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Health Human Capital and Economic Development

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Abstract: This study examines the long-run and short-run relationships between health and economic development for 12 developing countries. The study attempts to answer one critical question: Does health has any significant influence on economic development in developing countries? The study employs time series data for the period 1960-2010. Johansen Cointegration results reveal long run relationships between health and economic development in all selected countries. It finds that in the long run 1% increase in life expectancy contributes an average 7.34% to GDP and 4.16% to GDP per capita. The finding of the study reveals that there is significant impact of health on economic development in the developing countries in long run. However, error correction mechanism could not show significant effect of life expectancy on GDP and GDP per capita in short run in developing countries.

JEL Classification: H51 · I15 · I18 · O40
Key words: Health · Life Expectancy · Economic Development · Cointegration · Human Capital

INTRODUCTION

Economic development of a country always remains a key concern for economists. It is more relevant to measure progress and quality of life in developing nations. In the earlier period, it has been established that the country with higher GDP per capita income lead to enhance the living standard, health and longer life expectancy. While in the recent time, it has been observed that human health composed of education, migration, other investment also cause to enhance the individual productivity [1]. Economic growth is positively affected by human health like education [2].

It is fact that healthy person is physically and mentally more enthusiastic and dynamic, lives long (expected), learns more (through his experience), works more (by better use of time and resources), produce more, gets more (income)/receives high wages, leads to directly increase in productivity. While unhealthy person is physically and mentally apathetic and lethargic lives short (expected), learns less, works less (mostly absent from his job due to his ailment), produces less, gets less (income) lead to directly decrease productivity [3]. Changing in labor supply, productivity, investment and saving bring about augmentation in per capita GDP [4]. Generally, growth in human capital is also associated with improvements in health.

An individual having long life expectancy, save and invest more in physical and intellectual capital. Betterment in health increases the growth in human capital lead to growth in capital [5]. Generally, it has been found that rate of economic growth has been significantly affected by health (life expectancy) [6]. Guest and Swift [7] reported in his study that reduction in child mortality rate lead to increase motivation and ability of parents to invest more on education of their children, resultantly, positive effect on productivity will be enhanced. In World Health Organization (WHO) report, it has been illustrated that GDP growth can be enhanced by increasing expenditure on health in both developed and developing countries [8]. There is bidirectional relationship between health and economic development. High development can be achieved by utilizing resources and technology through health human capital and physical capital. If some portion of income is spent on health, in return, per capita income would be enhanced. Better living standard and health facilities, better nutrition and sanitation, medical technology and innovation bring about the improvement in economic development [5].

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Remarkable increase had been seen in health (life expectancy) of developing countries in twentieth century, especially after Second World War. According to World Development Report [9], average life expectancy was 40 years in 1950 while it had enhanced to 63 years in 1990. There were many factors like better health facilities, advancement in medial technology, better food and nutrition, lead to increase human life expectancy in developing countries based on better economic development. In literature large numbers of studies are available for OECD/developed countries on this logic while a few studies are available for developing countries which discussed only individual countries.

This study tries to confirm whether relationship exists between life expectancy and economic development (GDP and GDP per capita are used as indicators of economic development)? It also attempts to verify whether this relationship, if exists, affect economic development in short run and/or long run. To seek the answer of above mentioned questions, 50 years of time series data of life expectancy, GDP and GDP per capita have been used for 12 developing countries. Real GDP, GDP per capita and life expectancy have been used as proxy for economic development and health respectively. After applying proper time series techniques for the analysis the study finds long run relationship between health and economic development but could not find any such evidence for the short run.

The study consists of five sections. After this introductory section, section II reviews the literature review. In Section III data sources and methodology have been presented. The result and estimation has been described in details in section VI. Conclusions and policy recommendations for developing countries have been given in the last section.

Lierature Review: As already it has been described that significant increase had been seen in health (life expectancy) of developing countries in twentieth century, especially after 1940. Previous studies find many factors like better health facilities, advancement in medical technology, better food and nutrition lead to increase human life expectancy which further affect economic development. Life expectancy is most important determinants among various determinants of economic development. Barro RJ [2] finds positive relationship between health and growth. The study argued that with other economic factor, education and health also have positive impact on growth. In World Development Report [10], it has been concluded that human capital raises economic growth at decaling rate. To find out the relationship between human capital and growth, they used data of the life expectancy, adult literacy rate and years of secondary schooling to measure human capital. Sachs JD and Warner AM [11] examine that health as human capital generates productivity gains. Furthermore, longer life expectancy leads to increase the demand for education and saving that is why health is more effective for development and key determinants of economic growth.

