Fiscal Expenditure, Trade Openness and Income Distribution

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As a policy tool of income redistribution, fiscal expenditure cannot change the unfair primary distribution caused by trade openness. Moreover, the effect of trade openness on the scale of fiscal expenditure distorts its income redistribution effect. This paper's empirical analysis shows as follows. (1) Both fiscal expenditure and trade openness expand income gap on the whole. (2) Whatever budget structure and expenditure category, fiscal expenditure cannot affect the scale of trade openness significantly, which means that fiscal expenditure cannot indirectly affect trade openness' income distribution effect through its scale. (3) Trade openness can reduce the scale of public finance expenditure and most categories' fiscal expenditure, which means that trade openness can indirectly affect fiscal expenditure's income redistribution effect through its scale. Therefore, trade openness will limit and distort fiscal expenditure's income redistribution effect. While improving the income distribution effect of fiscal expenditure, we should also recognize that this effect is limited.

Keywords: fiscal expenditure, trade openness, income distribution, budget structure, expenditure category

1. Introduction

Fiscal expenditure is an important policy tool of national income redistribution. At present, the theoretical circle generally think that it is necessary to give full play to income redistribution function of fiscal expenditure, to reduce income gap between residents by improving expenditure efficiency and optimizing expenditure structure (Wolff and Zacharias, 2007; Cong, 2012). However, even if fiscal expenditure can positively adjust unfair income distribution, its adjustment ability will also be challenged by trade openness.

On the one hand, trade openness may limit the ability of fiscal expenditure to adjust income distribution. The effect of fiscal expenditure on income distribution

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is mainly concentrated on national income redistribution, while it cannot have a substantial impact on primary distribution of national income (that is, the factor income distribution). This basic feature determines the boundary of impact of fiscal expenditure on income distribution: fiscal expenditure only can reduce income gap as much as possible by optimizing redistribution on the basis of unjustness of the primary income distribution, while the income inequality caused by primary income distribution cannot be changed (Yang, 2013). At present, the academic circles generally believe that the Stolper-Samuelson Theorem is true in China, that trade openness has caused unfair primary distribution in China to a certain extent (Li *et al*., 2011; Zakaria and Fida, 2016). Therefore, trade openness will inevitably distort primary distribution of national income, and thus restrict the adjustment ability of fiscal expenditure on income distribution.

On the other hand, trade openness may distort the ability of fiscal expenditure to adjust income distribution. Both theoretical research and practice in various countries show that trade openness may affect the scale of fiscal expenditure, but there are disputes in specific ways of influence. Some scholars support the "efficiency hypothesis", and think that trade openness reduces the scale of fiscal expenditure (Alesina and Perotti, 1997; Gao and Huang, 2016); and some scholars support "compensation hypothesis", holding that trade openness increases the scale of fiscal expenditure (Rodrik, 1998; Gao and Mao, 2011). In addition, the impact of trade openness on the scale of fiscal expenditure is likely to vary from time to time, place to place and different factor endowments (Mao *et al*., 2015; Mei and Gong, 2012; Arawatari, 2015). Whichever of the "compensation hypothesis" or "efficiency hypothesis" is true, trade openness will significantly affect the scale of fiscal expenditure, which is likely to distort the adjustment ability of fiscal expenditure on income distribution. Therefore, trade openness will distort the adjustment effect on income distribution by influencing the scale of fiscal expenditure, and this distortion has certain unpredictability.

On the basis of full consideration of budget structure and expenditure category, this paper uses the simultaneous equation model and panel data of 27 provincial units from 1998 to 2009 to verify the effect of fiscal expenditure, trade openness and the possible relationship between the two on income distribution. The conclusion is that trade openness indeed restricts and distorts the income distribution adjustment ability of fiscal expenditure to some extent, and China's fiscal expenditure has expanded income gap overall, and has produced a clear reverse adjustment on income distribution. Therefore, when using fiscal expenditure as a policy tool to adjust unfair income distribution, we should fully realize that its ability of adjusting income distribution is limited. At the same time, we should do everything possible to fully explore the function of fiscal expenditure to adjust income redistribution, and to minimize the distorting effect of trade openness on

income distribution.

The innovation and contribution of this paper are as follows. (1) The paper proposes the core argument of "trade openness may restrict fiscal expenditure's ability to adjust income distribution", analyzes and verifies the limited ability of fiscal expenditure to adjust income distribution, thus enriching the related research on income distribution. (2) The paper puts forward the core argument of "trade openness may distort fiscal expenditure's ability to adjust income distribution", and discusses the income distribution effect caused by the impact of trade openness on the scale of fiscal expenditure for the first time, which enriches the related research on the relationship between trade openness and fiscal expenditure. (3) Based on different budget structure and expenditure category, the paper categorizes fiscal expenditure in a more specific way, and discusses the income distribution effect of different budgetary structures and different expenditure categories on the premise of ensuring the reasonable and basic statistics, which enriches the related research on fiscal expenditure.

2. Literature Review

2.1. The Effect of Fiscal Expenditure on Income Distribution

The income distribution effect of fiscal expenditure has always been research hotspots. The existing research showed that most scholars believe that China's fiscal expenditure has not only failed to effectively adjust, but even expanded the income gap. Mo and Zhang (2011) argued that in the framework of Chinese local government's pursuit of economic growth and dual economic structure, the increase of fiscal expenditure would increase the Gini coefficient and expand social income distribution gap. Lu and Chen (2004), Lei and Cai (2012) believed that urban-oriented fiscal expenditure policy had led to continuous expansion of income gap between urban and rural areas in China. The study of Shen and Zhang (2007) showed that in China's rural public expenditure, the ratio of productive expenditure and basic construction expenditure was too high, while the expenditure on agricultural scientific research and social welfare was too low. This expenditure structure restricted the income adjustment ability of fiscal expenditure.

