

Effect on the Transfer of Implicit Carbon Emissions in the Sino-US Goods Trade Competitiveness

Jianna Zhao, Chunchen Wang

*Department of Economics and Management, North China Electric Power University,
Baoding 071000, China*

Abstract: As the two largest trading nations in the world, Sino-US bilateral trade in goods is increasing. While, China and the US is in different stages of development and influenced by technology and international environment the structure of production and trade structure has a huge difference. The Chinese exports is providing impetus for the development of the world economy, at the same time China has paid a tremendous resource and environmental costs, especially suffered tremendous pressure in terms of carbon emissions. In this context, the research on the transfer of implicit carbon emissions in the Sino-US goods trade can define their respective responsibilities and obligations, also can help China to establish a good international image. In this paper, through the analysis of the transfer of implicit carbon emissions in the Sino-US goods trade competitiveness, make clear the relationship between the goods trade competitiveness and environmental responsibility, which provides a basis for the two countries to bear the responsibility.

Keywords: Trade competitiveness, transfer of implicit carbon emissions, environmental responsibility

I. INTRODUCTION

With the development of economic globalization and product internationalization, the situation that the implicit carbon contained in the trade in goods transfers with trade should be placed in a fairer and more reasonable position [1]. Sino-US bilateral trade in goods embodied carbon emissions is huge, the Sino-US trade in goods embodied carbon emissions transfer amount to also have very big difference. In international trade, goods trade competitiveness is an important index of trade volume, so the Sino-US goods trade competitiveness is the cause of the transfer of implicit carbon emissions? Is to promote the transfer of implicit carbon emissions, or hinder the transfer of implicit carbon emissions? This paper, through the establishment of model, proves that the goods trade and the transfer of implicit carbon emissions has a causal relationship, and there is a linear correlation.

II. ESTABLISH INDEXES

A. Competitiveness of Goods

The competitiveness of goods is ability that a country or a region trades their self-products, industry, and services on the foreign market of open to domestic to exploit and occupy market and to gain profit. The competitiveness of goods stands in the angle of buyer and reflects the buyer's rate of import

goods in this paper, and it is the rate of goods imported from other countries [2, 3]. Computation formula is as follows:

$$X = S_Z / S_M \quad (1)$$

$$S_Z = E_Z / E_{EM} \quad (2)$$

$$S_M = E_M / E_{EZ} \quad (3)$$

Among them, X is competitiveness of goods; S_Z is the share of goods trade volume of China's export in goods trade volume of whole United States export; S_M is the share of goods trade volume of United States export in goods trade volume of whole China export; E_Z is the goods volume of trade which China exports to the United States, E_{EM} is the trade volume of United States whole export; E_M is the goods volume of trade which United States exports to the China, E_{EZ} is the trade volume of China whole export. With the ratio of the share of goods trade volume of China's export in goods trade volume of whole United States export and the share of goods trade volume of United States export in goods trade volume of whole China's export is regarded as indexes of measuring competitiveness of goods, and it is used to reflect the change trend of competitiveness. If X is less than 1, it indicates that the China's competitive is less than the United States competitive, or it indicates that the United States competitive is less than the China competitive.

B. Degree of Environmental Responsibility

Degree of environmental responsibility is represented that a country or a region remove it which a product or service should be produced in the domestic to other countries by trading to reduce its carbon dioxide emissions and reduce environmental responsibility that should be undertaken by itself. The subject of this study is the carbon dioxide of affecting atmosphere, and its computation formula is as follows:

$$Y = C_Z / C_M \tag{4}$$

$$C_Z = C_{EM} / C_{AZ} \tag{5}$$

$$C_M = C_{IM} / C_{AM} \tag{6}$$

Y is degree of environmental responsibility; C_Z is the ratio of the implied carbon emissions in the China goods exports to the United States and the carbon dioxide emissions of the China as a whole; C_M is the ratio of the implied carbon emissions in the China goods imports from the United States and the carbon dioxide emissions of the United States as a whole; C_{EM} is the implied carbon emissions in the China goods exports to the United States; C_{AZ} is the implied carbon emissions of the China as a whole;

C_{IM} is the implied carbon emissions in the China goods imports from the United States; C_{AM} is the carbon dioxide emissions of the United States as a whole. If Y is less than 1, it indicates that the degree of environmental responsibility of our country is more than the United States, or it indicates that the degree of environmental responsibility of our country is less than the United States.

