Economics

Does the adjustment of industrial structure restrain the income gap between urban and rural areas

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Abstract: Industrial structure adjustment is a process that involves reconfiguring input factors to enhance productivity and efficiency. One crucial aspect of this adjustment is the transformation of the labor force composition, which subsequently affects the employment structure. Consequently, variations in productivity levels lead to the cross-departmental migration of workers, resulting in changes to the income gap among employees. This paper examines the impact of China's industrial structure adjustment and labor mobility on the urban-rural income gap between 1990 and 2019. Employing an empirical approach, the study investigates the influence of industrial structure adjustment and the direction of labor mobility on the urban-rural income gap. The findings indicate that the quality of industrial structure adjustment contributes to the widening of the urban-rural income gap, whereas labor mobility helps to narrow it. In regions experiencing a net influx of labor, a superior quality of industrial structure adjustment amplifies the urban-rural income gap, whereas labor migration diminishes it. Conversely, in regions witnessing a net outflow of labor, a superior quality of industrial structure adjustment reduces the income gap, while labor mobility widens the urban-rural income disparity. Notably, in more developed areas of China, the quality of industrial structure adjustment has widened the income gap, whereas labor mobility has narrowed the urban-rural income gap. However, in less developed regions, labor mobility exacerbates the urban-rural income gap.

Key words: Industrial structure adjustment; Urban-Rural income gap; Labour mobility;

Economic development; Spatial econometrics

1. Introduction

The most important problem facing developing countries is the social gap between the rich and poor. Historical development has proven that the most effective method of narrowing the gap between the rich and poor is to expand labour mobility and narrow the income gap between urban and rural areas through the effect of reconfiguring labour in different sectors. The root of labour mobility allocation lies in the adjustment of the industrial structure. Adjustment of the industrial structure or spatial layout has changed the balance between the supply and demand of the labour force. On the one hand, it has caused the rural labour force to face unemployment due to insufficient skills associated with the adjustment or upgrading the industrial structure and forced the rural surplus labour force to return to the countryside, thus reducing the wage income of the rural labour force and widening the income gap between urban and rural areas. On the other hand, adjusting the industrial structure in underdeveloped areas has brought about an increase in jobs, which has led a large surplus of the rural labour force to leave but also increases the per capita capital of agriculture (Chusseau et al.,2008; Shin,2012) and improves the efficiency of agricultural production, thereby enabling rural labourers to obtain the benefits introduced by adjusting the industrial structure. Therefore, how does adjusting the industrial structure affect labour mobility? Thus, how to change the income gap between urban and rural areas is worthy of further discussion.

With the deepening of market-oriented reform, the government has become aware of the increasingly uneven distribution of wealth among members of society and has

taken a series of measures, such as increasing subsidies for agriculture, rural areas and farmers, increasing rural infrastructure construction, helping the poor, and building a modern agricultural industrial system. However, the mainstream view is that broadening the income sources of the rural labour force will improve their relative income (Morduch and Sicular,2002; Risso and Edgar,2012; Ezcurra,2009) or measures should be implemented to improve agricultural income and solve the urban-rural income gap (Davis,2008; Goto,2014). However, due to the typical dual economic structure in China, agriculture is mainly concentrated in rural areas, which is restricted by land resources and technical conditions (Calderón and Chong,2004; Ju et al.,2016； Li et al.,2020). The fact that the income of rural residents has increased cannot be fundamentally changed by the improvement of production efficiency in the traditional agricultural sector.

In fact, the income gap is based on the industrial development gap, and industrial development provides support for regional economic development (Goldberg and Nina, 2007; Lee,2016). When there is a gap in regional economic development, the income gap between urban and rural areas is reflected in the unbalanced allocation of capital, labour and technology between urban and rural areas. The essence of industrial structure adjustment is to realize the reallocation of resources and other elements in different areas with different levels of economic development. From this perspective, industrial structure changes can change the urban and rural income distribution (Hayter and Weinberg,2011). It is important to narrow the income gap between urban and rural areas by adjusting the industrial structure to increase the income of grassroots workers.

The development experience of other countries also shows that the flow of factors brought about by the upgrading of industrial structure affects the distribution of various resources between urban and rural areas and then affects the income gap between urban and rural residents. Therefore, studying the causal relationship between industrial structure adjustment and labour mobility on the income gap between urban and rural residents can not only provide deeper information on the effects of industrial structure adjustments on labour mobility but also help to identify a method of narrowing the income gap between urban and rural areas from the aspects of regional industrial structure adjustment and resource allocation.

2. Model

2.1 Family sector

It is assumed that all families have the same risk preference characteristics and the utility function is a function with a relative risk aversion coefficient of 1.

Suppose that there is no population growth in the economy and the population size is unitized. The maximization of family utility includes the following:

$$Max(C_t, C_{t+1}) = U(C_t) + \delta U(C_{t+1}) = lnC_t + lnC_{t+1} \quad (1)$$
$$S.t.\, C_t + \frac{C_{t+1}}{1 + r_{t+1}} = W_t; C_{t+1} = (1 + r_{t+1})(W_t - C_t)$$

where C_t and C_{t+1} are the first and second consumption, respectively, W_t is the wage income obtained for the first period of supply labour; r_{t+1} represents the real interest rate level; and δ represents the discount factor.

We introduce the budget constraint formula into the utility function and obtain the unconstrained utility function as follows:

$$MaxU(C_t, C_{t+1}) = U(C_t) + \delta ln[(1 + r_{t+1})(W_t - C_t)] \quad (2)$$

Formula (2) applies to the first consumption (C_t) and the second consumption (C_{t+1}) to obtain the following:

$$C_t = \frac{W_t}{1+\delta} \tag{3}$$

$$C_{t+1} = \frac{\delta(1+r_{t+1})}{1+\delta} \tag{4}$$

2.2 Industrial sector

The national economic sector is divided into the traditional agricultural production sector and the nonagricultural production sector. It is assumed that the traditional agricultural sector inputs the only factor of production (labour force L_a), while the nonagricultural sector inputs the factors of production (labour force L_b), material capital (K) and technological progress (A). Technological progress applies to the industrial structure (φ). Assume that there is no capital adjustment cost or depreciation. The agricultural sector usually absorbs low-skilled or unskilled labour for employment, with diminishing returns to scale. However, the nonagricultural sector absorbs relatively highly skilled and skilled labour for employment, and the return on scale remains unchanged. Set the production functions of two production departments as follows: $Y_b = A(\varphi)K^{1-\beta}L_b^{\beta}; Y_a = L_a^{\alpha}$, where σ and b are the output elasticity of labor forces.

