Academic Journal of Engineering and Technology Science
ISSN 2616-5767 Vol.5, Issue 4: 18-22, DOI: 10.25236/AJETS.2022.050404

Analysis of Logistics Industry Demand Forecast in China

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Abstract: *The outbreak of covid2019 coronavirus disease has a certain impact on the development of logistics industry. This paper aims to find out the typical factors affecting the logistics demand before and after covid2019, and predict the logistics demand in the next decade. This paper selects the total amount of social logistics from 2010 to 2020 as the index to measure the logistics demand, analyzes the factors affecting the total amount of social logistics, and establishes a logistics demand prediction model based on multiple linear regression. The results show that the demand of social logistics is most closely related to the total cost of social logistics and the investment in fixed assets of the whole society, but weakly related to the total import and export. At the same time, this paper also forecasts the logistics demand in the next decade to provide decision support for relevant departments.*

Keywords: *Logistics demand; Multiple linear regression; Prediction model*

1. Introduction

With the development of economic globalization and regional economic integration, logistics, as an emerging service industry with broad development prospects and value-added functions, is booming. The development of logistics industry can be reflected by the total logistics volume of the whole society. Figure 1 shows the development trend of China's total social logistics from 2010 to 2020. Overall, the total logistics volume of the whole society is in a stable state of development. Although the growth rate has decreased, the total volume continues to grow. Forecasting the demand of logistics industry is helpful to grasp the total demand of social consumption, so as to help the government make the strategic decision of regulating the market.

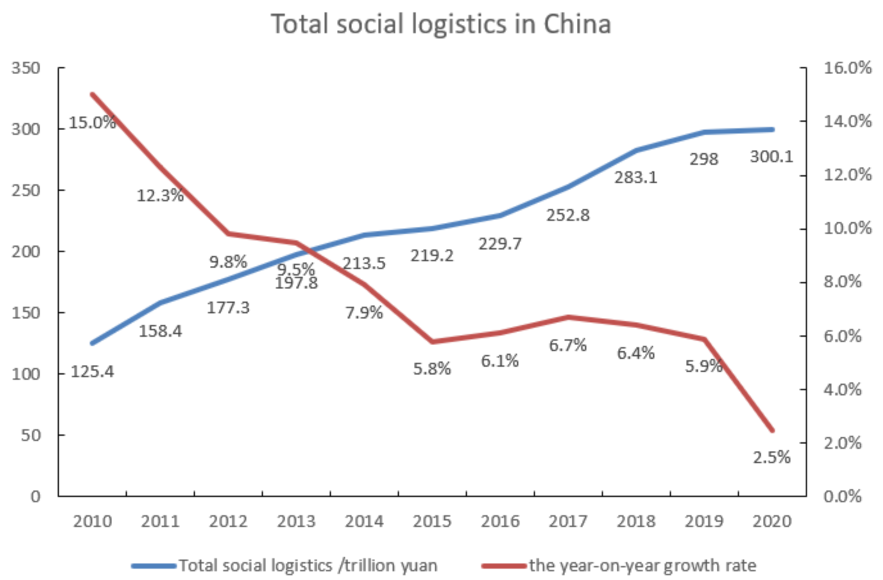

Figure 1: Total change of national social logistics

In the logistics industry demand forecasting research, domestic and foreign scholars have done a lot of research. Foreign scholars mainly use neural network model for prediction. Literature [1] uses the grey

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BP neural network to forecast the logistics development demand of a city. Literature [2] introduces time series on the basis of neural network. Domestic scholars have more diversified methods for logistics demand prediction. Literature [3] predicts logistics demand in Nanjing metropolitan area based on gray GM (1,1), and the results show that the model has certain practicability. Literature [4] proposed a combined forecasting model of logistics demand based on entropy method, and predicted the logistics demand of Chongqing from 2009 to 2018. The results show that the combined method has better forecasting effect than the single model. Literature [5] uses BP neural network to predict logistics demand in Chengdu, and the results show that the model prediction results can truly reflect the development of logistics demand in Chengdu.

