The Impact of Population Growth on the Economic Growth of Selected South Asian Countries: A Panel Cointegration Analysis

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This study is done to assess the relationship between the population growth and economic growth. The analysis is carried out on a sample of five South Asian countries. The study investigates the impacts of population growth and the problems due to this change in population and its influence on economic growth. We take the time series data with the sample size from 1980 to 2015. In this research paper, economic growth is the dependent variable and population, urban population, fertility rate and life expectancy at birth rate are the independent variables; data collected from World Development Indicators (WDI). Unit root tests, Cointegration tests, and Granger causality tests, followed by Vector Error Correction Model (VECM) is used to examine the relation between population and per capita GDP for the selective South Asian countries. The VECM result reveal that in the long run equilibrium, the population growth and strength has no significant impact on per capita GDP. The granger causality test shows that there also exists no causality between economic growth and population growth. The research paper concludes that a long-run relation between population and real per capita GDP does not appear to exist and therefore, population growth neither causes growth of economic growth, nor is caused by it.

Field of Research: Economics

1. Introduction

Do we increase our population, which in turn will increase our labor force and make production and development faster or will the large population will in turn become a burden and drag the development process down?

According to the Malthusian theory, population growth contributes negatively to per capita income and harms the human development index. So, a higher rate of population growth results in a slower rate of growth of real per capita income (Johnson, 1999; Schultz, 2003). In contrast, Johnson (1999) claims that population growth contributes positively to economic development. He denies the traditional view linking population growth to slower growth of per capita income. Johnson also noted that population growing rapidly and improvement in the standard of living occurred simultaneously (Johnson, 1999).

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The impact of population growth on the economic growth is a topic that has stirred up a decade long debate between researchers. One group of researcher has shown evidence that there is a positive relationship between population growth and economic development. Whereas another group of people provided results from their research that has shown a negative relationship between population and economic growth. Some research has also provided insight where it could not find any significant statistical relationship between population growth and economic development. There are also researches which has shown population growth has an impact on the growth of the economy and economic growth has an impact on the growth of population which shows a bi-directional relationship. South Asia has always given a complex picture of their economy (Fox & Dyson, 2015). Though South Asia has only 20% of the world's population, they are almost one half of the world's poor. All of the countries of South Asia has shown rapid population growth, which puts immense damage on the lands and other resources available (Rasul, 2014).

We understand that the countries need to immediately worry about its population growth rate if the countries want to witness sustainable economic growth in the long term. The high population development in South Asia has backed off monetary development, rising the trade imbalance, and growing poverty from the perspective of Economics. Furthermore, the growth of population development has overburdened the region's educational system. Literacy rate has been going down consistently due to lacking assets accessible for instruction (Yanjiu, 1983). Also, young labor is inadequate in skills, preparing, and work involvement, and related efficiency has declined. Therefore, benefits, capability to invest, and wages are additionally declining. (Yanjiu, 1983)

The issues of the oversupply of labor, unemployment, and neediness have additionally turned out to be progressively serious. Likewise, the population growth has increased the weight on the supply of food and declined the needed nourishment of the overall population (Hotchkiss, 2005). Lately, South Asia has been trying to manage different issues caused by the rising population development. Measures have been taken to control the population development, also by spreading the population to places outside urban communities. South Asian countries require additional time to accomplish positive changes between the population development and the economic development (Yanjiu, 1983).

Many researchers have participated in studying the effect of population growth on economic development for many individual countries and also papers were done considering all the populated countries together as a whole, but none have been done from South Asia's perspective. This research paper is likely to show that if the population growth has a positive or negative unidirectional or a positive or negative bi-directional causal impact on the development of an economy in South Asian countries. This paper can be helpful to understand some important issues which has not been discussed earlier as the long span of time considered, 1980-2015, will increase the accuracy of the research paper. Existing literature reviews shows mixed results of a positive relationship, mostly negative relationship between population growth and economic development.

The causality from population to economic growth has been brought up in the past. Enough research papers do exist showing the impact of the growth of population on the growth of the economy. Many papers written, identifies the possible relationship between these variables of population and economic growth for individual South Asian countries, but there was no paper considering many South Asian countries together in terms of their population and economic growth. This paper is written in the context of five countries– Bangladesh, India, Pakistan, Nepal and Sri Lanka and a panel cointegration analysis is done to fill the research gap.

