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Higher Education, Real Income and Real Investment in the Selected OIC Members: Evidence from ARDL and Panel Data Approaches

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Abstract

Higher education, through increasing the human capital stock of individuals, improves productivity and therefore contributes to economic growth. From economic point of view, this type of expenditure is considered as a long-run investment which increases growth rate and forms a higher capacity of human capacity. The implication is that a dynamic relationship between growth rates of education, income and investment can be implemented in a specific time path.

This paper employs ARDL and Panel Data modeling to test the causal relationship between real income, real investment and human capital using data for the 16 selected OIC members over the period 1980-2005. The empirical results approve a long-run effect of human and physical investments. The results also imply a crucial rate of human capital which will play in the future developments of the OIC countries.

Key words: Higher Education, Real Income, Real Investment, OIC, Co-integration Approach.

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1- Introduction

The main engine of growth is the accumulation of human capital – of knowledge – and the main source of differences in living standards among nations is differences in human capital. Physical capital plays an essential but decidedly subsidiary role (Lucas 1993).

The growth literature suggests that education human capital has a positive impact on the growth rate of income. But it is not clear what level of education human capital is positively related to the growth rate of income. Some researchers stress the importance of research and development (hence higher education) as the source of growth (for example, Hall and Jones, 1999; Romer, 1990; Nelson and Phelps, 1966), others argue that primary education is the major source of economic growth, at least in Less Developed Countries (LDCs) (Petrakis and Stamatakis, 2002; McMahon, 2002). If educational attainment in countries increases with the level of income, it will not be surprising that higher education becomes more important for the growth process as income level increases, since countries have access to financial resources to increase both higher and lower levels of education.

While investment in physical capital is a source of observed differences in cross-country income growth rates, there could be other equally important sources. Among these are differences in endowments of human capital. Human capital, broadly defined, has several aspects, including education, training, and health. This paper explores the growth effects of one aspect of human capital, proxied by the number of enrolments in education.

One of the many ways to evaluate the social impact of human capital is to estimate its impact on the growth rate of income per capita. We focus on the growth impact of higher education without getting into the debate about the relative importance of primary and higher education in the growth process. Thus, this paper investigates the long-run and short-run effects of human capital on the growth rate of income per capita in the select OIC members during the period 1980–2005. We do so by estimating an expanded neoclassical growth equation with the variable of higher education enrolnments standing for human capital.

The rest of the paper is organized as follows: Section 2 provides a brief review of previous studies that are pertinent to this paper. Section 3 specifies an economic growth model in forms of the single time series equations for each of 16 countries, and panel data for all counties. The resources of data are referred in this section. Section 4 represents empirical results which are related to both time series and panel data procedures. Section 5 concludes the paper.

2- Review of Literature

The importance of human capital generally, and of education in particular in growth theory was emphasized only in the 1980s and 1990s by endogenous growth models and the expanded neoclassical growth model of Mankiw, Romer and Weil (1992), MRW. The expanded neoclassical growth model considers human capital as a new explanatory variable; hence countries that have faster growth rate of education will have faster transition growth rates and higher incomes. Endogenous growth models see education as a process that changes the production technology itself (Romer 1990 and 1993; Aghion and Howitt 1998; Nelson and Phelps (1966), makes it easier to adapt foreign technology (Barro 1999 and 1997; Barro and Sala-i-Martin 1995[11]; Sala-i-Martin 1997; Hall and Jones 1999), or facilitate resource transfer to the most technologically dynamic sector of the economy (Kim and Kim, 2000; Schiff and Wang, 2004). In the endogenous growth literature, education is seen as subject to increasing returns so it could overcome the growth reducing effect of diminishing returns to physical capital (Romer 1986; Lucas 1988). It appears that in either endogenous or expanded neoclassical growth model, education should have a positive effect on the growth rate of income. However, it is possible that a minimum level of education is required in order for education to have any measurable growth impact (Azariadis and Drazen 1990; Rebelo 1991).

