and more developed economies when it comes to reducing trade costs and increasing the volume of foreign trade.

An analysis conducted by Gani (2017) confirmed that logistic performance in low- and middle-income countries are at a lower level than in high-income countries. Obstacles in the form of inadequate infrastructure, inefficient customs procedures, a physical inspection of goods and corruption of customs officers, as well as the lack of adequate and consistent transport strategies by government authorities, make these countries unable to compete globally. Wang and Choi (2018) have proven that trade impact is more robust in developed than in developing countries and that developing countries should prioritise their efforts to improve export competitiveness in customs, infrastructure and monitoring. Host, Pavlič Skender, and Zaninović (2019) proved that logistics performance is more critical for exporting countries than for importers. At the same time, the size of the two economies is positively correlated with the volume of international trade between them. Analysing logistics as a determinant of exports to different regions, Martí et al. (2014) conclude that implementing measures to facilitate trade through improving logistics performance over five years has yielded favourable results in terms of export growth, especially in the African, South American and Eastern European regions. It also points out that developing countries require even more progress in the areas of infrastructure, logistics services and the efficiency of national and customs authorities, in order to compete equally in a complex international trade network. The positive link between these logistics performances and bilateral trade has also been confirmed by Felipe and Kumar (2012) on the example for the region of Central Asia.

Based on the aforementioned, it can be highlighted that competitive logistics network is the “backbone” of international trade (Arvis et al., 2016). For this reason, improving logistics performance is vital for all groups of countries, both developed and developing countries. The Logistic Performance Index (LPI) was developed in 2007 by the World Bank (Arvis et al., 2007) can be used as an instrument for monitoring the logistic performance of the economy. This index provides an analysis of key

differences between countries by providing an overview of customs procedures, logistics costs and the quality of infrastructure required for land and maritime transport. Insights and comparisons of index values make it possible to identify and overcome obstacles to further economic development and stimulate international trade (Chin-Chia, 2011). Considering that so far the examinations of the effects of logistics performance have been mainly related to the global level, the contribution of this paper is to examine these effects using the gravity model approach on the specific example of CEECs and Western Balkans countries, in order to present the particular results in 2007 and 2018.

2. Methodology

The gravity model of trade is used as a theoretical framework for studying the effects of logistics performance on international trade flows. This model has gained prominence in the 1970s and is widely used by now in numerous works (Almog et al., 2019; Anderson, 1979; Bergstrand, 1985, 1989; Evenett & Keller, 2002; Greaney & Kiyota, 2020; Prehn et al., 2016). The basic form of this model is that bilateral trade flows are positively correlated with the size of the two economies, measured by countries' GDP while increasing the distance between trading partners has a negative impact. Distance is a proxy for transport costs and can be measured as the geographical distance between the capital cities (Vido & Prentice, 2003). In addition to these variables, the model can be complemented by other factors. Dummy variables can be added and approximated as the effects of the common border between countries and membership in the same economic integration. The presence of a common border, as well as membership in the same economic integration, contribute to increasing trade. In the case of examining the effects of logistics performance on international trade, the equation is supplemented by the summary Logistic Performance Index (LPI) and its subcategories.

A gravity model will be used to identify the determinants which affect international trade in selected countries, with special attention on logistics performances, as part of the following equation where it presents the factor of trade facilitation:

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(LPI_{it}) + \beta_5 \text{Log}(LPI_{jt}) + \\ & \beta_A W + \beta_B W + u_{ij}, \end{aligned} \quad (1)$$

where: X_{ij} – Quantity trade by country i to country j in year t ; GDP_{it} – GDP of country i in year t ; GDP_{jt} – GDP of countries j in year t ; D_{ij} – Distance between countries i and j ; LPI_{it} – Logistic Performance Index for country i in year t ; LPI_{jt} – Logistic Performance Index for country j in year t ; W_A – Dummy variable (border); W_B – Dummy variable (economic integration); u_{ij} – Standard error.

