*Economic Society and Humanities Vol. 2 No. 1, 2025*

# Rural Labor Force, Changes in Industrial Structure and tThe Urban-Rural Income Gap

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**Abstract: This study uses inter-provincial panel data from the China Statistical Yearbook 2007-2020 to conduct research, in which the relationship between rural labor force, industrial structure, and the urban-rural income gap is examined using the Spatial Durbin Panel Model (SDPM). Through a series of studies, it is found that, first, the free movement of rural labor is able to significantly reduce the urban-rural income gap. Second, the coupling between labor mobility and industrial structure upgrading helps to reduce the urban-rural income gap. These conclusions are verified in the robustness test.**

**Keywords: Rural Labor Mobility; Industrial Structure Change; Coupling Degree; Urban-Rural Gap; Spatial Durbin Model.**

## 1. Introduction

Since the reform and opening up, China's economy has achieved years of rapid growth , while in the urban-rural relationship it is manifested in the movement of rural laborers to the towns and cities, and this movement is the key reason for the miracle of China's economy to achieve years of continuous growth. Most scholars believe that labor migration will narrow the income gap. Duan Pingzhong and other scholars (2005) [1] believe that there is a strong correlation between the gap in the regional distribution of population mobility and the regional gap in economic growth, and that population mobility has an obvious convergence effect on the growth gap. At the same time, some scholars point out that the labor force across the region is conducive to narrowing the regional gap, on the one hand, this free flow of rural labor force for the rural areas can bring a lot of capital and investment; and secondly, the rural labor force outflow, rural per capita resources compared to the previous will be more ( Wang Xiaolu ,2004) [2] . There are also a few scholars have different views, Li Shi (2003) [3] pointed out that the rural labor force mobility for rural income gap reduction does not play a lot of role, this kind of mobility in the poor and affluent places of this kind of free flow of labor to play a different role, on the contrary, it may deepen the Matthew effect to widen the gap (Zhang Qing et al., 2006 [4] ; Ziduo Sun, 2004 [5] ).

In terms of the effect of industrial structure on the urban-rural income gap, one viewpoint holds that the upgrading of industrial structure will widen the urban-rural income gap (Yu Changlin,2011[6];Sun Yongqiang,2015[7]);another viewpoint holds that the upgrading of industrial structure will widen the urban-rural income gap in the short run and the opposite in the long run (Yang Xiaofeng, 2014 [8] ; Zheng Wanji, 2015 [9] ); and Xu Chunhua (2015) [11] argues that the industrial structure upgrading has a "U-shape" characteristic of narrowing the urban-rural income gap firstly and then expanding it.

As the carrier of the use and allocation of many factors, the flow of labor and the changes in regional labor supply will have the most direct impact on the transformation and upgrading of industrial structure, and it is of great academic value and practical significance to explore the impact of the flow of rural labor and the upgrading of industries on the urban-rural income gap and the inherent mechanism of its functioning. In addition, this study can also provide us with insights on how to promote the reduction of the urban-rural income gap and promote economic growth and social development.

## 2. Theoretical Component

This paper draws on the Temple and Wößmann [12] theoretical framework of the urban-rural dichotomy, which consists of a model of economic growth with two industrial sectors, agricultural and non-agricultural, and where the output of both sectors can be traded in the market. The production function for each of the

two sectors can be expressed as:

$$Y_r = A_r F(K_r, L_r); Y_u = A_u G(K_u, L_u) \quad (1)$$

The total regional output can then be expressed as:

$$Y = Y_r + Y_u \quad (2)$$

Among them, $A_r$、$A_u$ is used to denote the technology factor inputs of the two sectors; $L_r$ and $L_u$ denote the labor factor inputs of the two sectors; $K_r$ and $K_u$ denote the capital factor inputs of the two sectors. Assuming that the rate of return of factors in the two sectors is determined according to the marginal output, since the tendency of factor migration depends on the ratio and difference of the rate of return of factors in the two sectors, assuming that the economy is in long-run equilibrium, the ratio of the return of factors in the two sectors is $K = W_u/W_r$ , and when $W_u/W_r > K$ , the factors in the traditional sector will flow to the modern sector. Denote the process of change of factor return gap of factors in two sectors by X, i.e.,$X = \varphi(\frac{w_u}{Kw_r} - 1)$ , where $\varphi$ denotes the speed of the economic system in the transition to the long-run equilibrium state, and P denotes the probability of transfer of factors from the traditional sector to the modern sector, which is positively proportional to the factor return ratios in the two sectors, and can be expressed as follows.

$$P = \frac{X}{1+X} \quad (3)$$

Then the quantitative relationship of factor returns in the modern sector can be obtained as according to $w_a$ ,$P$ ,$K$ and $\varphi$ :

$$W_u = W_r K(1 + \frac{1}{\varphi}\frac{p}{1-p}) \quad (4)$$

Since it is assumed that factors can move between sectors and that the factor rate of return is determined according to marginal output, and that the rate of profit on capital is also the same in both sectors when the economy is in long-run equilibrium, the partial derivation of equation (1) with respect to capital gives:

$A_r F_k = qA_u G_k = r$, i.e.$r = r_r = r_u$

Using $\eta = \frac{W_r L_r + W_u L_u}{Y}$ to denote the share of labor in real gross income, $1 - \eta = \frac{rK}{Y}$ denotes the share of capital in real gross income. The real national output growth rate (time-continuous) is:

$$\frac{dY/dt}{Y} = \frac{\dot{Y}}{Y} = s(t)\frac{Y_r}{Y_r} + [1 - s(t)]\frac{Y_u}{Y_u} = s(t)\frac{\dot{A_r}}{A_r} + [1 - s(t)]\frac{\dot{A_u}}{A_u} + [1 - \eta(t)]\frac{\dot{K}}{K} + \frac{W_r L}{Y}\frac{\dot{L_r}}{L} + \frac{W_u L}{Y}\frac{\dot{L_u}}{L} \quad (5)$$

Where $s(t) = \frac{Y_r}{Y_r + qY_u}$ denotes the share of real output of the rural sector in total output of the economy in period t and $1 - s(t)$ denotes the share of real output of the modern sector in total output. Let $\emptyset = \frac{W_r L_r}{Y}$ and $\lambda = \frac{L_u}{L}$ be obtained by substituting equation (4) into equation (5):

$$\frac{\dot{Y}}{Y} = s(t)\frac{\dot{A_r}}{A_r} + [1 - s(t)]\frac{\dot{A_u}}{A_u} + (K-1)\emptyset\dot{\lambda} + K\emptyset\frac{1}{\varphi}\frac{p}{1-p}\dot{\lambda} \quad (6)$$

As can be seen from equation (6), the latter two items, i.e., the result of the free movement of labor and the allocation of its reallocation to sectors with higher rates of return to more returns, and the first two items are the result of the economic growth within the region based on the technological level of the traditional and modern sectors of the entire economic system. At the same time, since the propensity to migrate P is related to the degree of structural change $\dot{\lambda}$ , it indicates a coordinated relationship between labor mobility and industrial restructuring, and this interaction further contributes to the increase in production capacity in both sectors, while indicating a diminishing relationship between upgrading of the industrial structure and the returns to factors. In addition to this, this increase in production capacity that occurs due to labor migration reduces the urban-rural income gap, while there is an interaction and mutual interaction relationship between the free movement of rural labor and industrial restructuring.

The hypotheses of this paper can be derived from the above analysis:

H1: Free movement of labor may be able to reduce the urban-rural income gap;

H2 : With the upgrading of industrial structure will instead widen the income gap between urban and rural areas.