To sum up, there are many methods for logistics demand forecasting. Because the logistics demand is affected by many factors, some methods have some defects in accuracy and universality. Considering the impact of coronavirus disease on the world economy in 2019, the development of logistics industry is still affected by some uncontrollable factors. Before the outbreak of coronavirus disease in 2019, this paper analyzes the factors affecting the logistics demand, and forecasts the logistics demand in the next decade. Therefore, this paper will use multiple linear regression model to predict the development scale of China's logistics industry.

2. Analysis of factors affecting logistics demand

Total social logistics covers a number of industries, a more comprehensive reflection of logistics demand. In this paper, the total social logistics costs, cargo transport volume, cargo transport turnover, social investment in fixed assets and total import and export are selected as the influencing factors of logistics demand.

(1) The impact of total social logistics costs on logistics demand

The total cost of social logistics refers to the sum of all the costs used for social logistics activities. The total cost of social logistics is closely related to the total amount of social logistics. The quantitative relationship between them can be expressed as $y = -35.1698 + 23.2014 * x$, $R^2 = 0.9869$, see Figure 2.

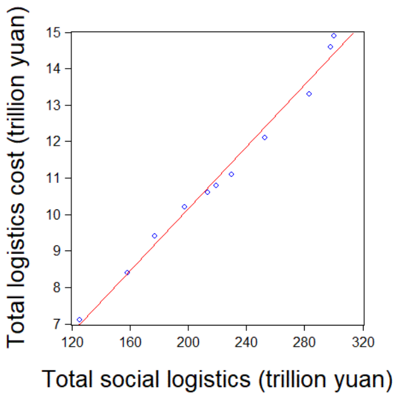

Figure 2: Relationship between logistics demand and total social logistics cost

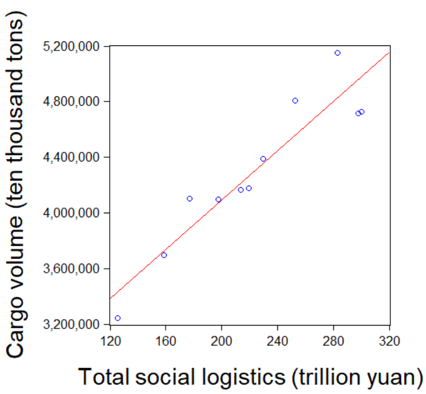

Figure 3: Relationship between logistics demand and freight volume

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(2) The impact of cargo transport volume on logistics demand

Transportation is an important part of logistics the size of transportation will greatly affect the logistics cost. Therefore, total social logistics is affected by transportation costs, and their quantitative relationship can be expressed as $y = -199.2 + 9.830 * 10^{-5} * x$, $R^2 = 0.8709$, as shown in Figure 3.

(3) The impact of cargo transportation turnover on logistics demand

The increase of the turnover of goods will increase the cost of logistics, so the turnover of goods will affect the logistics demand. The quantitative relationship between them can be expressed as $y = -283.055 + 47.160 * x$, $R^2 = 0.9283$, as shown in Figure 4.

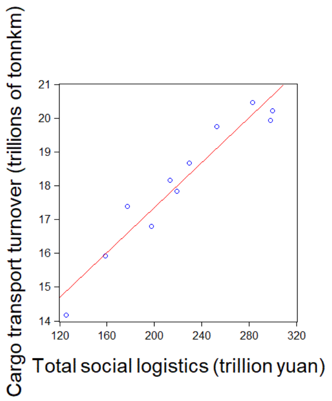

Figure 4: Relationship between logistics demand and cargo transportation turnover

