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The Impact of Health on Economic Growth: A Panel Data Investigation of Asia

Bilal Tariq[1], Muhammad Shakeel[2] and Shaher Bano[3]

Abstract

This research investigates the relationship between health and economic growth by using a balanced panel of 42 Asian economies over the time period ranging from 1995 to 2016. Panel co-integration test with Dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS) are part of our analysis to check the association between health indicator and economic growth of both the genders. This study has positive and statistically significant effect of health changes on per capita income of male and female. Moreover, this research concludes the economic performance has also a significant impact on health improvement ceterus paribus. These findings imply that health improvement policies should be used as apparatus to economic growth and vice versa.

Keywords: Health, life expectancy, economic growth, panel cointegration, panel Granger causality.
JEL classification: O15; O11; I15

1 Introduction

Socio-Economic development is linked linearly with the growth of economic output for a nation. In particular, health of individuals which is an integral part of human capital formation in the economy is pertinent to the level of income and its growth rate. There is contemporary evidence discussing the role of human capital in elucidating the income differentials in many of the developed and developing regions of the world (see e.g. Tan, 2014; Pelinescu, 2015). Many of the literature on the buildings blocks of the human capital emphasize the connotation of education in the growth models. New endogenous growth theory signifies the education in relation to technology development and other skillful techniques to produce more economic output/income.

Nonetheless, the fundamental aspect of human capital measured by health based

[1] Assistant Professor, Department of Management Sciences, COMSATS University Islamabad, Pakistan.
Email: bilal.tariq@ciitvehari.edu.pk
[2] Assistant Professor, Department of Economics, Virtual University of Pakistan, Pakistan.
Email: m.shakeel32@gmail.com for correspondence
[3]COMSATS University Islamabad, Pakistan.
Email: shaherbano222@hotmail.com

indicators is somewhat underestimated/neglected while health is a better predictor of economic growth (Banerjee, 1999; Howitt, 2005). Health improvements can be measured with many factors like easier excess to better sanitation, good medical care, safe water, diet, nutrition and public health infrastructure among others. There is some evidence suggesting that valuing health as development with going beyond the concept of economic production growth has also emerging and highlighting the pivotal role of health in an independent broader spectrum (e.g. Fan et al. 2018).

Health upgrades can improve economic growth. There are in reality numerous ways by which health improvement can impact and particularly increase growth (Odrakiewicz, 2012; Fan et al., 2018). Moreover, healthy employees are commonly more energetic, physically and mentally strong leading toward higher wages/incomes of individuals. Also, productivity can be influenced by health in an indirect way through education, savings and labor market support. For example, changes in health standards can expand the education in various ways and above all, the inspiration to spend more on education, increasing investments on R&D and thereby promote higher productivity.

There are diverse ways that one can use in order to examine the relationship between health and economic growth. First of all, the connection between health and growth can be directed at an either a singular level or on a regional level inside an economy. A few researches use microecono and other macroeconomic evidence and tools (e.g. Bloom and Canning, 2005; Bloom et al., 2019). By utilizing microeconomic data a researcher can adjust their results and discover the size of the effect of health at an aggregate level, albeit with macroeconomic data it is easier to estimate the aggregate relationship directly. Macroeconomic methodologies consider life expectancy, health consumption, Adult survival rate (ASR) and others. With respect to microeconomic ones, the indicators of health level considered are malnutrition, anemia, exposure to sickness in utero and childhood, and others. At last, another separation among studies is the methodology they utilize (Fraser and Sayah, 2011).

The main objective of the study is to assess if there is a realationship among health and economic growth in both the short-run and the long-run. We utilize life expectancy as a proxy of health and GDP per capita as determinants of growth. Where we distinct life expectancy of males from that of females and present their effects on GDP per capita. In particular, we utilize a cointegrating examination and present both equilibrium relationship and error correction models (ECMs). The benefits of the macroeconomic appoach over the microeconomic one is that the last overlooks the individual effects of health capital on society, as it measure the impact of individual health status is based on just their own income. Therefore, it doesn't consider the so-called externalities. However, macroeconomic regression catches the externalities, yet they are still suffering from omitted variable bias.