Logarithmic transformation of the variables is done in order to interpret the coefficients as elasticities. It is

expected that the majority of variables included in the gravity model have a significant positive impact on total bilateral trade flows, except the distance variable, which should have a negative effect on trade flows. The larger and closer the two countries are, the higher the volume of their mutual trade can be expected. The focus of the paper is on examining the effects of LPI so that other variables have a controlling character.

In addition to analysing the total LPI score, the article also focuses on creating a gravity model and examining the effects of all individual LPI sub-indicators (Customs, Infrastructure, International shipments, Logistics quality and competence, tracking and tracing, and Timeliness). Those components will be analysed for 2007 and 2018 to see the difference and influence on trade in selected countries. LPI subcategories also have values from 1 (worst) to 5 (best). Each of LPI component would present a positive coefficient. Comparing the results, we will be able to evaluate which of these sub-indicators has the most significant impact on trade in observing years. Since it is not possible to show their influence through one equation, the following equations have been formulated separately:

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(Customs_{it}) + \beta_5 (Customs_{jt}) + \\ & \beta_A W + \beta_B W + u_{ij}; \end{aligned} \quad (2)$$

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(Infrastructure_{it}) + \\ & \beta_5 (Infrastructure_{jt}) + \beta_A W + \beta_B W + u_{ij}; \end{aligned} \quad (3)$$

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(International\ shipments_{it}) + \\ & \beta_5 (International\ shipments_{jt}) + \beta_A W + \beta_B W + u_{ij}; \end{aligned} \quad (4)$$

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(Competence_{it}) + \\ & \beta_5 (Competence_{jt}) + \beta_A W + \beta_B W + u_{ij}; \end{aligned} \quad (5)$$

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(Tracking_{it}) + \beta_5 (Tracking_{jt}) + \\ & \beta_A W + \beta_B W + u_{ij}; \end{aligned} \quad (6)$$

$$\begin{aligned} \text{Log}(X_{ijt}) = & \beta_0 + \beta_1 \text{Log}(GDP_{it}) + \beta_2 \text{Log}(GDP_{jt}) + \\ & \beta_3 \text{Log}(D_{ij}) + \beta_4 \text{Log}(Timeliness_{it}) + \beta_5 (Timeliness_{jt}) + \\ & \beta_A W + \beta_B W + u_{ij}. \end{aligned} \quad (7)$$

The current study is focused on 16 countries of Central and Eastern Europe (Albania, Bosnia and Hercegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, North Macedonia, Montenegro, Poland, Romania, Serbia, Slovak Republic and Slovenia). The years covered by the analysis are 2007 (when the LPI was first published by the World Bank) and 2018 (the latest available LPI dataset).

The dependent variable is international trade. This data, as the total volume of import and export from one country to another, is obtained from the UN Comtrade database. The volume of trade between all pairs of countries in the observed sample includes a total of 120 bilateral trade flows in 2007, the same as in 2018. This base is the most comprehensive available dataset on international trade.

GDP and LPI data with its components are taken from the World Bank. LPI sub-indicators are defined as follows (Arvis et al., 2016):

- Customs – the measure of efficiency and simplicity of customs agencies. In order to implement efficient customs clearance, this procedure should be as efficient as possible and with fewer bureaucratic procedures.
- Infrastructure – the quality of transport infrastructure necessary for the logistics and international trade (roads, railway, ports, airports). Better transport infrastructure aims at a more straightforward flow of physical traffic of goods, faster and safer transport.
- International shipments – ease of organising shipment and delivery at competitive prices.
- Logistics quality and competence – the quality and expertise of logistics services and operators (trucking, forwarding, customs brokerage).
- Tracking and tracing – the ability to efficiently track and locate shipments.
- Timeliness – delivery of shipments on time, within the planned or expected deadline.

