Study on the Contribution Rate of Innovative Talents to Economic Development in Sichuan

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Abstract. This paper takes Sichuan province as the research object, based on the provincial panel data from 2010–2019, establishes the function model of innovative talent capital stock, material capital stock, and regional economic gross product, and calculates the output elasticity coefficient through the improved Cobb-Douglas production function, so as to further obtain the contribution rate of innovative talent to economic development.

Keywords: innovative talent stock · Sichuan Province · contribution rate

1 Introduction

The external environment facing the development of science and technology in China is becoming increasingly complex, and to solve the science and technology problems as soon as possible, we should focus on the cultivation of basic research talents, which is the source of innovation activities and plays a key role in the original innovation. In this way, we can also show that China needs innovative talents in all industries in the future, and talents are the best resources for the society in the future for better economic development. Sichuan, as a large province in the west, has two technological cities, Chengdu and Mianyang, with rich educational resources and a large population base. Thus, this paper takes Sichuan as the research object and uses the model to study the contribution rate of innovative talents to economic development by using the panel data of each factor from 2010–2019 and gives the corresponding analysis and suggestions.

2 Literature Review

In foreign literature, Sefer Gümü et al. (2013) suggest that the most important part of human resource management is talent management and that good employees can bring great benefits [1]. Costantini (2006) argue that the acquisition of human resources is of paramount importance in sustainable development strategies [2]. The acquisition of human resources is considered by Costantini. The domestic scholars have also conducted various researches on this issue, and Wang Keming & Chen Zhaoyin (2022) have proposed specific measures to develop innovative talents through laboratory teaching in universities [3]. Wang Keming proposed specific measures to cultivate innovative talents

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through laboratory teaching in universities. Cui Xiangmin & Cai Chenxing (2022) used the Durbin model to study the spatial effect of the concentration of penetrating talents on the quality development of urban economy, and examined the effect of the concentration of innovative talents on the level of quality development using a panel double threshold model [4]. Song Jingyang studied the development of innovative talents on Northeast industry. Zhou Yuzhong et al. (2020) chose the provincial panel data of China from 2007–2017 to empirically examine the relationship between innovative talent gathering, industrial structure upgrading and economic growth by [5].

3 Model Construction and Selection of Indicators

3.1 Model Construction

Combined with previous studies in the literature, this paper analyzes the data model of Sichuan region based on the basic model of Cobb-Douglas production function with corresponding improvements, $Y = f(K, H)$, where Y represents the output, K is the physical capital stock, and H is the human capital stock. The expressions are as follows.

$$Yi = f(K, H) = AiK_i^{\alpha} H_i^{\beta} \tag{1}$$

formula (1), Yi that the economic GDP in the i year; Ai that the technology level in the i year, without considering the effect of the integrated technology level, so set the value of A as a constant; Ki that the physical capital stock in the i year; Hi that the innovative talent capital stock in the i year α for the output elasticity coefficient of physical capital input, β for the output elasticity coefficient of human capital input.

In order not to better analyze the results of linear regression, the two-sided logarithm treatment is made for the axiom (1), from which the axiom (2) can be obtained as follows.

$$LnYi = LnA + \alpha LnKi + \beta LnHi \tag{2}$$

To better express the contribution of the model results to the economic development of the Sichuan region, the two sides of Eq. (2) are differenced to obtain its growth model as

$$\frac{\Delta Yi}{Yi - 1} = \frac{\Delta Ai}{Ai - 1} + \alpha \frac{\Delta Ki}{Ki - 1} + \beta \frac{\Delta Hi}{Hi - 1} \tag{3}$$

In Eq. (3), $\frac{\Delta Yi}{Yi-1}$ is the growth rate of Sichuan's economic GDP in year i; $\frac{\Delta Ki}{Ki-1}$ is the growth rate of Sichuan's physical capital stock in year i; $\alpha \frac{\Delta Ki}{Ki-1}$ is the rate of physical capital's effect on Sichuan's regional economic development; $\frac{\Delta Hi}{Hi-1}$ is the growth rate of Sichuan's innovative human capital stock in year i; $\beta \frac{\Delta Hi}{Hi-1}$ is the rate of Sichuan's innovative human capital stock's effect on regional economic development. Finally, the congratulation rate of each factor on the economic development of Sichuan region is not obtained, and the rate of each factor on the economic development of the region is obtained by dividing $\frac{\Delta Yi}{Yi-1}$.

