Research Article

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# 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. A 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 disparities among employees. This article 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, superior industrial structure adjustment amplifies the urban–rural income gap, whereas labor migration diminishes it. Conversely, in regions witnessing a net outflow of labor, superior 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.

**Keywords:** industrial structure adjustment, urban, rural income gap, labor mobility, economic development, spatial econometrics

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## 1 Introduction

The most significant challenge facing developing countries is the widening wealth gap. The development of Chinese history has proven that the most effective way to narrow this gap is to expand labor mobility and reduce the urban–rural income gap through the reconfiguration of labor in different sectors. The root of labor mobility allocation lies in the adjustment of the industrial structure. Adjustments to the industrial structure or spatial layout have altered the balance between the supply and demand of the labor force. On one hand, it has caused rural laborers to face unemployment due to insufficient skills associated with the industrial restructuring or upgrading, forcing the rural surplus labor force to return to the countryside, thereby reducing their wage income and widening the urban–rural income gap. On the other hand, adjusting the industrial structure in underdeveloped areas has created more jobs, leading to a large outflow of the rural surplus labor force, which increases the per capita capital of agriculture (Chusseau et al., 2008; Shin, 2012) and improves the efficiency of agricultural production, thereby enabling rural laborers to benefit from the industrial structure adjustment. Therefore, understanding how industrial structure adjustment affects labor mobility is crucial to addressing the urban–rural income gap.

With the deepening of China's market-oriented reform, the Chinese government has realized the increasingly unequal distribution of wealth among members of society and has taken measures such as increasing subsidies for agriculture, rural areas, and farmers, expanding rural infrastructure, providing poverty alleviation assistance, and establishing a modern agricultural industry system. However, the mainstream view is that broadening the income sources of the rural labor force (Ezcurra, 2009; Morduch & Sicular, 2002; Risso & Edgar, 2012) or improving agricultural income and productivity (Davis, 2008; Goto & Endo, 2014) will help resolve the urban–rural income gap. Yet, due to China's typical dual economic structure, where agriculture is mainly

concentrated in rural areas and constrained by land resources and technological conditions (Calderón & Chong, 2004; Ju et al., 2016), the increased income of rural residents cannot be fundamentally changed by improving production efficiency in the traditional agricultural sector alone.

In fact, the income gap is rooted in the industrial development gap, as industrial development provides the foundation for regional economic growth (Goldberg & Nina, 2007; Lee, 2016). When there is a gap in regional economic development, the urban–rural income gap is reflected in the unbalanced allocation of capital, labor, and technology between urban and rural areas. The essence of industrial structure adjustment is to realize the reallocation of resources and other elements across areas with different levels of economic development. From this perspective, changes in industrial structure can alter the urban–rural income distribution (Hayter & Weinberg, 2011). It is crucial to narrow the urban–rural income gap by adjusting the industrial structure to increase the income of grassroots workers. The development experiences of other countries also show that the factor flows brought about by industrial structure upgrading affect the distribution of various resources between urban and rural areas, thereby impacting the urban-rural income gap. Therefore, studying the causal relationship between industrial structure adjustment and labor mobility on the urban–rural income gap can not only provide deeper insights into the effects of industrial structure adjustments on labor mobility but also help identify ways to narrow the urban–rural income gap through regional industrial structure adjustment and resource allocation.

This article makes a theoretical contribution by analyzing firm behavior under the context of industrial restructuring, as well as the microeconomic theory of the urban–rural income gap under cross-sector labor mobility. We empirically examined the impact of industrial restructuring and labor mobility on the urban–rural income gap from two perspectives. From a spatial viewpoint, the analysis explores how labor mobility, industrial structure adjustment, income type, and household registration status influence the urban–rural income disparity.

# 2 Model

This article constructs a theoretical model of household firm equilibrium from the perspective of the urban–rural income gap. The model incorporates a household sector with two-stage consumption characteristics and a firm sector with binary structural characteristics (Ju et al., 2016). Building on this theoretical framework, the analysis examines the impact of industrial restructuring and cross-sectoral labor mobility on the income disparity between urban and rural residents.

## 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:

$$\mathrm{Max}(C_t, C_{t+1}) = U(C_t) + \delta U(C_{t+1}) = \ln C_t + \ln C_{t+1}, \quad (1)$$

$$\text{S. t. } C_t + \frac{C_{t+1}}{1 + r_{t+1}} = W_t; C_{t+1} = (1 + r_{t+1})(W_t - C_t)$$

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 labor; $r_{t+1}$ represents the real interest rate level, and $\delta$ represents the discount factor.

