Research on the Impact of Human Capital and Its Composition on Regional Technical Efficiency in China

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Abstract

The acceleration and increasing of the human capital can promote regional economic growth, but the lack of it hindered regional economic growth and the development of regional technical efficiency. The paper has collected the data of 31 provinces of China from the year of 2001 to 2008. And measured the influence of the human capital to regional technical efficiency, the result indicates that the improvement in human capital's technique level and education level could promote the technical efficiency. Therefore, Chinese regions should take some measures, such as establish a fair, open, reasonable application system and so on, to improve the level of regional human capital and regional technology efficiency.

Keywords

Human capital, regional technology efficiency, technology level, educational level.

1. Introduction

Although the concept of human capital can be traced back to 1906, but the concept is still quite extensive. Until 1960, the famous American economist Theodor W·Schultz [1] elaborated the concept of human capital in a speech entitled "Investment in human capital" at the annual meeting of the American economic society. He points out that the effectiveness of human capital is carried out under non-uniform conditions, which means that it has the advantage of creating new products and bringing more value. Because the use value of human capital could not only be reused, but also could increase the function and efficiency of human capital. At the same time, Theodor W Schultz pointed out that human capital has an active role in promoting economic growth. In 1980s, on the basis of rethinking the neo-classical growth theory, some famous economists, such as Romer [2] and Lucas[3], have published a group of papers focusing on "endogenous technological change". These papers explore the possible prospects for long-term economic growth, and the new growth theory was born. The new growth theory stresses that economic growth is not the result of external forces (such as exogenous technological change), but of the internal power of the economic system (such as endogenous technological change). The new growth theory attaches importance to the research on the influence of new problems on the long-term economic growth, such as knowledge spillover and human capital investment.

Additionally, empirical research shows that the accumulation of human capital can improve the utilization of physical capital. The improvement of human capital accumulation is the effect of TFP on economic growth [4], which has a positive effect on regional economy, and it has obvious regional difference [5-6]. At the same time, the structure of labor force has a significant impact on China's regional technical efficiency. However, China's current labor structure doesn't meet the needs of Chinese economic 's development and technological efficiency's improvement. The high labor force in the structure of labor force is low, which restricts the improvement of regional technical efficiency in China [7]. In order to further test the influence of human capital on Chinese regional technical efficiency, this part will use the stochastic frontier analysis method to carry on the empirical research from two angles of technical level and academic degree.

2. Research methods and models

This part uses Battese & Coelli model [8] and SFA technology based on Cobb Douglas production function, to measure the relationship between human capital and regional technology efficiency. The specific analysis model is as follows:

$$\ln(Y_{it}) = \beta_0 + \beta_1 in(K_{it}) + \beta_2 \ln(L_{it}) + (V_i - U_i) \quad (1)$$

$$m_{it} = \delta_0 + \delta_1 SP_{it} + \delta_2 SWP_{it} + \delta_3 MLP_{it} \quad (2)$$

In formula (1), Y_{it} is the annual GDP (unit: million yuan), K_{it} is the annual fixed capital stock (unit: million yuan), L_{it} is the annual labor force (unit: person), β_1 actually is the capital stock output elasticity of all provinces, β_2 actually is the labor output elasticity. i is the sequence number for the provinces, among them, i =1, 2,... ,31; t is the period serial number, among them, t =1, 2,... ,9; β_0 is the intercept term, β_1 and β_2 are the parameters to be estimated. The error term in Formula (1) is consists of V_i and U_i, the first part V_i belongs to iid and obeys the distribution of the $N(0,\sigma_v^2)$; The second part U_i is greater than 0 which reflects the random factors that only affect the i provinces. U_i belongs to iid and subject to the normal distribution of positive half and the $N(m_{it},\sigma_u^2)$. Meanwhile , V_{it} and U_{it} a are independent from each other.

