A Research on the Relationship of Logistics Industry Development and Economic Growth of China

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Abstract

This paper selects Gross Domestic Product (GDP) as referential series of dependent variable, and selects logistics industry value added, total employment of logistics industry, new fixed assets investment, freight volume, freight turnover as compared series of independent variable, uses grey relational analysis method, researches on the relationship between China logistics industry development and national economic increase from two angles of logistics size and logistics efficiency.

Keywords: Logistics industry, Economic increase, Grey relational analysis, Logistics size, Logistics efficiency

1. Introduction

Logistics industry is a rising basic industry in China, and it is playing a more and more important role in national economy and social development. There is a strong coupling between logistics industry and other industries of national economy, it comes along with the great social demand to logistics activities. Today, while other input factors are gradually becoming perfect, logistics become the restrictive factor to increase of overall economic benefit and social benefits (Shuai, 2006, P.58). In socialized production, all industrial departments are interdependent, any industry can not produce and develop without logistics. It is very important, for the healthy development of logistics industry in the future, to research into the correlative relationship between logistics industry and others, and reveal the relation structure and proportional relationship, and reasonably position the logistics in national economy.

2. Study Method and Literature Review

To analyze the relationship between logistics industry development and economic growth, we can build a statistics model by analyzing the relationship among all factors, such as regression analysis, variance analysis, principal component analysis. But these methods have very high requirements to the sample size and sample distribution, even we have a large sample size, it still need study population to obeys some certain typical probability distributions. Grey relational analysis method has unique advantages, it can avoid the limits of mathematical statistics method. Grey relational degree analysis (GRA) measure relational degree among factors, open out the character and degree of dynamic correlation of things based on similar and dissimilar degree of development trend among factors. (Deng, 1997, P.40) Compared with mathematical statistics method, grey relational analysis method has no special requirements to sample size and data distribution, it has low computational complexity, and easy to realize. Thereby, it makes up the shortcomings of mathematical statistics method.

At the present time, there is seldom research on correlation between logistics industry and national economy. (Huang & Xu 2005, P.1) analyzed the relationship between logistics industry and economic development by qualitative analysis method, they pointed out the macroeconomic and microeconomic significance of developing modern logistics industry. Using comparative analysis method and linear regression analysis method, (Tang & Zou, 2007, P.23) demonstrated that modern logistics which is based on expressway could change the economic increase style by increasing circulation efficiency and reducing operation cost. (Liu & Li, 2007, P.151) analyzed the relationship between modern logistics industry development and economic increase from the angles of supply promoting and demand pulling. That paper, with Granger causality test method, also analyzed the bilateral causality between logistics industry development and economic development taking Zhejiang Province as an example. Literatures [(Song, Li, Zhu, Ruan)] all researched on correlative industries of logistics industry in the input-output method by analyzing the section data and calculating the correlation coefficient of industrial relationship. This paper, using grey relational analysis method and time series data, studied the relationship between logistics industry and national economy from the dynamic angle.

3. Index Selection and Grey Relational Analysis Method

3.1 Index Selection

Logistics industry development has close relationship with economic increase. This paper selects Gross Domestic

Product (GDP) as economic increase index. Logistics industry development level can be reflected by benefit indexes and dimension indexes, such as output and employment. On the aspect of scale, we select logistics industry value added, total employment of logistics industry and fixed assets investment three indexes to reflect output scale and employment scale of logistics industry. Because of statistical data limit, we use freight volume and freight turnover two physical quantity indexes to reflect benefit of logistics industry (Wu, 2008, P.118). This study depends on the publication data from China Statistical Yearbook issues from 2001 to 2008.

