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Original Paper

Research on the Impact of GNI on Express Delivery Volume in China

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Abstract

This paper selects the relevant data of 30 years from 1989 to 2018 from the National Bureau of Statistics. This paper selects the gross national income as the focus variable, and the number of business outlets, cargo transportation volume, investment in fixed assets and the total population of the country as the control variables to make an empirical analysis on the influencing factors of express delivery volume in China. EVIEWS software is used to estimate, test and correct the parameters of the model. The economic significance of the final results is analyzed, and then the research conclusion is drawn and the existing deficiencies are summarized.

Keywords

Express delivery volume, gross national income, influencing factors, OLS

1. Problem Introduction

1.1 Introducing Issues

With the rapid development of China's economy and the improvement of social openness, e-commerce has gradually integrated into all aspects of people's life and work. In the field of consumer goods such as food, clothing and daily necessities, people are increasingly relying on the consumption channels of e-commerce mode, and various online consumption apps are emerging one after another. What directly reflects this series of changes is the changes in the national express delivery volume. However, what is closely related to the number of express delivery nationwide is the gross national income. If the amount of money available to people increases, people's desire to consume online will also increase. However, the national population, cargo transportation volume and investment in fixed assets will also have an impact on the national express delivery volume. Therefore, this paper focuses on the impact of GNI on the national express delivery volume under the condition that other factors remain unchanged, which is

conducive to clarifying the current social development trend and the changes in people's lifestyle and consumption concepts.

1.2 Research Contents and Methods

This paper consists of five chapters. The research framework of this paper is as follows:

The first chapter is about the influencing factors of the number of express delivery in China. Firstly, it explains the factors that affect the number of express delivery in China and the focus variable that affects the number of express delivery in China-GNI, including the external factors such as domestic economic development and the development of public investment, etc. On this basis, it selects the control variables.

The second chapter is of data description. It mainly explains the data sources and explains the relevant variables, and describes the characteristics of data change trends, laying a foundation for the next empirical analysis.

The third chapter is an empirical analysis of the influencing factors of China's express delivery quantity. The regression analysis model in econometrics is used for analysis. Based on time series data samples, a time series model is constructed. For the processing of the model, firstly, the unit root test, namely ADF test, is carried out. Then the cointegration test of the explanatory variables and the explained variables in the model is carried out, It is found that there is a cointegration relationship at the significance level of 0.05. Then an error correction model is established to further explore the significance and influence degree of explanatory variables on the explained variables. Finally, Granger causality test is carried out to test whether there is a one-to-one corresponding prediction causality between the explanatory variables and the explained variables.

In the fourth chapter, the adjusted model is tested for heteroscedasticity and autocorrelation, and the cointegration model is tried to be tested to make the model more in line with reality.

The fifth chapter is the research conclusion and deficiency. Firstly, the conclusions drawn from the empirical analysis of the multiple regression model in this paper are summarized, and reasonable suggestions are put forward to promote the stable development of China's logistics express industry. Combined with the model and the actual analysis one by one, the deficiencies in the research process are put forward.

2. Modeling

2.1 Model Selection

Since the hypothesis testing of nonlinear models involves very complicated mathematical calculations, this paper considers making a linear model, so there are many testing methods and the analysis of the accuracy of the model is more reliable.

2.2 Variable Selection

There are many factors that affect the volume of express delivery, including the number of business outlets nationwide, cargo volume, investment in fixed assets, the total population of the whole country,

the gross national income, etc. But considering comprehensively, this paper selects the gross national income as the focus variable, and the number of business outlets, cargo transportation volume, investment in fixed assets, and the total population of the whole country as the control variables to conduct the research. In order to find the data conveniently, this paper selects the relevant data from 1989 to 2018 from the National Bureau of Statistics.

2.2.1 Number of Online Stores

The amount of express delivery is closely related to people's online shopping level. The more business outlets, the more able they are to deliver express delivery, which naturally attracts consumers. Therefore, the number of business outlets is related to the amount of express delivery. This paper predicts that this factor is positively related to the amount of express delivery.

2.2.2 Cargo Transportation Volume

This paper predicts that the amount of express delivery is related to the amount of goods transported. The higher the amount of goods transported, the higher the efficiency of express delivery, which also indicates that the country or region has a higher level of economic development and people's consumption concept can keep up with the trend of the times. Therefore, the explanatory variable cargo transportation volume is introduced, and a priori it is expected that it is positively correlated with express delivery volume.

