

The Correlation Effect Analysis of the Human Capital and Industrial Transformation and Upgrading in Inner Mongolia

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Abstract: *The economic growth of Inner Mongolia region is sluggish in recent years, Inner Mongolia region is into the crucial stage of industry transformation and upgrading and human capital is one of the important driving force of industrial transformation and upgrading. In this paper, studying the linkage between human capital and industrial transformation and upgrading of Inner Mongolia by constructing the model of industry transformation and upgrading based on the research of scholars both at home and abroad. Through the study found that Inner Mongolia region and industrial transformation and upgrading of human capital have mutual promotion effect, at the same time, industrial transformation and upgrading of Inner Mongolia is more prominent to the role of human capital stock, transformation and upgrading of industry needs more effective human capital accumulation.*

Keywords: *Inner Mongolia; human capital; industrial transformation and Upgrading*

1. INTRODUCTION

Relying on the development of coal, natural gas and other non-renewable energy, there were the rapid economic development and achieved a historic leap in Inner Mongolia in the 21st century, and there were economic growth ranking first in the country for eight consecutive years since 2002. However, with the increasing economic pressure, the extensive economic mode which relying solely on the development of resources began to existing many problems in Inner Mongolia. There were the growth rate rapidly declined to 11.7% in economic from 2012, and the national ranking of the growth rate was declined from fifth to thirteenth place. Then, there were the further decline in the annual growth rate to 9%, which was the first time fell below double digits since the new century. And the first half of 2014, the growth rate is only 7.6% which was the first time the growth rate below the national average in years. From the experience of the development of the Lorraine, the Ruhr and other regional economic, the extensive economic mode is bound to bring economic problems of hazardous, which included resource-based industries lack competitiveness, sluggish growth in economic and some other thorny social problems in Inner Mongolia. These problems indicate that the economic growth pattern has undergone profound changes, there are facing a serious challenge of the industrial structure and Entering an important stage of industrial transformation and upgrading in Inner Mongolia. The regional human capital has the important impact on the industrial structure in the era of the knowledge economy, and the human capital was the main driving force of technological progress which was the main part of the industrial transformation and upgrading. Therefore, this paper analyze that the correlation effect of the human capital and industrial transformation and upgrading with econometric analysis in Inner Mongolia.

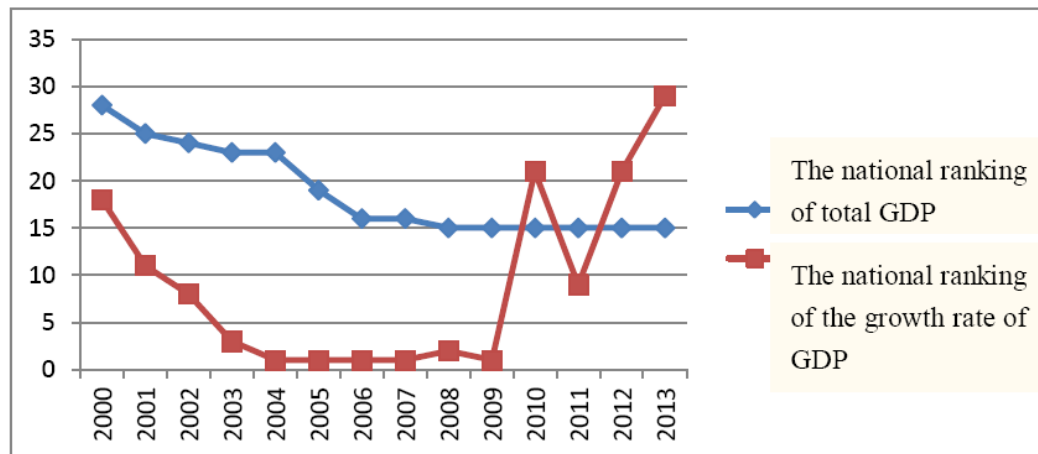


Figure1. The national ranking of Inner Mongolia about the total GDP and the growth rate

