

# Population Pyramid and Economic Growth: An Econometric analysis of Sri Lanka

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**Abstract-** Economists are torn between basically three schools of thoughts where the first theory states that the population growth will stimulate the economic growth of a country and other believes that the population growth will bring detrimental or adverse impact to the economic growth. Not only that, but there is another school of thought, which believes that the population growth is a neutral factor in economic growth. Given this diverse of opinions, through this study it is expected to established a firm relationship between the population growth and the economic growth of Sri Lanka. This study developed an econometric model using time series data from 1980 to 2015 and tested the relationship not only the GDP of Sri Lanka, but other significant variables of an economy such as Domestic Savings, Private consumption and Total Investment as well. The results of this study indicate absence of a long term relationship between the population growth and the GDP of Sri Lanka and there will be no any relationship between the other selected variables and the population growth of Sri Lanka. The Granger Causality Analysis found out a unidirectional relationship between the GDP and the population growth, running from population growth to GDP. The study concludes that in Sri Lankan context, the population growth will not have any significant impact on the economic growth.

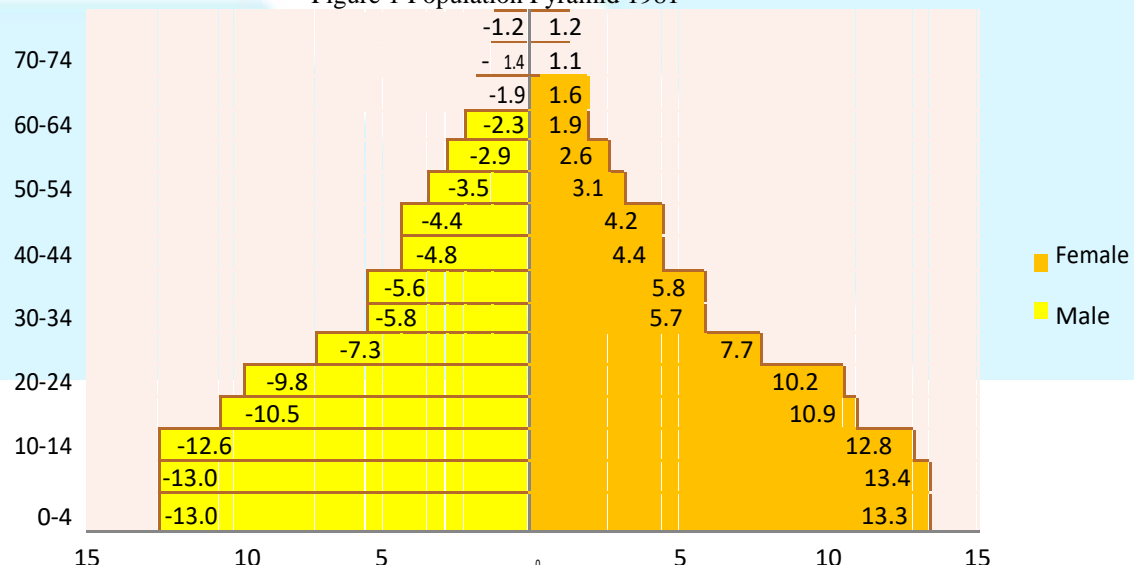
**Key Words:** Population Growth; Economic Growth; Sri Lanka

## 1. INTRODUCTION

The growth of the Sri Lankan population throughout the 20<sup>th</sup> century did not indicate a uniform pattern. De Silva (2015, p 29)[7] has identified the three demographic components, such as fertility, mortality and migration as the major culprits behind this irregular behavior of the Sri Lankan population growth. In a nutshell, the natural increase of the population (difference between the number of births and the number of deaths of a population) and the net migration (difference between the number of

immigrants and migrants) can be identify as the reasons behind the changes happen in Sri Lankan population. For the span of 1980 to 2015, the consideration time period for this study, Sri Lanka has experienced a three comprehensive census of population. With reference to the annual report of Central Bank of Sri Lanka 2015, the midyear population of Sri Lanka is approximately 21 million. The below population pyramid will show how the total population of Sri Lanka vary from 1980 to up to date which is the concerning period for this research.