Of course, some scholars hold a relatively positive view on the income distribution adjustment ability of fiscal expenditure. Wolff and Zacharias (2007) showed that government expenditure alleviated income inequality as a whole. Wu *et al*. (2006) believed that government's welfare expenditure and transfer payments had a more significant role in adjusting income in rural sector. Hong *et al*. (2014) further pointed out that the growth of the livelihood fiscal expenditure and its capital investment had

the "rural-oriented" characteristics, which would effectively reduce the income gap between urban and rural residents. Therefore, Cong (2012) suggested that in order to improve the distribution pattern of national income, China should gradually reduce the expenditure on economic construction, control and reduce administrative expenditure of government, and increase the expenditure on of people's livelihood and social welfare.

2.2. The Effect of Trade Openness on Income Distribution

The effect of trade openness on income distribution has always been research hotspots. According to the existing research, scholars generally believe that the Stolper-Samuelson Theorem is true, trade openness will expand domestic income gap. Egger and Etzel (2012) found that trade openness would expand income inequality between trade sector and non-trade sectors. Egger and Kreickemeier (2012) showed that the inequality of domestic income resulted from trade openness would be more serious and more diverse with the expansion of trade openness. Zhang *et al*. (2012) conducted theoretical analysis and empirical tests and showed that under the influence of international trade, technological progress of developing countries was biased towards capital, which led to the decline of labor income. Bergh and Nilsson (2010), Foellmi and Oechslin (2010), Zakaria and Fida (2016) used transnational panel data and the results showed that trade openness would expand domestic income gap in developing countries.

In researches taking China as sample, Li *et al*. (2011) studied the impact of trade openness on the income distribution of Chinese urban residents in detail and the results showed that the impact of trade openness on high skilled labor force was greater than that on low skilled labor force, and the impact on capital income was greater than labor income. Zhao and Zhang (2013) showed that international trade led to redistribution of capital and labor among different sectors, which led to the deepening of the capital intensive sectors and the shrinking of labor intensive sectors in China, and eventually reduced total labor income share continuously in China. Zhang and Yuan (2011) empirically tested the impact of trade openness on domestic income gap since the entry into WTO, and the results showed that in the short term, trade globalization would deteriorate China's domestic income distribution.

2.3. The Effect of Trade Openness on the Scale of Fiscal Expenditure

Academia has always been divided about the impact of trade openness on fiscal expenditure. Some scholars support the efficiency hypothesis and believe that trade openness enhances the liquidity of factors, that factor owners can demand the government to reduce intervention by threatening to withdraw or withdrawing.

Therefore, the government will reduce tax rate, and the scale of fiscal expenditure to attract international factor inflow by increasing "efficiency". Alesina and Perotti (1997) believed that trade openness made the government mitigate the control and intervention of market, which will bring about the promotion of market efficiency and the reduction of the scale of fiscal expenditure. Hu *et al*. (2013) found that trade openness can improve government efficiency and was conducive to suppressing the expansion of local government scale as well as leading to the adjustment of government expenditure scale and structure in the future.

Other scholars support the compensation hypothesis, which believes that trade openness will lead to greater external risks, thus lead to domestic economic fluctuations, unemployment and other problems. Therefore, the government will increase the scale of fiscal expenditure to "compensate" the individuals who have suffered losses in the process of trade openness. Rodrik (1998) found that economies with relatively high trade openness generally had relatively large government expenditure scale. Ram (2009) analyzed panel data of 150 countries over 41 years, and concluded that foreign trade would significantly expand government scale. Jetter and Parmeter (2015) found that countries with high trade openness tended to have larger government scale.

In addition, some scholars hold a relatively comprehensive view. Mao *et al*. (2015) found that the impact of trade openness on government scale was not static, and showed different mechanisms in different historical periods. Mei and Gong (2012) showed that the relationship between trade openness and the scale of fiscal expenditure was obviously different between developing countries and developed countries as well as among different regions in one country. Arawatari (2015) believed that whether "compensation hypothesis" or "efficiency hypothesis" was tenable depended on differences between domestic and trading partners' factor endowments.

On the whole, the academic circles have discussed income distribution effect of fiscal expenditure, income distribution effect of trade openness and the impact of trade openness on fiscal expenditure, but there is still some room to be improved. First, there is not enough attention to the income distribution effect caused by trade openness on the scale of fiscal expenditure. Second, budgetary structure of fiscal expenditure has been ignored. Third, the classification of fiscal expenditure functional is not accurate enough, and the processing of statistic scope is too simple. To sum up, this paper intends to put fiscal expenditure and trade openness in the same framework to analyze fiscal expenditure, trade openness and the impact of the possible interaction between the two on income distribution. At the same time, this paper will give full consideration to budget structure and expenditure categories of financial expenditure on the basis of ensuring reasonable and consistent statistics.

3. Theoretical Analysis

This paper first analyzes the impact of trade openness on fiscal expenditure by an endogenous economic growth model which introduces fiscal expenditure and trade openness, and then puts fiscal expenditure and trade openness in the same framework to analyze its impact on income distribution, thus proving that trade openness will restrict and distort the income distribution effect of fiscal expenditure.