Armer and Liu (1993) examined annual data for Taiwan from 1953 to 1985, and used an empirical model to look at human capital and schooling. Human capital was measured in their study as the number of people in a population who have completed different levels of schooling. They found that only primary and junior high school educations had strong positive effects on economic growth.

Lau et al. (1993) employed cross-state data from Brazil in 1970 and 1980. Human capital was measured as the average number of years of formal education per person in the labor force. They concluded that average education has a large, positive, and significant effect on real output. However, Benhabib and Spiegel (1994) concludes that education has no direct effect on economic growth; but it positively affects economic growth indirectly through technical progress. Some researchers find a positive and statistically significant relationship between male education and income growth, but not for female education (Barro, 1997, 1999; Barro and Sala-i-Martin, 1995; Sala-i-Martin, 1997; Caselli et al., 1996). Artadi and Sala-i-Martin (2003) finds a positive relationship between school enrolment rates and growth rate of GDP per capita in African countries.

Lee, Liu, and Wang (1994) investigated the role of human capital in economic growth as measured by education attainment in South Korea and Taiwan. Employing annual data from these two countries, they showed that technical progress played a key role in Korea's economic development, while Taiwan's economic growth relied heavily on human capital enhancement.

Tallman and Wang (1994) also used annual data from Taiwan for 1965–1989. They incorporated human capital proxies and labor to form an effective labor input. The human capital in their empirical model was measured by the number of people in a population who had completed different levels of schooling. The performance of the growth model in Taiwan is improved by combining a labor quality index into labor input. McMahon (1998) employed cross-country panel data from East Asia. Human capital in his model was measured by gross enrollment rates. His results revealed that secondary and higher education expenditures were more significant in the event of primary enrollments.

Betherlemy et al. (2000) find that 40 per cent of educated human capital in a sample of African countries is devoted to rent seeking activities and this reduces income growth rate by 0.9 percentage points annually. Rogers (2003) finds similar results for rent seeking activities and emigration. This suggests that the growth impact of education partly depends on the proportion of educated people who are productively employed. Pissarides (2000) argues that the growth effect of higher education depends on the growth-enhancing quality of education as well as the efficiency with which labor markets allocate skilled labor to productive activities.

Finally, Lin (2003) investigated the effect of education and the role of technical progress on economic growth in Taiwan over the period 1965–2000. He found that education had a positive and significant effect on growth, but the role of technical progress did not appear to be extraordinarily important to growth. In his study, the effect of education on growth is an overall effect.

3- The Model

As discussed in the previous section, the related literature emphasizes on the significant effect of education on economic growth. The approach we use to investigate the effect of higher education on income growth in the selected OIC member countries is to estimate an augmented neoclassical growth equation of the MRW type that use the higher education enrolments. There are several reasons why education would have positive effects on growth. In endogenous growth models, education can affect economic growth through technical progress either developed domestically or through importation and adaptation of foreign technology to local conditions.

Greiner and Semmler (2002) find that there are positive externalities in physical capital investment only when human capital is available and this explains why some developing countries demonstrate convergence while others do not. Education is also likely to increase the efficiency with which other inputs are used, hence contributing to increases in total factor productivity (TFT). Hall and Jones (1999) claim that technical progress is not likely to be dependent on primary education, but rather on higher education. Higher Education is also likely to improve the quality and quantity of other inputs as well as improve the institutional environment in which growth takes place. For example, higher education improves health and physical capital formation.

