

Opening to the Outside World and Income Gap between Urban and Rural Areas Based on Panel Data of 30 Provinces and Cities

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Abstract: Opening to the outside world has an impact on Income gap between urban and rural areas. From the perspective of internal transmission mechanism, opening to the outside world has promoted the redistribution of labor force between urban and rural areas and the increase of rural residents' wages while adjusting the industrial structure. From the perspective of external transmission mechanism, trade openness has a significant impact on Income gap between urban and rural areas through the regulation of transportation infrastructure. Based on the above analysis, this paper explores the specific impact mechanism of opening to the outside world on income gap between urban and rural areas. Using Theil index to construct an index to measure the income gap between urban and rural areas, this paper empirically explores the impact of opening to the outside world on Income gap between urban and rural areas through adjustment effect test and mediation effect test, and further explores the impact of various influencing factors on income gap between urban and rural areas and the specific transmission mechanism.

Keywords: Opening to the outside world, Re-allocation of urban and rural labor force, Upgrading of transportation infrastructure, Income gap between urban and rural areas.

1. I. Introduction

At present, the international situation is facing an unprecedented change in a century. In the face of an epidemic situation, trade protectionism is gaining momentum again. Western countries, including the United States and the United Kingdom, have adopted a series of trade measures against developing countries, including China, to curb the development of each country through trade wars and other means.

The opening to the outside world has an impact on the income gap between urban and rural areas. From the perspective of internal transmission mechanism, trade liberalization has promoted the redistribution of labor force between urban and rural areas while adjusting the industrial structure, so as to raise the wages of the rural population. From the perspective of external transmission mechanism, opening to the outside world is regulated by transportation infrastructure, which has a significant impact on the income gap between urban and rural areas.

Based on the above analysis, the remaining articles are arranged as follows: The second part analyzes the possible mechanism of opening to the outside world on the income gap between urban and rural areas. In the third part, model selection, regression model, data sources and variables are introduced. The fourth part carries on the benchmark regression and the robustness analysis to the model. The fifth part analyses, tests and discusses the mechanism and channels of the impact of opening to the outside world on the income gap between urban and rural areas, and analyses the heterogeneity. Finally, the thesis is concluded.

The salient feature of opening up to the outside world is foreign trade, whose regional distribution of capital, technology and management elements and the concentration of advantageous resources have an important impact on China's economic development [1]. Liu and Zhao found that

opening up increased the inflow of foreign direct investment [2]. Liu and Li point out that the direct economic impact of FDI inflows is the increase in employment demand [3]. Trade openness stimulates the development of labor-intensive industries and provides corresponding employment opportunities for the rural surplus labor force, which in turn drives the rural surplus labor force to work in cities. The employment effect in turn brings about the income distribution effect and improves its income level, realizing the employment effect and income distribution effect in the opening-up to the outside world, thus narrowing the income gap between urban and rural areas.

2. Model Selection, Model Setting, Data and Variables

2.1. Model Select

In this paper, Hausman test is used to determine the correct form of model selection. On the surface of the test result, the chi-square statistic is 28.11, and the corresponding adjoint probability is 0.000. Therefore, the original assumption should be rejected, that is, the estimation of random effect model is inconsistent, and fixed effect model is more appropriate. That is, the fixed effect model is adopted for estimation.

2.2. Model Setting

In order to examine the impact of trade openness on the income gap between urban and rural areas, based on the above model selection, this paper establishes a time-province dual fixed effect model to control the other differences of the research object at the provincial level and the time level, so as to truly separate the effect of trade openness. Therefore, this paper constructs the following model:

$$Dif_{it} = \beta Maoyi_{it} + \varphi Control_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (1)$$

Where, i and t represents the i th province and the t th period respectively

The explained variable Dif_{it} represents the number of polluting enterprises newly added in the i th province in t , and $Maoyi_{it}$ is an agent variable of trade openness, which measures the trade openness of a province in t ; otherwise, the value is 0. $Control_{it}$ represents other control variables, which are other important factors that affect the urban-rural income gap except for trade openness. μ_t is the fixed effect of time and γ_i is the fixed effect of province, they more accurately reflect the time characteristics and individual characteristics, and can represent the unobservable factors that affect the time or individual changes that are difficult to be measured by economic variables, thus alleviating the endogenous problem caused by missing variables to a certain extent. According to the design of the time-province dual fixed effect model, β is the core estimation coefficient of the explanatory variable in this paper.

