



Human Capital Investment and Economic Growth in Saudi Arabia: Error Correction Model

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ABSTRACT

To examine the relationship between investment in human capital and economic growth in the Kingdom of Saudi Arabia for the period 1970-2014. Quantitative research design has been implemented. Granger Causality approach has been employed, followed by error correction model. The data stationarity and integration order have been tested, using the augmented Dickey-Fuller. Any long-run or short-run causality was not observed between expenditure on education and economic growth (per capita gross domestic product). 73.6% variation has been indicated by fixed capital formation of gross national product, which is considered as an effective aspect. The results indicated that results are statistically significant with P value (0.000) at 5% level of significance. Investment in human capital, with the right policy assessments and rehabilitation, can be translated into an essential element of growth in the Saudi economy.

Keywords: Economic Growth, Human Capital, Error Correction model

JEL Classifications: G0, G10, G38

1. INTRODUCTION

Human capital alludes mainly to health, education on-job training. According to Imran et al. (2012) “the aggregation of the innate abilities and the knowledge and skills that individuals acquire and develop throughout their lifetime.” According to OCEL Report, human capital can be termed as “the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being” (OCED, 2001. p. 18). The human capital and economic growth relationship lingered as an important subject matter in the literature of economic theory. It is copiously used in both historical literature and economic research. Nowadays, there is expanding evidence on the significance of human capital investment in sustaining economic growth.

In Saudi Arabia, a considerable emphasis on human research was placed due to its essential role in accomplishing the objectives of socio-economic development and growth. Allocations assigned for human resources development, witnessed a remarkable continuous increase during the country’s developing process, and its nine (5-year) plans (1970-2015). Expenditure on human resource

development accounted for SR7 billion during the first program (1970-1975)¹, while investment in social and health amounted to SR3.5 billion. Maintaining to give priorities for human resources, the country allocated SR731.5 billion (50.6% of total Government Expenditure on development) for human resources during the ninth plan, and SR273.9 billion (18.96) for social and health (Ministry of Economics and Planning, 2014).

Coping with rapid worldwide economic and technological changes, Saudi Arabia focuses on putting more efforts and programs for the sake of developing its human resources’ capacities. Despite this, several challenges need further efforts targeting the development of human resources. In addition to the heavy reliance on oil, Saudi Arabia is facing several economic challenges in term of its human resources. The primary intention of the study was to find the impact of Saudi Arabian investments on human resources and economic growth. Expenditure on health and education was used as proxies for human capital investments. The fixed capital formation was the proxy for physical capital, and economic growth was explained by per capita gross domestic product (GDP).

¹ This amount was mainly allocated for education.

The error correlation model has been applied to examine the human capital investment and economic growth in Saudi Arabia. The strong connection between the error correction and cointegration models stems from the Granger theorem of representation. This theorem states that two or more integrated time series, which are cointegrated have a representation of error correction. Precisely, these concepts are isomorphic as each idea implies of others. It is important that the statistically model integrated data must make reference to the many econometric error correction models (ECMs) (Grant and Lebo, 2016). The causal relationship is carried out for the period 1971-2014, following Granger causality and ECM approaches. The study has been divided into three sections. The theoretical framework regarding the association between human capital and economic growth is represented in the first section. Also, a brief of previous empirical studies has been reviewed. The second section concerns with the empirical model of investigating the relationship between investment in human capital and economic growth. Estimates are carried out through E-views statistical package. Johansen (1991) co-integration approach has been performed, followed by ECM and Granger causality test. In the third section, finally, the empirical results discussion, and present some concluding remarks have been summarized.

2. THEORETICAL FRAMEWORK

Economists have long recognized human resource as an essential element of nations' wealth. The idea that investment in human resources results in increased economic growth, date back to the time of Smith (1776), or even earlier². In this book "Wealth of Nations," Smith introduced human being as a part of the nations' wealth, by which he developed the basic concepts of growth theory. Subsequently, many other scholars involved importance to the idea of human capital as an investment that generates a return. However, these contributions had not been firmly developed into theoretical formation till the second half of the twentieth century.

In pursuit of the upsurge of growth theory in the 1950s and 1960s, the relationship between human capital and economic growth gained increasing visibility and had been extensively discussed in the economic literature. A growing attention was given to the quality of labor, especially the level of education and training. Based on Solow's (1956), the contribution and the analysis of growth accounting turn out to be increasingly prevalent. Following by Chicago school studies (Schultz, 1961; Becker, 2009), the obvious entrant was human capital. Earlier, economists limited their views of human capital to the importance of acquired skills through education from which better opportunities and salary differentiation can be accrued. In its place, Chicago school theories measured the impact of human capital on economic growth at the macro level.

