

The Effects of Foreign Trade and FDI on Income Distribution in the BRICS – from a Macro Perspective to a Case Study

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Abstract: The foreign trade and FDI affect the economic growth of BRICS countries. This paper constructs static panel data model and dynamic panel data model to analyze the influence effects that foreign trade and FDI made on income distribution of BRICS countries. The results show that changing of import and export and FDI has the same direction with economic growth of BRICS countries. Then we use national time series data to analyze the influence of foreign trade and FDI on national economic growth. We find that the influences of foreign trade and FDI on economic growth in the BRICS countries are quite different.

Key Words: Foreign trade, FDI, Economic growth, BRICS countries

1. Introduction

BRIC, without South Africa, was originally coined in 2003. South Africa was added to the list on April 13, 2011 creating BRICS. At present, the national territorial areas of BRICS are 3944.7 million square kilometers which accounts for about 29.6% of the world. As of 2014, BRICS countries represent almost 3 billion people, which is 40% of the world population. The gross domestic product (GDP) of BRICS occupies 18% of the world. And the trade volume of BRICS account for 17% of the world. BRICS increasingly contributes to the world economic growth with 3.9% average economic growth rate. With the increasing of foreign trade and economic growth, the domestic gap of income distribution becomes widening. The Gini coefficients of South Africa, Brazil, China, Russia and India are 0.631, 0.547, 0.474, 0.401 and 0.40, respectively. You may want to ask the following question. Do foreign trade and FDI of BRICS countries impact on the gap of income distribution? How heavily the effects?

Heckscher, E. (1919) and Bertil Ohlin (1933) laid the groundwork for substantial developments in the theory of international trade by focusing on the relationships between the composition of countries' factor endowments and commodity trade patterns as well as the consequences of free trade for the functional distribution of income within countries. The Heckscher–Ohlin Theorem states that countries export those commodities which require, for their production, relatively intensive use of those productive factors found locally in relative abundance.

After the 1970s, trade liberalization worsens the income inequality of developing countries, such as Brazil and China. Many academic scholars gave up trade inequality theory to analyze this issue but from the technical, institutional and legal perspective to analyze the income gap. However, with the spring up of new trade theory, the influence mechanism of trade made on income inequality becomes a hot topic of academic scholars again. From the perspective of

intermediate goods trade, Feenstra and Hanson (1997) found that trade scale would exacerbate domestic income inequality. Robertson (2000) studied the relationship between foreign trade and income inequality by utilizing the data of Mexico. Galiani and Sanguinetti (2003) analyzed the relationship between income polarization and trade liberalization of Argentina in 1990s. They found that the penetration rate of import and wage income differentiation have the same direction change. Mehta and Hasan (2012) analyzed the impact mechanism of trade liberalization made on wage income gap of India. Zhang L, Li J Y and Xu X X. (2012) found that developing countries tend to technological progress of capital which leads the element income slanting to capital. After the 2008 financial crisis, emerging economies became the stabilizer of the world economy. The BRICS countries, as the first echelon of emerging economies, have naturally become the focus of academic scholars. Some academic scholars carried out many studies about agricultural products, service trade, economic growth and carbon emissions of BRICS countries (Tao M and Deng J K., 2010; Pao H and Tsai C 2010; Chen Q F, 2013). However, the research on the relations between foreign trade and domestic income gap of BRICS is rare. This paper further explores the influence effects that foreign trade and FDI made on income distribution of BRICS countries by using the data of World Bank, which is based on the panel data model.

2. Model constructing and empirical analysis

Free trade can result in the owners of relative abundant factors getting income increased, and the income of owners of relative scarce factors declines, which means foreign trade, can make the income distribution pattern of factor owner's change. The income distribution of BRICS countries presents a deteriorating trend in the process of involving in foreign trade and national economic cooperation. Therefore, this paper constructs static and dynamic panel data model which is based on controlling economic growth and social system.