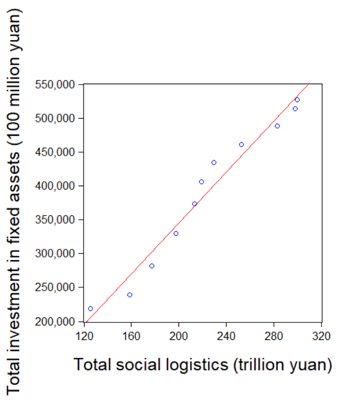

Figure 5: Relationship between logistics demand and fixed assets investment

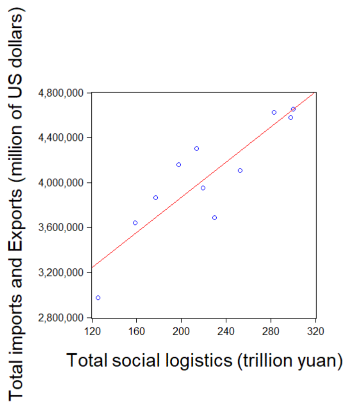

Figure 6: Relationship between logistics demand and total import and export volume

(4) The impact of social fixed asset investment on logistics demand

The logistics industry needs the support of fixed assets, so the investment of fixed assets in the whole society will affect the logistics demand. The quantitative relationship between them can be expressed as $y = 23.18 + 5.149 * 10^{-4} * x$, $R^2 = 0.9662$, as shown in Figure 5.

(5) Impact of total import and export on Logistics Demand

With the influence of economic globalization, the impact of international trade on the national economy is bigger and bigger. However, the impact of COVID-19 on imports and exports weakens the demand for domestic logistics. The relationship between them can be expressed as $y = -181.4 + 9.990 * 10^{-5} * x$, $R^2 = 0.7803$. As shown in Figure 6, the goodness of fit can be seen by graphs and equations, which is more influenced by COVID-19. It cannot be used as an influencing factor to predict the domestic logistics demand in the next decade.

(6) Logistics demand impact degree analysis

Pearson's rank correlation coefficient can be used to calculate the degree of correlation between two variables. The greater the absolute value of the correlation coefficient, the stronger the correlation, the closer the correlation coefficient is to 1 or -1, the stronger the correlation, the closer the correlation coefficient is to 0, the weaker the correlation. The calculation steps are as follows.

$$\text{Cov(X,Y)=E[(X-}E[X]\text{)(Y-}E[Y]\text{)} \tag{1}$$

$$S = \sqrt{\frac{((x_1 - x)^2 + (x_2 - x)^2 + \cdots + (x_n - x)^2)^2}{n}} \tag{2}$$

$$\rho_{X_1 Y} = \frac{\operatorname{cov}(X, Y)}{\sigma X \sigma Y} = \frac{E[(X - \mu x)(Y - \mu y)]}{\sigma X \sigma Y} \tag{3}$$

The correlation coefficients are sorted as follows: total social logistics cost =0.9934531 > total social fixed asset investment =0.9829399 > cargo transport turnover =0.9634697 > cargo transport volume: 0.9332113 > total import and export =0.8833528. It can be seen from the calculation results that the five factors have a great impact on logistics demand, among which the total social logistics cost has the greatest impact on logistics demand, and the total import and export volume has the least impact on logistics demand.

3. The construction of logistics demand forecasting model

This chapter takes five factors as independent variables: total social logistics cost, freight volume, cargo transportation turnover, total social investment in fixed assets and total import and export. Set total social logistics Y and influencing factor X_1, there is a correlation between X_5, random variable and general variable X_1, the linear retrospective model of X_5 is $y=\beta_0+\beta_1 x_1+\cdots+\beta_p x_p+\varepsilon$.

Where, y is the dependent variable and random variable; $x_1,\cdots,x_p$ are independent variables and non-random variables; ε is random error term, random variable; β_0 is the intercept item; β_j is the slope term corresponding to x_j.

4. Case analysis

On the basis of the analysis results in the previous chapter, this chapter uses Eviews8 software for predictive analysis.

