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Fixed capital and human capital inputs and economic growth

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ABSTRACT

Multiple studies proved that human capital and economic growth deeply related. In China, many scholars have discussed the positive relation between human capital and economic growth, however, few scholars emphasized on the effect of unbalanced distribution of human capital on economic growth. The unbalanced human capital caused inequality economic growth in difference provinces. Based on this situation, this paper is using MRW as the fundamental theory model to research and analyze how fixed capital and human capital influence the provincial economic growth in China through nonparametric estimation of fixed effects panel data method based on the statistics of 31 provinces from 2001 to 2010. The conclusion provides some suggestions to make the human capital harmoniously develop which also benefit for overall economic growth in the country.

KEYWORDS

Economic growth; Fixed capital; Human capital; Nonparametric estimation of fixed effects panel data model.

INTRODUCTION

In 2012, Chinese financial education founds reached 2.2 trillion, the first time 4 percent higher than GDP. People argued that the country does not put enough fund for education, which has been a hot topic for years. This research focused on the relationship of fixed capital, human capital, and economic growth of diversity provinces. The hypothesis is increasing the input of fixed capital and human capital leading to increase of economic growth of provinces.

DATA AND RESEARCH METHODS

The fundamental theory of this research is Mankiw,Romer and Weil's (1992) MRW model. MRW model assumed two common categories utilized in assessing the resources of companies: one for physical products producing that called produce department; the other one for "knowledge" product producing that called research and development department. Human capital, as one of the important producing elements, occupied proportion in both departments. The produce department used human capital and whole physical capital to made product, while research and development department more focused on human capital and few physical capital. If research and development department is only using human capital, it will get the production function of produce department. In the research, the hypothesis is increasing fixed and human capital input will leading increased of regional economic growth. The independent variables are the average of physical and human capital (using average of education for per person for instead) for per person. Dependent variable is output per capita. The nonparametric estimation of fixed effects panel data models of the research is:

$$\ln y_{i,t} = g(\ln k_{i,t}, \ln h_{i,t}) + u_i + v_{i,t} \quad t = 1, 2, \cdots, 10; i = 1, 2, \cdots, 31 \qquad \textbf{(1)}$$

$y_{i,t}$ is GDP per capita which relating to 31 provinces' GDP per capita from 2001 to 2010, and 2001 as base year. It is the actual value deflator from regional GDP per capita that eliminated effect of inflation. $k_{i,t}$ represents per capita physical capital that used regional fixed capital price index to eliminated effect of inflation. $h_{i,t}$ is the regional education per-capita. In the research categorized the regional education levels to five items (r=1,2,3,4,5). From 1 to 5, they means not educated, primary school, middle school, high school, and university and above. The education years represented by h_r (r=1,2,3,4,5), 1 means 0 years, 2 means 6 years, 3 means 9 years, 4 means 12 years, and 5 means 16 years. The ratio of every categories' population in total is n_r(r =1,2,3,4,5),and $\sum_{r=1}^{5} n_r = 1$. The average of education year of each region is $h = \frac{\sum_{r=1}^{5} h_r n_r}{\sum_{r=1}^{5} n_r} = \sum_{r=1}^{5} h_r n_r$.

In formula (1), the format of $g(\cdot)$ is not certainty. β_{1i}, β_{2i} represents coefficient of elasticity of physical and human capital to economic growth. u_i is entity fixed effects regression model. $v_{i,t}$ is independent distribution stochastic error. The data of the research is from *Statistics China* (2002-2011) and related regional statistics in the same time period.

ANALYZES AND RESULTS

This research is using Henderson (2008) nonparametric estimation of fixed effects panel data models to analyze data. The results is displaying on TABLE 1.

Fixed effect

The range of fixed effect for every province is between -0.3714 and 1.0755. The highest is Tibet (1.0755), the lowest is Beijing (-0.3714). The relationship between region and economic growth is not very obviously.

Fixed capital coefficient of elasticity

Fixed capital coefficient of elasticity expresses a positive correlation between fixed capital input and economic growth, the range of coefficient is from 0.1741 to 0.2322. On the top forward ranking, there are developed provinces like Zhejiang (0.2322) and Jiangshu (0.2274), while there are also developing provinces like Ningxia (0.2296) and Guizhou (0.2281). Meanwhile, on the top behind ranking, there are developing provinces as Tibet (0.1741) and Heilongjiang (0.1898), while there are also developed provinces as Tianjing (0.19421). The investment distribution of regions is not standing out in the research. There is no huge difference between investment and economic growth in diversity provinces. The average of fixed capital coefficient of elasticity is growing steadily from 2001 to 2010 in China. It was 0.2029 in 2001 and increased to 0.2251 in 2010. The investment utilization performance of 31 provinces is keeping increasing that is a positive influence in the process of economic growth.

