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The Long-Run Perspective of Life Expectancy and Economic Growth in the South Asian Countries

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Abstract: Economic growth is one of the prime priority of macroeconomic aspirations of any country. The major focus of this study is to examine the long-run dependency between life expectancy and economic growth in six south Asian countries. The study has used secondary data to find the relationship over the time 1984 to 2017. Non-stationary panel techniques have been employed for empirical works. Results of Levin, Lin and Chu t* test; Breitung t-stat; Im, Pesaran and Shin W-stat; Augmented Dickey Fuller(ADF) Fisher Chi-square and PP Fisher Chi-square test reveals that data set is stationary. Using Pedroni residual cointegration and Kao residual cointegration test the study has confirmed that there is long-run relatiohship between the life expectancy at birth and economic growth. Then employing panel dynamic ordinary least square (DOLS) the study has indicated significant positive relation between life expectancy and economic growth.

Keywords: economic growth, life expectancy, panel cointegration, panel DOLS.

Introduction

The human capital accelerates the economic growth of a country according to the neo growth theory (Ngangue & Manfred, 2015). Healthy population and economic prosperity both are positively interlinked (Piabuo & Tieguhong, 2017). Healthy population performs better in creativity, education, skills, and life expectancy and as a consequence the tendency of social savings increases which in turns eventually affects the economic growth by enhancing the physical capital stock (Somayeh et al., 2014). On the other hand, improvement in longevity may lead to lower per capita income because of the increased population and having narrow scope to get expansion of existing resources among the huge population (Sharma 2018). The importance of health can be justified by the popularity of Human Development Index (HDI) in different countries (Djafar & Husaini, 2011). High-income countries generally have low mortality rate than low-income countries, which means that the mortality is associated with the income across the countries (Shkolnikov et al., 2019). The life expectancy plays an important role to improve the per capita income (Boucekkine & Azomahou, 2007).

The change in life expectancy changes the stock of human capital and the change in human capital influences the economic growth of a country. Moreover, there exists a research gap in the literature which investigates the long-run dependency between life expectancy and economic growth in South Asian countries as a whole. Thus the study has

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been conducted with an objective of addressing whether there exists or not any long-run dependency between life expectancy and economic growth in South Asia.

Health is a part of human capital and health is represented by life expectancy at birth. On the other hand human capital significantly affects economic growth. That's why we are willing to observe the impact of life expectancy at birth on the economic growth of six South Asian countries at big scale as health sector is less perfect in these south Asian countries than that of developed countries.

Literature Review

Currais (2000) and Zaman et al. (2017) found that per capita income and health expenditures are positively related whereas Babatunde (2012) showed that the health to government expenditures ratio negatively affects the economic growth in Nigeria. Rengin (2012) and Piabuo & Tieguhong (2017) revealed the presence of the long-run dependency between economic growth and heath expenditures. Rengin (2012) also confirmed that this sort of relationship does not exist in the short-run. Bloom et al. (2004), Aghion et al. (2011), Babatunde (2012), Mahumud et al. (2013), Somayeh et al. (2014), Ngangue & Manfred (2015), Mahyar (2016), Kouton et al. (2018), and Sharma (2018) found that life expectancy and economic growth are positively related. This kind of relationship has the high probability to happen in Asian countries in the long-run rather than in the short-run according to Djafar & Husaini (2011). On the other hand, Ismail et al. (2015) did not find any long-run relationship between economic growth and life expectancy in Malaysia. Boachie (2015) found both the short-run and long-run relationships in the context of Ghana. GDP and life expectancy are positively related according to Ebenstein et al. (2015), Bai et al. (2018), and Shafi & Fatima (2019). Hansen & Lønstrup (2015) represented the negative relationship between life expectancy and economic growth by analyzing 141 developing countries. Brendan & Sek (2017) expressed that in the long-run the population with a high number of old aged people negatively affects the economic growth whereas the population with a high number of young aged people positively affects the economic growth.

Although many researchers analyze the dependency between life expectancy and economic growth in the context of both developed and developing countries including the Asian countries, but there are no rigorous studies found that explain the same topic dedicatedly in the context of South Asian countries as a whole in the long-run time frame. This is why the present study has been initiated.

Data and Method

To investigate the effect of life expectancy on economic growth in six South Asian countries the study used secondary data. The data of those six countries namely Bangladesh, India, Pakistan, Sri-Lanka, Nepal and Bhutan over the time 1984 to 2017 collected from world development indicators. In this study the data of cross section and time series have been pooled together to realize the relationship between life expectancy and economic growth.

The study has the following model:

$$EG = \beta_0 + \beta_{1i} LEB_{it} + \varepsilon_{it}$$

Where EG represents economic growth taken as percentage form of annual GDP growth and LEB represents life expectancy at birth (converted as annual percentage form). Where the subscript i = 1,….N that denotes individual countries and t = 1,….T represents time period, β_0 is the constant term, β_{1i} represents the change in EG as a result of one extra unit change in LEB, and ε_{it} represents idiosyncratic error term which captures the effects of the factors on the dependent variable that vary both across entity and over time and hence purely random.

