Determinants of logistics efficiency with the comparison among China and EU-OBOR countries

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Abstract

The proposal of One Belt One Road has brought great space for the development of logistics industry in this era. It will promote the logistics industry in all aspects, but at the same time, it requires countries to speed up the improvement of logistics efficiency in order to occupy a place in the fierce international competition. The main purpose of this paper is to analyze determinants that affect the logistics efficiency of various countries. The methods of the study are DEA, a system composed of multiple input variables and multiple output variables and Tobit, a regression model of dependent variables can ensure the accuracy and scientific. These two methods are used to analyze six micro determinants and four macro determinants separately. The results show that the logistics efficiency of most countries is still in a state of inefficiency, and there are great differences in logistics efficiency among countries, only five countries – China, Greece, Malta, Portugal and Romania reached the effective logistics efficiency. It can also be concluded that the invalid of logistics efficiency of most countries are caused by both the pure technical efficiency and scale efficiency, between which the pure technical efficiency has a great impact.

Introduction

In 2013, Chinese President Xi put forward cooperation initiatives for the "New Silk Road Economic Belt" and the "21st Century Maritime Silk Road." , which is known as the "One Belt One Road", it aims to achieve political communication, free trade, financing, infrastructure connectivity and interlinked public-opinion between China and other countries along the route [Nazarko, Kuźmicz, 2017, p. 497-503].

With the development of it, it gradually means opportunities and risks for participant countries. OBOR as one of the greatest logistics catalytic agent at 21 centuries urges countries pay attention at logistics industry. Poland and other European Union countries who participant OBOR have to actively improve their logistics efficiency in order to get the opportunities to acquire further development rather than risks.

The main purpose of this thesis is to have a clear understanding about the logistics efficiency and ways to improve it for EU-OBOR countries, which allows countries have further development of their logistics industry and win the chances to occupy a place in the international competition by evaluating their logistics technical efficiency, pure technical efficiency as well as scale efficiency step by step and analyzing whether determinants that have positive influence for logistics efficiency. The determinants can either higher or even lower the logistics efficiency, from which every countries can acquire advises of improve own logistics efficiency. DEA and Tobit method here are conducted to calculate their efficiencies and coefficient. DEA is a method can enable the efficiency of results to be analyzed depending on the expenditure incurred. Tobit method is an explained variables limited method which just in line with the results of DEA method.

1. The concept of logistics efficiency

1.1. Concept of logistics

Recently, the definition of logistics has been in continuous improvement and development, academic scholars do not have a unified view of the basic concept of logistics because different scholars from different countries and different schools define logistics from different perspectives. The origin of "logistics" is the United States, which turned out to be referring to the delivery of goods. The concept of logistics appeared later than in USA, but it had a fast growing trend, and it made Japan became one of the most developed countries in logistics industry. In 1981, in the concept of logistics put forward by Japan, it is the first time that logistics is a process and has value. Then, in 1992, the American Logistics Association expanded the scope of logistics to services and related information, identifying customer needs and a range of activities that support transferring - planning, implementation, controlling and storage. In 1994, ELA-European Logistics Association believes that logistics is a system which pays more attention to the integrity of logistics. Once again, the scope of the main body of logistics transportation has been expanded by United Nations joint Logistics Centre in 1999, with emphasis placed on raw materials, in-

termediate products and final products. After one year, logistics conception presented by Council of Logistics Management of USA was connected with whole supply chain, and integrating the ideas of forefathers, which can be concluded that logistics nowadays is one part of the whole supply chain, and a process to cater to the needs of customers, make sure that merchandise, services and relevant information are able to have a high-efficiency, high-value flow between supplying and receiving place, memory happened plan, implement and control [Larson, Halldorsson, 2004, pp. 17-31]. The purpose of implementing logistics management is to achieve the established level of customer service under the lowest possible total cost, that is to seek a dynamic balance of service advantages and cost advantages, and thus to create strategic advantages in competition.