3.1. Analysis of Impact of Trade Openness on Fiscal Expenditure

Referring to Barro (1990) and Hu *et al*. (2013), this paper constructs an endogenous economic growth model including fiscal expenditure and trade openness at the same time:

$$Y = K^{\alpha}(AL)^{\beta} EX^{\gamma} TR^{\theta}$$

$$\dot{K} = sY - \delta K - EX$$

$$\dot{A} = gA,\ \dot{L} = nL$$

Among them, Y represents gross output, K represents total capital input, A represents technological level, L represents total labor input, EX represents total government fiscal expenditure, TR represents total volume of trade, $0<\alpha,\beta,\gamma,\theta<1$ and $\alpha+\beta+\gamma+\theta=1$, s represents saving rate, g represents technological progress rate, n represents population growth rate, δ represents capital depreciation. Dividing abovementioned variables by AL ($y=Y/AL$, $k=K/AL$, $ex=EX/AL$, $tr=TR/AL$), so:

$$y = k^{\alpha} ex^{\gamma} tr^{\theta}$$

$$k = sk^{\alpha} ex^{\gamma} tr^{\theta} - (n+g+\delta)k - ex$$

Make $\dot{K} = 0$, so:

$$sk^{\alpha} ex^{\gamma} tr^{\theta} - (n+g+\delta)k - ex = 0$$

Take the derivative of tr on both sides of the equation:

$$s\alpha k^{\alpha-1} ex^{\gamma} tr^{\theta} \frac{\partial k}{\partial tr} + s\gamma k^{\alpha} ex^{\gamma-1} tr^{\theta} \frac{\partial ex}{\partial tr} + s\theta k^{\alpha} ex^{\gamma} tr^{\theta-1} - (n+g+\delta)\frac{\partial k}{\partial tr} - \frac{\partial ex}{\partial tr} = 0$$

Make $f(k,ex,tr)=\dfrac{(n+g+\delta)-s\alpha k^{\alpha-1}ex^{\gamma}tr^{\theta}}{s\gamma k^{\alpha}ex^{\gamma-1}tr^{\theta}-1}$, $g(k,ex,tr)=\dfrac{s\theta k^{\alpha}ex^{\gamma}tr^{\theta-1}}{s\gamma k^{\alpha}ex^{\gamma-1}tr^{\theta}-1}$, so:

$$\frac{\partial ex}{\partial tr}=f(k,ex,tr)\frac{\partial k}{\partial tr}-g(k,ex,tr)$$

From the last equation, it is clear that the symbol of $\partial ex/\partial tr$ is determined by $f(k,ex,tr)$, $g(k,ex,tr)$ and $\partial k/\partial tr$, it can be positive or negative. That is to say, trade openness may expand the scale of fiscal expenditure (i.e. compensation hypothesis), it also may reduce the scale of fiscal expenditure (i.e. efficiency hypothesis). Based on that, this paper puts forward the following hypotheses.

Hypothesis 1: Trade openness will significantly affect the scale of fiscal expenditure, but the direction is undefined.

3.2. Analysis of the Impact of Fiscal Expenditure and Trade Openness on Income Distribution

Suppose an open economy is composed of two sectors *M* and *N*, per capita net income of sector *M* and *N* is *m* and *n* respectively. Because fiscal expenditure and trade openness will significantly affect national income, and trade openness will affect the scale of fiscal expenditure, *m* and *n* can be expressed as the function of trade openness (*TR*) and fiscal expenditure (*EX*):

$$m\left(TR,\ \theta\cdot EX(TR)\right),\ n\left(TR,(1-\theta)\cdot EX(TR)\right)$$

Among them, θ is the ratio of fiscal expenditure obtained by sector *M* of total fiscal expenditure, $(1-\theta)$ is the ratio of fiscal expenditure obtained by sector *N* of total fiscal expenditure.

Make *incgap*=*m*/*n*, take derivative of *EX* on both sides of the equation, so we have income distribution effect of fiscal expenditure:

$$\frac{\partial incgap}{\partial EX(TR)}=\frac{1}{n^2}\left[m_2n\theta-mn_2(1-\theta)\right] \tag{1}$$

Furthermore, take derivative of *TR* on both sides of *incgap*=*m*/*n*, so we have income distribution effect of trade openness:

$$\frac{\partial incgap}{\partial TR}=\frac{1}{n^2}\left(m_1n-mn_1\right)+\frac{1}{n^2}\left[m_2n\theta-mn_2(1-\theta)\right]\cdot\frac{\partial EX(TR)}{\partial TR} \tag{2}$$

Take equation (1) into equation (2):

$$\frac{\partial incgap}{\partial TR} = \frac{1}{n^2}\left(m_1 n - m n_1\right) + \frac{\partial incgap}{\partial EX(TR)} \cdot \frac{\partial EX(TR)}{\partial TR} \tag{3}$$

In the above equation, the first item on the right side of the equation $\frac{1}{n^2}\left(m_1 n - m n_1\right)$ represents the direct impact of trade openness on income distribution, the second item on the right side of the equation $\frac{\partial incgap}{\partial EX(TR)} \cdot \frac{\partial EX(TR)}{\partial TR}$ represents indirect impact of trade openness on income distribution by influencing the scale of fiscal expenditure.

In view of the impact of trade openness on national income mainly in primary distribution, while fiscal expenditure mainly affects national income in redistribution. If $\frac{1}{n^2}\left(m_1 n - m n_1\right) > 0$, the Stolper-Samuelson Theorem is true, trade openness will deteriorate the primary income distribution, and fiscal expenditure can only reduce income gap as much as possible by optimizing redistribution on this basis, which is actually a restriction of fiscal expenditure in the field of income distribution. At the same time, in view of the uncertainty of the impact of trade openness on the scale of fiscal expenditure, the distorting effect of trade openness on fiscal expenditure's income adjustment ability $\frac{\partial incgap}{\partial EX(TR)} \cdot \frac{\partial EX(TR)}{\partial TR}$ will also show certain unpredictability. In this case, even if fiscal expenditure can effectively adjust income distribution, its ability to adjust income will also be challenged by trade openness. Based on this, the following hypotheses are proposed.