The study addressed following objectives

- To analyze the relationship between health and economic growth in Asian economies.
- To investigate the short run and long run impact of both the genders health and economic growth and vice versa.
- To suggest suitable policy recommendations about health standerd on the basis of empirical findings.

2 Literature Review

Barro (1996) yielded the results that showed positive and significant connection between life expectancy and growth rate. Likewise, Antwi et al. (2013) utilizes 71 countries for the time period 1965-75, 86 countries for 1975-85 and 83 countries for 1985-95 out of a panel set up. The estimation results demonstrate that better health prompts higher economic growth. Barro (2013) investigated the sources of economic growth utilize 85 countries for the time of 1965-75 and 95 countries for 1975-1985. Life expectancy at birth, which is utilized as an indicator of health status, was appeared to be positive and most significant in growth regressions (growth rate of real GDP per-capita is the endogenous variable of the equation).

Grossman (2010) examined the commitment of human capital regarding schooling and health to economic growth. This study included a panel of 104 countries for the time 1960-1990 (at regular intervals) with nonlinear two stages least squares. The writers find that health has a positive and statistically significant impact on economic growth. Ecevit et al. (2013) explored the connection among economic growth and health for a panel of of 21 countries of economic co-operation and development (OECD) from 1970 to 2010. He utilizes panel cointegration and causality tests. The finding showed positively significant impact of life expectancy at birth on real GDP per capita

Furthermore, Peykarjou et al.(2011) analyze the connection between health and economic growth in the Organization Islamic Conference (OIC) party states. They utilize panel fixed impacts strategy for the period 2001-2009. They infer that the increase of life expectancy improves economic growth in the particular countries. However , there is a negative connection among fertility rate and economic growth.

As indicated by all the above investigations, there is a positive effect of health standard on economic growth. By the by, there are a few researchers, who support the inverse. Acemoglu et al. (2008) at al. for a panel of 75 countries from Western Europe, Oceania, the Americas, and Asia for the eras 1940-1980 and 1940-2000. Knowles et al. (2002) found a negative however statistically insignificant impact of life expectancy on growth real GDP per capita.

The present study aims to find out the long-term linkages among the economic growth and health variables segregated for male and females and thus provide a further evidence to support the policy analysis of the region.

3 Data and Methodology

In this examination we will research both the short-run and the long-run connection among health and economic growth. We use for this life expectancty of male and female as a indicator of health. In particular, we analyze the connection among health and GDP per capita. Along these lines, we utilize three variables in our examination. The first is GDP per capita and has been taken from World bank data. The second one male life expectance at birth has been taken from Human Mortality Database. The last variables female life expectance at birth is also taken from the Human Mortality Database (see Table 1)

Table 1
Data Source

Variable over year 1995-2016	Source
GDP per capita	World bank data 2018
Male life expectance atBirth	Human Mortality Database. 2018
Female life expectanceat Birth	Human Mortality Database. 2018

We are estimating impact of health on eeconomic growth.

$$DLGDPPC = \alpha_0 + \alpha_1 DLLEM + \alpha_2 DLLEF + \varepsilon_i \quad (1)$$

Where,
DLGDPPC = is used as difference of GDP per capita
DLLEM = is used as difference of log of life expectancy male.
DLLEF = is used as difference of log of life expectancy female.

