An empirical analysis of the impact of education on economic growth

Dr Shweta Sood, PHD Economics India.

Abstract

Background: Economic theory holds that education, as the main institutional mechanism for the accumulation, production, and diffusion of human capital, is also an externality for the dissemination of market and non-market interests. To analyse the impact of higher education on economic growth.

Materials & methods: GDP is the gross domestic product used as a proxy for economic growth, HEP indicates higher education progress, HEU denotes higher education utilization, LF is the total employed labor force, GEE is government expenditure on education and HEP∗tHTIt illustrate the interaction between higher education utilization and high-tech industry.

Results: The KPSS and ADF test results confirm that none of the variables are integrated with the second-order difference I(2), thus validating the use of ARDL techniques in the proposed model. The results show a mix of variable integrations, such as gross domestic product (GDP), higher education progress (HEP).

Conclusion: Highly educated workers can significantly contribute to economic growth when employed in high-tech industries.

Keywords: Economic development,education.

Introduction

The concept of economic complexity in a country refers to the production of domestically-based knowledge products as well as the diversification of export goods by the country. By economic complexity, the emphasis is on the intense application of technical knowledge in product diversification to encompass it in the domestic consumer markets on the one hand and foreign markets on the other. However, the economic complexity of countries' production is not limited to the ability to apply knowledge to the production process; rather it encompasses much broader dimensions. [1]Economic development is considered to be a high ranking issue in literature, as it is linked to various micro and macro issues, such as inflation, income, education, health, and environment, etc. [2,3]However, a large number of empirical studies have investigated the influencing factors that lead to an increase in the economic growth. Solow have reported that labor and capital are the key determinants of economic growth. [2]Later, the Solow growth model has been extended by using education, health, carbon emission, energy consumption, industrialization, urbanization, taxes, foreign direct investment, etc., and these factors have confirmed mixed evidences due to the geographical differences, demographics, time periods, market structures, economic system, etc.[4,5]

The mature economics literature on the impact of human capital on economic growth underscores Solow's early work in neoclassical economics that economic growth can be explained not only by increases in capital and labor but also by technological progress as one of the main factors.[6,7] Education facilitates the implementation and execution of modern inventive techniques, first proposed by Nelson and Phelps.[8] Countries with large amounts of human capital and lagging technological capabilities may be best placed to catch up with technological leaders faster, in which case productivity gains may be facilitated as human capital levels affect growth. Mankiw et al. [9] extended the growth model of Solow's by incorporating an explicit process of human capital accumulation. [6]Incorporating physical and human capital into the Solow model of economic growth determines steady-state per capita income and economic growth. Romer proposed a new perspective that extends the theory of endogenous growth by adopting new modern technologies rather than old traditional technologies; his observations reflect that high-skilled labor is an important input required for R&D activities. [10,11]Such skilled labor is human capital and a key input in the

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production process. Lucas believes that education is the carrier and main source of human capital, and an important production input factor in addition to labor and physical capital. This means that a more educated workforce leads to significantly higher levels of productivity, which in turn improves the overall economic outlook.[12] Hence, this study was conducted to analyse the impact of higher education on economic growth.

Materials & methods

Solow growth model is highlighted in the following form:

$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta}$

where Y stands for total production, K indicates physical capital accumulation, H represents human capital, and A and L show technical efficiency and labor, respectively. The model assumes that labor (L) and technical efficiency (A) increase exogenously and at constant rates n and g, respectively. The parameters α and β measure the output elasticity of the relevant input, Transform Equation into a per capita income equation that considers the form of diminishing returns to scale, i.e., $\alpha + \beta < 1$. GDP is the gross domestic product used as a proxy for economic growth, HEP indicates higher education progress, HEU denotes higher education utilization, LF is the total employed labor force, GEE is government expenditure on education and $HEP*tHTIt$ illustrate the interaction between higher education utilization and high-tech industry. The KPSS and ADF tests were done.

Results

The KPSS and ADF test results confirm that none of the variables are integrated with the second-order difference I(2), thus validating the use of ARDL techniques in the proposed model. The results show a mix of variable integrations, such as gross domestic product (GDP), higher education progress (HEP), and labor force (LF) at the I(0) level, while capital formation (CF), higher education utilization (HEU), and Government expenditure on education (GEE) are integrated at the first differential I(1).

