

THE IMPACT OF POPULATION CHANGE ON ECONOMIC GROWTH IN KENYA

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ABSTRACT

The debate on the relationship between population growth and economic growth has been undergoing and varies across countries. The first theory states that population growth stimulates economic growth. The second theory view population growth as a factor that adversely affects economic growth while a third school is that population growth is a neutral factor in economic growth and is determined outside standard growth models. Given this scenario there was a need to establish the relationship between economic growth and population growth in Kenya. The study employed Vector Auto Regression estimation technique and used annual time series data for the period 1963 to 2009. The results indicated population growth and economic growths are both positively correlated and that an increase in population will impact positively to the economic growth in the country. The study concludes that in Kenya population growth promotes economic growth and subsequently economic development.

CHAPTER ONE INTRODUCTION

1.1 Background

A high population growth is a growing concern throughout the world and a challenge to countries' economies. The world's population was about a billion in 1800 and rose to 2.5 billion in 1950 (Martin 2009). In the year 2007 the world's population was 6.7 billion and is projected to rise to 9.2 billion by 2050 with almost all population growth projected to occur in what are now considered less developed regions. Between 1950 and 2000, when the world's population increased from 2.5 billion to 6.1 billion, the major shifts in population weights by continent were the result of changes in fertility and mortality rather than large-scale migration (Martin, 2009).

Economists are torn between three theories; one that state's that population growth helps a nation's economy by stimulating economic growth and development and another that bases its theory on Robert Malthus' findings. Malthus (1798) stated that population increase is detrimental to a nation's economy due to a variety of problems caused by the growth. For example, overpopulation and population growth places a tremendous amount of pressure on resources, which result in a chain reaction of problems as the nation grows. The third school of thought is that population growth does have any impact on economic growth.

Malthus (1798) pointed out that population tends to grow geometrically, whereas food supplies grow only arithmetically. According to the Malthusian model, the causation goes in both directions. Higher economic growth increases population by stimulating early marriages, high birth rates, and reducing mortality rates from malnutrition. On the other hand, higher population depresses economic growth through diminishing returns. This dynamic interaction between population and economic growth is the centre of the Malthusian model, which implies a counter balancing effect on population in the long-run equilibrium.

According to Malthusian theory, a high population growth is associated with food problem, i.e., malnutrition and hunger but Bloom and Freeman (1998) differ with the theory noting that food problem is more of a problem of poverty and inadequate income than a matter of high population growth. The population and food problem can be solved when income is enough to buy adequate food as prices provide adequate incentives to produce. On the other hand, developing economies would have to export more, receive foreign aid or borrow overseas to meet their increased demand for food by increased imports. 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. Population pressure is likely to intensify the foreign exchange constraints by placing more pressure on the balance of payment. The need to import food will require the development of new industries for export expansion and/or import substitution. The rapid increase in school-age population and the expanding number of labour force entrants puts ever-greater pressure on educational and training facilities and retards improvement in the quality of education, which is a problem in developing economies. Also, too dense a population aggravates the problem of improving the health of the population and intensifies pressure on employment and the amount of investment available per labour market entrant (Martin 2009).

More people may mean a country can produce and consume more goods and services, leading to economic growth. But this can only occur when employment opportunities grow at least as fast as the labor force and when people have access to the necessary education and training. A larger population may help overcome possibly diminishing returns to this generation's human capital in the production of the next generation's human capital because greater population growth induces more specialization and a larger market that raise returns to human capital and knowledge. If human capital per capita were sufficiently large, the economy would move to steady state growth, whereby in the steady-state growth path, consumption per capita would increase at a slower rate than human capital if the population is growing and if the production of consumer goods has diminishing returns to population. However, consumption per capita can still be increasing, despite these diminishing returns, if the positive impact of the growth in human capital on productivity in the consumption sector more than offsets the negative impact of population growth. Thus, zero population growth is not necessary for sustainable growth in per capita consumption, even with diminishing returns to population in the production of consumer goods (Gerald and Meier, 1995).

Economists advocating the positive side to population growth, say that the population growth creates problems in the short run that include poverty, famine and unemployment. Yet, they also state that in the long run, it leads to new developments through advancement in technology that leave countries better off than if the problems never occurred. On the positive side, there is a chain reaction of events caused by population growth. According to the neo-classical growth model, population is beneficial to an economy due to the fact that population growth is correlated to technological advancement. Rising population promotes the need for some sort of technological change in order to meet the rising demands for certain goods and services. With the increased populace, economies are blessed with a large labor force, making it cheaper as well, due to its immense availability. An increase in labor availability and a low cost for labor results in a huge rise in employment as businesses are more inclined to the cheap labor. Low labor costs results in a shift of money usage from wages into advancement through technology (Coale and Hoover, 1958).

According to Friedberg and Hunt (1995) population growth and urbanization go together, and economic development is closely correlated with urbanization. Rich countries are urban countries. Population growth increases density and, together with rural-urban migration, creates higher urban agglomeration. And this is critical for achieving sustained growth because large urban centers allow for innovation and increase economies of scale. Companies can produce goods in larger numbers and more cheaply, serving a larger number of low-income customers. Many countries have companies which have been benefitting from increasing population growth and density in targeting the large numbers of lower and lower-middle income. Their business model is viable because they can serve a multi-million customer base.

1.2 Population Growth and Economic Growth in Kenya

The trend in population growth and Gross Domestic Product (GDP) in Kenya from 1963 to the year 2009 is shown in figure 1.1. The figure shows that the trend in population growth in Kenya has been fluctuating over the years. The figure shows that the country recorded the highest population growth in 1967 at 4.7 percent. In 1979 the growth rate increased to 3.8 percent from a growth rate of 3.3 percent in 1969. The population growth rate

decreased between the years 1979 and 1989 recording a growth rate of 3.4 percent. For the period between 1989 and 1999 growth rate was 2.9 percent which again increased to 3.0 percent for the period 1999 to 2009 (Republic of Kenya, 2010).

During the same period the rate of growth of GDP was cyclical. As can be observed from figure 1.1, the growth rate has also been fluctuating over the years. In 1968 the growth rate declined to only 3.4 percent from an all time high of 14.7 percent in 1966. GDP growth improved in the year 1973 recording a growth rate of 7 percent. In 1974 the economy recorded a negative growth of 0.24 percent. There was a marked performance in the year 1977 when the economy grew by 8.6 percent. One of the worst performances for the economy was recorded in 1984 with the economy recording a growth rate of negative 0.8 percent. This decline was attributed to the famine that occurred in that year. The economy again improved in the following years but in 1993 it went down to 0.2 percent. There was a turnaround in the economic performance during the period 2003-2008 when the economic growth increased from 2.9 percent in 2003 to 7.1 percent in 2007. The growth rate however declined to 1.6 percent in 2008 due to the post elections violence that engulfed the country in December 2007.