H3: The free movement of factors ultimately creates a rational allocation in industries and thus industrial restructuring, so the coupling of labor mobility and industrial structure will narrow the urban-rural income gap;

## 3. Selection of Variables and Econometric Modeling

### 3.1 Construction and Description of Econometric Models

The theoretical model finds that the free movement of labor can reduce the urban-rural income gap, and the upgrading of industrial structure will have a negative effect on the urban-rural income gap. This paper constructs the regression model shown in equation (7).

$$tl_{it} = \beta_0 + \beta_1 \text{labor}_{it} + \beta_2 \text{idc}_{it} + \beta_3 control_{it} + \lambda_i + \lambda_t + \varepsilon_{it} \quad (7)$$

Where tl represents the urban-rural income gap, labor represents urban-rural labor mobility, idc represents industrial structure upgrading, and based on the theoretical assumptions, it is expected that $\beta_1$ is smaller than 0 and $\beta_2$ is larger than 0. $control$ represents a series of control variables, $\lambda_i$ and $\lambda_t$ represent the province fixed effects and year fixed effects, respectively, and $\varepsilon_{it}$ is the residual term.

In order to better understand the interactions of internalization of internalities and internalization of externalities between regions, this paper introduces a spatial econometric model that considers spatial spillover effects for analysis. In this study, the initial model is set as the Spatial Durbin Panel Model (SDPM),which is expressed as follows.

$$tl_{it} = \alpha + \rho \sum_{j=1}^{n} W_{ij} tl_{it} + \beta synergy_{it} + \theta \sum_{j=1}^{n} W_{ij} synergy_{it} + \lambda_i + \lambda_t + \varepsilon_{it} \quad (8)$$

where $W_{ij}$ is the spatial geographic matrix. In the model setting, when $\rho$ is equal to 0, the development gap between urban and rural areas in the region will be affected by a series of development in the nearby regions, and Eq. (8) is degraded to spatial error model (SEM). When $\theta$ is equal to 0, equation (8) degenerates into a spatial lag model (SAR).

### 3.2 Selection of Variables

Wang Shaoping et al. (2007) showed that the urban-rural Tel index (TL) is a more accurate measure of the urban-rural gap, which is mainly used as an explanatory variable in the empirical analysis; and the ratio of the number of people employed in secondary and tertiary industries to the total employed population (stj) is used to measure the labor force mobility ( Liao Hsien-lang, 2012 [17] ). In this paper, we study the urban-rural relationship, so we cannot ignore the agricultural output. This paper draws on Xu Min and other scholars (2015) [18] used the index of upgrading between the three industrial structures to measure the overall industrial structure, which is calculated as.

$$idc = \sum_{M=1}^{3} y_{u,i,t} * m \qquad 1 \le m \le 3$$

Where, $y_{u,i,t}$ represents the proportion of industry u in the GDP of region i in period t, and u takes 3 as the maximum, which can represent each industry, the larger value of idc means the more advanced industrial structure.

In this paper, the coupling coordination degree model of labor mobility and industrial structure change is constructed, and the higher value indicates the higher degree of coupling. The formula is.

$$sygy = \sqrt{\frac{labor * idc}{\frac{labor}{2} + \frac{idc}{2}}}$$

Among them,$sygy$ denotes the coupling degree, whose value is between 0 and 1, $labor$、$idc$ denotes the degree of labor mobility and industrial structure upgrading, respectively, and the larger value of$sygy$ denotes the higher level of coordinated development of labor mobility and industrial structure change.

In order to minimize the effect of legacy variables in the economic environment, a total of five control variables were selected in the paper: the degree of nationalizationnation, the degree of government interventionintervene, the dual economic structurestru, the Internet infrastructureinternet, and the level of urbanizationcity.

### 3.3 Data Sources and Explanations

The provincial data used in the benchmark regression come from the China Statistical Yearbook, the local statistical yearbooks of each province, and the Compendium of Statistical Information on 60 Years of New China Agriculture. A total of 14 years of data from 2007 to 2020 have been selected in the paper, while Tibet has been excluded from the national data because of missing data.