According to logistics goal, the basic problem of logistics management is to supply the right product to the customer at the right time and at the right place with the right quantity and the right price [Fisher, 1997, pp. 105-117]. From the perspective of this, therefore, logistics is in the process of goods flowing from the place of supply to the destination, according to the actual needs of the customer, transport, procurement, storage, loading and unloading, processing, packaging, distribution, information processing and other basic functions are organically combined to achieve the purpose of goods transfer [Srinivasan, Bansal, Karimi, 2006]. These above activities are included in both macro-logistics and micro-logistics. The difference between them is that the characteristics of macro logistics is to look at logistics from a general point of view rather than from a certain component of logistics, while the characteristics of micro logistics is to focus on a part of the whole logistics activities, a link of logistics. Macro logistics refers to the overall reproduction of society, industry or large groups of logistics activities, which have a more comprehensive and overall impact on a country, including social logistics, national economic logistics and international logistics. Micro logistics mainly refers to the specific and practical activities that consumers and producers are engaged in or need. They are logistics activities aimed at specific customers and specific products, including supply logistics, sales logistics, recycling logistics, waste logistics, Production logistics and enterprise logistics [Xiafang, 2004].

1.2. Concept of logistics efficiency

There are problems of a clear understanding of the concept of logistics efficiency in the literature. Nowadays the concept of logistics efficiency is extended form the definition of efficiency. Under the situation that there is no authoritatively recog-

nized definition of logistics efficiency, the concept of logistics efficiency can be derived from the concept of efficiency. From an economic point of view, efficiency refers to the process of increasing its output while reducing or maintaining the same input. From a management perspective, efficiency is more like a tool for measuring inputs and outputs.

According to the mentioned definitions of efficiency, logistics efficiency in a micro scope means the ratio of input resources and output in a company's logistics part; logistics efficiency in a macro scope should be used to measure and reflect the utilization of input resources in a country's logistics industry, that is the ability of logistics industry to transform input into output. If logistics input can completely transformed into logistic output, we can make a conclusion that the logistics efficiency is relatively high. If logistics resource input is not fully utilized, then the logistics efficiency will be low.

The concept of logistics efficiency is different to logistics performance, but both of them are the evaluation of input and output, while logistics efficiency must be the ratio of input and output, but performance can be an absolute result, such as profit. In the process of selecting the determinants of logistics efficiency, we can draw lessons from logistics performance indicators [Arvis, Ojala, Wiederer, et al., 2018]. However, determinants of macro logistics efficiency and determinants of micro logistics efficiency are not the same because of the different measurement subjects, as shown in fig. 1 below.

The Figure represents that macro logistics and micro logistics have different focus on micro determinants, while the macro determinants of them are the same.
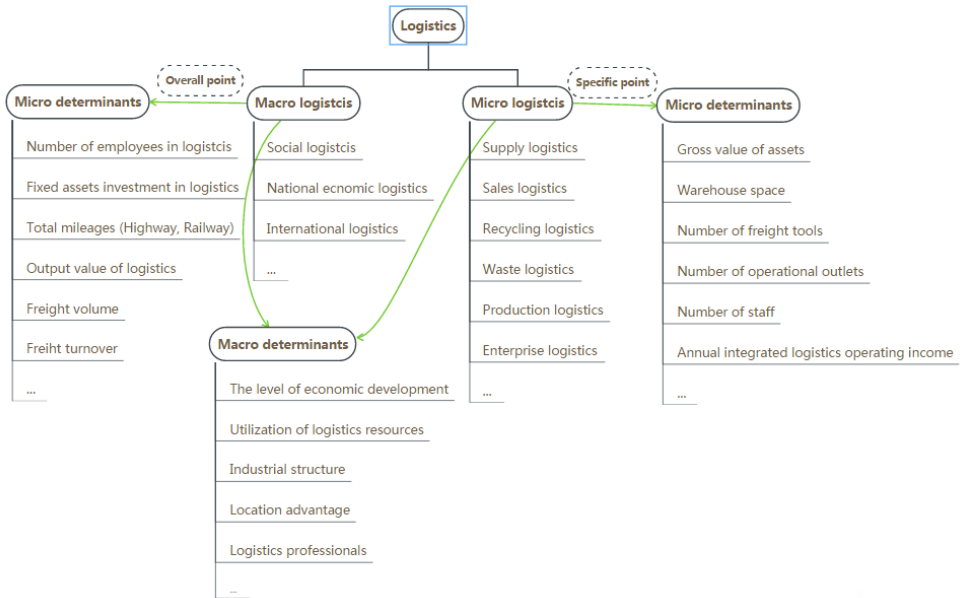
Fig. 1. Examples of Macro logistics and Micro logistics and examples of determinants of their efficiency