Distances between countries and dummy variables, as a proxy variable of trade cost, are taken from Centre d' Etudes Prospectives et d' Informations Internationales (CEPII). Distance is calculated as the average distance between capital cities in kilometres. Dummy variables take values 1 and 0, respectively, depending on whether the countries have a common border, and whether they are part of the same economic integration or not. Integrations include membership in EU and CEFTA membership for non-EU Balkan countries.

3. Empirical findings

Descriptive statistics provide a brief insight into the value of the data used (see Table 1). Observing 16 CEECs in two years, the average value of overall LPI increased, the same as its maximum and minimum levels. The Czech Republic has the highest value of LPI in 2018 (3.68), and Albania records the minimum value (2.66). The value of bilateral trade between CEECs also increased in the observed period.

The empirical analysis was conducted using separate equations of the gravity model with the focus on the assumption that LPI represents a trade facilitation factor. The first estimation was done for LPI overall score in 2007 and 2018. The estimated coefficients are in line with our expectations and previous studies mentioned earlier in

Table 1. Summary descriptive statistics for the key variables (authors' calculations)

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|------------------|-----|-----------------|-----------------|---------------|-----------------|
| LPI_score_2007 | 16 | 2.76 | 0.35 | 2.08 | 3.15 |
| LPI_score_2018 | 16 | 3.07 | 0.31 | 2.66 | 3.68 |
| GDP_2007 | 16 | 84 163 920 393 | 108 737 141 609 | 3 680 710 375 | 429 063 549 984 |
| GDP_2018 | 16 | 108 559 423 454 | 147 727 014 594 | 5 504 166 667 | 585 663 814 824 |
| Total_trade 2007 | 120 | 1 011 822 314 | 2 378 067 539 | 26 827 | 16 728 909 508 |
| Total_trade 2018 | 120 | 1 756 049 729 | 3 989 715 093 | 377 325 | 26 370 448 629 |
| Distance | 120 | 1102 | 651 | 138 | 2782 |

the text. The volume of trade between the two countries is positively correlated with the size of their economies (measured by GDP) while the distance between countries, as a measure of trade cost, is a limiting factor of bilateral trade. The results of all variables on the sample of 16 CEECs with their coefficients and levels of statistical significance are presented in Table 2.

Table 2. Coefficients of Gravity estimation for 16 CEECs in 2007 and 2018 (authors' calculations)

| | 2007 | 2018 |
|-------------|-----------|-----------|
| GDP_i | 0.719*** | 0.805*** |
| GDP_j | 1.055*** | 0.875*** |
| Distance | -2.619*** | -1.852*** |
| LPI_i | 2.715** | 2.606* |
| LPI_j | -0.266 | 1.107 |
| Contig | -0.341 | 0.483* |
| Integration | 1.102*** | 0.341* |
| R-squared | 0.852 | 0.889 |

Note: *, ** and *** denote test statistical significance at the 10%, 5% and 1% levels, respectively.

The results show the standardised coefficients for each of the analysed areas. GDP and distance values are significant at 1% level in both observed years. For the volume of bilateral trade in 2018, we can notice that the size of both trading countries is equally important since the GDP coefficients in 2018 are at a similar level. The volume of bilateral trade between the two countries is conditioned by their size. The larger the two economies are, the higher their mutual trade is. Distance has a negative value whose coefficient weakened in 2018 compared to 2007 (-2.619, -1.852, respectively). It indicates that, in the group of CEECs, the distance between countries has a smaller negative impact on the volume of international trade in 2018 than in 2007. Since in this period there is an intensification of international trade between the observed countries (see Table 1), it can be considered that the distance between trade partners became less important for international trade among CEECs, which confirms second hypothesis (H₂). This finding is in line with Halaszovich

and Kinra (2018), who confirmed that more developed national logistics and transportation systems are able to overcome the costs of distance to some degree.

