ANALYSIS OF LOGISTIC PERFORMANCE IN SOUTHEAST EUROPEAN COUNTRIES

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Abstract

The logistic capability of a region or a country is of outmost importance to its economic competitiveness. Hence, the basic goal of this study is to explore the logistic capability in Southeast European countries by applying the LPI methodology. This methodology provides the analysis of aggregate factor of logistic capability, as well as of individual indicators that constitute the index. The goal of the research is to establish a level of correlation between the aggregate factor of logistic performance and its constitutive indicators, but also the strength and direction of correlation between each of these individual indicators and global index of competitiveness. The research will focus on recognising the individual indicators that have a direct and relevant impact on the competitiveness of each country and of the whole region. The suggested frame of research could help in decision-making by providing a basis for better assessment of competitive advantages and the development of individual indicators that form the index of logistic performance.

Key words: logistic performance index (LPI), global competitiveness index (GCI), Southeast European countries

1. INTRODUCTION

Logistics is a high cost activitie and usually represent the prerequisite for economic development or an important development accelerator. Also, logistics infrastructure is an integrating factor within a territory. The logistics infrastructure of Southeast Europe is an important segment of the European macro-logistic system. This is confirmed by the presence of five Paneuropean corridors (IV, VII, VIII, IX and X), and ofshoots of corridors V, Vb and Vc in this area. These corridors are in function of creating a singular transport and logistics European network, but also provide a better connection between each of the Southeast European countries and their connection with the rest of Europe, as well as higher efficiency of their logistic and economic systems.

Efficiency of a country's logistic system is measured by the index of logistic performance. This research initiates from the implied importance of a developed logistic system in economic functioning of a country or region and so the focus will

be on all of the six indicators that form the logistic performance index by applying the method of analysis and synthesis, the comparative method, and the method of descriptive and inferential statistics. Such an approach will provide the recognition of those individual indicators that directly and significantly influence the competitive capability of the countries and region as a whole. The results are based on secondary data resources, that is the World Bank LPI and GCI reports.

2. RESEARCH PROBLEMS

Southeast European countries (Albania, Bosnia and Herzegovina, Bulgaria, Greece, Croatia, Macedonia, Montenegro, Serbia, Slovenia and Romania) represent the economic, transportation and logistic perifery of Europe. With a global competitiveness index of 4,44, Bulgaria is positioned as the 50th out of 138 countries. However, in 2016, Bulgaria had the highest global competitiveness index in Southeast Europe, while Bosnia was at the back, with a global competitiveness index of 3,80 and thus was placed as 107th. Similar results are obtained if these countries are observed within global framework. Greece is placed at number 47 out of 160 countries, while Montenegro is the worst, placed at 123. Accordingly, it seems appropriate to examine the relation between the logistic development of Southeast Europe and their global competitiveness.

Designing a logistic network, i.e. pinning down the number of the necesssary logistic centres (NLC), Zelenika and Pavlić (2007,384) see this as a mathematical function of the number of inhabitants (P), surface or the gravitational area that needs to be covered (A), the level of economic development measured in GDP/p.c., the development of transport branches (TM) and roadways (TC):

NLC= f (P, A, GDP/p.c.,TM, TC)

(1)

In line with this, the conclusion would be that the development of economic and transportation systems is a prerequisite for the development of a logistic system. Segetlija (2002,269) asserts the following general conditions for formation of an international logistic system: transportation distances, means of transport, institutions, documents, information etc. Vittorio d'Aleo (2015) explores the role of the logistic performance index as a mediator variable between the global index of competitiveness and the GDP of EU28 countries, and concludes that improvements in logistic system have a positive effect on the growth of national wealth and that the logistic performance index may serve as a good predictor of the GDP movement. Zekić, Samaržija and Pupavac (2017) evaluate that a country's competitiveness is influenced by the LPI in global terms at different levels of economic development. Their conclusion is that factor-driven economies should focus on macro-logistics, while the efficiency-driven economics should be oriented towards developing micro-logistics system. The innovation-driven economies should invest in maintaining existing and developing new infrastructure based on information and communication technologies. Pupavac and Golubović (2015) assert the importance of logistics in economic activities and determine the existence of a firm and positive relation between the movement of logistic performance index as a composite notion and the

global competitiveness index. Unlike the aforementioned researches, this one will attempt to determine the level of correlation between the aggregate indicator of logistic performance and its constitutive factors, as well as the correlation between each of these factors and the global competitiveness index.