Source: Zhao X, Tang Q. (2009), Analysis and strategy of the Chinese logistics cost reduction. International Journal of Business and Management, 2009, 4(4): 188-191.

2. Research methods and Analysis

2.1. DEA method and Analyzing of logistics efficiency

2.1.1. Basic concept of DEA method

Data Envelopment Analysis (DEA) is a non-parametric frontier efficiency analysis method. At present, it is widely used to evaluate the production efficiency of decision making unit (DMU) with multiple inputs and outputs [Joumady, Ris. 2005]. According to whether the return to scale of the evaluated object changes or not, it can be divided into CCR model (constant return to scale) and BCC model (variable return to scale); it can also be divided into input-oriented and output-oriented according to the orientation.

According to Charnes and Cooper, the principle of this method is to make the input or output of the decision DMU invariant, and then estimate an optimal matching value according to the observed values of the input and output data. The actual input-output matching value is calculated according to the actual input and output data, and compared with the best matching value, then the relative validity is determined according to the deviation degree between the actual matching value and the best matching value. After the random error is excluded, if the matching value is 1, it shows that the value of the decision making unit falls on the best matching value, and the decision making unit is effective, which is also called DEA efficiency. If the calculated matching value is between 0 and 1, it shows that the actual matching value is not equal to the best match value, and the input or output needs to be improved to achieve the best efficiency value, which is called DEA invalid. The difference between the actual matching value and the best matching value is considered as the inefficiency degree of input and output [Charnes, Cooper, Rhodes, 1997].

2.1.2. Evaluation of logistics efficiency based on micro determinants

According to the international cooperation module of China's Belt and Road Website, in addition to Poland, EU countries that have signed Belt and Road-related documents with China also include Austria, Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Portugal, Romania, Slovakia, Slovenia, Therefore, these 17 countries are selected as the decision-making units in the DEA model, and their logistics efficiency from 2013 to 2017 will be calculated and analyzed.

Therefore, research data from 2013 to 2017 will be their statistics on number of employees, fixed assets investment, highway and railway mileage, output value of transport, warehousing and postal service, freight volume and freight turnover. The data are secondary, mainly from the European Commission's database, the Organization for Economic Cooperation and Development (OECD) database and the annual statistical reports published by countries.

The software Frontier Analyst Application is used to calculate the technical efficiency of China and EU-OBOR countries under the modes of minimize input and CCR. According to the collected data of relevant countries, the specific results of technical efficiency of logistics efficiency in 2013-2017 measured are as the tab. 1 shows.

Tab. 1. Measurement results of logistics technical efficiency in China and EU-OBOR countries from 2013 to 2017