Assuming that manufacturers compete freely in the labour market, capital market and product market, then maximizing the profits of manufacturers is equivalent to maximizing their output. Therefore, when the output is maximized, the optimal material capital quantity input selected by the two production departments makes the marginal output of capital equal to the marginal cost (i.e., market interest rate). The optimal quantity of labour is that the marginal output of labour is equal to its marginal cost (wage level); therefore, it is as follows:

$$R = \frac{\partial Y}{\partial k}(1-\beta)A(\varphi)K^{-\beta}L_b^{\beta} \tag{5}$$

$$W_a = \frac{dY_a}{dL_a} = \alpha L_a^{\alpha-1} = \alpha(L-L_b)^{\alpha-1} \tag{6}$$

$$W_b = \frac{dY_b}{dL_b} = \beta A(\varphi)K^{1-\beta}L_b^{\beta-1} \tag{7}$$

where W_a、W_b is the average income level of the agricultural sector and nonagricultural sector, respectively, and r represents the return on capital. The average

wage in the agricultural sector is a decreasing (increasing) function of the labour force in the agricultural sector (or the labour force in the nonagricultural sector). The average wage of the non-agricultural sector is a function of the industrial structure of material capital and human capital. According to Formula (5) and Formula (7), the derivative of material capital (k) is obtained:

$$\frac{\partial R}{\partial K} = -\beta(1-\beta)A(\varphi)K^{-\beta-1}L_b^{\beta} \quad (8)$$

$$\frac{\partial W_b}{\partial K} = \beta(\beta-1)A(\varphi)K^{-\beta}L_b^{\beta-1} \quad (9)$$

Equations (8) and (9) show that $\partial R/\partial K < 0$ and $\partial W_b/\partial K > 0$ That is, with the development of the economy, capital accumulation in the nonagricultural sector increases, and the marginal output of capital decreases. The marginal output of labour is increasing, and the relative shortage of highly skilled labour in nonagricultural sectors leads to labour mobility.

In the same way, based on Formula (6) of the wage level of the labour department and Formula (7) of the wage income level of the labour department, the input of the factor labour force (L_b) in the nonagricultural department is derived.

$$\frac{\partial W_a}{\partial L_b} = -\alpha(\alpha-1)(L-L_b)^{\alpha-2} \quad (10)$$

$$\frac{\partial W_b}{\partial L_b} = \beta(\beta-1)A(\varphi)K^{1-\beta}L_b^{\beta-2} \quad (11)$$

In Formula (10) and Formula (11), $\partial W_a/\partial L_b > 0$ explains the mobility of the nonagricultural labour force (L_b) and the increasing function of the average wage of the agricultural sector (W_a) while $\partial W_b/\partial L_b < 0$ indicates that the wage level (W_b) of nonagricultural production is a decreasing function of the flow of the nonagricultural labour force (L_b).

2.3 Equilibrium

When workers can choose cross-sectoral choices, rational workers will meet with two choices. First, they will continue to engage in the original agricultural sector, and their utility function is $lnC_{at} + lnC_{a,t+1}$. Second, the labour force is transferred from

the agricultural sector to the nonagricultural sector for production activities, and its utility is as follows: $lnC_{bt} + \delta lnC_{b,t+1} - D_t(\varphi_t)$, where $D_t(\varphi_t)$ is the flow cost of labour engaging in production in traditional agricultural sector and flowing to a nonagricultural sector.

Because of the transfer cost of labour mobility, whether labour mobility across departments depends on the utility level in both cases. Therefore, when the system is balanced, the resource allocation utility of the labour force in the two departments is equal:

$$lnC_{at} + \delta lnC_{a,t+1} = llnC_{bt} + \delta lnC_{b,t+1} - D_t(\varphi_t) \tag{12}$$

When the utility is maximized, the consumption of the first stage and the second stage is substituted into Formula (12), and it is obtained as follows:

$$ln\frac{W_{at}}{1+\delta} + \delta ln\frac{\delta(1+r_{t+1})W_{at}}{1+\delta} = ln\frac{W_{bt}}{1+\delta} + \delta ln\frac{\delta(1+r_{t+1})W_{bt}}{1+\delta} - D_t(\varphi_t) \tag{13}$$

The wage level of the nonagricultural production department in period T can be obtained:

$$W_{at} = e^{\frac{D_t(\varphi_t)}{1+\delta}} W_{bt} \tag{14}$$

where $T = W_{bt}/W_{at}$; t represents the income level gap between urban and rural areas and is associated with labour transfer costs; and $D_t(\varphi_t)$ indicates the change in the industrial structure (φ). The transfer cost and industrial structure function of the income gap is derived as follows:

$$\frac{dT}{dD_t(\varphi_t)} = \frac{1}{1+\delta} e^{\frac{D_t(\varphi_t)}{1+\delta}} \tag{15}$$

$$\frac{dT(\varphi)}{d\varphi_t} = \frac{dT}{dD_t(\varphi_t)} \frac{dD_t(\varphi_t)}{d\varphi_t} = \frac{1}{1+\delta} e^{\frac{D_t(\varphi_t)}{1+\delta}} D'(\varphi_t) \tag{16}$$

In Formula (15), $dT/dD(\varphi_t) > 0$, which shows that the transfer cost of labour from the agricultural sector to the nonagricultural sector is an increasing function of the urban-rural income gap; that is, the greater the transfer cost of labour is, the greater the income gap between urban and rural areas. The size of the income gap between urban

and rural areas caused by changes in the industrial structure depends on the transfer cost ($D(\varphi_t)$) of the industrial structure (φ_t) partial derivation.

2.4 Urban-rural income gap

To better describe how industrial structure adjustment and labour mobility under microscopic conditions affect the income gap behaviour of urban and rural residents, we obtain the ratio of (6) and (7) of urban and rural average wages when the output of the production department is maximized:

$$T(\varphi) = \frac{W_{at}}{W_{bt}} = \frac{\alpha(L-L_b)^{\alpha-1}}{\beta A(\varphi) K^{1-\beta} L_b^{\beta-1}} \tag{17}$$

Take the logarithm on both sides of the equation:

$$lnT(\varphi_t) = (\alpha-1)\ln(L-L_b) - (\beta-1)lnK - lnA(\varphi) - (\beta-1)lnL_b + \ln(\alpha/\beta) \tag{18}$$

The two sides of Formula (18) are related to L_b. The derivative is determined and the formula is simplified as follows:

$$\frac{\partial T/\partial L_b}{T} = (1-\alpha)/(L-L_b) - (\beta-1)/L_b \tag{19}$$

In Equation (19), $\partial T/\partial L_b > 0$ indicates the ratio of urban and rural income (T) with the expansion of nonagricultural labour mobility. Changes in industrial structure in the urban-rural income gap (φ) derivative lead to the following:

$$\frac{T'(\varphi)}{T(\varphi)} = \frac{1-\alpha}{L-L_b}\frac{dL_b}{d\varphi} - \frac{A'(\varphi)}{A(\varphi)} - \frac{\beta-1}{L_b}\frac{dL_b}{d\varphi} \tag{20}$$

To simplify:

$$\frac{T'(\varphi)}{T(\varphi)} = \left(\frac{1-\alpha}{L-L_b} - \frac{\beta-1}{L_b}\right)\frac{dL_b}{d\varphi} - \frac{A'(\varphi)}{A(\varphi)} \tag{21}$$

In summary, the micro mechanism of the urban-rural income ratio in Formula (21) mainly includes two aspects. First, the change in industrial structure makes the labour force in traditional agricultural sector flow to non-traditional agricultural sector, and the change in absolute income of urban and rural residents will have an impact on the relative income between urban and rural areas. Second, the influence of technological progress brought about by industrial restructuring on the urban-rural income ratio.