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

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

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

$$C_t = \frac{W_t}{1 + \delta}, \quad (3)$$

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

## 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 (labor force $L_a$), while the nonagricultural sector inputs the factors of production (labor force $L_b$), material capital ($K$), and technological progress ($A$). Technological progress applies to the industrial structure ($\varphi$). Assume that there is no capital adjustment cost or depreciation. The agricultural sector usually absorbs low-skilled or unskilled labor for employment, with diminishing returns to scale. However, the nonagricultural sector absorbs relatively highly skilled and skilled labor for employment, and the return on the 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 $\sigma$ and $b$ are the output elasticity of labor forces.

Assuming that manufacturers compete freely in the labor 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 labor is that the marginal output of labor 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 $W_a$, $W_b$ are 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 labor force in the agricultural sector (or the labor 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 formulas (5) and (7), the derivative of material capital ($K$) is obtained:

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

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

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 labor is increasing, and the relative shortage of highly skilled labor in nonagricultural sectors leads to labor mobility.

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

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

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

In formulas (10) and (11), $\partial W_a/\partial L_b > 0$ explains the mobility of the nonagricultural labor 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 labor force ($L_b$).

## 2.3 Equilibrium

When workers can make 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 $\ln C_{at} + \ln C_{a,t+1}$. Second, the labor force is transferred from the agricultural sector to the nonagricultural sector for production activities, and its utility is as follows: $\ln C_{bt} + \delta \ln C_{b,t+1} - D_t(\varphi_t)$, where $D_t(\varphi_t)$ is the flow cost of labor engaging in production in the traditional agricultural sector and flowing to a nonagricultural sector.

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

$$\ln C_{at} + \delta \ln C_{a,t+1} = l \ln C_{bt} + \delta \ln C_{b,t+1} - D_t(\varphi_t). \tag{12}$$

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:

$$\begin{aligned} &\ln\frac{W_{at}}{1+\delta} + \delta \ln\frac{\delta(1+r_{t+1})W_{at}}{1+\delta} \\ &\quad = \ln\frac{W_{bt}}{1+\delta} + \delta \ln\frac{\delta(1+r_{t+1})W_{bt}}{1+\delta} - D_t(\varphi_t). \end{aligned} \tag{13}$$

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 labor transfer costs; and $D_t(\varphi_t)$ indicates the change in the industrial structure ($\varphi$). The transfer cost and industrial structure function of the income gap are derived as follows:

$$\frac{\mathrm{d}T}{\mathrm{d}D_t(\varphi_t)} = \frac{1}{1+\delta} e^{\frac{D_t(\varphi_t)}{1+\delta}}, \tag{15}$$

$$\frac{\mathrm{d}T(\varphi)}{\mathrm{d}\varphi_t} = \frac{\mathrm{d}T}{\mathrm{d}D_t(\varphi_t)}\frac{\mathrm{d}D_t(\varphi_t)}{\mathrm{d}\varphi_t} = \frac{1}{1+\delta}e^{\frac{D_t(\varphi_t)}{1+\delta}}D'(\varphi_t). \quad (16)$$

In formula (15), $\mathrm{d}T/\mathrm{d}D(\varphi_t) > 0$, which shows that the transfer cost of labor 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 labor 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 ($\varphi_t$) partial derivation.

## 2.4 Urban–Rural Income Gap

To better describe how industrial structure adjustment and labor mobility under microscopic conditions affect the income gap behavior 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:

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

Take the logarithm on both sides of the equation:

$$\ln T(\varphi_t) = (\alpha-1)\ln(L-L_b) - (\beta-1)\ln K - \ln A(\varphi) - (\beta-1)\ln L_b + \ln(\alpha/\beta). \quad (18)$$

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

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

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

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

To simplify:

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

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 labor force in the traditional agricultural sector flow to the nontraditional 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

The index of changes in industrial structure was calculated using the research methods developed by Du Caju et al. (2010) and Findeisen and Südekum (2008). This involved calculating the total employment of industrial enterprises in the region, which reflects the degree of industrial structure adjustment (adj). The calculation procedure is as follows:

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

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 labor allocation in the industry.

