



# Advanced Human Capital Structure and Urban-Rural Income Gap--Based on the Perspective of Industrial Structure

Jiaqing Xie

College of Business and Tourism, Sichuan Agricultural University, Dujiangyan, Chengdu, 624014, China

3069708518@qq.com

**Abstract.** Reducing the urban-rural income gap is an inevitable requirement for realising the common wealth of all people, and the degree of structural advancement of human capital, as a key factor in income formation, may have an important impact on the regional urban-rural income gap. Based on China's provincial panel data from 2000 to 2021, this paper conducts an empirical study on the nonlinear relationship between the development of regional human capital structure and the urban-rural income gap. Based on the intermediary effect model, this paper discusses the effect of the upgrading of human capital structure on the income gap between urban and rural areas through the upgrading and rationalization of industrial structure.

**Keywords:** Advanced human capital structure, advanced industrial structure, rationalisation of industrial structure, urban-rural income gap.

## 1 Introduction

Human capital, as a key element of wealth creation and income formation, plays a critical and important role in the rural-urban income gap. However, existing studies have mostly focused on the human capital stock or education level on income disparity, and less on the link between regional human capital structure and its level of sophistication and the urban-rural income gap. In fact, as an momentous source of modern economic growth, human capital structure can directly or indirectly affect regional economic development by influencing production, consumption, savings and investment.

In recent decades, China's education has flourished, the education level of urban and rural residents has generally risen, and the structure of urban and rural human capital and income patterns have quietly changed. Then, what impact will the above changes brought about by the advanced human capital structure have on the urban-rural income gap? How does its impact arise? This paper analyzes the above issues based on the data of China's provincial expert groups from 2000 to 2021.

## 2 Theoretical Analysis and Research Hypothesis

### 2.1 Advanced Human Capital Structure and the Urban-Rural Income Gap

Much of the current literature discusses the relationship between urban-rural income gap and the human capital, there are two main views. The first group of views considers that the ‘universal, non-discriminatory and beneficial’ nature of human capital can give rural areas a latecomer's advantage between urban and rural areas by ‘promoting employment and raising incomes’<sup>[1-3]</sup>. Thus, it plays a role in narrowing the income gap. A second strand of literature, on the other hand, argues that because of the wider systematic differences in factor endowments between urban and rural areas in China, an increase in the level of regional human capital, while it may promote an increase in the overall regional income level, and it may be amplified by the selective migration of labor, labor market distortion and the solidification of employment class<sup>[4-6]</sup>.

To sum up, human capital level of the region may have both positive and negative impacts on the income gap between urban and rural areas, and it may not be a simple linear relationship. During the evolution of regional human capital structure, the urban-rural income gap may first narrow and then widen. Accordingly, hypothesis 1 is proposed in this paper:

**Hypothesis 1:** There is a non-linear U shaped relationship between the advanced level of regional human capital and the urban-rural income gap.

### 2.2 The Mediating Role of Industrial Structural Upgrading

As the concrete embodiment of the transformation of economic growth mode and development mode, industrial structure optimization and upgrading may play a key intermediary role in the influence of regional human capital upgrading on urban-rural income gap.

The optimization of industrial structure is mainly embodied in the two aspects of industrial structure upgrading and industrial structure rationalization. The advancement of human capital can provide talent support for the industrial structure, and provide farmers with more income-generating possibilities while enhancing the efficiency of agricultural production, thus narrowing the income gap between urban and rural areas<sup>[7-9]</sup>. However, on the other hand, when the regional economic foundation and development environment are not yet mature, the advanced human capital may also bring about a mismatch between human capital and industrial structure, not conducive to deepening the cultivation of advantaged industries and industrial transformation through the division of labour, and restricting the technological advancement<sup>[10]</sup>, widen the urban-rural income gap.

In summary, human capital advancement can act on industrial structure upgrading, which in turn affects the urban-rural income gap, but between the human capital advancement and industrial structure advancement and rationalisation may be non-linear. On this basis, this paper puts forward hypothesis 2:

**Hypothesis 2:** The advanced human capital may affect the urban-rural income gap through its non-linear effect on the advanced industrial structure and rationalisation.