2.3. Data Sources

This paper selects 30 provinces in China from 2012 to 2018 as the research sample (i.e. excluding Xinjiang, Tibet and Hong Kong, Macao and Taiwan). The data are derived from China Statistical Yearbook, statistical yearbooks of various provinces, China Urban Construction Statistical Yearbook, China Rural Poverty Monitoring Report, etc. For data processing, this paper refers to the practice of Caietal [5]. In order to control heteroscedasticity and statistical error, the model takes logarithm for some explanatory variables and centers some explanatory variables in transactional analysis to control multicollinearity.

2.4. Variable Selection

2.4.1. Dependent Variable: Urban-Rural Income Gap

Urban-rural income gap (dif). The urban-rural income gap is an important indicator to measure the degree of income gap between urban and rural areas. Domestic commonly used urban and rural per capita disposable income value difference, Theil index, Gini coefficient to measure the degree of income gap between urban and rural areas. Compared with the difference between urban and rural per capita disposable income, Theil index takes more factors into account, and decomposes the income gap between urban and rural residents into inter-group gap and intra-group gap, which can better reflect the degree of rural poverty reduction [4]. The larger the value of urban-rural income gap, the larger the gap. This paper uses Theil index to measure the income gap between urban and rural residents. In the robustness analysis, this paper uses the incidence of poverty in each region collected in China Rural Poverty Monitoring Report as an agent variable to measure the results of rural poverty reduction, which makes the article more reliable.

2.4.2. Core Explanatory Variable: Trade Openness

The core explanatory variable in this paper is trade openness ($maoyi$), which is measured by the ratio of total import and export volume to GDP in the current period. Trade openness refers to the ratio of total regional imports and exports to the gross domestic product or gross national product of the region. The degree of trade openness reflects the dependence of a country's economic growth on import and

export trade. It is the main indicator to measure a country's degree of trade integration and an important indicator to measure a country's degree of opening to the outside world. The change in proportion represents the change in the position of foreign trade in the national economy.

2.4.3. Control Variables

(1) The Industrial development level (thirdproperty). Measured using tertiary industry share. At the macro level, the tertiary industry is one of the important factors to promote the high-quality development of the industry and an important indicator to measure the development of the industrial structure towards higher level. The industrial upgrading will affect the income level of local personnel. Here, this paper selects the proportion of tertiary industry to measure, in order to control the impact of different levels of industrial development in each province on the urban-rural income gap [5].

(2) Technology capital stock (lnpatant). The stock of scientific and technological capital, especially the number of patents, will have a greater impact on the regional economic development. This paper uses "the volume of patent applications accepted" to measure the stock of regional scientific and technological capital. The higher the index value, the more active the scientific and technological development in the province, the higher the level of scientific and technological development and the higher the regional income level. In this paper, the number of patent applications accepted is used as a logarithmic measure.

(3) Economic development level (GDP). It is measured using the GDP deflator to reflect the level of regional economic development. The economic structure of a country or region changes from a low level to a high level as the economy continues to grow. The higher the level of economic development, the higher the income of the low-income group through the three-time distribution mechanism, thus affecting the income gap between urban and rural areas.

(4) Human capital (Regional education level, edu). Measured by the average length of schooling, there are differences in the degree of education popularization between different provinces. Krueger (2001) pointed out that education plays an important role in raising individual wage income. The higher the education level, the richer the human capital and the higher the wage rate. This paper intends to use the average length of education to control the impact of the provincial human capital on the urban-rural income gap.