Figure 1 Population Pyramid 1981

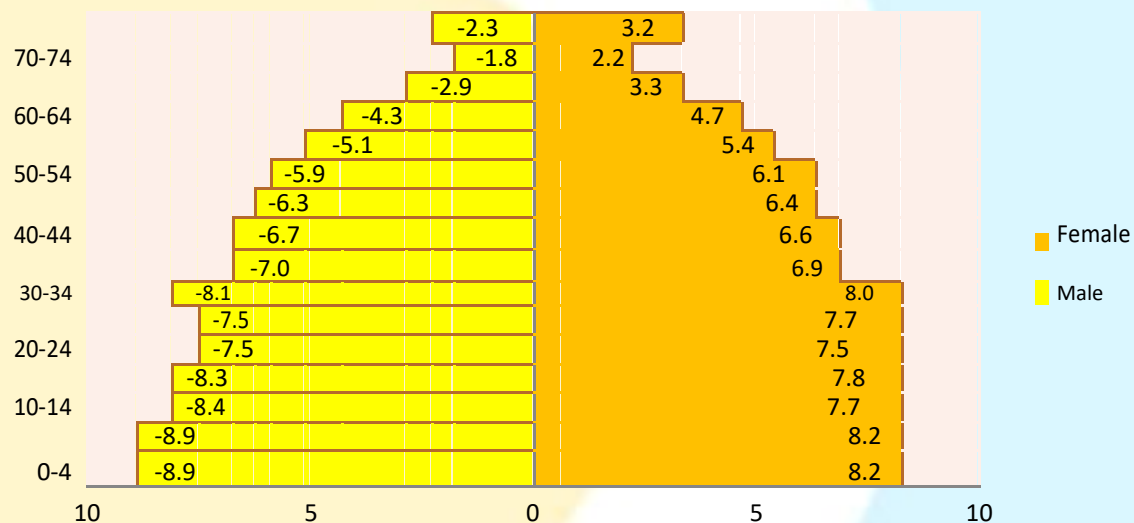


Source: Author Compiled by using data from Department of Census and Statistics

When it comes to the comparison of the two pyramids in 1981 and 2011, the very first observation will be the shapes of the two pyramids. From a clear and neat shape of “pyramid” in 1981 it has been shifted to a shape of “Pagoda” in 2011. With reference to the department of Census and statistics, which quote the results of the census of housing and population in 1981 and 2011, the

Sri Lankan population has grown from 14.8 million to 20.4 million within the period of thirty years. One of the most important observations of the pyramid of 2012, compared to the 1981, is that the expansion of the top proportion of the pyramid which indicate an increase of the share of “old population”.

Figure 2 Population Pyramid 2011



Source: Author Compiled by using data from Department of Census and Statistics

Census and Statistics Department of Sri Lanka states that the percentage of old population by 2012 is 12.4% and it was about 6.6% in 1981. This is mainly due to the control of prenatal and infant mortality, decline in birth rates, improvements in nutrition and basic health care, control of infectious diseases in many part of the world etc. (Shuman 1984, pp 175-181). Not only have that, but the expansion of the top proportion of the pyramid explained the increase of the life expectancy of the Sri Lankans during this time period.

## 2. POPULATION THEORIES

When it comes to the relationship between population growth and the performance of an economy, the economists play around basically three school of thoughts; one state that the population growth will detrimental to a economy due to the various problems related with the population growth whereas some argued that the population growth will enhance the economy by stimulating the economic growth and the development. The third school of thought state that the population growth does have any impact on the performance of an economy. The prime facts backing up the optimistic view on the relationship between population and the economic growth is that the enlargement of the labor force, large domestic markets, encourages competition etc. and the opposition school come up with arguments such as constraints on savings, food problem, issues of minimum wages and etc. The population theories can be classified mainly into three eras. Namely, the theories are Pre-

Malthusian theories, Malthusian Theory and Post Malthusian Theories.

The pre- Malthusian theories have torn between two opinions on how the population growth affected on the economy. Basically, during this era some argued that the population is an accretion factor to the economic development and some present the population growth as a restraining factor on the economic development. Pre-Malthusian theories have both optimistic and pessimistic views on the population growth. Malthusian theory, which is presented by the Thomas Malthus come up with a counter argument against the optimistic view on population growth. Malthus (1798)[16] pointed out that the population growth is an exponential growth and the food and the other resources show and arithmetical growth. This exponential growth will exceed the arithmetic growth and this will effect on the development of both human and economy in negative manner.