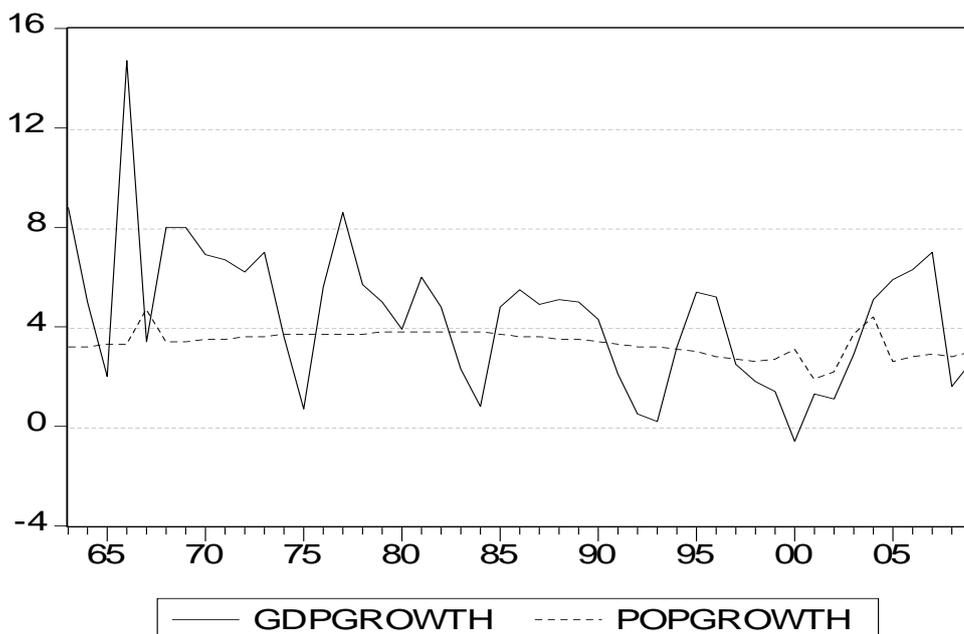


Figure 1.1 Trends in GDP growth and population growth over the period 1963-2008

Source: Republic of Kenya *Economic Survey and Statistical Abstract* for various years

1.3 Trends in Demographic Development in Kenya

Population growth in Kenya continues to exert pressure on land and other resources. High fertility, combined with declining child mortality, gave Kenya one of the world's fastest population growth rates in the 1970s and 1980s (Ajayi and Kovole, 1998). The total population rose from about 10 million at independence to 15 million by 1978. This rapid growth, combined with an economic slowdown, prompted the government to promote family planning to lower fertility rates. Kenya was one of the first African countries to adopt a policy to slow population growth (Ajayi and Kovole, 1998).

Total fertility rate is the average number of children that would be born to a woman over her productive life. In Kenya total fertility rate has been fluctuating over the years. The total fertility rate was 8.1 children per woman between 1975 to 1978. Fertility rate decreased to 6.7 children for the period 1982 to 1988 and it declined further to 5.4 children between 1990 to 1992. Between the periods of 1995 to 1997 the fertility rate was 4.7 children per woman. There was an increase in fertility rate to 5 children per woman for the period between 1999 and 2000. Fertility rate decreased again to 4.6 children between 2006 and 2008 (NCPD *et al.*, 1999; Republic of Kenya, 2009). There was a disparity in fertility among rural and urban women which could be attributed to the significant role played by education in population growth. When literacy of women improves fertility rates also tend to decrease. Contraceptive use has increased from 39 percent of married women in 2003 to 46 percent in 2009 (Kenya National Bureau of Statistics, 2009).

1.4 Population Programs in Kenya

Since attaining political independence, the government has prioritized the improvement of the health status of Kenyans. The government recognizes that good health is a prerequisite to socio-economic development. A number of government policy documents and successive national development plans have stated that the provision of health services should meet the basic needs of the population, place health services within easy reach of Kenyans, and emphasize preventive, promotive, and rehabilitative services without ignoring curative services. Perhaps as a result of these policies, both infant mortality and life expectancy at birth, which are basic indicators of health status, have improved significantly (Ngigi and Macharia, 2006).

Kenya was the first Sub-Saharan African country to have a population policy by forming of the National Family Planning Programme to reduce population growth in 1967. However the implementation of the population policy did not yield the desired results and led to the revision of the 1967 policy to form the Sessional Paper No. 4, of 1984 on Population Policy (Muia *et.al* 2003). The 1984 policy incorporated demographic and socio-economic goals and diversified implementing ministries and nongovernmental and religious organizations. The demographic intentions in the Sessional paper were to reduce the population growth rate, reduction of fertility, Reduction of mortality particularly infant and child mortality and also the reduction of rural–urban and rural–rural migration.

In 2000, the government of Kenya launched the National Population Policy for Sustainable Development (National Council for Population and Development, 2000). This policy builds on the strength of Kenya's first national population policy outlined in Sessional Paper No. 4 of 1984 on Population Policy Guidelines. The policy outlined ways to implement the programme of action developed at the 1994 International Conference on Population and Development in Cairo, Egypt. The policy also addressed the issues of environment, gender, and poverty, as well as the problems facing certain segments of the Kenyan population, such as its youth. Among the salient features of these policy included improvement of the standard of living and quality of life, improvement of the health and welfare of the people through provision of information and education on how to prevent illness and premature deaths among risk groups, especially among mothers and children, sustenance of the ongoing demographic transition to further reduce fertility and mortality, especially infant and child mortality, continuing motivation and encouragement of Kenyans to adhere to responsible parenthood and sustainability of the population programme among others.

Under the long term development of vision 2030 the Kenyan government through the National Coordinating Agency for Population and Development, has initiated a review of the National Population Policy for Sustainable Development. This review is aimed at updating the said policy blueprint, whose implementation period ended in December 2010. The review aims at aligning the population policy, strategies and programmes with the Millennium Development Goals (MDGs), and Kenya Vision 2030. It also seeks to incorporate the newly emerging population issues within the development framework.

Owing to its high fertility and declining mortality, Kenya is characterized by a youthful population. Projections show about 43 percent of the population is younger than 15 years (Republic of Kenya, 2009). This implies that over three-fifths of Kenya's population, or about 25 million people in 2009, are less than 25 years old. Consequently, Kenya faces the formidable challenge of providing its youth with opportunities for a safe, healthy, and economically productive future. The 1994 International Conference on Population and Development (ICPD) endorsed the right of adolescents and young adults to obtain the highest levels of health care. In line with the ICPD recommendations, Kenya has put in place an Adolescent Reproductive Health and Development policy (ARH&D) (Odini, 2008).

