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The Impact of Trade Openness on the Income Gap between Urban and Rural Areas in China - From the Perspective of Spatial Econometrics

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Abstract

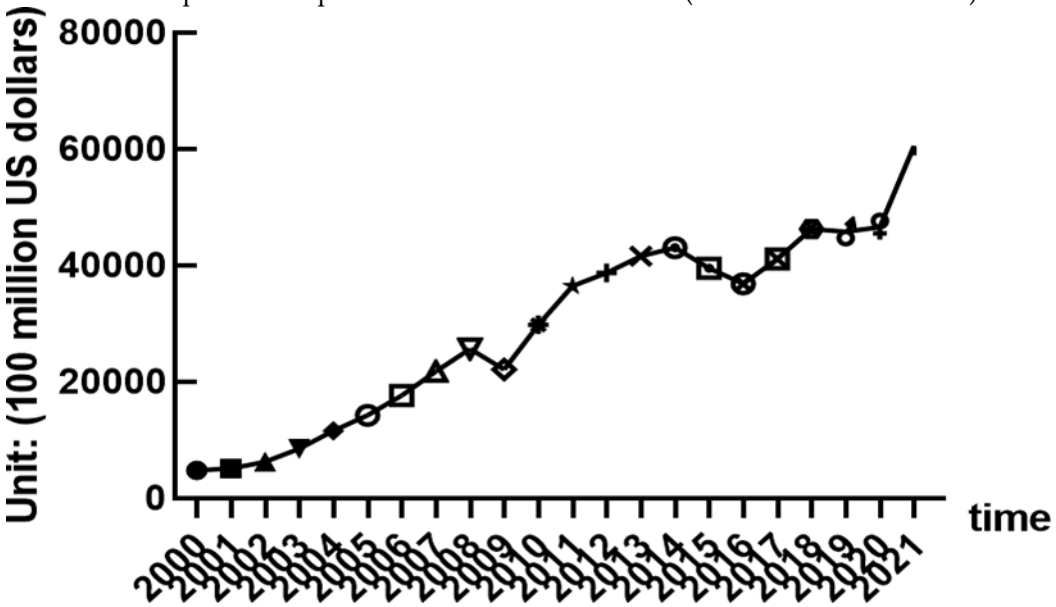
This article uses provincial panel data from 2000 to 2021 in China to study the impact of trade openness on the urban-rural income gap from the perspective of spatial econometrics. Firstly, this article proposes a theoretical hypothesis: the impact of trade openness on the income gap between urban and rural residents is uncertain, while spatial correlation has a positive effect on the income gap between urban and rural residents. This article further verifies the above hypothesis and concludes that trade openness has increased the income gap between urban and rural residents in China, and spatial correlation also has a positive effect on the income gap between urban and rural residents. From the results of other control variables, the increase of regional economic strength, financial service industry level, regional industrial development, local government expenditure level and urban and rural fixed assets investment ratio will expand the income gap between urban and rural residents, but the increase of labor input level will narrow the income gap between urban and rural residents.

Keywords: Trade openness; Income gap between urban and rural areas; Spatial econometrics

Introduction

Since the reform and opening up, the Chinese economy has been continuously accelerating, and China's openness to foreign trade has been increasing (see Figure 1). Trade has become one of the "three carriages" of China's economic development. At the same time, with the rapid development of the Chinese economy, the income gap between urban and rural areas is also increasing. According to the 2014 China Social Blue Book released by the Chinese Academy of Social Sciences, the wealth gap has replaced housing prices as the most concerning issue for Chinese residents. In recent years, many scholars have conducted empirical studies on the relationship between trade openness and income inequality (Gaston and Treffler, 1994; Currie and Harrison, 1997; Galiani and Sanguinetti, 2003; Lu Ming and Chen Zhao, 2004, etc.), but the conclusions drawn are inconsistent. Some scholars believe that trade openness will increase income inequality within a country, while others believe that the impact of trade conferences on income inequality is inverted in a U-shaped shape, meaning that trade openness will increase income inequality in the short term, but in the long run, trade openness will reduce income inequality to a certain extent. The author notes that in existing relevant research literature, most research perspectives focus solely on regional trade openness and income inequality, without taking into account geographical connections between regions. Both trade openness and income inequality have strong spatial correlations. In view of this, this article considers the spatial spillover effects of provinces to study the impact of China's trade openness on urban-rural income inequality and conducts a specific analysis.

