A causality analysis of the link between higher education and economic development: empirical evidence

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ABSTRACT

This study aims to investigate the relationship between expenditure on higher education and economic development in Saudi Arabia, which has invested in higher education and knowledge creation since its independence as part of the sustainable development process. Accordingly, this study aims at conducting an initial survey of the policies of expenditure on higher education in Saudi Arabia and then developing a standard model in which the results of this investment will be measured in achieving the economic development in Saudi Arabia for a period of forty years from (1978) until (2017). Based on econometric instruments; the study model did not succeed in finding a relationship between investment in higher education and economic development in Saudi Arabia.

1. Introduction

Since its independence, the Kingdom of Saudi Arabia has paid considerable attention to the issue of investment in education as a prerequisite for social and economic growth and has placed education at the forefront of development plans since independence until today. Thus, was investment in education in Saudi Arabia an input to the development process?

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 (Buzinskiene and Rudyte, 2004).

The study seeks to provide empirical evidence on the relationship of investment in higher education to economic growth in the Saudi Arabia. It aims to evaluate the policies taken in investing in higher education in one of the Gulf countries and their effects on economic growth over a relatively long period of time to provide precise results and precise approaches to the feasibility of policies on higher education. The objectives that the study seeks to achieve, we can show in the following points: first, Monitor and compare investment in higher education and knowledge creation in Saudi Arabia through a descriptive, disaggregated and analytical study aimed at taking apart the phenomenon and showing its Interlocking relations. Second, Investigating the impact of investment in higher education in Saudi Arabia in achieving economic growth or, conversely, looking at the part of growth achieved through investment in higher education. The above-mentioned lines carry the gap of the study, as it aims at practical approach, gives accurate results on the relationship of education to economic growth, contributing to the debate in the academic and executive circles about the feasibility of this investment in the creation of development.

The rest of the paper is organized as the following; the second part presents a literature review from which hypothesis development proceeds. The third part, in explicating methodology and sampling technique, articulates the study model, variables, and metrics. The fourth part elaborates a descriptive study. The fifth part discusses the empirical...
results. In the final part, conclusions are put forth and a consideration of implications receives attention. Future studies are suggested.

2. Literature review

Castells (1994) sees higher education as an engine for development in the new global economy. Higher education is a form of investment in human capital development and has a real contribution to the economic growth of countries. At present, higher education provides an input to the transformation of countries into knowledge economies. It contributes to the creation of educated workers and those capable of dealing with the knowledge economy. Higher education contributes to the socialization of individuals, helps in the modernization and transformation of societies and, perhaps more importantly, through teaching and scientific research to create, absorb and disseminate knowledge (Pillay, 2010). Therefore, challenges of the role of higher education which include the need for re-affirmation of the value of sustainability in HEIs, management dilemmas, the lack of involvement of academics, and the lack of external evaluation (Xiong and Mok, 2020).

There is no clear agreement among scientists on the role of higher education in economic growth. Some have not found a link between higher education and economic growth, especially in developing countries where primary education is more important than higher education (Psacharopoulos and Patrinos, 2004). For a long period of time, investment in higher education has been neglected, considering that investment in primary and secondary education gives better social returns than higher education. Therefore, this kind of education must receive the minimum resources of society (Schultz, 1993). Even in the middle of the 20th century, which saw an increasing interest in human capital, the focus was on factors that directly affected human capital and the elimination of poverty. These factors were primary education and health (Kapur and Crowley, 2008).

Vedder (2004) study has questioned that higher spending on higher education necessarily provides greater economic returns. This study, conducted in the United States, found an inverse relationship between spending on higher education and economic growth, putting many doubts about the feasibility of public investment in higher education, and the fact that higher education is an important factor in achieving economic growth.

While Bloom et al. (2005) the belief that the role of higher education in economic growth is limited, this study provides evidence of the role of higher education in economic growth and poverty reduction in sub-Saharan Africa, where the lowest proportion of university education in the world 5%, in which international organizations encouraged African governments to pay attention to primary and secondary education at the expense of university education to improve economic growth. This trend led them to cut spending on tertiary education, causing further failure to achieve economic growth. Higher education contributes to economic growth in several ways, including: keeping up with technological development, transferring knowledge and raising awareness, which contributes to reducing the knowledge gap and poverty in this region. Moreover, Liao et al. (2019) concluded that the investment in education have the most obvious effects on the economy.