One of the fundamental problems in logistic systems of Southeast Europe arises from the fact that Albania, Macedonia, Bosnia, Montenegro and Serbia are not members of the European Union, and that they will not be any time soon. This significantly slows down the flow of transport and goods, increases logistic expenses, decreases the productivity of transportation and logistic companies and complicate the management of a common cohesive transport and logistic policy. This is also the main reason for underutilisation of corridor X (cf. figure 1), incidentally, the corridor with the biggest potential for connecting the countries of Southeast Europe and for connecting them with the Western and Northwestern Europe.

Figure 1. Corridor X

Source: authors prepared according: Balkan railways, From Berlin to Beijing, The Economist, Sep. 16, 2010.

With this in mind, the representatives of national railways from Croatia, Serbia and Slovenia have founded a common company in 2010, Cargo X. Montenegro and Macedonia have declined to be a part of this partnership. Founding a common company meant approaching the goal of quicker transportation of goods on the Paneuropean transport corridor X and an increase in its competitiveness in relation to corridor IV. If transport time would be shortened from 60 to 25 hours ride, transport of goods from corridor IV might be transferred to corridor X. There are about 700 trains on relation Ljubljana-Zagreb-Belgrade-Dimitrovgrad-Istanbul within corridor

X, while there are about 7000 trains within the corridor IV, which is also longer and passes through Hungary. It is in the interest of parties within corridor X to attract a number of trains from corridor IV (Zuko, 2011).

A separate problem is the railway system in countries of Southeast Europe. Its infrastructure is obsolete, non-electrified and consists of mostly one-track railways, technical standards of the TEN-T network are insufficient, narrow passages are common and generally, the uncompetitiveness of the railway system is severe. Uncompetitiveness disables application of modern technologies and significant development of multimodal transportation. Underdevelopment of multimodal transport where railway is only of slight importance negatively affects the development of logistic activities related to transport and distribution. Undeniably, the majority of mega-logistic and macro-logistic centres should be located on main transport routes, that is corridors, and in gravitational areas of seaports, river ports and airports (Zelenika, Pavlić, 2007, 384).

Insufficient exchange of goods between the countries of Southeast Europe and almost exclusively nationally oriented transportation and logistic systems restrain these countries' full exploitation of their transport, logistic and economic potentials. Only Pireus in Greece has managed to position itself among the top 20 European cargo ports (on number 8) with 3,58 million of containers, and in 2015 Romanian Constantza (on number 15), with 56,3 million tons of cargo (*www.portofrotterdam.com*). National profiling of Southeast European ports' transport and logistic systems is confirmed by the amount of traffic in their largest ports, as in the Albanian Durres, Bar in Montenegro or Varna and Burgas in Bulgaria. The same could be said for Rijeka, Croatian most significant port. Cargo transport in Rijeka is dependent on the movement of GDP, which did not change even after Croatia became member of the European Union. This is confirmed by the following correlation analysis between the total cargo transport of the Port of Rijeka, its container terminal and Croatian GDP in the period 2000-2016 (cf. Table 1).

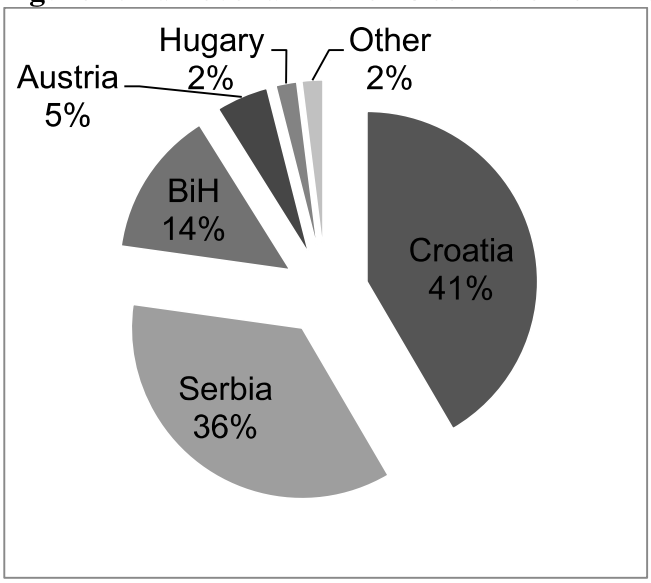
Table 1. Correlation between Port of Rijeka's total cargo transport, container terminal and Croatian GDP.

		GDP value
Total cargo transport	Pearson's correlation coefficient P value	0,68 0,002365
TEU transport	Pearson's correlation coefficient P value	0,86 0,000006

Correlation is significant on 0,01 level
Source: authors' calculation

The figure 2 also shows that PoR (Port of Rijeka) remained predominantly the port of Croatia, Serbia and Bosnia and Herzegovina.