Figure 1 China's total trade import and export volume from 2000 to 2021 (in billions of US dollars)



Literature review

The most important theory related to the impact of trade openness on income inequality is the S-S theory proposed by Stolpa and Samuelson in the neoclassical trade theory. The S-S theory systematically explains that trade openness will exacerbate the widening of income inequality for developed countries or regions with more endowments, while reducing the widening of income inequality for developing countries or regions with less endowments, However, scholars have put forward different views on this theory (Beyer and Vergara, 1999; Caine et al., 2001), believing that technology diffusion is the reason for the widening income gap in developed countries. At present, there are different opinions in the academic community on whether trade openness has widened the income gap within a country (Gaston and Treffler, 1994; Currie and Harrison, 1997; Galiani and Sanguinetti, 2003). Specifically, when it comes to the impact of trade openness on the income gap between urban and rural residents in China, research perspectives mainly include the following: some studies suggest that China's government's subjective bias towards policy bias has led to this reason, Lu Ming and Chen Zhao (2004) attributed the reason to a series of urban-rural segmentation management systems implemented in China. Some studies have also shown (Zhang Hanlin, Yuan Jia, 2011) that the impact of trade openness on China's urban-rural income gap is not linear. Specifically, there may be a risk of widening the urban-rural income gap in the short term, but in the long term, it will help narrow China's urban-rural income gap. Scholars have found that the reason why trade openness affects the urban-rural income gap is due to the upgrading of trade products and technological progress (Li Shupei, 2009). He found that the structural upgrading speed of trade products is faster than the speed of technological expansion, leading to the widening of the urban-rural income gap. But some scholars have also found (Li Lei, 2011) that the imbalance in China's trade development is the main reason for the urban-rural income gap. Some scholars have also studied the issue of imbalanced trade development between different regions in China (Sun Yongqiang and Wan Yulin, 2011). The study suggests that China's trade openness will widen the urban-rural income gap in the central and western regions, while the impact on the eastern region is not significant

Comparing the above studies, it can be found that scholars generally hold two different views on the impact of trade openness on the urban-rural income gap. Most scholars believe that trade openness will increase the income gap between urban and rural residents in China, while another group of scholars believe that trade openness will narrow the income gap between urban and rural residents in China. There is also a small number of scholars who believe that the impact of trade openness on income gap presents an inverted "U" shape. Given this, this article systematically studies this issue from the perspective of spatial econometrics.

Research hypotheses and spatial correlation analysis

Research hypothesis

The core research object of this article is the degree of trade openness, therefore, the proportion of import and export trade GDP and the proportion of foreign investment GDP are respectively selected to measure the degree of trade openness in a region. Using the above two core explanatory variables based on spatial econometrics to study the impact of trade openness on the income gap between urban and rural residents.

Firstly, let's take a look at the proportion of import and export GDP. Considering China's typical urban-rural dual economic structure, the article assumes that China is divided into two labor markets: the urban skilled labor market and the rural skilled labor market. The skilled labor market only engages in technology intensive work, while unskilled labor only engages in labor-intensive work. Luc, Lrc, Lrrc and Luo, Lro, Lrro respectively represent urban skilled labor, rural unskilled labor, and rural surplus labor in the absence and existence of foreign trade conditions. Assuming that the urban-rural income ratio is under the condition of not opening up to the outside world, where Wu and Wr respectively represent urban and rural wage income. At this point, if the region opens up for trade, there may be two situations: if the demand for technology intensive products increases relatively, the demand for skilled labor will increase relatively, while the demand for unskilled labor will decrease relatively. At this time, compared to the period when the region is not open to the outside world, the income gap between urban and rural areas in the region will increase, that is, Ic<Io.
In addition, if the demand for labor-intensive products increases relatively, the demand for unskilled labor will increase relatively, while the demand for skilled labor will decrease relatively. At this time, compared to the period of not opening up to the outside world, the urban-rural income gap in the local area will decrease, that is,

