Is Population Growth Beneficial or Detrimental to Economic Development? A New Evidence from Pakistan

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Introduction

New forms of Malthusian idea of the limited resources, especially food supplies and energy, have reappeared in debates among economists and policy makers. The 1970s' "oil shock" and the more recent warnings of the impending "food crisis" have produced worries among the general public and stimulated debates among development and population economists about the ability of the world economy to sustain the ever expanding world population.

Population growth has a substantial impact on any country's economic performance. For example, the declining fertility rates in the industrialized nations may lead to labour shortages and put strain on their pension systems. On the other hand, the rapidly expanding population in the developing nations has been viewed as a potential impediment to their socio-economic development which prompted some countries (e.g., China, Singapore) to introduce policies aim at decreasing the fertility rates.

In recent years the relationship between population growth and economic development in the developing countries has attracted a considerable attention of economists and researchers. As Dawson and Tiffin (1998:149) have observed, "The relationship between population growth and economic development has long been thought to be fundamental to our understanding of less developed countries (LDCs). Indeed, most textbooks on economic development include a section on "population and development'". However, there is still no consensus whether population growth is beneficial or detrimental to the economic performance of a developing nation. The

relationship between the upward demographic trend and economic growth has been described as "a complex one, and the historical evidence is ambiguous, particularly concerning what is cause and what is effect" (Thirlwall, 1994:143).

In those developing countries where the relationship between population growth and economic performance could be viewed as positive, the demographic situation stimulates economic development, which leads to a rise in the living standards. This is because in these countries population growth tends to encourage competition in business activities and expands the markets' potential. The expansion of the markets encourages the entrepreneurs to set up new businesses. A prominent population economist, Julian Simon, has highlighted the positive side of population growth when he noted that a human being is the vital essential element and "the ultimate resource" that contributes to economic growth (Simon, 1996: 589).

By contrast, if the relationship between the population growth and economic performance in a country could be regarded as negative, the increase of population is likely to become an impediment to the country's economic development. This is because the rapid expansion of population increases the dependency burden (i.e., the number of people who are considered to be economically unproductive, such as children and the elderly).

It should be noted that the negative views regarding the consequences of population growth have been prevailing over the positive opinions ever since Thomas Malthus (1798) warned of the danger of "over-population". As Kelley and Schmidt (1996:13) have pointed out,

> *Pessimism about the economic impacts of population has dominated the thinking of population analysts since the original alarmist treatise by the Reverend Thomas Malthus was published over two centuries ago.*

With the two schools of thought expounding diametrically different opinions regarding the impact of population growth on economic development, the current inquiry selects Pakistan as a case study to examine empirically the long-run relationship between population and economic growth.

Several empirical studies have been done on the long-run relationship between population growth and economic development. A majority of these academic inquiries used cross-section regression to analyse the relationship (Ahlburg, 1996; Easterlin, 1967; Kelley and Schmidt, 1996; Kuznets, 1967; Simon, 1992; Thirlwall, 1972), which may pose a considerable methodological problem. More precisely, in the academic inquiries on the relationship between per capita income and population growth the cross-section regression analyses tend to suffer from the problem of heteroskedasticity. On the other hand, the main problem faced by the researchers who use time-series regression analysis is a lack of adequate data sets.

In recent years, reliable time-series data sets that are extensive enough to allow conducting time-series regression analyses have been increasingly available. The availability of the good quality data sets has stimulated further research on the relationship between population growth and economic development. For example, Dawson and Tiffin (1998) employed the time-series data to analyse a long-run relationship between population growth and economic development in India. They used the augmented Dickey-Fuller (ADF) unit root test and the Johansen (1988; 1991) co-integration test to analyse the co-integrating relationships between the two variables. However, the study did not detect a long-run equilibrium relationship between the population expansion and economic performance in India. As the researchers concluded, "…Population growth neither causes per capita income growth nor is caused by it" (Dawson and Tiffin, 1998:154).

John Thornton (2001) has conducted a research on the long-run relationship between population growth and economic development of seven Latin American countries, namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela. The findings of his research supported the conclusion reached by Dawson and Tiffin

(1998). As Thornton (2001:466) pointed out, "A long-run relation between population and real per capita GDP does not appear to exist; hence, population growth neither causes growth of per capita GDP nor is caused by it".