To the best of our knowledge, a research investigating a relationship between population growth and economic growth in South Asia, including Bangladesh, India, Pakistan, Nepal and Sri Lanka, has not been conducted yet. As we have identified this research gap, we want to use the resources available to identify whether this relationship exists, and if it does not, the extent to which it will affect the future of South Asia. The main objective of this paper is to model this with the help of the methods of econometrics, which will help us understand the impact of population growth on the South Asian countries.

Two questions we seek the answer to are as follows:

1. To examine the long run co-integrating impact of Population Growth Rate on Economic Growth Rate in South Asia
2. To detect causal relationship between the variables

Rest of the paper is organized as follows. Section 1 deals with Introduction. Section 2 focuses on the literature review, where we discussed the papers written in the past. Section 3 contains the overview of the South Asian countries in terms of their population growth and economic growth, followed by Methodology in section 4. Discussions of results are provided in section 5. Section 6 and 7 will discuss the conclusion and mention references to end the paper respectively.

2. Literature Review

Population growth showed a significant affect in last two decades for the economic development, which has been observed in many available literature of macroeconomics. Ali et al. (2015) conducted a research on the relationship between population growth and economic growth using the Durbin-Watson test and Jarque-Bera (JB) tests of Normality. They had considered the time period 1981-2014, in Bangladesh and the outcome shows that the population growth adversely affects the economic growth in Bangladesh among the variables considered. Investment coefficient implies that investment growth will considerably contribute to economic growth which in turn depends on high saving rate.

Hasan (2002) carried out a research on the correlation between population and per capita income for Bangladesh, where he had considered the time period 1973-1997. He used different methodologies like, Cointegration test, Granger Causality test and Vector Error-Correction Modelling (VECM) and concluded that population and per capita incomes are cointegrated and exhibit a long-run relationship. His results also indicate a

bi-directional causality when causality is assumed to real per capita or vice versa in the long-run.

Later in 2010, Hasan has executed another research paper on the relationship between population and per capita income using the Granger-causality, Vector Error Correction Model (VECM), Cointegration test and Stationarity test, considering the period 1952-1998, in China and the outcomes had shown that both the variables are cointegrated and exhibits a reliable long-run relationship. This paper also shows no causality in the long-run to flow from per capita income to population. (Hasan, 2010)

Another paper was pursued by Mahmud (2015) in finding out the relationship between population growth and economic growth in India over the period 1980-2013. He had analyzed using the Johansen Cointegration test, Vector Error Correction, Granger Causality test, Wald test, and Normality tests. He had also used the So/low Growth Model to find out the long-run economic growth by looking at capital accumulation, population growth, and technological progress. The results of the analysis had shown that the variables have relationship in the long-run. However, he has discovered a unidirectional causality running from GDP to population growth.

Mohseen and Chua (2015) investigated the role of trade openness, investment and population in Syria over the period 1980-2010. The cointegration test indicated that GDP is positively and significantly related to all the three variables. The Granger causality test showed bidirectional causality relationships between trade openness, investment, population and GDP in the short-run and also shows long-run bidirectional causality relationships between investment, population and GDP, and long-run unidirectional causality relationship running from trade openness to GDP. This research paper concludes that population has the biggest effect on Syria's GDP.

With the help of Multi Linear regression tests on excel, Trang and Hieu (2002) found out that the Asian developing countries over the time period 1960-2000, shows lower GDP per capita due to higher population growth. Eight developing countries were taken into account for this paper: China, Indonesia, Pakistan, Vietnam, Philippines, Thailand and Iran. According to the researchers the economy of the mentioned developing countries can be pulled down due to capital dilution, standard of living, resource shallow and age structure respectively.

Mushtaq (2006) conducted a research by collecting the data from 1960 to 2001 in Pakistan. With the help of cointegration analysis and Augmented Dickey–Fuller (ADF) Unit Root Test, he found out that Population growth neither causes per capita income growth nor is caused by it. Another paper got published recently by Ahmed and Ahmad (2016) on the same usage of variables in Pakistan over the period 1981 to 2010. They also conducted the same tests just like Mushtaq, along with Auto-regressive Distributed lags test, where they found different results. Their research paper concluded that Population creates negative impact on economic growth of Pakistan and also create lot of problems adding more in unemployed population of the country.