2.2.3 Investment in Fixed Assets

Investment in fixed assets is a comprehensive index that reflects the scale, speed, proportion and use direction of investment in fixed assets. Fixed asset investment has a significant impact on the distribution and development of industries in a region. It can not only stimulate regional economic growth, but also improve public infrastructure and service level for the public. For example, for the part of investment in fixed assets that is used for infrastructure investment, transportation investment can expand the transportation network, greatly shorten the transportation time of express delivery on the road, and improve the efficiency of express delivery. Investment in the postal industry can add outlets of rural postal and express delivery enterprises to improve the level of express delivery services. Investment in electric wires can speed up the construction of the Internet, expand the coverage of the Internet, provide a broader platform for online shopping, and further promote the increase in the demand for express delivery. This paper predicts that the volume of express delivery is related to GDP, so the explanatory variable GDP is introduced and a priori expects that it is positively related to the volume of express delivery.

2.2.4 Total Population

The number of express delivery refers to the number of goods purchased online by the national population. The larger the population, the more potential consumer groups, the more likely the online shopping is. This paper predicts that express delivery is related to the total population of the country, so the explanatory variable of the total population of the country is introduced, and a priori predicts that it is positively related to express delivery volume.

2.2.5 GNI

This article predicts that the volume of express delivery is related to the gross national income, The higher the gross national income, the higher the level of economic development and people's living standard is. A high level of economic development means a fast-paced life. A high quality of living also means that people are pursuing higher living goals. Online shopping is a new way of shopping and meets people's living needs. Therefore, the explanatory variable total import and export volume is introduced, and a priori it is expected that it is positively correlated with express delivery volume.

3. Data Source and Model Setting

3.1 Sources and Processing of Data

In this paper, the relevant data of 30 years from 1989 to 2018 from the National Bureau of Statistics are selected and processed: Y indicates the express delivery volume (10,000 pieces); X1 indicates the number of business outlets (number); X2 represents the freight volume (10,000 tons); X3 indicates the investment in fixed assets (100 million yuan), X4 indicates the total population of the country (10,000 people); X5 represents gross national income (billion yuan); N is a random perturbation term. The data are shown in Table 1.

Table 1. List of Original Data of Influencing Factors Related to Express Delivery Volume in China

Year	The express delivery volume	The number of business outlets	The freight volume	The investment in fixed assets	The total population of the country	The gross national income
N	Y	X1	X2	X3	X4	X5
1989	247.3	53092	988435	4410.4	112704	17188.4
1990	343.3	53629	970602	4517	114333	18923.3
1991	566.7	54006	985793	5594.5	115823	22050.3
1992	959.2	54891	1045899	8080.1	117171	27208.2
1993	2156.2	57005	1115902	13072.3	118517	35599.2
1994	4019.5	60447	1180396	17042.1	119850	48548.2
1995	5562.7	61898	1234938	20019.3	121121	60356.6
1996	7096.6	72500	1298421	22913.5	122389	70779.6
1997	6878.9	79300	1278218	24941.1	123626	78802.9
1998	7667.7	102225	1267427	28406.2	124761	83817.6
1999	9091.3	66600	1293008	29854.7	125786	89366.5
2000	11031	58437	1358682	32917.73	126743	99066.1
2001	12652.7	57100	1401786	37213.49	127627	109276.2

2002	14036.2	76400	1483447	43499.91	128453	120480.4
2003	17237.8	63600	1564492	55566.61	129227	136576.3
2004	19772	66400	1706412	70477.4	129988	161415.4
2005	22880.3	65917	1862066	88773.62	130756	185998.9
2006	26988	62799	2037060	109998.2	131448	219028.5
2007	120189.6	70655	2275822	137323.9	132129	270704
2008	151329.3	69146	2585937	172828.4	132802	321229.5
2009	185786	65672	2825222	224598.8	133450	347934.9
2010	233892	75739	3241807	251683.8	134091	410354.1
2011	367311	78667	3696961	311485.1	134735	483392.8
2012	568548	95572	4100436	374694.7	135404	537329
2013	918674.9	125115	4098900	446294.1	136072	588141.2
2014	1395925	137562	4167296	512020.7	136782	642097.6
2015	2066637	188637	4175886	561999.8	137462	683390.5
2016	3128315	216708	4386763	606465.7	138271	737074
2017	4005592	278025	4804850	641238.4	139008	820099.5
2018	5071043	274635	5152732	645675	139538	896915.6

According to the data provided in Table 1, the statistical software Eviews8 is used to make a scatter plot for the above-mentioned set model, as shown in the following figure.