Theodore Schultz (1961)³ played a crucial role in emerging the awareness for the importance of human capital investment. It has mainly recognized the human capital as one of the important factors that determine economic growth. This theory concentrated on the investment in human capital that yields a return over an extended period. Six major categories have been discussed: Healthcare services and facilities; on-job training; formal education, elementary, secondary and higher levels; study programs for adults; and migration for the sake of job opportunities. Becker (2009) developed the main idea of what is termed as "the economic approach of human behavior," presenting education as an instrument to obtain qualified and better-paid job opportunity. Investment logic was patiently embraced when speaking about education and training, using the impact of differences in abilities and differences in opportunities. Later, Becker the work of 1962, defined human capital theory in terms of the individuals' investment in education up to the point, where their return from extra income will be equal to the cost of education⁴. Subsequently, the endogenous theories of growth focus on the significance of human capital on economic growth and emerging a notable pioneering study in this field (Romer, 1986; Barro, 1991). Similar to physical capital, Lucas (1988) clarified human capital as a factor of production in theory. It has been claimed that the accumulation of human capital is accountable for a sustained economic growth. Barro (1991) declared that educational situation of a country is considered as a motor generating tool for economic growth. Thus, based on this theory, Human capital impact on economies appear mainly through capital accumulation, which is generated through education and health. When the society education and the population health (human capital) increase, the productivity increases, and correspondingly, welfare and economic growth increase.

Over the last four decades, a large body of literature on economic growth has been produced exploring the association between human capital investment and economic growth directly. A large number of growth regressions including human capital variables have been presented. In this study, Barro (1991) applied data for 98 countries for the period 1960-1985, where the school enrollment rates of 1960 were used as a proxy for human capital as related to the real growth rate per capita GDP. The results showed that 1% percentage increase in the enrollment of primary school and secondary school caused 2.5% and 3% increase in GDP growth respectively. It has been concluded that there is a significant difference between the GDP growth and education. Akpolat (2014) studied the long-run impact of both human and physical capitals on economic growth, using the panel data set of thirteen developed and eleven developing countries. The results suggested that the effect of physical capital and education expenditures on economic growth during 1970-2010 in the developed countries was higher than effects in the developing countries. Inversely, the influence of life expectancy at birth on economic growth is higher in the developing countries.

2 The concept of co-integration has been introduced by Granger (1983) followed by Engle and Granger (1988), then tested with the VAR approach by Johansen (1988). Johansen method allows for more than one co-integrating regression, unlike the Engle-Granger approach.

3 Schultz is a Nobel Prize-winning economist who was credited for embedding the concept "human capital," and he was the first to relate productivity and education.

4 In his Nobel lecture "The economic way of looking at life," published by Journal of Political Economy.

Various theoretical literatures assessed the importance of human capital as an element of the economic growth; empirical studies revealed conflicted results and human capital has been depicted as a driver of economic growth for developing countries as well (Hanushek, 2013; Whalley and Zhao, 2013; Murphy and Topel, 2016). Human capital provides with the skills and knowledge that is brought by an individual to an organization (Hanushek, 2013). Some of them state that human capital positively affects the economic growth, while some deny the existence of any relation between economic growth and human capital components. Their mixed and ambiguous results may be due to several reasons, which includes the adopted methodology and estimating approach, spurious regressions, data quality and the selected variables as proxies for human capital.

3. EMPIRICAL STUDIES

Human capital is introduced differently in empirical studies depending on the theory, and often been measured concerning explicit knowledge and cognitive skills. Hence, education and training are considered as key contributors to knowledge and expertise development and used to influence the human capital impact in the production and growth process (Wilson and Briscoe, 2004). While, Barro (1991) measured school enrollment rates for the purpose of examining the association between economic growth and human capital. Some other economists estimated the stock of human capital employing different educational factors such as education expenditure (Akpolat, 2014), tertiary education (Chudáková and Verner, 2012), quality of schooling (Hanushek and Kimko, 2000)⁵, skilled-adults (Romer, 1986) or research and development (R and D) (Khan et al., 2015). Factors such as high-level qualification; the level of graduation output; the number of hours per week spent on self-study; rates of return to education; matching of education to occupation; and many others are mentioned by OCED (2001)⁶.