3.1 Unit Root Test

At the point when the variables are not covariance stationary, cointegration investigation is the one that can give a system for estimation, inference, and interpretation. Therefore, the primary thing that is done is to test the stationarity of the a series in question. The fundamental test we use for this scope is the Im Pesaran and Shin (IPS) (2003) unit root test. Analytically, think about an AR (1) process:

$$y_{it} = \rho_i y_{it} + X_{it}\delta_{it} + \imath_{it} \quad (2)$$

Where i=1,… ., N cross-section units and t=1,… ., T time series. The X_{it} Shows the independent variables in the model, ρ_i The autoregressive coefficients and $\imath_{it}$ the error term (is thought to be iid). In the event that, $|\rho_i| < 1$, y_i Is said to be weakly (trend) stationary. Then again, if $|\rho_i| = 1$, at that point y_i Contains a unit root.

3.2 Cointegration tests

There are three types of Co-integration test which are given as.

The Engle-Granger (1987) cointegration test depends on the study of the residuals of a spurious regression, with I (1) variables. We say that the variables are cointegrated if the residuals that we find by regression the variables to one another are I (0). In the event that they are I(1), at that point the variables are not cointegrated.

With respect to the Pedroni (1999, 2004) test, it permits intercept and trend coefficients crosswise over the cross-section to be heterogeneous. The regression that is study is as follows:

$$y_{it} = \kappa_i + \nu_i t + \xi 1_i x 1_{i,t} + \xi 2_i x 2_{i,t} + \ldots\ldots + \xi M_i x M_{i,t} + f i_{,t} \quad (3)$$

Where i=1, …. , N, t=1,…., T, m=1,…., M and y,x are integrated of order one, in other words, I(1).

The main idea is to get the residuals from the above regression and then we test if the residuals are I (1) by running the regression:

$$fit = pifit - 1 + wit \tag{4}$$

The null hypothesis of the test show that there is no cointegration between the variables. What's more, the alternative that for all I (homogeneous alternative) or pi<1 for all I (heterogeneous alternative). The primary alternative a refers to the inside measurement test or panel test and the second to the between-measurement or group statistic test. We ought to likewise specify that, on account of the Pedroni cointegration test, there are four panel statistics and three group panel statistics. In the initial ones, the first order autoregressive term does not change over the cross section. Be that as it may, in the group panel statistics the term change over the cross section. Then again, the Kao (1999) test, in spite of the fact that it takes after a similar methodology, it determines cross-section particular intercepts and homogeneous coefficients on the first stage. By the Granger Representation Theorem, when two variables are cointegrated their relationship can be given by an Error Correction Model (ECM) (Gujarati, 2004).

3.3 Ordinary Least Squares Estimates

The FMOLS estimator was proposed by Phillips and Hansen (1990). It utilizes a semi-parametric correction, keeping in mind the end goal to minimize the issues that are caused by the long run correlation between's the cointegrating regression and stochastic regressors innovations. The particular estimator is asymptotically unbiased and has a completely efficient blend normally asymptotic. Along these lines, it allows us to do standard Wald tests utilizing asymptotic Chi-square.

With a specific end goal to remove the feedback in the cointegrating equation Saikkonen (1992) and Stock and Watson (1993) proposed DOLS as an asymptotically efficient estimator. The cointegrating condition is given by:

$$y_t = X_t'\eta + D_{1t}'\zeta + \sum_{j=q}^{r} \Delta X_{t+j}'\phi + u_{it} \tag{5}$$

Least square estimator of η has an indistinguishable asymptotic distribution of those output by FMOLS, as long as the long-run connection between's the u_{1t} and u_{2t} Is splashed up by Lages q and leads r of the differences regressors that are incorporated into the above regression

We take after the Engle-Granger two-step methodology (Brooks, 2008), which is: a) we look at the order of integration of the variables. On the off chance that they are all I (1) and cointegrated we run the cointegrating regression with FMOLS and DOLS and take the residuals (RESID). Logically, the cointegrating condition will be:

$$LGDP_t = \beta LLF_t + RESID_t \tag{6}$$

Where β is the FMOLS and DOLS estimator in view of which methodology (FMOLS or DOLS) we use. In addition, the estimated cointegrating vector is (1– b), where b the FMOLS and DOLS estimator of β, separately. Note that in the Engle-Granger two-step methodology the OLS method is recommended. In any case, because of the way that we have panel data, we utilize FMOLS and DOLS (as literature recommends) with a specific end goal to get the cointegrating regressions. ECMs will be, separately:

$$DLGDP_t = \beta 1 DLLF_t + \gamma_4 RESID_{t-1} + \varepsilon_t \quad (7)$$

$$DLGDP_t = \beta_2 DLLF_t + \beta_3 DLGDP_{t-1} + \beta_4 DLLF_{t-1} + \gamma_2 RESID_{t-1} + \varepsilon t \quad (8)$$