Step 1: Import the data of dependent variable and independent variable into eviews8 software, get the multiple regression equation:

$$\begin{aligned} y=&-53.93+13.27\times X_1+1.5\times 10^{(-5)}\times X_2-66.71\times X_3 \\ &+1.552\times 10^{(-4)}\times X_4+4.128\times 10^{(-6)}\times X_5 \end{aligned} \tag{4}$$

R^2=0.9986, indicating that the effect of the equation is very significant.

Step 2: Select variables by stepwise regression

Through the test, it can be seen that only X_1 and X_2 values of t-test are significant, indicating the existence of multicollinearity. It can be seen from Table 1 that the predicted values of model regression, X_3 and X_5 are obviously dependent on each other, so the new model can be obtained by gradually deleting variables X_3 and X_5:

$$Y=-55.31\ +14.44X_1+1.550\times 10^{-5}X_2+1.316\times 10^{-4}X_4 \tag{5}$$

Step 3: multiple linear detection

At this point, serious multilinearity still exists between variables X1 and X4. In order to solve this problem, variables are further deleted and X4 (multicollinearity is eliminated) and C (accuracy is increased) are selected to be eliminated, and the model is obtained:

$$Y=23.40X_1-\ 8.535\times 10^{-6}X_2 \tag{6}$$

The F value, P value and T value of the model conform to the economic test and statistical test.

It can be found from the previous chapter that the correlation coefficient between logistics demand and total social logistics is the largest, so the quantitative relationship between the two can be expressed as:

$$y=\ -35.1698+\ 23.2014*x \tag{7}$$

The final prediction results of univariate regression and multivariate regression are shown in Table 1.

It can be seen from table 1 that the maximum absolute error of multiple linear regression is 7.687 and the minimum is 1.001; The difference between the predicted value and the actual value is very small. The maximum relative error is 4.34%, and the minimum relative error is 0.47%; The average value of relative error is 1.79%, and those less than 10% account for 100%. The maximum absolute error of univariate linear regression is 13.09, the minimum is 2.735, the maximum relative error is 10%, and the average relative error is 3.5%, which shows that the prediction of multivariate linear regression model is more reasonable and effective, and can be used for logistics demand prediction.

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Table 1: Comparison of prediction results

Time	Univariate regression prediction (trillion yuan) (as (7))	Multiple regression prediction (trillion yuan) (as (6))	Actual value (trillion yuan)
2010	138.490	129.560	125.400
2011	165.028	159.722	158.400
2012	182.923	184.987	177.300
2013	201.484	203.722	197.800
2014	210.765	212.499	213.500
2015	215.405	217.107	219.200
2016	222.365	225.328	229.700
2017	242.162	248.567	252.800
2018	271.276	280.408	283.100
2019	303.570	301.446	298.000
2020	307.531	303.331	300.100

Thus, when the first mock exam is affected by various uncertainties, the mid and long-term forecasting results of the multivariate model are better than the single model. Therefore, multiple regression model and time variable t are used to predict the results in Table 2:

Table 2: Final prediction results

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
320.34	336.05	351.76	367.47	383.19	398.890	414.61	430.32	446.04	461.75

5. Conclusion

Scientific prediction of logistics demand is an important means of economic development planning and industrial layout decision-making. Firstly, this paper analyzes the relationship between the total amount of social logistics and the total cost of social logistics, freight volume, freight transportation turnover rate, total investment in fixed assets and total import and export of the whole society. On this basis, a logistics demand forecasting model based on multiple linear regression is established. The results show that the total cost of social logistics has the greatest impact on logistics demand, while the total cost of import and export has the least impact on logistics demand. At the same time, the prediction accuracy of multiple linear regression is higher than that of univariate linear regression. This is in line with the objective development law of logistics demand. The research method of this paper has strong practicability and wide applicability, and can provide some reference value for logistics management departments to grasp the development trend of logistics demand.

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