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AN EMPIRICAL TEST ON EFFECT OF INTRA-PRODUCT TRADE ON REGIONAL INCOME DISTRIBUTION: THE CASE OF LIAONING, CHINA

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ABSTRACT

This paper examines the relationship between intra-product trade and regional income distribution by empirical tests of co-integration and Granger causality with time series data from 1994 to 2013. The conclusion shows that intra-product trade and regional income distribution have a long-term equilibrium relationship. The exports of intra-product trade can significantly reduce the income gap between urban and rural residents, while the imports have a negative influence. At the meantime, the intra-product exports and imports are the one-way causal of income distribution. In addition, the capital contribution can enlarge the urban and rural income gap significantly. Education also has a negative influence, but it is non-significant.

Keywords: Intra-product trade, Income distribution, Liaoning, ADF test, Co-integration test, Granger causality test.

Contribution/ Originality

This study contributes in the existing literature in two main areas. First, this study focuses on the effect of intra-product trade on urban and rural income gap. Second, this study does an empirical test with Liaoning China which is rarely discussed in the intra-product trade literature.

1. INTRODUCTION

Traditional trade theory like comparative advantage, factor endowments and new trade theory in sixty or seventy time of twentieth century have analyzed the trade patterns and trade income of inter and intra industry trade which from the perspective of economies of scale and product differences. But the important assumptions of these theories are suited that the exchange of products are the basic unit of exchange and cannot be separated. With the development of economic globalization, the exchange activities of goods and services are not confined to a

product. With the continuous extension of industrial chain, many products are separated by the way of production processes into different countries which the developed countries are engaged in the capital and technology intensive processes, and the labor intensive processes like assembly processing is transferred to the developing countries who with cheap labor. The mode of international division of labor with the typical characteristics of vertical specialization once described as value chain division (Krugman, 1995) outsource (Feenstra and Hanson, 1997) fragmentation of production (Jones, 1997; Deardorff, 2001), intra product specialization (Arndt, 1997) etc. With the important impact to the global economic structure of this mode of division (Lu, 2004), the intra product trade has gradually became one of the research hot spot in the academic circles.

2. LITERATURE REVIEW

According to the factor endowment theory, the division of labor pattern of the intra product trade can make countries participate in the international division of labor based on comparative advantages and benefit from it .And with the trade development, the pattern will ultimately promote the equalization of factor of production income .However, many scholars have found that the intra product trade has no effect. In addition, due to the difference of the historical inheritance and the advantage of location, the developed and e developing countries show different situations of production factor abundance.

The developed countries are abundant of capital and technology, while the developing countries are generally abundant of labor. Therefore, in the mode of division products trade, developed countries as employers are often at the high end of the value chain, while the developing countries as contractors are in the low-end of the value chain .Therefore, intra product will inevitably have different effects on income distribution of the developed countries and the developing countries. Feenstra and Hanson (1996), Feenstra (1998) analyze the reasons why the income distribution gap was enlarging among America technology workers in seventy to ninety time of twentieth century by use the three factor model (skilled labor, non-skilled labor and capital).They thought it was because labor intensive production process was transferred to other developing countries by American manufactures .It made the non-skilled labor demand decline, while the skill labor demand increase relatively. Aitken and Harrison (1996) compared the effects of intra product trade on wage income among Mexico, Venezuela and America. The result shows that in Mexico and Venezuela, average wage level of industry was growth in the intra product trade. Deardorff (1998) analyzed the effect of intra product trade on comparative advantage and found the intra product trade played an important role in each nation's specialization, but the factors prices would be equalized.

In addition, Jones and Kieizkowski (2001), Jones (2005) thought that intra product trade has an important influence on non skilled labor and skilled labor income distribution, but it depends on the situation of labor abundance and intensive of outsourcing product factor. Deardorff (2005)

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analyzed the influence of income distribution brought by outsourcing activities in developed countries and developing countries. He believed non skilled labor income of developed countries will decrease to the level of developing countries if developed countries outsource the skilled labor to developing countries. With the difference of factor endowment and the formation of specialized division of labor conditions, both skilled and non skilled labors in developed nations could have benefited from it, bur the income distribution is expanding. Grossman and Hansberg (2006) analyzed the falling of outsourcing cost impacts on the income distribution in the intra product trade. They thought the decline in the cost will affect the production efficiency, relative prices and labor supply, which have different influence on income level of skilled labor and non-skilled labor. Koskela and Stenback (2010) analyzed the influence of outsourcing on wage income in incomplete labor market. They found the outsourcing enlarge the wage gap between skilled labor and non-skilled labor.