Hypothesis 2: Trade openness will directly affect income distribution in primary income distribution, which actually limits financial expenditure's role as a redistribution policy tool in income distribution.

Hypothesis 3: Trade openness will indirectly affect income distribution through the impact of the scale of fiscal expenditure on income redistribution, which is essentially a distortion of fiscal expenditure's ability to adjust income, and the direction of this distortion is uncertain.

4. Model, Indicators and Data Sources

4.1. Empirical Model

Referring to the practice of Chao and Shen (2014), this paper uses a simultaneous equation model to make an empirical analysis. Through the construction of a

complete structural equation to analyze the impact of fiscal expenditure, trade openness, and possible interaction relationship between the two on income distribution. The basic form of the simultaneous equation model is as follows:

$$\begin{cases} gini_{it} = \alpha_0 + \alpha_1 trade_{it} + \alpha_2 \exp_{it-1} + \alpha_3 \exp_{it-2} + \sum_{j=3}^{n1} \alpha_j X_{jit} + \mu_{Gi} + \varepsilon_{Git} & (4) \\ trade_{it} = \beta_0 + \beta_1 \exp_{it} + \beta_2 \exp_{it-1} + \beta_3 \exp_{it-2} + \sum_{j=2}^{n2} \beta_j Y_{jit} + \mu_{Ti} + \varepsilon_{Tit} & (5) \\ exp_{it} = \gamma_0 + \gamma_1 trade_{it} + \gamma_2 \exp_{it-1} + \gamma_3 \exp_{it-2} + \sum_{j=2}^{n3} \gamma_j Z_{jit} + \mu_{Ei} + \varepsilon_{Eit} & (6) \end{cases}$$

The simultaneous equation model in this paper consists of three basic equations, in which Gini represents income distribution, trade represents trade openness, *exp* represents the scale of fiscal expenditure, *X*, *Y* and *Z* are the set of control variables of corresponding equations, μ_{Gi}, μ_{Ti} and μ_{Ei} are individual effects, ε_{Git}, ε_{Tit} and ε_{Eit} are random disturbance. Specifically, equation (4) is the income distribution equation. It mainly studies the influence of fiscal expenditure and trade openness on income distribution, and it is the main equation of this paper. As the main role of fiscal expenditure is to provide public services (such as education, medical care, social security, etc.), these public services do not directly affect the current income distribution, but will have an impact on income distribution in the future. Therefore, in the income distribution equation, this paper selects the scale of fiscal expenditure lagging one and two periods as the core explanatory variables of current income distribution. Equation (5) is the trade openness equation. It mainly studies the influence of the scale of fiscal expenditure on total volume of trade, it is an auxiliary equation of this paper. Equation (6) is the fiscal expenditure equation. It mainly studies the influence of trade openness on the scale of fiscal expenditure, and it is also an auxiliary equation of this paper.

In the specific empirical analysis, the linear combination of all exogenous variables is used as instrumental variable of endogenous variables, and a three stage least square method (3SLS) is used to estimate the simultaneous equation model. In the 3SLS processing mode, all endogenous variables on the right side of the equation group are estimated by instrumental variables, which can solve the multiple collinearity and endogeneity to a certain extent, thus ensuring the accuracy of the parameter estimation to a certain extent.

In the simultaneous equations, α_1 represents the income distribution effect of trade openness. α_2 and α_3 represent the income distribution effect of fiscal expenditure. β_1, β_2 and β_3 indicate the possible impact of fiscal expenditure on trade openness, γ_1 indicates the possible impact of trade openness on fiscal expenditure. Specifically: (1) If α_1, α_2 and α_3 are significant, while β_1, β_2 and β_3 are not significant, it means that both trade openness and fiscal expenditure can affect income distribution, but fiscal expenditure cannot affect the scale of trade openness. This shows that fiscal expenditure can neither significantly affect primary distribution, nor significantly affect trade openness which is the key factor

in distorting primary distribution. So it can be concluded to some extent that "trade openness restricts the ability of fiscal expenditure to adjust income distribution". (2) If γ_1 is significant, and α_2 or α_3 is also significant, it means that trade openness can affect fiscal expenditure and fiscal expenditure can affect income distribution. This shows that trade openness will indirectly affect the income distribution effect of fiscal expenditure by influencing the scale of fiscal expenditure. So it can be concluded to some extent that "trade openness distorts the fiscal expenditure's ability to adjust income distribution".

4.2. Indicators Design and Data Sources

gini represents the overall situation of income distribution, which is represented by the Gini coefficient of residents' income. The specific algorithms and data sources are detailed in Tian (2012); *trade* represents the degree of trade openness and is expressed by (import + export) /GDP, and the related data are derived from *China Statistical Yearbook* over the past years; *exp* represents the scale of fiscal expenditure, which can be expressed by total fiscal expenditure /GDP, and total fiscal expenditure equals total expenditure of public budget plus total expenditure of government fund budget, and relevant data are derived from local financial statistics over the past years.