(1) Static panel data model design

Based on the research of Meschi and Vivarelli (2009), this paper constructs the static panel data model as Eq.(1).

$$GINI_{it} = a_1 trade_{it} + a_2 fd_{it} + \sum_k a_k X_{ikt} + \gamma_t + \lambda_i + \varepsilon_{it} \quad (1)$$

Here, $GINI_{it}$ denotes the situation of income inequality of i country in t period. a_1, a_2 and a_3 are coefficients. $Trade_{it}$ measures the degree of foreign trade of a country. fd_{it} is situation of utilizing foreign capital of a country. X_{ikt} are other control variables that influence income inequality. γ_t denotes time unobserved effects which mainly reflects the influences as time varying, such as employment policy, transfer payment policy and the price changing of main consumer products. λ_i represents region unobserved effects which reflects persistent differences between countries, such as economic development stage, social system and cultural tradition. ε_{it} is random error term.

(2) Dynamic panel data model design

The changes of any economic factors are likely to have a certain amount of inertia. The previous results may have a certain influence on the next period. The income gap of BRICS countries may have lag effect. Therefore, introducing lag variable into dynamic model can better control lag factors. The difference GMM and system GMM estimation method can estimate dynamic panel data model. This paper constructs the dynamic panel data model as Eq.(2).

$$GINI_{it} = \phi GINI_{i, t-1} + a_1 trade_{it} + a_2 fd_{it} + \sum_k a_k X_{ikt} + \gamma_t + \lambda_i + \varepsilon_{it} \quad (2)$$

The dynamic panel data model has the following two advantages. Firstly, regression process

may omit variables which relates to income distribution, such as cultural tradition and economic developing stage. However, these factors usually do not change over time. Taking difference can eliminate these invariant with time variables and individual unobserved effects. Therefore, taking difference can solve the problem of missing variables. Secondly, difference can eliminate reverse causality. However, dynamic panel data model may have endogenous problem. To solve this problem, this paper adopts the system GMM estimation method which is proposed by Arellano and Bover (1995). The specific method combines level regression equation and differential regression equation to estimate. Delayed leveling is instrumental variable of first-order difference in this estimation method and first-order difference is the instrumental variable of level variable. If the virtual test can be accepted, the instrumental variable in the model is appropriate.

(3) Index selection

The Gini coefficients of every country represent dependent variable in the model. The data of Gini coefficients come mainly from the World Bank database. The missing data are calculated by the following three approaches. The first one is calculated by the tendency charts of Gini coefficients which are provided by correlational studies. The second is double exponential smoothing method. The last is H-W smoothly added processing.

The foreign trade index is represented by export and import. The foreign capital actually utilized of every country represents FDI. These two indexes are processed by dividing by the CPI to eliminate the effects of price factor. In addition, the factors related to economic growth, public goods supply, employment and institutional factors can influence distribution of national income.

Economic growth indexes are denoted by per capita GDP and fixed asset investment. Under the condition of the emphasis on economic efficiency, economic grows faster, while social justice can be suppressed. Too much emphasis on social equity may also damage the economic efficiency. Therefore, there is a trade-off between economic growth and social equity. Simon Kuznets found that as an economy develops, market forces first increase and then decrease economic inequality by analyzing the data of America, the U.K., Germany, and so on. Kuznets believed that inequality would follow an inverted “U” shape. As research continues, many academic scholars find that inverted “U” shape curve is not suitable for every country. However, whether this curve is applicable to the BRICS countries need further discuss and verification. Therefore, this paper introduces the square of the per capita GDP in the regression model. The fixed asset investment index is represented by the World Bank database. Government investment in education represents public goods supply index. Education input variables mainly adopts public education expenditure. These three indexes are also processed by dividing by the CPI to eliminate the effects of price factor. Marketization, Urbanization and employment policies represent institutional factors. Marketization reflects the boundary between government and market. The more government intervenes to economic activities, the lower the marketization is. The BRICS countries, as emerging economies, the governments intervene a lot in the economic development process. Therefore, the marketization level is represented by the ratio of total government spending of financial expenditure. The improving of urbanization can help accelerate the resources flow in the urban and rural and eliminate economic development obstacle caused by dual structure. Urbanization is represented by the ratio of urban population of total population. The employment policies can influence the employment rate of a country. When the unemployment is high, the government can promulgate expanded employment policy to solve employment difficulties. The employment policies can solve the difficulties of low-income groups and increase their income

level. The data of employment are come from the World Bank database. Joining the World Trade Organization can significantly affect the foreign trade and foreign investment activities of BRICS countries. This paper introduces dummy variable (wto). If the BRICS countries don't join in the WTO, the value of 'wto' is 0. If not, the value of 'wto' is 1.