Human capital coefficient of elasticity

From TABLE 1, it shows that the coefficient range of human capital to GDP per capita from 0.0125 to 0.2715. Obviously, human capital has positive correlation with economic growth. In other words, human capital promotes economic development for diversity provinces in China. The lowest coefficient is Tibet (0.0125), the highest is Beijing (0.2715), as 20 times higher than Tibet. TABLE 1 also illustrated that the human capital coefficient of elasticity of different provinces are decreasing, from 0.1213 in 2001 to 0.0982 in 2010. In order to illustrate the data clearly, the research categorized 31 provinces to 4 categories as showing at TABLE 2.

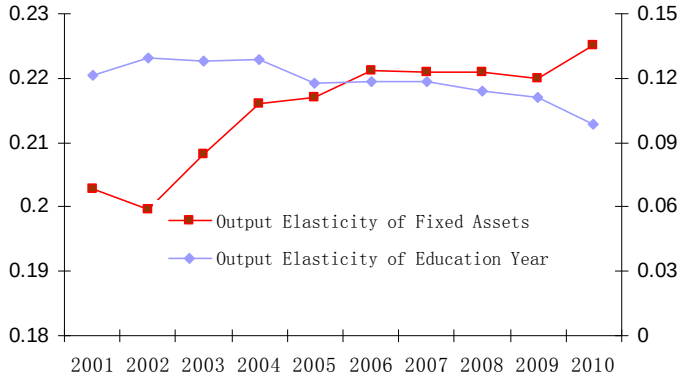

Figure 1 : Average of 2001-2010 china fixed capital, human capital input coefficient of elasticity

TABLE 1 : Result of nonparametric estimation of fixed effects panel data models

Province	Fixed Effect	Fixed Capital Coefficient of Elasticity	Education Year Coefficient of Elasticity	Provinces	Fixed Effect	Fixed Capital Coefficient of Elasticity	Education Year Coefficient of Elasticity
Beijing	-0.3714	0.2126	0.2715	Hubei	-0.0181	0.2169	0.1118
Tianjing	-0.1223	0.1942	0.1855	Hunan	-0.0329	0.2076	0.1228
Hebei	0.0020	0.2183	0.1118	Guangdong	0.3378	0.2178	0.1123
Shangxi	-0.1724	0.2092	0.1285	Guangxi	-0.1287	0.2061	0.1208
Mongolia	-0.1376	0.2251	0.0882	Hainan	-0.0482	0.2131	0.1211
Liaoning	-0.0747	0.2095	0.1408	Chongqing	-0.0787	0.2265	0.0990
Jilin	-0.2778	0.2097	0.1338	Sichuan	0.0437	0.2204	0.1099
Helongjiang	0.0259	0.1898	0.1460	Guizhou	-0.0856	0.2281	0.0982
Shanghai	-0.0904	0.2078	0.2354	Yunnan	0.0959	0.2257	0.0899
Jiangshu	0.1758	0.2274	0.0874	Tibet	1.0755	0.1741	0.0125
Zhejiang	0.2392	0.2322	0.0838	Shanxi	-0.2371	0.2168	0.1122
Anhui	0.0943	0.2148	0.1125	Gansu	0.0666	0.2213	0.1066
Fujiang	0.2281	0.2277	0.0915	Qinghai	-0.0984	0.2194	0.1104
Jiangxi	-0.0940	0.2101	0.1196	Ningxia	-0.3135	0.2296	0.0923
Shandong	0.1046	0.2273	0.0918	Xinjiang	-0.2191	0.2186	0.1118
Henan	-0.1001	0.2124	0.1159				

TABLE 2 : Human capital coefficient of elasticity by regions

Category	Provinces	Characteristics
First	Beijing,Shanghai,Tianjing(3)	Linear Increasing
Second	Fujian,Ningxia,Shandong,Suzhou,Zhejiang,Chongqing,Mongolia,Guizhou,Gansu(9)	Linear Decreasing
Third	Hubei,Shanxi,Hebei,Anhui,Sichuan,Qinghai,Guangdong,Xinjiang,Hunan,Hainan,Shanxi,Henan, Guangxi,Jiangxi,Jilin,Liaoning,Heilongjiang,Tibet(18)	Wave Decreasing
Fourth	Yunnan(1)	Wave Increasing