In 2001 Bhargava *et al*. [12] used panel data of GDP series based on purchasing power comparison and the Adult Survival Rate (ASR) and find significant effect of ASR on economic growth for low income countries with 1% increase in ASR lead to increase 0.05% in growth rate on other hand 1% increase in investment /GDP ratio bring about 0.014% increase in growth rate. They find similar results by replacing ASR with life expectancy. This indicates the positive relationship between health (ASR/LE) and economic growth. Aroar [13] conducts a study for 10 industrial countries using life expectancy as proxy for health. The study argues that slow growth rate in developing countries is due to increase in disease and high mortality rate. He argues that 30-40% economic growth may be enhanced by improving the health condition. Similar results are found by Wiel [14] form cross country regression. He argues that health is important determinant of income variation.

Jamison *et al*. [15] use data of 53 countries over the period 1965-90. They conclude that health has no effect on changing the rate of technical progress but has on income level. Improvement in health contributes on average 0.23% per year to income growth during period and 11 % growth seen overall. Acemoglu and Johnson [16] evaluate the effect of life expectancy on economic growth through the health improvement in panel of 59 countries. Predicted mortality as an instrument that has huge impact on life expectancy they found that 1 % change in LE bring about 1.7 to 2% increase to population while it has little effect on GDP. Aghion *et al*. [3] combines the Lucas [17] and Nelson-Phelps [18] approach to find out relationship between health and growth. They use cross country data over the period 1960-2000 and find that better life expectancy both at higher initial level and higher rate of improvement has significant positive impact on per capita GDP growth. Finally they conclude that positive relationship exists between health and growth.

Swift [5] uses the data of 13 OECD countries of last two centuries ranging from 1820 to 2001 and from 1921 to 2001. The study finds long run positive relationship between life expectancy and GPD and GDP per capita and argued that the coefficients of these relationships have remained stable over very long time periods. It finds that 1% change in life expectancy raised average 6% change in GDP & 5% raise in GDP per capita in the long run. He reported long term gain in human and physical capital can be gained through better health that lead to economic growth.

Finally, it can be concluded on the basis of literature cited above that there exists positive relationship between health and economic development. Subsequently, this study tries to find whether this relationship is long run and/or short run.

MATERIALS AND METHODS

The main focus of the study is whether health has any significance influence on economic development in developing countries. The most common indicators considered for measurement of economic development is GDP per capita which is total value of goods produced in the country divided by the population. The life expectancy normally used as an indirect measure of food supply and health facilities [1, 5, 11]. This study purposes two indicators, total GDP and total GDP per capita, as indicators of economic development while life expectancy is proxied as health indicator.

Data: Data from 1960 to 2010 of total GDP, total GDP per capita and life expectancy for Cameroon, China, India, Korea, Malaysia, Nigeria, Pakistan, Sri Lanka, Sudan, Syria, Tunisia and Turkey (12 developing countries) have been retrieved from World Bank Database [19]. GDP and GDP per capita are expressed in constant US$ and Life expectancy at birth, total (years).

Theoretical Model: The model is bivariet that depict economic development is the function of health. It has already mentioned that real GDP and GDP per capita as proxies for economic development and life expectancy as proxy for health have been used.

$$GDP_t = F(LE_t) \quad (1)$$

where, GDP represents the Gross Domestic Product and LE represents the Life Expectancy, while t-sign signifies the time period. On the basis of these observations very simple model has been made. The model 1 can be written in empirical form as below:

$$GDP_t = \alpha + \beta LE_t + \varepsilon_t \quad (2)$$

The entire variables have been transformed in log form to reduce the variance. So, that coefficient can be interpreted as elasticity. The software (OxMetrics, version 5.10) have been used for calculation and estimation. The data used in this study are time series which are mostly integrated. The estimates of ordinary least square (OLS) are misleading and spurious when the series are non-stationary (integrated). Therefore, first step is to check the order of integration of the series.