### 3 Model Setup and Data

#### 3.1 Empirical Model Construction

Based on the above analysis, this paper establishes the following empirical econometric model:

$$Theil_{it} = \alpha_0 + \alpha_1 Hstruc_{it}^2 + \alpha_2 Hstruc_{it} + \alpha_3 C_{it} + \delta_i + T_t + u_{it} \quad (1)$$

In the above equation, the explanatory variable is the urban-rural income gap in year  $t$  of region  $i$ ; the core explanatory variable is the index of advanced human capital structure;  $C_{it}$  is the control variable associated with the explained variable,  $\delta_i, T_t$  is a series of control time and area separately,  $u_{it}$  is the random error term.

#### 3.2 Variable Setting and Measurement Methods

Explained variable: adopts the Thiel index to evaluate the urban-rural income gap, which is calculated by the formula shown below:

$$Theil_{it} = \frac{I_{it}^u}{I_{it}} \times \ln \frac{I_{it}^u/P_{it}^u}{I_{it}/P_{it}} + \frac{I_{it}^r}{I_{it}} \times \ln \frac{I_{it}^r/P_{it}^r}{I_{it}/P_{it}} \quad (2)$$

$I_{it}$  represents the gross income of region  $i$  in period  $t$ ;  $P_{it}$  represents the gross population of region  $i$  in period  $t$ .

Core explanatory variable: The high-level calculation of human capital structure is as follows:

$$Hstruc_{it} = \sum_{k=1}^5 \sum_{j=1}^k H_{jit} \quad (3)$$

In the above equation, human capital is ranked in order of educational attainment in five categories: college and above, high school, middle school, primary school, and illiterate and semi-illiterate, and their weights are set as ( $j = 1, \dots, 5$ ).

Mediating variable: the ratio of output value of tertiary industry to output value of secondary industry is used to measure the advanced industrial structure (TS), and the rationalization of industrial structure is measured by calculating the degree of structural deviation (Sedv).

Control variables: The level of government expenditure (Gov), measured by the ratio of government expenditure to the gross domestic product of each province. Level of foreign development (Open), measured using the ratio of total exports and imports to GDP for each province. Level of foreign investment (Pdf), measured by the ratio of total foreign direct investment in each province to gross domestic product. Level of economic development (Pgdp), measured using gross domestic product per capita. Rural-Urban Education Gap (Edur), measured using the ratio of average years of schooling in urban areas to years of schooling in rural areas.

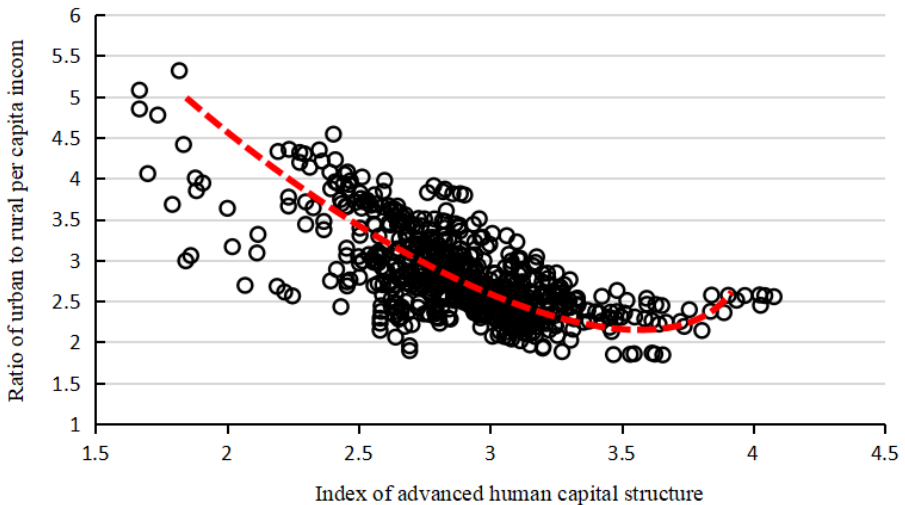
### 3.3 Data Sources

The specific sources of data are as follows: income of urban and rural residents in each province and city, gross domestic product, value-added of industries are obtained from the National Bureau of Statistics and the China Statistical Yearbook. The total amount of imports and exports, deposits of banking financial institutions, government expenditures, and the exchange rate of RMB in each province are all from the China Statistical Yearbook. The years of schooling of urban and rural residents in each province are obtained from the China Population and Employment Statistical Yearbook.