In the year 2012, Wako executed a research on the impact of growth of workers on the per capita income in Ethiopia over the period 1950 to 2011. The tests performed were

Vector Error Correction Models, Augmented Dickey–Fuller (ADF) Units root tests, Heteroscedasticity test and Cointegration test. He considered Population growth rate, real GDP per capita, Employment growth. Openness, Human Capital and Domestic Investment for a clearer result, where he found a negative long-run relationship between per capita income and population growth and a positive relationship between the growth of workers. (Wako, 2012)

Thuku et al. (2013) in their paper studied the impact of population in the economic growth in Kenya. They incorporated the date from (1963 to 2009) in their research paper. They analyzed their data using Stationarity test, Exogeneity, Vector Auto regression analysis (VAR) and Causality Test, setting the parameters using Gross domestic product growth rate with Population increase. They concluded that population will impact positively to the economic growth in Kenya and population growth promotes economic growth and subsequently economic development. Since Kenya is also a developing country, the pattern seen in South Asian Countries, might be similar to Kenya. Thus, this tells us that South Asia's growing population might also serve to its prospering economy.

Chang et al. (2014) attempted to find out the relationship between Population Growth and Economic Growth based on data collected from 21 countries over the period 1870 to 2013. In order to find the impact, he used the Bootstrap Granger Causality Test and the Cross-Sectional Dependence Test. Following the tests, they found out that population growth causes economic growth. That in turn causes population growth. As per their research, there is a bi-directional causality between population and economic growth.

Anudjo (2015) carried out a research between population density and economic growth for Ghana, where he had considered the time period 1980-2013. He used different methodologies like, unit root tests, Cointegration test along with Diagnostic tests, and Granger Causality test and concluded that population density and labour force had a positive statistically effect on economic growth.

Thornton (2001) conducted a research, checking the relationship in the long-run, between the two concerned variables, population and economic growth for seven Latin American countries, namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. The research paper used data over the period 1900-94. He concluded that there is no relationship between the two variables in any of the seven countries in the long-run. Neither population growth Granger causes economic growth nor is caused by it.

From the above literature review, we see that no exclusive study was conducted in South Asia as a whole linking Population Growth and Economic Growth. We are expecting to find the impact of population growth on the economics growth of South Asian countries. Existing literature shows mixed results. An in-depth analysis for can help us answer our questions accurately.

3. Overview of South Asian Countries

Since the 1980s, South Asian economy achieved outstanding rates of economic growth. From 1980 onwards the output for India, Pakistan, Bangladesh, and Sri Lanka has rapidly grown than for any other region except East Asia. South Asian countries have not been characterised by particularly high rates of investment, as the level of investment has averaged just one-half to two-thirds of the levels typical in East Asia during its sustainable growth period (Collins, n.d).

South Asia is home to over 1.7 billion people. India itself counts over a billion people. Bangladesh and Pakistan are populated with millions. In this world, no other region has to face such population problems the way South Asia does (World Bank, 2017). These numbers are a matter of concern, as the number is actually increasing every second. Increasing number of fertility kept on going higher, as this was preferred by the big traditional families, which created a huge gap between the birth rates and the death rates (WHO, 2017). The multiple regions who has been the most populated - India, Pakistan, and Bangladesh is surrounded by Nepal and Sri Lanka, each developing in its own way.

Bangladesh is a developing country, which faces severe problems in their environment. The increasing rate of population growth and the impactful GDP growth have put extreme pressure on the natural resources of this country with the increase in pollution. The huge expansion in urbanization has expanded levels of modern waste, water contamination, and vehicle emissions that have brought about genuine medical issues in numerous regions of the nation. There is a close relationship between increasing population development and deficiency. The occurrence of poverty shows that it declined in 1980s and later increased in 1990s that have influenced the poor families to train themselves for their wellbeing. The issue of neediness in Bangladesh has its importance for reasonable advancement. Different approaches are received that decrease the concentrated control of advantages and unequal access to instruction and wage acquiring openings. (World bank, 2017)