### 3.1.2 Quality of the Industrial Structure Adjustment

The quality of industrial restructuring can be characterized by two key aspects. First, it involves a change in the proportional relationship between input factors. Second, it encompasses an improvement in labor productivity. The adjustment of the industrial structure has shifted the original factor market from sectors with lower productivity to those with higher productivity and technological complexity. This has resulted in changes to the structure of labor-intensive, capital-intensive, and knowledge/technology-intensive industries. The calculation procedure to quantify these changes is as follows:

$$\mathrm{qua}_{it} = \sum_{j=1}^{n} S_{ijt} \times F_{ijt}, \quad (23)$$

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 gross domestic product (GDP) at time $t$ and region $i$; and $F_{ijt}$ represents the productivity of regional industry $j$ at time $t$ and region $i$.

#### 3.1.3 Labor Mobility

The spatial distribution pattern of the labor force is usually caused by the imbalance of regional economic development, and the main factor of labor mobility is the difference in income level introduced by regional economic development. According to the research of Fang et al. (2008), Zhan et al. (2020), and other scholars, the calculation formula of the labor mobility index is as follows:

$$\begin{aligned}\text{Floating population} = {} & \text{Permanent population} \\ & - \text{registered population} \\ & + \text{total change in registered population} \\ & - \text{natural growth of the local population.}\end{aligned} \tag{24}$$

If the amount of labor mobility is positive, it indicates a net inflow of labor force in this area, and if the amount of labor mobility is negative, it indicates a net outflow of the population.

## 3.2 Explained Variable

Two primary methods for measuring the income gap between urban and rural areas are the Gini index and the Theil index. However, the Gini coefficient has some inherent flaws in its calculation method. Specifically, if two countries have the same Gini coefficient, the underlying meanings may differ, suggesting potential errors when comparing the degree of income distribution inequality across different countries or regions. Additionally, the Gini coefficient is not sensitive enough to accurately reflect significant improvements in the situation of low-income groups, nor can it precisely capture changes affecting high-income groups. Consequently, the Gini coefficient may overlook the interests of low-income populations and struggle to fully explain the characteristics of income inequality.

$$\begin{aligned}\text{Thi}_{it} = {} & I_{uit}/I_{it} \ln((I_{uit}/I_{it})/(P_{uit}/P_{it})) \\ & + I_{rit}/I_{it} \ln((I_{rit}/I_{it})/(P_{rit}/P_{it})),\end{aligned} \tag{25}$$

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 macrolevel of measuring urban and rural income.

## 3.3 Control Variables

This study includes the following control variables: Urbanization level (urb): The relationship between urbanization and urban–rural income distribution is not linear but exhibits an inverted U-shaped pattern (Anand & Kanbur, 1993). The urbanization level is measured as the ratio of the urban population to registered population. Government scale (gov): The government plays a key role in income redistribution through taxation and the provision of public goods, as well as by protecting grassroots workers through the social security system. The government scale is measured as the ratio of fiscal revenue to expenditure. Unemployment rate (une): An increase in the unemployment rate, as per Okun's Law, indicates an economic recession, which can lead to a decrease in residents' wage income due to a shrinking market. Human capital (edu): Human capital is a crucial factor affecting economic development, as workers can change their income levels through learning and cross-regional mobility. The average years of education serve as a proxy variable for human capital. Transport infrastructure convenience (tra): The construction of transportation infrastructure not only reflects the convenience of regional transportation but also expands the circulation of goods. A more developed infrastructure can attract investment and employment, leading to a spillover effect that enhances market potential (Bronzini & Piselli, 2009). This variable is measured as the ratio of the sum of railway and highway mileage to the regional area. Ownership structure of employment (own): The employment ownership structure has a dual effect on urban–rural income. First, the mobility of grassroots laborers intensifies competition in the urban labor market, reducing urban wages. Second, labor mobility has improved the efficiency of human resource allocation during employment restructuring. The employment share of state-owned enterprises is used to represent the ownership structure.

## 3.4 Data Source and Description

This study examines a sample of 30 provincial units in mainland China from 1990 to 2019 for the following reasons: China's Gini coefficient hovered around 0.3 in the 1980s, indicating a relatively reasonable income gap. The urban–rural income gap began to expand rapidly in the mid-to-late 1990s. Data availability and statistical consistency: Hainan and Chongqing had missing variables prior to 1990, so the study period was limited to 1990–2019. Additionally, due to a severe lack of data, Tibet was excluded from the sample.