(5) The degree of aging (public service, fuyang). The greater the degree of aging, the greater the number of dependents borne by the labor force per capita, which means the more serious the dependency burden of the labor force. The dependency ratio of the aged population is a relatively more direct measure of the pension burden of the labor force. The result of the aging population will directly lead to the continuous increase of the dependency ratio of the elderly population. Therefore, the dependency ratio of the elderly population is the focus of attention in the aging society. The more jobs they have, the more employment assistance they provide, thus affecting the income gap between urban and rural areas. This paper uses social dependency ratio to measure.

Table 1. Variables and their descriptive statistics

Variable	Variable name	Variable definition	Sample size	Average/mean value	SD	Min.	Max.
Core explained variable	dif	Income gap between urban and rural areas	210	0.097	0.043	0.020	0.222
Core Explanatory variable	Maoyi	Trade openness	210	0.097	0.043	0.020	0.222
	Maoyi_lag	Lagging trade openness	210	0.267	0.293	0.018	1.441
Control variables	Thirdproperty	Industrial development level	180	0.271	0.301	0.018	1.441
	Lnpatant	Technological capital stock	210	2.297	10.006	0.327	58.200
	Fuyang	public services	210	9.874	1.602	4.796	13.078
	Olderfuyang	Dependency ratio of aged population	210	36.420	6.382	21.180	50.560
	Edu	Average length of schooling	210	13.738	3.139	7.000	22.690
	Highedu	Proportion of people in higher education	210	9.122	1.115	4.222	12.597
	Consume	Household consumption index	210	0.136	0.073	0.024	0.487
	Curate	Urbanization rate of resident population	210	134.587	7.112	119.480	163.871
	GDP	Level of economic development	210	0.567	0.130	0.227	0.896

3. Empirical Results and Robustness Analysis

3.1. Benchmark Regression Results

Table 2 is the regression result of the relationship between trade openness and urban-rural income gap using trade openness as the core explanatory variable. Table 2, sections (1)-(6), presents the results of estimation using the time-province dual fixed effect model and using cluster robust standard error at the provincial level. Column (1) only controls the time trend and the fixed effect of provinces. The results show that the trade openness index increases by 1 and the income gap between urban and rural areas decreases by

about 0.06, which is significant at 1%. Column (2) adds a control variable to measure the level of industrial development. As a result, the impact of apparent trade openness on the urban-rural income gap is still significantly negative under the significance of 1%, indicating that the more open trade is, the smaller the urban-rural income gap is. Among them, the agency variable of industrial development level is significantly positive under the significance of 5%. The reason may be that the tertiary industry is more concentrated in cities and towns, providing employment opportunities for the urban population, which has little impact on the permanent residents in rural areas, but leads to an increase in the income gap between urban and rural areas.

Table 2. Benchmark Regression

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dif	Dif	dif	dif	dif	dif
Maoyi	-0.0625***	-0.0775***	-0.0935***	-0.0862***	-0.0852***	-0.0874***
	(0.0146)	(0.0127)	(0.0134)	(0.0124)	(0.0117)	(0.0114)
Thirdproperty		0.240***	0.162**	0.138**	0.126*	0.121*
		(0.0844)	(0.0652)	(0.0612)	(0.0656)	(0.0649)
GDP			-0.0549***	-0.0557***	-0.0570***	-0.0577***
			(0.0144)	(0.0139)	(0.0138)	(0.0133)
Fuyang				0.00126**	0.00117*	0.00104
				(0.000613)	(0.000656)	(0.000705)
Lnpatant					-0.00395	-0.00406
					(0.00586)	(0.00555)
Edu						-0.00438
						(0.00446)
Constant	0.135***	0.0376	0.160***	0.125***	0.173**	0.222**
	(0.00617)	(0.0360)	(0.0346)	(0.0364)	(0.0810)	(0.0995)
Time fixed	Y	Y	Y	Y	Y	Y
Provincial fixed	Y	Y	Y	Y	Y	Y
Observations	210	210	210	210	210	210
R-squared	0.479	0.529	0.557	0.570	0.571	0.572