1.5 Statement of the Problem

There is continued divergence of opinions regarding the consequences of population growth on economic growth. The debate between positive impact and negative impact of population growth on the economy is thus still ongoing. On the positive side, population growth induces technological advancements and innovations. This is because population growth encourages competition in business activities and, as the country's population grows, the size of its potential market expands as well. The expansion of the market, in its turn, encourages entrepreneurs to set up new businesses (Simon 1992).

A large population growth on the other side is not only associated with food problem but also imposes constraints on the development of savings, foreign exchange and human resources. The increase in demand for food leads to a decrease in natural resources, which are needed for a nation to survive. Other negative effects of population growth include poverty caused by low income per capita, famine, and disease since rapid population growth complicates the task of providing and maintaining the infrastructure, education and health care needed in

modern economies (Barro, 1991; Mankiw, Romer and Weil, 1992). The third school of thought is that population growth is a neutral factor in economic growth and is determined outside standard growth models (Felmingham 2004).

Cross national evidence on the relationship between population growth and economic growth is inconsistent because the underlying parameters and assumptions vary across countries. The existing literature also points out that depending on the country; population growth may contribute, deter or even have no impact on economic growth. This result is explained by the fact that the effects of population growth change over-time. For example, a higher fertility rate can have a short-term negative effect caused by the cost of expenditures on children whereas it has a long-run positive effect through the larger labour force it generates. Due to this divergent views among scholars on whether its population growth that drives economic growth or vice versa, the following research questions emerged:

- i. What is the causal relationship between population growth and economic growth in Kenya?
- ii. Is the relationship a short term or a long run phenomenon?
- iii. What is the response of population growth due to shocks in economic growth?
- iv. What is the response of economic growth due to shocks in Population growth?
- v. What are the sources of variations of economic growth?
- vi. What are the policy implications of the study findings?

1.6 Research Objectives

- i. To determine the causal relationship between population growth and economic growth in Kenya
- ii. To determine if the relationship between population growth and Economic growth in Kenya is a short-term or a long run phenomena.
- iii. To determine the response of population growth due to shocks on economic growth in Kenya.
- iv. To determine the response of the economic growth due to shocks in population growth.
- v. To examine the sources of variations of economic growth.
- vi. Draw policy implications from the study.

1.7 Significance of the Study

Population growth is a key factor to the growth and development of any country. And with continued divergence of opinions regarding the consequences of population growth on economic development, this study will thus serve as a necessary contribution to knowledge offering information regarding the same in Kenya. The study will also serve as a resource material to policy makers and scholars by providing the relevant information regarding the issue.

Secondly, it provides information on the impact of population growth and how these growths influence the economic development. The results of this study will be helpful to the policy makers by giving them useful information on various explanatory variables that may be targeted in the evaluation of policy changes and the provisions of new policies in order to enhance the desired level of economic growth. The study may help to provide useful information to the private and the public agencies in designing projects and programmes that can assist in bringing a balance between growth in population and growth in economic growth.

1.8 Scope and Limitations of the Study

This research deals with the population growth and economic development for the period 1963-2009. Given the big scope on the topic of population, the research is narrowed down only to the study of population growth. This has left out the other dimensions of population which include population density and size structure, and also population aging. Thus there is room for further research on the effect of these other dimensions of population on economic development.

CHAPTER TWO LITERATURE REVIEW

2.1 INTRODUCTION

The literature review focuses on both general and empirical studies carried out to examine the relationship between population growth and economic development.

2.2 General Literature

Malthus (1798) believed that the world's population tends to increase at a faster rate than its food supply. Whereas population grows at a geometric rate, the production capacity only grows arithmetically. Therefore in

the absence of consistent checks on population growth, Malthus made the prediction that in a short period of time, scarce resources will have to be shared among an increasing number of individuals. However, such checks that ease the pressure of population explosion do exist, and Malthus distinguished between two categories, the preventive check and the positive one. The preventive check consists of voluntary limitations of population growth. Individuals before getting married and building a family, make rational decisions based on the income they expect to earn and the quality of life they anticipate to maintain in the future for themselves and their families. The positive check to population is a direct consequence of the lack of a preventive check. When society does not limit population growth voluntarily, diseases, famines and wars reduce population size and establish the necessary balance with resources.

Boserup (1965) found out that population growth is an autonomous factor, which affects agricultural productivity rather than being affected by it, as suggested by the Malthusian school. The study claimed that Malthus' assumption of diminishing returns to labor needs not hold in the long run, as higher population may lead to a more efficient division of labor as well as to improved agricultural practices (signaled by the frequency of cropping). The study concluded that soil fertility should not be viewed as fixed and given by nature, but instead can be improved by substituting the agricultural technology to a better one, which is likely to be a result of an increase in population. Primitive communities with higher population growth rates are more likely to experience economic development, provided that the necessary investment in agriculture is undertaken.

Thirlwal (1973) investigated the relationship between population growth and economic development with special reference to developing economies. The study found out that the relationship between population growth and economic development is a complex one, particularly concerning what the cause is and what the effect is. Rapid population growth lowers per capita income growth in least developed countries (LDCs), yet there are many ways in which population growth may be a stimulus to progress, and there are many rational reasons why families in developing countries choose to have many children. The study concluded that complexity of the subject is compounded by the fact that, economic development is a multidimensional concept. The pace of economic development depends on the diversion of resources from consumption to uses that raise future output. A population with a high ratio of dependents on producers consumes more of a given output and devotes less to investments. Thus, high fertility, which produces a high level of dependency, promotes consumption at the expense of investment.

Simon (1977) investigated the long run benefits of population growth. Whereas population growth has a negative effect on living standards in the short run due to diminishing returns and the temporary burden it poses on society, it has positive effects on living standards in the long run due to knowledge advances and economies of scale. Employing a simulation model, the study found out that in the long run (after 30 to 100 years) and when compared to constant-size population, moderate population growth improves standards of livings both in more developed and in less developed countries. In the long run, a growing population tends to advance knowledge, which, in turn, increases productivity and output at a higher rate than that of population growth. Nevertheless, a country's optimal policy regarding population growth depends on the weight given to future periods relative to the present. The more weight a country gives to future generations and the more willing a country is for the short run decline in standards of livings, the better it is for that country to pursue a policy of moderate population growth. The long run benefits of population growth that links to economic development of poor countries are on the positive balance, contrary to conventional wisdom.