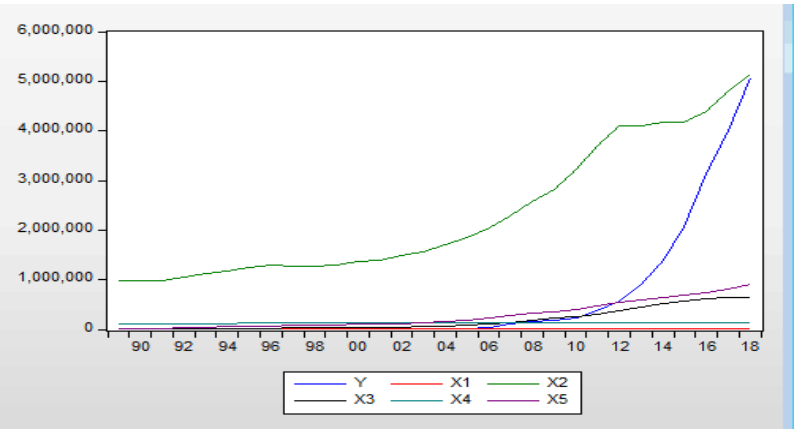

Figure 1. Relationship between National Express Delivery Volume and Various Variables

In order to obtain a more accurate multiple regression model and make a more accurate prediction, we first use Eviews software to estimate the linear relationship between Y and Xi. As can be seen from Figure 1 below, Y has obvious linear correlation with X1 and X4, Y may have linear correlation with X3 and X5, and may have other relationships with X2. The following will analyze their relationship step by step.