Technical efficiency						
Country	2013	2014	2015	2016	2017	Mean
	In%					
China	100.00	100.00	100.00	100.00	100.00	100.00
Greece	100.00	100.00	100.00	100.00	100.00	100.00
Malta	100.00	100.00	100.00	100.00	100.00	100.00
Portugal	100.00	100.00	100.00	100.00	100.00	100.00
Roma-nia	100.00	100.00	100.00	100.00	100.00	100.00
Latvia	100.00	100.00	100.00	100.00	96.50	99.30
Austria	100.00	99.70	96.60	98.20	95.90	98.08
Poland	87.10	88.20	83.70	99.40	100.00	91.68
Croatia	86.00	91.00	79.10	91.60	100.00	89.54
Bulgaria	75.10	89.60	85.20	91.00	90.20	86.22
Slovenia	74.90	94.80	83.20	77.30	95.40	85.12
Lithua-nia	68.90	76.90	78.30	83.90	96.10	80.82
Estonia	60.10	66.90	82.40	79.90	85.80	75.02
Czech	44.90	53.40	57.40	54.20	63.90	54.76
Slovakia	52.10	50.30	51.80	49.20	56.90	52.06
Hungary	42.40	37.90	38.50	39.50	37.30	39.12

Source: own study.

Based on collected data of number of employees, fixed assets investment, total mileage, output value, freight volume, freight turnover of each country.

As can be seen from the above table, there is a large gap in the technical efficiency of logistics in various countries. The technical efficiency of China, Greece, Malta, Portugal and Romania in every year are all one, which means that the logistics input of these five countries has been reasonably and fully utilized and the output has been maximized each year, and provides a good economic environment for the development of logistics industry.

Latvia, Austria and Poland followed by a mean of technical efficiency of 0.9 and above. It means that, while their logistics inputs are not fully translated into outputs, it is highly possible to make their technical efficiency achieve one or stable at one as long as they reduce input or increase output. Latvia, in particular, reached DEA efficiency from 2013 to 2016, less than one in 2017, perhaps because of the new increase in investment in 2017, but in the last few years the return could be reflected. Poland's technological efficiency changes in the opposite direction. It didn't reach one in the first four years, but it reached one in 2017. This shows that after several

years of efforts, Poland has found ways to improve the utilization of logistics inputs and reduce unnecessary waste.

In the rest of the countries, Croatia, Bulgaria, Lithuania and Slovakia all have technical efficiency of more than 0.8, indicating that they have great potential to reach one. The input and output of logistics industry in Estonia, Czech Republic, Slovakia, Hungary is not very coordinated. Hungary in particular, in the case of fluctuating growth in other countries, has been at around 0.40 without growth.

2.2. Tobit method and Analyzing of macro determinants

2.2.1. Basic concept and modeling of Tobit method

Tobit method is a regression model of dependent variables which needs to satisfy some constraint conditions. It is shown that the explained variables of the model generally have a limited range of values, which belongs to the limited dependent variable regression [Odah, Bager, Mohammed, 2017]. Because the efficiency interval obtained by DEA method is [0, 1], the dependent variable data is a limited dependent variable. It has a huge possibility to satisfy two basic requirements of using Tobit method, which include the explained variable must take a positive probability of zero and the remaining non-zero samples are in a continuous state above zero. And it is a kind of intercepting regression model which uses maximum likelihood method instead of ordinary least square (OLS) [Xu, Lee, 2015]. It has the character of discontinuity of explained variable value and can ensure the accuracy and scientific of the estimated parameter value.

The basic expression of the Tobit model is as follows:

$$Y = \begin{cases} Y^* = \beta X + \mu & Y^* \geq 0 \\ 0 & Y^* < 0 \end{cases}$$

Y is explained variable, that is, logistics efficiency value of each country from 2013 to 2017; Y^* is truncated explained variable; X is explanatory variable, that is, macro determinants of logistics efficiency in each country; β is regression parameter; μ is random error item.

As macro determinants of logistics efficiency, the level of economic development, the utilization rate of logistics resources, the industrial structure and location advantages have a certain regular influence on logistics efficiency, so they are chosen as explanatory variables in this paper. In order to digitize the explanatory variables to facilitate modeling and computing, it is necessary to measure the explanatory

variables in the Tobit method. On Tab. 2 the name of macro determinants and their corresponding indexes and codes are listed.

Tab. 2. Macro determinants and its indexes

Name of macro determinants	Index of determinants	Code of determinants' index
The level of economic development	GDP per capita growth rate	GR
Utilization of logistics resources	freight volume per 10000 km of rail and highway (billion tons)	FV
Industrial structure	the proportion of annual services value added to GDP	SV
Location advantage	location quotient	LQ

Source: own study.

