

Does Population Growth Granger Cause Economic Growth in Jamaica?

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Abstract: Assessing the consequences of population growth on the pace and process of economic growth and development has long been a source of discussion in economic literature. Some scholars have argued that population growth is detrimental to growth while others agreed that population growth promotes economic growth. Over time, both the population and economy has been growing in Jamaica but whether or not this growth can be linked together remains an area of research in Jamaica. Thus, this study investigated the causal relationship between population and economic growth using data from 1960-2004. The study found that though there tend to be a long run relationship between population and economic growth in Jamaica this relationship is not clear-cut. As such there may be other factors that help stimulate growth within the economy.

Key words: Population growth, economic growth, economy, relationship, stimulate, Jamaica

INTRODUCTION

Assessing the consequences of population growth on the pace and process of economic growth and development has long been a source of discussion in economic literature. Some scholars have argued that population growth is detrimental to growth while others argued that population growth promotes economic growth. This discussion stems from the fact that in as much as population growth expands the labour force and consequently increases economic growth, a large population also provides a large domestic market for the economy which enhances growth. Furthermore, population growth encourages competition which induces technological advancements and innovations. Nevertheless, Meier (1995) posited that a large population growth is not only associated with food problem but also imposes constraints on the development of savings, foreign exchange and human resources.

In many developing countries, Jamaica inclusive, the issue of whether or not population growth is beneficial to economic growth has remained contentious with relatively limited empirical evidence. In Jamaica, for instance, there is a relatively high dependency burden as well as high unemployment rate. Also, poverty and inequality has been and continues to be a problem. The debt burden continues to deteriorate as the government has to borrow to meet most of her expenses. One observable scenario is the fact that the population continues to grow and real

GDP seems not to be growing in the same or even a faster pace especially when compared to some Caribbean countries. This seems to be in line with Malthus hypotheses which states that population grows at a faster rate than economic growth.

Thus, overtime, both the population and economy has been growing in Jamaica but whether or not this growth can be linked together remains an area of research in Jamaica. Thus, this study intends to investigate the causal relationship between population and economic growth (Proxied by per capita income).

Literature review: The relationship between population growth and economic development has been a long standing debate within and outside the field of economics. This debate has ignited a plethora of empirical studies of differing views and methodology both within and outside the field of economics.

There are some theorists and researchers that argue that population growth may hinder economic development. According to Meier (1995) as cited in Tsen and Furuoka (2005), higher population growth imposes constraints on the development of savings, foreign exchange and human resources (Which are the drivers of economic development).

One of the early theorists on population growth and economic development, Malthus (1798) held the view that rapid population growth results in chronic low levels of living or absolute poverty. The researcher stated that

population would grow at a geometric rate due mainly to a lack of conscious restraints on fertility while food would grow at an arithmetic rate due to a large extent to diminishing returns to increasingly scarce land. The resulting outcome would be food shortages, starvation and deaths. However, in the long run, population size would be held in check by food availability and mortality. Thus, population pressures would constrain income per capita to a low level of subsistence (A Malthusian trap).

This theory is further backed by empirical studies of which Barlow (1994) is a prime example. Barlow examined the correlation between economic growth and population after controlling for fertility for 86 countries over two non-overlapping periods 1968-1974 and 1977-1983. He found a negative relationship between population and economic growth and thus supports Malthus view that population growth may act as a hindrance to economic development.

In his own study Meier (1995) cautioned that population growth is much more than a food problem. A high rate of population growth not only has an adverse impact on improvement in food supplies but also intensifies the constraints on development of savings, foreign exchange and human resources. Rapid population growth tends to depress savings per capita and retards growth of physical capital per worker. The need for social infrastructure is also broadened and public expenditures must be absorbed in providing the need for a larger population rather than in providing directly productive assets.

Becker *et al.* (1999) concluded that an increase in population may both reduce fertility and raise the accumulation of human capital. They demonstrated in a theoretical model that population growth will increase parental utility if it has a sufficiently positive impact on human capital accumulation or if the impact on current production is not too negative. They maintained that since human capital is more important at higher levels of development, greater population is likely to raise per capita welfare in more developed economies. Conversely, they stated that an increase in population growth may lower the productivity of farming in poorer agricultural economies, so that output per capita there would be lower initially. However, even in these economies, greater population growth would tend to raise the accumulation of human capital by raising rates of return on investments in schooling and other human capital. Moreover, families would lower their fertilities if population growth raises rates of return on investments in children because that would increase the cost of having large families compared with investing more in each child. Therefore, the demographic transition towards smaller families in

economies with initially high fertility and low income per capita may be stimulated by an initial growth in population.

