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Impacts of Education and Life Expectancy on Economic Growth: Panel data Evidence from Developing Economies

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Abstract

This study examines the linkage between human capital and economic growth in the 33 developing countries. This study uses two components of human capital namely education and health, where the former component is measured by primary, secondary and tertiary school enrolment, while, the later by life expectancy. Annual panel data for the period 1995 to 2016 are used. After checking data, the $Dynamic\ OLS\ (D-OLS)$ *and* $Fully\ Modified\ OLS\ (FM-OLS)$ *estimators are employed. The results of the empirical investigation using FM-OLS and D-OLS techniques expose that human capital has a significantly positive impact on the long-run growth in the 33 developing countries. Thus, the findings highlight the prominence of education and health human capital for growth and development. Therefore, the policy makers need to devise effective, worthwhile and appropriate educational and health policies in order to accelerate economic growth and improve social welfare.*

Keywords: Education; Health/life expectancy; economic growth; panel data
JEL classification Codes: C23; I25; J13; J24; O40

I. Introduction

This intellectual exercise aims to give answers of the questions, i.e., firstly, what is the impact of health as human capital[i] on growth? and secondly, does education human capital promote economic growth?. There is a growing concurrence among the researchers that improving human capital is as one of the significant factors affecting growth and development. In general, economic development refers to a viable process that enlarges the quantity and multiplicity of goods and services for the people in order to satisfy their material needs that cover food, health care and shelter. Whereas, traditionally, economic development is measured through real national income and per capita income growth. Extending the scope of economic development, the term 'human development' is used which means a sustainable process of economic development that increases and bolsters people's capabilities that include to read and write, mitigate premature death, to buildup individual's confidence, and improve standard of living. Presumably, the widely acceptable indicator of human development is $Human\ Development\ Index\ (UNDP, 1990)$. It is endorsed by Haq (1976) that "the objective of development must be viewed as a selective attack on the worst forms of poverty. Development goals must be defined in terms of progressive reduction and eventual elimination of malnutrition, disease, illiteracy, squalor, unemployment, and inequalities. The concerns for more production and better distribution should be brought together in defining the pattern of development".[ii]

In a study, Becker (1962, p. 9) mentions that "the many ways to invest include schooling, on-the job training, medical care, vitamin consumption, and acquiring information about the economic system. They differ in the relative effects on earnings and consumption, in the amount of resources typically invested, in the size of returns, and in the extent to which the connection between investment and return is perceived. But all improve the physical and mental abilities of people and thereby raise real income prospects". Though, the factor of production function indicates that there are three main factors which include land, labour and capital. Where, capital is produced by human, therefore, capital is not an original source of wealth. Likewise, we are left with land and labour, but explicitly land without labour is idle. Now it is obvious, that resources are mostly defined by human knowledge. It all reveals that the most important and primary source of all wealth is human labour (Rashid, 2000). It is also endorsed by Berkeley (1953) that a human ability is the primary factor of growth.

Due to the overwhelming significance of human capital for economic growth, researchers have been interested to verify the link in human capital and growth. Whereas, it is highly vital for less developed countries in particular to focus more on the encouragement of human capital, if they want to reduce poverty and improve social welfare. Hopefully, it will identify the needs of a nation to improve human capital and growth as well in order to stimulate sustainable economic growth. Though, there is strong pervasive belief that human capital or investment in human capital development is a vital factor determining growth. For experimental examination, we use panel data ranging from 1995 to 2016. The empirical investigation of this study is exclusively concentrating on the developing countries which needed more research. Therefore, this study covers 33 less developed countries (List of countries given in Appendix Table-1). We also assume that all these countries have almost similar characteristics. According to our knowledge, the available empirical studies focusing on the role of education human capital and health human capital in accelerating growth in these selected developing countries are scarce. Therefore, this is an inclusive study on the subject under the study which deals only with the two components of human capital i.e., education human capital measured by primary, secondary and tertiary school enrolments and health measured by life expectancy. Time period, countries and panel data set are different compared to the former studies. The outcomes of this study are expected to provide management authorities and decision makers, especially in developing economies, with insight which will certainly help them to devise and execute right and effective policy in order to boost largely social welfare.