The data sources for this study include the Statistical Yearbooks, China Rural Statistical Yearbooks, China Population and Employment Statistical Yearbooks, and China Township Enterprise Yearbooks. Some provincial data were missing and were supplemented through interpolation.

## 3.5 Econometric Model

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

$$\ln \mathrm{Thi}_{it} = \alpha_0 + \alpha_1 \mathrm{lab}_{it} + \alpha_2 \mathrm{ind}_{it} + \delta \ln X_{it} + \varepsilon_{it}, \quad (26)$$

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 labor 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, $\alpha_0$ is the intercept term, and $\varepsilon_{it}$ is a random error term.

Actually, adjusting the industrial structure and labor 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 labor 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:

$$\ln \mathrm{Thi}_{it} = \alpha_0 + \alpha_1 \mathrm{lab}_{it} + \alpha_2 \mathrm{ind}_{it} + \alpha_3 \ln \mathrm{Thi}_{it-1} + \delta \ln X_{it} + \varepsilon_{it}. \quad (27)$$

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 article. 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 SAR model is chosen, whereas when the error term of the model is spatially autocorrelated, the SEM is selected. The two models are expressed as follows:

$$Y = \rho WY + \beta X + \varepsilon, \quad (28)$$

$$Y = \beta X + \varepsilon; \varepsilon = \lambda w\varepsilon + \mu, \mu \sim (0, \sigma^2 I). \quad (29)$$

In formulas (27) and (28), $Y$ and $X$ represent dependent variables and independent variables, respectively; $\alpha_j$, $\rho$, and $\lambda$ are coefficients of the variable, $\varepsilon$ and $\mu$ 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 labor mobility is the difference in 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 labor 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 article will use the dynamic spatial panel model to test the impact of industrial structure adjustment and labor mobility on the income gap. The following model is obtained:

$$\begin{aligned} \ln \mathrm{Thi}_{it} &= \theta \ln \mathrm{Thi}_{it-1} + \rho \sum_{j=1}^{n} w_{ij} \ln \mathrm{Thi}_{it-1} + \alpha_1 \mathrm{lab}_{it} \\ &\quad + \alpha_2 \mathrm{ind}_{it} + \delta \ln X_{it} + \nu_{it} + \varepsilon_{it}, \\ \varepsilon_{it} &= \lambda \sum_{j=1}^{n} w_{ij} \varepsilon_{it} + \mu_{it}, \end{aligned} \quad (30)$$

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

**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.

# 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.

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

This study first analyzes the estimated results of the urban–rural income gap under the combined effects of industrial restructuring and labor mobility (Table 2). To ensure the robustness of the regression results, core explanatory variables were incorporated into the models. Model (1) and Model (2) examine the effects of the adjustment range and quality of the industrial structure, respectively, on the urban–rural income gap. Model (3) considers the combined impacts of the adjustment range and quality of the industrial structure on the urban–rural income gap. Finally, Model (4) accounts for the dynamic effect of the income gap over a lagged period.

The estimation results across the different models with varying core explanatory variables remain robust (Table 2). From Model (1) to Model (4), it is evident that the adjustment of the overall industrial structure nationwide does not have a significant impact on the urban–rural income gap. However, the quality of industrial structure adjustment has indeed widened the income disparity between urban and rural residents. This study posits that the quality of industrial adjustment represents the progression from low-level to high-level processing and intelligent production of commodities, thereby indicating the developmental trajectory of the entire industrial system. Across the industrial structure, the quality of industrial adjustment typically evolves from agriculture to manufacturing and finally to the service sector. Correspondingly, the industrial focus has shifted from labor-intensive to capital-intensive and technology-knowledge-intensive industries, as China's industrialization has transitioned from the high-speed development stage to the later phase. Existing research (Luo et al., 2021; Sharon et al., 2020) has concluded that a larger share of the secondary industry or manufacturing sector in GDP is associated with a narrower urban–rural income gap, while a greater proportion of the tertiary industry or service sector corresponds to a wider income disparity. From a micro-perspective, the process of industrial structure adjustment involves a complex evolution from low-tech to high-tech enterprises. If local governments excessively pursue industrial upgrading or "deindustrialization," it may lead to an increased unemployment rate among low-skilled rural workers, thereby reducing the overall income of low-income groups. However, the upgrading of industries

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

**Table 2:** 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 |
| Log *L* | −73.067 | −68.17 | −58.39 | −544.12 |
| $\rho$ | −0.525*** | −0.678*** | −0.763*** | −0.511*** |
| | (−4.97) | (−5.51) | (−5.38) | (−4.53) |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

can also result in higher income levels for high-skilled urban residents, further exacerbating the widening urban–rural income gap.