More recently, Bucci and La Torre (2007) employed a two-sector endogenous growth model to examine the relationship between population growth and economic development. They pointed out that population growth may have a negative or an ambiguous effect on the economic development. In other words, when the physical capital and the human capital are substitute, the population growth has a negative impact on the economic performance. On the other hand, when the physical capital and the human capital are complementary, the effect of the population growth on economic development becomes ambiguous.

In order to analyse the relationship between population growth and per capita growth Turnemaine (2007) has developed a model in which technical progress, human capital, and population interact endogenously. He pointed out that population growth could have both positive and negative impacts on the economic development, and the outcome would depend on the relative contribution of the population and human capital to the economy.

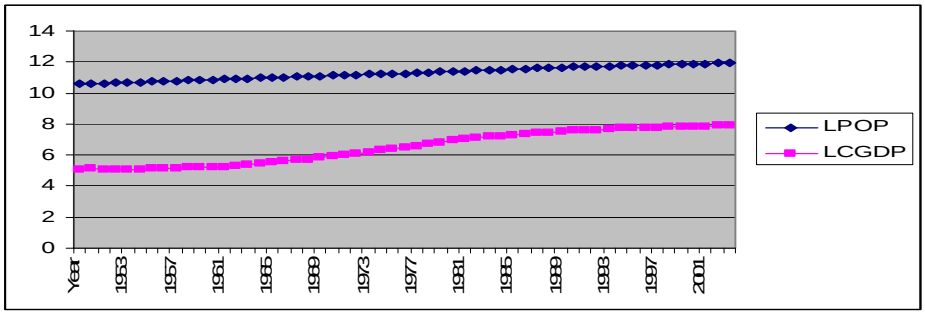
Klasen and Lawson (2007) have examined the relationship between population growth and economic development by using both cross-country data and panel data. The empirical findings from the cross-country and the panel data indicated a negative relationship between the population expansion and economic performance. As the researchers concluded, all of the regressions of per capita economic growth suggested that "population growth has a highly significant negative influence on per capita economic growth" (Klasen and Lawson, 2007:11).

The present study aims to provide additional empirical evidence to the on-going debate on the relationship between population expansion and economic growth and chooses Pakistan as a case study. Pakistan is a developing country with the population of approximately 180 million, as of 2009. This relatively big population may

be an impediment to the country's economic development. On the other hand, Pakistan's neighbouring country, India, with a considerably larger population of approximately 1.06 billion has shown a very impressive economic performance. This fact may indicate that big population may have a positive influence on a country's economic development. Among the reasons for this phenomenon could be a plentiful supply of workforce. Also, more populous countries may have a more vigorous market competition between the companies which would spur economic activities and the economic growth.

Figure 1 shows the relationship between population and economic development in Pakistan for the period 1951-2004. As seen in the Figure, the expansion of population in Pakistan was relatively constant with the population growth rate of approximately 2 percent per year. At the same time, despite minor fluctuations, Pakistan experienced a steady economic development over the period 1951-2004. However, as Figure 1 indicates, compared to the population growth, the economic development in Pakistan tended to be less stable. For example, in the mid-1950s and in the beginning of the 1960s, Pakistan registered a relatively slower economic development compared to the 1970s. More recently, from 1995 to 2004, the economic growth rate was low at 3 percent per year.

Figure 1: Population and Economic Development in Pakistan (1951-2004)



The main research question this paper addresses is: Was the population expansion in Pakistan an impediment or a boon for the nation's economic development? To answer this question, econometric analyses, such as unit root test, Johansen

co-integration test, and Granger causality test, are used in this study to examine a long-run relationship between population expansion and the economic performance in Pakistan. The present study consists of four sections. Following this Introduction, Section 2 discusses research methods employed in the study. Empirical findings are reported in Section 3 while Section 4 offers concluding remarks.

Research Methodology

Empirical analysis in the present study consists of the following three tests, 1) augmented Dickey-Fuller (ADF) unit root test, 2) Johansen cointegration test, 3) Granger causality test. First of all, the classical regression analysis is based on an assumption that the variables – population and economic growth in the case of the present study -- are stationary (i.e. they have a constant mean and variance over time). In the cases where the variables are nonstationary (i.e. they have a time-varying mean or time-varying variance, or both), the classical regression analysis may be invalid (Thomas, 1996). This study firstly uses the ADF test to examine whether the variables are stationary.

