

Research on Influencing Factors of Logistics Efficiency Based on DEA Model

Guili Huo

Management College of Qufu Normal University, China

Abstract. This paper studies the input and output indicators of logistics and various factors that affect logistics efficiency, constructs DEA model and multiple regression model, analyzes and predicts each factor, and then obtains the influence of each factor on logistics efficiency. It is found that the influence of technological progress on logistics efficiency is very important. Through the analysis of the data, it is found that the logistics industry generally has the problem of high cost, which seriously hinders the development of the logistics industry. Based on the traditional DEA model, this paper continuously optimizes it, introduces dynamic DEA model, and comprehensively uses cross-sectional data and time data for analysis, which improves the accuracy and precision of studying logistics efficiency. By using multiple regression model, several samples are selected, and the overall trend is inferred according to the sample prediction results, which simplifies the process of solving and data processing. The comprehensive application of various models makes the research results more convincing.

Keywords: Logistic Efficiency; DEA Model; Multiple Regression; Correlation Analysis

1. The Background of the Topic

With the development of economy and the improvement of people's living standards, online shopping has gradually replaced physical store shopping and become the most sought-after shopping method. The popularity of online shopping has given birth to the development of express logistics industry. At present, the logistics industry is also growing rapidly, and the proportion of logistics service industry in the tertiary industry is also increasing, which urges logistics enterprises to be oriented to meet the needs of consumers, and the logistics industry should deeply integrate big data and the Internet to upgrade the industry, optimize and innovate the industrial structure, and promote the transformation of traditional logistics industry to intelligent logistics industry. At present, there are two important indicators in the logistics and transportation industry: one is to improve the efficiency of logistics and transportation; The second is to reduce the cost of logistics and transportation. Based on the rapid development of logistics industry, this paper focuses on the influencing factors of logistics efficiency and analyzes the influence of each factor on logistics efficiency.

2. The Index Analysis

2.1. Variable Selection

In order to study the influencing factors of logistics efficiency, this paper selects the following indicators for data analysis, and estimates the influence degree of influencing factors on logistics efficiency through data preprocessing and related software. The selection of indicators is shown in Table 1.

3. The Data Description

3.1. Data Analysis and Preprocessing

In order to study the current situation of domestic logistics development, this paper searches all kinds of relevant data for evaluating the logistics transportation index system. Before analyzing the data, we should first preprocess the data and keep only some data we need. At the same time, we should



also consider the timeliness of the selected data. It is best to use the data in recent years for analysis, which can better reflect the overall trend of logistics development and conform to objective facts.

Table 1. Evaluation Index System of Logistics Efficiency

Primary index	Secondary index	Variable unit
transportation charge	transport mileage	kilometre (km)
warehouse charges	Inventory quantity	piece
Distribution location	Site selection quantity	individual
Capital factor input	Fixed assets investment	hundred million yuan
engineering level	Technical input	hundred million yuan
Labor input	employee	human
Output index	Income of logistics industry	hundred million yuan

First of all, the factors that affect logistics efficiency are evaluated, and the factors that have a greater influence are found as the key research objects. Among them, the cost has the greatest influence on logistics efficiency. Therefore, for the control of logistics cost, this paper selects logistics management expenses, sales expenses and warehousing expenses as independent variables, and logistics income as dependent variables, and evaluates the correlation between the dependent variables and independent variables through SPSS software.

4. Model Establishment and Solution

4.1. DEA-Malmquist Index Model

1. Model introduction

The traditional DEA model can only make a static analysis of logistics efficiency, but can't well reflect the dynamic change process of logistics efficiency. In order to study the dynamic change of logistics efficiency, this paper improves the traditional DEA model and fully considers the dynamic change of logistics efficiency to establish DEA-Malmquist index model.

2. Model building

DEA-Malmquist index model is a model to study the dynamic change process of logistics efficiency. The model divides the influencing factors into two parts: technical progress and technical efficiency, and mainly studies the dynamic change of the output of input factors. These two indicators are introduced into the research of logistics efficiency to measure the influence degree of technology on logistics efficiency. Establish DEA-Malmquist index model;

$$M(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\frac{D^t(x^{t+1}, y^{t+1})}{D(x^t, y^t)} \times \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^{t+1}(x^t, y^t)} \right]^{\frac{1}{2}} = \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D(x^t, y^t)} \underbrace{\left[\frac{D^t(x^{t+1}, y^{t+1})}{D^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D^t(x^t, y^t)}{D^{t+1}(x^t, y^t)} \right]^{\frac{1}{2}}}_{\text{Coefficient of technological progress}} = effch \times techch \quad (1)$$

4.2. Multiple Regression Model

In order to further understand the influence degree of each factor on logistics efficiency, this paper improves it, establishes a multiple regression model, analyzes the influence of each factor on logistics

efficiency, and makes regression analysis with logistics efficiency as the dependent variable and various influencing factors as the independent variables:

$$Y_i = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n, i = 1, 2, 3, \dots, n \quad (2)$$

Table 2. Variable declaration

variable	variable declaration
x^t	t Investment in the period
y^t	t Output during the period
x^{t+1}	$t + 1$ Investment in the period
y^{t+1}	$t + 1$ Output during the period
D^t	distance function

Among them, it is a dependent variable Y_i (logistics efficiency) and an independent variable X_i (impact factor).