X is a set of control variables of the income distribution equation, referring to the existing literature (Lu and Chen, 2004; Li *et al*., 2011), here the industrial structure (*estru*), urbanization rate (*urb*), capital openness degree(*capit*), economic development (*pergdp*), ownership structure (*private*) and fiscal decentralization (*fd*), as well as entering into WTO as dummy variable (*D2001*), income tax sharing mechanism reform as dummy variable (*D2002*) are controlled. *Y* is a set of control variables of the trade openness equation, referring to the existing literature (Xu *et al*., 2006; Gu and Ma, 2015), here the domestic saving investment ratio (*S*/*I*) and financial development degree (*finance*), population age structure (*astru*), local population scale (*psize*), urbanization rate (*urb*), capital openness degree (*capit*), economic development degree (*pergdp*), ownership structure (*private*) and fiscal decentralization (*fd*), as well as entering into WTO as dummy variable (*D2001*), income tax sharing mechanism reform as dummy variable (*D2002*) are controlled. *Z* is a set of control variables of the fiscal expenditure equation, referring to the existing literature (Gao and Mao, 2011; Mao *et al*., 2015), here the industrial structure (*estru*), population age structure (*astru*), local population scale (*psize*), urbanization rate (*urb*), and capital openness degree(*capit*), economic development degree (*pergdp*), ownership structure (*private*) and fiscal decentralization (*fd*), as well as entering into WTO as dummy variable (*D2001*), income tax sharing mechanism reform as dummy variable (*D2002*) are controlled. Relevant data come from *China Statistical Yearbook*, *Yearbook of China's Population and Employment Statistics,* and *Yearbook of China's Taxation*.

According to the identification condition of simultaneous equation model, the

simultaneous equation model established in this paper is over identified. In view of the availability of data, the income Gini coefficient of residents in Jilin, Shandong, Hainan and Tibet cannot be calculated, the income Gini coefficient of only 27 provinces can be obtained. Meanwhile, since the local fiscal statistics since 2010 cannot be obtained, the data analyzed in this paper is only that from 1998 to 2009. Based on this, this paper uses the panel data of 27 provincial units from 1998 to 2009 for empirical analysis. The detailed calculation method of the variables involved in the model is shown in Table 1.

Table1. Variables Definition and Calculation Method

Symbols	Variables	Calculation method
gini	Gini coefficient of residents	Tian (2012)
trade	Trade openness degree	(Import + Export) /GDP
exp	The scale of fiscal expenditure	(Public fiscal budget expenditure + Government fund budget expenditure) /GDP
estru	Industrial structure	Employment in the tertiary industry /Total employment
S/I	Domestic saving investment ratio	Residents saving balance/total investment in domestic fixed assets
finance	Financial development degree	RMB loan balance at the end of the year / RMB balance at the end of the year
astru	Population age structure	Total rearing ratio of the population over 14 and under 65
psize	Local population scale	Local total population/local total area
urb	Urbanization rate	Non-agricultural population/total population
capit	Capital openness degree	FDI/GDP
pergdp	Economic development degree	GDP growth rate per capita
private	Ownership structure	Non-state-owned sector fixed assets investment /total fixed assets investment
fd	Fiscal decentralization	Tax revenue actual stored of local government/total tax revenue of local government
D2001	Entering into WTO as dummy variable	0 in 1998-2000, 1 in 2001-2009
D2002	Income tax sharing mechanism reform as dummy variable	0 in 1998-2000, 1 in 2001-2009

5. Empirical Test

In this paper, the 3SLS method is used to estimate the simultaneous equation model, and the regression results are shown in Table 2. The empirical results show that in the income distribution equation, the coefficient of *trade* is 0.134 and significantly positive, the coefficient of *exp* (–1) is 0.166 and significant positive, which indicates that trade openness will significantly deteriorate domestic income distribution, and fiscal expenditure in China expands the income gap and produces a “reverse adjustment” to income distribution. In the trade openness equation, the coefficients of *exp*, *exp* (–1)

and *exp* (–2) are not significant, which indicates that the expansion of fiscal expenditure does not have a significant impact on trade openness degree, but also means that fiscal expenditure cannot change the unfair income distribution caused by trade openness by affecting trade openness scale. Therefore, there exists the inhibitory effect of trade openness on fiscal expenditure's income adjustment ability. In the fiscal expenditure equation, the coefficient of *trade* is –0.131 and significantly negative, which indicates that the increase of trade openness will significantly inhibit the scale of fiscal expenditure, and the "efficiency hypothesis" is true. Therefore, trade openness will reduce the impact of fiscal expenditure on income distribution by restraining the scale of fiscal expenditure. When fiscal expenditure adjusts income distribution adversely, the "efficiency hypothesis" makes trade openness alleviate the adverse adjustment of the unfairness of the fiscal expenditure to the income distribution to a certain extent.

However, if government can make fiscal expenditure positively adjust the unfair income distribution by increasing expenditure efficiency and optimizing expenditure structure, then under the influence of the "efficiency hypothesis", trade openness will in turn restrict fiscal expenditure's ability to adjust unfair income distribution positively. Therefore, the distorting effect of trade openness on the adjustment of fiscal expenditure is also objective. Generally speaking, the above regression results are basically consistent with theoretical hypotheses proposed in this paper, trade openness limits and distorts adjustment of fiscal expenditure to income distribution.

Table 2. Regression Results

Variables	*gini*	*trade*	*exp*
trade	0.134***		–0.131*
	(0.0415)		(0.0718)
exp		2.862	
		(3.195)	
exp(–1)	0.166**	–3.407	0.939***
	(0.0678)	(3.215)	(0.0956)
exp(–2)	–0.0922	0.959	–0.214**
	(0.0656)	(0.839)	(0.0840)
Control variable	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes
Sample	270	270	270
R-squared	0.925	0.959	0.935

Note: ***,** and * represent that the regression coefficient is significant at the confidence level of 1%, 5% and 10%, respectively, the same below.