In India, the population has expanded from 682.5 million in 1980 to 1324 million in 2016. Though the GDP in 1980 is 186 billion US Dollars and it has achieved another height by getting near 2 trillion dollars. Fortunately, in India, the increase in GDP has effected the population development and this prompted a positive advance in the nation. If India is compared to any other country and alternate countries, which is advanced and were in level 30 years back, then India shows a very slow growth. The vast majority of the research papers express that the constant increment in the number of dwellers in the country has prompted the moderate development rate of country (Koduru, 2016). However, the expansion in population has prompted the increase in labor force. This increase in labor also prompted the general increase in efficiency of the country. So, the population increase cannot be accused for the motivating number in the labour force. The Governments' inefficiencies might be one reason for backing off in India. The literacy rate might be one reason for the financial development of this country and in the meantime the joblessness in the country additionally brings negativity in the nation. (World bank, 2017)

In Nepal, the economic development has been confused and influenced by the consistent change in political situations which has run from government to being ruled by the Communist party. With an Agrarian culture until the mid-twentieth century, Nepal entered the advanced period in 1951 without schools, better infrastructure, medical facilities, broadcast communications, electricity, and industry etc. The nation has progressed toward maintainable economic development since the 1950s and opened the nation to monetary progression prompting economic development and change in expectations for everyday comforts than compared to the past. The greatest difficulties looked by the nation in accomplishing higher economic improvement are the successive changes in political initiative. The number of people in Nepal has been rising in late decades. In 2001 June, there was a population of around 23 million in Nepal. The population expanded by 5 million from the last statistics (1991); the development rate is 2.3%. The present population is approximately 30 million which adds to an expansion of around 3 million individuals at regular intervals. (World bank, 2017)

In case of Pakistan, population is one of those issues which influenced its economic, social and political framework. In past year, population increase was not that high but rather this economy confronted a responsively high population development later. Pakistan was the thirteenth incomparably populated nation in the general world with a population of 32.5 million, later in 1996 it was seventh with a population of 140 million. Presently, Pakistan is positioned at sixth among the nations with high population. A century ago numerous attempts were taken to control population and its effects yet not prevail because of less mindfulness among individuals about it. As indicated by economic overview of (2013-2014), the population development was 1.95 percent that is most elevated in Asia and because of this Pakistan falling behind when contrast with the other creating nations. Population of Pakistan came at a falling position and making obstacles in its monetary welfare. It is anticipated that population of Pakistan will spread to 210.13 million by 2020. High populace development not just puts a nation's monetary resources under anxiety, yet in addition increases reliance proportion of youngsters and in this manner constraints development in the economy (World Bank, 2017).

Sri Lanka as a South Asian country is a lower middle-income country with 21.2 million people and had a per capita GDP of $3,835 in 2016. The economy has grown on average at 6.2 percent a year, showing a commitment to reconstruction and growth, but also there have been signs which shows a downfall in the last three years (World bank, 2017).The economy is moving from rural-based to urbanized oriented. The government is helping by carrying out reforms, improving public financial management, increasing investments in both public and private sector, building infrastructure and thus, improving competitiveness. Sri Lanka has shown a great amount of progress in human development as the social indicators rank among the highest in South Asia. Unlike other South Asian countries, Sri Lanka is facing an aging population. The current population is 20,904,316, based on the latest United Nations estimates. The country ranks number 58 in the list of countries by population and also by dependencies and 19.4 % of the population (World Bank, 2017).

Table 2: UNDP, Human Development (Annual Population Growth Rate % for South Asian countries, 2015)

Country	Annual Population Growth rate %	
	Before 2001	2001-2015
Bangladesh	2.4	1.8
India	2.0	1.3
Pakistan	2.8	2.4
Nepal	2.4	2.0

According to the above calculations prepared by UNDP (2015) in table 2, the annual population growth rate has fallen over the decade. Before 2001, the population growth rate of Pakistan was the highest among South Asian countries thriving at 2.8% and later at 2.4% in the period 2001-2015. Bangladesh and Nepal are found to have the same percentage before 2001. However, during the period 2001-2015 the population growth rate of Bangladesh fell by 33 and Nepal fell by 20%. The population growth rate in Sri Lanka had already been the lowest comparatively and it has been following a downward trend from 1.3% to 0.7% in the recent years. India on the other hand has presented the greatest difference in its population growth rate dropping down from 2.0% to 1.3%.