Figure 2. Turnover at the PoR's container terminal per country



Source: authors prepared according to ICTSI 2017, http://www.ictsi.com (13.05.2017.)

Progress of the entire logistic system in the countries of Southeast Europe is an important factor of region's competitiveness and of its more acute inclusion in the global flow of goods. Logistic performance index is a means of measuring logistic performance of a particular country. It provides a means of comparison between 160 countries in six domains: (1) efficiency of the clearance process by customs and other border agencies; (2) quality of transport and information technology infrastructure for logistics; (3) ease and affordability of arranging international shipments; (4) competence and quality of logistics services; (5) ability to track and trace international shipments; and (6) timeliness of shipments in reaching destination.

In order to analyse and evaluate logistic capability of countries in Southeast Europe, the following information could be of help (cf. Table 3.):

Table 3. LPI rank, LPI value and values of LPI indicators.

Country	LPI rank	LPI score	Customs	Infra-strcture	Interna-tional shipm-ents	Logisti-cs compe-tence	Tracking & tracing	Timeli-ness
Greece	47	3,24	2,85	3,32	2,97	2,91	3,59	3,85
Slovenia	50	3,18	2,88	3,19	3,10	3,20	3,27	3,47
Croatia	51	3,16	3,07	2,99	3,12	3,21	3,16	3,39
Romania	60	2,99	3,00	2,88	3,10	2,82	2,95	3,22
Bulgaria	72	2,81	2,40	2,35	2,93	3,06	2,72	3,31
Serbia	76	2,76	2,50	2,49	2,63	2,79	2,92	3,23
BiH	97	2,60	2,69	2,61	2,28	2,52	2,56	2,94
Macedonia	106	2,51	2,21	2,58	2,45	2,36	2,32	3,13
Albania	117	2,41	2,23	1,98	2,48	2,48	2,15	3,05

Montenegro	123	2,38	2,22	2,07	2,56	2,31	2,37	2,69
Average_se10		**2,80**	**2,61**	**2,65**	**2,76**	**2,77**	**2,80**	**3,23**
Average_160		2,88	2,72	2,75	2,87	2,82	2,86	3,27
Average_top10		5,37	4,01	3,86	4,08	3,99	4,08	4,25

Source: authors prepared according 2016 LPI, https://lpi.worldbank.org/international/global (15.03.2017.)

According to data in Table 3, only three out of ten countries have LPI>3 and that indicates the uncompetitiveness of these countries. LPI values range from 1 (worst) to 5 (best) and show that developing the capacity to connect firms, suppliers and consumers is a key in a context where predictability and reliability are becoming as important as costs in sourcing decisions. A value of less than 3.0 usually reflects an array of problems within a nation's freight distribution system causing undue delays and additional costs. For instance, a difference of one point lower in the LPI is related to two to four additional days of port hinterland access and a 25% higher physical inspection rate at customs. Table 3 also shows that Southeast Europe significantly lags behind the top ten countries (with highest LPI), but also on a global level, which is especially worrying. This lag is visible in every area that constitutes LPI.

3. DATA AND RESEARCH METHODOLOGY

Data is obtained from the LPI Global Rankings 2016 surveys, conducted by the World Bank in partnership with academic and international institutions and private companies and individuals engaged in international logistics. Second source of data is The Global Competitiveness Report 2016-2017. The GCI includes an average of many different components, each measuring a different aspect of competitiveness. This study applied desk research scientific methods: methods of analysis and synthesis, comparative method, methods of descriptive and inferential statistics. Numeric calculations are performed using the Statistica software.

4. RESEARCH RESULTS AND DISCUSSION

Correlation analysis for 160 world countries was carried out using the Statistica software, to determine the level of correlation between the aggregate logistic performance index and its constitutive indicators. The results are shown in Table 4.

Table 4. Correlation analysis between LPI and its indicators.