3.2 Indicator Selection and Metrics

This paper takes Sichuan province from 2010 to 2019 as the research object, and draws on various studies on the relationship between innovative talents and regional economic development by domestic and foreign scholars, as well as the selection of indicators. The following indicators are finally selected to measure the development of regional economy.

1) Gross National Economic Product Y_i

Gross national product (GNP), which is the total value of production development of a country or region for all its units over a period of time, can measure the level of economic development over that period of time. In this paper the GNP of Sichuan region from 2010–2019 was selected through the Sichuan Statistical Yearbook.

2) Physical Capital Stock K_i

Physical capital stock is a reflection of the material base and conditions of the region, and is another important factor affecting economic development. Relevant scholars believe that when analyzing physical capital stock, it is equal to fixed capital plus working capital. However, due to the limited data of current statistical information, the data of the whole society's capital stock cannot be found in the statistical yearbook, and the data source and scope of use of liquid capital are not very clear. Therefore, this paper chooses the amount of social fixed asset investment as the stock of physical capital. Such selection will reduce the role of physical capital on economic growth, but it is ignored considering the small impact on the contribution rate. Therefore, the amount of social fixed assets in Sichuan from 2010–2019 is selected in this paper.

3) Innovative talent stock H_i

Innovative talents are creative people who can contribute to the development of society and the economic level of the region. Inspired by the method of years of education, and drawing on the calculation method of Peng Guohua (2005) for the method of years of education, the average number of years of education of the Sichuan labor force is calculated according to public (4) [6].

$$\begin{aligned}&\text{Average number of years of education in the labor force} =\\&\text{share of employed population who are illiterate and semi} - \text{literate} * 1.5 +\\&\text{share of employed population who received primary education} * 7.5 +\\&\text{share of employed population who received junior high school education} * 10.5 +\\&\text{share of employed population who received senior high school education} * 13.5 +\\&\text{share of employed population who received college education and above} *\\&17 \text{ Public announcement}\end{aligned} \tag{4}$$

The return to education in China is 0.18 at the primary level, 0.134 at the secondary level, and 0.151 at the tertiary level, as estimated by Psaeharopoulos et al. (2004). Thus, the human capital per capita can be calculated based on the average number of years

of education in the labor force. Next, further using the data available above, the human capital stock is calculated using public (5).

$$H = \exp(Lnh) * L \text{ Public announcement} \quad (5)$$

4 Empirical Analysis

Combining the data derived above, linear analysis of the table was performed using SPSS25.0 statistical software, setting LnY as the dependent variable and LnK, LnH as the independent variables, and the regression results were obtained (Table 1).

According to the Table 1, it can be seen that the correlation coefficient $R^2 = 0.991$, both close to 1, indicates that the model has a good fit. The F is 376.19 and $P < 0.001$, then this linear regression equation is significant. Both Ln_K and Ln_H are positively related to Ln_Y (Ln_K: $\beta = 0.853$, $p < 0.01$; Ln_H:$\beta = 0.163$, $p < 0.05$),indicating that the Ln_K and Ln_H are the significant predictor.

From the results of the model, it can be concluded that the investment in physical capital and the investment in innovative human capital in Sichuan Province has a significant impact on the regional GDP. The output elasticity of physical capital investment in Sichuan province α is 0.749, which means that for every percentage point increase in physical capital investment, the economic level of Sichuan province will increase by 0.749 percentage points. The output elasticity of innovative talent input is 0.921, which means that for every percentage point increase in innovative talent input, the economic level of Sichuan province will increase by 0.921 percentage points. This shows that the impact of the investment in innovative talents on economic growth is greater than that of physical capital, and in general, the investment and cultivation of human capital in Sichuan Province has achieved certain results.