Some Chinese scholars have analyzed the influence of intra product trade on income distribution based on searching China and other developing countries. Chen (2007) believed that intra product trade can improve the wages of workers who work on the foreign trade industry. And he thinks the wages of workers who work in the department of export enhance more significant. Zong (2008) thought intra product specialization has increased the Chinese capital and wages of labor intensive products, and the wages of capital intensive products grow greatly. Gao (2008) used time series data of 1995-2006 to test the effect of intra product trade of income distribution of manufactory workers and found an increase of intermediate inputs export could improve the relative wages of non-technology employees and then decreased the income gap between technology and non-technology workers.

Gu (2009) analyzed the relationship between intra product trade and income of urban and rural residents, and find it will narrow the gap, but the effect is not significant. Li (2011) thought the intra product trade will enlarge the income gap of industries between technology intensive and technology-capital intensive, while reduce the income gap of heterogeneous labor between labor intensive industry and capital intensive industry. Teng and Zhu (2011) conducted an empirical test with 31 industry segments, and found that intra product trade could improve the skilled labor wage and expand the income gap, which is contrary to the effect of final product trade on income gap. Fan and Yin (2013) compared the effects of intra product trade and common trade on income gap of China, the results showed that intra product trade could enlarge the wage gaps of Chinese skilled and unskilled labors.

To sum up, majority researches are based on skilled and non-skilled labor to analyze the influence of intra product trade on income distribution, but the conclusions are different. In further, there are a lot of researches about manufactory labors' income in Chinese literatures, because of the important role of manufactory in intra product trade in China. However there is lack of analysis on the effect of intra product trade on income distribution between urban and

rural residents. As one of the biggest developing countries, China has a higher international vertical specialization.

It plays an important role in promoting employment and improving the income level. Especially in the process of urbanization in China, It plays an irreplaceable role in transferring the labor employment in rural and increasing the income. Therefore, the government can use intra product trade to regulate the income distribution through the studies on their relationship.

3. MODEL CONSTRUCTION AND VARIABLES DESCRIPTION

3.1. Model Construction

Considering dualistic characteristics in Chinese economy, we can construct a model composed of agriculture sector and non agriculture sector. Both of them use capital, rural labor (non skilled labor) and urban labor (skilled labor) as production factors. We assume the two sectors can be divided and product can be produced dispersedly in different countries. But production densities in different production processes are different. X_i stands for production process of the product based on Cobb Douglas Function, and then X_i can be expressed as,

$$PT_i = AK^m \left[\min \{ RL, UL \} \right]^n \qquad (1)$$

After evaluating the logarithm on both sides, equation (1) can be rewritten as following,

$$\ln PT_i = m \ln K + n \left[\min \{ RL, UL \} \right] + u \qquad (2)$$

Based on the methodology of Feenstra and Hanson (2001), urban and rural income distribution can be written as a function of intra product trade.

$$I = \alpha + \beta_1 MPT + \beta_2 XPT + \beta_3 K + \beta_4 EDU + \varepsilon \qquad (3)$$

In the type:

I —— income distibution

MPT —— intra product import trade

XPT —— intra product export trade

K —— capital stock

EDU —— the human capital.

In the intra product trade, if an area undertakes the process of skilled labor intensive, the labor demand in urban area is relatively increased. It can improve the urban labor wages. On the contrary, if an area undertakes the process of non skilled labor intensive, the labor demand in rural area is increased. It can improve the rural labor wages and the income distribution gap between urban and rural will narrow.

3.2. Variables Description

3.2.1. Income Distribution (I)

Gini coefficient, the ratio of urban and rural residents' income per capita, and Theil index are the common indexes. Gini coefficient is more sensitive to the income of middle class. Theil index is sensitive to income changes. At the same time, the two calculation methods are complicated. However, the ratio of urban and rural residents' income per capita is easier and more convenient to obtain and calculate.