	Means	**Std.Dev.**	**LPI**	**Customs**	**Infrastructure**	**International shipments**	**Logistics competence**	**Tracking & tracing**	**Timeliness**
LPI	2,883	0,6272	1,000	0,963583	0,975845	0,965969	0,981540	0,976455	0,959787
Customs	2,715	0,6409	0,963	1,000000	0,943819	0,918808	0,932734	0,928468	0,903137

Infrastructure	2,754	0,7190	0,975	0,943819	1,000000	0,926196	0,961143	0,944117	0,909110
International shipments	2,866	0,5744	0,965	0,918808	0,926196	1,000000	0,939090	0,924880	0,916664
Logistics competence	2,824	0,6452	0,981	0,932734	0,961143	0,939090	1,000000	0,953064	0,926110
Tracking & tracing	2,863	0,7009	0,976	0,928468	0,944117	0,924880	0,953064	1,000000	0,938997
Timeliness	3,268	0,6197	0,959	0,903137	0,909110	0,916664	0,926110	0,938997	1,000000

Source: Source: authors' calculation

Data from Table 4 show a strong and positive correlation between the LPI and all its indicators. Correlation between the LPI and logistic competence (r=0,98), between the LPI and tracking and tracing (r=0,97) and between the LPI and infrastructure (r=0,97) have the highest Pearson's correlation coefficients. With these indicators standard deviations are the largest (infrastructure-SD=0,719; tracking & tracing-SD=0,7; logistics components-SD=0,645), also variations (infrastructure-s=0,517; tracking & tracing-s=0,49; logistics competence-s=0,416) and coefficients of variations (infrastructure-CV=26,1; tracking & tracing-CV=24,47; logistics competence-CV=22,84). This indicates the importance of these three indicators in the increase of logistic capabilities in the systems of Southeast Europe.

Analytical relationship between individual LPI indicators and GCI in 160 world countries can be shown as follows (Table 5):

Table 5. Regression analysis of LPI and its individual indicators

Regression Summary for Dependent Variable: LPI R= ,99961056 R^2= ,99922127 Adjusted R^2= ,99917917 F(6,111)=23738, p						
	b*	**Std.Err. - of b***	**b**	**Std.Err. - of b**	**t(111)**	**p-value**
Intercept			-0,004920	0,011321	-0,43458	0,664714
Customs	0,134890	0,008787	0,131586	0,008572	15,35076	0,000000
Infrastructure	0,181227	0,011390	0,157629	0,009907	15,91127	0,000000
International shipments	0,177211	0,007866	0,196019	0,008701	22,52768	0,000000
Logistics competence	0,203096	0,011867	0,197621	0,011547	17,11381	0,000000
Tracking & tracing	0,163663	0,011363	0,146270	0,010155	14,40364	0,000000
Timeliness	0,169177	0,008574	0,170626	0,008648	19,73098	0,000000

Source: authors' calculation

The regression analysis shows that logistics competence b*=0,203) and infrastructure (b*=0,181) have the largest beta coefficients and this additionally asserts the importance of the two in the increase of logistic capabilities in the countries of Southeast Europe.

The correlation between the LPI and its individual indicators can be shown mathematically as follows:

$$LPI = -0,00492+0,135C+0,181I+0,177IS+0,203LC+0,163TT+0,169T \quad (2)$$

Accordingly, from this point on, this research will explore the strength and direction of correlation of each indicator forming the LPI and the global index of competitiveness. The results of correlation analysis for the available 118 countries are shown in Table 6:

Table 6. Correlation analysis between LPI and GCI.

	GCI	Customs	Infrastr-ucture	International shipments	Logistics competence	Tracking & tracing	Timeliness
GCI	1,000000	0,836926	0,877338	0,822326	0,878295	0,855783	0,834294
Customs	0,836926	1,000000	0,943231	0,905248	0,928509	0,928809	0,910299
Infrastructure	0,877338	0,943231	1,000000	0,913886	0,960884	0,950309	0,918643
International shipments	0,822326	0,905248	0,913886	1,000000	0,927069	0,920775	0,909824
Logistics competence	0,878295	0,928509	0,960884	0,927069	1,000000	0,959078	0,927898
Tracking & tracing	0,855783	0,928809	0,950309	0,920775	0,959078	1,000000	0,940617
Timeliness	0,834294	0,910299	0,918643	0,909824	0,927898	0,940617	1,000000

Source: authors' calculation

Data in Table 6 show a strong and positive correlation between all the individual indicators that constitute the LPI and GCI. The strongest correlation is between logistics competence and GCI (r=0,981), and between infrastructure and GCI (r=0,877). Also, this indicates the importance of the two in increasing the economic competitiveness of Southeast Europe. Analytic correlation between the individual indicators of the LPI and the GCI can be shown as follows (Table 7).