Stationarity Testing: For stationarity testing unit root test have been used. General equation for unit root testing is used by adding lags of dependent variable by applying Augmented Dickey-Fuller (ADF) test, whether the series have unit root or not.

$$\Delta Y_t = \alpha + \beta x_t + (\lambda - 1)Y_{t\_1} + \sum_{t=1}^{k} \theta \Delta Y_{t-1} + u_t \quad (3)$$

If series are stationary then we can use the OLS and if unit root exists in all series then cointegration is applied to check whether long run relationship exists or not.

Johansen Cointegration T est: Whether the long run relationship exists between series or not, for this purpose, the cointegration technique has been employed. Johansen cointegration approach (based on the VAR Model) has been adopted. When there is no clear distinction between dependent and independent variables called endogenity problem. In endogenity the classical method are biased. To control endogenity following procedure are used like: GMM, IVLS, 2SLS and VAR. Among these procedures, the most reliable method is VAR (when two variables are interdependent: Y depends on X and X depends on Y). The test based on the relationship between the rank of matrix and its eigenvalues or characteristic roots. The results of trace test and maximum eigenvalues test have been presented in Table 2 & 3.

Vector Error Correction Model (VECM): If the cointegration exists between series, it depicts that long run relationship is present between two variables. So, in order to find out the short relationship we apply Vector Error Correction Mechanism (VECM). If x_t and y_t are cointegrated, we can include a lagged version of $y_t - \theta x_t$ to study the short-run dynamics in the relationship between x_t and y_t. This term is called an error correction term. For instance, a Error Correction Mechanism is presents as follows:

$$\Delta y_t = \alpha + \beta_1 \Delta y_{t-1} + \beta_2 \Delta x_t + \delta(y_{t-1} - \theta x_{t-1}) + u_t \quad (4)$$

where δ<0.

RESULTS AND DISCUSSION

Relative Change: Changes in life expectancy, total GDP and GDP per capita (GPC) as well as relative changes for each country for the period of 1960 to 2010 is presented in Table 1. The results clearly indicate that there have been huge percentage increase in both GDP and GPC in the selected developing countries as life expectancy has increased, with an average 37.4% increase in GDP and 15.1% in GDP per capita for each 1% change in life expectancy over the sample period, while Swift (2011) shows that in OECD countries 30.4% and 14.6%: GDP and GPC respectively for 1% change in life expectancy from 1921 to 2001. The results indicate that change in GDP and GPC is 7% and 0.5% more respectively in developing countries than developed.

Main reason behind such results is because life expectancy is comparatively low in developing countries as compare to developed countries. Moreover, in developing countries working age population is more than developed countries. The results show that health has more significant impact on economic development in developing countries than developed countries, though there are many other factors that may lead to increase in economic development as well as improvement in health. Therefore, co-integration technique has been applied to verify the long run relationship between health and economic development.

Stationarity Testing (Unit Root Test): The results show that all the Augmented Dickey-Fuller test (ADF) value for each series for each country is greater than critical value. So, hypothesis of no unit root (Ho) can not be rejected, means that all the series have unit root. Thus, all time series for each country is non-stationary. While their first difference null hypothesis of unit root is rejected because their ADF value less than critical value at 5% significance level. Hence, all the time series for each country are stationery and integrated order is I (1)[1].

Long-Run Relationship: Engel Granger [20] illustrated that if two time series are co-integrated then long run relationship exists between these variables as well as short run relationship may also exists. Therefore, to verify whether the log run relationship exists between health and economic development? Two Cointegration techniques have been followed: Johansen Cointegration for long run relationship and Vector Error Correction Model (VECM) for finding how short run errors can be adjusted in long run relationship.

Johansen Cointegration Test: Johansen Cointegration [21] approach based on VAR model proposed two tests: a trace test and a maximum Egienvalue test. The estimated results of long run coefficient (β) of the matrix) for the rank (r) are presented in Table 2 and 3. It tells the number of co-integrating vectors between variables. Output shows that P-value is significant (less than 0.05) for rank (r) = 0, thus null hypothesis of no cointegration is rejected while for rank (r) = 1, the P-value is not significant (greater then 0.05); so, null hypothesis of no cointegration cannot be accepted.

Table 2 presents cointegration rank test results based on maximum eigenvalue and trace. The results show there is no country in the sample that has no cointegration in LE and GDP. Therefore, there exists long run relationship between health and economic development.