Ic<Io. From this, it can be seen that the impact of trade openness on the urban-rural income gap in a region is based on the demand for local products. Overall, an increase in demand for labor-intensive products will reduce the regional income gap, while an increase in demand for technology intensive products will increase the income gap between regions. Therefore, this article proposes the following assumptions:
Hypothesis 1: The impact of trade openness on the income gap between urban and rural residents is uncertain - after opening up to the outside world, if labor-intensive products are the main focus, it will have a negative effect; Technology intensive products have a positive effect.
Next, this article studies the impact of foreign direct investment on the income of urban and rural residents. The main reasons for FDI inflows include market openness, local infrastructure construction level, and human capital structure. Therefore, it can be assumed that urban areas have relatively more resources and complete infrastructure, while rural areas have relatively fewer resources and relatively backward infrastructure. According to the above assumption, if a region introduces foreign investment through trade openness, more foreign investment will flow into urban areas, resulting in Wu>Wr, i.e. Ic<Io. Therefore, this article proposes the following assumptions:
Hypothesis 2: An increase in foreign direct investment will lead to an widening income gap between urban and rural residents.
Spatial correlation analysis
This article will introduce spatial geographic information to examine the impact of trade openness on the income gap between urban and rural residents. It is believed that the income gap between urban and rural areas may also come from spatial correlation. Specifically, factors such as knowledge externalities, economies of scale, and the flow of endowments may all lead to spatial correlation in income inequality. From the specific situation in China, provinces with similar resource structures are prone to have similar industrial structures and may lead to economic agglomeration. In addition, China's regional economic development strategy can also easily create spatial connections between provinces, resulting in agglomeration development. Therefore, spatial factors gather provinces with large or small income disparities and spatial connections by influencing the flow of factors. Based on this, this article proposes the following hypothesis: Hypothesis 3: Spatial correlation has a positive effect on the income gap between urban and rural residents.
Empirical results
Model design and variable description
According to the question, this article constructs the following model:

$$I_{it} = \rho \sum_{j=1}^{n} W_{ij} I_{jt} + X_{it}\beta + Y_{it}\gamma + \alpha_i + \varepsilon_{it} I_{it} \quad (1)$$

$$I_{it} = X_{it}\beta + Y_{it}\gamma + \partial_i + \Phi_{it} \quad (2)$$

Wherein, $\Phi_{it} = \lambda \sum_{j=1}^{n} W_{ij}\Phi_{ij} + \varepsilon_{it}\Phi_{it}$

In the above equation, (1) and (2) represent the spatial lag and spatial error panel models, respectively. The dependent variable of the above model is the income gap between urban and rural residents, which is represented by the symbol I. The core explanatory variables of this article are trade freedom and FDI openness, represented by the symbols T and F. In addition, Wij is a general geographic weight matrix. If regions i and j are adjacent, 1 is taken, otherwise 0 is taken. Y represents a series of control variables, which will be explained in detail below. β、γ The coefficients are respectively, ϱ Is the spatial autoregressive coefficient, λ Is the spatial autocorrelation coefficient, α For intercept items.
The specific meaning of the above variables is that the dependent variable, the income gap between urban and rural residents, is the ratio of urban per capita disposable income to rural net income published in the statistical yearbooks of

each province. The core explanatory variable is trade freedom, which is the proportion of GDP in the total import and export trade of the region, and FDI openness, which is the proportion of GDP in FDI. The above two core explanatory variables can effectively measure the level of trade openness in the region. In order to ensure accurate results, this article selected a series of explanatory variables: the proportion of urban employed persons, which is the proportion of urban employed persons to all employed persons; The proportion of personnel in the secondary industry refers to the proportion of employees in the secondary industry to the total number of employees; The ratio of urban and rural fixed assets investment is the ratio of urban and rural fixed assets investment; The degree of financial development refers to the ratio of loan balance to GDP, fiscal expenditure to GDP, industrial output to GDP, Ln (per capita GDP), and the square of Ln (per capita GDP) of financial institutions. The above data sources are all from statistical yearbooks of various provinces.

The time range for selecting variables in this article is provincial panel data in China from 1978 to 2013. Table 1 shows the descriptive statistics of the variables.

Table 1 Statistical Description of Variables

variable	symbol	mean value	standard deviation	Maximum value	minimum value
Urban-rural income ratio	I	23234	0.673	4.821	0.931
spatial weight matrix	W	*	*	*	*
openness	T	0.241	0.421	0.3832	0.004
Import openness	E	0.14	0.235	1.884	0.001
Export openness	M	0.125	0.249	3.231	0.001
Openness of foreign direct investment	F	0.025	0.033	0.242	0.001
The proportion of urban employed personnel	EU	0.324	0.161	0.892	0.119
The proportion of personnel in the secondary industry	ES	0.242	0.121	0.593	0.032
Ratio of urban and rural fixed assets investment	IR	6.534	5.341	45.12	0.682
Financial development level	FN	0.837	0.302	2.433	0.124
The proportion of fiscal expenditure to GDP	FG	0.143	0.144	1.241	0.043
The proportion of industrial output value to GDP	IG	0.374	0.103	0.841	0.063

Ln (per capita GDP)	G	6.453	0.733	8.832	5.123
Ln (per capita GDP) square	GS	45.42	9.839	78.32	26.34

Empirical testing

Firstly, a spatial autocorrelation test was conducted on the dependent variable of this article. Table 2 provides a detailed explanation of the test results for each commonly used variable, indicating that all indicators have passed the significance test, indicating a significant spatial autocorrelation in China's urban-rural income gap.