3.1.1 OLS analysis between Y and Explanatory Variables

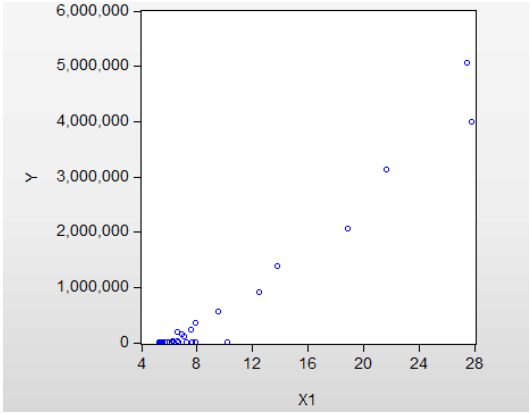

Figure 2. A Scatter Plot of Y and X1

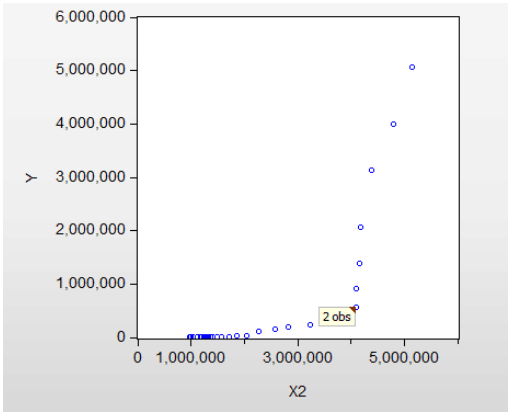

Figure 3. A Scatter Plot of Y and X2

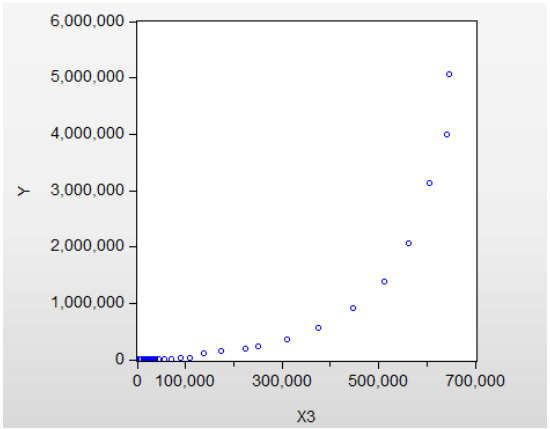

Figure 4. A Scatter Plot of Y and X3

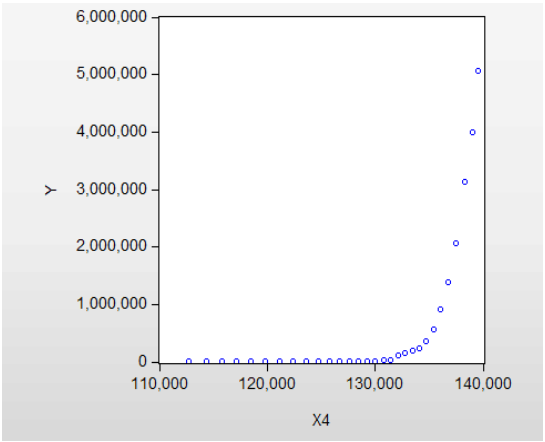

Figure 5. A Scatter Plot of Y and X4

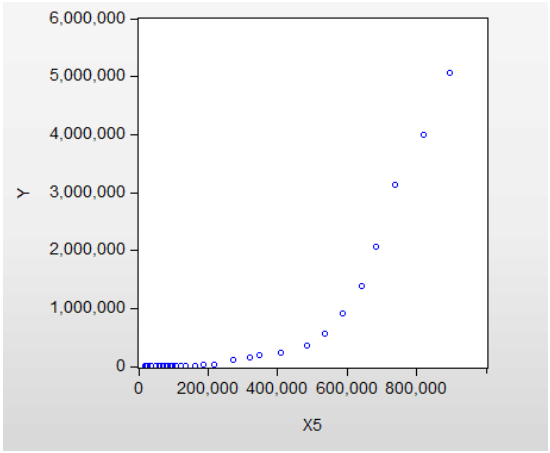

Figure 6. A Scatter Plot of Y and X5

3.1.2 The following table shows OLS estimates between Y and each explanatory variable.

Table 2. OLS Estimation between Y and Log Form of Explanatory Variables

	Beta Coefficients	T-Statistics	p-value	R-squared
X_1	200723.4	24.6494	0.0000	0.9559
INX_1	4.9052	7.8392	0.0000	0.6870
X_2	0.7563	7.0590	0.0000	0.6402
INX_2	1622374	5.3668	0.0000	0.5071
X_3	5.0975	9.3830	0.0000	0.7587
INX_3	516110.6	4.3961	0.0001	0.4084
X_4	100.1654	4.0743	0.0003	0.3722
INX_4	12305853	3.897428	0.0006	0.3517
X_5	4.0666	8.7598	0.0000	0.7327
INX_5	671485.9	4.3076	0.0002	0.3986

The comparative analysis table shows that the goodness-of-fit coefficients of X1, X2, X3, X4 and X5 are greater than the goodness-of-fit coefficients of their logarithmic values, so X1, X2, X3, X4 and X5 are selected as explanatory variables. Based on the above analysis, we set up the model as follows:

$$Y=\beta1+\beta2^* X1+\beta3^* X2+\beta4^* X3+\beta5^* X4+\beta6^* X5+u$$

Since all time series data are subject to unit root test, we will carry out unit root test on the preliminarily determined model in the next step. If there is a unit root, we will correct the model.

3.2 Constructing Time Series Model

3.2.1 Unit Root Inspection and Correction of X1

Null Hypothesis: X1 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.260393	0.9999
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Figure 7. Unit Root Check of X1

Null Hypothesis: D(X1) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.972727	0.0022
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Figure 8. Unit Root Correction of X1

When the unit root test is carried out on X1, p = 0. 9999 is very close to 1, which indicates that there is a unit root. When the second-order difference correction is carried out on X1, given the significance level = 0.05, P = 0. 0022 < 0.05, and t = -4. 9728, H0 is not acceptable, and the sequence has no unit root and is gentle.

The Unit Root Test and Correction of Y

Null Hypothesis: Y has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		10.36258	1.0000
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Figure 9. Unit Root Check for Y

Null Hypothesis: D(Y) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.001234	0.9941
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Figure 10. First-order Unit Root Correction of Y

Null Hypothesis: D(Y,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.460969	0.0001
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Figure 11. Second-order Unit Root Correction of Y

Similarly, ADF test is carried out on other control variables to obtain the following table.