Table 1: Exploring variable integration order with ADF and KPSS testing.

Variables	ADF		KPSS	
	At level	First difference	At level	First difference
GDP	-1.620***	-2.142***	0.412***	0.589***
HEP	-2.152***	-3.520***	0.845**	0.835***
LF	0.2***	1.5***	0.2*	0.41***
HEU	-3.2	-4.10***	0.10	0.3***
GEE	4.1	4.9***	0.4	0.72***

*, **, and ***are significant levels at 10, 5, and 1%, respectively.

Discussion

Since the human factor is one of the most important productive factors contributing to economic growth, the interest in investing in education has increased. The recognition of the effective role of investment in education in achieving comprehensive economic and social development has begun. Although this fact has stimulated the appetite of companies to invest in scientific research and knowledge creation since the end of the twentieth century, due to the large economic surpluses achieved by the adaptation of knowledge in consumer life, and the competitive advantage of these companies. However, in the opposite direction, governments have realized what investment in education is and the creation of knowledge from the benefits of economic growth reaching to knowledge economy. Economic growth, social and economic stability are all dependent on the creation of knowledge and its practical applications. [13] Hence, this study was conducted to analyse the impact of higher education on economic growth.

In the present study, the KPSS and ADF test results confirm that none of the variables are integrated with the second-order difference I(2), thus validating the use of ARDL techniques in the proposed model. A study by Qi D et al, the asymmetric effects of higher education progress (highly educated employed workforce), higher education utilization (highly educated unemployed workforce), and the separate effects of higher education utilization interactions with high-tech industries on economic growth in China from 1980 to 2020. Likewise, an increase in higher education utilization (the unemployed labor force with

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higher education) suppresses economic growth, while a decline in the higher education utilization (the unemployed labor force with higher education) promotes economic growth. The study also found that the expansion of high-tech industries and government spending on education significantly stimulate economic growth. The moderating role of higher education utilization (unemployed labor force with higher education) in the impact of high-tech industries on economic growth is significantly positive. Moreover, the country is required to invest more in higher education and the development of high technological industries across all regions, thus may lead to higher economic growth.[14]

In the present study, the results show a mix of variable integrations, such as gross domestic product (GDP), higher education progress (HEP), and labor force (LF) at the I(0) level, while capital formation (CF), higher education utilization (HEU), and Government expenditure on education (GEE) are integrated at the first differential I(1). Another study by Batool SM et al, the correlation between different socio-economic indicators and students' enrollment was positive and highly significant (0.73 to 0.99), except for the unemployment rate (- 0.39 to -0.57). PCA showed that the first two components were the most influential with 93.85% of the total variation. Enrollment (total and male) showed significant relationships with general government expenditure and unemployment rate, while female enrollment showed a significant relationship with general government expenditure. Findings revealed that socio-economic factors can serve as a significant predictor of students' enrollment in higher education. The minimum values of correlation coefficient (R) and adjusted R2 for enrollment were ranged from 0.875 to 0.748 (female enrollment), while maximum values (0.987 to 0.993 and 0.973 to 0.983), respectively were observed for total enrollment.[15] A strong relationship between economic growth and higher education suggests that these variables are necessary for each other. A highly subsidized education system needs to be introduced to increase enrollment in higher education.[16] The higher government spending and the number of schools demonstrated a positive impact on student enrollment in Pakistan.[17] However, poverty and household income are reported to influence primary school enrollment.[18] Lower student enrollment in developing countries cannot be attributed due to a smaller number of institutes as other factors such as government disbursement, employment rate, and expenses on health sector is reported to increase enrollment in all levels of education in Pakistan. [19] As for the education, higher education in high income countries is one of the main factors of economic growth, which is insignificant in remaining sub-groups. The insignificance of education is contradicting with Valero and Van Reenen, Abbas, and Greer and Kuhlmann.[20-22] However, the main reason for the significance of education in high income countries is the research based and advanced education structure that is designed according to the current needs. Further, the education quality in high income countries is based on research and the development of advanced technologies, instead of being focused on old and outdated technologies.[23] On the contrary, low income countries follow traditional educational patterns and also face lack of resources, which does not guarantee economic development. [24]

Conclusion

Highly educated workers can significantly contribute to economic growth when employed in high-tech industries.

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