(4) Data description statistical analysis and ADF unit root stationary test

The relate data of BRICS countries are showed in Table 1.

Table 1 The related data descriptive statistics of BRICS countries

Variables	Observations	Mean value	Standard deviation	Minimum value	Maximum value
GINI	230	46.606	12.011	24.0	67.4
cap	230	2.19e+11	5.84e+11	15	3.85e+12
cty	230	48.136	20.743	19.358	84.871
edu	230	3.882	1.423	1.671	6.547
emp	230	20.865	27.28	2.1	78.1
ex	230	2.35e+10	6.98e+10	7.261	3.71e+11
fd	230	3.97e+08	1.42e+09	-4.52e+08	9.63e+09
gdp	230	7.99e+11	1.22e+12	6.60e+10	8.22e+12
im	230	3.12e+10	9.92e+10	9.064	6.62e+11
mkt	230	1.23e+11	1.79e+11	1.22e+10	1.12e+12
tim	230	1996	9.557	1980	2012
wto	230	0.495	0.501	0	1

For dynamic panel data mode, the panel data must be smooth under the premise of effective estimation, otherwise may lead to spurious regression problem. In order to obtain a reliable conclusion, this paper adopts PP-Fisher and ADF unit root testing approaches to carry out stationary test. The test results are showed in Table 2. The results show that the original data are not stationary series. The first-order difference data present stable characteristics.

Table 2 The related data stationary test of BRICS countries

Variables	ADF test Statistics	PP test Statistics	Variables	ADF test Statistics	PP test Statistics
D(GINI)	64.668***	124.782***	D(ex)	36.535***	81.462***
D(cap)	24.01***	55.126***	D(fd)	58.391***	92.86***
D(cty)	41.211***	77.719***	D(im)	29.625***	53.365***
D(edu)	48.255***	71.595***	D(mkt)	18.646	19.698
D(emp)	38.16***	40.66***	D(pgdp)	21.676***	27.021***

Notes: *** denotes 10% significance level, ** denotes 5% significance level.

(5) Regression results

In order to better analyze, this paper construct static panel model and dynamic panel data. The random effects model of the static panel model removes interclass mean. The dynamic panel data model contains the estimation of first-order difference model. Therefore, the above mentioned approaches both eliminate individual unobserved effects. There are some influence-factors changed over time in the model, such as income distribution policies, structure changes of factor endowments and economic cycle. The time unobserved effects have similar influences on every country. We can obtain the influences made by these changes by introducing time dummy variable in the model. Therefore, this paper introduces time trend variable (tim) to control the influences made by polices, structure changes of factor endowment and economic

cycle.

Due to the imperfectness of Russia's time series data, this paper only analyzes the other four countries. Based on the data of China, Brazil, India and South Africa from 1980 to 2012, this paper constructs the panel data model. The estimation results are showed in Table 3 and Table 4. According to the regression results of model 1, the comprehensive influence coefficient of foreign trade and investment on the income distribution of BRICS countries is 0.072 (see Table 4). Every 1% increasing of foreign trade and investment will lead the income distribution gap of BRICS countries to enhancing 7.2%.

The monomial coefficient and quadratic term coefficient of per capita GDP are statistically significant. The coefficient of quadratic term is minus, which means that the relation between per capita GDP and income distribution gap of BRICS countries is obviously reversed U-shape. The income Kuznets hypothesis is tenable. The result of model 1 derived from static panel data regression model. Without consideration of endogenous, the results of random effects model in model 1 are likely to be biased and inconsistent.