Finally, using the data obtained from the model, the contribution rates of each factor in Sichuan Province from 2010–2019 are obtained, and the details are shown in Table 2.

As can be seen in Table 2, ssduring the period 2010–2019, the regional GDP growth rate generally showed a trend of first increasing and then began to gradually decline, with a small increase in 2016–2017, after which it then showed a decreasing trend. The growth rate of innovative human capital was higher in 2010 and 2011, with 5.83% and

Table 1. Regression analysis

	β	SE	B
Constant		3.466	-6.626
Ln_H	0.163*	0.39	0.921
Ln_K	0.853***	0.061	0.749
R2	0.991		
F	376.195***		

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 2. Growth rates of the three factors and the contribution of physical capital and innovative human capital

Year	Gross regional product growth rate %	Innovative Talent Capital Growth Rate %	Physical Capital Growth Rate %	Innovative Talent Capital Contribution Rate %	Physical capital contribution %
2010	21.38%	5.83%	13.02%	25.12%	45.61%
2011	22.21%	11.40%	11.35%	47.26%	38.29%
2012	13.64%	0.47%	19.27%	3.18%	105.82%
2013	10.85%	2.46%	16.69%	20.89%	115.20%
2014	8.95%	1.12%	12.01%	11.56%	100.51%
2015	5.02%	0.75%	10.16%	13.69%	151.63%
2016	9.22%	-1.98%	12.14%	-19.81%	98.63%
2017	13.18%	2.76%	10.20%	19.29%	57.95%
2018	8.07%	3.83%	10.20%	43.76%	94.68%
2019	4.82%	-4.06%	9.90%	-77.52%	153.82%

11.04% respectively, and the growth rate of innovative human capital was generally low from 2012 onwards, with negative growth in both 2016 and 2019. The growth rate of physical relative to material capital is more average over the years, at about 12.5%. By examining the contribution rate of physical capital and the contribution rate of innovative talent in all years, it can be seen that the contribution rate of innovative talent capital is larger in the years with higher growth rate of gross regional value, while the contribution rate of material capital is smaller in other years, such as 2010, 2011 and 2017. Thus, it can be seen that innovative human capital has a certain contribution to economic growth.

5 Conclusions

5.1 Capitalize on the Educational Advantages of Colleges and Universities in Sichuan Province, and Further Increase the Cultivation of Talents Above College

Sichuan Province itself is rich in educational resources, with no shortage of excellent schools from high school to university. Under the national call for education reform. On the one hand, it should maintain the advantages of its own undergraduate class schools in the region, and constantly improve the level and quality of teaching; on the other hand, it also needs to focus on vocational colleges and universities, by strengthening the investment in education in vocational colleges and universities, to improve the quality of students trained by the schools and train blue-collar and other technical talents.

5.2 Sound Human Resource Market Environment and Reasonable Arrangement of Talent Flow

Sichuan Province is the most populous province in the western region, and its human capital outflow is also more intense [7]. Sichuan provincial government also plays an important role in the construction of talent environment. It should gradually improve the human resource market environment, establish a mechanism for the exchange of specialized talents, and the government should take the lead in formulating policies for the flow of human capital in conjunction with the employment guidance department, so as to retain the talents in the province and bring in human capital from abroad. In addition to improving the social security mechanism, developing appropriate vocational training measures and cultivating scientific and technological talents in rural areas are also areas that need to be considered.

5.3 Improve Labor Quality and Vigorously Develop High-Tech Industries

From the above data, we can also see that innovative talents are more obvious for the development of regional economic level, and their elasticity coefficient is higher than that of material capital. Therefore, if the government wants to realize the economic transformation, it still needs to maintain the development policy of developing high-tech enterprises, and also improve the comprehensive quality of the labor force, such as doing a little non-formal education employment training know, so that the quality of the labor force can adapt to and support the development of high-tech enterprises. At the same time, the mechanism of incentive and entrepreneurial environment can be increased to further enhance the environment for the development of high-tech industry.

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