Table 2 Spatial autocorrelation test

	(1) Nation wide	(2)Nationwide	(3)Nationwide	(4)Nationwide	(5)eastern	(6)central section	(7)west	(8) 2000-2007	(9) 2008-2014	(10) 2014-2021
Moran'I	0.831 (0.00)	0756 (0.00)	0551 (0.00)	0.821 (0.00)	0.648 (0.00)	0.636 (0.00)	0.392 (0.00)	0.894 (0.00)	0.839 (0.00)	0.738 (0.00)
LM-Error	1429.2(0.00)	2172.3 (0.00)	4076.4(0.00)	1394.2(0.00)	145.4 (0.00)	101.3 (0.00)	118.4 (0.00)	578.3 (0.00)	495.6 (0.00)	394.1 (0.00)
R-LMErr or	0.572 (0.03)	6.025(0.01)	1.048(0.00)	5.581(0.02)	7.432 (0.01)	0.342 (0.00)	7.654 (0.04)	0.425 (0.01)	1.157 (0.04)	0.648 (0.05)
LM-Lag	1634.5(0.00)	2634.2(0.00)	3723.1(0.00)	1563.6(0.00)	253.5 (0.00)	145.3 (0.00)	293.5 (0.00)	609.3 (0.00)	528.3 (0.00)	510.4 (0.00)
R-LMLag	204.3	457.3	738.3	174.3	101.3	39.43	184.3	31.45	84.52	114.2

After passing the spatial autocorrelation test, this article estimates the spatial regression model mentioned above. Firstly, the regression of the basic model is performed without considering the control variables. This article uses the MLE method to estimate the Sar FE, Sem FE, Sem FE, and Sar RE models separately. In addition, considering the vast territory of China, the Chinese provinces are divided into eastern, central, and western regions for estimation. Finally, the author divides the time period considered in this article into three parts: 2000-2007, 2008-2014 And from 2015 to 2021, we will examine in detail the spatial impact of China's trade openness on the urban-rural income gap. The specific estimated results are shown in Table 3.

Table 3 Estimated Results

	(1) Pnl-FE Nationwide	(2) Sar-FE Nationwide	(3) Sem-FE Nationwide	(4) Sem-RE Nationwide	(5) Sar-RE Nationwide	(6) Sar-FE Nationwide	(7) Sar-FE ntra l section	(8) ar-FE west	(9) Sem-RE 2000-2007	(10) Sem-RE 2008-2014	(11) Sem-RE 2015-2021
T(E)	0.411***	0.079**	0.002*	0.004*	-0.456***	0.127***	3.504**	1.171**	-0.123**	-0.121	-0.163*
M					0.165**						
F	1.435***	2.234**	1.183**	0.432**	1.773***	3.481***	4.538*	-0.938	10.32***	1.237***	-2.023
ϱ(λ)		0.684**	0.803***	0.834***	0.675***	0.227***	0.204**	0.648**	0.493***	0.793***	0.651***
A-R^2	0.146	0.718	0.736	0.721	0.718	0.403	0.584	0.684	0.585	0.884	0.948
L value		-639.1	-564.1	-594.2	-594.4	-664.3	-312.3	-145.3	-243.3	-54.34	6.644
AIC		1261.2	1079.3	1330.5	1195.2	647.3	295.4	595.3	515.3	118.98	-7.09
SC		1243.1	1077.4	1327.3	1193.3	645.3	293.5	595.3	514.2	116.58	-9.04
Sample size	848	1054	1054	1054	1054	374	272	408	372	372	372

The estimated results in Table 3 show p or λ If it is positive, it indicates that the local area will be positively affected by neighboring areas. The coefficient of trade openness is 0.0079, indicating that an increase in trade openness will increase the income gap between urban and rural areas. According to the theoretical analysis in the previous text, several explanations can be given for this: firstly, foreign trade is unbalanced in the development of urban and rural areas in China. Specifically, urban development should prioritize the development of rural areas. Secondly, the upgrading of industrial results brought about by foreign trade mainly increases the demand for technology intensive products, leading to changes in the industrial structure and a relative reduction in the demand for unskilled labor in rural areas.