In order to test the robustness of regression results, this paper uses the urban income Gini coefficient (*ugini*), rural income Gini coefficient (*rgini*), and urban and rural income ratio (*urgap*) instead of the resident income Gini coefficient (*gini*) in the main regression,

and re-estimates the 3SLS of the simultaneous equation model, and the regression results are shown in Table 3.[1] In general, the results of robustness test are basically the same as those of main regression, which further verifies the core argument of this paper.[2]

Table 3. Robustness Test

Variable	*ugini* simultaneous equations			*rgini* simultaneous equations			*urgap* simultaneous equations		
	ugini	*trade*	*exp*	*rgini*	*trade*	*exp*	*urgap*	*trade*	*exp*
trade	0.106**		–0.124*	0.371***		–0.176***	0.708**		–0.163**
	(0.0500)		(0.0751)	(0.0975)		(0.0670)	(0.349)		(0.0723)
exp		3.030			3.669			3.407	
		(3.238)			(3.168)			(3.214)	
exp(–1)	0.180**	–3.663	0.937***	0.477***	–4.149	0.898***	0.982*	–4.173	0.886***
	(0.0837)	(3.250)	(0.0974)	(0.160)	(3.187)	(0.102)	(0.583)	(3.225)	(0.0952)
exp(–2)	–0.0335	0.950	–0.220***	–0.0244	1.129	–0.206*	0.234	1.055	–0.213**
	(0.0902)	(0.850)	(0.0843)	(0.161)	(0.832)	(0.105)	(0.629)	(0.844)	(0.0841)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	270	270	270	270	270	270	270	270	270
R-squared	0.637	0.958	0.937	0.196	0.954	0.915	0.952	0.955	0.921

6. Further Test Based on Budget Structure and Expenditure Category

6.1. Further Test Based on Budget Structure

In terms of the determination of expenditure scale and the way to use capital, public fiscal budget expenditure and government fund budgetary expenditure are distinctly different (Hu and Liu, 2016). Therefore, it is necessary to analyze them separately. Besides, from the economic classification[3] of fiscal expenditure, a large part of public

[1] The data of urban residents' income Gini coefficient *ugini* and rural residents' Gini coefficient *rgini* are derived from Tian (2012). The income of urban and rural residents ratio *urgap*=per capita disposable income of urban residents / per capita net income of rural residents.

[2] In addition, this paper also refer to Mao (2015), using *trade*02= (import + export v) / (GDP –third industry added value) instead of *trade* for robustness test. It is found that the regression results are basically consistent with the main regression, and the direction of each core variable does not change obviously. This further verifies the theory of this paper. Due to space constraints, detailed empirical results are not reported here.

[3] The economic classification of fiscal expenditure is a classification according to the economic nature and specific use of expenditure. The classification subjects of China's expenditure economy include 12 kinds: wages and welfare, goods and services, subsidies to individuals and families, subsidies to enterprises and institutions, transfer, gift, debt interest, debt, infrastructure, other capital expenditures, loan transfer and equity participation and other expenditures.

budget expenditure is wage and welfare expenditure and subsidies for individuals and families, so the scale of the financial support population can represent the scale of the "personnel budget expenditure" to a certain extent. Based on this, this paper will analyze the income distribution effect of public finance budget expenditure (*pexp*), government fund budget expenditure (*fexp*) and financial support population (*fisdep*) respectively within the framework of abovementioned simultaneous equation model, and the regression results are shown in Table 4.[1]

Table 4. Further Test Based on Budget Structure

Variable	*pexp* simultaneous equations			*fexp* simultaneous equations			*fisdep* simultaneous equations		
	gini	*trade*	*pexp*	*gini*	*trade*	*fexp*	*gini*	*trade*	*fisdep*
trade	0.136***		–0.135**	0.155***		–0.0332	0.117***		0.00614
	(0.0378)		(0.0565)	(0.0483)		(0.0374)	(0.0404)		(0.0185)
pexp		2.358							
		(3.128)							
pexp(–1)	0.218***	–2.768	0.995***						
	(0.0716)	(3.216)	(0.0849)						
pexp(–2)	–0.109	0.875	–0.236***						
	(0.0777)	(0.895)	(0.0873)						
fexp					35.08				
					(35.05)				
fexp(–1)				0.292*	–29.41	0.720***			
				(0.163)	(27.51)	(0.104)			
fexp(–2)				0.209	3.472	–0.141*			
				(0.179)	(4.364)	(0.0822)			
fisdep								4.394	
								(17.76)	
fisdep(–1)							–0.177	0.441	0.440***
							(0.193)	(8.096)	(0.0800)
fisdep(–2)							–0.00730	–1.347	0.0368
							(0.106)	(0.836)	(0.0447)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	270	270	270	270	270	270	270	270	270
R-squared	0.917	0.963	0.932	0.913	0.699	0.812	0.927	0.965	0.981

In the *pexp* equation, the coefficient of trade in the income distribution equation is 0.136 and significantly positive, the coefficient of *pexp* (–1) is 0.218 and significantly positive, the coefficients of *pexp*, *pexp* (–1) and *pexp* (–2) of the trade openness equation are not significant, and the *trade* coefficient in the fiscal expenditure equation is –0.135 and significantly negative. In the *fexp* equation, the coefficient of trade in the income distribution equation is 0.155 and significantly positive, the coefficient of *fexp*

[1] Public finance budget expenditure *pexp*=public budget expenditure /GDP, government fund budget expenditure *fexp*=government fund budget expenditure /GDP, fiscal support population = administrative, public institutions, financial support population / non-agricultural population.

(–1) is 0.292 and significantly positive, and the coefficients of *fexp*, *fexp* (–1) and *fexp* (–2) of the trade openness equation are not significant, and the coefficient of *trade* in the fiscal expenditure equation is not significant. In the *fisdep* equation, the coefficient of *trade* of the income distribution equation is 0.117 and significantly positive, and the coefficients of *fisdep* (–1) and *fisdep* (–2) are not significant, the coefficients of *fisdep*, *fisdep* (–1) and *fisdep* (–2) of the *trade* openness equation are not significant, and the coefficient of *trade* in the fiscal expenditure equation is not significant.