A. Education, life expectancy and economic growth

History tells us that after World War II, some researchers including Becker (1962), and Mincer (1981) have developed the "human capital theory" to evaluate education's benefits for individuals and society as well. Usually, the stock of human capital is measured using proxies as formal education that includes adult literacy rates, gross school enrolment rates. Similarly, human capital is also measured in the form of health using proxies' life expectancy at birth, infant mortality rate, and outlays on health. Human capital is widely considered as one of the central elements of growth and development across the world since 1965.[iii]The study of Bloom et al. (2005) notes that higher education generates better tax revenue, enlarges savings and investment, increases individual productivity and creativity, promotes entrepreneurship and society. Alongside, human capital also helps to condensed population growth, augments technology, and supports governance. Consequently, such economic and social benefits may contribute to the sound health, good health and standard of living as well.

The study of Biciunaite (2014) reveals that better income is a sign of better access to shelter, education, and health services expectancy. Where, higher aggregate income is the results of prolonged life expectancy. Meanwhile, the available studies reveal that the effects of prolonged life expectancy may have positive or negative. Presumably, lesser mortality can upsurge individual income by fostering the output of existing scarce resources such as human capital. In contrast, lesser mortality may lead to expand inhabitants' size, where, in case of fixed factors of production, vast inhabitants tends to decrease per capita income (Jayachandran &Lleras- Muney, 2009).

On the other hand, some previous studies provide evidences that human capital growth rate does not expressively determine the economic growth rate. Even some studies suggest that education and schooling rates play a negligible role in explaining cross-country difference in growth rate.[iv] Similarly, the study of Mushkin (1962) also focuses on the significance of health and considers it better than the other form of investment in human capital. In a study, Ranis et al. (2000) explains that due to an increase in income as the results of the institutional environment and the allocation of resources can help to enhance human capital. Where, an increase in income on the household level can increase quality in human capital, if the extra income is used to educate the youngsters instead of spending it on gambling or smoking. Likewise, at the government level, a rise in income may be consumed to promote education instead of to accumulate armaments. Moreover, higher income can help to promote human development through its effect on life expectancy.

This study is structured as follows. Section 2 deals with the review of literature. Section 3 discusses empirical methodology which includes model specification, and data description. Section 4 deals with results and discussions. Section 5 deals with the concluding remarks on the study.

II. Literature Review

Several prior studies explain the importance of education for growth, where, many researchers discover that schooling and economic growth are closely correlated across countries (Romer, 1990; Mankiw *et al.*, 1992). The study of Schultz and Paul (1992) confirms that "human capital is an important determinant of modern economic growth and a critical factor explaining the convergence in growth across countries." In a study Barro (2013) indicates that males aged 25 and over schooling (at the secondary, and higher level) has considerably positive effects on growth for 100 countries during 1960-1990. In case of 10 countries from central Asia, Azam and Ahmad (2015) observes that human capital and growth has helpful relationship during 1993 to 2011. Azam (2016) indicates that human capital (life expectancy) has substantial impact on growth of 11 economies from Asia from 1990-2011. Ogundari&Awokuse (2018) observe that human capital is positively related with growth in 35 countries from Sub-Saharan Africa during 1980–2008. Granger causality test by Liao et al. (2019) reveals the existence of the feedback causation in education and growth in Guangdong province of China from 2000–2016.

Similarly, several prior studies evaluate the impact of health human capital on growth as discussed earlier also. For example,Turan (2009) finds that an expansion in life expectancy has a positive impact on economic growth through fertility for 28 sub-Saharan Africa countries during 1975-2007.The study of Barro (2013) finds "the coefficient on the log of life expectancy at birth is 0.042 (0.014) for 100 countries during 1960-1990. This result implies, other things equal, that a rise in life expectancy from 50 to 70 years (that is, by 40 percent) would raise the growth rate on impact by 1.4 percentage points per year". p. 317).

On the other hand, some prior studies for instance Bils and Klenow (2000) for 85 countries during 1960 -1990 finds that education human capital in the form of schooling has weak effect on growth. Similarly, the study Prichett (2001) study fails to observe any association between schooling and growth. While, Bosworth and Collins (2003) fail to validate a strong and significantly positive correlation between years of schooling and growth for 84 countries from 1960–2000. The study of Jaoul (2004) fails to finds impact of education on economic growth for Germany in the period before the Second World War. The study of Farzanegan (2011) finds that there is no significant impact, if not negative, of education expenditures on aggregate output of labor in Iran during 1959–2007. Some previous relevant empirical studies on the link between human capital and growth are reported in Table 1.