Table 3 The regression results of foreign trade and FDI influenced on income distribution gap of BRICS countries

Variables	Estimation method:	Estimation method:	Estimation method:	
	RE effect Model 1	Difference MM Model 2	System GMM	
	Model 1	Model 2	Model 3	Model 4
GINI _{i,t-1}	-	0.44*	0.281***	0.212***
cap	0.047**	0.090**	0.04**	0.041***
cons	-2.51	-5.23	-2.926*	-10.36***
cty	0.620*	0.51*	0.390***	0.018***
edu	-0.12*	-0.043**	-0.090***	-0.107***
emp	0.019*	-0.012*	-0.0038*	-0.0011*
ex	0.061**	0.028*	0.058***	0.05***
ex2	-	-	-	-
fd	0.0068**	0.007*	0.0086***	0.008*
fd2	-	-	-	-
gdp	2.562**	0.487*	1.967***	2.53***
gdp2	-0.045*	-0.01**	-0.035***	-0.046***
im	0.0056*	0.002*	0.013*	-
im2	-	-	-	-
mkt	0.036*	0.078*	0.019*	0.018*
tim	-0.015*	-0.018*	-0.011***	-
wto	-	0.005*	0.003*	-
Wald chi2	0.993	0	0	0
Prob>chi2				
Sargen test	-	0.582	0.253	0.19
p				
Number of obs	230	230	230	230
Data form	Panel data	Panel data	Panel data	Panel data

Note: *** denotes 10% significant level. ** denotes 5% significant level. * denotes 1% significant level.

Due to the endogenous among variables, the estimation results may be biased and inconsistent. Model 2 adopts difference GMM estimation approach. Model 2 estimates the relations between export, import, and FDI and income distribution gap. The probability value of Sargen test is above 0.1, which means we cannot refuse the null hypothesis under 10% significant levels. The null hypothesis is that instrumental variable is excessiveness identified. Therefore, instrumental variable is exogenous. The regression results of model 2 show that export and import, FDI have the same change direction with the income distribution gap of BRICS countries. As the foreign trade and FDI increasing, the domestic income distribution gap will enlarge. The excessiveness identified is minus, which means economic growth can help narrow the income gap. This conforms to Kuznets curves.

Model 3 adopts system GMM estimation approach. The regression results show that the comprehensive influence coefficient of foreign trade and investment on the income distribution of BRICS countries is 0.008. The influence of foreign trade and investment ranks only second to economic growth, export and fixed-asset investment. In addition, the coefficient obtained by system GMM approach obviously exceeds the difference GMM. The quadratic term coefficient of per capita GDP are all minus in model 1, model 2 and model 3, which conform to the shape of Kuznets curve. Although the income distribution gap of BRICS countries is large, it will shrink as the economic growth of BRICS countries. The income gap of Brazil and South Africa has showed a declined trend under the intervention of government's policies. The income gap of China will also narrow with technological progress and optimizing foreign trade structure. Therefore, the results are consistent with the basic situation.

3. Comparative analysis of influences of foreign trade and FDI on income gap of BRICS countries

Participating in foreign trade and investment profoundly affects the economic growth and income distribution pattern of the BRICS countries. However, the BRICS countries join the WTO in different time and the scale of investment and foreign is different. Moreover, the policies and cultural tradition are various. Therefore, foreign trade and investment make different influences on the income gap of each country. In order to distinguish these differences, this paper utilizes the time series data of BRICS countries to construct economic model. Firstly, the data have been carried out dimensionless method and stationary test. Then this paper estimates the model by using OLS approach. The regression results are shown in Table 4.

Model 1 utilizes the data of Brazil over 1961-2012 to estimate. When the economic growth and policies variables are controlled, the foreign trade and introduction of foreign capital almost make no change on the income distribution. The coefficient of 'wto' variable is 0.035. The income distribution gap presents widening tendency which verifies that the export and import and FDI enlarge the income gap of Brazil. We can obtain that Brazil conforms to the income Kuznets curve according to the regression results of quadratic term coefficient of per capita GDP.