The above regression results show as follows. (1) The public fiscal budget expenditure and government fund budget expenditure significantly expand residents' income gap, which indicates that fiscal expenditure adversely adjust unfair income distribution significantly. (2) Trade openness will significantly inhibit public budget expenditure scale, but it will not significantly affect government fund budget expenditure scale, which shows that trade openness will distort income distribution effect of public finance budget expenditure, but will not distort income distribution effect of government fund budget expenditure. (3) The expansion of the "personnel budget expenditure" represented by fiscal support population will not significantly affect income distribution. Trade openness will not significantly affect the size of fiscal support population either, which indicates that the expansion of government personnel budget expenditure will not have significant impact on national income distribution, and trade openness will not affect government's decision-making on the allocation of personnel funds. (4) Fiscal expenditure of different budgetary structures cannot affect trade scale significantly, which shows that fiscal expenditure cannot change unfair income distribution caused by trade openness.

6.2. Further Test Based on Expenditure Category

In order to further analyze income distribution effect of different categories of fiscal expenditure, this paper divides fiscal expenditure (including public fiscal budget expenditure and government fund budget expenditure) into four categories, industrial and commercial sector, agricultural sector, people's livelihood sector and the other departments.[1] With regard to public fiscal budget expenditure, this paper uses public fiscal budget data which has been specified to the subject "kuan" in local financial

[1] In particular, the industrial and commercial sector includes the industrial department, the transportation department, the trade department, the circulation department, the construction department, the post and telecommunications Department, the state asset department, the tourism department, the geological department and the energy sector. The agricultural sector includes the agricultural department, the forestry department, the water conservancy department and the meteorology department. The people's livelihood sector includes the education department, the science department, the health department, the social security department, the civil affairs department, the cultural department, the sports department, the media department, the family planning department. The other departments including all departments that are not included in the industrial and commercial sector, the agricultural sector and the people's livelihood sector (such as the defense department, the diplomatic department, the military police department and the department of the police, procuratorate, court etc.).

statistics, according to the same statistical caliber, total local public fiscal expenditure is counted to the above four categories. As for government fund budget expenditure, according to the same statistical caliber, total government fund expenditure is counted to the above four categories. Based on this, this paper will continue to use the empirical framework of the above simultaneous equation model to analyze the income distribution of industrial and commercial expenditure (*exp*01), agricultural sector fiscal expenditure (*exp*02), people's livelihood sector fiscal expenditure (*exp*03), and other sector fiscal expenditure (*exp*04). The regression results are shown in Table 5 and 6.[1]

Table 5. Further Test Based on Expenditure Category (1)

Variable	*exp*01 simultaneous equations			*exp*02 simultaneous equations		
	gini	*trade*	*exp*01	*gini*	*trade*	*exp*02
trade	0.123***		–0.0488*	0.131***		–0.0328**
	(0.0360)		(0.0253)	(0.0384)		(0.0139)
*exp*01		–20.41				
		(128.7)				
*exp*01(–1)	0.184	10.67	0.528***			
	(0.135)	(67.68)	(0.0727)			
*exp*01(–2)	–0.309**	–0.924	–0.0416			
	(0.134)	(11.35)	(0.0733)			
*exp*02					7.152	
					(7.215)	
*exp*02(–1)				0.495**	–5.807	0.482***
				(0.247)	(4.440)	(0.0846)
*exp*02(–2)				0.0559	–1.176	–0.0551
				(0.240)	(1.485)	(0.0829)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Sample	270	270	270	270	270	270
R-squared	0.931	0.900	0.789	0.926	0.963	0.863

In the *exp*01 equations, the coefficient of trade of the income distribution equation is 0.123 and significantly positive, the coefficient of *exp*01 (–2) is –0.309 and significantly negative, the coefficient of *exp*01, *exp*01 (–1) and *exp*01 (–2) of the trade open equation are not significant, the *trade* coefficient of the fiscal

[1] Specifically, a department's fiscal expenditure = a department's financial expenditure of public finance budget and government fund budget /GDP.

expenditure equation is –0.0488 and significantly negative. In the *exp*02 equations, the coefficient of *trade* of the income distribution equation is 0.131 and significantly positive, the coefficient of *exp*02 (–1) is 0.495 and significantly positive, the coefficient of *exp*02, *exp*02 (–1) and *exp*02 (–2) of the trade openness equation are not significant, and the *trade* coefficient of the fiscal expenditure equation is –0.0328 and significantly negative. In the *exp*03 equations, the coefficient of *trade* of the income distribution equation is 0.125 and significantly positive, the coefficient of *exp*02 (–1) is 0.236 and significantly positive, the coefficient of *exp*03, *exp*03 (–1) and *exp*03 (–2) of the trade open equation are not significant, the *trade* coefficient of the fiscal expenditure equation is –0.0553 and significantly negative. In the *exp*04 equations, the coefficient of *trade* of the income distribution equation is 0.135 and significantly positive, and the coefficient of *exp*04 (–1) and *exp*04 (–2) is not significant. The coefficients of *exp*02, *exp*02 (–1) and *exp*02 (–2) of the trade open equation are not significant, and the coefficient of *trade* in the fiscal expenditure equation is significant and negative.