3.Econometric model

3.1 Explanatory variables

3.1.1 Adjustment range of the industrial structure.

With reference to the methods of Findeisen et al. (2008) and Du et al. (2010), the adjustment range of industrial structure (adj) is reflected by measuring the intensity of the reconfiguration of the total employment of industrial enterprises in the region.

$$adj_{it} = \{[\sum_{i=1}^{n}|e(i,t+1) - e(i,t)|] - |e(t+1) - e(t)|\}/e(t) \quad (22)$$

where $e(i,t)$ represents the employment of industrial enterprises in industry i during period t and $e(t)$ represents the total employment in the region during period t. This index reflects the intensity of labour allocation in the industry.

3.1.2 Quality of the industrial structure adjustment

The quality of the industrial structure adjustment is based on the effect of the industrial structure adjustment on the original market elements, which shift from departments with lower productivity to departments with higher productivity and technical complexity. Generally, it leads to labour intensive, capital intensive and knowledge and technology intensive changes. The quality of industrial structure adjustment has two general connotations: first, the proportional relationship of input factors has changed; second, the labour productivity is improved. The measurement method is as follows:

$$qua_{it} = \sum_{j=1}^{n} S_{ijt} \times F_{ijt} \quad (23)$$

where i、j、t represent the region, industry and time, respectively; S_{ijt} represents the ratio of the added value of regional industry j to the added value of regional GDP at time t and region ¡; and F_{ijt} represents the productivity of regional industry j at time t and region i.

3.1.3 Labour mobility

The spatial distribution pattern of the labour force is usually caused by the imbalance of regional economic development, and the main factor of labour mobility is the difference in income level introduced by regional economic development.

According to the research of Zhan et al. (2020), Fang et al. (2008) and other scholars, the calculation formula of the labour mobility index is as follows: floating population =permanent population-registered population+total change in registered population-natural growth of the local population. If the amount of labour mobility is positive, it indicates a net inflow of labour force in this area, and if the amount of labour mobility is negative, it indicates a net outflow of the population.

3.2 Interpreted variables

There are two methods to measure the income gap between urban and rural areas: the Gini index and the Theil index. The Gini coefficient can only compare the income gap of the whole population in a country or region, and it can easily neglect the interests of the low-income class. It is difficult to explain the characteristics of the income gap, and its economic significance is limited. The Theil index is more sensitive in calculating the income gap. Therefore, the Theil index represents a more scientifically robust choice as the index of the urban-rural income gap.

$$Thi_{it} = I_{uit}/I_{it}\, ln\big((I_{uit}/I_{it})/(P_{uit}/P_{it})\big) + I_{rit}/I_{it}\, ln\big((I_{rit}/I_{it})/(P_{rit}/P_{it})\big) \qquad (24)$$

where Thi is the Theil index; I_{uit} and I_{rit} are the disposable income of towns and villages in period T in area I, respectively; P_{uit} and P_{rit} represent the population of towns and villages in period t in area i; and I_{it} represents the total regional income of region i during period t. Obviously, the Theil index of income not only considers the population structure but also the relative changes of residents' income and at the same time reflects the realistic background of the dual economic structure between urban and rural areas; therefore, it is more in line with the current situation of the income gap between high- and low-income groups on the macro level of measuring urban and rural income.

3.3 Control variables

The control variables selected in this paper include the following. (1) Urbanization level (urb), which does not have a single linear impact on urban and rural income distribution but has an inverted "U-shaped" feature (Anand and Kanbur,1993) and adopts the ratio of urban population to registered population. (2) Government scale (gov), with government departments mainly participating in income redistribution by means of taxation and providing public goods and providing protection for grassroots workers through the social security system, thus indicating that the government is a strong backer for narrowing the income gap between urban and rural areas. The ratio of fiscal revenue to expenditure is used to measure the government scale. (3) Unemployment rate (une), with an increase in this rate indicating an economic recession according to "Okun's Law". Economic recession leads to the shrinking of the market, which leads to a decrease in the wage income of residents. (4) Human capital (edu), which is a key factor affecting economic development, with workers changing their income level through learning by doing and cross-regional mobility. The average years of education is adopted as the proxy variable of human capital. (5)Transport infrastructure convenience (tra), with the construction of transportation infrastructure not only reflecting the convenience of regional transportation but also expanding the circulation of goods. Therefore, a more perfect infrastructure will attract investment and employment in the labour force and lead to a spillover effect to enhance market potential (Bronzini and Piselli,2009), which is expressed by the ratio of the sum of railway mileage and highway mileage to the regional area. (6) Ownership structure of employment (own), which has two main influences on the income gap between urban and rural areas. First, the mobility of a large number of grassroots labourers intensifies competition in the urban labour market and reduces wages in the urban labour market, Second, labour mobility has further improved the efficiency of human resource

allocation in the process of employment reconstruction, Therefore, the employment ownership structure has a dual effect on urban and rural income. The employment of state-owned enterprises accounts for the total employment.

3.4 Data source and description

In this paper, 30 provincial units in mainland China from 1990 to 2019 are taken as the sample interval, and the reasons are as follows. (1) China's Gini coefficient hovered at approximately 0.3 in the 1980s, and the income gap was relatively reasonable. Only in the middle and late 1990s did the urban-rural income gap show a trend of rapid expansion. (2) The availability of data and statistical calibre. For example, Hainan and Chongqing had some missing variables before 1990; therefore, we chose 1990–2019 as the study interval. In addition, due to the serious lack of data in Tibet, this region was eliminated. Data sources include Statistical Yearbooks, China Rural Statistical Yearbooks, China Population and Employment Statistical Yearbooks, China Township Enterprise Yearbooks, etc. The data of some provinces are missing, and the missing data are supplemented by interpolation.

3.5 Econometric model

Based on the above theoretical basis, we establish the following basic models:

$$lnThi_{it} = \alpha_0 + \alpha_1 lab_{it} + \alpha_2 ind_{it} + \delta lnX_{it} + \varepsilon_{it} \quad (25)$$

where *it* stands for the variable in period *t* and region i, Thi stands for the Theil index, which is used to measure the income gap between urban and rural areas, Lab stands for labour mobility (net inflow and net outflow), ind stands for the industrial structure adjustment (adjustment range and adjustment quality), X stands for the control variable set, α_0 is the intercept term, and ε_{it} is a random error term.