Table 7. Regression analysis of GCI and individual indicators of LPI

Regression Summary for Dependent Variable: GCI (Sve_LPI_GCI) R= ,88690388 R^2= ,78659850 Adjusted R^2= ,77495842 F(6,110)=67,577 p						
	b*	**Std.Err. - of b***	**b**	**Std.Err. - of b**	**t(110)**	**p-value**
Intercept			1,574235	0,209280	7,522144	0,000000
Customs	-0,018839	0,144901	-0,020373	0,156705	-0,130010	0,896796
Infrastructure	0,436280	0,188338	0,419817	0,181231	2,316479	0,022385
International shipments	-0,032013	0,129711	-0,039350	0,159437	-0,246803	0,805521
Logistics competence	0,449697	0,196717	0,484013	0,211728	2,286009	0,024169
Tracking & tracing	-0,016805	0,187493	-0,016673	0,186027	-0,089628	0,928746
Timeliness	0,078318	0,141191	0,087731	0,158161	0,554693	0,580231

Source: authors' calculation

The regression analysis confirmed the statistically significant influence of the two indicators on the LPI and GCI: infrastructure and logistics competence. In order

to obtain the conclusive mathematical model, regression analysis for these two indicators and the GCI was conducted. The results are shown in Table 8:

Table 8. Regression analysis between infrastructure, logistics competence and GCI

Regression Summary for Dependent Variable: GCI (Sve_LPI_GCI) R= ,88653504 R^2= ,78594437 Adjusted R^2= ,78218901 F(2,114)=209,29 p						
	b*	**Std.Err. - of b***	**b**	**Std.Err. - of b**	**t(114)**	**p-value**
Intercept			1,615890	0,149632	10,79908	0,000000
Infrastructure	0,435423	0,156462	0,418992	0,150558	2,78292	0,006307
Logistics competence	0,459904	0,156462	0,494999	0,168402	2,93939	0,003982

Source: authors' calculation

According to obtained data, the following mathematical model can be written thusly:

GCI=1,61589+0,418992I+0,494999LC (3)

Based on the presented global model, the evaluation of global competitiveness index for each of the Southeast European countries can be made, with emphasis on the aforementioned two indicators, if infrastructure and logistics competence would grow to the average level of the two indicators in the top ten countries based on LPI.

Table 9. Evaluation of average GCI value in Southeast Europe

Predicting Values for (Sve_LPI_GCI) variable: GCI			
	b-Weight	Value	b-Weight - * Value
Infrastructure	0,418992	3,860000	1,617310
Logistics competence	0,494999	3,990000	1,975047
Intercept			1,615890
Predicted			5,208247
-95,0%CL			5,091982
+95,0%CL			5,324512

Source: authors' calculation

The conclusion, according to the obtained data in Table 9, is that if Southeast Europe's average values of two indicators – infrastructure and logistic competence – would rise to the average values of the LPI top ten countries, their average GCI of 4,14 would rise to 5,21 and so would be among the most competitive economies in the world.

5. CONCLUSION

The logistic performance index is a way of measuring the logistic efficiency of countries. LPI values range from 1 (worst) to 5 (best). Three out of ten countries in Southeast Europe have the LPI>3, and this indicates their uncompetitive logistic

systems. The average LPI of these countries is 2,80, i.e. below the global average of 2,88. LPI provides the comparison of 160 world countries in the six following domains: (1) efficiency of the clearance process by customs and other border agencies; (2) quality of transport and information technology infrastructure for logistics; (3) ease and affordability of arranging international shipments; (4) competence and quality of logistics services; (5) ability to track and trace international shipments; and (6) timeliness of shipments in reaching destination. The comparative analysis has asserted the lag of Southeast Europe in all the six domains when compared to global average. This lag is even larger if compared to the LPI top ten countries.

The correlation analysis has asserted a strong and positive correlation between the LPI and all of its indicators. The highest coefficient of correlation occurred between the LPI and logistic competence (r=0,98), between the LPI and tracking & tracing (r=0,976) and between the LPI and infrastructure (r=0,975). Regression analysis has additionally emphasized the importance of infrastructure and logistic competence in advancement of logistic performances. Also, a strong and positive correlation between the two indicators of LPI and GCI was asserted. Regression model has confirmed that if Southeast Europe's average values of two indicators – infrastructure and logistic competence – would rise to the average values of the LPI top ten countries, their average GCI of 4,14 would rise to 5,21 and so would be among the most competitive economies in the world.

The main defect of this study arises from the fact that evaluations were made from observing the undeniable growth of the two indicators of LPI and GCI of Southeast European countries without making a proper research for the period between 2007 and 2016 to establish if the values of LPI were divergent or convergent between the developed and undeveloped countries. Future researches may focus on the process of divergence or convergence in the LPI of differently developed countries, but also in individual domains of the LPI.

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