Table 3 gives statistics of both tests (maximum eigenvalue and trace). This clearly indicates that the cointegration exists between GDP per capita and LE in all selected countries. In other word we can say that long run relationships are present between health and economic development in these developing countries. Therefore, health indicator has long run relationship with both indicators of economic development (GDP and GDP per Capita).

The results are similar to other studies on health for example [1, 5, 11]. This is evident that, like education, health also creates inclusive growth. Literature also shows that the impact of health is long run phenomenon but there is rare evidence of such short run relationship. Therefore, for confirmation how the short run changes will adjust in long run, we continue to estimate the VECM

[1]Results of Unit Root testing can be provided on request.

Table 1: Comparison of changes in life expectancy (LE), total GDP, GDP per capita (GPC).

Country Name	Change in LE (%)	Change in GDP (%) relative to change in LE (%)	Change in GPC (%) relative to change in LE (%)
Cameroon	23.0	17.7	1.4
China	68.6	65.8	32.1
India	53.4	20.9	6.6
Korea, Rep.	52.0	51.3	25.1
Malaysia	24.6	104.9	27.4
Nigeria	33.5	16.9	2.7
Pakistan	39.8	31.2	6.3
Sri Lanka	29.1	30.8	13.0
Sudan	46.9	12.2	1.2
Syria	43.6	30.2	4.6
Tunisia	54.3	18.9	6.6
Turkey	52.7	14.7	4.4

Table 2: Cointegration Rank Test (Maximum Eigenvalues & Trace) for LE and GDP.

	Rank	Eigenvalues	Trace Statistics	*p*-value
Cameroon	r = 0	0.450	30.528	0.000
	r = 1	0.011	0.598	0.439
China	r = 0	0.752	70.352	0.000
	r = 1	0.010	0.524	0.469
India	r = 0	0.868	105.24	0.000
	r = 1	0.070	3.661	0.056
Korea	r = 0	0.564	51.351	0.000
	r = 1	0.178	9.826	0.002
Malaysia	r = 0	0.981	206.01	0.000
	r = 1	0.098	5.173	0.023
Nigeria	r = 0	0.149	8.112	0.049
	r = 1	2.632	1.316	0.997
Pakistan	r = 0	0.972	180.22	0.000
	r = 1	0.028	1.438	0.230
Sri Lanka	r = 0	0.253	14.591	0.047
	r = 1	3.982	0.001	0.964
Sudan	r = 0	0.164	10.794	0.008
	r = 1	0.034	1.828	0.176
Syria	r = 0	0.981	201.67	0.000
	r = 1	0.060	3.097	0.078
Tunisia	r = 0	0.343	21.082	0.006
	r = 1	5.686	0.002	0.957
Turkey	r = 0	0.328	20.530	0.007
	r = 1	0.012	0.618	0.432

Table 3: Cointegration Rank Test (Maximum Eigenvalues & Trace) for LE and GPC.

	Rank	Eigenvalues	Trace Statistics	p-value
Cameroon	r = 0	0.486	35.145	0.000
	r = 1	0.035	1.831	0.176
China	r = 0	0.749	69.214	0.000
	r = 1	0.001	0.089	0.765
India	r = 0	0.877	111.18	0.000
	r = 1	0.117	6.256	0.012
Korea, Rep.	r = 0	0.565	51.173	0.000
	r = 1	0.173	9.537	0.002
Malaysia	r = 0	0.978	200.57	0.000
	r = 1	0.144	7.815	0.005
Nigeria	r = 0	0.191	10.868	0.035
	r = 1	0.004	0.242	0.623
Pakistan	r = 0	0.974	184.20	0.000
	r = 1	0.006	0.314	0.575
Sri Lanka	r = 0	0.380	24.244	0.001
	r = 1	0.006	0.338	0.561
Sudan	r = 0	0.166	10.434	0.028
	r = 1	0.026	1.345	0.246
Syria	r = 0	0.954	161.80	0.000
	r = 1	0.129	6.956	0.008
Tunisia	r = 0	0.319	19.254	0.012
	r = 1	0.000	0.014	0.905
Turkey	r = 0	0.166	9.129	0.046
	r = 1	0.000	0.006	0.935

Model. Table 4 gives both long run and short run coefficients that show the significance and impacts of the life expectancy. Some countries have higher long run impacts on economic development than the others.