Table 3. ADF Test of Different Significant Level

Variable	ADF	p-value	1% level	5% level	10% level	whether stable or not
Y	10.36258	1.0000	-4.309824	-3.574244	-3.221728	NO
D (Y)	-0.001234	0.9941	-4.323949	-3.580623	-3.225334	NO
D (Y, 2)	-6.460969	0.0001	-4.339330	-3.587527	-3.229230	YES
X_1	0.613657	0.9991	-4.309824	-3.574344	-3.221728	NO
D (X_1)	-4.972727	0.0022	-4.323979	-3.580623	-3.225334	YES
X_2	-0.741570	0.9599	-4.309824	-3.574244	-3.221728	NO
D (X_2)	-2.655881	0.2607	-4.323979	-3.580623	-3.225334	NO
D (X_2, 2)	-4.964479	0.0024	-4.339330	-3.587527	-3.229230	YES
X_3	-0.503412	0.9774	-4.309824	-3.574244	-3.221728	NO
D (X_3)	-0.620810	0.9696	-4.323979	-3.580623	-3.225334	NO
D (X_3, 2)	-5.000029	0.0022	-4.339330	-3.587527	-3.229230	YES
X_4	-7.695921	0.0000	-4.309824	-3.574244	-3.221728	YES
X_5	1.575026	1.0000	-4.309824	-3.574244	-3.221728	NO
D (X_5)	-3.157446	0.1133	-4.323979	-3.580623	-3.225334	NO
D (X_5, 2)	-5.767728	0.0004	-4.339330	-3.587527	-3.229230	YES

3.3 Cointegration Test

After ADF test of variables, further co-integration test is carried out on the model to test whether non-stationary explained variables and explanatory variables have co-integration concern. If so, an error correction model is established, the regression equation is estimated by OLS method, and the residual sequence is obtained. ADF test is carried out on the residual sequence. The results are as follows.

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.721916	0.0038
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Figure 12. ADF Test Results for Residual Sequence

Because of N=6, according to the critical value calculation formula:

$$C(\alpha)=\varphi_{\infty}+\varphi_1 T^{-1}+\varphi_2 T^{-2},$$

Select the significance level = 0.05, figure out the Critical value C(α):

$$C(\alpha)=-4.7048-\frac{17.120}{29}-\frac{11.17}{29^2}=\text{-5.588725}$$

$$C(\alpha)>t=(\text{-5.676992})$$

Therefore, the regression model has a cointegration relationship, indicating that there is a long-term equilibrium concern between the explanatory variable and the explained variable, but in the short term, there may be imbalance. In order to enhance the accuracy of the model, an error correction model is established to link the short-term factor changes with the long-term changes in the number of express delivery in China.

The structure of the modified model is as follows:

$$\triangle Yt=\alpha+\beta 1\triangle X1t+\beta 2\triangle X2t+\beta 3\triangle X3t+\beta 4\triangle X4t+\beta 5\triangle X5t+\beta 6\triangle X6t+\gamma ect\text{-}1+\varepsilon t$$

(ec represents the residual term in the long-term relationship model)

Dependent Variable: D(Y)
Method: Least Squares
Date: 12/11/19 Time: 20:17
Sample (adjusted): 1990 2018
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26588.25	217096.9	-0.122472	0.9036
D(X1)	73883.12	24417.81	3.025788	0.0062
D(X2)	-1.287991	0.406671	-3.167161	0.0045
D(X3)	-7.243764	2.220275	-3.262552	0.0036
D(X4)	-36.41491	172.1264	-0.211559	0.8344
D(X5)	17.05625	3.340025	5.106624	0.0000
RESID01(-1)	-0.757448	0.221361	-3.421779	0.0024

R-squared	0.800229	Mean dependent var	174855.0
Adjusted R-squared	0.745746	S.D. dependent var	328254.9
S.E. of regression	165517.8	Akaike info criterion	27.07805
Sum squared resid	6.03E+11	Schwarz criterion	27.40809
Log likelihood	-385.6317	Hannan-Quinn criter.	27.18141
F-statistic	14.68771	Durbin-Watson stat	1.545074
Prob(F-statistic)	0.000001		

Figure 13. OLS Estimation of Error Correction Model

D(y)=73883.12(x1)-1.287991(x2)-7.243764(x3)-36.41491(x4)+17.05625(x5)-0.757448resid(-1)

T= (3.0258) (-3.1672) (-3.2626) (-0.2116)

(5.1066) (-3.4218)

$\bar{R}^2$=0.7457 DW=1.5451>0.386

After debugging, the above-mentioned lag term (-1) is the best form of short-term relational regression model. The results show that, Under the condition that other variables remain unchanged, the number of business outlets has a significant impact on the number of national express delivery, the volume of goods transported and the investment in fixed assets have a negative impact on the number of national express delivery, and the total population of the country has no significant impact on the number of national express delivery. Under the condition that the confidence level is 100%, it is believed that the gross national income has a significant impact on the number of national express delivery.