Table 1: Selected prior studies on the human capital and growth relationship

Study	Data, countrie	Estimator (s)	Dependen variables	Independent variable	Findings
Kotáskova et al. (2018).	1975–2016 India from	FMOLS	Real GDP per capita	Primary, secondary and tertiary education	Education and growth (+)
Rehman et al. (2018)	1999–2015 3 central Asian countries	Panel least squares	Human Develo pment Index	Gross capital formation, health expenditure, government expenditure and secondary education	Human capital has positive impact on economic development
Mallick et al., (2016)	1973–2012 14 Asian countries	FMOLS	GDP	Public spending on education	Education and growth (+)
Khembo&Tcher eni (2013)	1990–1995; 1995-2000; 2000-	Fixed-effects	GDP per capita	Secondary school enrolment, infant mortality, labour force, physical capital formation	Education and growth (+)

	2005, 13 SADC				
Zaman (2012)	1980-2005 100 countries	OLS, IV regressions	GDP per capita	Average years of schooling (primary, secondary & tertiary	Education and growth (+)
Danacica (2011)	1985–2009 Romania	VAR	GDP per capita	School enrolment ratio	Education and growth (+)
Cooray (2009)	1999-2005 46 low and middle income economies	OLS, GMM	GDP Per Capita	Primary, secondary and tertiary enrolment ratios, total Govt. outlay on education as % of GDP, primary and secondary levels.	Primary, secondary and tertiary schools enrollments have positive impacts of growth
Ecevit (2013)	1970-2010 21 OECD	POLS, DOLS and FMOLS	Real per capita GDP	Life expectancy, exports, energy	Life expectancy is a fundamental determinant of economic growth
Ogungbenle et al. (2013)	1977 - 2005 Nigeria	VAR	Economic growth	public health spending and life expectancy	Life expectancy and public health spending have positive impact on growth
Hassan & Cooray (2012)	1960 – 2009 84 countries	Panel data OLS, SGMM, LSDVC	Real GDP	Capital, labor, human capital (i.e., male life expectancy; female life expectancy; male primary, male secondary; female primary and female secondary enrolment	Male life expectancy and growth (+). while that of female has a negative effect
Caselli et al. (1996)	1960-1985	GMM	GDP growth rate	Life expectancy, schooling	Life expectancy and growth (+).
Knowles & Owen (1995)	1960-1985 84 Developed and developing countries	OLS	log difference GDP per person	real investment in real GDP, population growth rate, secondary school, life expectancy at birth	Results are more robust on the relationship between life expectancy and income per capita than educational human capital

Source: Author's compilation

III. Empirical Methodology

A. Model Specification

Following, the study of Lucas (1988) where he developed the endogenous growth theory by basically embodies an extension of the Solow (1956) neoclassical growth model by including human capital. Based on Many erstwhile studies for example, Lucas (1988)- it can be inferred that the contribution of human capital in production is achievable through education and health sector. The following modified used in the present study is also used by some priors studies such as Baldacci et al. (2008), Sapuan and Sanusi (2013) and Ecevit (2013), which can be expressed algebraically as below:

$$logY_{it} = \alpha_0 + \alpha_1 logPSE_{it} + \alpha_2 logSSE_{it} + \alpha_3 logTSE_{it} + \alpha_4 \ log\ LE_{it} + \mu_{it} \qquad (1)$$

Where, Y is per capita GDP which represent economic growth and development, PSE is primary school enrolment, SSE is secondary school enrolment and TSE is tertiary school enrolment as proxies for education, and life expectancy at birth (LE) as a proxy for the health human capital. Moreover, α_i shows the constant and the coefficient of regressors, and $\mu_t$is the error term. The i and t represent the ithcountry and the t^{th} time period, respectively $(i = 1,2,\ldots,N;\ t = 1,2,\ldots,T)$.The log-linear specification of econometric model usually provides relatively efficient and reliable empirical evidence compared to simple specification. It is assumed that the μ_t is to be *independently and identically distributed* ($\mu t \sim iid\ (0, \sigma 2)$. The expected signs of $\partial Y_{it} / \partial LE_{it}, \partial Y_{it} / \partial PSE_{it}$, $\partial Y_{it} / \partial SSE_{it}$, $\partial Y_{it} / \partial TSE_{it}$ are yet to be determined in this study.