Mostly, standard health indicators used in literature included the public spending on healthcare expenditure (Elmi and Sadeghi, 2012); per capita health expenditures (Hassan and Kalim, 2012); numbers of beds in medical institutions (Taban, 2006); life expectancy at birth (Akpolat, 2004; Taban, 2006). Regarding the society, health level is an essential element that contributes to human capital; Taban (2006) examined the causal relationship between health and economic growth in Turkey. Several health indicators have been used in the matter of its relation to economic growth. The number of beds in medical institutions, the number of persons per health care providers, and life expectancy at birth were utilized as proxies for human capital. All previous indicators have found a causal relation with GDP, except the number of medical institutions. Rivera and Currais (2003) investigated the effect of health investment on productivity in Organization for Economic

Co-operation and Development (OECD) countries employing log-linear equation based on the augmented Solow model. The results have shown the positive impact in the health sector of the economy (Helliwell et al., 2014).

With the higher rates of human capital and physical accumulation, long-term sustainable economic growth is established. It relies on the capability of economy to assemble financial resources and to ensure the admittance by people to the productive assets, which must be invested more effectively. This process may review the role that financial institutions have played in growth and financial intermediation, explicitly to assemble the savings and allocate them to most growth-promoting and productive activities. The main dispute is that greater financial intermediation, provides rise to the higher productivity; and thus, obtaining higher national income/per capita (Mahran, 2012).

A study by Mahran (2012) examined the empirical association between financial intermediation and economic growth for Saudi Arabia during the last decades. The autoregressive distributed lag technique has been adopted to co-integrate the related ECM. The results indicated that financial intermediation has influenced negatively on long-run real GDP despite the minimal limitations imposed on the working of domestic financial system.

Samargandi et al. (2014) investigated the influence of the financial development on economic growth concerning the oil-rich economy of Saudi Arabia. By doing so, a difference has been established between the influences of financial development on the non-oil or oil sectors of the economy. The results have evaluated that the financial development has a positive effect on growth of the associated non-oil sectors. In comparison, its effect on the total GDP growth and oil-sector growth is either insignificant or negative. It has been recommended that the association between the growth and financial development might be essentially diverse in resource dominated economies.

Other studies confirmed the positive bidirectional causality between human capital and economic growth in the short-run or the long-run terms, the role of physical and human formation has also been studied (Tang, 2011; Aka and Dumont, 2008; Bilgili and Ozturk, 2015). Following the EMC methodology, Rahman (2011) found bidirectional causality between education expenditure and GDP in Bangladesh for the period 1990-2009. Elmi and Sadeghi (2012) revealed that there is a unidirectional short-run causality from GDP to health care spending in developing countries during the period 1990-2009. Hussin et al. (2012) found that economic growth has a bidirectional long-run with education and labor while, in the short-run Granger causality indicated a significant coefficient of education. Whereas, insignificant coefficient of labor as related to GDP growth in Malaysian economy was also indicated during the period 1970-2010. Hassan and Kalim (2012) found long-run triangular bidirectional causality between education, health and GDP in Pakistan during 1960-2012. Rehman et al. (2014) suggested bidirectional causality in long-run and short-run causality between enrollment in both primary and high schools and economic growth. However, a significant impact appears

5 However, Hanushek and Kimko (2000) does not attempt to use alternative formulations of modeling application, but rather they concentrate on constructing new measures of labor-force quality and student cognitive performance. These two factors were found to be necessary for growth.

6 A total of 24 factors are introduced to measure human capital by the OECD in 2001 on "The Well-being of Nations: The Role of Human and Social Capital."

for primary school compared to high school enrollment on the economic growth in Pakistan.

4. METHODOLOGY

The impact of human capital investment on the economic growth in Saudi Arabia during 1971-2014 has been evaluated by utilizing qualitative and quantitative method. Augmented Dickey-Fuller (ADF) unit root tests was applied to test the data properties and their stationarity. The existence of long-run relationship between the series of variable was evaluated. Vector ECM (VECM) was established to identify short-run relationship and error correction term (ECT). Granger causality was applied to examine the evidence of a bidirectional causal relationship between investment on health and economic growth. Figure 1 has elaborated the procedure graphically below. Furthermore, the study has evaluated the impact of human capital investment on the economic growth by applying regression analysis using SPSS version 20 and Eviews.

4.1. Empirical Model

In this section, ECM is applied to examine the causal relationship between investment in human capital and economic growth. Income (GDP) per capita has been used⁷ to measure the economic growth. For human capital investment, two proxies have been used, which includes education as measured by government expenditure on education (formal and literacy) and health as measured by government spending on health. As both human and physical capitals directly affect the productive capacity of the economy, gross fixed capital formation is induced in the model, as a proxy for physical capital. The time series data for all variables during the period 1971-2014 was attained from official national statistics, published by the Saudi Arabian Monetary Agency. Adopting error correction mechanism in examining the relationship between investment in human capital and GDP growth involves three main steps. First, determining the integration order by using ADF unit root test, second, running co-integration test, Third and last, investigating the long-run and short-run causality relationship.