The above analysis has proved that there are four factors that affect the number of express delivery in the country: the number of business outlets, the volume of cargo transportation, the investment in fixed assets and the gross national income all have a long-term equilibrium relationship. On this basis, Granger causality is used to further analyze whether there is causality between each explanatory variable and non-explanatory variable and the direction of influence.

3.4 Granger Causality Test

Granger's causality test thought is: if the change of X causes the change of Y, the change of X should occur before the change of Y. Granger causality test can only test the causality between two variables. For the two-variable causality test, the causality between αand λ is judged by checking whether the sum parameters in the following two formulas are all zero.

According to whether the sum parameters are all zero, there are four possibilities for the test results, and two of them are mainly considered in this paper, namely:

(1) X has a single influence on Y, which shows that at least one of the parameters before each lag term of formula X is not zero, while all the parameters before each lag term of formula X are zero.

(2) There is no influence between Y and X, which shows that the sum of parameters α and λ before each hysteresis term of Y and X in formulas (1) and (2) are all zero.

A prerequisite for Granger causality test is that the time series must be stationary, otherwise false regression may occur. According to the unit root test of the above variables, when the model becomes a two-order difference form, the time series is stationary, thus Granger test is carried out one by one between Y and X. The inspection results are shown in the following figure.

Pairwise Granger Causality Tests
Date: 12/11/19 Time: 20:42
Sample: 1989 2018
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
X1 does not Granger Cause Y	25	0.70425	0.6297
Y does not Granger Cause X1		4.52303	0.0116
X2 does not Granger Cause Y	25	9.55103	0.0004
Y does not Granger Cause X2		5.28529	0.0062
X3 does not Granger Cause Y	25	33.7041	3.E-07
Y does not Granger Cause X3		6.19757	0.0031
X4 does not Granger Cause Y	25	1.47242	0.2603
Y does not Granger Cause X4		1.83403	0.1706
X5 does not Granger Cause Y	25	3.12581	0.0422
Y does not Granger Cause X5		15.2977	3.E-05
X2 does not Granger Cause X1	25	4.10054	0.0167
X1 does not Granger Cause X2		0.43832	0.8145
X3 does not Granger Cause X1	25	3.59544	0.0267
X1 does not Granger Cause X3		0.78597	0.5766
X4 does not Granger Cause X1	25	3.96877	0.0188
X1 does not Granger Cause X4		1.49276	0.2541
X5 does not Granger Cause X1	25	2.59738	0.0729
X1 does not Granger Cause X5		0.29221	0.9094
X3 does not Granger Cause X2	25	6.34789	0.0028
X2 does not Granger Cause X3		5.53258	0.0051
X4 does not Granger Cause X2	25	1.31382	0.3138
X2 does not Granger Cause X4		14.6116	4.E-05
X5 does not Granger Cause X1	25	2.59738	0.0729
X1 does not Granger Cause X5		0.29221	0.9094
X3 does not Granger Cause X2	25	6.34789	0.0028
X2 does not Granger Cause X3		5.53258	0.0051
X4 does not Granger Cause X2	25	1.31382	0.3138
X2 does not Granger Cause X4		14.6116	4.E-05
X5 does not Granger Cause X2	25	4.02556	0.0179
X2 does not Granger Cause X5		1.65847	0.2092
X4 does not Granger Cause X3	25	1.06472	0.4203
X3 does not Granger Cause X4		5.11705	0.0071
X5 does not Granger Cause X3	25	5.49254	0.0053
X3 does not Granger Cause X5		1.54775	0.2382
X5 does not Granger Cause X4	25	3.83356	0.0213
X4 does not Granger Cause X5		1.03957	0.4327

Figure 14. Granger Causality Test with 5 Lag Periods

As can be seen from that inspection result, There is a bidirectional Granger causality between the express delivery volume and the freight volume when the lag period is 2, There is a single Granger causality between the freight volume and the investment in fixed assets to the express delivery volume when the lag is 4periods. When there is a lag of 5 periods, all variables have no Granger causality with the explained variables.

