Examining the Type of Relationship That Exit Between Higher Education and Economic Growth in USA

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Abstract
For a long time, economists and policymaker have argument relationship between higher education and economic growth (especially in long-term economic growth). In the face of the epidemic and financial shortages, some researchers have increased their interest in the rational use of limited resources to drive economic growth. The purpose of this paper is to examine the relationship among higher education investment, education acquisition, and growth rate. The fundamental determinants of growth theory for economic growth are human capital and labor. With the development of theoretical and empirical research in growth, a variety of viewpoints and controversies have been generated, and there are multiple development directions (Hanushek, E. A, 2016). The test results show that higher education expenditure indicators are factors that continue to affect economic growth fluctuations both in the short-term and in the long-term, and have made contributions that cannot be ignored. Higher education has brought huge returns to personal income and reduced unemployment. The educational investment will not directly lead to economic growth but will ultimately affect growth through human capital accumulation and STEM technology innovation. The impact process is a dynamic, self-reinforcing, and circular process. Higher education investment is an essential source of human capital, and the positive effect of human capital on economic growth can only be seen for a long time. Therefore, investment in higher education requires a long-term vision and a quickly transferred mindset.

Keywords: Higher Education, Economic Growth, Capital Accumulation

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Introduction

For a long time, economists and policymaker have argument relationship between higher education and economic growth (especially in long-term economic growth). In the face of the epidemic and financial shortages, some researchers have increased their interest in the rational use of limited resources to drive economic growth. The research on growth has developed in both theoretical and empirical fields, and there are many contradictory theoretical views on the relationship between educational investment and economic growth. Economic growth mainly depends on capital growth, labor growth, human capital growth, and STEM progress. Higher education is a crucial way to increase human capital. Higher education and economic development influence and promote each other. Higher education promotes technological innovation by improving the quality of workers, thereby effectively driving economic growth. Economic growth is the material basis and conditions for educational development. This is a symbol of the economic status of individuals and nations at the same time.

The purpose of this paper is to examine the relationship among higher education investment, education acquisition, and growth rate. It also provides an in-depth analysis of how to measure human capital and labor. Then, it provides data on the impact of human capital differences on economic growth, confirming the mutual relationship.

Conceptual Background

The fundamental determinants of growth theory for economic growth are human capital and labor. With the development of theoretical and empirical research in growth, a variety of viewpoints and controversies have been generated, and there are multiple development directions (Hanushek, E. A, 2016). Resources and policies Different potential models of how to affect growth. Moreover, in empirical analysis, people have been looking for the difference between education investment and economic growth maximization. This time, we use education income, unemployment rate, and growth rate to evaluate the value of education investment to economic growth in terms of human capital.

Investment in education obtains more human capital, thereby promoting sustained economic growth. On this basis, human capital investment will affect technological progress and long-term impact economic growth (Lucas, 1988). This has been proven in many endogenous growth models. Education promotes economic growth by increasing human capital and increasing physical capital and social capital. To enhance the status of personal income and national economic strength.

The research on the influence of the difference in growth rate has always maintained a high degree of enthusiasm. Different growth analysis methods are used for different problems, and at the same time, the differences caused by the use of different growth models are used. This article's focus is to understand further the potential and inherent impact of education and human resources by analyzing education investment, unemployment rate, and income.

How necessary are human capital in higher education and economic growth? At the same time, there are apparent differences in the impact of STEM on the economy, but like most theorists, this article pays little attention to the influencing factors of STEM. We consider the role of higher education investment and verify the value of human capital through the return

on investment, thereby determining the relationship between higher education and economic growth.

The modeling and measurement methods of human capital provide essential background for a better understanding of higher education and economic growth (Toutkoushian & Paulsen, 2016). The impact of labor on productivity has promoted the rapid development of the theory, experience, and empirical application of the concept of human capital on a wide range of issues. There is a corresponding relationship between investment in education and the return on the labor market.

Growth Model

The Solow economic growth model is a theoretical framework used to study economic growth, which was developed by American economist Robert Solow in 1956 (Solow, R. M. 1956). In the long-term economic environment, the Solow Growth Model is a neoclassical model of economic growth that aims to explain the long-run evolution of output per capita. In this model, the main exogenous variable is the rate of productivity progress through educational attainment, while capital per capita and labor force participation are considered endogenous variables, meaning that they are determined within the model. The Solow model predicts that an economy will converge to a steady state where the rate of investment is equal to the rate of depreciation, and capital per capita is constant.