B. Data Description

The data on GDP per capita in current USD, life expectancy at birth, total (years), primary school enrollment (% gross), secondary school enrollment (% gross), and tertiary school enrollment (% gross) in this study have been gleaned from the World Development Indicators (2018), the World Bank database. Table 2 portrays summary of the descriptive statistics and correlation matrix using panel data over the ranging from 1995 to 2016.

Table 2: Descriptive statistics and correlations

Statistics/ Variables	Y	LE	PSE	SSE	TSE
Mean	1854.921	63.34724	101.1088	6632.077	16.37093
Median	1089.689	66.3407	104.6099	57.47300	13.57615
Maximum	10666.06	76.19256	161.1266	3901171.	61.98091
Minimum	108.0146	31.23920	29.25506	5.199700	0.295590
Y	1.000				
LE	0.884	1.000			
PSE	0.249	0.242	1.000		
SSE	0.841	0.842	0.372	1.000	
TSE	0.753	0.696	0.212	0.835	1.000

IV. Results and discussion

The Levin, Lin and Chu (2002), and Im, Pesaran and Shin (2003), panel unit root tests have been employed. The results of LLC, and IPS tests are presented in Table 3, which shows that all variable are stationary at the level.

Table 3: Panel unit root tests

Variables/ tests	*LLC*	*IPS*
at level		
Y	10.108* (0.000)	-3.268* (0.000)
PSE	-4.103* (0.000)	-1.369*** (0.085)
TSE	-10.657* (0.000)	-8.579* (0.000)
SSE	-2.762** (0.002)	-2.005* (0.022)
LE	-14.741* (0.000)	-6.164* (0.000)

Note: Asterisk *, ** and *** shows significant at 1%, 5% and 10% level respectively

We further applied panel cointegration test for long-run investigation are developed by Pedroni (1999, 2004)). The results of Pedroni panel cointegration tests are reported in Table-4, and these results reveals that there are long term cointegration among variables. The Johansen Fisher panel cointegration test results are reported in Table 5. The results given in Table 5 further support for the existence of cointegration among variables by refusing the null hypothesis of no cointegration in each panel at 1% level of significance. The Kao residual cointegration test where the t-statistics is found -2.618 with p-value 0.004 indicates that there is long run relationship between variables.

Afterward, based on the foregoing empirical investigation, we employ the methods of $FM - OLS$ and panel D-OLS as analytical techniques for parameters estimation. According to Pedroni (2001) FM-OLS technique generates consistent estimates in small samples and does not suffer from large size misrepresentations in the existence of endogeneity and heterogeneous dynamics.

The empirical results of FM-OLS and D-OLS are given in Table-6, where the GDP per capita represent economic growth is the response variable. It is evident from Table-6 that all estimated coefficients are positive and statistically significant with the expectation of primary school enrollment. The estimated long-run coefficients using both the FM-OLS and D-OLS procedure are almost the similar. The estimated coefficients of 0.101-0.104 are obtained for the health human capital proxy used life expectancy variable which is positive and statistically significant at 1 percent level of significance. The result demonstrates that if all else is same, a one percentage point increase in the life expectancy leads economic growth by 0.101-0.104 percent. The finding that life expectancy has positive impact on economic growth is in accord with the findings by Turan (2009), Ogungbenle et al. (2013), and Barro (2013) and at variance with the findings by Caselli et al. (1996).

Table 4: Pedroni panel cointegration test results

Test	Panel Statistics (within-dimension)		Group Statistics (Between-dimension)
$v - \text{Statistic}\ (P - \text{value})$	-1.379(0.916)	-1.697(0.955)	
$rho - \text{Statistic}(P - \text{value})$	3.305(0.999)	3.426(0.999)	5.634(1.000)
$PP - \text{Statistic}\ (P - \text{value})$	-2.394(0.002)	-2.901(0.001)	-4.681(0.000)
$ADF - \text{Statistic}\ (P - \text{value})$	-3.502 (0.000)	-5.142(0.000)	-5.891(0.000)

Trend assumption: Deterministic intercept and trend

Table 5: Johansen Fisher panel cointegration test results

No. of CE(s)	Trace Statistics	P − value	Max − Eigen Statistics	P − value
None	1457.0*	0.0000	1155.0*	0.0000
At most 1	1230.0*	0.0000	814.2*	0.0000
At most 2	649.6*	0.0000	419.2*	0.0000
At most 3	346.3*	0.0000	282.4*	0.0000
At most 4	185.7*	0.0000	185.7*	0.0000

Note: Asterisk * show significant at 1% level of significance.