Non- stationary panel techniques have been employed here for empirical works of this study. So it is essential to check first whether there is unit root problem or not. To check the stationarity of data the study has chosen the Levin, Lin and Chu t, the Breitung t-stat, the Im, Pesaran and Shin W-stat, the ADF Fisher Chi-square, and the PP Fisher Chi-square tests based on augmented Dickey Fuller test (Maddala and Wu 1999) :

$$\Delta V_{it} = \mu_i + \rho_i V_{i,t-1} + \sum \beta_{ij} \Delta V_{i,t-j} + \varepsilon_{it}$$

where i = 1,….N and t = 1,….T

If $\rho_i = \rho$ for the i^{th} cross section unit then the null and alternative hypothesis of Levin-Lin test can be expressed as:

H_0: $\rho_1 = \rho_2 \ldots = \rho_N = \rho = 0$

H_1: $\rho_1 = \rho_2 \ldots = \rho_N = \rho < 0$

the Levin, Lin and Chu t, the Breitung t-stat, the Im, Pesaran and Shin W-stat, the ADF Fisher Chi-square, and the PP Fisher Chi-square tests

The Pedroni and Kao tests have been employed to check the cointegration between the observed variables. The Pedroni and Kao tests are based on Engle-Granger (1987) two step residual based on cointegration test. Pedroni (1999, 2004) and Kao (1999) extend the Engle-Granger framework to test involving panel data. If variables are cointegrated then we can apply DOLS for determining the nature of long run relationship.

Result Discussion

Results of Panel Unit Root Test:

Results of Levin, Lin and Chu t* test; Breitung t-stat; Im, Pesaran and Shin W-stat; ADF Fisher Chi-square and PP Fisher Chi-square test has been presented (table 1 to 4) to check the unit root problem when there is an assumption of individual effects as well as when there is an assumption of individual effects and individual linear trends of variables in both case of level forms and first difference forms of the variables. If the probability value is greater than 5% then we cannot reject the null hypothesis of unit root meaning that there exists unit root problem in data. All test results show that (from table 1 to table 4) the variables are non-stationary at levels but stationary at first difference in case of both assumptions that is individual effect as well as individual effect and individual linear trends.

Table 1: Panel unit root test, variables in level form (Individual effects)

Variables in level form	Levin, Lin & Chu t-stat (Prob)	Im, Pesaran & Shin W-stat (Prob)	ADF-Fisher Chi-square (prob)	PP-Fisher Chi-square (prob)
EG	-7.52136 (0.0000)	-8.29103 (0.0000)	84.9460 (0.0000)	85.1510 (0.0000)
LIFEEXP	1.54734 (0.9391)	1.53512 (0.9376)	12.2880 (0.4228)	2.77525 (0.9969)

Table 2: Panel unit root test, variables in level form (Individual effect and individual linear trends)

Variables in level form	Levin, Lin & Chu t-stat (Prob)	Breitung t-stat (prob)	Im, Pesaran & Shin W-stat (Prob)	ADF-Fisher Chi-square (prob)	PP-Fisher Chi-square (prob)
EG	-5.15561 (0.0000)	-3.92921 (0.0000)	-8.20297 (0.0000)	77.2429 (0.0000)	211.847 (0.0000)
LIFEEXP	-2.18696 (0.0144)	-1.57369 (0.0578)	-3.46239 (0.0003)	41.1040 (0.0000)	9.49012 (0.6606)

Table 3: Panel unit root test, variables in 1st difference form (Individual effects)

Variables in level form	Levin, Lin & Chu t-stat (Prob)	Im, Pesaran & Shin W-stat (Prob)	ADF-Fisher Chi-square (prob)	PP-Fisher Chi-square (prob)
EG	-9.80014 (0.0000)	-14.3539 (0.0000)	152.984 (0.0000)	160.715 (0.0000)
LIFEEXP	-4.80529 (0.0000)	-6.41144 (0.0000)	68.2084 (0.0000)	15.8783 (0.1969)

Table 4: Panel unit root test, variables in 1st difference form (Individual effect and individual linear trends)

Variables in level form	Levin, Lin & Chu t-stat (Prob)	Breitung t-stat (prob)	Im, Pesaran & Shin W-stat (Prob)	ADF-Fisher Chi-square (prob)	PP-Fisher Chi-square (prob)
EG	-7.52774 (0.0000)	-4.83063 (0.0000)	-13.1426 (0.0000)	135.200 (0.0000)	1396.26 (0.0000)
LIFEEXP	-1.03203 (0.1510)	-2.19873 (0.0139)	-4.66757 (0.0000)	47.0171 (0.0000)	7.53264 (0.8205)