Based on the foregoing, now we postulate the aggregate production function, expressed in per capita terms (*Y*), which would be a function of *K* (physical capital) and *H* (human capital). Formally, the production function is written as:

$$Y = aK^{\alpha} H^{\beta} \qquad (1)$$

Taking the natural log of the production function and differentiating the resulting expression with respect to time gives us the growth rate of per capita output as:

$$y = \alpha + \beta k + \gamma h \tag{2}$$

Where *y*, *α; k*; *h* are the growth rates of output, technology, physical and human capital, respectively. Human capital has several dimensions. Based on the discussion above, the variant of the MRW growth equation we estimate is defined as:

$$Lny = \alpha_0 + \alpha_1 Lnh + \alpha_2 Lngeh + \alpha_3 Lnle + \alpha_4 LnI + \varepsilon_t \tag{3}$$

where *y* is the real GDP per capita (in constant 1995 US$), *h* is human capital, which is proxied by an annual growth rate of enrolments of the university students, *Geh* is an annual growth rate of government expenditures on education, *le* is the annual growth rate of life expectancy, and finally *I* is the annual growth rate of gross fixed capital formation.

3-1- Empirical Specifications and Estimation Methods

To obtain the appropriate results for the determination of the relationship between higher education and economic growth in our sampling, we here develop the model shown in (3) in the light of two different approaches: 1) ARDL time series method, and 2) panel data framework.

The first method is applied for estimating 16 regressions separately regarding the selected countries. Thus, the re-specification of the model is defined as,

$$\ln y_t^k = \alpha_0 + \alpha_1 \ln h_t^k + \alpha_2 \ln geh_t^k + \alpha_3 \ln le_t^k + \alpha_4 \ln I_t^k + \varepsilon_t^k \tag{4}$$

Where k is an uppercase used for country (k= 1, …, 16), and t points out the considered time.

ARDL is an appropriate method suggested to analyze the long-term and short-term relationships between variables. This method estimates long-run and short-run variable relations simultaneously, while removes problems of missed variables and autocorrelation in structural models. An augmented ARDL model is shown as follows:

$$\alpha(L,P)y_t = \alpha_0 + \sum_{i=1}^{k} \beta_i (L, q_i) x_{it} + u_t, \qquad i = 1,2,....k \tag{5}$$

where α_0, y_t and L denote intercept, dependent variable and lag operator, respectively (that is, $L^j y_t = y_{t-j}$).

Accordingly, the relevant method is used to test the existence of the long-run relationship between considered variables. The test is done by the cointegration technique focusing on the following hypotheses:

$$H_0 : \sum_{i=1}^{m} \beta_i - 1 \geq 0$$

$$H_1 : \sum_{i=1}^{m} \beta_i - 1 < 0$$

These hypotheses are tested by the following t statistic developed by Banerjee, Dolado and Master (1998):

$$t = \frac{\sum_{i=1}^{m} \hat{\beta}_i - 1}{\sum_{i=1}^{m} S_{\hat{\beta}_i}} \tag{6}$$

Where $\hat{\beta}_i$ and S_{β_i} are the coefficient and their standard errors of the lagged dependent variables, respectively.

Also for the survey of the short-run relationship between variables, Equation (7) displays an error correction model (ECM) as follows,

$$\Delta \ln y_t^k = a_{0y} + \sum_{i=1}^{n} b_{iy} \Delta \ln y_{t-i}^k + \sum_{i=0}^{n} c_{iy} \Delta \ln h_{t-i}^k + \sum_{i=0}^{n} d_{iy} \Delta \ln I_{t-i}^k + \sum_{i=0}^{n} e_{iy} \Delta \ln geh_{t-i}^k + \sum_{i=0}^{n} f_{iy} \Delta \ln le_{t-i}^k + \sigma_{1y} \ln y_{t-1}^k + \sigma_{2y} \ln h_{t-2}^k + \sigma_{3y} \ln I_{t-3}^k + \sigma_{4y} \ln geh_{t-4}^k + \sigma_{5y} \ln le_{t-5}^k + \varepsilon_{1t} \quad (7)$$

Where Δ is the first difference operator?