LPI is considered to be one of the trade facilitation factors since the excellent logistics provide a chance for trade growth. Our result shows that the LPI of one country has a high coefficient in both observed years. It is significant at 5% and 10% levels. The value of LPI coefficient is the largest among the observed variables, which indicates acceptance of first hypothesis (H₁) that logistics performance of trade partners have a significant impact on the volume of bilateral trade of CEECs. That proves the original assumption and complements previous research which also confirms the importance of logistics performance for international trade promotion. Selected CEECs with higher logistics performance score are more likely to improve bilateral trade flows significantly.

In addition, the coefficients of dummy variables were tested in the analysis together with economic size, distance and logistics performances, in order to examine their effects on international trade. Coefficient values of the common border and belonging to the same economic integration, both show a slightly positive impact on bilateral trade in 2018. The economic integration shows a considerably lower coefficient and a lower degree of significance among CEECs in 2018 (0.341*) than in 2007 (1.102***), but it still plays a role as a decisive factor in increasing the volume of international trade, as well as the shared border. The result suggests that the presence of a common border between trading partners and affiliation of both countries to the same economic integration will lead to more significant bilateral trade.

In the case of the second analysed group, within the CEECs, gravity estimation was done for six Western Balkan countries which are the part of CEECs (Serbia, Croatia, Bosnia and Hercegovina, Montenegro, North Macedonia and Albania). The aim was to determine the coefficients of the same variables in this subgroup and to determine the significance of LPI and other independent variables on international trade in this smaller group of countries. The results indicate the same direction and approximate values of the coefficients for statistically significant values of GDP and distance. Value of the distance coefficient also decreased in 2018 compared to 2007 as it

is noticeable on the example of 16 CEECs, indicating distance as a smaller obstacle in the process of international trade, compared to the past.

In 2007, LPI showed an extremely high statistically significant coefficient, while in 2018, the value of the coefficient is lower and does not show a statistically significant result (see Table 3). However, the role of logistics shows a positive impact on bilateral trade among all countries in the group. Dummy variables, common border and integration, are also tested in the example of Western Balkans countries. The coefficient of the common border was negative and not statistically significant in 2007, but in 2018 it becomes highly significant and with a high value of the coefficient. This points to the importance of the neighbourhood of these countries in bilateral relations and international trade within the Western Balkan region. From the other side, economic integration had significantly high coefficient in 2007 when all six countries belonged to CEFTA, before Croatia joined the EU.

Table 3. Coefficients of Gravity estimation for 6 Western Balkans countries in 2007 and 2018 (authors' calculations)

| | 2007 | 2018 |
|-------------|-----------|-----------|
| GDP_i | 0.178 | 0.644** |
| GDP_j | 1.157*** | 0.745*** |
| Distance | -2.297*** | -1.815*** |
| LPI_i | 8.419*** | 2.332 |
| LPI_j | 7.399* | 1.604 |
| Contig | -0.251 | 1.089*** |
| Integration | 3.566*** | 0.296 |
| R-squared | 0.789 | 0.803 |

Note: *, ** and *** denote test statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4. Coefficients of the components of LPI in CEECs, 2007 and 2018 (authors' calculations)

| | 2007 | 2018 |
|-------------------------------|----------|----------|
| Customs_i | 2.690** | 0.877 |
| Customs_j | -0.834 | 0.817 |
| Infrastructure_i | 1.306 | 0.537 |
| Infrastructure_j | 0.588 | 0.478 |
| International shipment_i | -0.153 | 3.906*** |
| International shipment_j | -0.990 | 0.863 |
| Logistic quality competence_i | 2.262** | 2.363* |
| Logistic quality competence_j | -0.597 | 0.035 |
| Tracking tracing_i | 2.070*** | 2.506* |
| Tracking tracing_j | -0.206 | 1.079 |
| Timeliness_i | 1.744** | 1.094 |
| Timeliness_j | 0.097 | 0.819 |

Note: *, ** and *** denote test statistical significance at the 10%, 5% and 1% levels, respectively.