## 4 Empirical Analysis

### 4.1 Scatter Plot of Relevant Data

Figure 1 shows the scatter plot of the index of advanced human capital structure and the income ratio of urban and rural residents in 31 provinces from 2000 to 2021. From the figure, It can be found that with the continuous improvement of the advanced human capital structure, the urban-rural income gap tends to narrow and then expand. And the relationship between the two is in line with the characteristics of the ‘U’ shaped relationship.



**Fig. 1.** The descriptive statistical graph of the high-grade human capital structure and the urban-rural income gap.

### 4.2 Benchmark Regression and Robustness Tests

This paper first uses stepwise regression to test the effect of advanced human capital structure on the urban-rural income gap, and the relevant results are shown in Table 1.

Column (1) shows regression results with only core explanatory variables and explained variables, column (2) shows the regression results with relevant control variables added.

Meanwhile, column (3) replaces the Thiel Index with the ratio of urban to rural disposable income per capita. In column (4), a new index is used to test the core explanatory variables, that is, the vector Angle method is used, and then regression is performed and Column (5) to avoid reverse causality effects, uses the advanced human capital structure with a lag of 1 period as an instrumental variable of the current index for the robustness regression test. The above results show that there is a robust positive U-shaped relationship between the two.

**Table 1.** Regression analysis of human capital structure on urban-rural income gap

	(1)	(2)	(3)	(4)	(5)
<i>Hstruc</i> <sup>2</sup>	0.0770*** (0.012)	0.0658*** (0.010)	0.7455*** (0.162)		0.0790*** (0.010)
<i>Hstruc</i>	-0.4720*** (0.062)	-0.4066*** (0.059)	-4.500*** (0.873)		-0.5099*** (0.066)
<i>Hstruc</i> <sup>2</sup>				0.0088** (0.004)	
<i>Hstruc</i> <sub>2</sub>				-0.291** (0.138)	
<i>Year/Ind</i>	Yes	Yes	Yes	Yes	
<i>control</i>	No	Yes	Yes	Yes	
<i>N</i>	682	682	682	682	651
<i>R</i> <sup>2</sup>	0.943	0.950	0.732	0.787	0.8035
<i>Kleibergen-Paap rk LM</i>				78.776***	

### 4.3 Analysis of Threshold Effects

Based on the above analyses, it can be seen that the impact of human capital on the urban-rural income gap may have a U-shaped non-linear effect. In this regard, this paper takes human capital size as well as human capital agglomeration as the threshold variables to carry out the threshold test. Table 2 Threshold effect test results show that the threshold values of *Hstruc*, *Ts* and *Sdev* are measured to have only single-threshold effects, and there are no double-threshold and triple-threshold effects.

**Table 2.** The threshold benefit model

variables	Number of thresholds	F-statistics value	threshold value	P-value	95 per cent confidence interval
<i>Hstruc</i>	single	116.99	0.0043	0.01	[0.004 0.0047]
<i>Ts</i>	single	87.79	0.0179	0.003	[0.0176, 0.0181]
<i>Sdev</i>	single	333.8	0.0232	0.012	[0.0222, 0.0235]

#### 4.4 Intermediary Analysis

As shown in Table 3, Column (1) and Column (4) show the empirical regression results of human capital structure advancement affecting industrial structure advancement and rationalisation, respectively, while Column (2) and Column (5) show the regression results with urban-rural income gap as the explanatory variable, human capital structure advancement as the core explanatory variable, and industrial structure advancement and rationalisation indices as the mediator variables, respectively. In addition, considering that the impact of industrial structure may have a certain lag, in this paper, the rural-urban income gap will be delayed for a period before relevant regression, and the regression results are shown in columns (3) and (6), further verifying that industrial structure optimization has a robust intermediary effect.