4.1.1. Model specification

The model equations' variables were converted to the logarithmic form, as followed:

$$LG_t = \alpha_1 + \beta_1 LE_t + \delta_1 LH_t + \gamma_1 LF_t + \varepsilon_{t1} \quad (1)$$

$$LE_t = \alpha_2 + \phi_2 LG_t + \delta_2 LH_t + \gamma_2 LF_t + \varepsilon_{t2} \quad (2)$$

$$LH_t = \alpha_3 + \phi_3 LG_t + \beta_3 LE_t + \gamma_3 LF_t + \varepsilon_{t3} \quad (3)$$

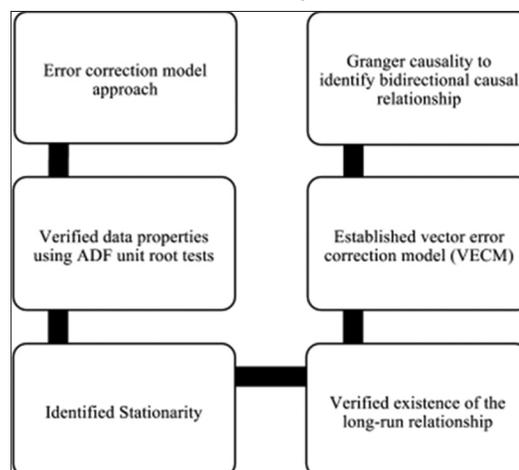
$$LF_t = \alpha_4 + \phi_4 LG_t + \beta_4 LE_t + \delta_4 LH_t + \varepsilon_{t4} \quad (4)$$

Where, t

LG = Per capita gross domestic product,

⁷ as; it enables to expand the country's output at a faster rate than its population growth rate.

Figure 1: Procedure to evaluate the impact of human capital investment on the economic growth in Saudi Arabia



LE = Expenditures on education,

LH = Expenditures on health,

LF = Gross fixed capital formation,

$\alpha, \beta, \delta, \gamma, \phi$ = Variables parameters,

ε = Random disturbance term.

4.1.2. Unit root test

To examine the above-mentioned relationship, the first and most important phase to run a non-spurious regression, detecting the non-stationary variables has been carried out⁸. Data series was examined for the existence of possible unit roots to detect the integration order of the model variables. ADF, initially formulated by Dickey and Fuller (1979; 1981), unit root test was obtained to check data stationarity⁹. Since the absolute value of ADF statistic at level is lower than the critical value; the four variables have a unit root (not stationary). But they became stationary after the first difference (with intercept, with intercept and trend, and without both), at 1% level of significance, as shown in Figure 1. When the first difference was taken, the unit root was eliminated, as shown in Table 1. Thus, the first difference series, can be directly used for the time series econometric modeling (co-integration regression).

4.1.3. Co-integration

Using the methodology developed in Johansen (1991) enables to run the vector auto-regression (VAR) model based on co-integration test.

⁸ Generally, non-stationary of explanatory variables due to the presence of unit roots lead to spurious regression and misleading results. In spurious regression, a high value of R and a lower value of Durbin-Watson statistics are likely to be found.

⁹ A series is thought to be stationary when the mean and autocovariance of the considered series do not depend on time. If time series are not stationary (non-stationary), the assumptions for the asymptotic analysis of Engle/Granger causality test will not be useable.

Table 1: Results of ADF unit root

Variables	At level			First difference		
	Intercept/no trend	Intercept/trend	No intercept/no trend	Intercept/no trend	Intercept/trend	No intercept/no trend
LG	-3.041565 (0.0391)	-3.229640 (0.0926)	1.260463 (0.9448)	-4.916098 (0.0002)	-4.977586 (0.0012)	-4.653409 (0.0000)
LE	-4.999500 (0.0002)	-6.286305 (0.0000)	3.412827 (0.9997)	-8.328533 (0.0000)	-9.444136 (0.0000)	-6.068577 (0.0000)
LH	-0.269377 (0.9198)	-3.324266 (0.0789)	2.834116 (0.9984)	-3.883322 (0.0049)	-5.703891 (0.0002)	-2.953072 (0.0042)
LF	-2.027583 (0.2744)	-2.484096 (0.3340)	2.174728 (0.9919)	-8.588125 (0.0000)	-8.590756 (0.0000)	-7.821291 (0.0000)