4. Verification of the Model

4.1 Heteroskedasticity Test and Correction

4.1.1 White Inspection

Heteroskedasticity Test: White

F-statistic	1.143751	Prob. F(6,22)	0.3707
Obs*R-squared	6.895200	Prob. Chi-Square(6)	0.3306
Scaled explained SS	5.142180	Prob. Chi-Square(6)	0.5257

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/12/19 Time: 19:28
Sample: 1990 2018
Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.55E+10	1.95E+10	0.791804	0.4369
D(X1)^2	-1.54E+09	9.29E+08	-1.660043	0.1111
D(X2)^2	-0.125231	0.196566	-0.637091	0.5306
D(X3)^2	-3.770232	5.002904	-0.753609	0.4591
D(X4)^2	-5168.596	12822.64	-0.403084	0.6908
D(X5)^2	11.32910	7.513963	1.507740	0.1458
RESID01(-1)^2	0.304510	0.197386	1.542717	0.1372

R-squared	0.237766	Mean dependent var	2.08E+10
Adjusted R-squared	0.029883	S.D. dependent var	3.41E+10
S.E. of regression	3.35E+10	Akaike info criterion	51.51627
Sum squared resid	2.47E+22	Schwarz criterion	51.84631
Log likelihood	-739.9859	Hannan-Quinn criter.	51.61963
F-statistic	1.143751	Durbin-Watson stat	2.068580
Prob(F-statistic)	0.370731		

Figure 15. White Test without Cross Terms

H0: There is heteroskedasticity in the model. Under the condition of = 0.05, the results show that 20.05 (5) = 11.0705, nR2=6. 895200 < 20.05 (5) = 17.708. The original hypothesis is not accepted, and there is no heteroskedasticity in the model.

Heteroskedasticity Test: White

F-statistic	214.6211	Prob. F(20,9)	0.0000
Obs*R-squared	29.93723	Prob. Chi-Square(20)	0.0709
Scaled explained SS	29.64270	Prob. Chi-Square(20)	0.0759

Figure 16. White Cross Item Test

4.2 Autocorrelation Test and Correction

4.2. 1LM Inspection

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	11.27545	Prob. F(1,21)	0.0030
Obs*R-squared	10.13117	Prob. Chi-Square(1)	0.0015

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/12/19 Time: 20:08
Sample: 1990 2018
Included observations: 29
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	185273.6	187537.8	0.987927	0.3344
D(X1)	-34238.65	22591.53	-1.515552	0.1445
D(X2)	0.709325	0.396676	1.788173	0.0882
D(X3)	4.633523	2.294403	2.019489	0.0564
D(X4)	-129.2757	147.2320	-0.878041	0.3899
D(X5)	-7.860032	3.617085	-2.173029	0.0414
RESID01(-1)	-1.164311	0.391954	-2.970529	0.0073
RESID(-1)	1.949072	0.580445	3.357894	0.0030

R-squared	0.349351	Mean dependent var	-1.58E-10
Adjusted R-squared	0.132468	S.D. dependent var	146715.9
S.E. of regression	136653.3	Akaike info criterion	26.71723
Sum squared resid	3.92E+11	Schwarz criterion	27.09442
Log likelihood	-379.3999	Hannan-Quinn criter.	26.83536
F-statistic	1.610778	Durbin-Watson stat	1.806799
Prob(F-statistic)	0.187040		

Figure 17. Correlation LM Test

The value of the test statistic nR2 is 10.1312, and the 2 distribution table can be found to be 0.052 (6) = 12.59 > 10.1312. Therefore, the original hypothesis cannot be rejected, and it is believed that the model does not have first-order sequence correlation and does not need correction.

5. Conclusions and Recommendations

5.1 Research Conclusions

System	Indicator Category	Indicators of specific influencing factors
Express Delivery Affects Demand Index	Economic aggregate category	GDP, total import and export, investment in fixed assets
	Residents' Living Consumption Level Category	Per capita consumption level
	Transportation category	Freight Transportation Volume, Street Lamp Volume
	Other Categories	Number of business outlets, total population of the country

Through this regression model, the following conclusions can be drawn:

(1) From the error correction results, it can be seen that the volume of online stores, cargo transportation, total fixed assets, the total population of the country and the gross national income have a significant impact on the volume of express delivery in China. Under the condition that the confidence level is 100%, it is believed that the gross national income has a significant impact on the number of national express delivery, which shows that for every unit of national income increase, the number of express delivery increases by 17.05625 units. The number of business outlets has a

significant impact on the number of national express delivery under the confidence level of 74.57%, which shows that for every unit added to the number of business outlets, the number of express delivery increases by 73,883.12 units. Goods transportation volume and fixed asset investment have a negative impact on the national express delivery volume, i.e., For each additional unit of goods transportation volume and fixed asset investment, the express delivery volume will decrease by 1.28 units and 7.24 units respectively. The total population of the whole country has no significant influence on the number of express delivery in the whole country.