3.2.2. Intra Product Trade (XPT/MPT)

Trade of product fragmentation, input trade and vertical specialization are usually used to measure intra product trade. Vertical specialization was given by Hummelsa *et al.* (2001), which has been seen as the most successful measurement method. And Vertical specialization has also been fully reflected in Chinese processing trade (Li, 2010). And meanwhile, it is difficult to obtain data in these measurements. Above all, the paper used processing trade volume as substitute proxies. And further it uses two indexes: intra product export trade (XPT) and intra product import trade (MPT).

3.2.3. Capital Variable (K)

Capital variable is indicated by capital stock. In view of the availability of data, we use fixed assets investment/GDP to substitute.

3.2.4. Human Capital Variable (EDU)

Factor endowment is an important determinant of intra product trade factors. Our country is still abundant in non-skilled labor, while the intra product trade bears the non-skilled labor intensive products. Therefore, we use the human capital as control variables, in order to analyze the effect of intra product trade on income distribution in urban and rural areas well. The relevant metrics of human capital are the enrollment rate of primary and middle schools, government spending on primary and middle school. But China is implementing 9 years compulsory education. Therefore, this index cannot be a good measure of human capital. In view of the education of our country is mainly depend on the government financial expenditure, we use expenditure on education/financial expenditure to indicate the human capital variable.

4. TEST AND ANALYSIS OF MODEL

4.1. Sample Selection and Data Sources

As of 2013, the amount of imports and exports of intra product trade is thirty-six billion seven hundred and seventy million dollars in Liaoning Province, which is 32.18% in total trade and close to the average level of China (32.63%). On the whole, intra product trade development

in Liaoning province is increasing rapidly. The amount of intra product trade in 2013 is 2163 times more than 1994, which the amount is seventeen million dollars.

In the most years from 1994 to 2013, the proportion of the amount of product trade is in 40% to 50%.In addition, Liu (2012) calculated the trade level of China's province according to the method that put forward by Hummels. The conclusion indicates that the level of intra product trade of Liaoning province has been ranked 3-6 in the whole country, and ranked the first in the northeast. Liaoning province participates in the international intra product trade actively with the factor endowment advantage of the large number of labor resources. Intra product trade has played an important role in promoting the economic development of Liaoning province. But at the same time, we cannot ignore the income gap between urban and rural residents is expanding. As of 2013, the per capita disposable income in urban is 25578 yuan. It is 8.4 times more than 1994, which is 3047 yuan. The net income in rural of Liaoning province is 10523 yuan. It is 7.4 times more than 1994. Although both urban and rural disposable incomes are increasing constantly, the income distribution gap is enlarged. Therefore, this paper selects Liaoning province as a sample to test the effect of intra-product trade on regional income distribution on model (3).

The data sample is 1994 to 2013, and from "Statistical Yearbook of Liaoning Province", "Statistical Communique of Nation Economic and Social Development of Liaoning in 2013. Because the data in 19994 and 1995 is missing, we calculate the growth rate as a complement. It is a commonly research method of studies of economic time series. So it won't affect the final result. In order to weaken the influence of heteroscedasticity, all variables in the model (3) are in logarithmic. The basic statistical characteristics of sample variables are shown in Table 1.

Table-1. Basic Statistics of Sample Variables

variables	averages	medias	maximums	minimums	Standard deviation
I	0.3634	0.3849	0.4224	0.2529	0.0495
MPT	2.4038	2.6894	2.9604	-0.0830	0.7843
XPT	2.5948	2.8573	3.1910	-0.1775	0.8393
K	-0.3419	-0.4003	-0.0383	-0.5781	0.2121
EDU	-0.8395	-0.8459	-0.7491	-0.8965	0.0376

4.2. The Test Results

Time series often have the spurious regression phenomena. To avoid the phenomenon, the paper first carries on the ADF test, and then analysis the relationship of long-term co-integration and causality.

4.2.1. ADF test

ADF test results as shown in table 2. Form the test result, the values of *MPT*, *XPT* and *EDU* are less than the critical value under the 5% level. So we reject the null hypothesis that unit

root exists, and they are steady. While the ADF value of K is greater than the critical value of 5%, we accept the null hypothesis that the unit root is existence, i.e. K is non stationary. And after the first order difference, they are still non stationary, but after the second order difference, they are steady. At this time, the variables meet the requirements of regression analysis. At the same time *I*, *MPT*, *XPT*, *K*, and *EDU* are the second order single integer, they satisfy the requirements of co-integration test.