4. Methodology

A combination of the independent and dependent variables in the data are related to five selective countries of South Asia, which are Bangladesh, India, Pakistan, Nepal and Sri Lanka, where the model is based on panel cointegration analysis. Panel data is a method to combine both cross sectional data and time series and because of this joint, the variable changes in each cross-section and time. The panel data are divided first from the perspective of priority of significance in sections or time and then the models applied are considered for each. There exists a number of tests for the Panel Unit Root Test and Panel Cointegration Test, along with Panel Causality Test and Panel Vector Error Correction Model (VECM). The objective of this research is to determine the impact of population growth on economic growth of particular South Asian countries are related and affect one another in the short or long-run.

Variables that are relevant, goes into the model, which are: Gross domestic Product (GDP) which indicates a country's economic performance over time, Population Growth Rate, Urban Population Growth, Life Expectancy at Birth and Fertility Rate.For this research paper, secondary data of Gross Domestic Product (GDP), Population Growth Rate, Urban Population Growth, Life Expectancy at Birth and Fertility Rate from World Development Indicators (WDI), 2017. The period of the research paper was 1980 to 2015.

The Panel unit root test is more in comparison to the same test in time series, all tests have been considered because there is a possibility of conflicts in the different panel unit root tests. First generation panel unit root tests base their hypothesis on the independence of cross-section, which means that the error terms should not be dependent in all sectional units. Second generation panel unit root tests relax the restrictive assumptions in the context of cross country regressions where macro time

series exhibit significant cross-sectional correlation across countries in the panel (EViews, 2017).

The first 'first-generation' panel unit root tests are started with the Levin, Lin and Chu Test (2002), which is also referred to as the LLC test, which assumes a homogeneous unit root process, which means that the test is assumed to have a common auto-regressive (AR) structure for all the cross-sectional units. In this test a model is considered in which the coefficient is restricted of the lagged dependent variable for being homogenous across all units of the panel. It has a three- step procedure approach, with necessary regressions by cross-sectional heterogeneity. For the first step, Augmented Dickey-Fuller (ADF) is used to test if the data is at stationary levels and if all of the series are at non-stationary levels, it must be stationary with the same level of lags. The second step is to bring an estimate for the ratio of the long run variance to the short run variance. The third step includes standardization of the residuals after which we run the OLS regression (Hlouskova& Wagner, 2015).

The LLC test has limitations because it is highly dependent on the assumption independently across all the cross-sectional units. LLC test is very restrictive because it assumes all the cross-sections have or does not have a unit root. The second 'first-generation' panel unit root test used is Im, Pesaran and Shin (2003) (IPS) test, which is different for Levin, Lin and Chu test as IPS is more restrictive then LLC because IPC allows for heterogeneous coefficients. This test is based on averaging individual unit root test statistics. Monto Carlo simulations reveal that the small sample performance of the Im-Pesaran-Shin test is better than Levin-Lin-Chu test. Im-Pesaran-Shin requires $N/T \rightarrow 0$ for $N \rightarrow \infty$. If N is relatively smaller or larger to T, then both Im-Pesaran-Shin and Levin-Lin-Chu show distorted sizes (Nell and Zimmermann, 2011).

The third test done is Maddala and Wu (1999), also a first generation panel unit root test, deals with the panel unit root testing problem with the idea of Fisher (1932). This test can be applied to the panel unit root testing problem, only if we can assume the cross-sectional independence. We implement this idea by applying ADF tests on the individual units. The Fisher test neither requires any identical lag lengths nor a balanced panel in the individual equations (Hurlin & Mignon, 2007).
The fourth test proposed is by Hadri (2000), which is based on the null hypothesis of stationarity. It is an addition of the stationarity test which was developed by Kwiatkowski et al. (1992) for the time series context. Hadri presents a residual-based Lagrange multiplier test for the null hypothesis that the individual series are stationary around a deterministic trend. (Barbieri, 2006)