III. DATA PROCESSING

A. Date Specification

In this paper, the implied carbon emissions of bilateral goods is on the basis of the implied carbon emissions of imported goods and exported goods which is obtained on the basis of calculating bilateral trade statistics in nearly a decade. The bilateral imported and exported trade is obtained on the basis of calculating statistics. Energy consumption data is obtained on the basis of calculating statistical yearbook of BP world energy. And output value of GDP is obtained on the basis of statistical yearbook [4]. And the carbon emissions of the China and the United States as a whole is came from the World Bank. Statistics list is showed at Table 1.

Table 1. Sino-US trade and carbon emission transfer data statistics.

Project year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
U. S. Overall exports	10201.90	11592.33	12814.59	14516.85	16431.68	18265.96	15707.97	18341.66	21128.25	22165.40
China's overall exports	4382.00	5933.00	7620.00	9690.00	12205.00	14307.00	12016.00	15778.00	18983.00	20487.00
China's exports to the U. S.	927.67	1249.42	1628.91	2034.48	2326.77	2523.84	2208.22	2832.87	3244.53	3517.77
China's imports from the U. S.	338.66	446.57	486.22	592.11	693.91	813.60	774.60	1020.99	1221.07	1328.96
China's exports goods implicit carbon	3.31	3.40	4.15	4.47	4.70	3.99	3.26	3.56	2.75	2.48
China's imports goods implicit carbon	0.57	0.55	0.60	0.60	0.69	0.69	0.63	0.74	0.66	0.54
China's carbon dioxide emissions	45.25	52.88	57.90	64.14	67.91	70.35	76.92	82.86	80.77	80.30
America's Carbon dioxide emissions	56.81	57.90	58.26	57.38	58.29	56.57	53.12	54.33	54.42	54.09

^aData In The Table Obtained By The Author's Collection

B. Model Assumption

In order to test the relationship between environmental responsibility and the competitiveness of goods, according to the above analysis we can see that the competitiveness of goods and environmental

responsibility has a certain linear correlation. So set the model as follows:

$$Y = \alpha X + \beta + \xi \tag{7}$$

Among them, Y is the degree of environmental responsibility, X is the competitiveness of goods, α , β is the correlation coefficient, ξ is the random error.

IV. RESULTS DEMONSTRATE

A. Causality Test

According to the establishment of above indicators and the assumption of model, between the degree of environmental responsibility and the competitiveness of goods are think of existing a certain linear relationship and certain causality. In order to verify the certain causality and study specific causality between the degree of environmental responsibility and the competitiveness of goods, causality test is needed to analyze their causality. In order to conveniently verify, the degree of environmental responsibility and the competitiveness of goods are take logarithm and they are LNY and LNX. Inspection result is showed at the Figure 1 [5-7].

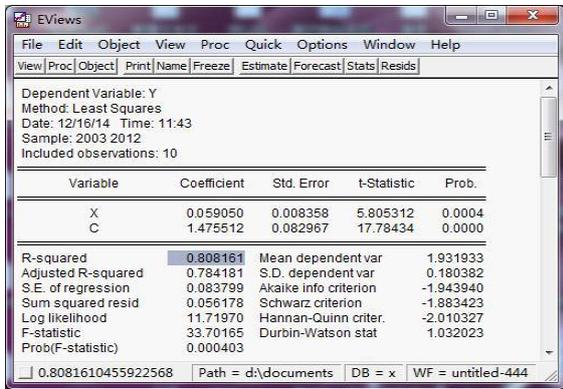


Figure 1. Granger causality test diagram.

According to Figure 1, the paper conclude that Y does not Granger Cause and P value of X is $0.8654 > 0.05$, so the original hypothesis is accepted and the degree of environmental responsibility is not granger cause of competitiveness of goods; X does not Granger Cause and P value of Y is $0.0420 < 0.05$, so the original hypothesis is rejected and the degree of environmental responsibility is granger cause of competitiveness of goods. Besides, this can illustrate that quite amount of carbon dioxide is removed by goods trade and the carbon dioxide emissions of buyer is reduced by buying product. The country of buying commodity removes environmental responsibility which should be undertaken by itself to commodity producers. The implied transfer of environmental responsibility is not fair to commodity producers. Because quite amount of carbon dioxide is removed by goods trade, linear regression analysis is needed to

analyze that how much is the effect which is the trade competitiveness on the implied transfer of carbon emissions.