3.2 Grey Relational Analysis Method (Liu & Dang, 2004, P.55)

Grey system theory was originated by Deng in 1982 and has been widely used to solve the uncertainly problems under the discrete data and incomplete information. It is a recent theory that deals with poor, incomplete, or uncertain problems of the systems. One of the major advantages of the grey system theory is that it can generate satisfactory outcomes using a relatively small amount of data or with great variability in factors since it can increase the data regularity with proper data treatment. Similar to fuzzy set theory, grey theory is an effective mathematical means of resolving problems containing uncertainty and indetermination. The concept of grey relational space was proposed by Deng, based on the combined concepts of system theory, space theory and control theory. It can be used to capture the correlations between the reference factor and other compared factors of a system. The grey relation analysis (GRA) is one that analyzes uncertain relations between one main factor and all the other factors in a given system. Fields covered by grey theory include forecasting, system control, data processing, modeling, and decision-making.

The calculation procedures are summarized as follows.

Step 1: Generate the referential series of $X_0 = (x_0(1), x_0(2), \cdots, x_0(n))$ and x_i is the compared series of $X_m = (x_m(1), x_m(2), \cdots, x_m(n))$, where. $i = 1, 2, \cdots, m$ The compared series x_i can be represented in a matrix form as (1).

$$X_i = \begin{vmatrix} x_1(1) & x_1(2) & \cdots & x_1(n) \\ x_2(1) & x_2(2) & \cdots & x_2(n) \\ \vdots & \vdots & \ddots & \vdots \\ x_m(1) & x_m(2) & \cdots & x_m(n) \end{vmatrix} \tag{1}$$

Step 2: Normalize the data set. The formula is defined as (2).

$$X_i' = X_i / x_i(1) = \begin{vmatrix} x_1'(1) & x_1'(2) & \cdots & x_1'(n) \\ x_2'(1) & x_2'(2) & \cdots & x_2'(n) \\ \vdots & \vdots & \ddots & \vdots \\ x_m'(1) & x_m'(2) & \cdots & x_m'(n) \end{vmatrix} \tag{2}$$

Step 3: Calculate the distance of $\Delta_i(k)$, that is, the absolute value of difference between $x_0'(k)$ and $x_i'(k)$. The formula of $\Delta_i(k)$ is defined as (3).

$$\Delta_i(k) = |x_0'(k) - x_i'(k)| \quad (i = 1, 2, \cdots, m) \tag{3}$$

Step 4: Calculate the grey relational coefficient $\gamma(x_0(k), x_i(k))$ using the equation (4).

$$\gamma(x_0(k), x_i(k)) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \xi \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \xi \max_i \max_k |x_0(k) - x_i(k)|} \tag{4}$$

$$(k = 1, 2, \cdots, n; \ i = 1, 2, \cdots, m)$$

Where ξ is the distinguished coefficient, $(\xi \in [0,1])$.

Step 5: Calculate the degree of grey coefficient. The grey relational grade is defined as (5).

$$\gamma(X_0, X_i) = \frac{1}{n}\sum_{k=1}^{n}\gamma(x_0(k), x_i(k)) \quad (i = 1, 2, \cdots, m) \tag{5}$$

According to the results of GRA, if any alternatives has highest grey relational grade, then it is the most important or optimal alternative.

4. Empirical Analysis

Logistics industry development has a close relationship with economic increase. This paper selects six indexes to analyze the relation of logistics industry development and economic increase, they are logistics industry value added, total employment of logistics industry, new fixed assets investment, freight volume, freight turnover and GDP.

Based on analysis demand, we select GDP as referential series of dependent variable, and select logistics industry value added, total employment of logistics industry, new fixed assets investment, freight volume, freight turnover as compared series of independent variable. By normalizing the data set with standardizing method, we can obtain the normalized referential series. (see Table 1)

From Table1, Difference sequences are:

$\triangle 1$= (0, 0.0099, 0.0033, 0.0846, 0.1012, 0.0879, 0.1102, 0.1446)

$\triangle 2$= (0, 0.1503, 0.2813, 0.4431, 0.7027, 0.9671, 1.2056, 1.5688)

$\triangle 3$= (0, 0.1436, 0.1573, 0.5862, 0.6720, 0.6860, 0.8612, 1.0680)

$\triangle 4$= (0, 0.0735, 0.1210, 0.2175, 0.3555, 0.4762, 0.6367, 0.8400)

$\triangle 5$= (0, 0.0288, 0.0692, 0.1538, 0.0446, 0.0358, 0.1315, 0.2268)

Where, $\triangle max$ = 1.5688, $\triangle min$= 0, ξ = 0. 5, we can get table of correlation coefficient, (see Table 2).