The findings further indicate that labor mobility has narrowed the overall income gap between urban and rural residents (Table 2). Since the 1980s, China's rural areas have implemented the household contract responsibility system, and the urban food rationing system has gradually disintegrated. These changes have resulted in a substantial increase in agricultural output and the emergence of an agricultural surplus. Consequently, a surplus labor force in the agricultural sector was observed, leading to a continuous large-scale migration of rural workers to cities in search of employment. The transfer of these rural laborers to urban areas has enabled farmers to obtain wage income outside of agriculture, thus increasing the overall income of the rural workforce. Concurrently, the large-scale adoption of agricultural mechanization has greatly improved agricultural productivity, reducing the demand for agricultural labor. However, this has not compromised agricultural production efficiency or crop yields and has instead led to increased operational income for farmers' households. Additionally, the Chinese government has implemented a series of policies aimed at benefiting rural residents. Collectively, these factors have directly or indirectly promoted the rise in household incomes of rural populations.

## 4.3 Differentiating the Impact of Labor Mobility Direction

On the basis of the above analysis, we further control the inflow and outflow of the labor 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).

The analysis of labor mobility patterns in Table 3 suggests that the adjustment of industrial structure, whether through net labor inflow or outflow, does not have a significant effect on the income gap between urban and rural areas. However, the quality of industrial restructuring in areas with net labor inflow tends to exacerbate the urban–rural income gap (Model (1) and Model (2)). This observation can be attributed to the fact that net labor inflow typically occurs in the relatively developed southeastern coastal regions of China. During the rapid period of political construction and development, when urban infrastructure was still being established, the demand for grassroots labor was substantial. However, as cities have become more advanced, the economies of these developed areas have undergone a transformation towards science- and technology-driven industries. The strategic shift towards capital- or technology-intensive sectors, such as high-end and knowledge-based industries, has often led to the exclusion or relocation of labor-intensive enterprises. Consequently, workers in the developed regions are frequently employed in labor-intensive industries. Therefore, in the process of upgrading the industrial structure in these developed areas, a large number of laborers are prone to lose their jobs, resulting in a decrease in the overall income of low-income groups (Neves & Silva, 2014; Phan & Coxhead, 2010).

In contrast, the analysis reveals that in areas with net labor outflow (Model (3) and Model (4)), the quality of industrial structure adjustment has had a restraining effect on the income gap between urban and rural areas. Compared to the net labor inflow regions, the net labor outflow areas are predominantly located in central and western China, where the industries tend to be either labor-intensive or capital-intensive. The industrial restructuring in these net labor outflow areas has primarily involved the transfer of labor-

**Table 3:** Estimates of the income gap between urban and rural areas by the direction of labor 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 |
| Log *L* | −44.79 | −419.19 | 208.88 | −413.77 |
| $\rho$ | −0.904*** | −0.693*** | −0.435*** | −0.323*** |
| | (−6.63) | (−5.76) | (−4.26) | (−4.59) |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

intensive and resource-intensive industries from the more developed regions. This process has absorbed a significant number of workers and increased the wage income of the rural labor force as a whole. Consequently, the adjustments to industrial structure in net labor outflow areas have provided more marginal benefits to rural grassroots workers than the changes in the urban industrial structure. Furthermore, the analysis suggests that the net outflow and net inflow of labor have opposing effects on the urban–rural income gap in this region. While the labor flow in net inflow areas suppresses the income disparities between urban and rural areas, the labor outflow in net outflow areas tends to widen the urban–rural income gap. This observation aligns with the general pattern that the income gap between urban and rural areas is typically larger in less developed regions. In other words, the more equitable the distribution of social wealth in the developed areas, the higher the overall well-being of the population (Cremer & Roeder, 2019). Importantly, the spatial spillover effect appears to constrain the urban–rural income gap in the neighboring areas, but exacerbate the gap in the net labor inflow regions.

## 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 labor 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 analyze the impact of the heterogeneity of regional economic development on the income gap between urban and rural residents in different areas (Table 4).