Vector Error Correction Model (VECM): To find out the long run as well as short run affect of one variable on other, VECM technique has been used which tells about speed at which dependent variables return to equilibrium after any shock in independent variables. The fact that variables are cointegrated implies that there is some adjustment process which prevents the errors in the long run relationship becoming larger and larger. It is also true that existence of cointegration is a necessary condition for ECM to hold. Such model currently represent the most common approaches to situation where it is wished to incorporate the both economic theory relating to the long run relationships between variables and short run disequilibrium behavior.

The β coefficients in Table 4 indicates long relationships between LE and GDP along with the α coefficients error correction that shows the speed of adjustment in error correction term towards the long run equilibrium after short run for each variable for each

Table 4: ECM Estimation for Life Expectancy (LE) and total GDP.

	ECT=β_1GDP + β_2LE		Speed of adjustment (α) of the ECT in the equation for	
	β_1GDP[a]	β_2LE	dGDP	dLE
Cameroon	1	-6.067*	-0.016	-0.004
		(-9.88)	(-0.625)	(-1.49)
China	1	-6.973*	-0.009	-0.000
		(-18.59)	(-0.693	(-0.224)
India	1	-5.583*	0.030	0.004*
		(-18.4)	(1.82)	(2.06)
Korea, Rep.	1	-8.851*	-0.118*	0.007
		(-61.0)	(-3.05)	(1.63)
Malaysia	1	-15.83*	-0.099*	0.002
		(-53.7)	(-2.26)	(1.28)
Nigeria	1	-7.032*	-0.068	0.008*
		(-19.9)	(-1.15)	(2.29)
Pakistan	1	-8.010*	-0.217	0.003
		(-31.1)	(-1.13)	(1.08)
Sri Lanka	1	-8.757*	-0.002	0.001
		(-21.5)	(-0.163)	(0.369)
Sudan	1	-4.905*	-0.094	-0.000
		(-31.7)	(-1.51)	(-0.381)
Syria	1	-6.997*	-0.133	-0.002
		(-37.00)	(-1.79)	(-0.059)
Tunisia	1	-4.942*	0.000	-0.0005
		(-36.5)	(0.024)	(-0.888)
Turkey	1	-4.251*	-0.074	0.019*
		(-43.41)	(-1.13)	(4.38)

[a]The β and α coefficient are normalized on GDP for ease of comparison.
* Significant at 5% Level, t values are given in parenthesis below each coefficient.

Table 5: ECM Estimation for Life Expectancy (LE) and total GDP per Capita (GPC).

	ECT=β_1GDP + β_2LE		Speed of adjustment (α) of the ECT in the equation for	
	β_1GDP[a]	β_2LE	dGDP	dLE
Cameroon	1	-2.191*	-0.110	0.019*
		(-8.61)	(-1.75)	(2.69)
China	1	-6.101*	-0.008	0.001
		(-7.90)	(-0.570)	(0.414)
India	1	-3.233*	0.052*	0.008*
		(-12.9)	(2.39)	(3.12)
Korea, Rep.	1	-7.312*	-0.119*	0.010*
		(-52.8)	(-3.13)	(2.32)
Malaysia	1	-10.144*	-0.200*	0.006
		(-58.00)	(2.83)	(1.91)
Nigeria	1	-1.971*	-0.181*	0.014*
		(-7.57)	(-2.17)	(2.53)
Pakistan	1	-3.73*	-0.022	0.012
		(-32.1)	(-0.498)	(1.64)
Sri Lanka	1	-6.058*	0.0017	0.002
		(-17.6)	(0.111)	(0.768)
Sudan	1	-1.123*	-0.087	-0.000
		(-6.96)	(-1.46)	(-0.161)
Syria	1	-2.877*	-0.269*	-0.000
		(-20.8)	(-2.67)	(-0.122)
Tunisia	1	-2.902*	0.004	-0.001
		(-24.9)	(0.111)	(-0.163)
Turkey	1	-2.278*	-0.129	0.016*
		(-31.4)	(-1.66)	(2.30)

[a] The β and α coefficient are normalized on GDP for ease of comparison.
* Significant at 5% Level, t values are given in parenthesis below each coefficient.

country. β coefficients are significant at 5% level for all countries suggesting that in long run 1% increase in LE leads to 4.25%: 5.58% 6.97%, 8.01% and 15.83% in GDP of Turkey, India, China, Pakistan and Malaysia respectively with an average increase in 12 developing countries under study is 7.34%. While average increase in OECD countries is 6.12% (Swift, 2011), indicates that increase in GPD due to LE in developing countries is more than developed countries. Empirical evidence is clearly indicating that influence of health on economic development is higher in developing countries than developed countries.