2. THEORY CLARIFICATION AND MODEL SELECTION

2.1. The Clarification of the Theory of the Human Capital and the Industrial Transformation

Human Capital refers to workers acquired the accumulation of the knowledge and skills when they were accepted investment by education, training, experience, migration, health and other aspects. The famous American economist I-Fisher, which proposed the concept of human capital for the first time in 1906 in *The nature of capital and income*, he suggested that the capital is property can bring income, and he also extended the definition of capital and expounded to the concept of human capital. Jacob Mincer published the paper in *Journal of Political Economy*, which open the prelude to the study of human capital. There are the beginning of the official theory research of the human capital in domestic academic in the late 1980s. Because of the late start, the initial theoretical research mainly began with the translation and introduction of the foreign human capital theory. There are more comprehensive relevant research articles which introduce the foreign human capital theory at the late 1990s, and it began rapid development of the research of human capital with China's national conditions and the actual area. Many scholars was given the concept and presentation with Chinese characteristics from their point of view of human capital, such as Zhongmin Li, Zhihong Mo.

The upgrading of the industrial structure is the evolution which include the industrial structure from the low-skilled, low value-added, high energy consumption and low output state to high-tech, high value-added, low-energy high-yield. Industrial transformation and upgrading consists of two levels, one is the rationalization of the industrial structure, which refers to the enhancement of the inter-related industries coordination capacity and the level of association, the other is the high-class industrial development, which refers to industrial development make the change to the direction of the high yield and low consumption on the basis of the industrial rationalization. The scholars were studied the human capital and industrial structure from the different angles in recent years in China. For instance, Furong Dong, Ping Li, etc, which analyze the role of human capital in economic growth by using empirical analysis method, and take the industrial structure and human capital of Guangdong Province since the reform and opening up for the example. The results showed that it's propitious to the rational allocation, investment in human capital, in favor of upgrading the industrial structure optimization, thereby enabling the industrial structure between human capital and the formation of positive interaction, to promote better economic and sustainable development. Wenzheng Huang make an in-depth analysis about the link between human capital accumulation and the upgrading of industrial structure by using cointegration, granger causal analysis and impulse response analysis. The results showed that the accumulation of human capital can promote the upgrading of industrial structure.

2.2. The Model Selection and the Data Description

From the industrial transformation and upgrading of the overall departure, there are the construction of concrete model of industrial upgrading on the study of the basis of domestic and foreign scholars. This model included that the proportion of the tertiary industry and the proportion of high-tech industries, the output of the energy consumption per unit, the output of the industrial wastewater and emissions per unit, the solid waste emissions per unit.

In the measurement of human capital stock, this paper used the method of years of education law which were chosen by the majority of scholars to represent the level of human capital in Inner Mongolia region. The stock of human capital $N = \text{The Number of employees} * H$, H expresses the average years of schooling and $H = \sum_{i=1}^n p_i e_i$, n expresses the number of groups in groups of educational attainment by points, p_i expresses the number of the employment in group i accounted for the proportion of all employed persons, e_i expresses the years of education in group i .

According to the constitution of the level of education of the region employment in China Labor Statistics Yearbook, the employment divided into seven groups in this paper, which refers to p_1 expresses the illiteracy which can't accept the schooling education, p_2 expresses the employee with the primary education whose years of schooling of 6 years, p_3 expresses the employee with the junior high school education whose years of schooling of 9 years, p_4 expresses the employee with the senior middle school education whose years of schooling of 12 years, p_5 expresses the employee with the junior college education whose years of schooling of 15 years, p_6 expresses the employee with the university education whose years of schooling of 16 years, p_7 expresses the employee with the postgraduate education whose years of schooling of 19 years. As the Table 1, this paper compute the years of education in Inner Mongolia, Guangxi Province, Shanghai and the average level of China from 2009 to 2013.