Where DLGDP is the first difference of the logarithm of GDP per capita, DLLF is the first difference of logarithm of life expectancy, DLLFt-1 and DLGDPt-1 are one-period lagged estimations of the above variables, RESIDt-1 is the ECT and εt is it. Notice that RESID has been estimated from the cointegration equation. Equation (8) will indicate us if DLGDP per capita relies upon DLLF, the one time frame slacked estimations of DLGDP per capita and DLLF and the RESIDt-1.

3.4 Panel Causality

The bi-variate regressions in a panel data dimension are

$$Y_{i,t} = \sigma_{0,i} + \sigma_{1,i} y_{i,t-1} + \ldots + \sigma_{l,i} y_{i,t-1} + \tau_{1,i} x_{,it-1} + \ldots + \tau_{l,i} x_{i,t-1} + \pi_{i,t} \quad (9)$$

$$X_{i,t} = \sigma_{0,i} + \sigma_{1,t} X_{i,t-1} + \ldots + \sigma_{1;i} X_{i,t-1} + \tau_{1,i} y_{,it-1} + \ldots + \tau_{1;i} y_{i,t-1} + \pi_{i,t} \quad (10)$$

Where t represents the period of time of the panel and i for the cross-section. There are two methodologies depend on which anyone can utilize Granger causality. The first is assuming that all coefficients are the same for each cross-section and the second one that they differ. We take after the second method, which is received by Dumitrescu-Hurlin (2012). In a mathematical view it implies that:

$$\sigma_{0,i} \neq \sigma_j, \sigma_{1,i} \neq \sigma_{1,j}, \ldots, \sigma_{l,i} \neq \sigma_{l,j}, \forall i, j$$

$$\tau_{1,i} \neq \tau_{1,j}, \ldots, \tau_{l,i} \neq \tau_{l,j}, \forall i, j$$

Granger Causality equation is utilized for each cross-section independently. At that point mean W-bar statistics are taken. Note that the Z-bar statistics, which is the standardized version of the above statistics is suitably said weighed in unbalanced panel.

4 Results and Interpretations

In this segment we will explore the connection between growth utilizing GDP per capita as its indicator and health status of the two genders. We will show both short run and long run impacts of life expectancy of male and females on GDP per capita.

We will utilize the IPS unit root tests, with a specific end goal to analyze if the series is stationary or not. We do the test considering about the AIC. Table 1 shows two cases, the result of the test in after including just individual intercept and both individual intercept and trends.

The numbers of the observation for life expectancy of males in the two cases are 769 and 760, separately. With respect to the life expectancy of female it is 770 and 773.

Table 1
IPS Unit Root Test

Log of life expectancy of:	Male		Female	
H_0: Unit root	t-stat.	Prob.+	t-stat.	Prob.+
Individual effects	-10.399	0.000*	-3.073	0.001*
Individual effects & trend	-2.037	0.021	-1.581	0.056

Probabilities are computed assuming asymptotic normality.Note: * denote rejection at 1%level,respectively.

Life expectancy of male and female reject the null hypothesis at 1% confidence interval in case of individual effect (Table 1). In case of both individual intercept and trend doesn't reject at 1% intervals. Accordingly, considering the IPS unit root test, and the graphs we presume that the two series are not stationary.