The basic assumption of the Solow growth model is fixed on the labor and capital ratio. The endogenous variable is investment. The exogenous variable is capital accumulation.

Assumptions of Solow growth model:

1. Only produce one product, this product can used as consumption or investment.
2. Price and earnings are variable.
3. Labor and capital are substituted for each other.
4. Exist technological progress.

The basic production function for the growth model is:

$$Q=A*K^{a*}L^{1-a} \quad (0<a<1)$$

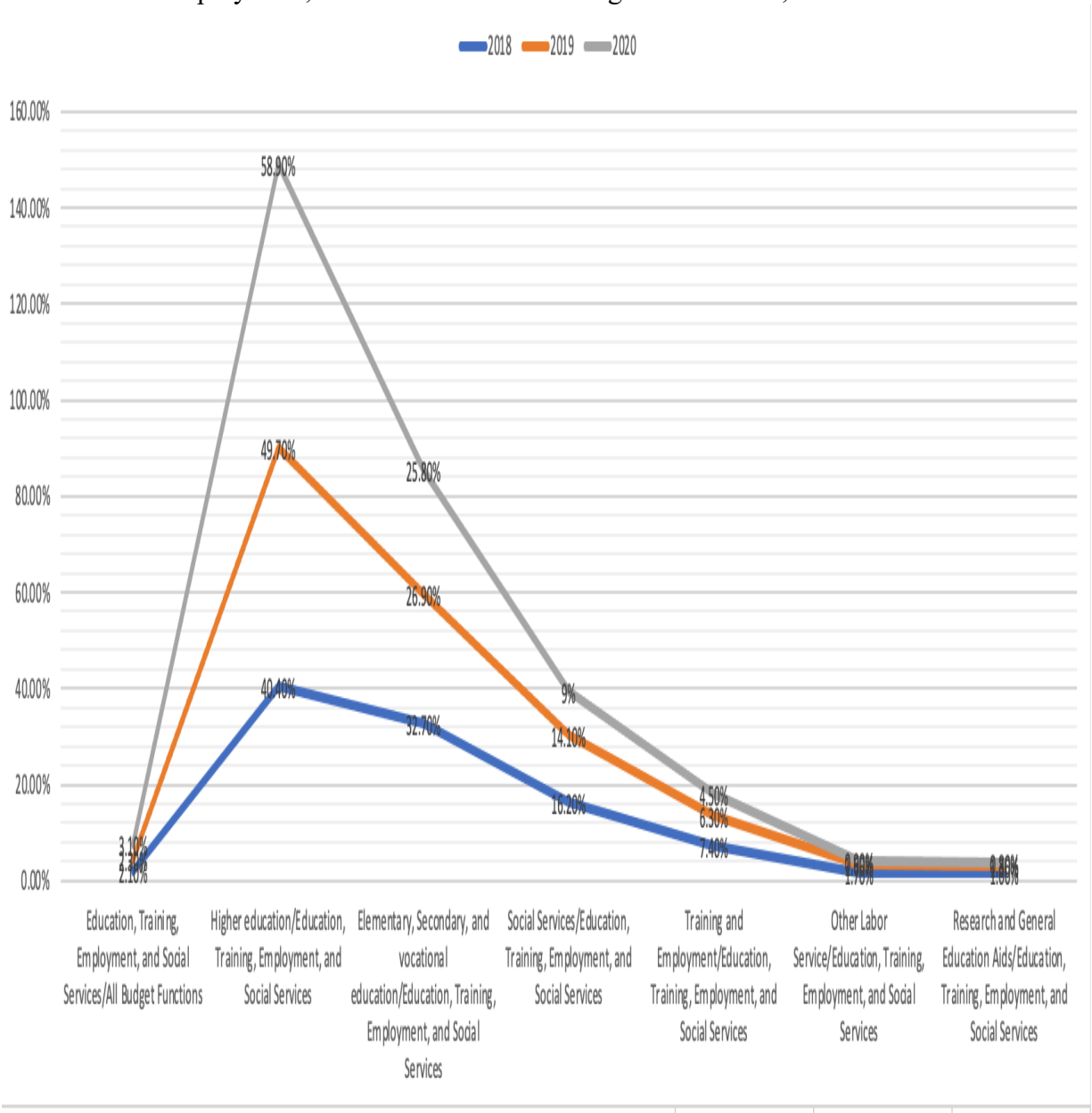
Where A is a constant representing technology, a is the capital share, C is consumption, d is the rate of capital depreciation, I is investment, K is the present capital input, K' is the future capital input, L is the labor input, Q is the output, S is the incomes.【Capital accumulation: $K' = (1–d)K + I$】