Table-2. ADF Test Result (5% significant level)

variables	ADF	Critical value	conclusion
I	-5.7717	-3.0810	stable
MPT	-13.3532	-3.0299	stable
XPT	-12.5408	-3.0299	stable
K	-0.6963	-3.0404	non stable
EDU	-3.4097	-3.0299	stable
D(*I*,1)	-4.2651	-3.7912	stable
D(*MPT*,1)	-3.3503	-3.0656	stable
D(*XPT*,1)	-3.5580	-3.0404	stable
D(*K*,1)	-2.4189	-3.0404	non stable
D(*EDU*,1)	-4.0294	-3.0656	stable
D(*I*,2)	-5.2192	-3.1199	stable
D(*MPT*,2)	-5.7128	-3.0656	stable
D(*XPT*,2)	-7.4829	-3.0656	stable
D(*K*,2)	-5.3126	-3.0522	stable
D(*EDU*,2)	-4.0294	-3.0656	stable

Notes: D(, 1),D(, 2)represent first order different and second order different.

4.2.2. Co-Integration Test

On the basis of stability test, we verify the existence of the long-term stable equilibrium relationship among variables. The results are shown in table 3. From the regression results, Adjusted-R^2=0.8484, showed the equation simulated well. The improvements of the volume of imports of intra product trade, the level of capital and the level of labor education have a positive effect on the income distribution gap between urban and rural areas, which the effects of the import of intra product trade and capital level are significant. When the import of intra product trade changes every 1%,it will bring a positive impact of income distribution gap and capital that changes 44.89% and 10.03%, and the impact of labor education level is not significant. But export has a significant reverse effect on income gap between urban and rural residents in Liaoning province, which the effect degree of 39.37%.

In order to determine the stability test, we extract the residual of the regression sequence data, and carry on the ADF unit root test. Residual test results show that, at the 5% significant level of the residual sequence, the ADF value is -3.0299.So we reject the null hypothesis, the residual sequence is stationary. Therefore there is a long-term equilibrium relationship in the effects of intra product trade on income distribution gap between urban and rural areas.

Table-3. Co-integration Test Results

variables	coefficient	Standard deviation	P value
MPT	0.4489	0.0821	0.0001
XPT	-0.3937	0.0736	0.0001
K	0.1003	0.0267	0.0019
EDU	0.1820	0.1905	0.3546
constant	0.4929	0.1453	0.0040
F-stat	27.5856	D-W stat.	1.5815
R²	0.8803	R2 Adj.	0.8484

4.2.3. Granger Causality Test

Table 4 gives the test results of causal relationship between intra product trade and urban and rural income distribution. The results show that in the 5% significant level, import and export of intra product trade are one-way Granger reason for income distribution gap between urban and rural areas.

Table-4. Granger Causality Test Results (5% significant level)

The null hypothesis	F statistics	probability	conclusion
MPT does not Granger Cause I	6.6755	0.0094	refuse
I does not Granger Cause MPT	1.7775	0.2148	accept
XPT does not Granger Cause I	7.8853	0.0054	refuse
I does not Granger Cause XPT	2.4182	0.1269	accept

5. CONCLUSION AND SUGGESTIONS

Based on constructing the mode that the effects of intra product trade on income distribution, we examined the relationship between the two of long-term co-integration and causality of Liaoning area with the sample data in 1994-2013.The results show that intra product trade have a negative impact on urban and rural income distribution. That is to say, to strengthen the import of intra product trade and capital is not conducive to narrow the income gap between urban and rural distribution. Labor education level also has a negative impact, but it is not significant. The exports of intra product trade are helpful to the income distribution. Imports and exports of intra product trade are the one-way Granger reason of the urban and rural income distribution. Intra product trade, especially the exports have an important influence on narrowing the distribution gap between urban and rural residents.

Therefore, the government can consider narrowing the income gap between urban and rural areas by developing intra product trade and avoiding the negative effect that the imports bring, improving the added value and marginal profit of intra product trade in the province. The high and new technology products imports should be enhanced to optimize import structure. In addition, rural labor should have more trained or educated to stable the employment.

6. ACKNOWLEDGEMENTS

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