Dawson and Tiffin (1998) study was on India. They used annual time series data over the period 1950-1993 to analyze the long-run relationship between population and economic growth in India using cointegration and Granger causality methods. They found no long-run relationship between the two variables. They concluded that population growth neither Granger causes economic growth nor is caused by it. Their findings was supported by Thornton (2001) who conducted a similar research on the long-run relationship between population and economic growth in seven selected Latin American countries namely, Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela for the period 1900-94. Thornton also found no long-run relationship between population and economic growth in any of the seven countries. Furthermore, population growth neither Granger causes economic growth nor is caused by it.

Despite these diverse findings, Barro led the emergence in the 1990s of empirical convergence models of economic growth. These endogenous growth models distinguished between factors (Economic, political, social institutional and geographic) that determine each country's long-run level of per capita output and the shorter-to-intermediate-run transition of countries to this longer-run state. These models investigate the impacts of demography since they have both short and long-run impacts.

For instance, Kelley (2001) stated that Kelley and Schmidt (1995) in their study distinguished between several alternative demographic influences on the economy's potential output in the long-run (Like the impacts of population size and density) and timing of demographic impacts (Like the timing of reductions in birth and death rates) which influence both the short and long run. These timing specifications highlighted the reality that birth-rate reductions have an immediate positive impact on growth by economizing on child-rearing expenses while in fifteen or so years, the impacts will be reversed, since there will be fewer persons entering their productive work force years. Death rate reductions, especially infant/child mortality can have similar timing impacts. Kelley and Schmidt (1994) found that these timing/transitional features were empirically important and the long-run impacts of both density and size added modestly to growth as well. In another study, mainly examined the long-run impacts of demography on economic growth and found that reductions in the total fertility rate positively enhance the potential for economic growth.

According to Revisionism as cited in the research of Darrat and Al-Yousif (1999), higher population growth increases the stock of human capital and thus stimulates economic development through increased demand and labour supply. Darrat and Al-Yousif tested the inter-temporal relationship between population growth and economic development using cointegration analysis in 26 developing countries for the period 1950-1996 and found a long-run relationship. They found that population and real per capita GDP were cointegrated. The research of Tsen and Furouka (2005) on the relationship between population and economic growth within Asian economies for the period 1950-2002 using cointegration and Granger causality further supports this argument that population growth stimulates economic growth and development. Fumitaka found that in some countries, for example in China, population growth granger caused economic growth and not vice versa.

In their study, Bloom and Williamson (1998) modified Barro's empirical framework to breakout an accounting reckoning of age-compositional impacts. Their accounting framework clearly exposes the impacts of changing age structures, driven by changes in fertility and mortality. These are quantitatively important impacts on the transition to long-run output per capita. Their results focused on East Asia where declines in fertility were rapid and shorter-run transition effects are predictably large.

Finally, Kelley and Schmidt (2001) evaluated all other studies and then summed up the various findings as follows that demography accounts for around 20% of changes in output per capita growth from 1960-1995 across a wide collection of countries. Also, population does matter but its impact is likely adverse over the period 1960-1995; this impact varies from decade to decade; components of demographic change exert both positive and negative impacts; these impacts vary notably from place to place and as a determining variable of long-run economic prosperity, population's impact is notable but not remarkable. In the shorter to intermediate run during periods of transition (Both demographic and economic), population's impact can be elevated or diminished, depending on the pace of demographic change and especially on the country's specific institutions (Government policy, efficacy of markets and definition of property rights).

Population dynamics and economic growth in Jamaica:

Jamaica's annual rate of population growth has been relatively stable since, roughly the end of World War I. Between 1881 and 1921, emigration and disease caused the rate of population growth to fall to very low levels. Some 156,000 Jamaicans emigrated during this period,

35% of the country's natural increase. Between 1911 and 1921, the rate of growth was only 0.4% per year as workers left Jamaica for Costa Rican banana plantations, Cuban sugar estates and the Panama Canal. The burgeoning industries of the United States and Canada also attracted many Jamaicans during this period. Thousands of Jamaicans however, returned home with the fall of sugar prices precipitated by the Great Depression. As a result, from 1921-1954 the rate of population growth rose, averaging 1.7% per year.