Table1. Parts of the average employment education fixed number of year (unit: year)

	Inner Mongolia	The average level of China	Guangxi Province	Shanghai
2009	8.6885	8.6537	8.4595	11.6138
2010	9.2386	9.0601	8.7927	11.2085
2011	9.8682	9.5706	9.1751	11.5697
2012	9.9756	9.6622	9.2412	11.7111
2013	9.8865	9.7294	9.2637	11.8735

From Table 1, we can see that the average years of education of employed persons are gradually improving with the overall trend, despite fluctuations in individual years in Inner Mongolia. Comparing to the national level and the Guangxi region which were the ethnic minority areas with Inner Mongolia, the average years of education slightly higher than other regions in Inner Mongolia. On the other hand, comparing to the Shanghai, the average years of education is very low in Inner Mongolia. Since the model of the industrial transformation and upgrading includes a plurality of indicators, you need to apply to the principal component analysis to generate a composite indicator to reflect the ability of the industry to upgrade. The principal component analysis model of the industrial transformation and upgrading process indicators were extracted two main component I_1 and I_2 , which can we seen the scoring matrix in Table 2

Table2. Score matrix composition

	I_1	I_2
The proportion of the tertiary industry (%)	-.124	.923
The proportion of high-tech industries (%)	-.854	.135
The output of the energy consumption per unit Ten thousand yuan per ton of the coal)	.826	.182
The output of the industrial wastewater per unit (Ten thousand yuan per ton)	.894	.149
The output of the industrial emissions per unit Ten thousand yuan per hundred million cubic meters)	.954	.185
The solid waste emissions per unit. Ten thousand yuan per ton)	.606	-.380

$I = 0.760473I_1 + 0.239527I_2$, I expresses the composite index of the industrial transformation and upgrading in Inner Mongolia. According to the formula of the I and N , we can draw the Table 3.

Table3. The index of the industrial transformation and upgrading and the human capital stock in Inner Mongolia region

	The index of the industrial transformation and upgrading, I	The stock of the human capital, N (Ten thousand People one year)
2001	-1.08356	8646.968
2002	-1.54362	8996.166
2003	-2.51887	8890.865
2004	-3.17164	8847.137
2005	-2.58944	9052.989

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2006	-2.49705	8865.19
2007	-1.44901	9220.328
2008	0.745239	9460.246
2009	0.703729	9926.611
2010	2.340177	10944.97
2011	2.154178	12328.34
2012	4.182089	13017.16
2013	4.727789	13922.17

From Table 3, we can see that it showing a gradual upward trend that the index of industrial transformation and upgrading of the Inner Mongolia region.

3. THE ANALYSIS OF THE CORRELATION EFFECT

3.1. The Unit Root Test

The unit root test is the method to test the stationary of the sequence. This paper get the trends of the index of the industrial transformation and upgrading and the stock of the human capital stock by using software Eviews. From the Figure 2 and 3, we can see that the I and N which has emerged as a clear upward trends. From the Table 4, we can see that the ADF statistics of the second-order difference sequence of the I and N are less than the critical value at the 5% significance level, which can explain $\Delta^2 I$ and $\Delta^2 N$ are smooth, and I and N are the single whole in the second order.

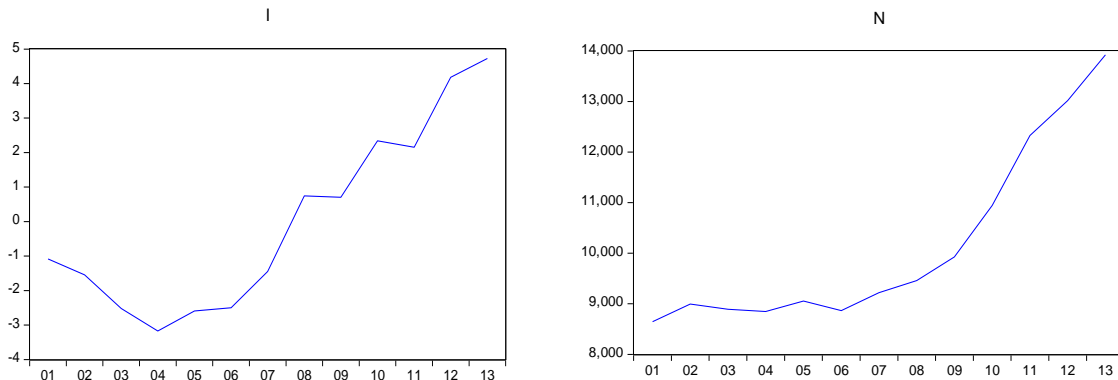


Figure2. Industrial transformation and upgrading Figure3. Human capital stock trends index change trend