The importance of logistics performance in international trade, in addition to the overall LPI score, was also tested through its individual components. Each of them was analysed as an independent variable in order to determine the impact on the volume of trade. The results of their coefficients are presented in Table 4.

Most of LPI subcomponents show a positive coefficient but without significant statistical impact for some of them. In 2007, coefficients of Customs, Logistic quality and competence, tracking and tracing, and Timeliness were notable with statistically significant and positive coefficients. The key variable in 2018 in CEECs is International shipment. This suggests that by focusing on improving this subcomponent, it is possible to contribute to the intensification of international trade of these countries. Besides that, Logistic quality and competence and tracking and tracing had significant positive coefficients in 2018.

The results of the gravity model estimations for CEECs indicate that there is a positive impact of logistics performance on the volume of international trade. The importance of logistics has been proven on the example of 16 countries and also in the case of 6 Western Balkans countries. Quality logistics thus justifies the role of a trade facilitator. At the same time, it has been proven once again that the size of the economy has a positive effect on the volume of international trade, while the distance between trading partners increases costs and its increase leads to a decrease in the volume of trade. However, it can be stated that the coefficient of the influence of distance on the volume of bilateral trade is decreasing, as we compare the given two years. Also, the positive effects of presence in the same economic integration and improvement of particular logistics services can contribute to the increase of trade and increasing the bilateral relations.

Conclusions

The paper examined the effects of logistics performance in international trade using a gravity model approach for 16 CEECs. Two hypotheses were raised and are as follows: i) LPIs of trade partners have a significant impact on the volume of bilateral trade of CEECs (H_1), and ii) Distance between trade partners became a less important factor for international trade among CEECs (H_2). For the purpose of testing the hypotheses, multiple regression models were employed in order to determine the impact of various independent variables on the volume of international trade between the countries. The emphasis is on logistics performance expressed with LPI and its components, performed to provide empirical evidence which logistical dimensions should be treated with priority. This article focuses on analysing the progress made in logistics by CEECs in two observed years with an interval of the 11-year period. In addition to the analysis of all 16 countries in Central and Eastern Europe, special attention is paid to 6 countries in the Western Balkans. It is worth mentioning that both hypotheses were supported.

The article has drawn several main insights. The most dedicated question about the logistics effects on the increase in trade volume has been confirmed. Countries' efforts to improve logistics performance indirectly affect the growth of international trade. This issue is also important from the international aspect and development of these countries. EU member states within the CEE region through efforts to improve logistics performance will enable the growth of international trade and thus potentially reduce the gap with the most developed member states. On the other hand, the way to increase foreign trade through improved logistics performance will enable the countries of the Western Balkans to intensify trade flows with the EU countries. In any case, the focus for policymakers, and also for the private sector should be on improving the logistical environment and services. It will contribute to the intensification of bilateral relations between the countries. When it comes to LPI components within CEECs, the analysis shows that International shipments have the most significant effect on the growth of bilateral trade based on latest data. Besides, focus on logistic quality and competence as well as tracking and tracing will give its contribution to international trade.

Additionally, the results of previous research regarding the effects of the size of the economy and the distance between trading partners have been confirmed. The positive correlation between the volume of bilateral trade and the size of the trading economies was proven. Greater distance between countries has a negative effect on trade, i.e. trade between more distant countries of the CEE region will be smaller compared to countries that are geographically closer. In addition to this confirmation, the research showed that the negative impact of distance on the volume of bilateral trade is smaller in 2018 than 11 years earlier. This could be attributed to the reduction of transport costs, the effects of liberalisation and increasing the level of cooperation within the region, as also evidenced by the fact that belonging to the same economic integration contributes to increasing the volume of trade between countries.

The limitations of the article are reflected in the fact that only two years have been taken into account. Future research may extend the time span and possibly compare two groups of countries in order to compare the effects achieved at the group level.

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