The classical theory under post Malthusian theory claim that the increasing population as an asset with reference to the production and it will caused to economic development. The neo Classical theory argues that the increasing population will cause to a down turn of the production. The main argument of this school of thought that the increasing population will add more “Mouths” to the economy and due to increasing trend of the demand for the resources will negatively affect to the economy. The “Optimum Population Theory” is an another theory under the post Malthusian theory and it suggest that up to optimum level of population will enhance the economic

development and beyond that it will restrict the economic development.

### 3. PROBLEM STATEMENT AND THE RESEARCH QUESTIONS

As comprehensively explained in the above section, there is an ongoing debate and divergence of opinion regarding the consequences of the population growth on economic development. In a nutshell, the population growth may contribute, deter or even will have no impact on the economic development based on these opinions. It is very much clear that the Sri Lankan population will be subjected to a drastic and radical change of its size, composition and structure within the next three decades. Therefore, through this study, it is expected to answer the problem of, whether the changes going to happen in the Sri Lankan population will contribute, deters or does not affect the Economic Development of Sri Lanka in the future.

### 4. LITERATURE REVIEW ON THE SELECTED VARIABLES

Simon, (1977)[17] has identified the population as the total number of individuals alive at particular point of time. Dawson and Tiffin (1998) had investigated the long term relationship between the population growth and the economic growth in India by using a time series analysis. The results of this study is in align with the conclusion draw by the Tsen and Furuoka (2005)[21] where the study indicate no evidences on long run relationship between the population and the economic growth in selected Asian economies. Furuoka (2010)[10] shows that the Philippines has a long run relationship between the population growth and the economic development and population growth induced the economic growth in the Philippine. Kothare (1999)[14] draw an important conclusion regarding the relationship between population growth and the economic growth in India by stating that, primary reason of India to become a one of the fastest growing economies of the world is that the rise of the population creates positive impact on its long term economic growth. Thornton (2001)[18] conducted a research in Latin American countries and this study is also reached a similar conclusion draw by the Dawson and Tiffin (1998) regarding the Indian economy. Tsangyao *et al* (2014)[20] study the casual link between the population growth and the economic growth in 21 countries including Sri Lanka and the study concluded that there are certain countries including Sri Lanka that there are no evidences on causal relationship between the variables. Abdullah *et al* (2015) conducted a similar study for the Bangladesh and the results of the study indicate a negative correlation between the population growth and the economic growth. Thuku, Paul and Almadi (2013) which is about studying the impact of population change to Kenyan economy by employing a Vector Auto Regressive estimation showed that population growth and

the economic growth in Kenya are positively correlated. Gideon, Thuku and Obere (2013) found a positive relationship between the population growth and the economic growth in Kenya which is exactly tally with the conclusion of the Thuku, Paul and Almadi (2013). Kelley (1988) revealed that the low population growth rate will enhance economic growth at a higher rate. Further, Kelley has elaborated that even though the population growth in most countries showed an insignificant impact on economic growth, based on the study, economic growth will show a higher value when there is a slower population growth rates in countries. Adidiran (2012) used ordinary least square method to analyze the same relationship for the Nigerian economy and detect a positive and significant impact on the GDP of Nigeria. Mahamud (2015) analyze the relationship between population growth and the economic growth in India. The study revealed a positive relationship between the population growth and the economic growth and existence of a unidirectional relationship running from economic growth to population growth. Ali and Amin (2013) investigate the relationship between the population growth and the economic development in Pakistan for the period of 1975 to 2008. and revealed that the population growth had a positive and significant contribution to the economic development to the Pakistan economy Peng (2002) based on six Asian economies to investigate the relationship between population growth, productivity and division of labor found that the productivity does not explained by the population but by the division of labor. Bloom and Williamson (1997)[4] has found a significant relationship between the population and the economic growth of an economy. The results of the literature review show that there is an ambiguity between the relationships of population growth and economic development. Thus, this study further empirically studies the relationship.