Results of Johansen co-integration test				
Hypothesized number of CE (s)	Trace statistic	0.05 critical value	Max-Eigen statistic	0.05 critical value
None	182.5321	47.85613	139.9088	27.58434
At most 1	42.62323	29.79707	34.71728	21.13162
At most 2	7.905945	15.49471	7.014212	14.26460
At most 3	0.891734	3.841466	0.891734	3.841466

ADF: Augmented Dickey-Fuller

$$\begin{aligned} \Delta LG_t &= \alpha_1 + \phi_1 LG_{t-1} + \beta_1 LE_{t-1} + \delta_1 LH_{t-1} \\ &+ \gamma_1 LF_{t-1} + \omega_1 \sum_{i=1}^p \Delta LG_{t-i} + \phi_1 \sum_{i=0}^p \Delta LE_{t-i} \\ &+ \theta_1 \sum_{i=0}^p \Delta LH + \psi_1 \sum_{i=0}^p \Delta LF_{t-i} + U_{t1} \end{aligned} \tag{5}$$

$$\begin{aligned} \Delta LE_t &= \alpha_2 + \phi_2 LG_{t-1} + \beta_2 LE_{t-1} + \delta_2 LH_{t-1} \\ &+ \gamma_2 LF_{t-1} + \omega_2 \sum_{i=0}^p \Delta LG_{t-i} + \phi_2 \sum_{i=1}^p \Delta LE_{t-i} \\ &+ \theta_2 \sum_{i=0}^p \Delta LH + \psi_2 \sum_{i=0}^p \Delta LF_{t-i} + U_{t1} \end{aligned} \tag{6}$$

$$\begin{aligned} \Delta LH_t &= \alpha_3 + \phi_3 LG_{t-1} + \beta_3 LE_{t-1} + \delta_3 LH_{t-1} \\ &+ \gamma_3 LF_{t-1} + \omega_3 \sum_{i=0}^p \Delta LG_{t-i} + \phi_3 \sum_{i=0}^p \Delta LE_{t-i} \\ &+ \theta_3 \sum_{i=1}^p \Delta LH + \psi_3 \sum_{i=0}^p \Delta LF_{t-i} + U_{t1} \end{aligned} \tag{7}$$

$$\begin{aligned} \Delta LF_t &= \alpha_4 + \phi_4 LG_{t-1} + \beta_4 LE_{t-1} + \delta_4 LH_{t-1} \\ &+ \gamma_4 LF_{t-1} + \omega_4 \sum_{i=0}^p \Delta LG_{t-i} + \phi_4 \sum_{i=0}^p \Delta LE_{t-i} \\ &+ \theta_4 \sum_{i=0}^p \Delta LH + \psi_4 \sum_{i=1}^p \Delta LF_{t-i} + U_{t1} \end{aligned} \tag{8}$$

manner. To do that, several selection information criteria can be used¹⁰. In this study, Akaike information criterion (AIC) has been selected. The criterion specified optimal lag length at P = 2 (2nd order) of the VAR model subjected to co-integration restrictions. The two suggested tests find out the number of co-integration vectors the included the trace and maximal Eigen value statistics applied. According to the results in Table 2, both trace test and max-Eigen value test yield two co integrating equations at the 0.05 level.

4.1.4. ECM and causality test

As series are known to be co-integrated confirming two co-integration vectors, hence a long-run equilibrium relationship existed between investment on education, health, fixed capital formation and per capita GDP. Granger causality test and the VECM can be carried out at this stage. ECT is demonstrated as shown in the following equations:

$$\begin{aligned} \Delta LG_t &= \alpha_{11} + \omega_{11} \sum_{i=1}^p \Delta LG_{t-i} + \phi_{11} \sum_{i=0}^p \Delta LE_{t-i} \\ &+ \theta_{11} \sum_{i=0}^p \Delta LH + \psi_{11} \sum_{i=0}^p \Delta LF_{t-i} + \eta_1 ECT_{t-1} + \mu_{t1} \end{aligned} \tag{9}$$

$$\begin{aligned} \Delta LE_t &= \alpha_{22} + \omega_{22} \sum_{i=0}^p \Delta LG_{t-i} + \phi_{22} \sum_{i=1}^p \Delta LE_{t-i} \\ &+ \theta_{22} \sum_{i=0}^p \Delta LH + \psi_{22} \sum_{i=0}^p \Delta LF_{t-i} + \eta_2 ECT_{t-1} + \mu_{t2} \end{aligned} \tag{10}$$

As Johansen (1991) approach is quite sensitive to the lag length, the suitable number of lag should be determined in a systematic

10 Such as, AIC; Hannan-Quinn criterion; Schwartz Information criterion; mean absolute error; and final prediction error criterion.