(2) From 1989 to 2018, under the condition that other explanatory variables remain unchanged, with China's economic growth, the growth rate of express delivery volume caused by the increase in the number of business outlets is larger than the growth rate of express delivery volume caused by the increase in national income. Therefore, the number of business outlets is the main factor affecting the amount of express delivery volume. That is, the number of business outlets has promoted the infrastructure construction in all regions of the country, increased people's attention and participation in online shopping, and the volume of express delivery has only increased.

(3) From 1989 till now, with the deepening of China's reform and opening up, the degree of social opening up in our country has continuously improved, and people's lives have undergone earth-shaking changes. Reform and opening up emancipate people's minds and make it easier for people to accept new things. The steady growth of economic level and the rapid development of the Internet have made China advance by leaps and bounds in the field of e-commerce. At the same time, the development of e-commerce also makes people's daily life more convenient, intelligent and sustainable. People can buy all kinds of products without leaving their homes, which not only saves time, but also promotes the increase of express delivery volume.

(4) Although this model does not take into account gender, age, the development of e-commerce industry and the educational level of residents, it does not mean these factors have no influence. Women are the favourites of online shopping. The development of e-commerce has a great impact on the younger generation. The development from computers to mobile terminals such as mobile phones and iPad has made it more convenient for people to buy online, thus affecting the number of express delivery.

5.2 Policy Recommendations

(1) Increase the number of business outlets and strengthen the supporting construction of highway transportation infrastructure.

Generally speaking, when people shop online, they will first consider the number of business outlets and the construction of transportation infrastructure in the place where they are located. Business outlets are an important factor affecting the carrying capacity of express delivery. The more business outlets are distributed from residential areas, the easier it is to arouse people's interest in online shopping, thus dramatically increasing the number of express delivery. Secondly, the transportation infrastructure is the stepping stone to open people's online shopping. The more developed the

transportation is in cities and towns, the more willing the residents will have in online shopping, because it not only saves people precious time, but also can experience the excitement and pleasure of shopping without leaving their homes.

(2) Accelerate the transformation and upgrading of the domestic electronic service industry and improve the informatization level of the tertiary industry.

Since the reform and opening up and the development of e-commerce industry, the degree of social openness in our country has improved significantly, but there are still some areas that do not know or even are completely unfamiliar with the Internet and e-service industry. Therefore, popularizing Internet knowledge, improving the structure of electronic service industry and improving the informatization level of the tertiary industry are major issues of the times. In accelerating industrial transformation and upgrading, the upgrading of electronic service industry is as important as the upgrading of energy industry. Entering a new era, people pay more attention to the quality of service and pursue an exquisite life. Popularization of online shopping information and specialization of service are conducive to people enjoying better service experience.

(3) Further strengthen the construction of network security and social security

Network security is an important factor that affects people's online shopping experience and thus the number of express deliveries. Therefore, the network supervision department needs to step up efforts to crack down on network fraud ,strengthen the construction of network security, ensure the safety of people's funds, and improve the trust of the network. In addition, social security cannot be ignored, especially public health security. People will only increase their consumption and purchase on the basis of ensuring their life and health. Therefore, relevant departments could establish relevant systems to eliminate potential safety hazards and achieve early reporting, early implementation and early management.

5.3 Inadequate Research

In this paper, multiple linear regression is used to predict the demand for express delivery. The model has strong practicability and high accuracy, but the error in the prediction itself cannot be avoided. We attach much importance to the impact of GNI on the number of express deliveries. According to the analysis of economic significance, these five factors are positively correlated with the number of express delivery. However, due to the error of model setting, the influence of missing variables and the choice of correction methods, the symbols of regression coefficients are opposite to expectations. Therefore, the model set in this paper is only for reference and cannot be used as a direct investigation of the relationship between economic variables.

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