Table 2
IPS Unit Root Test

Log of life expectancy of	Male		Female	
H_0: Unit root	t-stat.	Prob.+	t-stat.	Prob.+
Individual effects	-7.757	0.000*	-6.5422	0.000*
Individual effects & trend	-14.232	0.000*	-15.266	0.000*

Probabilities are computed assuming asymptotic normality. Note: * denotes rejection at 1% level.

From Table 2, we infer that the null hypothesis that the unit root is rejected at even 1% confidence interval for the two variables in the two cases, as the t-statistic p-values equivalent to zero, that is they are less than 0.01. Thus, the first difference in life expectancy of male and female is a stationary procedure. On the other hand, the levels of the series are integrated of degree one i.e., I (1). We have demonstrated that GDP per capita is, additionally, I (1). Thusly, we will test for cointegration the two variables.

Table 3 reports the outcomes of the Kao (no deterministic trend is prohibited) and Pedroni cointegration tests were considered three cases. Besides, the null hypothesis of the Pedroni and Kao cointegration test is that there is no cointegration connection between GDP per capita and life expectancy of male and life expectancy of female. On account of the male, the null hypothesis is rejected at even 1% confidence interval for a few of the panels and group tests, as the probability is less than 0.01, both including individual effects and individual effects and trends (on account of females just 5 tests reject).

In any case, on account of avoidance of individual effects and trends, the null hypothesis isn't rejected even at 10% confidence interval. On account of female life expectancy, when we

incorporate just consistent, 5 out of 7 tests dismiss the null hypothesis at even 1% level. Counting both steady and trends, yields that 6 out of 7 tests rejected at 1% level and the last one at 10%. On account of avoidance of both intercept and trend the null hypothesis isn't rejected. Subsequently, in light of the initial two cases, we can state that there is equilibrium connection between male life expectancy and GDP per capita, and female life expectancy and GDP per capita in few tests.

Table 3
Pedroni & Kao Cointegration Tests

		Male			Female		
		H_0: no cointegration between LGDPC and male LLF			H_0: no cointegration between LGDPC and female LLF		
	Pedroni	No Deterministic Trend	Determiistc Intercept and Trend	No Deterministic Intercept and Trend	No Determinist c Trend	Deterministic Intercept and Trend	No deterministic Intercept and
H_1:common ARcoef.	Panel v-Statistic	2.291 (0.011)**	3.775 (0.000) *	-3.084 (0.999)	1.036 (0.149)	6.254 (0.000) *	-3.014 (0.998)
	Panel rho-Statistic	0.163 (0.565)	2.539 (0.995)	1.908 (0.972)	0.644 (0.740)	1.809 (0.694)	1.940 (0.974)
	Panel PP-Statistic	0.076 (0.530)	2.633 (0.995)	1.294 (0.902)	0.517 (0.697)	0.728 (0.767)	1.333 (0908)
	Panel ADF-Statistic	-3.889 (0.000) *	-3.208 (0.000) *	0.316 (0.624)	-2.478 (0.006) *	-4.534 (0.000) *	0.162 (0.565)
H_1:individual coef.	Group rho-Statistic	2.639 (0.995)	3.491 (0.999)	6.424 (1.000)	2.405 (0.992)	3.347 (0.999)	-3.014 (0.998)
	Group PP-Statistic	1.187 (0.883)	0.009 (0.503)	4.719 (1.000)	0.751 (0774)	-0.013 (0.494)	1.940 (0.974)
	Group ADF-Statistic	-3.284 (0.000) *	-6.251 (0.000) *	1.126 (0.874	-4.793 (0.000) *	-5.592 (0.000) *	1.334 (0.908)
	Kao						
	ADF-Statistic	-0.778 (0.218)			-1.076 (0.141)		

Note: *,** denote rejection at 1%,5% level, respectively. Figure in () shows p- value.

Finally, will show the results of the Johansen unrestricted cointegration rank test. Table 4, presents the outcomes of Trace and Maximum-Eigenvalue tests. The null hypotheses are; a) there isn't cointegrating regression between the log of GDP per capita and life expectancy of male and females (4rd and sixth line), b) there is at most one cointegrating regressions somewhere in the range of them (5th and seventh lines).