Increased emigration after World War II reduced the rate of population growth once again. Between 1954 and 1970, the rate of growth was only 1.4% because large numbers of Jamaicans moved to Britain, the United States, Canada and elsewhere. This exodus continued unabated during the 1970s and early 1980s, when 276,200 men and women, over 10% of the total population, departed. A significant percentage of the emigrants were skilled workers, technicians, doctors and managers thus creating a huge drain on the human resources of Jamaican society. The world economic recession of the 1980s reduced opportunities for migration as a number of countries tightened their immigration laws. Nevertheless, by the mid 1980s it was estimated that more than half of all Jamaicans lived outside the island.

Between 1970 and 1982, Jamaica's average annual rate of population growth was 1.1%, a relatively low rate in comparison with other developing countries. In July 1983 the Jamaican Parliament adopted the National Population Policy which was developed by the Population Policy Task Force under the auspices of the Ministry of Health. The objectives of the policy were to achieve a population not in excess of 3 million by the year 2000; to promote health and increase the life expectancy of the population; to create employment opportunities and reduce unemployment, underemployment and emigration; to provide access to family-planning services for all Jamaicans and reduce the average number of children per family from four to two thus, achieving replacement fertility levels; to promote balanced rural, urban and regional development to achieve an optimal spatial distribution of population and to improve the satisfaction of basic needs and the quality of life through improved housing, nutrition, education and environmental conditions.

In 1986 Jamaica had an estimated population of 2,304,000 persons, making it the most populous of the english-speaking Caribbean islands. The most recent census in June 1982, recorded a total population of 2,095,858 persons, an increase of 13.4% over the 1970 census count of 1,848,508. Despite this, there was a drop in the rate of population growth to 0.9%. Jamaica's low

rate of population growth reflected gradually declining birth rates and high levels of emigration, the country's most striking demographic feature. Nevertheless, significant reductions in mortality rates, resulting from better health care and sanitation also affected the overall population growth rate, tending to raise it.

In line with the 1983 National Population Policy target which stipulates a growth rate of below 0.8% over the medium term and a projected population size of under 3.0 million by the year 2020, the population growth rate has consistently remained below 1.0% since 1997 through 2003.

Family planning services which have been visible, accessible and active in Jamaica since the 1960s also played some roles in the maintenance of a fairly stable population growth rate. Through family planning, Jamaica's birth rate reduced by about 35% from 1965-1985. The Planning Institute of Jamaica, a government agency, estimated that the crude birth rate (The annual number of births per 1,000 of total population) was 24.3 per 1,000 in 1985. The total fertility rate (The average number of children born to a woman during her life time) decreased from 5.5 in 1970-3.5 by 1983. The government perceived its population goal of 3 million or less by the year 2000 as feasible only if the yearly population growth rate did not exceed 1.6% and the replacement fertility rate were two children per woman.

The crude death rate (The annual number of deaths per 1,000 of total population) was quite low at 6 per 1,000 population in 1985. By comparison, the United States had a crude death rate of 9 per 1,000 in the same year. Between 1965 and 1985, Jamaica's crude death rate declined by 44%, the result of significant levels of investment in health care delivery systems and improved sanitation facilities during the 1970s. In 1985 life expectancy at birth (The average number of years a newborn infant can expect to live under current mortality levels) was very high at 73 years. The infant mortality rate (The annual number of deaths of children <1 year old per 1,000 births) was 20 per 1,000 births during the mid 1980s and this rate was consistent with that of 23 per 1,000 found in other English speaking Caribbean islands.

Jamaica, like most of the other Commonwealth Caribbean islands is densely populated. In 1986 its estimated population density was 209.62 persons km⁻². In terms of arable land, the population totaled nearly 1,000 persons km⁻² making it one of the most densely populated countries in the world. Since, the 1960s, the population has become increasingly urban. In 1960, only 34% of the population lived in urban areas but in the late 1980s, >50% of the population was urban. And this trend has continued. Presently, Jamaica has a population of about 2.7 million.

The Jamaican economy is heavily dependent on services which now account for 60% of GDP. The country continues to derive most of its foreign exchange from remittances, tourism and bauxite/alumina. During the 1950s and 1960s, Jamaica had a stable growth rate of her economy. This can be attributed to the fact that during this time the bauxite industry boomed. Real GDP growth averaged about 4.5% during these two decades. But from 1972-1986, economic growth rate was unstable and weak but between 1973 and 1980, Jamaica experienced consecutive years of negative growth. The consequence of which was a mass exodus of both labor and capital especially skilled labor and investment capital. Precisely, GDP declined by 4.5% in 1985 but rose again in 1986 by >2%. The negative growth in the 1980s was generally attributed to the acute decline in the world bauxite market. Economic growth fluctuated in the 1990s but the terrorist attacks in the US on 11 September 2001, stunted economic growth in Jamaica. In 2003/2004, there was a boom in tourism and the economy rebounded back moderately.