Actually, adjusting the industrial structure and labour mobility are continuous processes, and the income gap between urban and rural areas will not only be affected by their current levels but also by the early stage level. Therefore, the lag period of the industrial structure adjustment belt and labour mobility on the urban-rural income gap is taken as the explanatory variable, and the lag period is selected to control and eliminate endogeneity. The following dynamic panel model is constructed:

$$lnThi_{it} = \alpha_0 + \alpha_1 lab_{it} + \alpha_2 ind_{it} + \alpha_3 lnThi_{it-1} + \delta lnX_{it} + \varepsilon_{it} \quad (26)$$

With the strengthening of the industrial association and personnel mobility between regions, there is not only a significant path dependence in economic development between regions but also a strong spatial linkage effect in the income gap between urban and rural areas. If only the ordinary panel model is considered and the spatial correlation between variables is ignored, the result will be biased. Therefore, a spatial econometric model is selected to study the problems in this paper. Commonly used spatial econometric models include the spatial autoregressive model (SAR) and spatial error model (SEM). When the spatial dependence among variables plays a decisive role in the model and leads to spatial autocorrelation, the spatial autoregressive model is chosen, whereas when the error term of the model is spatially autocorrelated, the spatial error model is selected. The two models are expressed as follows:

$$Y = \rho WY + \beta X + \varepsilon \quad (27)$$

$$Y = \beta X + \varepsilon; \varepsilon = \lambda w\varepsilon + \mu, \ \mu \sim (0, \ \sigma^2 \mathrm{I}) \quad (28)$$

In Formula (27) and Formula (28), Y and X represent dependent variables and independent variables, respectively; α_j, ρ and λ are coefficients of the variable, ε and μ are error terms that obey a normal distribution, other variables are the same as

in the above formula, and W is the spatial weight matrix. Considering that an important factor of labour mobility is the difference of regional economic development level, when choosing the spatial weight matrix, the weight of the economic distance ($w1$) can reflect the difference of economic development between different regions. The structure takes the reciprocal of the absolute value of the difference in the per capita GDP between the two regions during the investigation period as the weight, namely: $w_{ij} = 1/|\bar{X} - \bar{Y}|$, where $\bar{X}$ indicates the regional per capita GDP and $\bar{Y}$ indicates the per capita GDP of the region.

Because the labour mobility caused by adjusting the industrial structure in different regions is a continuous process, the resulting income gap depends not only on the current factors but also on the previous factors; that is, the income gap may have dynamic effects. This paper will use the dynamic spatial panel model to test the impact of industrial structure adjustment and labour mobility on the income gap. The following model is obtained:

$$lnThi_{it} = \theta lnThi_{it-1} + \rho \sum_{j=1}^{n} w_{ij}\, lnThi_{it-1} + \alpha_1 lab_{it} + \alpha_2 ind_{it} + \delta lnX_{it} + \nu_{it} + \varepsilon_{it} \quad (29)$$

$$\varepsilon_{it} = \lambda \sum_{j=1}^{n} w_{ij}\varepsilon_{it} + \mu_{it}$$

where $\alpha_{it}, \nu_{it}, \varepsilon_{it}$ are the regional effect, time effect and random disturbance, respectively; ρ and λ are the spatial lag coefficient and spatial error coefficient, respectively; and other explanatory variables are the same as in the above formula.

4.Results and analysis

Traditional econometric models may ignore the deviation caused by spatial factors. However, spatial correlation tests represent an important basis for distinguishing traditional econometric models from spatial econometric models.

4.1 Spatial correlation test

Table 1 shows the Moran's I test results of the urban-rural income gap from 1990 to 2019. The Moran test of the urban-rural income gap under the weight of economic space passed the 1% significance test except in certain years. Generally, the income gap between different regions does not show completely random characteristics, with a very obvious spatial correlation observed between the urban and rural income gaps, especially since 2005.

Table 1. Moran's I test of the urban-rural income gap from 1990 to 2019

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Moran's I	0.165***	0.319***	0.283***	0.251***	0.175***	-0.24	-0.159*	-0.116	-0.112	-0.099
	(5.57)	(3.59)	(3.21)	(2.88)	(2.11)	(0.102)	(-1.54)	(-0.83)	(-0.80)	(-0.66)
Year	2000	2002	2001	2003	2004	2005	2006	2007	2008	2009
Moran's I	-0.129	0.180**	-0.083	-0.251	-0.162	0.468***	0.475***	0.494***	0.465***	0.135*
	(-0.95)	(1.98)	(-0.49)	(-0.16)	(-0.27)	(5.16)	(5.22)	(5.43)	(5.11)	(1.76)
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Moran's I	0.473***	0.472***	0.484***	0.504***	0.476***	0.444***	0.471***	0.459***	0.472***	0.377***
	(5.20)	(5.18)	(5.31)	(5.54)	(5.257)	(4.91)	(5.20)	(5.07)	(5.21)	(5.95)

Note: t statistics are in brackets, * indicates p<0.1, ** indicates p<0.05, *** indicates p<0.01; the same below.

Before parameter estimation, it is impossible to judge the spatial dependence characteristics of variables according to experience. First, the model that meets the actual requirements must be selected. According to the criterion proposed by Anselin and Florax (1995), the LM-test value of the SAR model is significantly better than that of the SEM model under the economic weight matrix, R-LMERR is significant, but R-LMLAG is not significant. Therefore, the spatial error SAR model is superior to the spatial lag SEM model[①].

4.2 Basic regression

First, we analyse the estimated results of the income gap between urban and rural areas under industrial restructuring and labour mobility as a whole (Table2). To ensure the robustness of the regression results, we chose to add core explanatory variables into

① Due to limited space, the SAR and SEM model test results are not provided. Please contact the author if necessary.

the models. Model (1) and Model (2) investigate the effects of the adjustment range and quality of the industrial structure, respectively, on the income gap between urban and rural areas, Model (3) considers both the adjustment range and the adjustment quality of the industrial structure on the urban-rural income gap, and Model (4) considers the dynamic effect of the income gap under a period of lag.

Table2. Estimation of the income gap between urban and rural areas

Variable	Model (1)	Model (2)	Model (3)	Model (4)
Thi_{t-1}				0.736***
				(3.37)
adj	-0.120		-0.207	0.211
	(-0.24)		(-0.47)	(0.64)
qua		0.016***	0.091**	0.072**
		(3.51)	(2.10)	(2.04)
lab	-0.473***	-0.609***	-0.299**	-0.348***
	(-3.28)	(-4.21)	(-2.46)	(-3.42)
urb	-1.245***	-1.086***	-0.274***	-0.119***
	(-10.93)	(-9.85)	(-5.87)	(-3.71)
gov	-0.681***	-1.056***	-0.518***	-0.185***
	(-8.81)	(-12.19)	(-7.12)	(-3.65)
une	0.039**	0.051***	0.054***	0.021**
	(2.79)	(3.69)	(3.43)	(1.96)
edu	0.069***	0.131***	0.091	0.198
	(4.02)	(3.25)	(0.31)	(0.95)
tra	-0.070***	-0.077***	0.0179***	-0.006
	(-6.11)	(-7.03)	(4.03)	(-0.20)
own	-0.557***	-0.525***	-0.032	-0.045
	(-3.87)	(-3.89)	(-0.51)	(-1.07)
Fixed effects	Yes	Yes	Yes	Yes
R-sqr	0.497	0.504	0.548	0.800
LogL	-73.067	-68.17	-58.39	-544.12
ρ	-0.525***	-0.678***	-0.763***	-0.511***
	(-4.97)	(-5.51)	(-5.38)	(-4.53)