Table 4
Johansen Cointegration Test
Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

		Male				Female			
	Null Hypothesis	Trace	Prob.+	Max-Eigen	Prob.+	Trace	Prob.+	Max-Eigen	Prob.+
No intercept or trend in CE or Var	None (r=0)	512.7	0.000*	485.3	0.000*	464.8	0.000*	442.7	0.000*
	Atmost 1(r<=1)	123.6	0.003**	123.6	0.003**	116.4	0.011**	116.4	0.011**
Intercept & trend in CE & no trend in Var	None (r=0)	4031.	0.000*	1052.	0.000*	4407.	0.000*	1010.	0.000*
	At most 1 (r<=1)	185.9	0.000*	185.9	0.000*	205.4	0.000*	205.4	0.000*

Probabilities are computed using asymptotic Chisquare distribution. Note: * denote rejection at 1%level respectively.

Based on Table 4, in case of male life expectancy, the null hypothesis that there is no cointegrating equation between the variables in question, is rejected at even 1% confidence interval, in both cases we consider. On the other hand, the null hypothesis that there is at most one cointegrating equations between the variables is not rejected even at 10% confidence interval. As for female life expectancy, we get the same results in the case of exclusion of constant and trend.

Table 5 shows the cointegrating equations of logarithm of life expectancy at birth of male and female (LLF for both of them) and the logarithm of GDP per capita. Columns 3-5 account for the case of male and 6-8 of female employed both with FMOLS and DOLS methods,. The number of observations when we take into account life expectancy of males is 882 and 798 in the case of FMOLS andDOLS method, respectively. However, taking into account life expectancy of females, it is 882 and 798, respectively.

Table 5
Cointegrating Equations

		Male			Female		
		1.LGDPC= βLLF					
Method	Variable	Coefficient	t-stat.	R^2	Coefficient	t-stat.	R^2
FMOLS	LLF	6.977*	18.349 (0.000)	0.982	29.160*	19.414 (0.000)	0.982
DOLS	LLF	10.551*	20.168 (0.000)	0.995	35.852*	20.415 (0.000)	0.996

Note: * denotes significance at 1% level. Figure in () shows p- value

As should be obvious from Table 5 that the log of life expectancy of both male and female is statistically significant it is possible that we utilize FMOLS or DOLS at even 1% confidence interval. We observe, additionally, that the R-squares are too large. When we utilize FMOLS, R-square is around 98% for the instance of male and 98% for the instance of female.

This is recommended health standard of male (females) show the model by 98% (98%). Moreover, the coefficient in interest, that explain to us the long run connection between GDP per capita and life expectancy of male or females is around 6.97 or 29. 10.

This implies, if life expectancy at birth of male or female increase by 1%, GDP per capita will increase by 6.97% and 29.10%, individually for both genders respectively. Also, the same that we analysis the model utilizing DOLS method, these coefficients will be 10.5 and 35.8, separately. That is, if life expectancy of male or female increase by 1%, GDP per capita will increase by 10.5% and 35.8%. We observe, from the above examination, that the coefficient of life expectancy at birth of males and that of females are much close in the two cases (FMOLS, DOLS). Subsequently, the health level of male and females has positive, statistically significant, and of same size effect on GDP per capita.

The above was the initial step of the Engle-Granger two-step methodology (Brooks, 2008). Beneath we estimate the second one. In this method we get the residuals from the initial step estimations (with FMOLS and DOLS) on account of male life expectancy and female future. We assume that the two regressions. In the first we do exclude the lages, however in the second one we include one lag in the two variables. Note that including more Lages the outcomes are fundamentally the same as.

