The Impact of Education Input on China's Economic Growth

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Abstract: This study examines the correlation between education investment and economic growth in China, with a focus on regional differences. The study aims to shed light on the positive impacts of education investment on a country's economic development and emphasizes the importance of understanding these dynamics for policymakers and stakeholders. The motivation behind this study is to recognize the critical role that education plays in shaping a country's economic landscape. As China continues to undergo rapid economic transformation, understanding the delicate relationship between education investment and economic growth becomes imperative. This paper reveals the different impacts of education spending through a comprehensive analysis of education spending patterns and economic indicators in different regions. The results of the study show that education investment has a positive and substantial impact on China's overall economic growth. In addition, the study identifies regional differences, emphasizing that the extent of this impact varies across different regions of the country. This differential effect can be attributed to different levels of educational infrastructure, government policies, and economic activities in each region. Influenced by factors such as geographic location, resource conditions, and policy advantages, China's industrial structure exhibits developmental differences in the spatial economic pattern. The significance of this study is that it has the potential to sensitize policymakers, educational institutions, and investors on the strategic importance of promoting education for sustained economic development. Recognizing the impact of different regions requires targeted policies to address the specific educational challenges and opportunities in different regions of China.

SCIENCE AND TECHNOLOGY PUBLICATIONS

1 INTRODUCTION

Since China's reform and opening, China's modernization has entered a rapid growth, in the past decades of China's becoming the world's factory, due to the demographic dividend brought about by the economic growth of the population after the number of people brought by the benefits of a slightly exhausted economy. The quality of the labor force has become particularly important. The contradiction between the development needs of late-developing countries such as China and the layout of the global industrial chain is the root cause of the long-standing problem of the imbalance between human capital and industrial structure. Therefore, to solve this problem, we can not only take short-term measures to catch up with the other side but also focus on the dynamic process of China's sustainable economic development and promote the long-term coordination of human capital accumulation and industrial structure upgrading (Ni & Ding, 2022). At the beginning of the 21st century, China's working-age population had an average of 7.18 years of education, and the figure rose to 10.9 years by 2021, which is enough to show that the structure of China's human capital has undergone a great change (Zhang, 2022). It is undeniable that the human capital dividend will replace the demographic dividend as the new engine of China's economic growth. Higher education is regarded as an important support for economic and social progress, and the relationship between higher education concentration, human capital, scientific and technological R&D, and economic growth has attracted a lot of attention and become a focus of discussion in all walks of life (Cai & Tan, 2024).

Education is one of the key determinants of a country's economic well-being, as it can increase the human capital of the country's labor force, thereby promoting economic development and improving people's living standards (A, 2010). Stable economic growth and development in the long term can only be achieved through three main factors: the development of science and technology, the growth of the various capital factors, and the development of the education

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system. Education is the means to raise the national average level of professional skills and knowledge by training and attracting the necessary resources. Defining the dynamic evolution of low educated and low skilled primary human capital towards high skilled and highly educated advanced human capital as the process of advanced human capital structure (Zhang, 2023). The International Bureau of Education (IBE) is the only international organization that has a mandate to promote and protect human rights in the field of education. With the improvement of national education level, well educated individuals are more likely to have innovative abilities, problem-solving skills, and flexibility to adapt to changes. At the same time, educated people are more likely to engage in research and development and innovation activities, thereby contributing to the technological level of the economy. Human capital accumulation acts as a powerful catalyst, providing a constant source of motivation and support in the process of technological innovation (Zhang, 2022). In addition, human capital has other positive effects, including a decrease in crime rates or an improvement in health conditions, which are expected by society (Valero). With the accumulation of human capital, it will also have further positive effects, such as an increase in the moral level of the entire society. Education has a tremendous power to trigger change. By providing knowledge, developing skills, and shaping values, it can improve individual health and livelihood conditions, contribute to social stability, and effectively promote economic growth in the long term (Brooks). Education, to a certain extent, improves the quality of individuals and thus has a sense of social responsibility, which can work together to maintain social stability and ensure stable economic development (Liu, 2023).

Therefore, how to better understand the impact mechanism of human capital on economic growth is of great significance to implementing the innovation-driven development strategy and promoting high-quality development (Ni & Ding, 2022).

The research on human capital can be traced back to Schultz, who is the founder of human capital theory and the main practitioner of human capital investment today (Zhang, 2023).

This thesis analyzes the correlation between education investment and local economic growth in 21 provincial administrative regions, including Liaoning, Heilongjiang, Tianjin, Beijing, Shanghai, and Jiangsu. The relationship between education investment and GDP changes in each region is analyzed while controlling for four constant variables: investment (real utilized foreign capital), the number of tertiary education students (university plus postgraduate students), the urbanization rate, and the level of per capita consumption.