Porter (1996) employed a Solow-Swan economic growth model with exogenous saving rates to determine the relationship between population growth and economic growth. The model assumed that both the saving rate and the consumption rate are given. Taking a household owns the input and manages the technology. The production technology is assumed to take the form

$$Y = F(K, L), \quad (2.1)$$

Where Y is total output,
K is total physical capital,
And L is the size of the labour input

The production function exhibits positive and diminishing marginal products with respect to each input and also exhibits constant returns to scale. The economy is assumed to be a one-sector economy, where output can be either consumed or invested and capital depreciates at a constant positive rate (δ). The growth rate of population is exogenous. The model further assumes that this growth rate is a constant (n) and that labour supply per person is given. Normalizing the population size at time zero and the work intensity to one yield the following is the labour input

$$L = e^{nt}. \quad (2.2)$$

The net increase in per capita capital is:

$$\dot{k} = sf(k) - (n + \delta)k. \quad (2.3)$$

The first term on the right-hand side (RHS) is saving per capita out of output per capita and the second term is the effective depreciation per capita. Defining a steady state as a situation in which the quantities, such as capital, population, and output, grow at constant rates. In the Solow-Swan model a steady state exists if the net increase in per capita capital is equal to zero. Denoting steady state values with an asterisk the steady state values are given by:

$$sf(k^*) = (n + \delta)k^*, \quad y^* = f(k^*) \quad \text{and} \quad c^* = (1 - s)f(k^*).$$

Since the per capita values are constant in steady state the levels of total output, total consumption, and total capital must grow at the same rate, which is the same as that of population growth (n). An increase in the rate of population growth in steady state does not affect the growth rate of the per capita variables, since these rates are equal to zero in steady state. However, an increase in fertility does lead to a decrease in the level of capital per capita and therefore to a decrease in output and consumption per capita. This is the capital dilution effect. An increase in the population growth rate leads to a decline in the growth rate of the per capita variables. For model with exogenous saving rates higher population growth leads to lower standard of living per capita measured either as consumption or in growth of consumption.

Becker *et.al* (1999) developed altruistic models of intergenerational transfers where the behavior of individuals is guided by a utility function that is increasing in own consumption and the utility achieved by one's offspring. The utility of the offspring depends, in turn, on their own consumption and the utility of their offspring. Through this inter-linking chain the current generation consumes and transfers resources to its children influenced by its concern not only for its own children but for all future generations. An important implication of this model is that familial transfers will neutralize fiscal policy. When a government exercises expansionary fiscal policy it stimulates the economy by increasing current spending financed by issuing debt. From the perspective of intergenerational transfers, the policy is an effort to stimulate spending by transferring resources to current generations from future generations. According to this model however, the public policy is undone by altruistic households. They compensate future generations by increasing their saving and accumulating wealth, exactly offsetting the increase in public debt. This model implies that public intergenerational transfers and private intergenerational transfers are perfect substitutes. A change in public transfers is matched dollar for dollar by a compensating change in private transfers.

2.3 Specific Literature

Bloom and Freeman (1986) provided a comprehensive organizing framework for analyzing the impact of population growth on labor supply and employment. In particular, they identified two distinct mechanisms through which population growth affects labor supply and employment. One is the "accounting" aspect that refers to changes in the demographic structure and cohort size. The other is the "behavioral" aspect that refers to the decision to participate in the labor force, particularly for women. Fertility, mortality and migration will affect labor supply differently. Mortality and migration will have immediate effects while fertility will have delayed effects. They also pointed out that the structure of the labor market mediates the impact of population growth on employment. For instance, in a neoclassical labor market rapid population growth will instantaneously depress wages. In a dual labor market where one market (modern) is behaving like a new classical labor market and another (traditional) is characterized by surplus labor and low wage rates, rapid population growth will delay the tightening of and eventual dissolution of the low wage traditional labor market (or the elimination of the dualistic structure). In their review of labor markets in developing countries covering the period 1960-80, they concluded that despite population increasing rapidly, developing countries managed, on the whole, to improve their economic positions significantly.

According to Kelley (1988) a lower the pace of population growth will help to enhance economic growth at a higher rate. The study elaborated that economic growth would be higher in the situation of slower population growth even though the impact of population growth in many countries was insignificant. Population and per capita income are closely associated to depict the picture of economic growth. Lower the population growth and higher the per capita income show that nation achieve their growth targets. Countries with population growth under 1 percent, their per capita income could increase at the rate of 2.5 percent annually. Countries with population growth more than 2 percent had a little increase in per capita income of less than 2 percent.

Mankiw *et.al* (1992) used a Cobb-Douglas economy-wide production function to investigate the impact of population growth on 'steady state' income per capita as well as on economic growth in the transition to the steady state. They revealed out that an increase in the population growth rate of 10% (e.g. 3% to 3.3%) would reduce per capita income in the steady state by 5%. If, however, one considered human capital to be an additional factor of production (which is eminently reasonable), then the negative impact of population growth is larger as population growth now forces economies to use their scarce savings to equip young people with physical and human capital. As a result, a 1% increase in population growth would decrease per capita income by 2%.

Bloom and Williamson (1997) also found that demographic factors are important determinants of economic growth. Their results show that it is not overall population growth rate that drives economic performance but age distribution. The age distribution effect operates through the difference in growth rates of the working-age and the dependent population. The study found that population dynamics explain as much as 1.4 to 1.9 percentage points of the GDP per capita growth in East Asia or as much as one third of the average East Asian miracle GDP per capita growth rate (1.9/6.1). In Southeast Asia, the estimated effect ranges from 0.9 to 1.8 points of economic growth or about half (1.8/3.8) of the recorded growth in GDP per capita.

Bucci (2003) investigated whether there is a long-run relationship between population (size and growth) and per-capita income focusing on human and physical capital as reproducible inputs. The study found out that population growth exerts a negative effect on economic growth. However, when individuals choose endogenously how much to save, population growth can also have a neutral influence on economic growth. The study also extended its analysis to the case where physical and human capital can interact with each other in the production of new human capital. When the two types of capital are substitutes for each other in the education sector, the effect of population growth on per-capita income growth is always negative. Instead, if human and physical capital is complementary for each other, the impact of population change on real per-capita income growth becomes ambiguous. The intuition is the following. For given per-capita physical capital stock, an increase of population causes the aggregate physical capital to rise. If physical and human capital are substitutes for each other (in the sense that the larger amount of physical capital now available in the economy deters the demand and, thus, the consequent supply of human capital), the increase of population size, together with the reduction of the aggregate human capital stock, determines an unambiguous decline of the per-capita level of skills and, via this channel, a lower per-capita income growth rate. On the other hand, if physical and human capital are complementary for each other (the increase in the supply of physical capital spurs the demand and, therefore, the consequent production of new human capital), the final effect on the per-capita level of skills and, hence, on per-capita income growth of an increase in population may be either positive, or negative, or else equal to zero. Long-run per-capita income growth can be positive even without any population change; in equilibrium, both the growth rate and the level of per-capita income are independent of population size; the long-run level of per-capita income is proportional to per-capita human capital.

CHAPTER THREE THEORETICAL FRAMEWORK

3.1 Introduction

This chapter describes theoretical model, empirical model and the research design. The research design reveals the type of data and the method of data collection.