B. Co-integration Test

Between of LNX and LNY is existed co-integration relationship by stationary test. This paper takes classic Engle-Granger two-step method to make co-integration test on LNX and LNY. Firstly, residual series is made stationary test. Secondly, regression model is estimated by least square method. The test is showed at Figures 2 and 3.

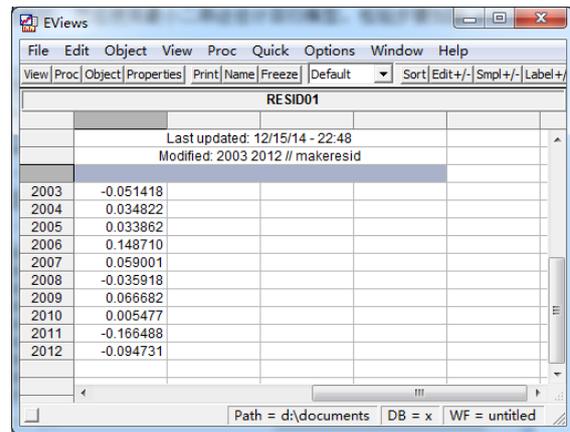


Figure 2. Unbalanced error inspection.

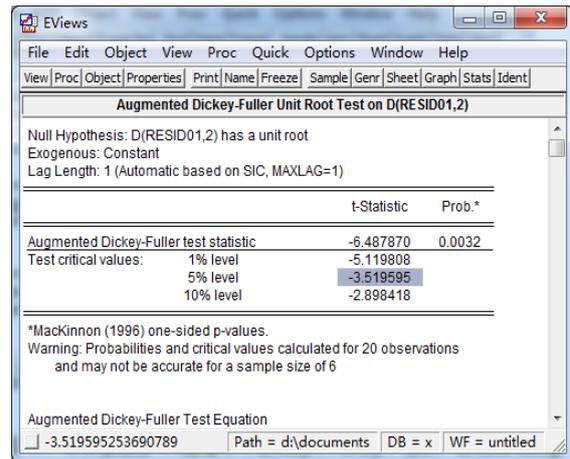


Figure 3. Residual sequence stationarity test.

As can be seen from Figure 2 residual sequence at 5% significant level is stationary. This also shows that it has a stable long-term cointegration relationship between the variables LNX, LNY. LNX, LNY were analyzed by OLT regression analysis. Estimation of the regression model are shown in Figure 4.

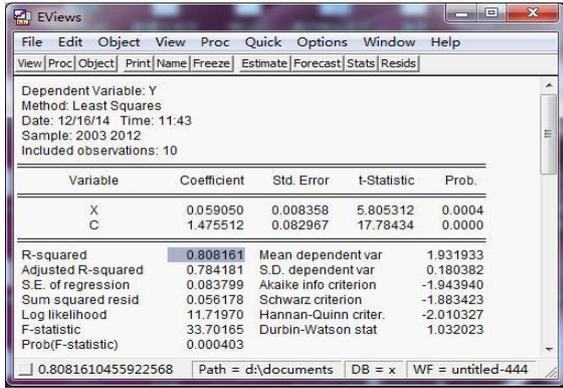


Figure 4. Least squares estimate output figure.

As can be seen from Figure 4, the fitting goodness of R2 is 0.808161. In the standard of Ordinary least squares estimation regression model, more than 0.8 can be considered a relatively high degree of fitting goodness, so the numerical calculation of LNX, LNY can be considered a high goodness of fit. At the same time parameter significance test (t test) with probability T statistics of P value is 0.0008<0.001. Therefore, refuse to test null hypothesis at the 0.001 level, and the regression parameters are very significant. The same equation significant test (F test) with probability F statistics of value is 0.0008<0.001. Therefore, refuse to test null hypothesis at the 0.001 level. The overall regression of equation is remarkable. But the value of Durbin-Watson stat was 1.032 under the significance level of 5%, n=9, k=1, conclusion by look-up table is that dL = 0.8241, dU = 1.32. Because of the dL<d<1.032<dU, it is unable to determine the correlation. By using the LM test can be seen that the P values are greater than 0.05, so there is no autocorrelation.