In formula (2), δ_i is a set of parameters to be estimated, among them, i =0,1,…,5; SP_{it} is the percentage of professional and technical personnel of state-owned and state-controlled enterprises account for all employed persons, SWP_{it} is the percentage of professional technicians in urban units account for all employed persons, MLP_{it} is the percentage of all professionals with the college degree or above accounted for all employment personnel.

3. Research samples and data sources

In this paper, thirty-one provinces, autonomous regions and province-level municipalities are selected as research samples. The relevant data used are from the China Statistical Yearbook (from 2001 to 2016) and the China Labor Statistics Yearbook (from 2001 to 2016). The details would be shown as follow:

1.Y is the average annual GDP of the provinces. The average annual GDP = (GDP at the beginning of the year + GDP at the end of the year) ÷ 2. In the research of this paper, the GDP of various provinces and cities over the years have converted according to the price benchmark of 2001.

2.K is the average annual fixed capital stock of the provinces. Data on the fixed capital stock of the provinces over the years has not been looked up in China's current statistical data, therefore, in this paper, the research methods and results of F. He [9] are used to calculate the capital stock of each province, the annual capital stock of each province, and the capital stock of various provinces and cities over the years have converted according to the price benchmark of 2001.

3.L is the average annual employment of the provinces. The average annual employment= (employment at the beginning of the year + employment at the end of the year) ÷ 2 .

4.Human capital indicators. Currently, Chinese scholars mainly use the average years of education as the index to measure the quality of human capital [10]. This approach has the following disadvantages: firstly, it has a certain misleading effect [11]; secondly, in the model based on this index, the first order difference of educational variables will weaken the role of human capital change to economic growth [12]; thirdly, the correlation between the change of average years of education and human capital is weak [13]. Therefore, to measure the level of regional human capital from two angles of human capital's technical level and academic degree, this part take the following three indicators:

(1) SP_{it} is the percentage of professional and technical personnel of state-owned and state- controlled enterprises account for all employed personnel.

(2) SWP_{it} is the percentage of professional technicians in urban units account for all employed persons. At present, owing to the lack of systematic and comprehensive statistics of employment personnel 's technical degree, therefore, this paper adopt this two indicators to measure the technology degree of human capital.

(3) MLP_{it} is the percentage of all employed staff members with college education or above accounted for all employed personnel. This index is used by measuring the educational structure of labors in our country.

4. Conclusion of empirical analysis

The model of the formula (1) and formula (2) is estimated by the maximum likelihood method, the specific results are shown in Table 1.

Table 1 The estimation results of the SFA model

variable	coefficient	T statistical value
β_0	-64.0012	-1.2815
β_1	0.3740	76.1219***
β_2	0.1315	3.0116***
δ_0	-124.2501	-1.2113
δ_1	-0.4391	-5.8082***
δ_2	-0.4133	-16.4602***
δ_3	-0.1112	-6.4129***
γ	0.8255	5.6017***
log likelihood function	-153.6509***	
LR	33.5021***	

Note: * indicates significant at the 10% level; * * * indicates significant at the 5% level; * * * * indicates significant at the 1% level. LR is the statistic of likelihood ratio test, which conforms to the mixed chi square distribution.

(1)γ=0.8255, and the two equations all passed the LR (likelihood ratio test) test at a significant level of 1%. This shows that the error term in formula (1) has a very obvious composite structure, so it is necessary to use SFA technology for these data.

(2)Parameters δ_1 = -0.4391, δ_2 =-0.4133, δ_3 =-0.1112. This shows that among all the employed personnel, each increase of 1% state-owned and state-holding enterprise professionals will promote its technical efficiency increased by 0.4391%; each increase of 1% urban units professionals will promote its technical efficiency increased by 0.4133%; each increase of 1% college degree or above professionals will promote its technical efficiency increased by 0.1112%. It can be seen that among all the employed personnel, the proportion of state-owned and state-holding enterprise professionals in each province, the proportion of urban units professionals, and the proportion of college degree or above professionals are positively correlated with their technical efficiency. From this, it can also be seen that the improvement of human capital technology and academic level will help to promote regional technical efficiency. Therefore, the quality of human capital and regional technical efficiency are proportional relationship. The main reason is that the quality of human capital not only influences the cultural view and values of the regional main body directly, but also influences the

regional main body labor productivity enhancement, the innovation ability enhancement and to the resources conformity utilization ability level and so on.