**Table 1. Results of Descriptive Statistics**

| NAME | Obs | Mean | SD | Min | Median | Max |
|---|---|---|---|---|---|---|
| tl | 420 | 0.105 | 0.051 | 0.018 | 0.098 | 0.274 |
| labor | 420 | 65.627 | 15.421 | 25.879 | 63.405 | 98.035 |
| idc | 420 | 234.729 | 13.346 | 210.200 | 232.561 | 283.600 |
| sygy | 420 | 10.046 | 1.001 | 6.814 | 9.969 | 12.010 |
| nation | 420 | 27.560 | 10.832 | 9.432 | 25.943 | 55.990 |
| intervene | 420 | 23.541 | 10.016 | 8.711 | 21.446 | 64.301 |

| | | | | | | |
|---|---|---|---|---|---|---|
| stru | 420 | 10.238 | 4.210 | 3.220 | 9.346 | 30.982 |
| internet | 420 | 1.902 | 0.189 | 1.092 | 1.937 | 2.204 |
| city | 420 | 55.875 | 13.322 | 28.230 | 54.059 | 89.608 |

## 4. Empirical Results and Analysis

### 4.1 Baseline Regression

According to the results of benchmark regression, the coefficient of labor mobility is positive at 1% and 5% significance level, which indicates that labor mobility and urban-rural income gap have a positive effect, and since the smaller the Tel index is, it means that the urban-rural gap is decreasing when the labor mobility is more, which confirms hypothesis 1. The coefficient of industrial structure upgrading is always positive at 1% significance level, which indicates that industrial structure upgrading has a negative impact on the urban-rural income gap, thus confirming hypothesis 2. The coefficient of industrial structure upgrading is always positive at 1% level of significance, indicating that industrial structure upgrading has a negative impact on urban-rural income gap, thus confirming hypothesis 2.

**Table 2. Benchmark Regression Results**

| NAME | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | tl | tl | tl | tl | tl | tl |
| labor | -0.002*** | -0.002*** | -0.001*** | -0.001*** | -0.001*** | -0.000** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| idc | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| intervene | | 0.000 | 0.001*** | 0.001*** | 0.001*** | 0.000 |
| | | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| internet | | | -0.150*** | -0.147*** | -0.145*** | -0.075*** |
| | | | (0.017) | (0.017) | (0.018) | (0.013) |
| nation | | | | -0.000 | -0.000 | 0.000 |
| | | | | (0.000) | (0.000) | (0.000) |
| stru | | | | | 0.000 | 0.000 |
| | | | | | (0.000) | (0.000) |
| city | | | | | | -0.004*** |
| | | | | | | (0.000) |
| _cons | 0.030 | 0.030 | 0.251*** | 0.246*** | 0.234*** | 0.287*** |
| | (0.059) | (0.061) | (0.058) | (0.058) | (0.061) | (0.038) |
| N | 420 | 420 | 420 | 420 | 420 | 420 |
| $R^2$ | 0.951 | 0.951 | 0.961 | 0.961 | 0.961 | 0.974 |
| year | YES | YES | YES | YES | YES | YES |
| province | YES | YES | YES | YES | YES | YES |

Note: *, **, *** denote significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses, as in the table below.

### 4.2 Robustness Tests

Considering that the time interval of the sample selected in this paper includes 2008 and 2020, which are strictly exogenous external shocks to the macroeconomy, if this factor is not taken into account, it may lead to the endogeneity problem of omitted variables. After excluding the special samples before 2008 and 2020, the regression is conducted again, if the core explanation of the significant amount of the previous conclusions remain consistent in this case, indicating that the results are more robust, the regression results are shown in the first column of Table 4. At the same time, in order to exclude the possible modeling bias caused by the bias of variable form setting, this paper will turn the explanatory variables into the logarithm of GDP per capita and then regress again, if the conclusion is consistent with the previous section, it indicates that there is no bias in the form of variables.