According to Table2, the estimation results with different core explanatory variables are still robust. From Model (1) to Model (4), it can be found that adjusting the industrial structure in the whole country has no significant impact on the income gap between urban and rural areas, although the quality of the industrial structure adjustment has widened the income gap between urban and rural residents. This paper holds that industrial adjustment quality represents the deep processing and intelligent

processing of commodities and thus indicates the development process of the whole industrial structure system from a low level to a high level. Throughout the industrial structure, the industrial adjustment quality usually gradually evolves from agriculture to industry and the service industry. The industrial emphasis has also evolved from labour-intensive industries to capital-intensive and technology-knowledge-intensive industries in turn, while China's industrialization has passed the high-speed development stage and is entering the later stage of industrialization. According to the conclusions of previous research (Sharon et al.,2020; Luo et al.,2021), a larger ratio of secondary industry or industry to GDP corresponds to a smaller income gap between urban and rural areas, while a larger ratio of tertiary industry or service industry to GDP corresponds to a larger income gap between urban and rural areas. From a microscopic perspective, the process of industrial structure adjustment is a complicated development process from low-tech enterprises to high-tech enterprises. If the local government excessively pursues the upgrading of industries or "deindustrialization", it will lead to an increase in the unemployment rate of low-skilled people, who are mainly rural labourers, which will reduce the overall income of low-income groups. However, the upgrading of industries will lead to an increase in the income level of high-skilled people or urban residents, which generally aggravates the widening income gap between urban and rural residents.

In addition, we also find that labour mobility has narrowed the income gap between urban and rural residents as a whole (Table2). On the one hand, since the 1980s, China's rural areas have begun to implement the household contract responsibility

system and the urban food rationing system has gradually disintegrated, resulting in a substantial increase in agricultural output and the emergence of agricultural surplus. A surplus labour force in agriculture was also observed, and a continuous large-scale rural rich labour force began to flow to cities in search of employment. The transfer of rich rural labourers to cities has led farmers to obtain wage income outside agriculture, thus increasing the income of rural labourers as a whole. On the other hand, with the large-scale use of agricultural mechanization, agricultural productivity has been greatly improved, which has reduced the demand for agricultural labour. However, agricultural production efficiency and crop yield have not been reduced and the operational income of farmers' families has increased. In addition, the Chinese government has issued a series of policies to benefit farmers. All these factors have directly or indirectly promoted the increase in household income of rural residents.

4.3 Differentiating the impact of labour mobility direction

On the basis of the above analysis, we further control the inflow and outflow of the labour force and investigate its impact on the income gap between urban and rural areas. Because the unbalanced panel data cannot be used for spatial measurement, time and regional data are deleted and retained as synchronously balanced panel data, and then the spatial measurement analysis is carried out (Table 3).

Table3. Estimates of the income gap between urban and rural areas by the direction of labour mobility

Variable	Net labor inflow regions		Net labor outflow regions	
	Model (1)	Model (2)	Model (3)	Model (4)
Thi_{t-1}		0.301***		0.083***
		(6.75)		(5.26)
adj	-0.928	-0.45	0.076	-0.051
	(-1.12)	(-0.16)	(0.98)	(-0.70)
qua	0.264***	0.231***	-0.113***	-0.136**
	(4.08)	(3.35)	(-3.23)	(-2.49)
lab	-1.361***	-0.755***	0.086***	0.062**
	(-4.26)	(-2.99)	(3.06)	(2.49)

Control variables	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
R-sqr	0.534	0.638	0.663	0.704
LogL	-44.79	-419.19	208.88	-413.77
ρ	-0.904***	-0.693***	-0.435***	-0.323***
	(-6.63)	(-5.76)	(-4.26)	(-4.59)

According to the situation of controlling the direction of labour mobility in Table 3, the adjustment range of industrial structure, whether it is the net inflow or outflow of labour, still has no significant effect on the income gap between urban and rural areas. However, the quality of industrial structure adjustment in areas with a net inflow of labour still widens the income gap between urban and rural areas (Model (1) and Model (2)). In this regard, our view is that the net inflow area of the labour force is usually the relatively developed southeast coastal area. In the high-speed historical period of political construction and development, especially when the infrastructure of the city had not been perfected, the demand for the grassroots labour force was very great. However, as the construction of the city became increasingly advanced, the economy of the developed areas began to transform based on scientific and technological information industries. The layout of capital- or technology-intensive industries, such as high-end industries and intelligence, can be guided. Adjusting the industrial structure in these developed areas is more of a "cage-for-bird" industrial strategy adjustment, and the industrial layout often shifts or excludes labour-intensive enterprises. Correspondingly, labourers in developed areas are often engaged in labour-intensive industries. Therefore, in the process of improving the industrial structure in developed areas, a large number of labourers will lose their jobs, which will result in a decrease in the overall income of low-income groups (Phan and Coxhead,2010; Neves et al.,2014).

In addition, in Table 3, the labour inflow in areas with a net labour inflow has narrowed the income gap between urban and rural areas. As a relatively developed area with better infrastructure, which is the net inflow area of labour force, the flow of labour, land and capital is more adequate, the regional economic development is more balanced, and the grassroots labour force in the region has more choices associated with urban-rural integration, which leads to a smaller income gap between urban and rural areas in developed areas.

In addition, in the areas with a net labour outflow (Model (3) and Model (4)), the quality of industrial structure adjustment has restrained the income gap between urban and rural areas. Compared with areas with a net labour inflow, the areas with a net labour outflow are mainly in the central and western regions while the industries with a net labour inflow are mainly labour intensive or capital intensive. Industrial structure adjustments are mainly performed to transfer labour-intensive and resource-intensive industries in developed areas, which absorbs a large number of employed people and increases the wage income of the rural labour force as a whole. Therefore, compared with cities and towns, adjusting the industrial structure in areas with a net inflow of labour brings more marginal contributions to rural grassroots workers. In Table3, we also find that the net outflow and net inflow of the labour force have opposite effects on the income gap between urban and rural areas in this region. The flow of labour in areas with a net inflow of labour suppresses the income gap between urban and rural areas, while the flow of labour in areas with a net outflow of labour widens the income gap between urban and rural areas. For an underdeveloped area, the income gap

between urban and rural areas is larger than that in developed areas; that is, the more rational the distribution of social wealth in developed areas, the higher the overall happiness of the population (Cremer and Roeder,2019). The spatial spillover effect will restrain the income gap between urban and rural areas in neighbouring areas but widen the income gap between urban and rural areas in areas with a net labour inflow. A difference is observed between the two views. With infrastructure investment, the government's investment in urban and rural infrastructure and people's welfare security, such as education, medical care, and social security, is far greater in developed areas than underdeveloped areas.