4.3. Model Solution

In this paper, several regions are randomly selected as sample data, and the model is solved by data processing software through relevant data from statistical associations. See Table 3 for the solution results:

Table 3. Logistics Efficiency in Different Regions from 2017 to 2021

region	Comprehensive technical efficiency	Pure technical efficiency	Scale technical efficiency	Scale income type
Shanghai	1.000	1.000	1.000	unchanged
Zhejiang(Province)	0.870	0.885	0.925	increase successively
Guangdong	0.904	1.000	0.904	decrease by degrees/gradually/progressively/successively
Beijing	1.000	1.000	1.000	unchanged
Hainan	0.429	0.677	0.633	decrease by degrees/gradually/progressively/successively
Chongqing	0.499	0.621	0.763	increase successively
Jiangsu(Province)	0.934	0.972	0.974	increase successively
Hunan	0.734	0.741	0.559	increase successively
Sichuan(Province)	0.439	0.522	0.625	increase successively
Yunnan(Province)	0.340	0.505	0.755	decrease by degrees/gradually/progressively/successively

As can be seen from Table 3, the technological development level of Beishangguang and other regions is relatively high, and the logistics efficiency is also relatively high, followed by Zhejiang, Chongqing, Sichuan and other places. This shows that the logistics efficiency is closely related to the

level of economic development, and the logistics efficiency is often higher in the more developed regions. In order to improve the logistics efficiency, logistics enterprises must vigorously develop science and technology, master advanced technology, and realize the automatic operation of enterprises.

5. Conclusion and Suggestions

5.1. Conclusion

According to the above analysis, logistics efficiency is affected by various factors. Among them, the level of technological development has the greatest influence on logistics efficiency; Secondly, the cost also restricts the development of the logistics industry, among which the management cost is the most obvious, and the transportation cost also accounts for a large proportion. To improve the logistics efficiency, the cost must be strictly controlled; In addition, the location of distribution stations and the length of transportation distance are also very important to improve logistics efficiency. Therefore, logistics enterprises must comprehensively consider all aspects, deeply analyze various influencing factors, formulate improvement measures for various factors, strengthen enterprise management and improve operational efficiency.

Reasonable planning of logistics transportation routes and selection of reasonable transportation modes can achieve optimization in route selection and mode selection. Strengthen the effective docking of distribution stations in various regions, give full play to the geographical advantages of distribution centers, and build a network logistics service system that is "point-centered, area-based, and radiating the whole country". The distribution center should be built near the express delivery stations with large express demand, so as to reduce the transportation frequency of the express delivery points with large demand and greatly shorten the transportation distance, thus saving transportation costs.

5.2. Suggestions

First of all, enterprises should improve the degree of automation, introduce advanced equipment, and train senior technicians and equipment operators. Managers should also strengthen the study of technical knowledge, attach importance to the role of advanced technology in improving the efficiency of enterprises, establish an information logistics and intelligent logistics platform, speed up the improvement of the network information service platform of the logistics industry, and truly make the goods all over the world and things flow smoothly.

Secondly, we must strengthen the control of various costs, especially the control of management expenses, transportation expenses and storage expenses, rationally allocate the resources of transportation vehicles, select appropriate transportation modes and routes, and reduce unnecessary waste in all transportation links.

Finally, the distribution center should be built near the express delivery station with large demand, so as to reduce the transportation frequency and shorten the transportation distance of the express delivery point with large demand, and the distribution centers should keep a moderate distance and coordinate with each other. In addition, the state should increase financial support for the logistics industry, intensify efforts to encourage new logistics modes of transportation, implement various preferential policies for the logistics industry to encourage its development, and at the same time, strengthen investment in railway, highway, aviation and other modes of transportation to create a good business environment for the logistics industry. In addition, we should also pay attention to the joint inventory management of the upstream and downstream of the supply chain, establish long-term strategic cooperative relations between upstream and downstream enterprises, maintain the consistency of supply and demand, speed up inventory turnover, and reduce inventory costs for both sides.

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