An analysis of the situation under differences in the regional economic development level (Table 4) showed that the regression results obtained by adding the non-lag term and lag term of the urban–rural income gap are essentially the same; therefore, this article focuses the analysis on the lag result. The findings indicate that the scope of industrial structure adjustment has no significant impact on the income gap between urban and rural areas in the eastern region. In contrast, the income gap was significantly restrained in the central region, while it was widened in the western region. These results suggest that the influence of industrial restructuring on the urban–rural income gap varies across different stages of regional economic development, particularly in the later phases of urbanization in more developed areas. However, in economically underdeveloped regions, where the economy is in a rapid growth phase, the absorption of a large number of industries and the expansion of employment opportunities have promoted the overall income of residents,

**Table 4:** 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 |
| Log *L* | −413.77 | −338.65 | −3386.59 | −1765.54 | −1615.24 | −374.18 |
| $\rho$ | −0.243*** | −0.901*** | 0.648*** | 0.210*** | −0.611*** | −0.414*** |
| | (−9.18) | (−7.17) | (17.17) | (4.63) | (−3.78) | (−3.23) |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

thereby narrowing the income gap between urban and rural populations. Conversely, in underdeveloped areas, adjusting the industrial structure has widened the income gap between urban and rural residents. This finding indicates that in the early stages of economic development, the severe divide between urban and rural systems and the unequal development opportunities cannot be easily reversed, which is likely a key driver of the persistent expansion of the urban–rural income gap (Aiyar & Ebeke, 2020; McCall, 2000). Furthermore, the analysis reveals a significant positive correlation between the quality of industrial structure adjustment and the income gap between urban and rural areas across the eastern, central, and western regions. This can be explained by the ongoing transition in China's industrial structure, where simple manual labor is gradually being replaced by adjustments, transformations, or upgrades. However, the vast majority of rural workers are still employed in primary and secondary industries with lower skill requirements. As a result, the rural labor force lacks a dominant presence in employment and the awareness and ability to advocate for its own interests. Table 4 also shows that labor 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.

### 4.4.2 Distinguishing the Income Type and Household Registration Type Based

The Chinese government initiated the reform and opening-up policy in 1978, which was accompanied by the implementation of the household contract responsibility system in rural areas. This policy change liberated many rural laborers from agricultural work, resulting in a large surplus of rural labor that began to migrate to cities, a phenomenon known as the "migrant worker tide." The influx of migrant workers to urban areas helped address the employment of surplus rural laborers. Furthermore, the rural labor force has diversified its income sources, which now primarily consist of wage income, operational income, net property income, and transfer income, with wage and operational income accounting for the majority of urban and rural residents' incomes. Accordingly, this article focuses on the wage income gap and the operational income gap between urban and rural areas as important factors influencing the overall urban–rural income disparity. These gaps are calculated using Model (25). Additionally, China's unique household registration system has led to a significant gap or discrimination in civil rights and social security between the floating population and local residents with registered household status, which in turn has contributed to the substantial urban–rural wealth divide. To capture this dynamic, the analysis distinguishes between the newly increased

registered population mobility (regis) and the non-registered labor mobility (no_regis). The formula for calculating the newly increased registered labor force is regis = registered population of the current year – natural population growth of the current year – registered population of the previous year. The floating population of non-registered labor force is calculated as permanent population – registered population. Furthermore, the employment choices of migrant workers during the labor mobility process also affect the urban–rural income gap. These choices primarily involve seeking employment in urban industrial enterprises or moving to township enterprises (including collective, cooperative, and individual enterprises organized by farmers). Accordingly, the analysis also considers the development level of regional township enterprises as an important explanatory variable influencing the increase in rural labor 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 the regional industry.

Table 5 shows the effects of industrial structure adjustment, labor mobility, and township enterprise development on the income gap between urban and rural areas when different labor mobility directions are distinguished.

**Table 5:** 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 |
| Log *L* | −195.332 | 276.113 | −272.286 | 816.5 |
| $\rho$ | −0.319*** | −0.590*** | −0.716*** | −0.452*** |
| | (−5.04) | (−2.19) | (−4.17) | (−5.47) |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

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 labor 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 labor, 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 labor, especially in rural labor, resulting in a widening wage income gap between urban and rural areas.