The second method relies on a panel specification in which a single model is formulated totally for the economic growth of all cross-sectional countries over the period 1980-2005. The advantage of this method is that we are able to consider the heterogeneity of the economic, social and cultural structures of the selected countries. The related effects should be embodied by the fixed or random effects, provided by the relevant Hausman test. One of the solutions to control for heterogeneity is the panel data procedure, which allows the intercepts of the growth model to be specific to each country (Cheng and Wall, 1999). The growth model using panel data is as follows:

$$\ln y_{it} = \alpha_0 + \alpha_i + \alpha_t + \beta_1 \ln h_{it} + \beta_2 \ln geh_{it} + \beta_3 \ln le_{it} + \beta_4 \ln I_{it} + \varepsilon_{it} \quad (8)$$

In this model the intercept contains three parts; the first, $\alpha_{0,}$ is the same for all years and countries, and the second, α_i refers to specific countries, but is the same for all years, which is allowed to be different across partner pairs, namely $\alpha_{ij} \neq \alpha_{ji}$. While $\alpha_{t,}$ becomes specific to year t but the same to all countries (that is, year fixed effect. The estimation results obtained by OLS, therefore, show serious problems of biasness due to the restriction that country intercept terms equal zero (or $\alpha_{ij} = \alpha$). Furthermore, if α_t is used in the model, panel data will convert to 'two way panel data', otherwise we will have 'one way panel data'. Under the method of two way panel data, α_t is present in the regression model that stands for the time effect, whereas it is not included in a regression estimated by the one way panel data method (Baltagi, 2005).

The panel data procedure consists of three estimation sets. The first set, 'between groups' (BG) estimates, captures differences between individuals, but ignores any information within them. It is usually used to estimate long-run coefficients (Martinez-Zarzoso and Nowak-Lehmann, 2001). In the second set, ‘fixed effects’ (FE) estimates, it is assumed that the slope of the growth equation is the same for all countries, but there are specific intercepts for each of them (individual effects) which would be correlated or uncorrelated with explanatory variables. The third estimation set (or the variance components method) relies on ‘random effects’ (RE) estimates in which there exist intercepts, affiliating the same distribution function with average α and variance $\delta^2\alpha$, that are uncorrelated with the explanatory variables. Since individual effects (α_i) are included in the regressions, we have to decide whether they are treated effectively as fixed or random effects. In order to distinguish between the FE and RE method, we investigate through the Hausman Test for the null hypothesis that the explanatory variables and individual effects are uncorrelated. The fixed effects estimates are consistent with both the null and alternative hypotheses, whereas the random effects estimates are only compatible with the null hypothesis. Therefore, the RE method is preferred if the null hypothesis holds, otherwise the FE method will be applicable (Hsiao, 2003).

All required Data of countries during 1980-2004 for GDP, gross fixed capital, higher education (university student enrolments), government expenditures on higher education and life expectancy are from the World Bank (www.worldbank.org), WTO (www.wto.org), and Nations- Master (www.nationmaster.com) and united nation statistics division (www.unstate.un.org).

5. Empirical Results

5.1. Results obtained by the ARDL Method

The model specified in (4), which is on ARDL – based, is estimated for each of the 16 selected OIC member country, using their relevant time series data over 1980-2005. Following MRW (1992), each country regression includes the natural log of GDP which is a function the natural log of government expenditures on education (*LnGeh*), the natural log of private investment (*LnI*), the natural log of higher education level enrolments (*LnH*) and the natural log of life expectancy (*LnLe*). Table 1 reports the long-run ARDL results on the elasticity coefficient for growth of all sampling OIC members, which are estimated by the Microfit Package[1]. Overall, the results obtained seem to be quite reliable.

Table 1: the ARDL results for the long-run elasticity coefficients of the selected OIC countries growth