In addition, this article decomposes trade openness into import openness and export openness. The estimated results of the article show that the coefficient of export openness is -0.456, while the coefficient of import openness is 0.165. This indicates that the main reason for the positive impact of trade openness on the urban-rural income gap is the impact of imports. Furthermore, it can be found that the negative effect of China's trade export openness on the urban-rural income gap may be due to China being a traditional manufacturing country, and China's export products are mainly in the manufacturing industry. After training, the majority of unskilled labor in rural areas of China are also engaged in such work, resulting in a rapid increase in their wages and narrowing the urban-rural income gap. From a regional perspective, the estimated results show that trade openness has to varying degrees widened the income gap between urban and rural residents in China, regardless of whether it is in the eastern, central, or western regions. Finally, in terms of time period, China's early trade opening-up had a certain inhibitory effect on the urban-rural income gap, but as the trade opening-up period increased, it gradually showed a positive correlation with the urban-rural income gap.

To verify the robustness of the research results, the author added various control variables and estimated the above model. The estimated results are shown in Table 4.

Table 4 Estimated results after adding control variables

	(1) Pnl-FE Nationwide	(2) Sar-FE Nationwide	(3) Sem-FE Nationwide	(4) Sem- RE Nationwide	(5) Sar-RE Nationwide	(6) Sar- FE eastern	(7) Sar- FE central section	(8) ar-FE west	(9) Sem-RE 2000-2007	(10) Sem-RE 2008-2014	(11) Sem-RE 2015-2021
T(E)	0.233***	0.129**	0.112**	0.034**	-0126**	0.127***	0.654**	2.731**	-0.003**	-0.053	-0.563*
M					0.105**						
F	-2.435*	0.334**	-0.483**	-0.432	0.2773*	1.881***	-0.003	-0.918	8.032***	1.237***	-2.023
G	1.533**	0.078**	0.222**	0.393**	0.081***	-0.064**	0.406**	0.191**	0.129***	0.111***	0.665***
GS	-0.078**	0.014**	0.009*	-0.032*	0.018**	0.021**	-0.006	0.011	0.008	-0.004	-0.064
FN	0.276**	0.589**	0.591**	0.684**	0.581**	0.580**	-0.294*	0.751**	0.743**	0.272**	0.546**
IG	0.996***	2.176***	2.735***	2.280***	1.838***	2.757***	0.339	3.024***	3.700**	0.685	1.479**
FG	-0.282	1.57***	1.512**	1.123**	1.335**	3.97**	1.004	1.249***	0.988**	1.056**	1.659**
IR	0.605***	0.021***	0.019***	0.017***	0.019***	0.024***	0.035***	0.016***	0.023***	0.011	0.028***
EU	0.373	-1.99**	-0.198	-0.362*	-2.283**	-3.02***	-1.94***	-2.495**	-0.145	-0.148	-1.143**
ES	-2.548***	-2.794**	-3.387**	-2.438**	-2.413**	-2.413**	0.995	-6.493**	-3.213**	-1.948**	-2.483**
p(λ)		0.384***	0.403***	0.734***	0.485***	0.227***	0.004	0.058	0.053	0.493	0.151
A-R2	0.563	0.604	0.585	0.596	0.584	0.584	0.583	0.485	0.586	0.675	0.548
L value		-639.1	-564.1	-494.2	-694.4	-164.3	-124.4	-314.3	-164.3	-16.43	-264.3
AIC		1260.3	1079.3	1195.4	1347.3	647.3	295.4	595.4	515.4	118.3	-7.09
SC		1258.4	1077.3	1194.3	1345.4	648.4	294.3	595.3	513.5	117.3	-9.04
Sample size	848	1054	1054	1054	1054	374	272	408	372	372	372

This article finds that in terms of adjusted R2, the benchmark model has the smallest value, and in addition, p or λ All passed the significance test. This indicates that the model can still exhibit strong spatial correlation after adding control variables. For both core explanatory variables and significance, they are highly consistent with the estimated results of the baseline model, indicating the robustness of the regression results. In addition, from the perspective of geographical regions, compared with the basic regression results, only the eastern region's regression results are still robust, while the central and western regions are not robust. In addition, after adding control variables, the regression results over time also became less robust.

Conclusion

This article uses provincial panel data from 2000 to 2021 in China to study the impact of trade openness on the urban-

rural income gap from the perspective of spatial econometrics. Firstly, the theoretical hypothesis of this article concludes that the impact of trade openness on the income gap between urban and rural residents is uncertain - after opening up to the outside world, if labor-intensive products are the main focus, it will have a negative effect; Technology intensive products have a positive effect. And spatial correlation has a positive effect on the income gap between urban and rural residents.