Table 6. Further Test Based on Expenditure Category (2)

Varibale	*exp*03 simultaneous equations			*exp*04 simultaneous equations		
	gini	*trade*	*exp*03	*gini*	*trade*	*exp*04
trade	0.125***		–0.0553*	0.135***		–0.111**
	(0.0378)		(0.0293)	(0.0421)		(0.0470)
*exp*03		5.205				
		(6.350)				
*exp*03(–1)	0.236*	–5.005	0.791***			
	(0.129)	(5.273)	(0.0801)			
*exp*03(–2)	–0.0321	1.526	–0.173**			
	(0.126)	(1.488)	(0.0755)			
*exp*04					15.50	
					(14.15)	
*exp*04(–1)				0.201	–15.55	0.773***
				(0.154)	(13.14)	(0.136)
*exp*04(–2)				0.134	2.712	–0.333**
				(0.182)	(3.333)	(0.148)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Sample	270	270	270	270	270	270
R-squared	0.929	0.962	0.916	0.924	0.931	0.709

The above regression results are shown as follows. (1) The fiscal expenditure of the industrial and commercial sector will significantly reduce domestic income gap, which may be because this kind of fiscal expenditure has promoted the economic development and per capita income in the backward areas, and then it shows a positive adjustment to unfair income distribution. (2) The fiscal expenditure of the agricultural sector will expand domestic income gap significantly, which may be because this kind of fiscal expenditure is easier to be obtained by high income groups in rural areas (Wan *et al*., 2015), and then it shows reverse adjustment of unfair income distribution. (3) The fiscal expenditure of the people's livelihood sector will significantly expand domestic income gap, which may be because this kind of fiscal expenditure has a serious "city bias" (Lu and Chen, 2004; Lei and Cai, 2012), and then it shows the reverse adjustment of unfair income distribution. (4) Other sectors have no significant impact on income distribution, indicating that fiscal funds providing pure public goods (such as defense, diplomacy, public safety) will not show obvious income distribution effect. (5) Trade openness will significantly inhibit the scale of different types of fiscal expenditure, which indicates that trade openness will distort the income distribution effect of different types of fiscal expenditure. (6) Different categories of fiscal expenditure cannot significantly affect the trade openness scale, which shows that fiscal expenditure cannot change unfair income distribution caused by trade openness.

7. Main Conclusion and Policy Recommendations

Using the panel data of 27 provincial units from 1998 to 2009, this paper analyzes the impast of fiscal expenditure, trade openness and possible interaction between them on income distribution under the framework of the simultaneous equation model. In order to reflect the characteristics of China's fiscal expenditure more comprehensively, according to different budgetary structures, this paper divides total fiscal expenditure into two parts of public fiscal budget expenditure and government fund budget expenditure. According to different categories of expenditure, the total expenditure is further divided into four categories including the fiscal expenditure of the industrial and commercial sector, that of the agricultural sector property, that of people's livelihood sector, and that of other departments. The empirical results are shown as follows. (1) Trade openness will significantly deteriorate domestic income distribution, and no budget structure or expenditure category can significantly affect trade openness, which indicates that fiscal expenditure cannot change unfair income distribution caused by trade openness by affecting trade openness degree, and trade openness inhibits the adjustment ability of income distribution of financial expenditure to a certain extent. (2) The "efficiency hypothesis" is true in China, trade openness inhibits the scale of fiscal expenditure of different budgetary structures and different expenditure categories, which shows that trade openness can indirectly affect the income distribution effect of

fiscal expenditure by affecting financial expenditure scale. trade openness distorts the income distribution adjustment ability of fiscal expenditure to a certain extent. (3) The fiscal expenditure in China has expanded the income gap on the whole, this adverse adjustment is mainly originated from fiscal expenditure of the agricultural sector and the people's livelihood sector which should effectively reduce the income gap.

To sum up, in China, trade openness does restrict and distort the adjustment of fiscal expenditure to income distribution. Meanwhile, fiscal expenditure has not narrowed but widened the income gap, which shows reverse adjustment of unfair income distribution. Based on this, this paper puts forward the following policy recommendations:

First, it is must be fully realized that the adjustment ability of income distribution of fiscal expenditure is limited. From the empirical results, under the condition of open economy, trade openness will inevitably restrict and distort the income distribution and adjustment ability of fiscal expenditure. Therefore, when choosing fiscal expenditure as a policy tool to adjust unfair income distribution, it is necessary to fully recognize its impact limit. Fiscal expenditure can only be one of the "package" policy tools, and its role is absolutely not omnipotent.

Second, we should fully tap the income redistribution function of fiscal expenditure. From the category of expenditure, the adverse adjustment effect of fiscal expenditure on unfair income distribution mainly comes from the agricultural sector and the people's livelihood sector, which shows that the fiscal expenditure of the above two categories did not play a positive role in adjusting unfair income distribution, which was supposed to be these two sectors' function. Therefore, we should eliminate the dual structure of urban and rural areas, improve the efficiency of fiscal expenditure, change the city bias of fiscal expenditure, push forward targeted poverty alleviation, and gradually realize the equalization of public service and so on, fully excavate the adjustment ability of income distribution of fiscal expenditure of agricultural sector and people's livelihood sector, so that it can be truly be an important policy tool to adjust unfair income distribution in the future.

Third, we should minimize the distorting effect of income adjustment ability of fiscal expenditure caused by trade openness. When the "efficiency hypothesis" is true, even if fiscal expenditure can effectively adjust unfair income distribution, its adjustment ability will be distorted by trade openness. Therefore, when promoting the adjustment ability of income distribution of fiscal expenditure, we should gradually change economic development mode, encourage local governments to attract the inflow of production factors by reducing tax rate and fiscal expenditure so as to reduce the restraining effect of trade openness on the scale of fiscal expenditure and then further reduce possible distortion of the adjustment effect of fiscal expenditure on income distribution.

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