Country/elasticity	*LnH*	*LnGeh*	*LnI*	*LnLe*
Benin	.57069 (2.5054)*	.12268 (2.2477)*	.15028 (2.1937)*	-1.2803 (-2.78912)*
Burkina Faso	.24205 (5.9821)**	.040839 (3.1874)**	.24880 (4.1830)**	-1.4574 (-2.8104)*
Egypt	.15373 (2.1415)*	.022343 (3.3363)**	.19788 (6.8248)**	2.5694 (3.0920)**
Indonesia	.38179 (3.1350)**	.060257 (4.9723)**	.41141 (5.0835)**	.072686 (2.0708)*
Iran	.27129 (4.4098)**	.16355 (2.9246)**	.19431 (5.8722)**	1.2906 (2.6113)*
Jordan	.65337 (3.7504)**	.33742 (2.7572)*	.037488 (2.3348)*	4.0261 (2.1838)*
Kuwait	.46792 (3.0126)**	.90626 (2.2202)*	.28151 (2.7776)*	1.0136 (3.4097)**
Malaysia	.022856 (3.1671)**	.057930 (2.3122)*	.55926 (2.6794)*	6.3953 (2.0460)*
Mali	.17149 (2.9899)**	.20327 (2.3911)*	.17576 (3.8040)**	-1.9076 (-2.4231)*
Mauritania	.062182 (2.9849)**	.059731 (2.2158)*	.11581 (3.4680)**	-6.4430 (-12.9749)*
Morocco	.18234 (2.9378) **	.083906 (2.8043)**	.31598 (3.2672)**	1.5177 (2.8168)**
Saudi Arabia	.43292 (2.6819)*	1.9327 (2.6110)*	2.4100 (3.5949)**	2.2670 (2.3059)*
Senegal	.017704 (3.2516)**	.14370 (2.4996)*	.39523 (5.9873)**	-.14785 (-2.4867)*
Tunisia	.19803 (2.9262)**	.35672 (4.0803)**	.11056 (3.8602)**	.089593 (2.2159)*
Turkey	.18591 (2.6692)*	.0023273 (3.0448)**	.084385 (2.7270)*	11.3305 (2.2200)*
United Arab emirates	.031408 (3.3588)**	.94038 (14.7528)**	.086988 (2.9108)**	.94782 (2.1909)*

-values in brackets stand for t-ratios
-*, ** indicate the 5% and 1% significant levels ,respectively.
-The optimum lags for the orders of ARDL have been selected by the Schwarz-Bayesian Critrion (SBC).
-The orders of ARDL for all countries are different, which are not reported here.

[1]- Values of the BDM (Banerjee, Dolado and Mester, 1992) statistics presented in table (A-1) in appendix confirm the ability of the ARDL regressions for estimation long-run elasticity coefficient of all countries.

The estimated higher education elasticity (coefficient of *LnH*) ranges from a minimum value for Senegal (0.0177) up to a maximum value for Jordan (0.653). Although inelastic, the higher education is highly significant for most countries, that is, a one percent increase in higher education (number of higher education enrolments) raises the growth rate by about 0.0177-0.653 in all countries. The estimated results for the government expenditures on education demonstrate the expected effect on the selected countries, growth, elasticity coefficients varies between 0.0023 (Turkey) - 1.93 (Saudi Arabia). It implies that the rate of growth in countries like Saudi Arabia, Kuwait and UAE is quite dependent of financial conditions of their own governments.

The private investment variable has the correct sign in all country regressions so that the significant coefficients approve the long-run relationships between private investment and economic growth. The relevant elasticity ranges from 0.0375 (Jordan) to 2.410 (Saudi Arabia). Except for poorer OIC members (such as Benin, Burkina Faso, Mali, Mauritania and Senegal), the effect of the life expectancy on the remaining OIC countries growth is also significant and positive, while Turkey and Malaysia has captured a higher value of the related elasticity during the estimation period. It implies the life expectancy, which is an education-based, has a positive effect on economic growth of most countries.

Finally, Table 2 reports short-run estimates of coefficient which are significant at the 5% and 1% levels. In principle, the error correction model (ECM) has provided such results which the estimated values are relatively smaller than those of the long-run period. In brief, they satisfy theoretical expectations.

