

Empirical Study on the relationship between logistics development and carbon emissions of logistics industry in Guangdong

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Abstract. Based on the sample data of Guangdong Province from 2000 to 2016, this paper conducts a unit root test, cointegration test and Granger causality test on the development of logistics industry and carbon emissions of logistics industry in Guangdong Province. The empirical results show that there is a long-term equilibrium relationship between the development of logistics industry and carbon emissions of logistics industry in Guangdong Province. Carbon emissions are not Granger of the development of logistics industry. The development of logistics industry is the Granger cause of carbon emission of logistics industry. The strategy of low-carbon development of logistics industry in Guangdong Province is put forward to promote the healthy and sustainable development of logistics industry in Guangdong Province.

1. Introduction

With the global shortage of resources, environmental degradation and other issues highlighted, vigorously developing a low-carbon economy has become a global consensus, modern logistics is a major energy consumption, but also carbon emissions, occupies a special position in the low-carbon economy. In recent years, the logistics industry in Guangdong Province has developed well, and has a great impact on carbon emissions. Studying the relationship between logistics industry and carbon emissions in Guangdong Province, and putting forward low-carbon development strategy, plays an important role in the healthy and sustainable development of logistics industry in Guangdong Province.

At present, there are many papers on carbon emissions, but there are few papers on carbon emissions of logistics industry. Liang Wen studies the dynamic relationship between logistics industry and carbon emissions in Anhui Province based on VAR model. The results show that the development of logistics industry will lead to the increase of carbon emissions, but when the development of logistics industry reaches a certain degree, people will be aware of environmental protection[1]; Ouyang Qiangbin estimates the carbon emission value of the logistics industry by using the carbon emission calculation formula, analyzes the change rule and the reason of the carbon emission, and puts forward the logistics industry low carbon countermeasures [2]; This paper empirically studies the relationship between the development of logistics industry and carbon emissions of logistics industry in Guangdong Province, and puts forward countermeasures for the development of low-carbon logistics industry in Guangdong Province.

2. Estimation of carbon emissions in Guangdong's logistics industry

There is no direct data to collect data on Guangdong's carbon emissions. According to the IPCC "bottom-up" method, this paper estimates the carbon emissions of logistics industry in Guangdong Province. The calculation formula is as follows:

$$C = \sum_{i=1}^n E_i H_i T_i \quad (1)$$

Note: E_i is the consumption of certain energy;

H_i is the coal folding coefficient of a certain energy source;

T_i is the carbon emission coefficient of a certain energy.

Considering the representativeness and measurability, raw coal, oil and electricity are selected to calculate the carbon emissions of Guangdong logistics industry. According to the China Energy Statistics Yearbook 2000-2016, the coal folding coefficient and carbon emission coefficient of these three kinds of energy are shown in table 1.

Table 1. coal folding coefficient and carbon emission coefficient of energy.

Energy type	raw coal	electricity	raw oil
coal folding coefficient	0.7143	0.1229	1.4728
carbon emission coefficient	0.7559	2.2132	0.5714

The paper selects the energy consumption of transportation, post and telecommunications industry to represent the energy consumption of the logistics industry. According to the energy consumption data of Guangdong transportation industry in China Energy Statistics Yearbook 2000-2016, using the formula (1), the carbon emissions and total amount of each energy source in Guangdong Province are calculated, as shown in Table 2.

Table 2. carbon emissions in logistics industry

Year	carbon emission of crude oil	carbon emission of electricity	carbon emission of raw oil	total
2000	6.932821511	5.1163628	503.34235	515.39154
2001	6.193104574	6.2587724	551.62657	564.07845
2002	3.380020456	7.5752634	601.01171	611.96700
2003	3.293630157	13.412432	690.96415	707.67022
2004	3.774176196	16.49965	811.81558	832.08941
2005	0.755915118	8.279749	1001.640769	1010.6764
2006	0.809909055	8.834634	1034.865916	1044.5104
2007	0.901698748	10.129365	1141.386425	1152.4174
2008	0.961092079	10.744090	1235.873367	1247.5785
2009	1.009686622	12.294503	1326.479354	1339.7835
2010	1.101476315	14.796924	1456.999275	1472.8976
2011	1.166269039	17.759029	1519.136239	1538.0615
2012	1.312052669	18.526075	1537.246148	1557.0842
2013	1.425439937	19.600484	1763.848062	1784.8739
2014	2.325172765	20.541612	1580.631184	1603.4979
2015	2.386789844	22.418428	1642.224429	1667.0296
2016	2.452404619	25.013330	1828.648563	1856.1142

From table 2, it can be seen that the carbon emissions of oil products in Guangdong Province are very large, all of which reach over 95%. The total amount of carbon emissions is relatively large, basically showing an upward trend, and the total carbon emission of 2016 is 3.6 times that of 2000.