Output per person:
$q=AK^a$
Where $q=Q/L$
According to the assumption of competitive equilibrium:
The attainment-investment identity: $Q=C+I$
Investor's budget: $Q=C+S$
Therefore, $I=S=sQ$.
So, Capital accumulation: $K' = (1–d)K + sQ=((1–d)K + sAK^a$

The Solow Growth Model with these variables highlights the importance of investing in education for sustained economic growth and development. By taking into account the role of higher education inputs and educational attainment, policymakers can make informed decisions on how to allocate resources for education to maximize the economic benefits.

Higher Education Input

Figure 1: Annual percentage increase - A Budget Sub-Function of Education, Training, Employment, and Social Services in Higher Education, 2018-2020



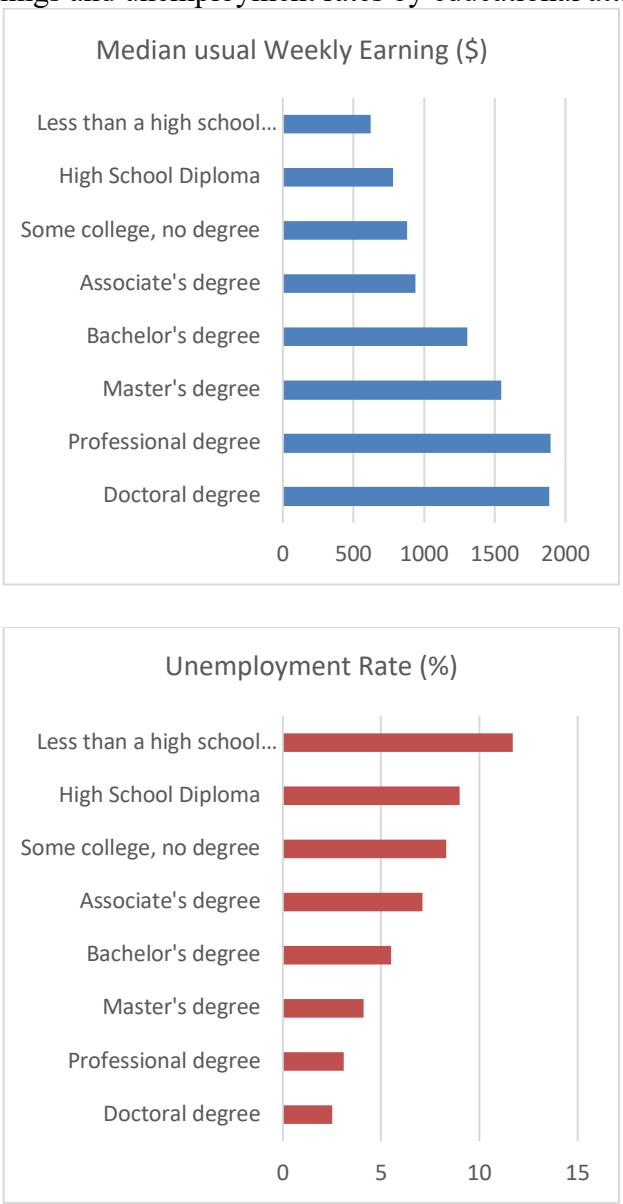
Source: USASPENDING

A Budget Sub-Function of Education, Training, Employment, and Social Services and the relationship between higher education conducted in-depth research on the related influence relationship and the dynamics between them. The data comes from the official website of USASPENDING. The variables are the percentage of annual education funding growth and

education category. From the analysis in Figure 1, we find that from 2018 to 2020, the percentage of government funding for each type of education has increased, but it is worth noting that the percentage of investment in higher education each year is the largest—almost half of the funds invested in education.