At the same time, the logistics efficiency of analyzed countries calculated above was supposed to be the explained variables. However, the results of DEA shows no efficiency is zero among all countries but every efficiency value belongs to zone between 0 and 1. Therefore, "one minus efficiency", expressed by IE will be the explained variable instead of efficiency in order to fulfill the requirements for using the Tobit model.

Then it is possible to establish a Tobit regression model to empirically study how each variable has an impact on logistics efficiency. The constructed model is:

$$IE_{it} = \alpha + \beta_1 GR_{it} + \beta_2 FV_{it} + \beta_3 SV_{it} + \beta_4 LQ_{it} + \mu_{it}$$

IE_{it} is the logistics inefficiency of country i in t year; GR_{it} represents the GDP per capita growth rate of country i in t year; FV_{it} is the freight volume per 10000 km of rail and highway of country i in t year; SV_{it} means the proportion of annual services value added to GDP of country i in t year; LQ_{it} is location quotient of country i in t year; β_1, β_2, β_3, β_4 are the regression coefficient of each explanatory variables respectively; α is the constant item.

2.2.2. Evaluation of macro determinants

The data selected for this part is mainly from World Bank, European commission and United Nations Economic Commission for Europe. Some of them is from

Statistic Poland and Statistic China. The descriptive statistics of them are shown on following tab. 3.

Tab. 3. Descriptive statistics of variables

Code of determi-nants' index	Number of ob-servations	Max	Min	Mean	Standard De-viation
E	80	1.00	0.37	0.84	0.20
IE	80	0.63	0	0.17	0.21
GR	80	7.89	-2.54	3.10	2.08
FV	80	0.19	0.01	0.06	0.05
SV	80	75.00	46.70	59.54	6.23
LQ	80	1.23	0.01	0.16	0.29

Source: own study.

Based on the data collected for level of economic development, utilization of logistics resources, industrial structure and location advantage of countries.

The xttobit model, a model of Tobit method for panel data, under Stata software is chosen to help to analyse the influences of macro determinants because the collected data are panel data. The empirical results after analyzing is able to be found at the tab. 4.

Tab. 4. Tobit model regression results

IE	Coefficient	Standard Error	Z	P
GR	-0.03	0.01	-3.58	0.00***
FT	-2.74	1.48	-1.85	0.06*
SV	-0.03	0.09	-2.74	0.01**
LQ	-0.36	0.20	-1.80	0.07*
Constant	1.86	0.56	3.29	0.00***

***, **, * are on behalf of 1%, 5%, 10% confidence intervals, respectively

Source: own study.

Based on statistics of each country's GDP per capita growth rate, freight volume per 10000 km of rail and highway, the proportion of annual services value added to GDP, location quotient.

The results showed that the coefficients of all indexes were negative, which indicated that the higher the value of GR, FT, SV, LQ was, the smaller the IE was.

And IE represents the lack of logistics efficiency in countries, naturally, the lower the better. Therefore, if we want to reduce the probability of logistics inefficiency in various countries, that is, to improve logistics efficiency, the higher the value of each index is, the better, which is fully in line with the previous assumption when measuring macro-determinants.

There is a negative correlation between the level of economic development and logistics efficiency in EU-OBOR countries. The correlation coefficient is -0.03, which is significant at the level of 1%, indicating that the improvement of economic development level can reverse reduce the level of logistics inefficiency, that is to say, it can promote the improvement of logistics efficiency in a positive way. For every 1% increase in the level of economic development, logistics efficiency will increase by 0.03%. The higher the level of economic development in a country, the more perfect the logistics infrastructure and various policies and systems, and the greater the input to the logistics industry. The more sufficient the conditions for promoting the development of logistics industry will be, the more conducive to the promotion of logistics efficiency. On the other hand, the higher the efficiency of logistics in a country, the more developed the logistics industry is, and because the logistics industry is a complex industry, containing a large number of industrial sectors, and each sector still affects and affects each other. Therefore, the more developed the logistics industry, the more the industrial departments have more impetus for development, which can promote the development of economy and promote the improvement of the level of economic development of a country.