### 5. METHODOLOGY AND DATA PRESENTATION

The main purpose of this study is to empirically analyze the relationship between the population growth and the economic development of Sri Lanka. Therefore, the quantitative research approach will followed when conducting the study. Not only that, but the researcher intent to follow the Inductive research approach where the researcher expect to develop an theory for the Sri Lankan context regarding the relationship between the population growth and the economic development in Sri Lanka based on hypothesis testing. This study intends to empirically analyze the relationship between population growth and the economic development of Sri Lanka. Since, the study followed a quantitative research approach data collection; analyzing and estimation will follow a quantitative approach as well. Primarily, this study employed the Ordinary Least Square (OLS) and simple linear regression technique, in order to determine the relationship between population growth and the economic development in Sri

Lanka. The research will entirely depend on the published data (Secondary data) for the period ranging 1980-2015 and publications of Central Bank of Sri Lanka and publications of Department of Census and Statistics and the World Bank data bases will serve as the main data sources for this study.

## 6. TEST OF STATIONARY

The Augmented Dickey Fuller (ADF) unit root test is used for check whether the data set is stationary or not. If the data set is free from unit root it is believed that the data set is a stationary. The unit root test results of the variables in the model is illustrated in the below table and the decision criteria is based on the above hypothesis.

Table 1: ADF Unit Root test Results

Variable					Decision
			T stat	Critical values	
GDP Growth	Level	Intercept	4.497632	-2.951125	Reject H0
		Intercept & Trend	4.434537	-3.548490	Reject H0
POP Growth	Level	Intercept	-1.823957	-2.948404	Reject H0
		Intercept and Trend	-1.632684	-3.544284	Reject H0
INV Growth	Level	Intercept	2.763508	-2.95113	Reject H0
		Intercept & Trend	0.572877	-3.54849	Reject H0
SAV Growth	Level	Intercept	2.552231	-2.95113	Reject H0
		Intercept & Trend	0.572877	-3.54849	Reject H0
CONS Growth	Level	Intercept	6.907748	-2.9484	Reject H0
		Intercept & Trend	2.415191	-3.544284	Reject H0

Source: Author Compiled

Based on the above results, it can be concluded that, at 95% confidence level the data set are stationary, at level.

## 7. RESULTS AND DEVELOPMENT OF THE MODEL

The study intended to investigate the relationship between the population growth and the economic development of

Sri Lanka. To accomplish that intention, the researcher has identified four dependent variables and one independent variable. Hence, the study employed four separate and different regression models which are independent from each other. These, regression models will examine the presence of long run relationship between the population growth and the selected variables.

Table 2: Population Growth and the GDP

Variable	Coefficient	Std. Error	T- Stat	Prob.
C	0.220806	0.102060	2.163481	0.0378
POPD1	-0.856076	7.828994	-0.109347	0.9136

Source: Author Compiled

Table 3: Overall Significance, Goodness of Fit and Validity of the Model

F – Statistics P value	0.913590
R - Squared	0.000362



Breush – Godfrey Stat	1.393312
White's Test Stat	0.7654

Source: Author Compiled

The overall model has a P Value of 0.913590 which is higher than the significance level of 0.05, implying that the alternative hypothesis has to be rejected in favor of the null hypothesis. Hence, it can be concluded that there is no significant long term relationship between the population growth and the economic growth when it comes to the Sri Lankan context. The result of this

regression model strongly backed by the study carried out by the Tsangyo *et al* (2014)[20], where that study concludes that, there is no evidence on the casual relationship between the population growth and the economic growth in few countries in the world including Sri Lanka.

Table 4: Population Growth and Private Consumption

Variables	Coefficient	Std. Error	T Stat	Prob.
C	0.132960	0.015825	8.402018	0.0000
POPD1	0.890674	1.213908	0.733725	0.4683

Source: Author Compiled

Table 5: Overall Significance, Goodness of Fit and Validity of the Model

F – Statistics P Value	0.468298
R - Squared	0.016052
Breush – Godfrey Stat	1.310024
White's Test Stat	0.7956

Source: Author Compiled

When testing for the overall significance of the model, a P –Value of 0.468298, which is more than the significance level of 0.05, implying that, the alternative hypothesis has to be rejected in favor of the null hypothesis. This

concludes that there is no any long term relationship between the population growth and the private consumption of Sri Lanka.