Blum and his colleagues, (2005) criticized the traditional theory that reduces the role of higher education in the return on investment at the individual and community level, and ignores its role in creating entrepreneurship, job creation, political and economic governance, and the role of educated cadres in the health and social fabric of countries. In another study of Meulemeester and Rokhart (1995) they found that there is a strong causal relationship between investment in higher education and economic growth in Japan, the UK, France and Sweden, while there is no relation to investment in higher education in economic growth in Italy and Australia.

Michel's (2014) study shows that spending on education by 1 percent of GDP contributes to economic growth by 0.3 percentage points. And Rita and Dalia (2014) who showed that investment in knowledge creation plays an important role in achieving long-term economic growth. In Algeria, Dahan (2010) study aimed at tracking investment in education and its role in economic growth during the period 1968–2007, which found that the contribution of human capital was positive, but at varying rates during the period of study. The study also found a long-term relationship between gross national product GNP and human capital in Algeria during the study period, and despite the important role of human capital in economic growth in Algeria, but it was not the engine of this growth, which was due to the accumulated investment in capital. The relationship between economic growth and investment in education is a reciprocal relationship. Chaudhary et al. (2009) have shown that investment in education contributes to improving long-term economic growth in Pakistan. Conversely, investing in education requires a thriving economy that can finance investment in education and create knowledge to sustain it.

The study of Khorasgani (2008) showed that higher education played an important role in the economic growth of Iran during the period 1959–2005. This study showed that increasing investment in higher education in Iran by one percent is likely to contribute to improving GDP 0.198 percent in the short term and 0.314 percent in the long term. The study of Al-Malki and Bin Obais (2004) examined the relationship between education and the GDP growth of non-oil sector in Saudi Arabia, in this context, the research aims to determine the determinants of government expenditure on education in the Saudi Arabia, the study found there is a mediation role of government expenditure in the relationship between higher education and economic growth. In related study (Mahajan, 2020) confirmed that education raises people's productivity and creativity as well as promotes entrepreneurship.

The research also found that the total population is another determinant of the relationship between higher education and economic growth. In a comparative study, Boudia and Ben Zidane (2013) found a positive relationship between investment in higher education and GDP in Algeria, Saudi Arabia, and Jordan. As evidence from Syria on the relationship between investment in education and economic growth, the Alban (1982) study showed that the contribution of education to economic growth ranged between 6-9 percent during 1970–1980.

Some studies have gone further than examining the impact of investment in education on economic growth to examine the differentiation between gender education and its role in economic growth. From Turkey The study of Tansel and Gungor (2013) found that the education of girls plays an important role in improving the productivity of work, and because of the importance of modern economic growth in Turkey, has agreed this result with the findings of the study, Mashal and Al-Srouji (2006) which examined the economic returns of women's education in Jordan, The results showed that women's education had a positive impact on their economic activity, their pattern of savings, their type of employment, the pattern of household consumption, and the level of income of the husband; there was a close correlation between economic growth and the empowerment of women; development itself achieved women's empowerment; Decision-making will directly affect development. As for the role of higher education in the knowledge economy, the World Bank report, (2001) concluded that higher education is essential for developing countries if they are to thrive in the new global economy, where knowledge has become a vital area of differentiation between countries.

In the present study, we provide evidence from Saudi Arabia, one of the emerging and oil-based economies, which is actively seeking to build a system of higher education that contributes to economic growth. Has investment in higher education in the Saudi Arabia contributed to building the human element capable of making an effective contribution to economic growth, helping it to sustain this growth beyond its oil boom? Investment in higher education must be consistent with long-term development plans and based on its foundations, not a way out of economic growth in which large financial returns are available to be directed towards education.
Relying on the previous theoretical discussion, the study’s hypothesis may be formulated as follows “There is no Relationship between Investment in Higher Education and Economic Growth”.