Educational Attainment

Figure 2: Earnings and unemployment rates by educational attainment, 2020

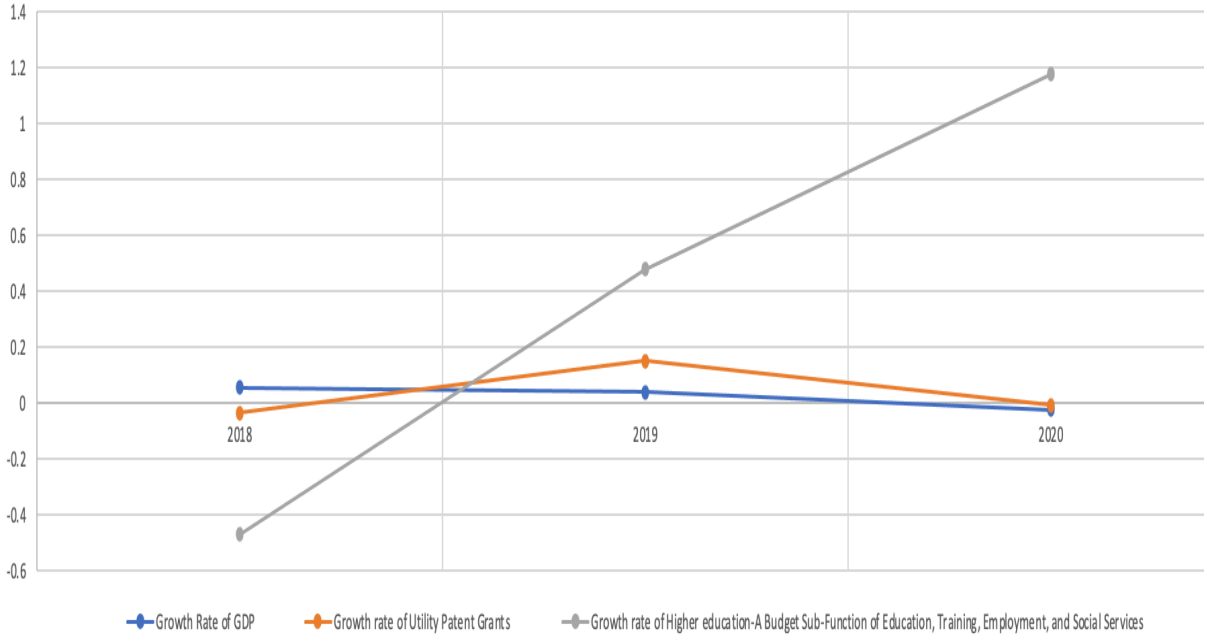


Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.
Source: U.S. Bureau of Labor Statistics, Current Population Survey.

The relationship between higher education level, median weekly earnings, and the unemployment rate has been studied. The data comes from the official website of the U.S. Bureau of Labor Statistics. The variables are median usual weekly earnings and unemployment rate. From the analysis of educational attainment in Figure 2. As the degree of education increases, the median weekly earnings will also increase as the degree of education increases and the unemployment rate decreases.

Growth Rate

Figure 3: Growth Rate of Higher Education, Utility Patent Grants, and GDP in USA, 2018-2020



Source: The World Bank, USPTO, and USASPENDING

This article focuses on the relationship between higher education investment, education acquisition, and economic growth and conducts an empirical study on its causality and the dynamic effects. The number of patents granted and the growth rate of patents are the two most common indicators that reflect STEM technology innovation. Since the number of patent authorizations is affected by human factors such as government organizations, the number of authorized patent applications is selected as the proxy variable to measure STEM technology innovation. The proxy indicators of economic growth and higher education investment will be represented by the current measured GDP and national fiscal expenditure on higher education.

Considering the above factors, the data from 2018 to 2020 are selected as the sample of this study. Respectively from the official websites of The World Bank, USPTO, and USASPENDING, empirical research is carried out based on a unified solution to the annual growth rate. Variables, using symbols such as GDP, spending, and patents to represent the current annual growth rate of GDP, the annual growth rate of national financial higher education funding, and the growth rate of patent application authorization.

From the analysis in Figure 3, we can see that from 2018 to 2020, the average annual growth rate of GDP at current prices has a slight downward trend. At the same time, the growth rate of the national financial higher education fund also showed an upward trend, but the fluctuation range of the growth rate of patent applications increased slightly and then slightly decreased. It is worth noting that the average annual growth rate of GDP, the growth rate of the national financial higher education fund, and the number of patent applications granted do not show the same fluctuating trend.

Discussion

How can investment in higher education promote economic growth through educational attainment? Education level is the source of power for social and economic development, and education is a crucial way to enhance cognition, labor, and human capital. Therefore, investment in higher education can improve the quality of talents and gradually increase human capital accumulation, thereby promoting economic growth. Furthermore, human capital and productivity, the core variables determining economic growth, will inevitably accelerate economic growth. Developed countries and developing countries have different levels of economic development and are human capital reserves at different stages. Therefore, investment in education, especially in higher education, accelerates economic growth through human capital.