3. Selection of indicators and data sources

Total carbon emissions of the logistics industry are represented by tpf, and the specific data are shown in Table 2. The development of logistics industry is represented by the added value of logistics industry (gdp). Considering the availability of data, it is replaced by the added value of transportation and postal industry. The data comes from Guangdong Statistical Yearbook 2000-2016. The raw data are shown in Table 3.

Table 3. logistics industry development and logistics industry carbon emission data

Year	carbon emission of logistics industry(tpf)	added value of logistics industry(gdp)	Year	carbon emission of logistics industry(tpf)	added value of logistics industry(gdp)
2000	515.3915405	908.45	2009	1339.783544	1595.34
2001	564.0784505	1073.81	2010	1472.897676	1825.29

2002	611.9670008	1157.75	2011	1538.061537	2090.36
2003	707.6702224	1207.67	2012	1557.084276	2367.46
2004	832.0894145	1351.62	2013	1784.873986	2450.51
2005	1010.676433	990.53	2014	1603.497969	2740.76
2006	1044.510459	1113.77	2015	1667.029647	2928.9
2007	1152.417489	1254.58	2016	1856.114297	3208.35
2008	1247.578549	1328.14			

4. Empirical analysis

4.1 ADF unit root test

Before regression analysis, we must test the stationarity of time series data first. In order to reduce the fluctuation of time series, the data are processed logarithmically. The ADF tests of lngdp and lntpf are carried out by EVIEWS software. The results are shown in Table 4. The ADF values of both of them are greater than the critical value of 5% as shown in Table 4. the data are not stable, so the data for first-order differential processing, and then ADF test, at this time Dlngdp and Dlnptf ADF values are less than 5% of the critical value, the data is stable, belong to the same order sequence, can be further co-integration test.

Table 4.ADF test.

variable	5% critical value	ADF	P-value	stability
lngdp	-3.175352	-1.238603	0.6165	unstable
lntpf	-3.259808	-2.665356	0.1161	unstable
Dlngdp	-3.172257	-3.212696	0.0351	stable
Dlnptf	-3.081002	-3.464963	0.0161	stable

4.2 Cointegration test

The number of variables studied in this paper is only two, and the EG two step method is used for cointegration test. lngdp was used as independent variable and lntpf as a dependent variable for regression analysis. The result was found in equation (1).

$$\text{Lntpf} = -4.681 + 0.902 \text{lngdp} \quad (1)$$

$$t \quad (-2.524) \quad (6.3107)$$

$$R\text{-squared} = 0.739903 \quad \text{adjusted } R\text{-squared} = 0.721324 \quad D.W = 0.259859$$

Since the value of D. W is far less than 2, there may be autocorrelation in the residual sequence. Using EVIEWS software to test the unit root of the residual \hat{u}_t , the test results are shown in Table 5. The ADF value of the residual sequence is greater than the critical value of 5%, so the residual data is not stable. Therefore, adding AR (1) to the regression analysis, a new regression equation is obtained as shown in equation (2). At this time, the value of D.W is greater than 2, and the ADF value of the new residue $\hat{\epsilon}_t$ is less than 5% critical value. After adding AR (1), the residue sequence is stable, and the AR root diagram shows that there is no root greater than 1, so it is a stationary system. There is a cointegration relationship between lntpf and lngdp, and there is a long-term and stable equilibrium relationship between sequence lntpf and lngdp. The elasticity of added value of logistics industry to carbon emissions is 1.3729, which means that the logistics industry will increase by 1%, and the carbon emissions will increase by 1.3729%.

Table 5. Unit root test for residual sequence

variable	5% critical value	ADF	P-value	stability
\hat{u}_t	-3.4689	-3.1149	0.1294	unstable
\hat{e}_t	-3.0998	-3.9197	0.0116	stable

$$\text{Ln}tpf = -2.9048 + 1.3729 \ln gdp + \hat{u}_t \quad (2)$$

$$t \quad (-1.01762) \quad (4.72653)$$

$$\hat{E}_t = 0.92207 + \hat{u}_t$$

$$t \quad (9.3702)$$

$$R\text{-squared} = 0.972503 \quad \text{adjusted } R\text{-squared} = 0.967920 \quad D.W = 2.1353$$