From the robustness test, we can get that the regression results are still significant after excluding the special years, labor mobility and industrial structure upgrading still have a significant impact on the urban-rural income gap,

and comparing the results of the baseline regression and the model after changing the dependent variable, we can see that the conclusion is still robust, labor mobility increases the per capita GDP of both urban and rural areas to narrow the urban-rural income gap, and industrial structure upgrading decreases the per capita GDP, and industrial structure upgrading reduces per capita GDP, thus widening the urban-rural income gap.

**Table 3. Robustness Test Results**

| NAME | Excluding exceptional years | Changing the explanatory variables | |
|---|---|---|---|
| | (1) | (1) | (2) |
| | tl | lnpgdp | lnpgdp |
| labor | -0.000*** | 0.011*** | 0.007*** |
| | (0.000) | (0.002) | (0.002) |
| idc | 0.001*** | -0.007** | -0.009*** |
| | (0.000) | (0.003) | (0.001) |
| intervene | 0.000 | | -0.018*** |
| | (0.000) | | (0.002) |
| internet | -0.069*** | | 0.980*** |
| | (0.014) | | (0.140) |
| nation | 0.000 | | -0.001 |
| | (0.000) | | (0.001) |
| stru | 0.000 | | -0.013*** |
| | (0.000) | | (0.002) |
| city | -0.004*** | | 0.016*** |
| | (0.000) | | (0.003) |
| _cons | 0.267*** | 11.484*** | 10.055*** |
| | (0.028) | (0.670) | (0.399) |
| N | 330.000 | 420 | 420 |
| $R^2$ | 0.866 | 0.970 | 0.985 |
| year | YES | YES | YES |
| province | YES | YES | YES |

### 4.3 Heterogeneity Test

In order to exclude the interference of regional factors on the results, and at the same time to further verify the impact of labor mobility and industrial structure upgrading on the urban-rural income gap, we further divided the 30 provinces examined above into East, Central and West to observe the impact of regional heterogeneity.

From the heterogeneity results, it can be seen that labor mobility and the urban-rural income gap in the east and central China show a negative correlation, and both are significant at the level of 1%, while the labor mobility in the west, on the contrary, is positively correlated with the urban-rural income gap and insignificant, that is to say, the faster the labor mobility in the west, the bigger the urban-rural income gap, which is due to the fact that the rural development in the west is more backward, and the imperfections in the market result in underemployment, hindering the increase of farmers' income. This is because the rural development in the west is more backward, and the imperfect market causes insufficient employment, which hinders the increase of farmers' income. The urban-rural income gap cannot be truly narrowed when the transfer of surplus labor is insufficient and the income from outside work is not enough to allow it to catch up with the growth of income in urban areas.

Meanwhile, the industrial structure and the east, middle and west all show a positive correlation, but only the west is significant at the 1% level, this is because along with the acceleration of the urbanization process in the east and middle land, the modern industry has been developed rapidly, the proportion of non-farm employment has also been increased, and the remuneration of farmers from the non-farm industry has increased, but the development of the industrial structure is still insufficient, so although the income from this non-farm industry has made a contribution to the suppression of the Therefore, although the income from this non-farm industry has contributed to suppressing the continuous widening of the urban-rural income gap, the main role of the upgrading of the industrial structure is still to widen the urban-rural income gap. When the level of urbanization in the western region is at a lower stage of development, the negative effect of industrial structure upgrading will significantly widen the urban-rural income gap.

**Table 4. Heterogeneity Results**

| NAME | nationwide | eastern part | Central Part | western part |
|---|---|---|---|---|
| | tl | tl | tl | tl |
| labor | -0.000** | -0.002*** | -0.001*** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| idc | 0.001*** | 0.000 | 0.000 | 0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) |