The empirical results of this article indicate that trade openness has increased the income gap between urban and rural residents. The role of spatial correlation is also consistent with theory. From the results of other control variables, the increase of regional economic strength, financial service industry level, regional industrial development, local government expenditure level and urban and rural fixed assets investment ratio will expand the income gap between urban and rural residents, but the increase of labor input level will narrow the income gap between urban and rural residents.

The research results of this article also indicate that China's current trade openness will expand the income gap between urban and rural residents, which indirectly judges China's current trade situation. From theoretical analysis, it can be seen that if trade openness is positively correlated with income gap, the possible reason behind it is that China's trade products are mainly concentrated in technology intensive products at present. In addition, the income gap between urban and rural areas of Chinese residents has obvious spatial spillover, which indirectly reveals a breakthrough point for the government to solve the income gap between urban and rural areas, that is, how to reduce this spatial spillover and make resource factors flow more reasonably.

Relevant policy recommendations

Based on the research findings of this article, the following policy recommendations are mainly provided:

Accelerate the trade development in the central and western regions, especially in the underdeveloped western regions

Firstly, the government should actively improve the infrastructure construction that restricts the economic development of the central and western regions, provide transportation channels for trade openness, and vigorously build infrastructure such as railways, highways, bridges, and electricity. Only in this way can we attract numerous investors, accelerate the development of local industries, and profit from trade openness. Secondly, the government should vigorously promote the construction of software facilities in the central and western regions, providing various guarantees for trade openness. The government should increase investment in technology, talent, and transfer payments in the central and western regions, gradually strengthening economic cooperation between the central and western regions and the eastern regions. Finally, fully leverage the comparative advantages of local industries and resources in the central and western regions, implement an economic development strategy that combines "bringing in" and "going out", and gradually narrow the income gap with the eastern region. For example, under the "the Belt and Road" strategic deployment, we will accelerate the process of free trade between the western region and surrounding countries, implement credit guarantee, export tax rebate, subsidies and other policies for export products, and provide more multilateral trade opportunities for the western region; At the same time, efforts will be made to build the brand of foreign trade enterprises in the western region, improve the quality of foreign trade products, and lay a solid foundation for the export of foreign trade products in the central and western regions.

Intensify the transfer of surplus rural labor to non-agricultural industries and vigorously promote the development of small and medium-sized towns

Deepen the adjustment of agricultural industrial structure, continuously increase resource investment in agriculture, rural areas, and farmers, vigorously support leading enterprises in agricultural industrialization, farmer professional cooperatives, family farms, and professional large households, promote the adjustment of agricultural industrial structure, and enhance the internal absorption capacity of surplus rural labor. In order to prevent the widening gap between urban and rural areas, it is not advisable to overly emphasize the urbanization of large and medium-sized cities while neglecting rural small towns. In the process of urbanization, we should vigorously develop county-level cities, focus on developing central towns, and promote the coordinated development of large, medium, and small cities and towns. Only by making small and medium-sized towns the main carriers for absorbing agricultural population transfer can we truly implement population urbanization and promote urban-rural integration development.

Accelerate the reform of the registered residence system and welfare system, and promote the full flow of rural labor force

In recent years, although the country has made some achievements in gradually reforming the single registered residence system, there is still obvious inequality between urban and rural residents in the housing, education, medical and other welfare systems attached to registered residence status, which is the main factor impeding the flow of rural labor. Therefore, the reform of the registered residence system will enable rural residents to enjoy the same medical and social security treatment as urban residents, and ensure that migrant workers and their children have fair access to education. It is of great significance to promote the full flow of rural labor force and thus play the role of trade openness in convergence of urban and rural income.

Developing rural finance and appropriately increasing the proportion of investment in rural areas

We should balance the proportion of urban and rural fixed assets investment, and maintain a fair policy of urban and rural fixed assets investment from the system; Continue to increase fixed assets investment in traditional agricultural fields such as rural housing, agricultural production equipment, farmland and water conservancy infrastructure, while improving the rural fixed assets investment environment to attract more funds to rural areas; Expand rural investment and financing channels, establish comprehensive and multi-level investment and financing channels that cover government investment, private investment, and other aspects. The institutional guarantee, scale expansion and structural optimization of rural fixed assets investment will lay a solid material foundation for the increase of rural residents' income.

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