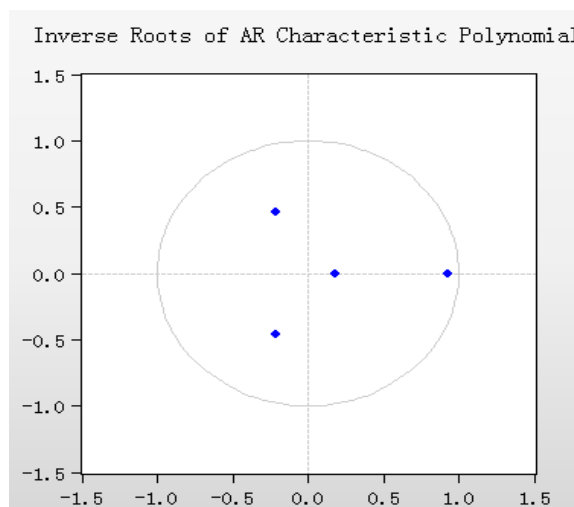


Fig. 1 AR root

4.3 Grainger causality test

Because $\text{Ln}tpf$ and $\ln gdp$ passed the cointegration test, and then Granger causality test, we selected the data lagging 4 periods to test at the level of 1% confidence, the results are shown in Table 6. The results show that carbon emissions are not the Granger cause of the development of logistics industry, and the growth of logistics industry is the Granger cause of carbon emissions.

Table 5. Granger causality test

Null Hypothesis:	obs	F-value	P-value	conclusion
$D\ln tpf$ does not Granger Cause $D\ln gdp$	12	27.1583	0.007	accept
$D\ln gdp$ does not Granger Cause $D\ln tpf$		0.41731	0.791	refuse

5. Conclusion and suggestion

Through the unit root test, co-integration test and Granger causality test, the following conclusions are drawn: the original sequence of logistics and carbon emissions in Guangdong Province is unstable, and there is a long-term equilibrium relationship between logistics development and carbon emissions in logistics industry; There is a one-way Granger causality between the development of logistics industry and carbon emission of logistics industry. Carbon emission of logistics industry is not the Granger cause of the development of logistics industry, the development of logistics industry is the Granger cause of carbon emission of logistics industry. For the low carbon development of Guangdong's logistics industry, the following suggestions are put forward:

5.1 Establishing a long-term low carbon policy mechanism

The Guangdong Provincial Government should speed up the formulation of low-carbon logistics laws and regulations, guide the logistics industry to take the road of low-carbon through the compulsory force of laws and regulations, set low-carbon measurable standards for logistics

enterprises through vehicle technical standards, packaging size standards, loading tools standards and other means, and formulating the total carbon emission of enterprises and implementing supervision and rewards and punishments for enterprises. Increase the budget for research and development of low-carbon technologies, increase financial support, tax incentives or loan discounts for low-carbon enterprises such as those using new energy to encourage low-carbon development. Carbon tax should be levied, a carbon fee system should be established, and a carbon tax should be levied on high-polluting and high-emission enterprises, forcing them to update equipment, reduce carbon emissions and environmental pollution.

5.2 Strengthening logistics low carbon awareness and training logistics low carbon talents

Strengthen the publicity of low-carbon logistics, through the public transport set up television advertising and other ways to promote low-carbon logistics; some leading enterprises in the logistics industry to play a leading role, adopt low-carbon packaging, e-sheets and other ways to reduce energy consumption. Logistics enterprises can also hold more meetings to publicize low carbon thinking and grasp new low carbon theories and technologies. Low-carbon logistics is not a slogan, we can see its long-term value through the implementation of people, and low-carbon logistics is a long-term process, Guangdong Province government and universities should recognize the importance of low-carbon logistics personnel training, through School-enterprise Cooperation to establish a long-term mechanism for low-carbon logistics personnel training, export more talents for enterprises.

5.3 Increase logistics and energy saving technology research and development

Among the total carbon emissions in Guangdong Province, the total amount of carbon emissions from oil products is the largest, so the logistics industry should try to introduce new energy vehicles and promote electric forklift trucks, reduce fuel consumption and carbon emissions, and constantly develop energy-saving and emission-reduction technologies to improve energy efficiency; increase the number of charging stations and charging stations to facilitate the use of natural gas vehicles, electric vehicles and electric forklift trucks, improve the infrastructure of new energy use, such as through mobile APP to find charging points and reserve charging; Logistics enterprises should rationally optimize the distribution route, reduce the no-load and roundabout rate, at the same time, reduce the traffic congestion caused by the logistics industry by traffic control, improve the efficiency of logistics transportation.

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References

- [1] Liang Wen, Study on the dynamic relationship between logistics industry and carbon emission based on VAR Model--Taking Anhui Province as an Example, *Resource Development and Market*, vol.32, pp. 107-111, 2016.
- [2] Ouyang Qiangbin, Empirical analysis of carbon emissions in logistics industry, *Chongqing and world*, vol.7, pp. 4-6, 2011.
- [3] Licheng Sun, Low-carbon city logistics distribution network design with resource deployment, *Journal of Cleaner Production*, vol. 10, pp. 223-228, 2016.