The fifth test used is Breitung Test (2000), a second generation panel unit root test, which develops a panel unit root test that does not require any bias correction factors, which is achieved by appropriate transformations of variables. The first step is same as in the Levin-Lin-Chu test, except the fact that there are no deterministic terms included. Regression is done and residuals are obtained. Later, forward orthogonalization transformation is applied for wanted results. Finally, pooled regression is run, which is asymptotically distributed. (Hlouskova & Wagner, 2015)

In this panel cointegration test, the economic relations in the long run are estimated and tested. Special set of variables specified are linked together in the long run when the economic theory is correct. Pedroni Cointegration is a two-step cointegration test, examining the residuals of an invalid regression. Pedroni's tests expands the Engle-Granger (1987) cointegration testing method for supporting panel data.

Next, the Johansen Cointegration Test is run to find out if there is any possible linear combination of the variables which can be considered stationary and if found, to check the possible direction of causality. (Johansen, 1991) According to Engel and Granger, if in the long run cointegration exists between variables (two or more), then there must be either unidirectional or bidirectional Causality between these variables. Panel Causality Test shows a causal long run relationship between non stationary time series, which can be derived when the variables are cointegrated.

Engle and Granger also demonstrated that the cointegrating variables can be represented by VECM (Vector Error Correction Model), which is an appropriate method to model the long-run and the short-run dynamics among the cointegrated variables. Hence, according to Granger, if there is evidence of cointegration between variables (two or more), then a viable error correction model should also exist between those variables.

5. Results and Discussions

After these econometric tests are done, now we will analyze the values and look into the results for a better understanding in this research paper. Unit root tests, Cointegration tests, and Granger causality tests, followed by Vector Error Correction Model (VECM) is used to examine the relation between population and per capita GDP for the selective South Asian countries. Firstly, we look into the table, which is table 3, showing the panel unit root tests for selective South Asian countries at level. Then we look into the second table, table 4, showing the panel unit root tests at first difference for selective South Asian countries.

Tables 3 and 4 shows the results of the panel unit root tests at level and at first difference for all the five countries, respectively. If a deterministic element is not included in the regression procedure, there will be inconsistency in the unit root test and if a deterministic is included in the procedure but not present in the observed data, the statistical power of the unit root will be reduced (Levin, et al., 2002). The loss of power, when the time trend is included and not present, it shows inaccurate results. In the following tables, both intercept and time trend are included for test specifications.

The procedures of econometric testing such a unit root tests, cointegration tests and causality tests involve appropriate autoregressive lag lengths. Schwarz Information Criteria (SIC) is used to measure the consistency of model/lag-length selection criteria. SIC was derived from the perspective of a Bayesian, which tells us that in the case of time series model, the selection of lag-length, longer than optimal.

Table 3: Panel Unit Root Tests for Selective South Asian Countries

	First Generation Tests				Second Generation Tests
	Levin, Lin & Chu	Im, Pesaran & Shin	Maddala & Wu	Hadri	Breitung
Intercept and Trend					
FR	-0.63452	1.60747	9.11193	7.08259	0.15882
	(0.2629)	(0.9460)	(0.5215)	(0.0000)	(0.5631)
GDP	10.6845	11.9734	0.09642	7.65227	4.65664
	(1.0000)	(1.0000)	(1.0000)	(0.0000)	(1.0000)
LIFE	-12.1273	-4.88360	49.8987	8.08171	3.90136
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(1.0000)
POP	-3.35524	-0.58782	14.2032	6.89846	1.10602
	(0.0004)	(0.2783)	(0.1639)	(0.0000)	(0.8656)
UPOP	-3.08639	-3.07450	33.8924	6.20911	1.73120
	(0.0010)	(0.0011)	(0.0002)	(0.0000)	(0.9583)

Notes: **Null Hypothesis: Panels contain unit roots.
 **Lag selection: Automatic selection of maximum lags and lag length based on Schwarz Information Criteria (SIC).
 **Probability values are reported in parentheses.