Secondly, even if the regression analysis indicates that there is a significant relationship among the nonstationary variables, the relationship still can be considered as spurious. However, as Engle and Granger (1987) pointed out, there can be a meaningful long-run relationship between the variables provided that the residuals from the Ordinary Least Square (OLS) estimation of the equilibrium relationship among the nonstationary variables are stationary. In other words, stationary residuals indicate that the nonstationary variables are cointegred. The current paper uses Johansen (1988; 1991) cointegration test to examine the cointegrating relationship between the variables. As Granger (1986) has noted, a cointegration test can be used as a pre-test to avoid a spurious regression situation.

Finally, although a regression analysis can indicate a dependence of one variable on other variable(s), this dependence does not necessarily imply a causal relationship between the variables (Gujarati, 2003). Therefore, the present study uses

the Granger causality test to examine the dependence relationship between the variables (Granger, 1969). According to Gujarati (2003), in a regression of the dependent variable on other variable(s), if we include the lagged values of the independent variable and, as a result, this significantly improves the prediction of the dependent variable(s), then we can say that the independent variable causes dependent variable(s).

Four types of causal relationship between population expansion and economic growth are possible: (1) Independence, which means that there is no causality between population growth and economic growth, (2) Population-driven economic growth, which means there exists a unidirectional causality from population growth to economic growth, but not vice versa, (3) Growth-driven population expansion, which means there is a unidirectional causality from economic growth to population growth, but not vice versa, (4) Two-way causality, which means that there exists a unidirectional causality from population growth to economic growth, and vice versa.

Regarding the method employed in the current study, as the first step, the unit root test is used to analyse whether the variables are stationary. Next, if the unit root test indicates that the variables are nonstationary, the Johansen (1988; 1991) cointegration test will be used to examine whether there exists a meaningful relationship among these nonstationary variables. Finally, even if the Johansen cointegration test indicates a meaningful long-run relationship among the nonstationary variables, there is a need to establish a causal relationship between the variables. Therefore, as a final step, this paper will employ the Granger causality test to examine whether there exists a causal relationship between the population growth and economic development in Pakistan.

Empirical Results

This section reports results of the statistical tests on the relationship between population growth and economic growth in Pakistan for the period 1951-2004. The data on the population and per capita real Gross Domestic Product (GDP) were obtained from the Penn World Table (Center for International Comparison at University of Pennsylvania, 2006).

First of all, the augmented Dickey-Fuller (ADF) unit root test was employed to test the existence of unit roots in the individual time series. The results obtained from the ADF test are shown in Table 1.

Table 1: ADF Unit Root Test *(POP)*

	Level		**First Difference**	
Variables	Constant without trend	Constant with trend	Constant without trend	Constant with trend
GDP	0.932(3)	-1.908(2)	-1.141(2)	-4.792(0)**
POP	1.507(3)	-1.665(2)	-1.171(2)	-4.004(1)*

Notes: Figures in parentheses indicate number of lag structures

** indicates significance at 1% level

* indicates significance at 5% level

Despite some differences in the findings, the individual ADF test could not reject the null hypothesis of unit roots at levels. On the other hand, the ADF test could reject the null hypothesis of unit roots at first differences. These findings indicate that GDP and POP are integrated of order one, I(1).

As a next step of the analysis, the Johansen (1988; 1991) co-integration test was used to examine the long-run movement of the variables. Results of the co-integration test based on the trace statistics of the stochastic matrix are reported in Table 2.

Table 2: Johansen Co-Integration Test

GDP and POP Lags Interval: 1 to 4				
Eigenvalue	Trace Statistic	5 percent critical value	1 percent critical value	Number of co-integrating equations
0.280	26.92	25.32	30.45	None*
0.188	10.43	12.25	16.26	At most 1

Notes: ** indicates significance at 1% level

* indicates significance at 5% level

Despite some minor disparities, the findings indicate that there existed a cointegrating relationship between the two variables, namely Pakistan's population and economic growth (POP and GDP), which means that these variables have a long-run equilibrium relation.

The long-run cointegration, when the variables are normalised by cointegrating coefficients, could be expressed as

$$GDP = 0.055\ POP - 68.30\ Trend$$

This cointegrating vector equation indicates that there existed a positive long-run relationship between the population growth and economic development in Pakistan. This means that Pakistan is an example of the population/development relationship where the population growth and economic growth have a positive relationship.