Table 6: Panel cointegration estimates

Response variable= Y				
Variables	$FM - OLS$		$D - OLS$	
	Coefficient	P-value	Coefficient	P-value
LE	0.101* [0.004]	0.000	0.104* [0.006]	0.000
PSE	0.002 [0.002]	0.366	0.0007 [0.004]	0.8397
SSE	0.014* [0.002]	0.000	0.013* [0.004]	0.0008
TSE	0.094* [0.017]	0.000	0.077 [2.960]*	0.003

Note: * show significant at 1% level of significance. Standard errors are in brackets [ ]

In the same way, education human capital proxy used secondary school enrollment contributes to economic growth and it is found statistically significant at 1 percent level of significance. The estimated coefficients found are 0.014-0.013, implies that one unit change in secondary school enrollment will bring 0.014-0.013 units change in the response variable. Unfortunately, the impact of primary school enrolment found though statistically insignificant but with positive coefficient sign, meaning that it is positively correlated to economic growth. The estimated coefficients of 0.094-0.077 are found for the tertiary school enrolment variable which is positive and statistically significant at 1 percent level of significance. The result suggests that if ceteris paribus, a one unit increase in the tertiary school enrolment will increase economic growth by 0.094-0.077 units. These results are in congruence with the findings of the studies carried by Cooray (2009), Azam and Ahmad (2010), and Khembo and Tchereni (2013), while contradictory with the findings of Bils and Klenow (2000) and Prichett (2001). Thus, the findings of the study in hand establish that human capital is positively related to economic growth and statistically significant during the period under the study. Therefore, the results of seems to be robust and expressive for onward policy consideration.

V. Concluding Remarks

There is a strong pervasive belief that investment in human capital development is a vital factor determining economic growth. Promoting human capital increases productivity which consequently leads to augment economic growth. Therefore, the aim of this study is to examine the impact of human capital on economic growth in the 33 developing economies over the period from 1995 to 2016. The results found exhibits the existence of cointegration among variables by refusing the null hypothesis of no cointegration in each panel. The results of the empirical investigation using FM-OLS and D-OLS techniques reveal that human capital has a significantly positive effects on the growth. Where, education human capital measured by secondary school and tertiary school enrolment has statistically significant and positive impacts on growth. Similarly, prolonged life expectancy has also significantly positive effect on economic growth. Thus, the results demonstrate that human capital is one of the vital determinants of GDP growth.

The findings of the study highlight the prominence of education human capital and health human capital for economic growth and development. Actually, investment in human capital is taking place through training and education, and health; therefore, there is a valid reason that government can play an important role to enhance human capital. The findings of this study recommend that the management authorities need to devise effective and worthwhile appropriate educational and health policies towards an expansion of their education and health sector in order to enhance potential gains in term of higher economic growth.

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Appendix

Table A1: Classification of Countries on the basis of 2011 GNI per capita and Region wise

Economy	Region
Belize[b], Bolivia[b], Colombia[a], Ecuador[a], El Salvador[b], Guatemala[b], Jamaica[a]	Latin America & Caribbean
Burundi[c], Benin[c], Burkina Faso[c], Cameroon[b], Ghana[b], Kenya[c], Malawi[c], Niger[c], Nigeria[b], Rwanda[c],Tanzania[c], Uganda[c]	Sub-Saharan Africa
Bangladesh[c], India[b], Pakistan[b]	South Asia
China[a], Fiji[b], Indonesia[b], Malaysia[a], Mongolia[b], the Philippines[b], Thailand[a]	East Asia & Pacific
Egypt[b], Iran[a], Tunisia[a]	Middle East & North Africa
Turkey[a]	Europe & Central Asia

Note: Group: a - Upper middle income: US$ 4036 to US$ 12475, b - Lower middle income: US$1026 to US$ 4035, c - Low income: US$1025 or less

End Note

[i] Knowles and Owen (1995) also note that so far quite slight empirical concentration has been given to the health capital component of human capital.

[ii] Khadija Haq’s lecturer at the UNDP MH Commemorative event, 22-Feb- 2011, Islamabad- Pakistan

[iii] Gylfason and Zoega (2003)

[iv] Benhabib and Spigel (1994)