3. Research methodology

In order to answer the questions of the study and its basic problems, this study employs both descriptive and practical analytical approaches in order to reach a perception of the mediation role of oil returns in relationship between investment in higher education and economic growth.

3.1. Study sample

The study data were collected to estimate their models for a period of 40 years from 1978-2017. It may represent the basic source for the study data through national disclosures and the World Bank database, which provide data on the level of expenditure on higher education, economic growth, and other variables necessary for the study model.

3.2. Study model

This study aims at measuring the relationship between investment in higher education in economic growth. To achieve this goal, the study used the following model:

\[ GDP_t = \alpha + \beta_1 L_t + \beta_2 K_t + \beta_3 P_t + \beta_4 Edu_t + \beta_5 Pop_t + \beta_6 Stud_t + \epsilon_t \]  

(1)

Where: GDP\(_t\): the growth in GDP for the year of \((t)\). \(\alpha\): constant. \(\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6\): Slope. \(L_t\): labor force in the year \((t)\). \(K_t\): capital accumulation in the year \((t)\). \(Edu_t\): Investment in higher education in the year \((t)\). \(Pop_t\): Population in the year \((t)\). \(Stud_t\): number of students’ enrollment in universities. \(\epsilon_t\): Random error.

4. Descriptive analysis

Investment in higher education is an investment in human capital, which may only show up after a period of time, at least five years. To analyze the long-term relationship between investment in higher education and economic growth in Saudi Arabia, we have divided the sample of the 40-year into eight periods, each period includes five years. We then calculated the average growth rate in investment in higher education in each period, and then find the average growth rate of GDP in the next five years. The results are as shown in Table 1.

It should be noted that periods of higher investment in higher education were not followed by periods of economic growth. For example, in the first period of the study, for the years 1978–1982, the average growth rate in investment in higher education was 96.227%. In the next five years (1983–1987), economic growth was only 0.603%. On the other hand, in the sixth period (2003–2007), the growth rate in investment in higher education was negative -11.536 while the seventh period (2008–2018) witnessed a growth in GDP by 4.536%.

Long-term analysis did not show a relationship between investment in higher education and economic growth in Saudi Arabia, which may indicate that there is no impact of investment in higher education in the economic growth. However, these indicators remain descriptive results subject to subjective considerations, including the choice of split periods.

5. Empirical study

5.1. Unit root test

In order to identify the degree of integration of the basic variables in the study model, the stability of the time series 1978–2017 (unit root) was tested as a first step in the analysis in order to avoid error in estimation (Ghedabna, 2015). Applied research using time series assumes the stability of these series (Stationarity), which requires that the mean and the variance are constant. The value of the Covariance between two time periods depends only on the time gap (Lag), not on the actual time at which it is measured Heterogeneity (Gujarati, 2003). To verify the variables, the extended Dicky-Fuller test ADF was used to test the stability of time series in the model described in the logarithm formula of the first difference.

The Dicky Fuller test in Table 2 shows that the time series is not stationary at the level for all variables except for the “population variable” and “number of students enrolled in national universities.” When taking the first difference and retesting it. Employing a single lag for all-time series to overcome non-stationarity enables the time series to become stationary and integrated at lag one a standard result in econometric studies for such time series (Arouri, 2011 and Aroruri and Fournier, 2009).

5.2. Cointegration test

Cointegration and the number of integration vectors will be tested for each equation we estimate based on the Johansen 1985, 1988 methodology. Since the Johansen methodology is sensitive to multicollinearity, the length of the appropriate delay will be determined to estimate a model that does not suffer from multicollinearity, the multicollinearity of the specified delay length is tested. Previously, the unit root results showed that most of the variables were not stationary at the level, and all became stationary after taking the first difference. Engel and his colleague Granger (1969) have pointed out that the instability of time series at the level does not negate the long-term linear relationship between the variables; therefore, we can conduct the joint integration test to detect the existence of that relationship using the Johansen Cointegration Test. The results are presented in Table 3.