Generally, the Jamaican economy faces serious long-term problems: high interest rates increased foreign competition; exchange rate instability; a sizable merchandise trade deficit; large-scale unemployment and underemployment and a growing stock of internal debt the result of government bailouts to ailing sectors of the economy, most notably the financial sector in the mid 1990s. The ratio of debt to GDP is 135%. Inflation, previously a bright spot is expected to remain in the double digits. Uncertain economic conditions have led to increased civil unrest including gang violence fueled by the drug trade. In 2004, the government faced the difficult prospect of having to achieve fiscal discipline in order to maintain debt payments while simultaneously attacking a serious and growing crime problem that is hampering economic growth. Attempts at deficit control were derailed by Hurricane Ivan in September 2004 which required substantial government spending to repair the damage. Despite the hurricane, tourism looks set to enjoy solid growth for the foreseeable future.

MATERIALS AND METHODS

Model specification: This study uses the Johansen cointegration test. The procedure is carried out in two steps. The first step is to test for order of integration of the variables. The order of integration is the number of times a variable has to be differenced before it becomes stationary. A condition for the tests is that the variables entering the cointegrating equation should be integrated of the same order. To test the degree of integration of the variables, the Augmented Dickey-Fuller test was done.

The Granger-causality test was then carried out and was interpreted as a within-sample causality test (Dickey and Fuller, 1979). This section benefits substantially from Mushtaq (2006).

The presence of unit roots (Non-stationarity) in the individual time series was tested using the augmented Dickey-Fuller test both with and without a deterministic trend. Like Mushtaq, the appropriate number of lags used in the Augmented Dickey Fuller test was chosen using the Breusch-Godfrey statistics to ensure the absent of serial correlation. As with Mushtaq in testing for unit roots using the Augmented Dickey-Fuller, the sequential procedure of Dickey and Pantula (1987) was used.

It is of importance to know if two variables are stationary. According to Hill *et al.* (2001) using non-stationary series in regression analysis may result in perceptibly significant regression results from unrelated data. These regression it is argued are said to be spurious. If the variables are non-stationary they will be first differenced so that they will become stationary. If the variables are integrated of the same order, Johansen and Juselius (1990) procedure will be used to test for the presence of a cointegrating vector between population and income as was done by Mushtaq.

According to Granger as cited in Mushtaq (2006), cointegration implies the existence of a meaningful long-run equilibrium. According to Mushtaq this procedure is based on maximum likelihood estimation of the error correction model:

$$\Delta z_t = \delta + \Gamma_1 \Delta z_{t-1} + \Gamma_2 \Delta z_{t-2} + \dots + \Gamma_{p-1} \Delta z_{t-p+1} + \pi z_{t-p} + u_t \quad (1)$$

Where, z_t is a vector of $I(1)$ endogenous variables $\Delta z_t = z_t - z_{t-1}$ and π and Γ_i are $(n \times n)$ matrices of parameters with $\Gamma_i = -(I - A_1 - A_2 - \dots - A_i)$, $(i = 1, \dots, k-1)$ and $\pi = I - \pi_1 - \pi_2 - \dots - \pi_k$. The expression πz_{t-p} gives information about the long-run equilibrium relationship between the variables in z_t . The rank of the π -matrix provides information about the number of cointegrating relationships among the variables in z_t thus, according to Mushtaq, if π is of reduced rank, the model is subject to a unit root and if $0 < r < n$ where r is the rank of π , π can be decomposed into two $(n \times r)$ matrices α and β such that $\pi = \alpha\beta'$ where $\beta' z_t$ is stationary. Where, α is the error correction term which measures the speed of adjustment in Δz_t and β contains r distinct cointegrating vectors that are the cointegrating relationships between the non-stationary variables. Equation 1 can be rewritten as:

$$\begin{bmatrix} \Delta P_t \\ \Delta(Y/P)_t \end{bmatrix} = \begin{bmatrix} \delta_1 \\ \delta_2 \end{bmatrix} + \sum_{i=1}^{p-1} \begin{bmatrix} \Gamma_{i,11} & \Gamma_{i,12} \\ \Gamma_{i,21} & \Gamma_{i,22} \end{bmatrix} \begin{bmatrix} \Delta P_{t-i} \\ \Delta(Y/P)_{t-i} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} [\beta_1 \beta_2] \begin{bmatrix} P_{t-p} \\ (Y/P)_{t-p} \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

Following Mushtaq's procedure, the Johansen procedure estimates (1) and trace statistics are used to test the null hypothesis of at most r cointegrating vectors against the alternative that it is greater than r . According to Mushtaq if cointegration exists between P_t and $(Y/P)_t$, the model in (2) can then be estimate Granger-causality (Granger, 1969) in either direction or feedback between P_t and $(Y/P)_t$.