4.4 Heterogeneity analysis

4.4.1 Differentiating the impact of economic development level

Due to geographical location, environmental factors, human capital and other factors, regional economic development levels are quite different. China's eastern coastal provinces have a relatively high level of economic development, while the central and western regions are relatively backward in economic development, which causes differences in industrial structure adjustment and labour mobility direction. Moreover, regional economic development has different influences on the income gap between urban and rural areas. Therefore, we chose to divide the 30 provinces into the eastern, central and western regions according to the level of economic development to further analyse the impact of the heterogeneity of regional economic development on the income gap between urban and rural residents in different areas (Table4).

Table4. Regional analysis of urban and rural income gap

Variable	Eastern region		Middle region		Western region	
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)

Thi_{t-1}		-1.228***		0.997**		0.735***
		(-7.88)		(2.28)		(4.82)
adj	0.327	0.460	-0.128	-0.112***	0.146*	0.551**
	(0.76)	(1.02)	(0.78)	(-3.54)	(1.89)	(2.13)
qua	0.676***	0.584***	0.099**	0.136**	0.338***	0.195***
	(5.10)	(4.62)	(2.52)	(2.28)	(7.56)	(3.51)
lab	-0.078***	-0.007***	-0.069**	-0.050**	0.250**	0.140
	(-3.75)	(-3.53)	(-2.45)	(-2.37)	(1.99)	(0.20)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R-sqr	0.23	0.122	0.362	0.310	0.112	0.580
LogL	-413.77	-338.65	-3386.59	-1765.54	-1615.24	-374.18
ρ	-0.243***	-0.901***	0.648***	0.210***	-0.611***	-0.414***
	(-9.18)	(-7.17)	(17.17)	(4.63)	(-3.78)	(-3.23)

An analysis of the situation under differences in the regional economic development level (Table4) showed that the regression results obtained by adding the nonlag term and lag term of the urban-rural income gap are basically the same; therefore, this paper chooses the lag result for analysis. The industrial structure adjustment range has no significant impact on the income gap between urban and rural areas in the eastern region. In the central region, the income gap between urban and rural areas was significantly restrained, while in the western region, the income gap was widened. These findings show that adjusting the industrial structure has different influences on the income gap between urban and rural areas in different periods of regional economic development, especially in the later period of urbanization in more developed areas. However, in economically underdeveloped areas, because the economy is in the stage of rapid rise, absorbing a large number of industries and expanding employment has promoted the overall income of residents, thus narrowing the income gap between urban and rural residents. In underdeveloped areas, adjusting the industrial structure has widened the income gap between urban and rural residents, which means that in the

early stage of economic development, the income gap caused by the severe division of urban and rural systems and the unequal development opportunities cannot be reversed in a short time, which is likely the main reason for the continuous expansion of the income gap between urban and rural areas (McCall,2000; Aiyar and Ebeke,2020). According to the quality of the industrial structure adjustment, a significant positive correlation is observed between the quality of industrial structure adjustment and the income gap between urban and rural areas in the eastern, central and western regions, which is also explained in this paper as follows: At present, simple manual labour is gradually being replaced with the adjustment, transformation or upgrading of China's industrial structure, while the vast majority of rural workers are still employed by primary and secondary industries with lower thresholds. Improving the quality of industrial structure adjustment has continuously raised the employment threshold of skilled human capital, resulting in an increase in the unemployment rate of grassroots workers. The rural labour force is not dominant in employment and lacks the awareness and ability to maintain its own interests.

Table4 also shows that labour mobility in the eastern and central regions has reduced the income gap between urban and rural residents in this region (Model (5) to Model (6)) but has not inhibited the income gap between urban and rural residents in the western region. Compared with the relatively compact urban-rural layout in the eastern and central regions, the western region has a vast territory, the urban-rural distribution pattern is very scattered, and economic ties between urban and rural areas are lacking. Moreover, urbanization and industrialization have a weak driving effect on

rural areas and the ability of rural residents to increase their nonagricultural income is extremely limited. In addition, the difference between urban and rural dual structures leads to the obstruction of the rural labour force. In addition, the government’s investments in western cities in terms of infrastructure investment, education, medical care, social security, etc. is far beyond that in rural areas. This kind of biased policy is an important reason for the income gap between urban and rural areas, which leads to the widening of the income gap between urban and rural areas.

4.4.2 Distinguishing the income type and household registration type based

The Chinese government began to implement the reform and opening-up policy in 1978 and the household contract responsibility system in rural areas. As a result, many rural labourers were liberated from agricultural labour and formed a large number of surplus labourers, who began to flock to cities in a "migrant workers' tide" phenomenon. The influx of migrant workers to cities for employment solved the employment of surplus rural labourers. Moreover, the rural labour force has expanded its income sources, which mainly include four items: wage income, operational income, net property income and transfer income, among which wage income and operational income constitute the main part of the income of urban and rural residents. When the rural labour force expands its income sources, it also has a certain impact on the employment structure and income of urban workers in cities. Therefore, the wage income gap between urban and rural areas and the operational income gap are selected as important factors that affect the income gap between urban and rural areas, where the wage income gap between urban and rural areas and the operational income gap

between urban and rural areas are calculated according to Model (24). In addition, due to China's unique household registration system, there is a huge gap or household registration discrimination between the floating population and local people with household registration in various civil rights and social security, which leads to a large gap between the rich and the poor between urban and rural areas. In the process of choosing urban employment, migrant workers hope to complete the conversion of household registration status, that is, from agricultural registered permanent residences or urban household registration in other areas to household registration in the place of employment (newly added household registration population), to obtain the same treatment as the local household registration employment labour force. Therefore, this paper divides labour mobility into the newly increased registered population mobility (*regis*) and nonregistered labour mobility (*no_ regis*). The formula for calculating the newly increased registered labour force is regis=registered population of this year-natural population growth of this year-registered population of last year. The floating population of nonregistered labour force=permanent population-registered population. In addition, the choice of employment channels in the process of labour mobility is also the reason for the income gap between urban and rural areas. The employment choices of migrant workers in the process of labour mobility mainly include two aspects: choosing urban industrial enterprises for employment and flowing to township enterprises (including collective, cooperative and individual enterprises organized by farmers). Therefore, we also choose the development level of regional township enterprises as an important explanatory variable affecting the increase in rural labour

employment income. The formula for calculating the development level of township enterprises is regional township enterprise development (*rur_ent*)=total output value of township enterprises/total output value of regional industry.