5. Research conclusions and policy recommendations

The above research results show that the improvement of the quality of human capital can effectively promote the regional technical efficiency. Therefore, in order to effectively promote the technical efficiency of each regions of China, each regions of China should take the following measures to strengthen the training of the labor force, increase the middle and senior labor force, improve the structure of the workforce, improve the quality of human capital：

5.1 Establish a fair, open and reasonable recruitment mechanism.

(1)Follow the scientific and reasonable recruitment principle, which is equivalent to the principle of meritocracy.

(2)Open recruitment of new employees through the labor market or other means.

(3)The entire recruitment process is guaranteed to be fair and transparent, equivalent to providing equal opportunities for all applicants. So that all candidates can be in a fair competitive environment for the application, and the recruiting unit should also publish the result of recruiting in time, so as to increase the transparency of recruitment.

(4)The employment conditions of each position are determined by the vocational skill requirements and educational requirements of different positions.

5.2 Establishing the scientific human capital development mechanism and the wage mechanism.

(1)Each regions of China should increase the input of regional education funds, try to improve the regional education resources and the imbalance of regional distribution, so as to provide a better educational platform for the residents of the region.

(2)Employing units not only should provide employees with vocational and technical training opportunities often, but also regularly carry out professional technical competitions in order to improve the professional skills of employees, increase the unit's human capital stock.

(3)Each region should establish a reasonable wage adjustment mechanism, while attracting seni- or workers to employment in the region, it also encourages the original employed in the region to attach importance to the self-development of knowledge and skills.

5.3 Establish the favorable human capital flow mechanism.

(1)In order to realize the information-based of human capital management. Through effective and feasible channels, such as network, timely release and update of human capital market demand information and supply information to let both the supply and demand obtain market information timely.

(2)Establish the price determining mechanism of labor price determined by market mechanism. At present, the price of Chinese labor is mainly determined by the employing unit, and the owner of human capital can only passively accept. And in some units, worker's wages are divorced from professional skills and academic qualifications. Lead to the lack of enthusiasm and creativity in the work of the owners of human capital for a long time, and the work efficiency is reduced seriously. Therefore, each regions should establish market mechanism of labor price determined by market according to market supply and demand information and human capital quality, and give full play to the moderating effect of price lever on human capital.

(3)To establish a sound and human capital market-related laws, regulations and systems to protect the legitimate rights and benefits of human capital.

(4)Rectify the intermediary organizations in the human capital market strictly and guide their lawful operation.

5.4 Establishing the scientific human capital assessment system and the stimulating mechanism.

(1)Establish scientific human capital assessment system. According to the characteristics of the industry to design a scientific, reasonable and differentiated industry human capital assessment system. This assessment system not only includes the obvious norms, such as marketing staff's sales index, but also includes the recessive norms, such as the employee's influence on organizational image. On the one hand, we should try our best to incorporate quantifiable indicators and enhance the objectivity of the assessment. On the other hand, We should establish a dynamic assessment system based on the internal and external environment of regional development. In addition, we should take a full range of assessment methods to improve the accuracy of the assessment.

(2)Establish an effective incentive mechanism for human capital. To design an effective human capital incentive mechanism in line with internal requirements according to the needs and characteristics of employees. Concretely speaking, it is based on the level of demand theory, the use of diversified incentive methods to stimulate the internal driving force of human capital, improve their work enthusiasm and labor efficiency.

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