**Table 3.** Intermediate effect test

	Advanced industrial structure			Rationalisation of industrial structure		
	<i>Ts</i>	<i>Theil</i>	<i>Theil<sub>-1</sub></i>	<i>Sdev</i>	<i>Theil</i>	<i>Theil<sub>-1</sub></i>
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Hstruc</i> <sup>2</sup>	1.247 *** (0.074)	0.054 *** (0.006)	0.057 *** (0.006)	-0.392 *** (0.877)	0.062 *** (0.005)	0.068 *** (0.005)
<i>Hstruc</i>	-6.977 *** (0.425)	-0.338 *** (0.074)	-0.351 *** (0.035)	2.575 *** (0.505)	-0.383 *** (0.029)	-0.409 *** (0.003)
<i>Ts</i>		0.010 *** (0.003)	0.011 *** (0.003)			
<i>Sdev</i>					-0.009 *** (0.002)	-0.006 *** (0.002)
Year/Ind control	Yes	Yes	Yes	Yes	Yes	Yes
cons	10.521 *** (0.670)	0.638 *** (0.052)	0.617 *** (0.053)	-4.879 *** (0.794)	0.697 *** (0.046)	0.757 *** (0.046)
<i>N</i>	682	682	651	682	682	651
<i>R</i> <sup>2</sup>	0.665	0.828	0.816	0.383	0.828	0.814
KHB		19.15%			25.12%	

In summary, the empirical results in Table 2 indicate that industrial structure upgrading plays a mediating role in human capital advancedisation affecting the urban-rural income gap. In addition, using the nonlinear model KHB mediation effect test method

to further test, the test results verify the existence of the mediation effect of industrial structure<sup>[11]</sup>. Among them, the intermediary effect of industrial structure upgrading and rationalization accounted for 19% and 25% of the total effect respectively.

## 5 Conclusions

Based on the provincial panel data from 2000 to 2021, this paper empirically studies the impact of the upgrading of human capital structure on the regional urban-rural income gap and its mechanism. The study shows that the impact of advanced human capital structure on the urban-rural income gap shows a positive 'U' shape. Moreover, the conclusion is still valid after a series of robustness tests. At the same time, the advanced industrial structure and rationalisation play a mediating role, and the relationship between the advanced human capital and the advanced industrial structure and rationalisation is positive and inverted, plus the advanced industrial structure tends to widen the urban-rural income gap, and the advanced industrial structure tends to widen the urban-rural income gap. In addition, the advanced industrial structure tends to widen the urban-rural income gap, and the rationalisation of industrial structure tends to curb the urban-rural income gap. Finally, there is a positive U-shaped relationship between the core explanatory variable and the explained variable.

To sum up, all regions should, according to the local actual situation and local conditions, formulate scientific and reasonable strategies for improving the level of local manpower, so as to avoid blindly "robbing people" or blindly pursuing the increase of the proportion of high-end talents, resulting in further widening of the urban-rural income gap.

## Reference

1. Rodolfo E M; Ananth S. Human Capital and the Wealth of Nations[J]. *The American Economic Review*, 2014, 104(9): 2736-2762.
2. Chunmei L, Guiting Z. Research on the Relationship between Level of Rural Human Capital and Urban-Rural Income Gap[J]. *International Journal of u- and e-Service, Science and Technology*, 2014, 7(2).
3. Ding M, Pei J. The Influence of Regional Resident Human Capital Investment on Income Gap Based on the perspective of population migration [J]. *E3S Web of Conferences*, 2021, 235.
4. Chao X, Tan X. How Does the Urban-rural Income Disparity Affect Economic Growth?[J]. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 2017, 65(1).
5. Sicular T Y, Custafsson B, et al. The Urban-Rural Income Gap and Inequality in China[J]. *Review of Income and Wealth* 2007(1):93-126.
6. Yang X. Dynamic Relationship among the Human Capital Distribution, Income Gap and Growth [J]. *Information Technology Journal*, 2013, 12 (10): 1950-1957.
7. Suseno Y, Standing C, Kiani-mavi R, et al. National Innovation Performance: the Role of Human Capital and Social Capital. [J]. *Innovation-the European Journal of Social Science Research*, 2020, 33(3):296-310.

8. Jiajun X. Digital economy, industrial structure upgrading and urban-rural income gap[J]. *Academic Journal of Business & Management*,2023,5(15).
9. Li C, Li Y, Wu J. Endowment Structure, Industrial Structure, and the Fluctuation of Urban-rural Income Gap—An Analysis of New Structural Economics[J]. *Accounting and Finance Research*,2023,12(1).
10. Mingyong H, Wenjie Z. Industrial structure upgrading, urbanization and urban-rural income disparity: evidence from China[J]. *Applied Economics Letters*,2021,28(15).
11. Kohler U, Karlson K B, Holm A. Comparing coefficients of nested nonlinear probability models[J]. *The Stata Journal*,2011,11:420-438.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