The results of ECM estimation for LE and GPC along with error correction term are presented in Table 5. β coefficient are significant at 5% level suggesting that in long run 1% increase in LE lead to increase in GPC from 1.97% in case of Nigeria to 3.23%, 6.10%, 3.73% and 10.14% for India, China, Pakistan and Malaysia respectively with an average increase in 12 developing countries under study is 4.16%. While average increase in OECD countries is 4.99% [5], indicates that increase in GPC due to LE in developing countries is 0.86% less than developed countries.

The results of Table 5 for GPC are almost similar to Table 4 for GDP but the values are small. This shows very slow rate of adjustment process in GPC supports the observation reported by [5]. Increase in economic development /growth can be achieved through health after very long period of time. Empirical evidence is clearly indicating that influence of health on economic development is higher in developing countries than developed countries.

The α coefficients that show the speed of short run adjustments through error correction process towards the long run equilibrium are presented in Tables 4 & 5. If the error correction term (α) is negative, it shows error correction process is taking place. The error correction term in equation of dGDP in table 4 is negative and significant only for two countries (Korea and Malaysia) while in case of dGPC (Table 5) error correcting term is negative and significant for four (Korea, Malaysia, Nigeria and Syria) out of twelve countries. These results indicate After that short run effects of health are limited on development. It can be concluded that effect of investment in health may not be seen in short run but in the long run it has significant impacts.

Table 6: Estimation of short-run coefficient of the VECM for GDP and LE.

	Short-run coefficient significance at 5% in the equation for dGDP	Short-run significance at 5% in the equation for dLE
Cameroon	dGDP: none dLE: none	dGDP: none dLE: Lags=1,2,3
China	dGDP: Lags=2 dLE: Lags=1,5	dGDP: Lags=1,2,5 dLE: Lags = 1,2, 3, 4 and 5
India	dGDP: none dLE: none	dGDP: none dLE: Lags = 1, 2
Korea, Rep.	dGDP: none dLE: none	dGDP: none dLE: Lags = 1
Malaysia	dGDP: none dLE: none	dGDP: Lags = 5 dLE: Lags = 1,2
Nigeria	dGDP: Lags=1,2,3,4 dLE: none	dGDP: none dLE: Lags = 1,2 and 3
Pakistan	dGDP: none dLE: none	dGDP: none dLE: Lags = 1,2, 3, 4
Sri Lanka	dGDP: none dLE: none	dGDP: none dLE: Lags=1,2,3
Sudan	dGDP: none dLE: none	dGDP: none dLE: Lags= 1,2
Syria	dGDP: none dLE: none	dGDP: none dLE:Lags= 1,2
Tunisia	dGDP: none dLE: none	dGDP: none dLE:Lags=1
Turkey	dGDP: none dLE: none	dGDP: none dLE: Lags = 1,2

Table 7: Estimation of short-run coefficient of the VECM for GPC and LE.

	Short-run coefficient significance at 5% in the equation for dGPC	Short-run coefficient significance at 5% in the equation for dLE
Cameroon	dGPC: none dLE: none	dGPC: none dLE: Lag = 1,2,3
China	dGPC: Lags = 1, 2 dLE: Lags = 1, 2,5	dGPC: Lags = 1, 2,3, 4 and 5 dLE: Lags = 3,5
India	dGPC: none dLE: none	dGPC: none dLE: Lags = 1,2
Korea, Rep.	dGPC: none dLE: none	dGPC: none dLE: Lags = 1
Malaysia	dGPC: none dLE: none	dGPC: Lags = 5 dLE: Lags = 1, 2
Nigeria	dGPC: Lags = 1,2,4 dLE: none	dGPC: none dLE: Lags = 1,2,3
Pakistan	dGPC: none dLE: none	dGPC: none dLE: Lags = 1,2, 3,4
Sri Lanka	dGPC: none dLE: none	dGPC: none dLE: Lags =1, 2,3
Sudan	dGPC: none dLE: none	dGPC: none dLE: Lags =1, 2
Syria	dGPC: none dLE: none	dGPC: none dLE: Lags =1, 2
Tunisia	dGPC: none dLE: none	dGPC: none dLE: Lags =1
Turkey	dGPC: none dLE: none	dGPC: none dLE: Lags =1, 2