Finally, the Granger causality test was employed to examine the causality relationship between population growth and economic growth in Pakistan. The Granger causality test was based on Vector Error Correction Model (VECM). This was done because a cointegrating relationship between POP and GDP in Pakistan was detected by the previous tests. The result of the chi-square statistics, its p-values, coefficient of error correction term (ECT_{t-1}) and its t-statistics are reported in Table 3.

Table 3: Granger Causality Test Based on VECM

Pakistan		
(a) POP→GDP		
Variable	Chi-square test statistics	Probability
ΔPOP	22.796	0.001
	Coefficient	t-statistics
ECT_{t-1}	-0.360	-3.887**
(b) GDP→POP		
Variable	Chi-square test statistics	Probability
ΔGDP	2.111	0.714
	Coefficient	t-statistics
ECT_{t-1}	0.387	0.440

Notes: ** indicates significance at 1% level

According to the results reported in Table 3, the null hypothesis that population growth (POP) did not Granger-cause economic development (GDP) could be rejected at 1 percent level of significance. Therefore, the results provide evidence that, in Pakistan, population Granger-causes the country's Gross Domestic Product. On the other hand, the null hypothesis that GDP does not Granger-cause POP could not be rejected. This is because the coefficients of the error terms are statistically significantly different from zero. This means that the obtained results do not provide evidence that in Pakistan economic growth (GDP) Granger-causes population growth (POP).

In short, the present study has detected a long-run cointegrating relationship between population growth (POP) and economic growth (GDP) in Pakistan. Also, in the case of Pakistan, a unidirectional long-run causality from POP to GDP was in evidence. In other words, Pakistan's population expansion Granger-caused the nation's economic development. These findings indicate that Pakistan represents a textbook example of the population-driven development where the population expansion induces economic development.

The results obtained in the current study are different from those reported in some previous studies (e.g., Dawson and Tiffin, 1998; Thornton 2001). The difference in the findings could be explained by the trends in population growth in these countries. The previous studies have established that the population growth in India (Dawson and Tiffin, 1998) and in seven Latin American nations (Thornton, 2001) was relatively less volatile. Thus, econometrically, the population in these countries was stationary at levels. However, in the case of Pakistan, population growth was relatively more volatile. Therefore, in the course of the econometric analysis, it became stationary only at first difference. If Pakistan's population growth stabilises, the relationship between the population expansion and economic development could be similar to that in the countries in the previous studies.

Concluding Remarks

The present study aimed to provide an additional insight into a complex relationship between population growth and economic development by selecting Pakistan as a case study. Several econometric tests were carried out to determine whether there existed a meaningful relationship between Pakistan's economic growth (GDP) and population expansion (POP).

Firstly, the unit root tests showed that both real per capita GDP and the population growth in Pakistan were integrated of order one, I(1). Further, the Johansen co-integration test confirmed the existence of a co-integrating relationship between the two variables, namely, POP and GDP. The Granger causality test indicated the existence of a unidirectional causality from POP to GDP in Pakistan.

Overall, the findings of the present study imply that the population growth in Pakistan had a positive impact on the country's economic development. This conclusion provides additional evidence in support of the population-driven economic growth proposition, and this is the most important finding of the current study.

Future research studies may want to ascertain factors that cause changes in demographic trends and identify determinants of economic growth. This could shed extra light on the relationship between economic performance of a country and its demographic situation. Considering a complex relationship between population growth and economic growth, different from this study's econometric methods could be employed to analyse the relationship between these variables.

The present research did not aim to explore what effect the quality aspect of population has on economic development but rather it examined how the population quantity may affect economic situation in a developing nation. Including the quality of population parameter into an empirical analysis could be a promising approach for conducting future research on the topic. It is possible that incorporating the population quality variable into empirical analysis could lead to different results from those

reported here. To conclude, trends in demographic situations in various parts of the world – be it the countries with a shrinking or a rapidly expanding population – stimulate a considerable interest and lead to an avid debate among researchers, policy makers, and the general public. This offers a fertile ground for development economists to conduct deeper inquiries into one of the fundamental socio-economic factors and test the existing theories on population and economic development.

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