The coefficient of utilization of logistics resources in these countries is-2.74 at a significant level of 10%, indicating that every increase in the utilization rate of logistics resources in EU-OBOR countries by one unit will increase the efficiency of logistics by 2.74 units. This also shows that the utilization rate of logistics resources is the most important factor that affects the logistics efficiency of various countries. If a country or region makes full use of logistics resources, such as roads, railways, warehouses and logistics information, the lower the input cost of logistics will be, the more optimized the input-output ratio will be, so as to improve the efficiency of logistics. In contrast, the more efficient the logistics industry is, the more advanced the management and planning of the logistics industry is, and the more perfect management system and operation procedure make it easier for each department of the logistics industry to cooperate and develop in a coordinated manner. Create maximum economic benefits. At the same time, it is beneficial for all kinds of input resources to make the best use of things and to exert their maximum efficiency in order to obtain higher level of output. Therefore, the utilization rate of logistics resources must be improved accordingly.

The negative effect of industrial structure on logistics inefficiency in EU-OBOR countries is significant at a level of 5%, and its correlation coefficient is -0.03, indicating that for every increase in the proportion of output value of tertiary industry in GDP by 1%, logistics inefficiency decreases by 0.03%. That is, logistics efficiency increased by 0.03% which is not a lot because according to the data collected, the tertiary industry has already in a kind of good condition in all countries as a whole, accounting for more than half of GDP in almost all countries and less than 50% in only a few countries. However, it still can be inferred that the rapid development of a country's tertiary products can promote the improvement of logistics efficiency to a certain extent. Logistics industry belongs to the category of the tertiary industry. In the process of optimizing the industrial structure, the logistics industry must be tilted to improve the efficiency of the logistics industry. In other words, the improvement of logistics efficiency will also increase the contribution rate of logistics to the tertiary industry.

The location advantage of 16 countries studied has a negative correlation with logistics inefficiency, that is, a positive correlation with logistics efficiency. And the significance level is 10%, the correlation degree is as high as 0.36, which shows that the location advantage plays a very important role in logistics efficiency, and countries with good location advantage can make full use of their own and surrounding resources to develop logistics industry. Improve logistics efficiency. Among these EU-OBOR countries, only China's LQ_i is greater than 1, indicating that China has obvious location advantages and has made a positive contribution to China's logistics efficiency. The location advantage of the remaining 15 countries is not obvious, which means that the location advantage has a greater room for improvement. With the increase of location advantage, naturally, the logistics efficiency of these countries can also be improved.

Conclusion

It is able to draw a conclusion that all macro determinants make a difference to logistics efficiency at all countries from the above analysis. And the macro determinants that affect logistics efficiency from large to small are logistics resource utilization, location advantage, economic development level and industrial structure according to the correlation coefficient. Therefore, countries should not only integrating and optimizing the scale of logistics industry, or establishing modern logistics information and transaction platform, but also work hard to improve those four determinants. Firstly, improve the utilization of logistics resources through the construction of logistics infrastructure and the encouragement of multimodal transport

because the research in the previous chapter shows that the utilization rate of resources has the strongest positive effect on logistics efficiency. Secondly, make full use of location advantage to build free trade area and cultivate logistics industry cluster, which is also one of the basic vision put forward by One Belt One Road. Thirdly, actively looking for new opportunities for economic development and implementing of industrial adjustment to find industrial balance for the development of logistics industry, and the improvement of logistics efficiency will bring further possibilities. Then, countries are supposed to consciously promote the logistics industry linkage development and participate in the organization of forums and meetings to complement their strengths and improve logistics efficiency.