Data sources: Time series annual data was used for the study and this covered the period 1960-2004. The data was sourced secondarily from the publications of the Planning Institute of Jamaica (PIOJ) and the Statistical Institute of Jamaica (STATIN). The natural logarithm of the variables was used for the analysis.

RESULTS AND DISCUSSION

The Augmented Dickey-Fuller unit root test was carried out on the logarithm of each variable population and GDP per capita. The lag length used to compute the ADF test statistic is based on Akaike Information Criterion (AIC). The results of the ADF unit root test statistics show that population is integrated of order zero for and both variables were found to be stationary at the 5% level of significance. Table 1 shows reports these results for the test for unit root using the ADF-tests with a linear trend.

Johansen procedure was carried out to determine if population and GDP per capita were cointegrated. The results of the test statistics are computed with unrestricted intercepts and no trends. The null hypotheses that there was no cointegrating vector ($r = 0$) and that there was at most one cointegrating vector ($r = 1$). Table 2 shows the trace statistics and results.

The null hypothesis that no cointegrating vector is present ($r = 0$) was rejected at the 5% level of significance as the trace statistics (20.607) was greater than the critical value (12.321). Thus indicating that the two variables are cointegrated. However, when the null hypothesis that at most one ($r \leq 1$) cointegrated vector was present was tested, the trace statistics (0.4559) was less than the critical value (4.130) and as such we fail to reject the null hypothesis.

The above indicates that population and economic growth are cointegrated. As such, there may be an existence of a long-run relationship between population and per capita GDP.

Granger causality test to try and determine the direction of causality between population and per capita GDP was also done. The results of Granger causality test are shown in Table 3. It was found that population growth

Table 1: Augmented Dickey-Fuller tests for unit roots

Variables	Test statistics	Tau (τ) statistics	
		5% level of significance	p-value
P_t	-4.796603	-3.520787	0.0020
$(Y/P)_t$	-6.401188	-3.518090	0.0000

Table 2: Cointegration results

H_0	Trace statistics	Critical values (5% level)
$r = 0$	20.6070	12.321
$r \leq 1$	0.4559	4.130

Table 3: Granger causality test result

Null hypothesis:	Obs	F-statistic	Probability
LRPCGDP does not Granger cause LPOP	43	0.47519	0.49459
LPOP does not Granger cause LRPCGDP	-	0.05158	0.82150

Pairwise Granger Causality tests; Date: 01/17/08; Time: 15:36; Sample: 1960-2004; Lags: 1

neither Granger causes economic growth nor is caused by it. This implies that population growth neither stimulates economic growth nor detracts from it. This result is similar to those of Dawson and Tiffin (1998) and Thornton (2001), whose studies on India and Latin America respectively show no causality between population growth and economic growth.

Thus, the result suggests that there is no clear-cut relationship between population and economic growth. An inference here is that population growth could be beneficial or unfavorable to economic growth and economic growth could have an impact on population growth. Thus, as Fumitaka (2005) puts it, some economies especially in Asia which achieve a low level of economic growth may not be affected by population growth but are affected by other factors such as political instability and lack of investments. On the other hand, some economies which achieve a high level of economic growth, may not have done so because of population growth but due to other factors. These factors are listed by Tan to include political stability, efficiency of public administration, successful implementation of export-oriented industrialization policies, quality of labour force and macroeconomic stability are among the factors that have contributed to economic growth in Asian NIEs. This can be said to be the situation in Jamaica, given the findings from the result.

CONCLUSION

The study examined the relationship between population and economic growth in Jamaica using secondary data for the period 1960-2004. It was found, among others that population growth and economic growth is stationary and co-integrated. As such, a long term relationship between population growth and economic growth may exist but none of them granger causes the other. This suggests that population growth could have a beneficial or unfavorable effect on economic

growth and economic growth could have an impact on population growth. Also, there may be some other factors that may induce more growth within the Jamaican economy.

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