The average value of speed of adjustment (α) of the ECT for 12 developing countries under study in the equation for dGDP & dGPC is 0.066 and 0.089 correspondingly that indicate on average 6.6% and 8.9% increase in long run in GDP and GPC due to increase in LE will take place each year while in 13 OECD countries on average only 2.64%, 3.5% of the long run increase in GDP and GPC respectively [5]. The results indicate the adjustment process in developing countries is 4.02% and 5.3% more in GDP and GPC than developed countries. In the last column of Table 6 and 7, values of α coefficient for dLE for each country have been presented that show 1% increase in LE lead to an average increase in 12 developing countries is 0.3% and 0.7% in GDP and GPC respectively while in long run, affect of LE on total GDP and GPC is 1.6% and 1.7% in developed countries [5].

Short Run Relationship: α coefficient of the ECT: presented in Table 4 & 5 in the equation for dGDP & dGPC are significant only for 2 & 5 countries respectively out of 12 indicate that short run relationships does not exists between LE and GDP & GPC over the period in most of developing countries i.e. increase in LE has no significant impact on GDP & GPC in short run in most of developing countries. In similar fashion, the α coefficient in ECT equation for dLE is significant only for 3 countries in case of GDP and 5 countries in case of GPC out of 12 depicts that increase in GDP & GPC has no significant affect on LE in short run in most of developing countries.

Furthermore, analysis of lag structure for short-run coefficients of the (VECM significance at 5% of each lag and variable in equation for the model dGDP, dGPC and dLE) for each country are presented in Table 6 and 7. The estimated results show that most of short run coefficient / lags of dLE are not significant for equation dGDP and dGPC that indicates changes in LE has no significant affect on GDP & GPC in the short run for eleven developing countries out of twelve. In similar fashion, short run coefficient / lags of dGDP & dGPC are not significant for equation dLE that represents change in GDP & GPC has no significant impact on LE in short run for ten out of twelve developing countries under study.

On the basis of empirical evidence we may say that health has no significant affect on economic development /growth in short run, although we have argued that improvement in health account for increase in economic development in long run. Life expectancy significantly affected by GDP and GPC in case of OECD countries (Swift, 2011), while in the current study it has been found

that GDP and GPC has no significant impact on LE in short-run. The results also in the line with [11, 1] that is the effect of health on the economic development is a long run phenomenon not the short run.

CONCLUSIONS

The purpose of study is to find out the long run and short run relationships between health human capital and economic development in 12 developing countries. The famous econometric techniques like: Johansen Cointegration, Error Correction Model (ECM) and Vector Error Correction Model (VECM) have been applied to accomplish that objective. The result of the cointegration confirmed that long run relationships exist between health human capital (life expectancy) and economic development (GDP and GPC per Capita) in developing countries under study. Health human capital has significant impact on economic development in the long run.

Empirical evidence is clearly indicating that influence of health on economic development is higher in developing countries than developed countries in the long run. The error correction term in equation of dGDP in table 4 is negative and significant only for two countries while in case of dGPC error correcting term is negative and significant for four out of twelve countries. These results indicate that short run effects of health are limited on development. It can be concluded that effects of investment in health may not be seen in short run but in the long run it has significant impacts.

It has been investigated that two way endogenous natures of relationships exist between health and economic development. Better economic development accounts for increase in the living standard, better nutrition and improvement of health as well as betterment in health lead to increase in economic development. However, our results show that human health has no significant affect on economic development /growth in short run and vice versa in developing countries. The results are similar to other studies like [1, 5, 11].

It has been found that better human health not only leads to increase economic growth but also raises economic development (higher productivity and GPC per capita) in long run. It is evident that for improvement in health, the developing countries would get better results by raising would the portion of their GDP on health in return they attain high level of economic development.

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