Source : summary of table 1

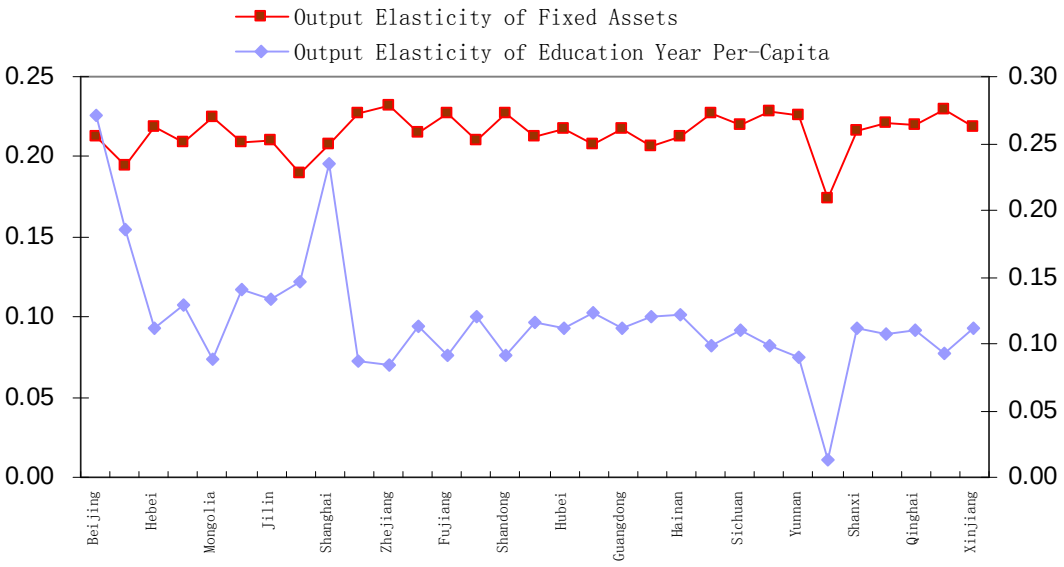

Figure 2 : Average of 2001-2010 China fixed capital, education year pre-capita coefficient of elasticity

CONCLUSIONS

As the result, fixed and human capital has significant influence to regional economic growth. China should has more fixed capital input and improve education funds especially for these developing provinces. Improvement of education not only contributes to regional economy, but also coordinates to the economic growth in the country. There are four possible suggestions for economic growth that based on the findings of the research.

Manipulate industry strictures, increase fixed capital input

2012 national GDP rankings explained that fixed capital input driving economic growth. Guangdong,Shuzhou and Shandong's GDP in 2012 is over 5 trillion, and fixed capital has dramatic contribution to it. Increasing the input of fixed capital will pushing the development of economy rapidly, while transforming economic growth methods includes manipulating industry structures and increasing domestic demands. The main strategy for regional economic growth is: eastern provinces "updating" the structure of industry, middle and western provinces expanding investment input to country areas.

Improve education funds

As provided, education has capability to drive regional economic growth. Furthermore, education narrows the economic gap between different provinces and contributes to economic coordination of provinces. Regional education input is relating to human capital and regional education level. By increasing human capital level to speed up economic growth in local is effective and intelligence.

Education funds take a little ratio in GDP so that government need increasing education funds for developing provinces and issuing policy for regions where has poor primary education. For the stable economic growth in China, government would lead social forces to invest education programs and expand universities and colleges to balance fund shortage of government that increased the average of education funds for per person and the quality of educations.

Optimize allocations of resources, balanced education development

The social economy is growth rapidly. It required modernized producing skills and abilities, which has more requirements for employees' education level. The high-educated employees are playing leading role in diversity industries and they have significant contributions for economy. In TABLE 2, Beijing,Tianjing, and Shanghai have better qualified higher education programs and the economic growth in these three provinces are above other provinces. The high level human capital pushes the economic development of Beijing,Tianjing, and Shanghai. In this way, it is important to increase education funds for developing provinces and optimizing allocation of education resources for every province.

In brief, for the future development, education becomes the most significant element to drive economic growth in China instead capital driving economy pattern. The policy of making 9-year compulsory education universal is the cornerstone of Chinese education, besides that improving the funds for higher education contributes to the quality of human capital and economic growth in provinces.

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