3.2 Theoretical Framework

The paper adopted the Solow swan model of growth. Solow's model takes the rate of saving, population growth and technical progress as exogenous. There are two inputs capital and labor which are paid their marginal products. Assuming a Cobb -Douglas production functions the production function at time t is given by:

$$Y(t) = K(t)^\alpha A(t)L(t)^{1-\alpha} \quad 0 < \alpha < 1 \quad (3.1)$$

Where: Y is output, K is capital, L is labor and A is the level of technology.

The initial levels of capital, labor and level of technology are taken as given. Labor and level of technology grow at constant rates:

$$\dot{L}(t) = nL(t) \quad (3.2)$$

$$\dot{A}(t) = gA(t) \quad (3.3)$$

Where n and g are exogenous parameters and where a dot over a variable denotes a derivative with respect to time.

Applying the result that a variables growth rate equals the rate of change of its log to equation (3.2) and (3.3) tells us that the rates of change of the logs of L and A are constant and that they equal n and g respectively. Thus,

$$\ln L(t) = \{\ln L(0)\} + nt \quad (3.4)$$

$$\ln A(t) = \{\ln A(0)\} + gt \quad (3.5)$$

Where $L(0)$ and $A(0)$ are the values of L and A at time 0. Exponentiating both sides of these equations gives us:

$$L(t) = L(0)e^{nt} \quad (3.6)$$

$$A(t) = A(0)e^{gt} \quad (3.7)$$

The number of effective units of labor, $A(t)L(t)$, grows at rate $n+g$.

The model assumes that a constant fraction of output s is invested. Defining k as the stock of capital per effective unit of labor, $k = K/AL$, and y as the level of output per effective unit of labor, $y = Y/AL$, the evolution of k is governed by

$$\dot{k}(t) = sy(t) - (n+g+\delta)k(t) = sk(t)^\alpha - (n+g+\delta)k(t) \quad (3.8)$$

Where δ is the rate of depreciation. Equation 3.8 implies that k converges to a steady state value \dot{k} defined by $s\dot{k}^\alpha = (n+g+\delta)\dot{k}$, or

$$\dot{k} = [s/(n+g+\delta)]^{1/(1-\alpha)} \quad (3.9)$$

The steady state capital labor ratio is related positively to the rate of saving and negatively to the rate of population growth. The central prediction of the Solow model concerns the impact of saving and population growth on real income. Substituting 3.9 into the production function (3.1) and taking logs we find the steady state income per capita is:

$$\ln \left[\frac{Y(t)}{L(t)} \right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha} \ln(s) - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \quad (3.10)$$

Because the model assumes that factors are paid their marginal products it predicts not only the signs but also the magnitudes of the coefficients on saving and population growth.

Relating theoretical model to the study, an extract from equation 3.10 can be expressed as:

$$\Delta \text{GDP}_t = f(\Delta \text{POP}_t) \quad (3.11)$$

Where:

GDP_t is the economic growth rate

POP_t is population change.

3.3 Empirical Model and Estimation Technique

3.3.1 Stationarity test

The study used time series data and therefore, there was need to determine whether the variables in question were stationary or non-stationary. Augmented Dickey Fuller (ADF) test was used to test for stationarity of the series. When time series data is non stationary and used for analysis it may give spurious results because estimates obtained from such data will possess non constant mean and variance.

3.3.2 Exogeneity

The other step was to test whether any of the variables in the model was weakly exogenous. A variable x_i is said to be weakly exogenous for estimating a set of parameters λ_1 if the joint probability density function $f(y_t; x_t; \lambda)$ can be partitioned as:

$$f(y_t, x_t; \lambda) = g(y_t | x_t; \lambda_1) h(x_t; \lambda_2) \quad (3.12)$$

So that inference on λ_1 can be conducted with no loss of information from the conditional density function $g(y_t, x_t; \lambda_1)$ (Engle *et.al*, 1983). Weak Exogeneity concerns the extent to which the parameters of the marginal distribution of the exogenous variable can be ignored when focusing on the conditional distribution of the endogenous variable given the exogenous variable. Should weak Exogeneity not hold, then estimation must account for both the marginal and conditional distributions. If all the variables happen to be weakly exogenous the use of a system of equations and VAR approach in the study would not be justified (Oduor, 2008). Weak Exogeneity tests were therefore necessary to detect specification errors in the model.

3.3.3 Vector Auto regression analysis (VAR)

The empirical approach on this paper was based on VAR approach. VAR is a method of time series analysis that does assume any structural relationship between the economic variables. The use of structural VAR was justified because of the possibility to simulate the response over time of any variable in a set to either an own disturbance or a disturbance to any other variable in a system of equations (Stock and Watson, 2001). A structural VAR was used to examine the relationship among a set of economic variables and analyze the dynamic impact of random disturbances on the system of variables in this study.

VAR econometrics analysis entails estimating regression equations in which the current value of each variable is expressed as a function of lagged values of itself and of each of the selected variables. No variable is assumed to be exogenous a priori and no variable is excluded from the autoregressive equation for any of the variables in the system. The paper employed a system of reduced form structural VAR to test for the impact of population growth on economic growth. The standard estimatable VAR (1) model with the variables in the relationship (3.11) was specified as:

$$GDP_t = b_{10} - b_{12}POP_t + c_{11}GDP_{t-1} + c_{12}POP_{t-1} + \varepsilon_{yt} \quad (3.13a)$$

$$POP_t = b_{20} - b_{21}GDP_t + c_{21}GDP_{t-1} + c_{22}POP_{t-1} + \varepsilon_{zt} \quad (3.13b)$$

In this type of VAR model each variable was regressed on a constant variable C_{ij} , p lags of itself, p lags of each of the other variable and the disturbance term e_t . The choice of the lag length (p) was determined using the Akaike (AIC) and the Schwarz Information Criterion (SIC).

3.3.4 Causality Test

Granger causality was used to determine whether one time series is useful in forecasting another (Enders, 1995). Granger causality tested the direction of causation between population and economic growth. The causality might be bi-directional and thus there was a need to establish which direction of causality was dominant. In this case failure to account for the reverse causation or feedback between variables is likely to either overstate or understate the contribution of a particular variable. The VAR equations were used to perform Granger causality tests. The F-statistic tested the null hypothesis that the coefficients on lagged values of a variable are zero in the equation of the other variable against the alternative hypothesis that the coefficient on lagged values of a variable are not zero in the equation of the other variable. The null hypothesis is rejected when F-statistic is greater than the P-value.

3.3.5 Impulse Response Analysis

The coefficients estimates were used in the derivation of impulse responses and forecast error decomposition. Impulse response analysis links the current value of the error term to the future values of Y_t or equivalently, the current and past values of the error term to the current values of Y_t . An impulse response enables one trace the effect of one time shock to one of the innovations on the current and future values of the endogenous variable. The impulse responses are obtained from a vector auto regression moving average (VARMA). Given a general representation of a VARMA as:

$$\Delta x_t = \sum_{j=0}^{\infty} \Phi_j \varepsilon_{t-1} \quad i=0, 1, 2, \dots, n \quad (3.14)$$

Where Φ_i is the impact multipliers denoting the response of each variable to innovations in each of the corresponding error terms on impact.