With the proposal and development of One Belt One Road policy, the process of globalization is more in-depth. As a new industry, logistics industry connects all parts of the world through freight transportation. It is an important help of trade and economic globalization, and it is also the key development object of countries under One Belt One Road. After the rapid development of the logistics industry, it has experienced a short cooling period, and the proposal of One Belt One Road Initiative has ushered in the climax of the development of the logistics industry again.

This article compares the logistics efficiency of China with other EU countries participating in One Belt One Road by using DEA-Tobit method, which can not only help them understand whether the current development of their logistics industry can meet the needs of national development and world competition, can also extract the suitable logistics development strategy for itself in the data. More importantly, bringing together the European Union-the world's largest economic group, One Belt One Road-the most populous project, combined with the logistics industry-a supporting industry, is a small aspect of analysis of the possibility of cooperation between them, which is able to consolidate the foundation for in-depth analysis.

Literature

1. Arvis J. F., Ojala L., Wiederer C., et al. (2018), *Connecting to Compete 2018*: Trade Logistics in the Global Economy. World Bank, s. 8-10
2. Charnes A., Cooper W. W., Rhodes E. (1978), *Measuring the efficiency of decision making units,* European Journal of Operational Research, 2(6), s. 429-444
3. Gudehus T., Kotzab H. (2012), *Comprehensive logistics*, Springer Science & Business Media, s. 5-7
4. Joumady O., Ris C. (2005), *Performance in European higher education: A non-parametric production frontier approach*. Education Economics, 13(2), s. 189-205

5. Larson P. D., Halldorsson A. (2004), *Logistics versus supply chain management: an international survey*. International Journal of Logistics: Research and Applications, 7(1), s. 17-31

6. Nazarko J., Kuźmicz K., A. (2017), *Introduction to the STEEPVL analysis of the New Silk Road Initiative*. Procedia Engineering, 2017, 182, s. 497-503

7. Odah M. H., Bager A. S. M., Mohammed B. K. (2017), *Tobit Regression Analysis Applied on Iraqi Bank Loans*, American Journal of Mathematics and Statistics, 7(4), s. 179-182

8. Srinivasan R., Bansal M., Karimi I. A. (2006), *A Multi-Agent Approach to Supply Chain Management in the Chemical Industry,* Multiagent Based Supply Chain Management

9. Xiafang Yang (2004), *International logistics management*, Tongji University Press, s. 1-2

10. Xu X., Lee L. (2015), *Maximum likelihood estimation of a spatial autoregressive Tobit model,* Journal of Econometrics, 188(1), s. 264-280

11. Zhao X., Tang Q. (2009), *Analysis and strategy of the Chinese logistics cost reduction*. International Journal of Business and Management, 4(4), s. 188-191

Determinanty efektywności logistycznej porównanie między Chinami a krajami UE-inicjatywa Pasa i Szlaku

Streszczenie

Propozycja One Belt One Road stworzyła wielką przestrzeń dla rozwoju branży logistycznej. Będzie promować przemysł logistyczny we wszystkich aspektach, ale jednocześnie wymaga od krajów przyspieszenia poprawy wydajności logistyki, aby zająć miejsce w ostrej międzynarodowej konkurencji. Głównym celem tego artykułu jest analiza czynników warunkujących wpływ na wydajność logistyczną różnych krajów. Metodami badania są DEA, system złożony z wielu zmiennych wejściowych i wielu zmiennych wyjściowych oraz Tobit, model regresji zmiennych zależnych może zapewnić dokładność i naukowość. Te dwie metody stosuje się do oddzielnej analizy sześciu mikro-determinantów i czterech makro-determinantów. Wyniki pokazują, że wydajność logistyczna większości krajów jest nadal w stanie nieefektywności oraz istnieją znaczne różnice w wydajności logistycznej między krajami. Tylko pięć krajów - Chiny, Grecja, Malta, Portugalia i Rumunia osiągnęły efektywność logistyczną.

Słowa kluczowe

logistyka, efektywność logistyczna, determinanty efektywności logistyki