As can be seen from table 2, the grey relational degree of logistics industry value added, total employment of logistics industry, new fixed assets investment, freight volume, and freight turnover are all bigger than 0.6, close to 1, which indicates that all the six indexes have greater impact on GDP. The most important factor is logistics industry value added, second is freight turnover, the influence degree of total employment of logistics industry and new fixed assets investment on national economy are relatively small.

5. Conclusion and advice

Through the correlation research of Chinese logistics industry and national economy increase, we can see that logistics industry value added, total employment of logistics industry, new fixed assets investment, freight volume, and freight turnover have greater impact on economic increase, the two most important factors are logistics industry value added and freight turnover. Logistics industry value added is part of logistics scale, and freight turnover is part of logistics efficiency. This indicates that both the enlargement of logistics scale and the increase of logistics efficiency can bring tremendous influence on the development of national economy.

Total employment of logistics industry is the minimum influence factor on national economy among the six measuring factors. Logistics industry of China is very short of professionals now. Just increasing the employment amount cannot meet the demand of the rapid development of logistics industry. Besides the increase of employment amount, we should pay more attention to improve the quality of employees. From the aspect of school education, we need reform the logistics professional education method, considering market demand, adjusting the curriculum, and innovating practice manner, to link the talents education well with the jobs needs. On the other hand, we should pay attention to the training for the current logistics employees, let them learn by doing in their jobs, increase their consciousness and ability of customer service.

New fixed assets investment of logistics industry is a relatively small influence factor on national economy too. Logistics industry development needs to increase the investment in fixed assets to construct logistics infrastructure. On the other hand, utilizing existing facilities effectively and improve their efficiency are more important. At the present time, the global economy is depressing, China is implementing economic stimulus plan. Logistics industry is one of the ten industries of revitalization plan, there will be a lot of logistics infrastructure projects. Therefore, both national and local governments should plan ahead to avoid repeated construction, and to lay a solid foundation to increase the utilization efficiency of logistics infrastructure.

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Table1. Normalized Data of Six Indexes from 2002-2007

	2000	2001	2002	2003	2004	2005	2006	2007
GDP	1	1.1052	1.2129	1.3690	1.6114	1.8467	2.1360	2.5151
logistics industry value added	1	1.1151	1.2162	1.2844	1.5102	1.7588	2.0258	2.3704
logistics industry total employment	1	0.9549	0.9315	0.9259	0.9087	0.8796	0.9304	0.9462
new fixed assets investment	1	0.9617	1.0555	0.7828	0.9394	1.1606	1.2749	1.4471
freight volume	1	1.0317	1.0918	1.1515	1.2559	1.3705	1.4993	1.6750
freight turnover	1	1.0765	1.1436	1.2152	1.5669	1.8108	2.0045	2.2883

Table 2. Six indexes' correlation coefficient table from 2002-2007

	2000	2001	2002	2003	2004	2005	2006	2007	grey relational degree
logistics industry value added	1	0.9875	0.9958	0.9027	0.8857	0.8992	0.8768	0.8443	0.9240
logistics industry total employment	1	0.8392	0.7360	0.6390	0.5275	0.4478	0.3942	0.3333	0.6146
new fixed assets investment	1	0.8453	0.8329	0.5723	0.5386	0.5334	0.4767	0.4235	0.6528
freight volume	1	0.9143	0.8663	0.7829	0.6881	0.6223	0.5520	0.4829	0.7386
freight turnover	1	0.9646	0.9189	0.8361	0.9462	0.9563	0.8564	0.7757	0.9068