From Table 3, the result of the impact test and the underlying root test indicate that the hypothesis that there is no single integrative vector in the study model, the stability of the time series 1978–2017 (unit root) was tested as a first step in the analysis in order to avoid error in estimation (Ghedabna, 2015). Applied research using time series assumes the stability of these series (Stationarity), which requires that the mean and the variance are constant. The value of the Covariance between two time periods depends only on the time gap (Lag), not on the actual time at which it is measured Heterogeneity (Gujarati, 2003). To verify the variables, the extended Dicky-Fuller test ADF was used to test the stability of time series in the model described in the logarithm formula of the first difference.

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From Table 3, the result of the impact test and the underlying root test indicate that the hypothesis that there is no single integrative vector in
the model is not accepted. Therefore, the error correction vector must be estimated to test the causality.

5.3 Causality test

This part of the study attempts to identify the direction of the relationship between investment in higher education and economic growth; this step is to determine the direction of the long-term and short-term causality as per Granger. When there is one integrative vector, the error correction methodology is used for Engel and his colleague Granger (1969). By applying this test at two lags to overcome the problem of not stationarity of some series, the results were shown as in Table 4. Seven proposed models are built-in dependent variables, with six independent variables per model. The analysis of the causality appeared in Table 4 shows that the model of the study, in which economic growth represented the dependent variable, is caused by the labor and the capital, which is consistent with the traditional economic theory. This economy is oil-dependent economy. However, the variable “investment in higher education” was not the cause of economic growth in Saudi Arabia. We cannot reject the null hypothesis that there is no causal effect of

Table 2. Unit root results.

| Variables                          | at the Level | The first difference |
|-----------------------------------|--------------|----------------------|
|                                    | ADF          | ADF                  |
| GDP logarithm                      | LGDP         | 2.310                | -4.187***         |
|                                    | (0.783)      | (0.002)              |
| Labor logarithm                    | LL           | -0.594               | -5.884***         |
|                                    | (0.860)      | (0.000)              |
| Capital logarithm                  | LK           | 2.514                | -4.408***         |
|                                    | (0.875)      | (0.001)              |
| Oil price logarithm                | LP           | -0.964               | -7.712***         |
|                                    | (0.757)      | (0.000)              |
| Investment in Higher Education     | LEDU         | -1.583               | -4.926***         |
| logarithm                          |              | (0.481)              | (0.000)           |
| Population logarithm               | LPOP         | -3.778***            | -4.914***         |
|                                    |              | (0.007)              | (0.000)           |
| Number of student's logarithm      | LSTUD        | -2.626*              | -3.790***         |
|                                    |              | (0.097)              | (0.006)           |

Note: ADF is the augmented Dickey-Fuller test. The ADF is based on the null hypothesis of a unit root “not stationarity”. ADF test (top), p-value (bottom). *, **, *** denote rejection of the null hypothesis at 10%, 5%, and 1%.

Table 3. Unit root results.

| Hypothesized No. of CE(s) | Unrestricted Cointegration Rank Test (Trace) | Unrestricted Cointegration Rank Test (Maximum Eigenvalue) |
|---------------------------|-----------------------------------------------|----------------------------------------------------------|
|                           | Trace test (p-value**) | Critical value at 5% | Max-Eigen (p-value**) | Critical value at 5% |
| None                      | 191.689*               | 125.615             | 61.693*               | 46.231             |
|                           | (0.000)               |                     | (0.001)               |                   |
| At most 1                 | 124.376*              | 95.754              | 47.896*               | 40.078             |
|                           | (0.002)               |                     | (0.006)               |                   |
| At most 2                 | 72.115                | 69.819              | 28.271                | 33.877             |
|                           | (0.117)               |                     | (0.216)               |                   |
| At most 3                 | 41.269                | 47.856              | 18.523                | 27.584             |
|                           | (0.360)               |                     | (0.472)               |                   |
| At most 4                 | 21.059                | 29.797              | 12.479                | 21.132             |
|                           | (0.534)               |                     | (0.518)               |                   |
| At most 5                 | 7.444                 | 15.495              | 6.367                 | 14.265             |
|                           | (0.668)               |                     | (0.580)               |                   |
| At most 6                 | 0.497                 | 3.841               | 0.453                 | 3.841              |
|                           | (0.553)               |                     | (0.507)               |                   |