Table5. Types of urban-rural income gap

Variable	Net labor inflow regions		Net labor outflow regions	
	The wage income gap	Operating income gap	The wage income gap	Operating income gap
	Model (1)	Model (2)	Model (3)	Model (4)
Thi_{t-1}	0.526***	0.314***	1.262***	2.061***
	(4.33)	(3.28)	(3.76)	(2.79)
adj	-0.454**	0.250	0.237*	0.102*
	(-4.54)	(1.09)	(3.31)	(1.88)
qua	-0.187***	0.122***	-0.196***	-0.363**
	(-2.74)	(3.88)	(-3.79)	(-1.97)
lab	-0.167***	-0.062***	0.263***	0.309 ***
	(-2.68)	(-5.14)	(5.03)	(4.12)
rur_ent	-0.184***	-0.421***	-0.354**	-0.083***
	(-2.94)	(3.67)	(2.16)	(3.38)
Control variables	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
R-sqr	0.771	0.528	0.622	0.862
LogL	-195.332	276.113	-272.286	816.5
ρ	-0.319***	-0.590***	-0.716***	-0.452***
	(-5.04)	(-2.19)	(-4.17)	(-5.47)

Table5 6 shows the effects of industrial structure adjustment, labour mobility and township enterprise development on the income gap between urban and rural areas when different labour mobility directions are distinguished. First, the lag period between the wage income gap between urban and rural areas and the operational income gap between urban and rural areas is significantly positive (0.526 and 0.314), indicating that the income gap is affected by the current situation. It will also be impacted by its history, and this influence is positive. In labour inflow areas (Model (1) and Model (2)), adjusting the industrial structure enlarges the wage income gap between urban and rural areas but narrows the operational income gap between urban and rural areas. We explain this as follows: in areas with a net inflow of labour, which are generally developed areas,

with the resolution of overcapacity in China in recent years, forced withdrawal of enterprises with high pollution and high energy consumption in developed areas has led to an increase in the number of unemployed people in grassroots labour, especially in rural labour, resulting in a widening wage income gap between urban and rural areas. Regarding the gap between urban and rural operational income, the adjustment of the industrial structure leads to an increase in the unemployment of the urban labour force and a decrease in wage income. As a result, its foreign investment declined due to the decrease in wage income, while in rural areas, agriculture was less affected by adjusting the industrial structure. The operational income source of rural labour mainly came from crop management, while the sources of urban and rural operational income were different, which led to the narrowing of the gap between urban and rural operational income.

Second, the quality of industrial structure adjustment has narrowed the wage income gap between urban and rural areas. Labour mobility and township enterprise development have both restrained the wage gap between urban and rural areas and the operational income gap between urban and rural areas. The quality of industrial structure adjustment reflects the size of labour productivity. The basic reason for the slow growth of rural residents' income is the low labour productivity and low added value of agriculture. When the quality of industrial structure adjustment leads to the increase of labour productivity and liberates more labour force, a large number of rural surplus labour force moves to cities and towns for employment and increases due to urbanization and industrialization, thus reducing the labour force engaged in

agricultural production and improving labour productivity, which leads to a further improvement of agricultural labour productivity and agricultural wage level. Thus, the wage income gap between urban and rural areas has narrowed. However, for the areas with a net outflow of labour, the outflow of labour widens the income gap between urban and rural areas (Table5, Model (3) and Model (4)). Areas with a net outflow of labour are generally economically underdeveloped areas, and the massive loss of human capital in economically underdeveloped areas will inevitably lead to a lag in the economic development level. The lag of economic development will obviously widen the income gap between urban and rural areas.

Table6. Distinguish labor mobility types

Variable	Net labor inflow regions			Net labor outflow regions		
	Urban-rural income gap	The wage income gap	Operating income gap	Urban-rural income gap	The wage income gap	Operating income gap
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
adj	0.308*	1.681**	0.177***	0.067**	0.215*	0.092*
	(1.68)	(2.65)	(3.02)	(2.02)	(1.47)	(1.90)
qua	0.404***	-0.311***	0.409*	-0.095***	-0.304**	-0.092**
	(2.62)	(-3.77)	(1.95)	(-3.08)	(-2.43)	(-2.29)
regis	0.219***	-0.192**	-0.237**	0.126***	0.082***	0.381***
	(2.99)	(-2.51)	(-2.33)	(3.57)	(2.99)	(2.77)
no_ regis	-0.428***	-0.113**	-0.102**	-0.229*	-0.612***	-0.253**
	(-3.57)	(-2.11)	(-2.08)	(-1.88)	(-3.38)	(-2.32)
rur_ent	-0.178**	-0.202**	-0.395	-0.126**	-0.167**	-0.086**
	(-2.21)	(-2.39)	(-1.25)	(-3.31)	(-2.16)	(-1.98)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-sqr	0.635	0.801	0.763	0.665	0.83	0.61
LogL	374.108	-216.228	558.139	229.132	389.382	-299.106
ρ	-0.347***	0.107***	-0.398***	-0.591**	-0.415***	-0.516***
	(-2.65)	(1.99)	(-2.16)	(-2.45)	(-4.74)	(-2.19)
Obs	320	320	280	280	320	320

On the basis of analysing labour mobility, we further divide the labour force into a registered labour force and a nonregistered labour force, which has an impact on the type of urban-rural income gap (Table6). First, in the labour inflow areas, the mobility of nonregistered labour and the development of township enterprises have significantly

reduced the income gap between urban and rural areas, which is further found by distinguishing income types. The adjustment of the industrial structure significantly enlarged the wage income gap between urban and rural areas, but the quality of industrial structure adjustment, newly increased registered labour force, the development of township enterprises and nonregistered labour force all significantly inhibited the wage income gap between urban and rural areas (Model (2)). The regression results of the urban-rural operational income gap show that (Model (3)), the range and quality of industrial structure adjustment have significantly widened the gap between urban and rural operational income, which this paper explains as follows: Generally, the inflow areas of the labour force are mainly economically developed provinces, and the newly increased registered labour force is mainly composed of people with higher education and the business floating population with certain assets. The main sources of income are wage income and operational income, which not only significantly improves the quality of human capital but also improves the industrial structure, enhances the innovation ability of the region, compensates for the gap of human resources elements, and breaks the institutional barriers to the free flow of labour elements, thereby gradually eliminating the income gap between urban and rural areas plays an active role.