Model 2 utilizes the data of China over 1980-2012 to estimate. When the economic growth and policies variables are controlled, the comprehensive influence coefficient of foreign trade and introduction of foreign capital is 0.14, which reflects that China's participation in national cooperation and international division of labor make the income gap widen. The coefficient of 'wto' variable is 0.040. The income distribution gap also presents widening tendency. The

quadratic term coefficient of per capita GDP is minus, which conforms to the Kuznets curve.

Model 3 carries out regression estimation by using the data of India from 1975 to 2012. When the economic growth and policies variables are controlled, the comprehensive influence coefficient of foreign trade and introduction of foreign capital is -0.23, which reflects that participation in national cooperation and international division of labor make the income gap of India shrink. The coefficient of 'wto' variable is -0.024, which illustrates the income gap of India narrow.

Model 4 carries out regression estimation by using the data of South Africa from 1963-2012. When the economic growth and policies variables are controlled, the comprehensive influence coefficient of foreign trade and introduction of foreign capital is 0.37. Due to the single products structure, foreign trade and introduction of foreign capital do not solve the problem of income inequality in South Africa. The coefficient of 'wto' variable is 0.025. We find that the income gap become large after joining WTO. The quadratic term coefficient of per capita GDP is positive number, which reflects that the Gini coefficient of South Africa does not conform to the Kuznets reversed U-shape curve.

Table 4 The regression results of influences foreign trade and FDI on income distribution gap

Variables	Model 1	Model 2	Model 3	Model 4
cap	-0.018***	-0.092**	-0.029*	-
cty	1.13*	5.201**	-2.28**	--0.194
edu	-0.07*	0.480*	0.042*	-0.158*
emp	-	1.859**	-0.028**	0.005*
ex	0.03***	0.087**	0.135**	0.366***
fd	0.008*	-0.0002*	0.013**	-0.004*
gdp	-0.0018**	0.086**	-10.92**	0.013**
gdp2	-0.02*	-0.026*	0.203**	0.001*
im	-0.0023*	0.058**	-0.20***	0.008*
mkt	0.072*	-0.156**	0.395**	0.080*
tim	-0.013**	-0.112**	-0.0003*	0.015**
wto	0.035*	0.040*	-0.024*	0.025*
Wald chi2	0.000	0.000	0.000	0.000
Number of obs	92	86	90	90
Data form	Time series	Time series	Time series	Time series

Note: *** denotes 10% significant level. ** denotes 5% significant level. * denotes 1% significant level.

4. Conclusions

BRICS countries participating in foreign trade and the introduction of foreign capital not only promote the economic growth, increase the resources utilization efficiency and become important forces in the world, but also profoundly affect their income distribution pattern. This paper utilizes the data of the World Bank to analyze this issue. We take BRICS countries as a whole and construct a dynamic panel data model by using GMM estimation approach. We find that the influence coefficients that export, import and FDI on income distribution gap of BRICS countries are 0.059, 0.014 and 0.087, respectively. The comprehensive influence coefficient of foreign trade and introduction of foreign capital on income gap is 0.081, which reflects that the income gap of BRICS countries in the process of opening up is expanding. According to the different condition

of each country, this paper establishes different models for each BRICS countries based on the time series data. We find that the income gap of Brazil, South Africa and China presents widening tendency after joining the WTO. The comprehensive influence coefficients of foreign trade and introduction of foreign capital on income gap in these three countries are 0.15, 0.37 and 0.14. However, the income gap of India shows a narrowing tendency after joining the WTO. India's comprehensive influence coefficient of foreign trade and introduction of foreign capital on income gap is -0.07. The time series data of Russia is too short that cannot be established econometric model to carry on the empirical analysis. However, Russia has been actively involved in the international economic cooperation and division of labor since 1989. The ratio of dependence on foreign trade has maintained above 50%. The Gini coefficient of Russia is more than 0.4. We can conclude that high foreign trade dependence and high income gap both exist in Russia.

Research on the relationship between foreign trade and national income gap is an eternal theme accompanied by the trade liberalization and global economic integration process. Due to the limitation of data source, this paper only analyzes the domestic income gap from foreign trade and FDI perspective and does not analyze from the aspects of intra-industry trade, service trade and so on. These are the direction for further research in the future.

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