ε_{t-1} are innovations

n is number of variables in the system.

$\Phi_i(0)$ $\Phi_i(1)$ $\Phi_i(n)$ are the impulse responses which will be plotted to trace the time path of the system variables as they respond to various shocks overtime.

3.3.6 Variance Decomposition

Variance decomposition separates the variations in an endogenous variable into the component shocks to the VAR. This variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

It tells how much of a change in a variable is due to its own shock and how much due to shocks to other variables. In the short run most of the variation is due to own shock. But as the lagged variables' effect starts kicking in, the percentage of the effect of other shocks increases over time.

3.4 Definition and measurement of variables

Gross domestic product growth rate (GDP): Represents the rate at which Kenya's GDP increases. This is the difference between current GDP and previous years GDP and is measured as a percentage.

Population increase (POP): Refers to the change in population over a unit time period or the Increase in the number of people over a given period of time.

3.5 Data Type and Source

This study made use of published data for the period ranging from 1963 to 2009. The main sources of these data were: Kenya National Bureau of Statistics publications, Government of Kenya Statistical Abstracts and Economic Surveys.

CHAPTER FOUR ANALYSIS AND ESTIMATION RESULTS

4.1 Introduction

This chapter presents the findings of the study.

4.2 Unit root tests

When time series data is non stationary and used for analysis it may give spurious results because estimates obtained from such data will possess non constant mean and variance. Because this study used time series data, it was therefore important to establish the stationarity of the data or what order they are integrated to make sure that the results obtained are not spurious. In this regard Augmented Dickey Fuller (ADF) was used to test for unit roots. The Augmented Dickey-Fuller (ADF) tests the hypothesis that $|\rho|=0$ against that $|\rho|<0$ in the autoregressive equations:

(i) ADF with intercept and a trend

$$\Delta y_t = \alpha + \rho y_{t-1} + \sum_{i=0}^k \delta_i \Delta y_{t-1} + \mu_t \quad (4.1)$$

(ii) ADF With both intercept and trend

$$\Delta y_t = \alpha + \beta_t + \rho y_{t-1} + \sum_{i=0}^k \delta_i \Delta y_{t-1} + \mu_t \quad (4.2)$$

The unit roots results of the variable in the model are reported in table 4.1. Since the calculated Augmented Dickey Fuller test statistic value is greater than the critical value at 95 percent confidence level implies that both economic growth rate and population growth rate are all stationary at levels.

Table 4.1: ADF Unit root tests

Variable			t-Statistic	Critical Values
Gdp growth Rate	Levels	Intercept	-3.373741	5% = -2.9271
		Intercept and Trend	-4.216166	5% = -3.5112
Population Growth Rate	Levels	Intercept	-3.157079	5% = -2.9271
		Intercept and Trend	-4.632663	5% = -3.5112

4.3 Granger Causality Test

The first objective of the study was to investigate the causal relationship between population rate and economic growth rate in Kenya and granger causality test was carried out to find the causation between the two variables. The results are reported on table 4.2. The Granger causality test results revealed a bi-directional causality between population growth and economic growth in Kenya.

Causality runs in both directions i.e. from population growth to economic growth and from economic growth to population growth. The two-way causality or a bi-directional causality from population growth to economic growth, and vice versa, could be interpreted as a mutually reinforcing bilateral causality between population growth and economic growth.

Table 4.2: Granger causality tests results

Null Hypothesis	F-Statistic	Lags	Probability	Conclusion
GDP Growth does not Granger Cause Population Growth	2.94545*	4	0.03418	Bi-directional Causality
Population growth does not Granger Cause GDP Growth	3.00778*	4	0.03156	
*Denotes rejection of the null hypothesis at 5% significance level				

4.4: Relationship between population growth and economic growth

The second objective of the study was to examine whether the relationship between population growth and economic growth was a short run or a long run phenomenon. The unit root tests (stationarity test) revealed that both population growth and economic growth are stationary at levels implying that there exists a long run relationship between the two variables. To further establish whether there exists a short run relationship between population growth and economic growth, regression analysis was carried out.

Table 4.3: Regression Estimation results (a)

Variable	Coefficient	Std Error	t-Statistic	Prob
Dependent Variable	GDPGROWTH			
POPGROWTH	1.146899	0.799801	1.433982	0.1585
C	0.604101	2.707912	0.223087	0.8245
R-squared	0.043699			
Adjusted R-squared	0.022448			
S.E. of regression	2.806949			
Sum squared resid	354.5534			
Log likelihood	-114.1768			
F-statistic	2.056303			
Prob(F-statistic)	0.158490			

Table 4.4: Regression Estimation results (b)

Variable	Coefficient	Std Error	t-Statistic	Prob
Dependent Variable	LNGDPGROWTH			
LNPOPGROWTH	1.355517	0.736138	1.841390	0.0723
C	-0.361092	0.889267	-0.406056	0.6867
R-squared	0.150196			
Adjusted R-squared	0.108742			
S.E. of regression	0.823773			
Sum squared resid	29.85851			
Log likelihood	-55.33123			
F-statistic	3.390717			
Prob(F-statistic)	0.072312			

The coefficients of the model in table 4.3 represent the long run marginal effects of the model since the regression was done at levels. The results in table 4.4 however represent the short run dynamics of the model. The theoretical expectations are that economic growth is determined by other factors besides population growth which are not included in the model and interpreting the coefficients of the independent variables in the model will however be misleading. Basing our analysis on the goodness of fit (adjusted r- squared) from the two models, the results indicate that goodness of fit improves with the short run dynamics as shown in both tables 4.3 and 4.4 respectively as compared to the long run effects of the independent variable. This indicates the existence of a short run relationship between economic growth and population growth.

4.5 Lag Selection

The study uses the lag selection criteria namely the Alkaike Information Criteria (AIC). The results of these selection criteria are reported in table 4.4. The decision rule is to choose the model with the lowest value of the information criteria. This ensures that the error term is not misspecified (Enders 1995).

Table 4.4: Results of the Var Lag Selection

Lag length	Alkaike Information Criteria
4	5.616051
3	6.086147
2	6.134634
1	5.988697

The results of the Alkaike Information Criteria lag selection in table 4.3 points to the use of 1 lag as the most appropriate lag length that would minimize the value of the selection criteria. Based on the results in table 4.3 the study employed the use of one lag.