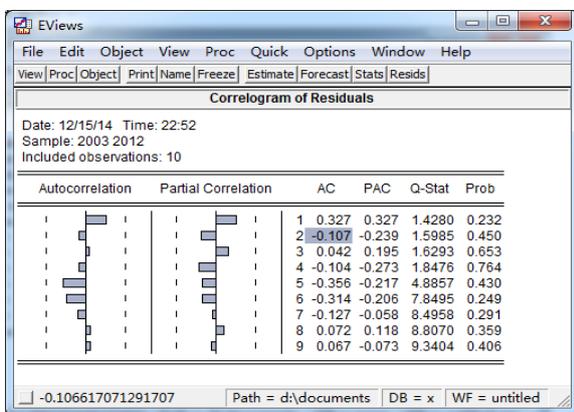


Figure 5. Autocorrelation correction results.

The regression co-integration equation can be concluded by the above results and it is showed at following:

$$LNY = 1.48 - 0.05 LNX$$

(0.082967) (0.008358)

The contents are standard error in the brackets.

By co-integration equations the paper concludes that LNX coefficient is negative and it illustrate that goods trade has an emission reduction's effect on implicit carbon emissions; Competitiveness of goods increase 1 unit and the degree of environmental responsibility will reduce 0.05 units. The carbon dioxide emissions of buyer can be reduced by buying product. At the same time the commodity producer produce more carbon dioxide. The degree of environmental responsibility is decreased with increasing competitiveness of goods. The decreased rate should be 1:0.05.

V. CONCLUSION

At first, this paper constructs the competitiveness of goods and environmental responsibility two indexes. Secondly, explain the data that are used in this paper and assume the conclusions by model. Finally, the correctness of the model is verified by co-integration test and Granger causality test.

In this paper, it is show that the goods trade competitiveness can promote the transfer of implicit carbon emissions. Goods competitiveness increases by one unit, goods producers should reduce 0.05 units of environmental responsibility accordingly. We should let goods purchase country to take the environmental responsibility. It is unfair to the goods produce country. The country of buying commodity removes environmental responsibility which should be undertaken by itself to commodity producers. The implied transfer of environmental responsibility is unfair to commodity producers. China should adjust the structure of production, change the current carbon accounting method, learn from the experience of developed countries emission reduction and strengthen international cooperation.

ACKNOWLEDGMENT

This research was financially supported by the Natural Science Foundation of Hebei Province.

REFERENCES

- [1] S. Nakano, A. Okamura, N. Sakurai, M. Suzuki, Y. Tojo, and N. Yamano, "The Measurement of CO2 Embodiments in International Trade: Evidence from the Harmonised Input-Output and Bilateral Trade Database," *STI Working*, No. 2009/03.
- [2] G. S. Ipek and E. Turut, "CO2 emissions vs. CO2 responsibility: An input-output approach for the Turkish economy," *Energy Policy*, vol. 35, no. 2, pp. 885-868, 2007.
- [3] A. James, "Research and Technology Transfer in china, Ecological Economic," *CO2 Emissions*, vol. 32, pp. 354-376, 2009.
- [4] B. wei, X. Fang, and Y. Wang, "Reach of the China International Trade of Carbon Emissions Based on Input Output Analysis," *Journal of Beijing Normal University*

- (Natural Science Edition), vol. 45, no. 4, pp. 413-419, 2009.
- [5] R. Yang, "Analysis of Carbon Emissions and the Policy Effect on Economic Growth in U.S.," *International Economic and Trade Research*, vol. 7, pp. 89-93, 2010.
- [6] A. W. Wyckoff and J. M. Roop, "The Embodiment of Carbon in Imports of Manufactured Products: Implications For International Agreements on Greenhouse Gas Emissions," *Energy Policy*, vol. 22, pp. 187-194, 1994.
- [7] R. Schaeffer and Andr Leal de S   "The embodiment of carbon associated with Brazilian imports and exports," *Energy Conversion and Management*, vol. 37, no. 6-8, pp. 955-960, 1996.
- [8] H. Hayami and M. Nakamura, *CO2 Emission of all alternative technology and bilateral trade between Japan and Canada:relocating production and an implication for joint implementation*, Tokyo: Keio University, 2002.