Second, in the labour outflow areas (Table6), the quality of the industrial structure adjustment and the flow of nonresident labour significantly inhibited the wage income gap between urban and rural areas (Model (5)). In addition, the newly added registered labour force has significantly expanded the urban-rural income gap (Model (4)), the

urban-rural wage income gap (Model (5)) and the urban-rural operational income gap (Model (6)). To this end, labour outflow areas are mainly economically underdeveloped or underdeveloped areas. The newly increased registered labour force in this area is usually mainly based on the emigration of registered population, who are mainly high-quality people or floating population with certain wealth; thus, this emigration is equivalent to the loss of high-quality human capital for the labour outflow areas, which will obviously widen the income gap between urban and rural areas. Through the analysis of nonregistered labour mobility in labour outflow areas, we also think that in labour outflow areas, the newly increased registered labour force not only increases the urban human capital stock but also makes the rural human capital stock flow to other developed areas. As a result, the income gap between urban and rural areas is increasing. Finally, we find that the development of township enterprises in China has significantly restrained the income gap between urban and rural areas, the wage income gap between urban and rural areas and the operational income gap between urban and rural areas. China's township enterprises are the main force of the rural economy and an important part of the national economy, and they are rooted in rural areas and serve farmers. These enterprises are an important part of the rural economy and have made important contributions to increasing farmers' income and transferring surplus rural labour. Especially since China's reform and opening up, due to the rapid development of township enterprises, these areas have absorbed a large number of surplus rural labourers for employment and provided more employment opportunities for rural labourers. The nonagricultural income obtained by families from township enterprises

is much higher than the income from agricultural planting. Therefore, while the labour force flows to urban enterprises for employment, the employment of township enterprises in developed areas is also one of the main channels to narrow the income gap between urban and rural areas.

4.5 Robustness test

Considering that there may be some errors in the model setting and variable selection processes, which may affect the reliability of the regression results, to further test the robustness of industrial structure adjustment and labour mobility on the income gap between urban and rural areas, the Theil index of urban and rural income is replaced by the Theil index of urban and rural residents' consumption (*Cthi*) and the per capita income ratio of urban and rural residents (*Dthi*) in this paper. Meanwhile, the transportation distance weight matrix ($w2$) is used instead of the economic distance weight matrix ($w1$) to re-examine the above empirical results, and the inspection results are shown in Table7.

Table7. Robustness estimation test

Variable	Full sample		Net labor inflow regions		Net labor outflow regions	
	Theil index of urban and rural consumption	Urban rural income ratio	Theil index of urban and rural consumption	Urban rural income ratio	Theil index of urban and rural consumption	Urban rural income ratio
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
$Cthi_{t-1}$	0.714***		0.027***		0.682	
	(3.37)		(3.31)		(1.12)	
$Dthi_{t-1}$		0.896***		0.076***		0.057***
		(5.95)		(6.01)		(3.37)
adj	-0.014**	0.089	-0.013**	-0.029***	-0.022	-0.115
	(-1.98)	(0.22)	(-2.26)	(-3.23)	(-2.00)	(-1.58)
qua	0.090**	0.068***	0.047*	0.012***	-0.046***	-0.117**
	(-2.46)	(3.28)	(1.66)	(3.63)	(-8.54)	(-2.46)
lab	-0.078***	-0.013***	0.016*	-0.038***	-0.059***	0.077***
	(-4.87)	(-2.67)	(1.71)	(-5.84)	(-3.31)	(4.87)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-sqr	0.298	0.672	0.517	0.700	0.816	0.552

LogL	2339.28	-456.92	679.312	873.28	564.80	-325.25
ρ	0.734***	0.077**	-0.659**	-0.170**	-0.239***	-0.558***
	(6.69)	(2.05)	(-2.13)	(-3.61)	(-3.41)	(-3.28)
Obs	870	870	304	304	266	266

Table7 shows the estimation results of the robustness test under the condition of a full sample and differentiated labour flow direction. Under the condition of a full sample (Model (1)~ Model (2)), it can be found that the explained variables lag by one period, and the core explanatory variables are basically consistent with the regression results in Table 2, although the significance of the control variables and the positive and negative directions of the regression coefficients are slightly different. Under the condition of distinguishing the direction of labour mobility, the robustness test in the area of net labour inflow shows that the regression results of the urban-rural income ratio are consistent with the benchmark regression results in Table3 and the Theil index of the core explanatory variables on urban-rural consumption is slightly different from the explanatory variables in Table3; however, the regression results of the other variables are basically consistent, which is why they are not repeated here.

5.Conclusions and policy implications.

This paper analyses the influence of industrial structure adjustment and labour mobility on the income gap between urban and rural areas from both theoretical and empirical aspects. First, the influence of the adjustment range and quality of industrial structure and labour mobility on the income gap are analysed between urban and rural areas throughout the whole country. Labour mobility has narrowed the income gap between urban and rural areas, while the quality of industrial structure adjustment has not narrowed the income gap between urban and rural residents. Second, in areas with a net inflow of labour, the quality of industrial structure adjustment enlarges the income

gap between urban and rural areas while the inflow of the labour force inhibits the income gap between urban and rural areas. Moreover, in areas with a net labour outflow, the quality of industrial restructuring has restrained the income gap between urban and rural areas and the net outflow of labour has widened the income gap between urban and rural areas. Third, the heterogeneity analysis results show that the quality of the industrial structure adjustment has widened the income gap between urban and rural areas in the eastern, central and western regions while labour mobility has narrowed the income gap between urban and rural areas in the eastern and central regions but widened the income gap between urban and rural areas in the western regions. The result of distinguishing the effect of income type and household registration type on the urban-rural income gap shows that the newly increased household registration labour force, the mobility of the nonhousehold registration labour force and the development of township enterprises have significant heterogeneous effects on the urban-rural wage income gap and urban-rural operational income gap.

Based on the above analysis, this paper draws the following policy implications:

First, to solve the problem of income gap between urban and rural areas, we should focus on exploring channels for increasing income of grass-roots labor force and improving the source of income of grass-roots labor force. Therefore, we should vigorously support the development of labor-intensive, small and micro enterprises in less developed areas, so as to solve the problem of more labor employment. In addition, we need to increase the proportion of tertiary industry and enhance the capacity of small and medium-sized cities to undertake industries and innovate. This will help optimize the economic development structure of urban areas, promote the reconstruction of

employment, attract rural migrant labor, especially increase the wage income of rural residents.

Second, support the development of private enterprises and enhance the ability of cities to absorb local labor force. Not only because private enterprises to revitalize the rural economy, rural industry revitalization, and private enterprises in narrowing urban and rural wage income gap play an irreplaceable role. Therefore, we should pay attention to and focus on solving the problems encountered by private enterprises in the process of development, which is not only conducive to expanding the external space of rural surplus labor employment, but also conducive to promoting the beneficial development of China's multi-ownership economy.

Third, while focusing on equality of results, we should also pay more attention to equality of opportunities. Due to the natural differences of regional natural endowment, human environment and geographical location, there are great differences in regional economic development level, which cannot be avoided in the short term. Therefore, from the perspective of social harmony and equal opportunities, the governments in central and western regions should take advantage of medium and long-term national development strategies, such as the "Belt and Road" construction and urban agglomeration strategic planning, to correct or narrow the urban-rural income gap. Fourth, improve the social security system to eliminate worries about labor mobility. Over the years due to the urban-rural dual structure and dual economic structure in the "double dual economy structure" existence is the main factor which leads to the income gap, and in the rural urbanization of the household registration system reform, to break

the industry, the dual structure of non-agricultural registered permanent residence management, eliminate the farmers into the city employment difficulty, discrimination factors such as wages and labor insurance benefits.

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