Second, the quality of industrial structure adjustment has narrowed the wage income gap between urban and rural areas. Labor 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 labor productivity. The basic reason for the slow growth of rural residents' income is the low labor productivity and low added value of agriculture. When the quality of industrial structure adjustment leads to the increase in labor productivity and liberates more labor force, a large number of rural surplus labor force moves to cities and towns for employment and increases due to urbanization and industrialization, thus reducing the labor force engaged in agricultural production and improving labor productivity, which leads to a further improvement of agricultural labor productivity and agricultural wage level.

On the basis of analyzing labor mobility, we further divide the labor force into a registered labor force and a nonregistered labor force, which has an impact on the type of urban–rural income gap (Table 6). First, in the labor inflow areas, the mobility of nonregistered labor 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 labor force, the development of township enterprises and nonregistered labor 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)),

**Table 6:** Distinguish labor mobility types

| Variable | Net labor inflow regions | | | Net labor outflow regions | | |
|---|---|---|---|---|---|---|
| | Urban–rural income gap Model (1) | The wage income gap Model (2) | Operating income gap Model (3) | Urban–rural income gap Model (4) | The wage-income gap Model (5) | Operating income gap 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 |
| Log *L* | 374.108 | −216.228 | 558.139 | 229.132 | 389.382 | −299.106 |
| $\rho$ | −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 |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

the range and quality of industrial structure adjustment have significantly widened the gap between urban and rural operational income, which this article explains as follows: Generally, the inflow areas of the labor force are mainly economically developed provinces, and the newly increased registered labor 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 labor elements, thereby gradually eliminating the income gap between urban and rural areas plays an active role.

Second, in the labor outflow areas (Table 6), the quality of the industrial structure adjustment and the flow of non-resident labor significantly inhibited the wage income gap between urban and rural areas (Model (5)). In addition, the newly added registered labor 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, labor outflow areas are mainly economically underdeveloped or underdeveloped areas. The newly increased registered labor force in this area is usually mainly based on the emigration of registered population, who are mainly high-quality people or a floating population with certain wealth; thus, this emigration is equivalent to the loss of high-quality human capital for the labor outflow areas, which will obviously widen 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 labor 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 article. 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 Table 7.

Table 7 shows the estimation results of the robustness test under the condition of a full sample and differentiated labor flow direction. Under the condition of a full sample

**Table 7:** 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 |
| Log *L* | 2339.28 | −456.92 | 679.312 | 873.28 | 564.80 | −325.25 |
| $\rho$ | 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 |

*, **, and *** are 10%, 5%, and 1% significant, respectively.

(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 labor mobility, the robustness test in the area of net labor inflow shows that the regression results of the urban–rural income ratio are consistent with the benchmark regression results in Table 3 and the Theil index of the core explanatory variables on urban–rural consumption is slightly different from the explanatory variables in Table 3; 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 study analyzes the impact of industrial restructuring and labor mobility on the urban–rural income gap from both theoretical and empirical perspectives. The theoretical analysis suggests that changes in industrial structure lead to the flow of labor from traditional agricultural sectors to non-agricultural sectors, which manifests as changes in absolute incomes. These changes in the absolute incomes of urban and rural residents, in turn, affect the relative income gap between urban and rural areas. Furthermore, the theoretical framework examines the impact of technological progress driven by industrial restructuring on the urban–rural income ratio. On the one hand, the changes in industrial structure are attributed to the unequal distribution of urban and rural resources, a product of the "urban–rural dual structure," which has widened the income gap between urban and rural areas. The empirical analysis, however, reveals a more nuanced picture. While labor mobility has narrowed the income gap between urban and rural areas, the quality of industrial restructuring has not necessarily reduced the income disparity between urban and rural residents. In fact, in areas with a net inflow of labor, the quality of industrial restructuring has actually widened the urban–rural income gap, even as the inflow of labor has suppressed the urban–rural income gap. The heterogeneity analysis further underscores these dynamics. The results indicate that the quality of industrial restructuring has widened the urban–rural income gap in the eastern, central, and western regions, while labor mobility has narrowed the

urban–rural gap in the eastern and central regions, but widened the rural–urban gap in the western region. Additionally, the analysis distinguishing the impact of income type and household registration type reveals that the newly registered labor force, the flow of non-registered labor force, and the development of township enterprises have a significant heterogeneous impact on both the urban–rural wage income gap and the urban–rural operational income gap.

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

First, to solve the problem of the income gap between urban and rural areas, we should focus on exploring channels for increasing the income of the grass-roots labor force and improving the source of income of the 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, and 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 has been 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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