Table 2: the ECM results for the short-run elasticity coefficients of the selected OIC countries growth

Country/elasticity	*LnH*	*LnGeh*	*LnI*	*LnLe*
Benin R-Squared=.91	.13326 (3.6671)**	.028647 (2.0965)*	.035090 (2.6794)*	-.29896 (-2.4973)*
Burkina Faso R-Squared=.53	.045799 (2.8016)**	.026941 (3.0736)**	.16413 (3.3869)**	-.21203 (-2.5413)*
Egypt R-Squared= .82	.0084462 (2.9194)**	.0020840 (3.3641)**	.16310 (5.9088)**	.23965 (4.1712)**
Indonesia R-Squared=.89	.13680 (2.4513)*	.027058 (2.0550)*	.35925 (7.6644)**	.026045 (3.0704)**
Iran R-Squared=.91	.14875 (4.2967)**	.082793 (2.1196)*	.19431 (5.8722)**	2.3226 (2.8878)**
Jordan R-Squared=.77	.31233 (2.7104)*	.17171 (3.8995)**	.016463 (2.3315)*	1.7681 (2.4720)*
Kuwait R-Squared=.66	.27758 (3.1045)**	.085080 (2.6143)*	.16700 (4.8476)**	.60128 (4.4000)**
Malaysia R-Squared=.86	.0038662 (4.1758)**	.053681 (2.6241)*	.27748 (8.5229)**	1.0818 (5.1887)**
mail R-Squared=.49	.081363 (2.0925)*	.096439 (3.8881)**	.083388 (4.4858)**	-.90502 (-2.7061)*
Mauritania R-Squared=.89	.055659 (2.1145)*	.086020 (2.3138)*	.051980 (2.8177)**	-2.3640 (-2.9023)*
morocco R-Squared=.59	.18234 (2.9378)**	.10574 (4.8370)**	.31598 (3.2672)**	1.5177 (2.8168)**
Saudi Arabia R-Squared=.93	.14146 (2.7223)*	.098622 (2.4467)*	.30497 (4.7298)**	1.1884 (2.6278)*
Senegal R-Squared=.62	.0095217 (2.2483)*	.077286 (2.8205)**	.21257 (4.2854)**	-.079519 (-5.4685)*
Tunisia R-Squared=.60	.11136 (2.0298)*	.20059 (3.9421)**	.062169 (2.0626)*	.050380 (3.2188)**
turkey R-Squared=.93	.054635 (3.7206)**	.045118 (2.5059)*	.24713 (7.7311)**	4.5661 (3.8946)**
United Arab emirates R-Squared=.93	.12603 (5.3324)**	.94038 (14.7528)**	.086988 (4.9108)**	.94782 (2.1909)*

-values in brackets stand for t-ratios
-*, ** indicate the 5% and 1% significant levels ,respectively.

5-2- The Empirical Panel Results

To reach a homogenous result on the OIC members, the growth regression shown in (8) has been estimated by the panel data methods using data of 16 cross –sectional countries over the period 1980-2005. The results have been obtained by the random- effects (RE) procedure after running several tests to select between pooling and fixed effects regressions [F_{Leamer} Test, (315.88, Pr=0.000)], and to select between fixed effects and random effects (RE) specifications [Hausman Test, (18.67, Pr=0.0009)]. The results approve finally the selection of random effects (see Table 3). They seem to be quite reliable [Wald Test, (3044.8, Pr= 0.000)] except for the log of life expectancy, other variables are significantly elastic. One percent increase in human capital (*LnH*), government expenditures on education and investment leads in economic growth of all 16 countries to increase, on average, by about 0.12, 0.06, and 0.30 percent, respectively. One percent increase in life expectancy also raises economic growth by about 2.13 percent implying the role of health conditions on the blocks development. Overall, the results support the significant roles of human development indicatory (education, human capital, health) on economic development in the OIC countries**.**