Column (3), column (4), column (5) and column (6) are sequentially added with each control variable, and the time trend and the province fixed effect are controlled, and the results are still the same. The results show that for every 1% increase in trade openness, the income gap between urban and rural areas is significantly reduced by 1%. Among them, the proportion of tertiary industry has always been significantly positive, and the coefficient between scientific and technological capital and human capital has always been negative. It can be seen that the improvement of scientific and technological capital (represented by the increase in the number of invention patent applications in this paper) and the improvement of human capital (represented by the increase in the average length of education in a region or a province) have a certain mitigation effect on the income gap between urban and rural areas. In column (2)-(5), the impact of the level of economic development on the urban-rural income gap is significantly negative under the significance of 1%, which may be due to the continuous improvement of China's distribution mechanism, so that the benefits of economic development will benefit more people. Under the effect of the three-time distribution, the urban-rural income gap will continue to decline.

3.2. Robustness Analysis

3.2.1. Representation Form of Substitution Variable

In addition to the urban-rural income gap constructed by Theil index, column (5) uses the incidence of poverty in each region collected in China's Rural Poverty Monitoring Report as an agent variable to measure the results of rural poverty

reduction, and further examines the relationship between opening-up and urban-rural income gap in order to eliminate the conclusion bias brought by the selection of specific indicators. The results show that the higher the degree of opening to the outside world, the stronger the effect of income gap between urban and rural areas. The degree of opening to the outside world increased by 1%, and the incidence of poverty decreased significantly by 7.718%. Theoretically, the difference between urban and rural income gap measured by Theil index may be due to different measurement methods. Theil index can measure the contribution of intra-group gap and inter-group gap to the total gap, which is more accurate and the measurement result is more accurate. However, the incidence of poverty in each region collected in China's Rural Poverty Monitoring Report only includes the eastern, central and western regions, with low accuracy, but the sign of its coefficient still has strong explanatory power.

Table (3) uses the proportion of higher education population and the dependency ratio of the elderly population to replace the original control variable. As a result, the coefficient of the core explanatory variable is still significant at 1%. Among them, the proportion of higher education is opposite to the average length of education used in table (6) of fig. 2. The reason may be that higher education benefits more urban residents and increases their income, while the proportion of rural population attending higher education institutions is relatively low, thus the impact is relatively small, thus widening the income gap between urban and rural areas to a certain extent.

Table 3. Robustness analysis

Variable name	(1)	(2)	(3)	(4)	(5)
	dif	dif	dif	dif	dif
Maoyi	-0.0825*** (0.0120)	-0.0833*** (0.00876)	-0.0853*** (0.0105)	-0.0812*** (0.0103)	-0.0874*** (0.0114)
Highedu	0.0216 (0.0506)				
Olderfuyang	0.00244* (0.00129)				
Constant	0.164* (0.0914)	-0.0440 (0.140)	-0.0248 (0.194)	0.140 (0.190)	0.222** (0.0995)
Other control variables	control	control	control	control	control
Timefixed	Y	Y	Y	Y	Y
Provincial fixed	Y	Y	Y	Y	Y
Observations	21 0	21 0	17 5	15 0	21 0
R-squared	0.577	0.582	0.548	0.824	0.572

3.2.2. Add Other Control Variables

In this paper, only five control variables are selected for the benchmark regression, while the other factors that may affect rural poverty reduction are controlled by time-fixed effect and province-fixed effect. However, this may lead to the existence of some strong third-party interference factors, which will also affect the rural poverty reduction and opening to the outside world. Each province may have different dynamic market sizes in the same period, and the market size may have a positive effect on trade openness. The stronger market size may have a certain impact on the urban-rural income gap to some extent through the distribution mechanism, which may lead to the estimation results being biased. In order to solve this problem, this paper further adds a 2005-based consumer

price index to reflect the market size of different provinces in different events. As shown in column (4), after the control variables are added, there is no significant difference between the core explanatory variables and the benchmark regression, and the core explanatory variables are still significantly negative at the significance level of 1%, indicating that the regression results in this paper are robust.