Table4. The unit root test results of I and N

Variable	Test form (C,T, K)	ADF statistics	The threshold			Conclusion
			1%	5%	10%	
I	(C, T, 1)	-3.066159	-5.124875	-3.933364	-3.420030	Non-smooth
ΔI	(C, T, 1)	-1.528565	-5.295384	-4.008157	-3.460791	Non-smooth
$\Delta^2 I$	(0,0,0)	-8.114597	-2.816740	-1.982344	-1.601144	Smooth
N	(C,T, 1)	-0.732915	-5.124875	-3.933364	-3.420030	Non-smooth
ΔN	(C, T, 1)	-2.288250	-5.295384	-4.008157	-3.460791	Non-smooth
$\Delta^2 N$	(0,0,0)	-4.254618	-2.816740	-1.982344	-1.601144	Smooth

3.2. The Cointegration

In order to verify the long-run equilibrium relationship between the industrial transformation and upgrading and the index of the human capital, we can make the cointegration to the industrial transformation and upgrading and the index of the human capital according to the results of the ADF statistics. The regression model are consist of the I_t and N_t $I_t = \alpha + \beta N_t + U_{1t}$, $N_t = a + b I_t + U_{2t}$. The regression results are as follows which were obtained by using OLS.

$$\begin{aligned}
 I_t &= -14.04469 + 0.001382N_t & N_t &= 10163.01 + 625.6911I_t \\
 t &(-8.264441) \quad (8.383429) & & (52.93957) \quad (8.383429) \\
 R^2 &= (0.864668) \quad DW = (1.073798) & R^2 &= (0.864668) \quad DW = (1.024453)
 \end{aligned}$$

From the R^2 of the two equations above, the degree of the model fitting better, and there are the mutual positive causal influence between the index of the human capital and the industrial

transformation and upgrading. On the one hand, I will raise 0.001382 units while N raise 1 unit. On the other hand, N will raise 625.6911 units while I raise 1 unit. But from the first formula, we can concluded that the stock of the human capital need increased by 723.589 units, greater than 625.6911, while the index of the industrial transformation and upgrading increased by one unit. It was indicated that the promoting effect which the index of the industrial transformation and upgrading generate the stock of the human capital are greater than the promoting effect which the stock of the human capital generate the index of the industrial transformation and upgrading. Then, verification from a long term equilibrium relationship between the stock of human capital and the index of the industrial transformation and upgrading, we need to make the unit root test of two equations residuals U_{t1} and U_{t2} , and the results are shown in Table 5.

Table5. The ADF test results of U_{t1} and U_{t2}

Variable	Test form (C,T, K)	ADF statistics	The critical value			Conclusion
			1%	5%	10%	
U_{t1}	(0, 0, 0)	-3.259217	-2.816740	-1.982344	-1.601144	Smooth
U_{t2}	(0, 0, 0)	-4.569506	-2.816740	-1.982344	-1.601144	Smooth

From the Table 5, we can see that the ADF test results of the residuals U_{t1} and the residuals U_{t2} are -3.259217, -4.569506, which both less than the critical value. It's means that the residuals U_{t1} and the residuals U_{t2} are smooth at the 5% significance level. Therefore, there are the cointegration relationship between the stock of the human capital and the index of the industrial transformation and upgrading.

4. CONCLUSION

We can discovered that the output of the industrial emissions per unit and the proportion of the tertiary industry are the main components which were highly contribution to I_1 and I_2 by using the principal component analysis for the index of the industrial transformation and upgrading in the scoring matrix of the initial index. Based on this, there are improving the capability of the industrial transformation and upgrading and the energy saving, and increasing the proportion of the tertiary industry in Inner Mongolia region. Meanwhile, we can discovered that there is a relationship of mutual promotion between the human capital and the industrial transformation and upgrading by the cointegration between the index of the industrial transformation and upgrading and the stock of the human capital. Compared with each other both, we can concluded that the improvement of the index of the industrial transformation and upgrading, which requires a higher stock of the human capital as a basement in Inner Mongolia, namely the industrial transformation and upgrading requires a lot of the human capital to provide intellectual support in Inner Mongolia.

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