Table 6: Population Growth and the Domestic Savings

Variable	Coefficient	Std. Error	T Stat	Prob.
C	0.209086	0.051760	4.039532	0.0003
POPD1	-4.233921	3.970478	-1.066350	0.2940

Source: Author Compiled

The derived model for the relationship will be, When it comes to the  $r^2$  again it shows a relatively small figure

and the very same reasons identified for the above two models applicable to here as well.

Table 7: Overall Significance, Goodness of Fit and Validity of the Model

F - Statistics	0.294005
R - Squared	0.033310
Breush – Godfrey Stat	0.892052

White's Test Stat	0.9913
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Source: Author Compiled

The P Value F Statistic indicates a direction towards not rejecting the null hypothesis implying that once again

there is no longer term relationship between the domestic savings and the Population growth in Sri Lanka.

Table 8: Population Growth and the Total Investment

Variable	Coefficient	Std. Error	T - Stat	Prob.
C	0.149158	0.038689	3.852676	0.0005
POPD1	-0.593854	2.967851	-0.200096	0.8426

Source: Author Compiled

When testing the White's test statistics it indicates the model is free of Heteroskedasticity this time as well.

Breush – Godfrey test Statistics once again favorable for the non-existence of Autocorrelation in the model.

Table 9: Overall Significance, Goodness of Fit and Validity of the Model

F - Statistics	0.842634
R - Squared	0.001212
Breush – Godfrey Stat	2.033900
White's Test Stat	0.2680

Source: Author Compiled

When testing the significance of the overall model, it indicates a rejection of the null hypothesis in favor of the alternative hypothesis. Both the White's test and Breush – Godfrey test statistic has implied a non presence of Heteroskedasticity and Autocorrelation in the model respectively. Based on the above table it can be stated that the other than the consumption, all the variables indicate a negative relationship between the dependent variable. The other important observation which can be made through the above matrix is that the all the values of the coefficient is closer to the “zero” which indicates a weaker linear relationship between the dependent and the independent variable. Between the population and the savings, can see the strongest relationship among the

variables and between the population and the GDP can identify the weakest relationship.

## 8. GRANGER CAUSALITY TEST

The next objective of this study is to investigate the casual relationship between the population growth and the economic development of Sri Lanka and to accomplish that objective the Granger Causality test was carried out by the researcher. The study employed the Alkaike Information Criteria (AIC) for the lag selection and the summary of the casual relationship is given in the Table 10.

Table 10: Summary of the casual relationship

Hypothesis	F Stat	Probability	Decision
POP doesn't Granger Cause GDP	3.97671	0.0141*	Reject H
GDP doesn't Granger Cause POP	0.54686	0.7032	Do not Reject Ho
POP doesn't Granger Cause CONS	2.14964	0.1086	Do not Reject H
POP doesn't Granger Cause INV	1.21213	0.3340	Do not Reject H
□ Rejection of null hypothesis at 5% significance level			

Source: Author Compiled

The above results were tested for both directions up to four lags. Based on the above Table 10, it can be conclude that the causation runs only one direction i.e. from population growth to GDP growth not vice versa when it comes to Sri Lanka. According to the above table population growth does not cause the consumption and

nor the consumption cause the population growth in Sri Lankan context. In this scenario as well there will be no causation between population growth and the investment in Sri Lanka. With the above evidence, it is clear that the there is no any causality runs between population and the savings.

## 9. CONCLUSION

The prime objective of this study was to investigate the relationship between the population growth and the economic growth with reference to Sri Lanka. By employing the describe methodology, the study found out that there is no long term relationship between the population growth and the selected independent variables of the study. This implying that the, when it comes to Sri Lanka the population growth will not affect the GDP and the decisions of Consumption, Savings or the investments in longer term. The outcome of the Granger Causality test has implied that the there is an unidirectional relationship between the GDP and the population growth in Sri Lanka running from population growth to GDP growth which implies that the in short term the population of Sri Lanka will affect to the GDP of Sri Lanka. But, for the other variables, the Granger Causality tests indicate a non-presence of Causality between the population and the respective variables. Therefore, the research problem which is expected to be answered at the end of this research can be answered now. The changes going to happen in the Sri Lankan population will not affect the future economic development of Sri Lanka, since the Sri Lankan population growth is a neutral factor to economic growth. Hence, it implies that the Sri Lankan economic development will dependent on some other factors, other than the population growth.

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