4.6 Exogeneity test

Exogeneity test were conducted to pick out the variable that were weakly exogenous and could not contribute to the feedback mechanism. The null hypothesis for this test was that a variable is weakly exogenous against the alternative that the variable is endogenous. A p-value of less than 0.05 led to the rejection of the null hypothesis (exogeneity), in favor of the alternative (endogeneity) at 5 percent level of significance. The results of Exogeneity tests are shown in tables 4.5 and table 4.6 respectively.

From the results economic growth had a p-value of 0.019210 at one cointegrating equation implying that the null hypothesis was rejected in favor of the alternative. Economic growth was thus endogenous in the model.

Population growth rate had a p-value of 0.005119 less than 0.05 implying that the null hypothesis was rejected in favor of the alternative. Population growth was thus endogenous in the model.

Table 4.5: Exogeneity test for Economic Growth

Restrictions:				
B(1,1)=1,B(1,2)=0				
Tests of cointegration restrictions				
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability
1	-125.0539	7.836792	1	0.005119

Table 4.6 : Exogeneity test for Population growth

Restrictions:				
B(1,1)=1,B(1,2)=0				
Tests of cointegration restrictions				
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability
1	-124.4956	6.720224	1	0.009533

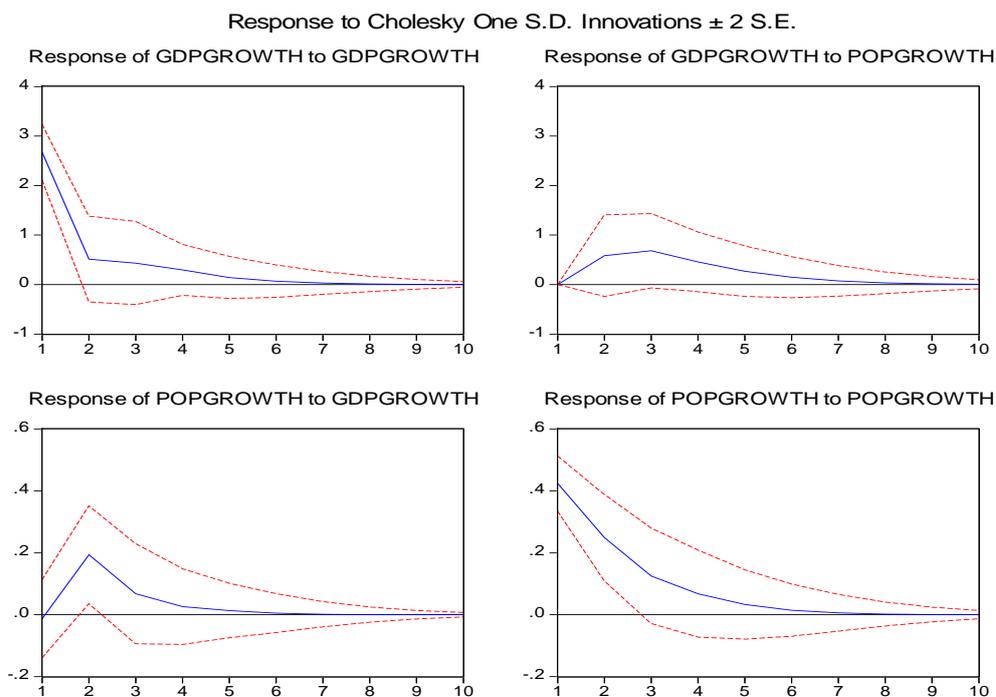
4.7 Impulse Responses Analysis Results

Impulse response analysis helped to trace the impact of a one standard deviation shock to the innovations on current and future values of all the endogenous variables of the system. Plotting the impulse response functions was a better way of tracing the time path of the system variables as they responded to various shocks over time.

The third and fourth objectives of the study were to determine the response of population growth due to shocks in economic growth and to determine the response of economic growth due to shocks in population growth respectively. This was achieved by the use of impulse response. The results are shown in figure 4.1.

The VAR results presented in table A4 in appendix C were not interpreted like ordinary regression equations because they were not derived from structural equations (Enders 1995). They were used for the generation of both the impulse functions and for conducting the variance decomposition analysis, which depicted the effects of population growth on economic growth.

Figure 4.1 Impulse response graphs



An impulse response function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. A shock to the i^{th} variable directly affects the i^{th} variable, and is also transmitted to all of the endogenous variables through the dynamic structure of the VAR (Enders 1995). The plots and impulse responses that follow summarize the results of the shock evaluation indicating the responses of each variable over the 10 years horizon to one standard deviation positive shock to each variable.

(a) The impact of population growth on economic growth.

The impact of one standard deviation shock to population growth on economic growth is shown in figure 4.1. The response to one standard deviation to population growth resulted in a stable time path which declined to zero with respect to economic growth as shown in figure 4.1. This effect lasted for nine years on the positive territory before fizzling out.

This phenomenon could be attributed to increased expenditure on health care by the government in improvement of child survival through various government programmes. For example, the substantial increases in childhood immunization and vaccination coverage levels at the national level and which has mostly contributed to the overall drop in childhood mortality in Kenya. Another important initiative is the improvement in key malaria indicators such as ownership and use of treated mosquito nets being provided for by the government for preventive treatment of malaria during and after pregnancy, and treatment of childhood fever.

The phenomenon could be further contributed by the increased expenditure by the government on education within the country and also the expansion of educational facilities mostly from private entrepreneurs. A comparison from various economic surveys reveals that the education sector has been getting the highest

allocation of the national income from the government. Due to the increase in population the demand of education services is high leading to the government high allocation to the sector and the subsequent expansion of the sector.

The evidence on the relationship between population growth and economic growth confirms that the relationship between population growth and economic growth vary among countries. Furuoka (2005) found a long-run equilibrium relationship between the population growth and per capita Gross Domestic Product (GDP) growth in Malaysia. Klasen and Lawson (2007) examined the relationship between population growth and economic development in Uganda. The empirical findings indicated a negative impact of population growth on economic development. Dawson and Tiffin (1998) used time-series data to analyze a long-run relationship between population growth and economic development in India. No long-run equilibrium relationship between the population growth and economic development in India could be established. Thornton (2001) conducted a similar research on the long-run relationship between population growth and economic development in seven Latin American countries, such as Argentina, Peru, Brazil, Chile, Colombia, Venezuela and Mexico. The findings were that a long-run relation between population and real per capita GDP does not appear to exist hence.

(a) The impact economic growth on population growth

The response to one standard deviation innovation to economic growth resulted in a stable time path which declines to zero with respect to economic growth as shown in figure 4.1. The effect of a one standard deviation shock on economic growth on population growth lasted for nine years on the positive territory. This result is in support of Becker (1981) who found out that when a country is in a demographic transition, population growth increases with an increase in economic growth in the short run.