2 LITERATURE REVIEW

The theory of human capital holds that in the process of economic growth, the importance of human capital exceeds that of material capital. Human capital investment is directly proportional to national income, and compared to material resources, the growth rate of human capital is faster. The core of human capital is to improve population quality, and education investment is the main component of human capital investment. The human capital theory originated from economic research. American economists Schultz and Becker explored the reasons for the rapid economic growth and productivity improvement in some developed countries after World War II, and found that the main reason was the increase in high-quality talents who received education in these countries (Cai & Tan, 2024). The human capital possessed by high-quality talents is demonstrated through higher education, which in turn leads to an increase in social output (Cai & Tan, 2024). Since the introduction of the human capital theory, several empirical studies have emerged in academia on the role of education in economic growth, such as Schultz's residual method of measuring national income growth through education investment, and Denison's growth accounting method of linking factor investment with economic growth.

Chen Zhao (2004) studied the differences in human capital and education development among regions in China and found that balanced development of higher education will help to narrow the income gap between regions (Zhang, 2022). Higher education is usually accompanied by economic benefits. A study by economist and global human development professor George Psacharopoulos and World Bank advisor Harry Patrinos found that for every additional year of education, a person's income increases by 10%(Brooks). Therefore, higher education is considered an important support for economic and social progress, and the relationship between the concentration of higher education and economic growth has received much attention, becoming a focus of discussion in various sectors of society. According to a recent study by the National Bureau of Economic Research (NBER) in the United States, learning institutions have found that more education investment has an impact on national and state

economies of over $200 billion. Therefore, it is evident that education plays a crucial role in the economic development of a country (Brooks).

Existing literature usually defines the core connotation of economic growth as the growth of gross domestic product (GDP). Many existing studies use per capita GDP or the growth rate of per capita GDP as a proxy variable to represent economic growth. This study uses each province's regional gross domestic product as a proxy variable for economic growth.

How to leverage the economic growth effect of human capital based on the regional industrial structure differences in China has always been a focus of academic research point. Early literature formed a consensus view that in the regional industrial environment, the role of human capital in the central and western regions is not significant, and the efficiency of human capital investment in the service industry is relatively high. This paper further explores the impact of education investment on economic growth in different regions based on this.

In summary, this article proposes the following hypothesis: the increase in education investment has a positive impact on China's economic growth, and the impact of education investment on China's economic growth varies in different regions.

3 THE IMPACT OF EDUCATION INPUT ON CHINA'S ECONOMIC GROWTH

3.1 Model Building

In this paper, the following linear regression model is used for empirical analysis:

$$G_{it} = \alpha + \beta E_{it} + yH_{it} + \partial I_{it} + \delta C_{it} + \varepsilon \quad (1)$$

Wherein, i represents the city and t represents the year. The dependent variable Git represents the economic growth situation, for which the GDP of each province is selected as an indicator. Eit stands for the education expenditure for each province.; Following the research in existing literature, this paper incorporates other factors that may affect economic growth as control variables into the model, including the human capital level Hit. The metrics in this study include the local higher education graduates, investment (actual utilization of foreign capital) Iit, and urbanization rate (urban population/total population) Cit. In addition, ε represents the random disturbance term, and α is the constant of the model.

This paper conducts empirical analysis based on data from 22 provinces in China, including Jiangsu, Anhui, Shanghai, Hubei, etc., for the years 2012-2021. All data were obtained from the statistical yearbooks of each province and directly administered municipality each year. For a small amount of missing data, interpolation or extrapolation methods were employed for supplementation.

3.2 Data Analysis

Table 1 reveals significant variations in the maximum and minimum values of each variable, indicating substantial fluctuations in variables such as regional gross domestic product (GDP), education expenditure, human capital level, actual utilization of foreign capital, and urbanization rate across provinces. This paper conducts empirical analysis based on data from 22 provinces in China, including Jiangsu, Anhui, Shanghai, Hubei, etc., for the years 2012-2021. All data were obtained from the statistical yearbooks of each province and directly administered municipality each year. For a small amount of missing data, interpolation or extrapolation methods were employed for supplementation.

Table 1. Descriptive statistics of variables.