3.2.3. Reduce the Time Span and The Number of Cross-Section Samples

Column (3) of Table 4, column (4) is the regression for reducing the time span and reducing the number of cross-sectional samples respectively. Column (3) shows that the time span for reduction is 5 years, and the coefficients of the core explanatory variables are not significantly different from

the benchmark regression, and are highly significant, indicating that the regression results are robust. Column (4) in Table 3 is a random sample of 25 provinces for regression. The coefficients of the core explanatory variables are not significantly different from the benchmark regression, and the

core explanatory variables are still significant. It can be seen that the regression results are still robust whether the sample time span is reduced or the cross-section sample number is shortened, which indicates that the regression in this paper is highly reliable.

Table 4. Extended Analysis

Variable name	(1) dif	(2) Curate	(3) dif	(4) dif	(5) dif	(6) dif
Curate			-0.376*** (0.123)			
Maoyi	-0.0874***	0.117***	-0.0435**	-0.0795***	-0.133**	-0.574*
Control variable	control	control	control	control	control	control
Time fixed	Y	Y	Y	Y	Y	Y
Provincial fixed	Y	Y	Y	Y	Y	Y
Observations	210	210	210	84	77	63
R-squared	0.572	0.895	0.604	0.766	0.894	0.400

4. Extended Analysis

4.1. Mechanism Analysis

In this part of the analysis, this paper points out that trade openness will affect rural poverty reduction by affecting the redistribution of urban and rural labor. It also points out that the effect of trade openness on income gap between urban and rural areas will be adjusted by the density of transportation infrastructure.

4.1.1. The Effect of Promoting the Urban-rural Re-allocation of Labor Force

Permanent population urbanization rate (curate) refers to the proportion of urban permanent population in the total permanent population. This indicator reflects the ability of China's urbanization construction to attract a large number of farmers to enter cities, become urban permanent population and obtain employment in cities, which reflects the intensity of urban and rural labor force redistribution. Taking the urbanization rate of the resident population as an intermediate variable, and drawing on the research of Wen Zhonglin et al. [6], the intermediate effect model is constructed as follows:

$$Dif_{it} = \beta_1 Maoyi_{it} + \varphi Control_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (2)$$

$$curate_{it} = \beta_2 Maoyi_{it} + \varphi Control_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (3)$$

$$Dif_{it} = \beta_3 Maoyi_{it} + \beta_4 curate_{it} + \varphi Control_{it} + \mu_t + \gamma_i + \varepsilon_{it} \quad (4)$$

Among them, $curate_{it}$ indicates the urbanization rate of the i th province's resident population in t , i.e. the intensity of urban-rural redistribution of the province's labor force. The other control variables are defined as described above.

The results of the above model are reported in columns (1)-(3) of Table 4. Column (1) reflects the result of formula (8). It can be seen that, similar to the previous, trade openness has a significant negative impact on the urban-rural income gap. The results of columns (2) and (3) show that the degree of trade openness has a significant positive impact on the urban-rural redistribution of labor force, and the intensity of urban-rural redistribution of labor force has a significant negative impact on the urban-rural income gap. Compared with the regression coefficient in column (1), the regression coefficient after controlling the intensity of urban-rural redistribution of labor force has a slight decrease, which

indicates that urban-rural redistribution of labor force is an important channel for trade openness to promote the reduction of urban-rural income gap.

4.1.2. Analysis of the Interaction Between Transportation Infrastructure and Trade Openness

Column (7) of Table 5 adds traffic network density to reflect the intensity of traffic infrastructure construction, and adds the intersection of traffic network density and trade openness. In order to control multicollinearity, the traffic network density is centralized in this paper. The regression results show that the cross-term coefficient is significantly positive and the trade openness coefficient is significantly negative, indicating that the upgrading of transportation infrastructure can positively adjust the negative impact of trade openness on the urban-rural income gap, that is, with the continuous upgrading of transportation infrastructure, the mitigation effect of the improvement of trade openness on the urban-rural income gap tends to be enhanced gradually.