An increase in economic growth of the country leads to growth in population up to the third year and then starts to decline and the impact fizzles out after nine years towards its original path. Considering the causality from economic growth to population growth first, it is likely that in the short term, high economic growth in a developing country will increase population growth, mainly through reducing mortality rates. This is the typical process of a country beginning a demographic transition which initially increases population growth rates. In the long term, however, it is very likely that economic growth will reduce population growth as wealthier parents choose smaller families which will over time reduce population growth as in the case of rich countries. The situation could be further explained by the decline in child mortality enhanced by the government expenditure on child health care.

4.8 Variance Decomposition Analysis

Variance decomposition provides a different method of depicting the system dynamics. Impulse response functions trace the effects of a shock to an endogenous variable on the variables in the VAR. By contrast, variance decomposition decomposes variation in an endogenous variable into the component shocks to the endogenous variables in the VAR. The variance decomposition gives information about the relative importance of each random innovation to the variables in the VAR.

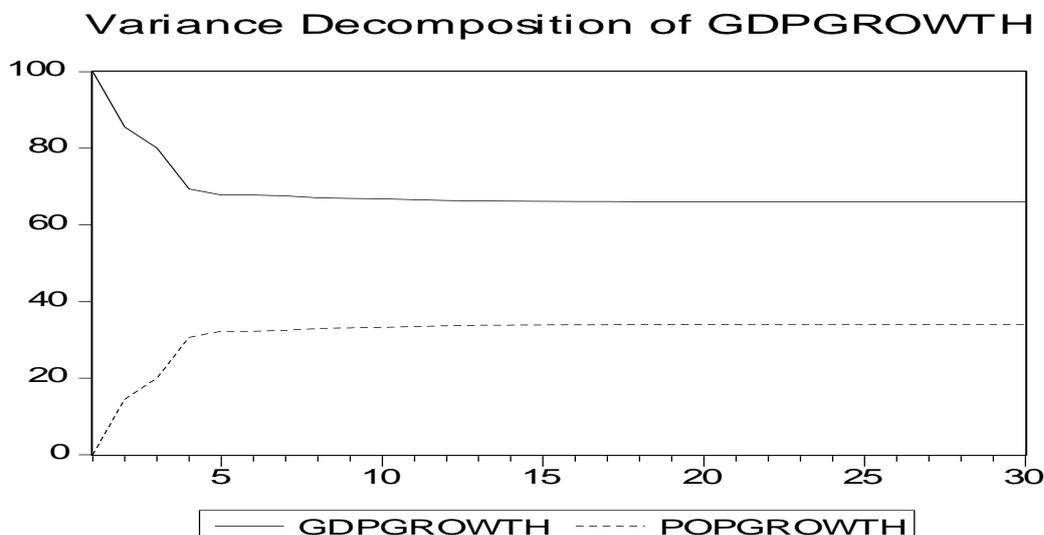


Figure 4.2 Variance decomposition of GDP growth

The variations in economic growth rate brought about by changes in population growth were analyzed. This was an alternative method to impulse response functions for examining the effects of shocks to economic growth rate.

The results of Variance Decomposition analysis of economic growth rate show that all the variations in economic growth rate were due to its own shocks at 100 percent in the first year. This implies that population growth did not contribute at all to the variations in economic growth in the first year. The variations of own shocks in economic growth reduced to 85.53 percent in the second year. In the third year the variations reduced to 80.91 percent and continued to reduce as the forecasting horizon increased. The forecast error decomposition technique continues to reveal that after the eighth year, the variations in economic growth are entirely dependent on its composition but not population growth.

A further observation of the variance decomposition results revealed that the effect of population growth in the system increased with the forecast period. This implies that economic growth had feedback effects with population growth and the effects were multidirectional.

CHAPTER FIVE SUMMARY CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study and makes conclusion based on the results. The policy implications from the findings are also presented.

5.2 Summary

The relationship between population growth and economic growth has therefore been fundamental to the policy makers in different countries. However, there has been no consensus whether population growth is beneficial or detrimental to the economic growth in the developing countries. Given this scenario, there was thus a need to establish the relationship between population growth and economic growth in Kenya. The study conducted a granger causality test and the results indicated that there was bi-directional causality between population growth and economic growth in the country. The study further indicated that the relationship between population growth and economic growth was a long-run relationship. Through the use of Vector Auto regression Approach (VAR) the results indicated population growth and economic growth are both positively correlated and an increase in population will impact positively to the economic growth in the country both in the short run and also in the long run.

5.3 Conclusion

The finding of the study support the existence of a long-run relationship between population and economic growth in Kenya and provide strong support for the hypothesis that population is driving economic growth in the country. The results of causality tests suggest that there appears to be bi-directional causality when causality is assumed to run from population to economic growth or from economic growth to population growth. Overall, the relationship between population and economic growth is strong and positive in Kenya over the period of the analysis. This suggests that Kenya seem to be in the second stage of the demographic transition, called post-Malthusian regime, in which the relationship between economic growth and population growth remains highly strong and positive. These findings give support to the population-driven economic growth hypothesis that states that the population growth in a country's promotes its economic growth development.

5.4 Policy Recommendations

With the results indicating a positive correlation between population and economic growth in Kenya, then a carefully planned population growth strategy coupled with institutional and policy changes could be beneficial to this country. A well managed population expansion will ensure that both the population and the economy are complementing each other without concerns that population expansion will lead countries to famines and lack of other socio economic facilities since its the inadequate government policies, rather than population growth which are responsible for the woes including, famines that besiege most developing nations.

The government should also put measures to ensure that the economy grows at a higher rate than the population growth. This will ensure that the increasing demand of services arising from the population growth is met. Having a larger, healthier, and better-educated workforce will only bear economic fruit if the extra workers can find jobs. Open economies, flexible labor forces, and modern institutions that can gain the confidence of the population and markets alike may help countries reap the potential benefit created by their demographic

transition. Openness to trade can be a key driver of economic growth, helping to significantly boost the benefits a country receives from the demographic transition.

Population growth can influence economic growth through two essential channels including technical progress and economies of scale. An increase in population leads to innovations. Technological advances in turn promote productivity and economies of scale, hence the national output. There is need for the government to change the education system to ensure that new training methods, which develop existing skills and create skills where they do not exist are implemented. There is also a need to put in place training policies that will strengthen the competitive capacities of the work force and increase the competitiveness. Education is the principal supplier of highly skilled and effective human resources. The most important thing is to take action to amend and reform mostly the higher education and makes it a useful tool in the service of the development process, and to link it to the global market so as to meet the demands of the labor market and create new job opportunities for the population.

The purpose of sustainable development is to create and improve an environment in which all people can expand their capabilities and requires good governance. That concept is distinguished by its transparency and accountability as well as its effectiveness and justice. The provision of employment opportunities is the peak of any economic and social reform plan that aims to improve quality of life by achieving sustainable human development. In that respect, the role of good governance in providing job opportunities need not to be emphasized. A better political environment would also encourage private investment since its contribution to economic growth cannot be under estimated.

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