Variable Name	Max	Min	Mean	Standard Deviation	Median
GDP(in hundred million CNY)	124369.67	828.2	27937.444	23910.462	21499.28
Education Expenditure (in ten thousand CNY)	37966900	1071776	9363447.233	5867674.779	8085153
Foreign Direct Investment (in ten thousand USD)	18400200	321	1180908.298	2255023.056	719749.5
Higher Education Enrollment (in people)	1178402	33500	412398.838	221547.547	393658
Urbanization rate/%	93.768	23.93	60.383	13.471	59.771

Table 2. Analysis of regression result.

	Standardized Coefficients		
	(1)	(2)	(3)
Education Expenditure	0.937		0.891
Foreign Direct Investment		0.637	-0.001
Higher Education Enrollment		-0.063	-0.014
Urbanization rate		0.251	0.166
R^2	0.877	0.537	0.899

The paper adopts the method of controlling variables. Specifically, in columns (1) and (2), education expenditure and control variables are individually added to the regression model, while column (3) includes all variables simultaneously in the regression model. In multivariate analysis, the value of the normalization coefficient represents the standardized change of the dependent variable when the unit standard deviation of the independent variable changes. This aids in a more comprehensive understanding of the impact of each independent variable on the dependent variable and allows for a better comparison of their relative influences. Therefore, Table 2 selects the standardized coefficients of each independent variable for analysis.

The results indicate that, in the three models, the fit is higher for models (1) and (2) which include the independent variable of education expenditure, while the fit is lower for the model that includes only control variables. Moreover, the standardized coefficients for education expenditure are consistently around 0.9%. These findings strongly support the hypothesis proposed in the paper, indicating that an increase in education expenditure in various provinces leads to positive GDP growth. Specifically, a 1% increase in education expenditure is associated with approximately a 0.9% increase in GDP.

Next, the collected data will be segmented into three regions: East, Central, and West. Linear regression analysis will be conducted again to explore the varying impact of education expenditure on economic growth in different regions.

Table 3. The impact of education expenditure in different regions

	Normalization Coefficients		R^2	
	(1)	(2)	(1)	(2)
Eastern	0.974	1.029	0.948	0.976
Central	0.920	0.825	0.843	0.850
West	0.895	0.547	0.798	0.955

The eastern region comprises eight provinces, including Beijing, Tianjin, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, and Guangdong. The central region includes six provinces: Jilin, Heilongjiang, Anhui, Jiangxi, Hubei, and Hunan. The western region encompasses eight provinces: Inner Mongolia, Guangxi, Sichuan, Guizhou, Gansu, Qinghai, Ningxia, and Xinjiang. In column (1), education expenditure is individually added to the regression model, while column (2) includes all variables simultaneously for analysis.

From the results in Table 3, it is observed that the model has a high fit, and the single independent variable, education expenditure, positively influences economic growth. Additionally, it is noted that the influence of education expenditure on GDP growth decreases gradually from the eastern to the western regions. After incorporating control variables, changes in the standardized coefficients of education expenditure are observed. A comparative analysis of the data reveals that the eastern region, with stronger economic strength and better infrastructure, shows higher values for all variables compared to both the central and western regions. Consequently, education expenditure in the eastern region is significantly correlated with economic growth, with a 1% increase capable of driving approximately a 1.029% increase in GDP. Despite lower data values in the central region, education expenditure still exhibits a considerable impact on economic growth, with a 1% increase associated with approximately 0.825% GDP growth. In the western region, where economic development is slower compared to the eastern and central regions, and with the lowest data values, the

impact of education expenditure on economic growth shows the greatest variation.

4 CONCLUSION

From an overall analysis of the results, it can be observed that the growth in education expenditure effectively drives economic growth in China. In addition, there are significant differences in the impact of education expenditure on different regions of China. For the eastern region, an increase in education expenditure significantly stimulates economic growth. Higher education expenditure in the central region plays an important role in promoting economic growth. However, compared to other regions, the impact of education expenditure on economic growth is less pronounced in the western region.

Therefore, this article proposes the following suggestions for China's economic growth: firstly, increasing education investment in various regions is crucial to drive economic growth. Secondly, from the data, it can be seen that the infrastructure construction in some provinces is not yet developed enough, and the urbanization rate is relatively low. With the increase of urbanization rate, cities usually pay more attention to investment in infrastructure and educational resources. Therefore, it is necessary to vigorously promote infrastructure construction in various regions, increase urbanization rates, and create more favorable conditions for promoting economic growth through education investment. Finally, considering the significant regional economic disparities and imbalanced development, the effectiveness and focus of education investment should vary among different regions. It is necessary to strategically allocate resources in each region in order to maximize the effectiveness of education investment under limited economic conditions.

AUTHORS CONTRIBUTION

All the authors contributed equally and their names were listed in alphabetical order.

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