Table 4: Panel Unit Root Tests at First Difference for Selective South Asian Countries

Tests	First Generation Tests				Second Generation
	Levin, Lin & Chu	Im, Pesaran & Shin	Maddala & Wu	Hadri	Breitung
Intercept and Trend					
FR	4.08202 (1.0000)	6.02278 (1.0000)	1.76805 (0.9978)	3.23683 (0.0006)	6.96624 (1.0000)
GDP	0.02893 (0.5115)	-0.70915 (0.2391)	18.6073 (0.0455)	7.32444 (0.0000)	-0.57785 (0.2817)
LIFE	-4.74380 (0.0000)	-6.55303 (0.0000)	62.0222 (0.0000)	1.55627 (0.0598)	-1.69318 (0.0452)
POP	-5.89221 (0.0000)	-9.10981 (0.0000)	87.9739 (0.0000)	0.46486 (0.3210)	-1.97132 (0.0243)
UPOP	-18.9650 (0.0000)	-16.1955 (0.0000)	95.2356 (0.0000)	2.63948 (0.0042)	-1.32233 (0.0930)

Notes: **Null Hypothesis: Panels contain unit roots.
   **Lag selection: Automatic selection of maximum lags and lag length based on Schwarz Information Criteria (SIC).
   **Probability values are reported in parentheses.

Here, in the tables 3 and 4 we have the panel unit root test results for the five selected countries of South Asia. All the variables are found to be stationary at level and first difference form, i.e. they are all I(1). Thus, if we run further regression our results will not be suspicious.To execute a cointegration analysis all the variables must be of the same order. After the panel unit root testing, panel cointegration testing is done. In tables 5 and 6, the Pedroni and Johansen-Fisher panel cointegration tests present the results for cointegration. The lag length for Pedroni test is automatically selected using Schwarz Information Criteria (SIC), which is a consistent model-selection criterion and includes a very strong penalty for over fitting the model. For the Johansen test, the results heavily depend on the number of lags of the VAR system.

Table 5: Pedroni Residual-Based Panel Cointegration Tests

Test	Statistic	Weighted Statistic
Within dimension		
Panel v-statistic (0.0000)	16.07689 (0.0000)	6.418757
Panel rho-statistic (0.0011)	-3.051912 (0.3161)	-0.478541
Panel PP-Statistic (0.3513)	-0.381825 (0.7258)	0.600215
Panel ADF-Statistic (0.3785)	-0.309508 (0.7258)	0.600126
Between dimension		
Panel rho-statistic (0.0636)	-1.525228	
Panel PP-Statistic (0.6954)	0.511189	
Panel ADF-Statistic (0.2585)	-0.647878	

Notes: **Lag selection: Automatic selection of maximum lags and lag length based on Schwarz Information Criteria (SIC).
**Probability values are reported in parentheses.

Table 6: Results of Johansen Fisher Panel Cointegration Test

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Fisher Stat.* (from max-eigen test)
None	194.1 (0.0000)	173.3 (0.0000)
At most 1	187.4 (0.0000)	166.5 (0.0000)
At most 2	117.9 (0.0000)	92.18 (0.0000)
At most 3	64.47 (0.0000)	60.45 (0.0000)
At most 4	19.90 (0.0302)	19.90 (0.0302)

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Table 7: Granger Causality Tests (Lags 2)

Hypothesis	F-Statistics	P-Value	Granger Causality
POP does not Granger Cause GDP	1.52716	0.2202	
GDP does not Granger Cause POP	0.98395	0.3760	
			No Causality
			No Causality
UPOP does not Granger Cause GDP	0.00740	0.9926	No Causality
LIFE does not Granger Cause GDP	0.55857	0.5731	No Causality
GDP does not Granger Cause FR	1.40595	0.2481	No Causality

Notes: **Lag selection: Automatic selection of maximum lags and lag length based on Schwarz Information Criteria (SIC)**Probability values are reported in parentheses.

According to table 5, for Pedroni Cointegration test, the variables are cointegrated (at most 1). Again, according to table 6, the Fisher cointegration test, we have five cointegration relationship among our variables at 90%. Now, as we know that in the long run our variables are cointegrated, we can run the granger causality to check the causalities between the concerned variables. Below, we have place 5 different hypotheses to measure the causality between the variables. Though our concerned variables are population growth and economic growth, we should also analyze with different control variables for a better understanding and a clearer study.