How does economic growth support the development of higher education? Economic growth provides a material foundation for the coordinated development of education. To a certain extent, education refers to activities formed through the primary form of human capital investment to cultivate and train labor ability in a planned way. From this perspective, the investment and operation of education can be seen as an industry's input and output process. From the main body of burden, the cost of education can be divided into two parts: social cost and personal cost. The expansion of higher education requires an increase in related investment. To achieve the coordinated development of education, we must base it on sustained and stable economic growth to ensure the long-term sustainability of education investment. Economic growth has a restrictive and guiding effect on the development of education. Economic development determines the scale, content, organizational form, teaching methods, educational methods of education, the quality of the labor force, and the quality of talent training. Fundamentally speaking, education, as an activity to train people, is an essential part of social development, and the level of economic development ultimately restricts its development. The level of economic development determines the amount of investment in education and the supply of investment in education. This inevitably requires that the scale and speed of education at all levels match and coordinate with the scale and speed of economic development quantity.

Education investment and economic growth are not simply causal. Education investment will not directly drive economic growth. On the contrary, it uses the accumulation of human capital and technological innovation for economic growth. Moreover, the conduction process is a dynamic cyclic process. Although there is no direct relationship between educational investment and economic growth, it ultimately promotes economic growth through the transmission of human capital accumulation and technological innovation. At the same time, economic growth can also create conditions for educational investment, indicating that economic growth has a direct and positive supporting role for educational investment.

STEM promotes scientific and technological progress, and education investment is the driving force of economic growth. Conversely, economic growth will also drive technological progress and education investment. From the perspective of the impulse response, investment in technology and education has noticeable long-term effects on economic growth. In addition, from the perspective of the direction of influence, the influence of technological progress and education investment on economic growth shows a trend of repeated fluctuations. Among them, STEM promotes scientific and technological progress to stimulate economic growth in the short-term direction and has a positive

cumulative effect in the medium and long term. After the fourth stage, higher education investment has a positive impact on economic growth. From the perspective of contribution, economic growth is affected by innovation, technological progress, and new investment in education. It has evident inertia and remained stable at the beginning of the ninth stage. On the whole, STEM's promotion of scientific and technological progress has a more significant impact on economic growth.

Educational investment, educational level, and economic growth have a direct or indirect interactive relationship. Education investment can increase the accumulation of human capital. The accumulation of human capital will bring technological innovation and progress to a certain extent. In addition, technological innovation and progress have also promoted economic growth. Then, economic growth is more likely to invest in education. If we further increase investment in education, they will enter a new cycle. In addition, it promotes technological innovation through the accumulation of human capital, thereby accelerating economic growth. Therefore, it is a spiral and self-reinforcing process. Technological innovation and economic growths are a mutual cause and effect relationship that promotes and restricts each other and a dual relationship: technological innovation and economic growth are intertwined. The two change simultaneously in the same direction. This relationship reflects the role of technological innovation in the production process in promoting economic growth.

Conclusions

Higher education investment and education level are two factors that affect economic growth. The test results show that higher education expenditure indicators are factors that continue to affect economic growth fluctuations, both in the short-term and in the long-term, and have made contributions that cannot be ignored. Higher education has brought huge returns to personal income and reduced unemployment. This is part of the reason, but perhaps more because of the potential impact on productivity and economic growth. Growth is highly correlated with national intellectual capital. Economic growth will give the country the status of economic power.

It is worth noting that the superimposed impact of higher education investment and STEM technology innovation has a particular long-term nature and will not weaken over time, but increase, which is consistent with our theoretical analysis. The technological transformation and innovation of human capital will eventually affect economic growth through accumulation, transfer, and transformation. From a direct perspective, the increase in investment in higher education is the driving force for technological innovation in human capital, and technological innovation is a factor in economic growth. From the analysis of the impulse response results, higher education has primary technological innovation provides a cumulative positive impact on economic growth, which slowly decays over time and has a robust long-term nature, which corresponds to the general law of gradual elimination of the introduction of new technologies.

Educational investment and economic growth are not a simple causal relationship. The educational investment will not directly lead to economic growth but will ultimately affect growth through human capital accumulation and STEM technology innovation. The impact process is a dynamic, self-reinforcing, and circular process. Higher education investment is an essential source of human capital, and the positive effect of human capital on economic

growth can only be seen for a long time. Therefore, investment in higher education requires a long-term vision and a quick and quick mindset.

The impact of higher education investment on economic growth lacks a good index of higher education quality to measure the corresponding standard, so the treatment of very different results is the same. However, there is a big difference.

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