$$\Delta LH_t = \alpha_{33} + \omega_{33} \sum_{i=0}^p \Delta LG_{t-i} + \phi_{33} \sum_{i=1}^p \Delta LE_{t-i} + \theta_{33} \sum_{i=0}^p \Delta LH + \psi_{33} \sum_{i=0}^p \Delta LF_{t-i} + \eta_3 ECT_{t-1} + \mu_{t3} \tag{11}$$

$$\Delta LF_t = \alpha_{44} + \omega_{44} \sum_{i=0}^p \Delta LG_{t-i} + \phi_{44} \sum_{i=0}^p \Delta LE_{t-i} + \theta_{44} \sum_{i=0}^p \Delta LH + \psi_{44} \sum_{i=1}^p \Delta LF_{t-i} + \eta_4 ECT_{t-1} + \mu_{t4} \tag{12}$$

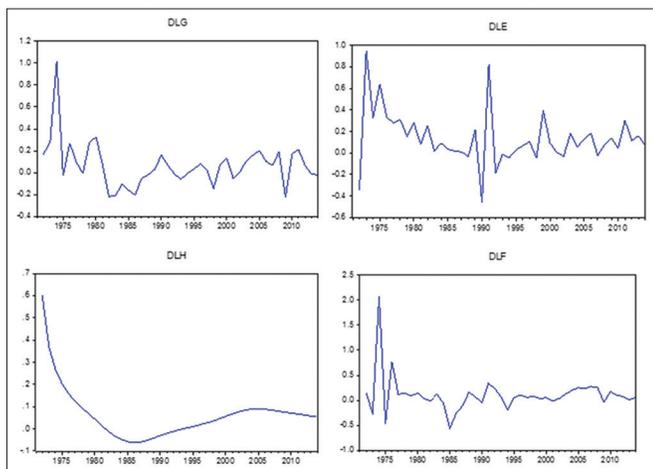
The VECM estimated results based on the baseline co-integrated model indicated that ECT found to be significant, insuring the existence of a long-run equilibrium between variables. The speed of adjustment toward long-run equilibrium is about 0.36, meaning that 36% of the preceding period's disequilibrium, which was

Table 2: VECM

Variable	Coefficient	SE	t-statistics
ECT (-1)	0.357814	0.28237	1.26717
D(LG (-1))	0.347045	0.23294	1.48985
D(LG (-2))	-0.082946	0.26186	-0.31676
D(LE (-1))	0.058258	0.14532	0.40089
D(LE (-2))	-0.076091	0.13811	-0.55095
D(LH (-1))	-0.006703	1.56358	-0.00429
D(LH (-2))	1.138702	1.09112	1.04361
D(LF (-1))	-0.310955	0.14190	-2.19142
D(LF (-2))	-0.032024	0.12562	-0.25493
C	0.006245	0.03879	0.16099
R ²	0.694832	F-statistic	6.830653
Adjusted R ²	0.593109	P (F-statistic)	0.000019
SE of regression	0.130960	Mean dependent variable	0.058040
Sum squared residual	0.514519	SD dependent variable	0.205306
Log likelihood	31.57447	Durbin-Watson statistics	1.692399

SE: Standard error, SD: Standard deviation, VECM: Vector error correction models, ECT: Error correction term

Figure 2: Variables conversion to stationary



Source: E-views results.

corrected by the system in the current period. In the same way, 36% of the previous year's GDP disequilibrium in the long-run will be eliminated each year. The ECT is insignificant neither the education nor in fixed capital formation equations. In the health equation, the coefficient on the ECT (-1) is 0.019, indicating that 1.9% of adjustment is needed in the long-run (Table 3).

When long-run co-integration between variables is confirmed, Engle and Granger (1987) suggested that the existed causal association must be either in one direction (unidirectional causality) or both directions (bidirectional causality). At this point, causality test can be employed, noting that the standard causality test is more suitable for the stationary series¹¹. Alternatively, Granger causality/block exogeneity Wald test has been employed based on VECM to determine the causality directions.

Table 4 displayed Chi-squared statistics for the joint significance of the model explanatory variables. As shown, there is no causality association between expenditure on education and GDP growth, but between education expenditure and health. Unidirectional causality has been found from fixed capital formation and GDP, and from health expenditure to capital formation. The relationship between health expenditure and GDP seems to be the only bidirectional causality in the model.