According to our results, in table 7 we see no causality between our two most concerned variables. One of the possible reasons can be from the household perspective. Population has no impact on the economy of these selective countries because as we know that for the GDP to rise it is very necessary that advancements should be made and for which investment is direly needed. For those investments, savings is needed. As the population goes up, i.e. if in a family the number of members go up then all sorts of needs and wants are consumed. There are many families with needs and wants, where the money goes for their consumption and therefore, they cannot have enough savings. If there is no savings, people are not being able to take loans for investments. Hence, no changes are taking place for which the GDP per capita in an economy will be affected for the level of population growth.Now we move forward for the short run causality through Vector Error Correction Model (VECM) for checking the impact of population on economic growth in the short run.

Table 8: VECM Test Results (Lag 2)

Variable	Null Hypothesis	Chi-square	Probability	Causality
GDP	POP does not Granger Cause GDP	0.258857	0.7723	No Causality
POP	GDP does not Granger Cause POP	0.517713	0.7719	No Causality

According to our results, in table 8, no causalities were found between our two main concerned variables, population and economic growth. One of the possible reasons is that the very sudden increase in population might not affect the economic growth or vice versa. Effect of the population growth on GDP is subject to timeline. A sudden increase in population may not increase economic growth. However, there are other factors that may influence economic growth/GDP in the short run.

6. Conclusion and Policy Implications

The aim of this research paper was to find out whether population growth has an impact on the economic growth of five South Asian countries namely, Bangladesh, India, Pakistan, Nepal and Sri Lanka. The tests that were used to come to these findings were Unit root tests, Cointegration tests, and Granger causality tests, followed by Vector Error Correction Model. Based on the findings of this paper, it can be said that there is no causal impact. Based on the tests, population growth does not have any impact on the economy both in the long and the short run. The results of this research paper are similar to the findings of Dawson and John Thorton's paper entitled "Population Growth and Economic Growth: Long-Run Evidence from Latin America" published in 2001. That research paper was conducted on the long-run relationship between population and economic growth in six Latin American countries, namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Population growth may not have any impact on PCI because of the inflationary effect on the price of goods and services. Increase in the value of the final output offsets the growth of population thus leaving no impact on economic growth.

With more than 70 percent of the population below the age of 40, Bangladesh is one of the youngest nations in the world. In a way, it is the ideal time for the country to maximize its productivity and improve its economy. However, the lack of jobs in South Asia, have paralysed the economy to a certain extent. The lack of skill development is one of the reasons behind the slow expansion of the job market.

In order to bring in more investment and increase jobs, the education sector of the country needs to focus more on vocational studies and skill-based training. It can follow the example of China. There is a notion around the world that investors go to China mainly because of the labour. However, that is not entirely true. Chinese labour can be as expensive as any other Asian country.

However, they have a workforce that is capable of producing good quality products and that is the reason why successful companies such as Apple have resorted to the labour force of the Asian country. At a time when the education sectors of various countries

focused on a variety of angles, China recognised the need for skill-based education early and as a result have boomed.

Some of the major earning sources of the country have taken a hit in recent times (Kinugasa & Hamori, 2013). The Garments industry isn't witnessing gains making to the past, while the remittance inflow is steadily decreasing due to the oil shock in the Middle East, something that their economy is still recovering from. As such, the country needs to work on other income sources in order to provide more jobs and in turn help the economy (Dumlao, 2016).

Studies have shown that the trust of the general public on the public institutions of the country has been following a declining trend. In order to improve the economy, the independence of these institutions must be ensured. Once that is ensured, growth in the other economic sectors, such as the stock market or even the real estate will follow automatically.

New findings were developed within this research correlating the variables Population Growth rate and Economic Growth rate for Bangladesh, Sri Lanka, Pakistan, India, and Nepal. This research can establish the basis for further investigation to be carried out in the future. The government can discover definite policies directed towards impact of population on economic growth.

Conducting this research had many limitations to itself. The very first issue was that the research paper had to deal with a short sample size of 35 years (1980-2015) for a panel cointegration. Short sample can cause various problems for determining the long run effect of the variables. Many other significant control variables have been excluded from this paper. The results might have been different than the ones gathered if the variables were included in the model. This research focuses mostly on the causal relationship between our concerned variables for final results. Other than this, the research paper has additionally a few constraints in regards to the typical time arrangement issues about managing the basic changes and serial relationship.

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