Table 6
Error Correction Models

		Male			Female		
		$2.DLGDPC=\alpha_1+\beta_1 DLLF+\gamma_1 ECT(-1)$					
Method	Variable	Coefficient	t-stat.	R^2	Coefficient	t-stat.	R^2
OLS	DLLF	0.189*	7.702	0.317	0.121*	3.531	0.302
			(0.000)			(0.000)	
	ECT(-1)	-0.019*	-5.917		-0.018*	-5.069	
			(0.000)			(0.000)	
	C	0.019*	24.022		0.019*	23.544	
			(0.000)			(0.000)	
	$3.DLGDPC=\alpha_2+\beta_2 DLLF+\beta_3 DLGDPC(-1)+\beta_4 DLLF(-1)+\gamma_2 ECT(-1)$						
Method	Variable	Coefficient	t-stat.	R^2	Coefficient	t-stat.	R^2
OLS	DLLF	0.177*	7.327	0.347	0.127*	3.645	0.335
			(0.000)			(0.000)	
	LGDPC(-1)	0.204*	9.446		0.208*	9.681	
			(0.000)			(0.000)	
	DLLF(-1)	-0.014	-0.598		0.062***	1.810	
			(0.549)			(0.070)	
	ECT(-1)	-0.018*	-5.732		-0.018*	-5.149	
			(0.000)			(0.000)	
	C	0.015*	16.839		0.015*	15.823	
			(0.000)			(0.000)	

Note: * and *** denote significance at 1% and 10% level, respectively.

ECMs are estimated by OLS using the residuals from FMOLS cointegrating regressions. Figure in () are p-value.

Table 6 shows two models for each gender, the one without lags and the one with one lag

in first differences of log of life expectancy of male or female and GDP per capita. The coefficients of the first difference, give us the short-run connection between the variables being referred to. They are on the whole positive and statistically significant at even 1% confidence interval, aside from DLLF (- 1), the one final time frames growth rate of life expectancy, which on account of male life expectancy is irrelevant at even 10% level and on account of female life expectancy is significant at the 10 % level. Additionally, we give it a second thought, likewise, about the error correction term (ECT). As should be obvious from table 6, this parameter is statistically significant at even 1% confidence interval in both two models and for both genders. Additionally, we see that it is negative, which guarantees that it adjusts the deviation from the long-run equilibrium relationship. Additionally, when we consider male life expectancy at birth as an is independent variable, the ECT is around - 0.019, however, when we consider female life expectancy it is - 0.018. That is, 1.9% or 1.8% of the inconsistency between GDP per capita and male or female life expectancy in the earlier year is wiped out this year. On the other hand, 1.9% or 1.8% of the last time frame's equilibrium error is adjusted.

Table 7
Error Correction Model

		Male			Female		
		2.DLGDPC=β_1DLLF+γ_1ECT(-1)					
Method	Variable	Coefficient	t-stat.	R^2	Coefficient	t-stat.	R^2
OLS	DLLF	0.157*	6.523	0.311	0.093*	2.731	0.298
			(0.000)			(0.006)	
	ECT(-1)	-0.013*	-3.724		-0.013*	-3.671	
			(0.000)			(0.002)	
	C	0.020*	24.634		0.021*	24.508	
			(0.000)			(0.000)	
	3.DLGDPC=α_2+β_2DLLF+β_3DLGDPC(-1)+ β_4DLLF(-1)+γ_2ECT(-1)						
Method	Variable	Coefficient	t-stat.	R^2	Coefficient	t-stat.	R^2
OLS	DLLF	0.151*	6.328	0.342	0.115*	3.284	0.333
			(0.000)			(0.001)	
	DLGDPC(-1)	0.202*	9.252		0.205*	9.427	
			(0.000)			(0.000)	
	DLLF(-1)	0.021	0.908		0.104*	3.028	
			(0.364)			(0.003)	
	ECT(-1)	-0.014*	-4.164		-0.015*	-4.54	
			(0.000)			(0.000)	
	C	0.016*	17.131		0.015*	16.335	
			(0.000)			(0.000)	

