Construction and Empirical Study of Human Capital Evaluation Index System --Taking the Yangtze River Economic Belt as an Example

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Abstract: Based on panel data from 11 provinces and cities in the Yangtze River Economic Zone from 2000 to 2019, this paper used Principal Component Analysis to establish a system of indicators for education human capital, health human capital and the comprehensive level of human capital . Established a regression model to study the impact of human capital on the economic growth of the Yangtze River economic belt. The study found that: firstly, the overall value of health human capital grew twice as fast as educational human capital. Secondly, the combined level of human capital had the greatest degree of influence on the economy of the Yangtze River Economic Zone.
Keywords: Human Capital; Yangtze River Economic Belt; Principal Component Analysis; Economic Growth

1. Introduction and literature review

The theory of human capital and economic growth reveals an important reason why the accumulation of human capital can keep the economy developing steadily. The overall quality of the labor force in the Yangtze River economic belt is one of the most important factors that determine the long-term and stable economic growth [1].

Mushkin [2] believes that health and education are the twin products of human capital. Meanwhile, this paper believes that using a single index to measure the human capital stock of a region may omit important information. Therefore, this paper believes that the multi index comprehensive method is more appropriate to measure human capital.

2. Research design

2.1 Selection and treatment of measurement and evaluation system

2.1.1 Selection of index system

The quality of human capital is even more important than its quantity for long-term steady economic growth in some regions[3]. In addition, the development of human capital is inseparable from financial support[4].Therefore, indicators for measuring educational human capital(EHC) include: Number of graduates of ordinary colleges and Universities($F1$), Number of full-time teachers in ordinary colleges and Universities($F2$), Education status of employed population($F3$), Proportion of employed population with college degree or above in the total employed population($F4$), Authorized amount of three patent applications at home and abroad($F5$), Government investment in Education($F6$), Residents investment in Education($F7$). Indicators for measuring health human capital (HHC) include: Number of beds in health institutions($X1$), Number of personnel in health institutions($X2$), Life expectancy($X3$), Perinatal mortality($X4$), Government investment in health care($X5$), Residents investment in health care($X6$). Indicators for measuring comprehensive level of human capital(CHC)include $F1 \sim X6$.

2.1.2 Data sources

All data in this paper are from China Statistical Yearbook, China Labor Statistical Yearbook and the National Bureau of statistics.

2.1.3 Index measure

KMO is 0.780 (EHC), 0.833 (HHC) and 0.881 (CHC) respectively. The P values of Bartlett's spherical test are all 0, which

shows the index is suitable for principal component analysis. After the calculation of principal components, two principal components are selected for all kinds of human capital indicators. Among them, the principal component of EHC accounts for 98.261% of the total information. The principal component of HHC accounts for 99.345% of the total information. The principal component of CHC accounts for 98.503% of the total information.

According to the principle of principal component analysis, the following formula is obtained.

The comprehensive score function of EHC is:
$$\text{ehc} = 0.56A_1 + 0.44A_2 \quad (1)$$

Similarly, the comprehensive score function of HHC is:
$$\text{hhc} = 0.566B_1 + 0.434B_2 \quad (2)$$

The comprehensive score function of CHC is:
$$\text{chc} = 0.552C_1 + 0.448C_2 \quad (3)$$

According to equations (1), (2) and (3), the comprehensive scores of EHC, HHC and CHC can be obtained. According to the ranking of human capital comprehensive evaluation values, there is a trend of "HHC > CHC > EHC". Data and finding is used to propose research hypotheses and empirical models.

2.2 Research hypotheses

The improvement of educational human capital accelerates the pace of innovative technology, which leads to the direct overflow of knowledge and innovation[5]. The health status of the population in the Yangtze River economic belt has been significantly improved, which can effectively open the window of opportunity for regional population[6].

Based on the comprehensive scores of various human capital, this paper puts forward the following assumptions:

A1: EHC will have a positive impact on the economy of the Yangtze River economic belt.

A2: HHC will have a positive impact on the economy of the Yangtze River economic belt.

A3: CHC will have a positive impact on the economy of the Yangtze River economic belt.

B1: The impact of HHC on the economy of the Yangtze River economic belt will be stronger than that of EHC.

B2: CHC will be the highest impact on the economy of the Yangtze River economic belt.

2.3 Modeling

The empirical analysis model with EHC as the core explanatory variable is:
$$\ln Y_{it} = \ln A + \beta \ln B_{it} + \beta_4 \ln gdbl_{it} + \beta_5 \ln dw_{it} + \beta_6 \ln fy_{it} + \varepsilon_{it} \quad (4)$$

Among them, Y represents GDP, B represents EHC, CHC, HHC. gdbl represents the stock of fixed assets, dw represents the degree of opening to the outside world, and fy represents the dependency ratio of the elderly population, β, β_4, β_5, β_6 represents the elasticity of the corresponding variable to Y, and A is a constant term, ε_{it} is the random disturbance term, i is the regional dimension, and t is the time dimension.

3. Empirical analysis

3.1 Unit root test

After the first difference is made for all variables, the assumption that there is a unit root is rejected in the LLC and ADF. Therefore, all variables are stable and belong to the same order single integer case between variables. There may be a cointegration relationship between variables.

3.2 Cointegration test

The p value of each model is 0, indicating that there is a long-term equilibrium relationship between the model variables, so the original equation can be directly regressed on this basis.

3.3 Regression analysis

According to the regression results of the core explanatory variables of model 1, model 2 and model 3, the hypothesis A1,A2,A3 of this paper is valid. The coefficient of CHC is the largest, indicating that it has the strongest driving force on economic development. The coefficient of HHC is twice that of EHC. The finding extends the research of Li Benzhao and Fan Honggang [7], and verifies the assumptions B1 and B2.

In addition, according to the regression results of the model control variables, dw has a positive impact on the total economic growth, but the impact of gdbl on economic growth is significantly negative at the level of 1%. The finding is in agreement with

the study of Kbl Kmad Lm Av & Bw[8].The fy has a positive impact on the economy of the Yangtze River economic belt. In order to ensure the pension dependency ratio of the elderly population and the income level of the working age population, the regional economic growth rate should be at least 4 About 4% and above [9]. In the past 20 years, the GDP growth rate of all provinces and cities in the Yangtze River economic belt has been higher than 4.4%, so the impact of population aging on the economy has been alleviated.

Table1 Regression results

	Model 1	Model 2	Model 3
lnEHC	0.6700***		
	35.2739		
lnHHC		1.2474***	
		59.3240	
lnCHC			1.2972***
			71.2780
lndw	0.1778***	0.2527***	0.1576***
	13.4004	27.4941	23.8106
Δlngdbl	-0.1804***	-0.1274***	-0.0719***
	-4.5681	-6.7009	-4.5171
lnfy	0.4908***	0.1373***	0.1797***
	14.3193	5.2811	8.4682
_cons	1.3972***	-5.3482***	-4.8537***
	9.7008	-27.8121	-28.4520

4. Conclusion

First, the comprehensive evaluation value of HHC is much higher than that of EHC, and its growth rate is twice that of EHC, resulting in a stronger role of HHC in promoting the economy after the regression.

Second, the Yangtze River economic belt has got rid of the previous material driven development mode. In addition, the high growth rate of GDP has alleviated the impact of population aging on the economy.

Third, EHC and HHC can use the mechanism of joint action to promote long-term stable economic growth.

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