The short-run causal relationships are conducted using the Wald test, from which the results suggested that LH and LF are the Granger causality of the LG in the short-run. This stated that in the short-run per capita GDP will be affected by health expenditure and fixed capital formation. While, insignificant coefficient of education expenditure (LE) indicated that investment on education does not influence economic growth in the short-run. Additionally, LG and LE are the Granger causality for health expenditure (LH), which is, in turn, Granger causality for capital formation (LF) in the short-run. In comparison with physical capital (fixed capital formation), investment in human capital (expenditure on education and expenditure on health) jointly have a higher significant impact on economic growth (per capita GDP).

The results in Table 5 have shown the Pearson correlation between gross national product (GNP) and expenditure on education. The relationship between GNP and expenditure on education is highly and positive correlated. The results also predicted that this relationship is statistically significant at 5% level of significance (0.000 < 0.05, n = 44). The results have shown correlation between GNP and expenditure on health. The relationship between GNP and expenditure on health illustrated to be highly and positive correlated. With the P = 0.000, the results predicted to be statistically significant at 5% level of significance.

Pearson correlation test has also been applied among GNP and fixed capital formation. The Pearson correlation coefficient has determined that the relationship between GNP and fixed capital

¹¹ Test the degree of causality among two variables, determining whether the endogenous variable can be treated as an exogenous variable or not. Meanwhile, the block exogeneity causality in VECM eliminates the influence of all other endogenous variables other than the lag of the considered dependent variable.

Table 3: VEC Granger causality/block exogeneity Wald tests

Dependent variable ΔLG		Dependent variable ΔLE		Dependent variable ΔLH		Dependent variable ΔLF	
Variables	Chi-square	Variables	Chi-square	Variables	Chi-square	Variables	Chi-square
ΔLE	1.008329 (0.6040)	ΔLG	3.039807 (0.1287)	ΔLG	7.503035 (0.0235)	ΔLG	1.281570 (0.5269)
ΔLH	7.189892 (0.0275)	ΔLH	1.878448 (0.3909)	ΔLE	9.355696 (0.0093)	ΔLE	0.497867 (0.7796)
ΔLF	6.236271 (0.0442)	ΔLF	0.693535 (0.7070)	ΔLF	2.247113 (0.3251)	ΔLH	41.95792 (0.0000)
ALL	49.70004 (0.0000)	ALL	17.45153 (0.0078)	ALL	21.23711 (0.0017)	ALL	104.7129 (0.0000)

Pearson correlation tests	
Correlation between GDP and expenditure on education	0.897
Correlation between GDP and expenditure on health	0.913
Correlation between GDP and fixed capital formation	0.858

GDP: Gross domestic product, VEC: Vector error correction

Table 4: Regression analysis

Variables	Coefficient	SE	t-statistic	P
GNP and expenditure on education	314998.3	38136.95	8.259661	0.0000
GNP and expenditure on health	365518.6	32633.37	11.20076	0.0000
GNP and fixed capital formation	329389.4	44438.93	7.412181	0.0000

GNP: Gross national product, SE: Standard error

formation, which was positively correlated. The results have also stated that this relationship is statistically significant with the P value (0.000) at 5% level of significance.

The results for regression analysis have shown the dependency of education expenditure on GNP. The coefficient of determination (R^2) has determined the total variation by the education expenditure in the GNP. A total of 80.5% variation is indicated by the expenditure on education in the total variation of GNP, which is assumed to be large. The results also indicated that results are statistically significant with P value (0.000) at 5% level of significance. It means that GNP of Saudi Arabia can be increased with an increase in expenditure on education.

The regression analysis between GNP and health expenditure has also been evaluated. The results have indicated that these two variables are statistically significant with P value (0.000) at 5% level of significance. However, the total variation in the GNP has been explained by the health expenditure. The coefficient of determination has indicated that 83.4% variation is explained by health expenditure on GNP. It can be determined that, with the increase in health expenditure GNP also increases.

The results for regression analysis have shown the dependency of fixed capital formation on GNP. The coefficient of determination (R^2) has determined the total variation by the fixed capital formation in the GNP. A total of 73.6% variation is indicated by the fixed capital formation in the total variation of GNP, which is assumed to be large. The results were statistically significant with P value (0.000) at 5% level of significance. It means that GNP of Saudi Arabia can be increased with an increase in fixed capital formation. The results have also shown the results obtained by applying the regression analysis through Eviews, taking dependent variable "GNP", and independent variables

expenditure on education, expenditure on health and fixed capital income formation respectively. The results of all three variables are same as the regression applied on SPSS. The results for all three independent variable taking "GNP" as dependent variable are found to be statistically significant.