Note: * denotes significance at 1% level. ECMs are estimated by OLS using the residuals from DOLS cointegratingregressions. Figures in ( ) are p- value

As indicated by Table 7, short run coefficients are again positive and statistically significant at even 1% intervals, aside from DLLF (- 1) which is statistically insignificant, just on account of male life expectancy. Besides, the ECT is again statistically significant at even 1% confidence intervalin both two models and for both genders. It is, likewise, negative and again this guarantees it amends the deviation from the long-run equilibrium relationship. When we consider male life expectancy at birth as an independent variable, the modification term is around - 0.013 and - 0.014 out of both models, separately. When we consider female life

expectancy as an independent variable, it is around - 0.013 and - 0.016, separately. That is, 1.3% or 1.4% of the inconsistency between GDP per capita and male life expectancy in the earlier year is wiped out this year. Likewise, 1.3% or 1.6% of the discrepancy between GDP per capita and female life expectancy in earlier year doesn't exist this year. Therefore, both male and female health standard influence economic growth not only in the short- run as well as over the long run.

Table 8
Granger Causality in Panel Sense
Note *, denoterejection at 1% level. The test is based on Dumitrescu- Hurlin (2012) technique.

	Male			Female		
Null Hypothesis:	W-Stat	Zbar-Stat.	Prob.	W-Stat	Zbar-Stat.	Prob.
DLLF does not Granger Cause DLGDPC	5.131	6.566	0.000*	4.450	4.968	0.000*
DLGDPC does not Granger Cause DLLF	2.694	0.847	0.396	3.755	3.339	0.000*

In Table 8, the null hypothesis considered are: (I) the growth rate of life expectancy of either male (lines 2-4) or female (lines 5-7) does not cause the growth rate of GDP per capita and (ii) the growth rate of GDP per capita does not cause the growth rate of life expectancy of either male or female. Accordingly, there is a weak causation running from the growth rate of life expectancy to the growth rate of GDP per capita. The second null hypothesis, however, is rejected at even 1% level in female case. There exists two-way causality between two sets of variables. At long last, the causation running from life expectancy to GDP per capita is predictable with the result of the statistically significant and positive short-run coefficients. Therefore, there is a positive and measurable noteworthy effect of the two sexes' health standard on GDP per capita in the short-run and over the long Run.

5 Conclusion and Policy Recommendations

Health enhancements can cause a rise in aggregate economic production/GDP through both the rise of population, yet for the most part, through the additions in human and physical capital. These human capital gains via health improvements directly add to the productivity and GDP per capita. In this study, we have utilized a balanced panel of 42 Asian countries, for the time period 1995-2016. We analyzed the connection among economic production growth and both gender's life expectancy.

Above all else, we test for unit root all variables and yielded that they are all non-stationary, or integrated of degree one, I (1). At that point we present that there are balance relations between life expectancy (total, male, and female) and GDP per capita. Cointegrating equation, that were utilized through FMOLS and DOLS methodologies, present that health standard of the citizens of the nations have a positive and statistically significant impact on total and per capita output over the long run. Therefore, health levels of males and females have positive and statistically significant effect of a similar size with one another. Moreover, error correction models suggested that there is both short-run and long-run connection between total, male and female life expectancy and GDP per capita. Finally, the causality exists for growth rate of male life expectancy and both growth rate of GDP per capita, and growth rate of female life

expectancy and growth rate of per capita income. Thus, there is evidence that the health status of the total male and females has a positive, sizable and statistically significant effect on the economic growth of the country.

It would be useful if policy makers consideres health enhancement as an approach to accelerate the economy's growth. Health brings improvement not only to the social life of the people, but additionally to the economic standard of the economy also. As a consequence, policy makers should not ignore the profound effects of health on economic performance. In the country, they should use it as an apparatus to accelerate economic growth. Indeed, even the poorest countries can put resources into health intercession and thus have a high scale impacts on individuals' health leading towards higher productivity.

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