Notes: Trace test indicates 6 cointegrating eqn(s) at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

Table 4. Granger causality results.

| Dependent variable          | Independent variable | GDP                        | Investment in Higher Education |
|-----------------------------|----------------------|----------------------------|-------------------------------|
| GDP                         |                      | 0.363 (0.698)              |                               |
| Investment in Higher Education | 9.076*** (0.001)    | 0.363 (0.698)              |                               |

Notes: The null hypothesis states that there is no causal relationship between independent variables (on the horizontal side) and the dependent variable (on the vertical side). The higher value is for the F-Statistic test and below is the p-value. Symbols mean that there is a causal effect of the independent variable in the dependent at *** 1%, ** 5%, * 10%, respectively.
investment in higher education in Saudi economic growth. On the other hand, the fifth model - which expresses the dependent variable of investment in higher education - shows that economic growth in Saudi Arabia, is one of the causes of investment in higher education. Thus, the relationship between investment in higher education and economic growth in Saudi Arabia is directed towards the effect of economic growth on investment in higher education. In other words, spending on higher education benefits from economic prosperity and high oil revenues. However, this investment has not been effective in influencing economic growth and has not been used as a factor affecting the economic growth of the Saudi Arabia.

6. Conclusion and recommendations

Using the data for a 40-year period (1978–2017) and a set of theoretical approaches that underpin the relationship between higher education and economic growth, and the applied one's subject to advanced econometric models. There has been a marked growth in GDP, followed by a steady growth in the investment in higher education, and although growth in investment in higher education has been separated from economic growth. The growth in investment in higher education was not uniform. The dispersion between the increase and the shortage appeared from time to time as demonstrated by the descriptive analysis. This was followed by an attempt to assess the long-term relationship between higher education investment and economic growth; the five-year period, which witnessed growth in investment in higher education, was not followed by economic growth, all of which cast doubt on the role of investment in tertiary education in Saudi economic growth, so we went on to test causality between investment in higher education and growth. The results were decisive in the absence of a causality to invest in higher education in economic growth. On the contrary, the trend of causality was in terms of economic growth towards investment in tertiary education; in other words, spending on higher education in Saudi Arabia is based on economic growth, and investment for higher education to be one of the causes of growth as in the developed countries. Finally, the study results did not support the relationship between investment in higher education and economic growth.

The following points can be raised to activate the role of higher education in economic growth: First, set up a strategy for the development of national human resources and attention to the quality of higher education. Quality in higher education is directly related to economic growth. The introduction of high-quality graduates, the ability to communicate and work within groups, and the ability to absorb and develop technology Contributes to the desired economic growth. Second, to find more effective and less expensive tools to secure higher education, such as support for open universities, e-learning, and distance education, with arrangements to ensure the quality of higher education through them. Third; careful transition from traditional government funding to higher education to public-private participation in education, which will reduce costs on the one hand and achieve quality on the other. Encouraging the establishment of private universities on a non-profit basis and facilitating their competition for public universities. Fourthly; Link higher education to the social and economic needs of the state. Encouraging scientific research, innovation and partnership between universities and the industry, and dissolving the gap between educational institutions and the business sector through research excellence and providing technical and technical staff.

However, the success of national educational policy and making it a source of the social and economic welfare of peoples requires a long-term vision of spending on education as a means of investing in human capital in order to create knowledge and employ it in the real growth factors stemming from their cultural identity the peoples, and away from importing the knowledge that leaves its importer consumable. The results of this study leave our belief that our newly independent and developing Arab countries, despite the great strides they have made towards improving education, have not yet risen to be a significant factor in their economies.

Declarations

Author contribution statement

A. Sarea: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Hamdan: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

R. Hamdan: Contributed reagents, materials, analysis tools or data; Wrote the paper.

M. Anasweh: Conceived and designed the experiments.

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Competing interest statement

The authors declare no conflict of interest.

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