4.2. Heterogeneity Analysis

China's regional economic structure has for a long time reflected the situation that the eastern region has a high level of economic development and the central and western regions have a relatively low level of economic development. There are obvious regional economic inequalities. Therefore, it is of great policy significance to analyze the heterogeneous impact of trade openness on the urban-rural income gap from the perspective of regional economic status. Column (4)-(6) of Table 5 classifies the sample into three regions according to their regional economic status for grouping and regression. The regression results show that the improvement of trade openness in different regions has a significant effect on narrowing the income gap between urban and rural areas. Among them, for every 1% increase in trade openness, the income gap between urban and rural areas in the eastern region will drop by 0.0795%. The central region decreased by 0.133%. The western region decreased by 0.574%. It can be seen that the decline rate is the largest in the western region, followed by the central region and the smallest in the eastern region. The improvement of trade openness in the western region will bring the greatest relief to the income gap between urban and rural areas. The reason may be that the eastern region has a higher level of urbanization, a higher level of trade openness, a higher level of rural development, and a relatively low income gap between urban and rural areas than

the central and western regions. Further improvement of trade openness at this time has a lower potential to alleviate the income gap between urban and rural areas. The central region is radiated by the eastern region, and its urbanization level is also high. The western region is less developed than the eastern region, with a higher income gap between urban and rural areas and a lower degree of trade openness. The greater the openness of trade, the greater will be the alleviation of the income gap between urban and rural areas.

Table 5. Transactional analysis

Variable name	(7)
	dif
Maoyi	-0.114*** (0.0134)
Interaction	0.0881*** (0.0238)
Trans	0.0201 (0.0236)
Control variable	control
Time fixed	Y
Provincial fixed	Y
R-squared	0.783
Obs	210

5. Conclusions and Policy Implications

This paper takes trade openness as the core explanatory variable, selects panel data of 31 provinces and cities from 2012 to 2018, and systematically studies the impact of trade openness on urban-rural income gap. The study found that the expansion of opening up has a significant role in promoting income gap between urban and rural areas of various provinces. Further research finds that the impact of trade openness on regional economies in different regions is different. For example, the western region's opening to the outside world has the most obvious effect on reducing rural poverty, while the central and eastern regions are less affected than the western region. In addition, the impact of trade openness on the income gap between urban and rural areas is also regulated by the construction of transportation infrastructure, which will obviously promote the alleviation of the income gap between urban and rural areas. At the same time, this paper finds that the impact of trade openness on the income gap between urban and rural areas mainly plays a role through the mechanism of promoting the rural population to move to cities and towns to achieve the redistribution of labor force between urban and rural areas. Therefore, this paper puts forward the following policy implications:

(1) Facing the medium-and long-term high-quality development, China must unswervingly push forward the reform and opening-up in depth, expand all-round and systematic opening-up, expand market access and promote fair competition. Let the market play a decisive role in the allocation of resources and give better play to the role of the government. With all-round opening up, we are pushing for deep-level reform and seeking greater development space. To

further expand the level of opening up in the central and western regions. Opening wider to the outside world is always an important way to ease the income gap between urban and rural areas.

(2) In order to make the dividends brought by the opening more beneficial to the rural masses and achieve the goal of income gap between urban and rural areas, relevant departments need to take a package of measures, such as employment guidance and training, to improve the human capital of the rural labor force. From the aspect of rural education, attract more high-quality teachers to promote the improvement of rural human capital.

(3) In addition, relevant departments need to improve the transportation infrastructure and social public services to a certain extent. Transportation infrastructure is an important channel to adjust trade openness and reduce the income gap between urban and rural areas. Compared with the eastern region, the transportation infrastructure and public service level in the central and western regions are relatively low, which has great potential for improvement. Its effect of promoting urban-rural income gap through trade opening is better.

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