5. DISCUSSION

In the present study, expenditure on health and education has been considered as the core proxy for investment in human capital. Physical capital has been employed in empirical studies with a comparison of human capital and associated impact on the economic growth¹². Even though the impact of human capital on economic growth is the targeted subject; whereas, physical capital, and economic growth relationship are also noteworthy. The causal relationship between human capital and GDP in Bangladesh for the period 1990-2009 has been studied by Rahman (2011), which included the real gross fixed capital formation in the proposed empirical model. A significant stable long-run relationship existed between all variables according to the results. It has been mentioned that including human capital investment in the growth model of Bangladesh improved the significance of physical capital coefficients. Imran et al. (2012) reported that physical capital did not contribute to economic growth in Pakistan because the human capital was not supported as required. Total productivity relies on the effective interaction of human and physical capitals. Hussin et al. (2012) revealed that fixed capital formation (physical capital) has a positive relationship with GDP. Examining a panel set of data for the period 1970-2010 of 13 developed and 11 developing countries, Akpolat (2014) realized that investment in physical capital and education are more efficient to increase

12 Rahman (2011), Imran et al. (2012), Hussin et al. (2012), Akpolat (2014), Khan et al. (2015) and many others.

GDP in the developed countries as compared to the developing countries. The direction of causal relationship between physical capital and economic growth has been embraced in the causality analysis implemented by Khan et al. (2015). While investigating human capital and economic growth nexus, the result indicated the importance of physical capital as a factor of production in the economic growth of Pakistan.

Concerning the Granger causality relationship, empirical studies fall short of providing the consensus results. Several studies could not confirm the influence of human capital on economic growth. Amassoma and Nwosa (2011) found no causality between human capital development and economic growth in Nigeria. Khan et al. (2015) stated that there were no long-run or short-run causal relation between health and economic growth in Pakistan during the period 1971-2012. Hassan and Kalim (2012) suggested that no causality found between per capita health expenditure and capita GDP in the short-run, but it exists on the long-run. Jihène (2013) found no significant relationship between human capital and economic growth in Morocco and Tunisia, while a significant relation existed in case of Japan and Korea.

Unlike previous studies, a unidirectional causal relationship has been identified in several studies, either from human capital to growth or from growth to human capital. Mehrara and Musai (2011) indicated a unidirectional causal impact from GDP to health expenditure while they have no supported evidence that health expenditure can promote long-run economic growth in Iran. In a later study, Mehrara and Musai (2013) found a strong causality from economic growth to education. Education does not have any significant impact on economic growth in short- or long-run. In Greece, Solaki (2013) suggested a positive relationship between education and economic growth in the period 1961-2006. The results mentioned a unidirectional causality running from tertiary education and public expenditure on education to real per capita GDP. Secondary education seems to be oppositely directed referring to the influence from real per capita GDP to secondary education. However, Elmi and Sadeghi (2012) confirmed a unidirectional short-run causality from GDP to health care spending; however, in the long-run, bidirectional relationship has been found between health care spending and economic growth.

Briefly, according to the previous empirical studies' reviewed in the present study showed that the impact of investment in human capital on economic growth is still arguable. While some might have declared that it has the significant effect, others fail to prove this. The casual direction of the relationship between factors included as human capital and economic growth have also been observed arguable. Consequently, the present study has evaluated the long-run and short-run causal relationships between investment in human capital (namely education and health) and Saudi Arabian economic growth have been attempted.

6. CONCLUSION

In the attempt to investigate the impact of human capital investment on economic growth in Saudi Arabia during 1971-2014, the ECM approach has been employed. Data properties were examined to

verify their stationarity using ADF unit root tests, which indicated that variables tested stationary at first order. Johansen (1991) co-integration was confirmed, which clarified the existence of the long-run relationship between the four variables' series. Afterward, VECM was established to identify short-run relationship and ECT. Expenditure on education and fixed capital formation have found to be with non-significant impact on GDP. However, expenditure on health was observed strongly correlated with per capita GDP in the long-run and short-run. Granger causality found evidence of a bidirectional causal relationship between investment on health and economic growth. It has shown a unidirectional causality from investment in health to investment in education and from physical capital to economic growth. However, it is pertinent to pinpoint that investment in human capital (expenditure on education and expenditure on health) jointly have a higher significant impact on economic growth (per capita GDP) than investment in physical capital (fixed capital formation). These results proved that the massive investments in education fail to generate productivity and growth in Saudi Arabia, but investment in health and physical capital significantly contribute to economic growth.

7. RECOMMENDATIONS

The desirable policy which government needs to estimate, can be through reforming its educational system to become more market oriented. Increasing the quality and quantity of skills, innovations, R and D and entrepreneurship are needed to shift human capital towards the required participation in the real labor market, leading to higher and sustainable economic growth.

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