Table 3: the panel results for the elasticity coefficient of the selected OIC countries growth

```
Fixed-effects (within) regression      Number of obs      =       416
Group variable (i): id                 Number of groups   =        16

R-sq:  within  = 0.8829                Obs per group: min =        26
between = 0.9496                                      avg =      26.0
overall = 0.9424                                      max =        26

                                             F(4,396)   =    746.43
corr(u_i, Xb)  = 0.7905                     Prob > F      =    0.0000

----------------------------------------------------------------------
y |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+--------------------------------------------------------
h |   .1317008   .0168345     7.82   0.000     .0986047     .164797
geh |    .081711   .0169575     4.82   0.000     .0483729     .115049
i |   .2738191   .0191423    14.30   0.000     .2361859    .3114523
le |   2.124177   .1617859    13.13   0.000      1.80611    2.442243
_cons | -1.415521   .2443199    -5.79   0.000    -1.895847   -.9351946
----------------------------------------------------------------------
```

```
sigma_u |  .30182182
sigma_e |  .04530433
rho |  .97796558   (fraction of variance due to u_i)
----------------------------------------------------------------------
F test that all u_i=0:     F(15, 396) =   315.88     Prob > F = 0.0000

. est store fixed

. xtreg  y h geh i le, re

Random-effects GLS regression           Number of obs      =       416
Group variable (i): id                  Number of groups   =        16

R-sq:  within  = 0.8824                 Obs per group: min =        26
between = 0.9505                                       avg =      26.0
overall = 0.9441                                       max =        26

Random effects u_i ~ Gaussian           Wald chi2(4)       =   3044.80
corr(u_i, X)     = 0 (assumed)          Prob > chi2        =    0.0000

----------------------------------------------------------------------
y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------------------------------------------------------
h |   .1216794    .016752     7.26   0.000     .0888461    .1545126
geh |   .0955254   .0172079     5.55   0.000     .0617986    .1292523
i |   .2970466   .0191153    15.54   0.000     .2595814    .3345118
le |   2.128801   .1631777    13.05   0.000     1.808978    2.448623
_cons | -1.496034   .2498082    -5.99   0.000    -1.985649   -1.006419
-------------+--------------------------------------------------------
     sigma_u |  .17154774
     sigma_e |  .04530433
     rho |  .93480274   (fraction of variance due to u_i)
----------------------------------------------------------------------


. hausman fixed
```

```
     ---- Coefficients ----
|      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
|     fixed          .          Difference          S.E.
-------------+----------------------------------------------------------
h |     .1317008     .1216794        .0100215        .0016648
geh |  .081711     .0955254       -.0138145             .
i |     .2738191     .2970466       -.0232275        .0010168
le |     2.124177     2.128801       -.0046237           .
------------------------------------------------------------------------
b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

        Test:  Ho:  difference in coefficients not systematic

     chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
             =       18.67
    rob>chi2 =      0.0009
```

6- Conclusion

In the literature, a significant role is given to education which contributes to growth processes of countries through improvement of economic efficiency and input productivity. According to the endogenous growth models, other aspects of human capital indicatory, such as health and life expectancy, also raise the rate of economic growth.

The empirical results obtained by this study were classified separately into time series ARDL specification for each selected OIC country, and collectively into a panel framework. The relevant finding thus indicated that there were significant short-run and long-run relationships between economic growth and higher education, private investment, government expenditures on education as well as life expectancy.

The results approve the crucial role of higher education, which generate human capital, in the economic developments of the OIC countries. In addition, the greater level of health growth rate would lead to a higher rate of economic growth in these countries. This implies that the efficient policy of government toward education creates significantly new opportunities for economic growth. Also, investment by the private sector may expand the competitive markets, which promote substantially growth.

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APPENDIX: A

Table (A-1): BDM values for evaluating the existence of long-run relationships between variables.

Country	BDM Criterion*
Benin	4.5
Burkina Faso	4
Egypt	4.8
Indonesia	4.15
Iran	4.9
Jordan	4.4
Kuwait	5
Malaysia	5.92
Mali	4.25
Mauritania	4.45
Morocco	4.1
Saudi Arabia	5.56
Senegal	4.90
Tunisia	4.75
Turkey	5
United Arab Emirates	4.65

* shows the measurements developed by Banerjee, Dolado and Master (1998)

The critical value of the BDM is (3.82) allowing ARDL to estimate the long-run coefficients