Results of Panel Cointegration Tests:

Once the variables are stationary at first difference then the next step is to find the existence of long run relationship between the examined variables. For this the study proceeds with Pedroni test and Kao cointegration test to determine the long-run equilibrium relationship between the chosen variables under the null hypothesis. The null hypothesis is that there is no Cointegration. Automatic lag length selection is based on SIC with a max lag of 7 in case of no deterministic trend as well as deterministic intercept and trend. There are eleven statistics in Pedroni residual cointegration test (table 5). Among eleven statistics ten of them (table 5) are statistically significant as indicated by the corresponding probability value. As majority are statistically significant we can reject the null hypothesis of no cointegration that is we can accept the alternative hypothesis meaning that variables are cointegrated in the long-run as indicated by the Pedroni cointegration test. Moreover from the result of Kao residual cointegration test, we observe that probability value is statistically significant (table 6) at one percent level, hence we can reject the null hypothesis of no cointegration rather we can accept the alternative hypothesis, that is , variables are cointegrated meaning that there is long-run associated between the examined variables. Automatic lag length selection is based on SIC with a max lag of 8.

Table 5: Results of Pedroni residual cointegration test
Null hypothesis: No Cointegration

Automatic lag length selection based on SIC with a max lag of 7(no deterministic trend + deterministic intercept and trend)

	No deterministic trend		Deterministic intercept and trend	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	6.025471	0.0000	2.775144	0.0028
Panel rho-Statistic	-9.906447	0.0000	-7.360427	0.0000
Panel PP-Statistic	-9.140837	0.0000	-9.655702	0.0000
Panel ADF-Statistic	-8.868651	0.0000	-9.654393	0.0000
Panel v-Statistic (Weighted Statistic)	-0.226444	0.5896	-2.140600	0.9838
Panel rho- Statistic (Weighted Statistic)	-7.941933	0.0000	-5.764551	0.0000
Panel PP-Statistic (Weighted Statistic)	-8.002951	0.0000	-9.286006	0.0000
Panel ADF – Statistic (Weighted Statistic)	-7.892113	0.0000	-9.162218	0.0000
Group rho-Statistic	-6.785818	0.0000	-4.865393	0.0000
Group PP-Statistic	-10.56511	0.0000	-12.86703	0.0000
Group ADF-Statistic	-8.892367	0.0000	-9.501751	0.0000

Table 6: Result of Kao residual cointegration test
Null hypothesis: No Cointegration

Series: EG LIFEEXP

Automatic lag length selection based on SIC with a max lag of 8

ADF	t- Statistic	Prob.
	-8.237934	0.0000

Results of Dynamic Ordinary Least Square: (DOLS)

As there is a long-run relationship between the variables we can apply DOLS to check to identify the nature of relationship. The result of DOLS exhibits that (table 7) life expectancy has positive impact on economic growth of selected six south Asian countries and the result is statistically significant as indicated by the probability value. We see that if life expectancy increases by 1% then economic growth increases by 7.38%.

Table 7: Panel dynamic least squares when there is cointegration (DOLS)

variable	coefficient	t-statistic	Prob.
LIFEEXP	7.380319	11.71577	0.0000

Conclusion and Recommendation

The objective of this study is to find out whether there exists any long-run dependency between life expectancy and economic growth in six South Asian countries. For this the study has used panel data of those selected countries of South Asia over the time 1984 to 2017. Results of Levin, Lin and Chu t* test; Breitung t-stat; Im, Pesaran and Shin W-stat; ADF Fisher Chi-square and PP Fisher Chi-square test showed that there is no unit root problem in the data set i.e. data set is stationary. Then applying Pedroni residual cointegration and Kao residual cointegration test the study has confirmed that there is long-run association between life expectancy and economic growth of selected six south Asian countries. After then applying dynamic ordinary least square (DOLS) the study has confirmed there is positive relationship between life expectancy and economic growth and the finding is statistically significant. This findings support almost all literature that the study has reviewed such as Bloom et al.,2004, Babatunde 2012, Boachie 2015, Ngangue & Manfred 2015, Ebenstein et al.,2015, Mahyar 2016,Piabuo & Tieguhong 2017, Kouton et al.,2018, Sharma 2018 etc whereas the findings of the study contrast with the findings of Ismail et al.,2015, Hansen & Lønstrup 2015 etc. The main limitation of this study is that the study used only life expectancy at birth to represent human capital as independent variables but there are also other variables in HDI index that the study has overlooked due to unavailability of data. As health is wealth and healthy people live longer than others, good health allows poor people to escape from poverty and contributes much in economic growth therefore government of respective countries should adopt more welfare activities to increase human capital. Government of developing countries should adopt more welfare activities to increase human capital which ultimately enhance economic growth.

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