| | | | | |
|---|---|---|---|---|
| intervene | 0.000 | 0.000 | -0.000 | -0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| internet | -0.075*** | -0.006 | 0.016 | 0.079*** |
| | (0.013) | (0.013) | (0.042) | (0.021) |
| nation | 0.000 | 0.000** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| stru | 0.000 | -0.000 | 0.001*** | -0.002** |
| | (0.000) | (0.000) | (0.000) | (0.001) |
| city | -0.004*** | -0.002*** | -0.002*** | -0.004*** |
| | (0.000) | (0.000) | (0.000) | (0.001) |
| _cons | 0.287*** | 0.330*** | 0.191** | 0.020 |
| | (0.038) | (0.046) | (0.093) | (0.117) |
| N | 420 | 154 | 112 | 154 |
| $R^2$ | 0.974 | 0.987 | 0.974 | 0.973 |
| year | YES | YES | YES | YES |
| province | YES | YES | YES | YES |

### 4.4 Spatial Measurement Tests

First, spatial correlation test. In the paper, for the sake of robustness, the geographic neighborhood spatial weight matrix, geographic distance spatial weight matrix and economic distance spatial weight matrix are used respectively, and we get that the Morans' I index of the explanatory variables of urban-rural income gap are all positive, and at least pass the significance test of 5%, which indicates that there is an obvious spatial positive correlation characteristic of the regional development gap in China and the estimation of this paper by using the spatial econometric model It is reasonable. Second, the spatial measurement regression results. The LR statistic is tested at the 1% significance level, indicating that it is better to use the spatial Durbin panel model (SDM), and the Hausman test also shows that the double fixed effects model should be used at the 1% level. Therefore, the two-way fixed effects model under the spatial Durbin panel model is used in the following to analyze the regression results.

The results show that the spatial spillover effect of the coupling of labor mobility and industrial structure upgrading is larger than its direct effect, indicating that the interaction between the level of labor mobility and industrial structure upgrading in the region can not only promote the narrowing of the urban-rural income gap in the region, but also significantly contribute to the narrowing of the urban-rural income gap in the neighboring regions. By strengthening the coupling of labor mobility and industrial structure upgrading, it can not only gradually alleviate the phenomenon of regional factor endowment structure and industrial mismatch, but also provide new conditions for the narrowing of the urban-rural income gap.

**Table 5. Spatial Measurement Tests**

| NAME | (1) direct effect | (2) indirect effect | (3) total effect |
|---|---|---|---|
| synergy | -0.005** | -0.024*** | -0.029*** |
| | (0.02) | (0.00) | (0.00) |
| nation | -0.000 | -0.001** | -0.001** |
| | (0.50) | (0.03) | (0.03) |
| intervene | 0.000 | 0.002*** | 0.002*** |
| | (0.83) | (0.00) | (0.00) |
| stru | 0.000 | 0.002** | 0.002** |
| | (0.13) | (0.01) | (0.01) |
| internet | -0.035*** | -0.060** | -0.095*** |
| | (0.00) | (0.05) | (0.00) |
| city | -0.003*** | 0.000 | -0.002*** |
| | (0.00) | (0.83) | (0.01) |
| rho | 0.538*** | | |
| | (0.00) | | |
| Observations | 420 | 420 | 420 |
| R-squared | 0.805 | 0.805 | 0.805 |
| year | YES | YES | YES |
| province | YES | YES | YES |

### 4.6 Policies and Recommendations

(1) The coordinated development of urban and rural areas is not the elimination of differences and absolute equity, but the utilization of differences to narrow the gap. On the one hand, the development speed of cities is obviously faster than that of rural areas, but under the status quo of two-way flow of factors between urban and rural areas, the return of factors will form a new vitality to the industrial structure of

rural areas, and the integration of traditional backward industries with tertiary industries will be better, and the northeast and western regions are rich enough in natural resources to catch up with urban areas from the perspective of tertiary industries.

(2) The government's development strategy should be more coordinated. Fiscal transfers from the central and local governments should be basically oriented to promote regional division of labor, and should be invested more in infrastructure, public services and innovative industries than in agriculture, which is less productive and slower to develop, so as to not only strengthen factor flows between urban and rural areas, but also to reduce the widening of the gap brought about by infrastructure and public services.

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