RELATIONSHIP BETWEEN ECONOMIC GROWTH AND FERTILITY RATE IN KENYA BETWEEN THE PERIOD 1977 - 2019

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DECLARATION

STUDENT'S DECLARATION.

This project is authentic and has not been submitted to any other university for an award.

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The project is presented for consideration under my approval as a university invigilator

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DEDICATION

I dedicate this project to my family for social and financial support during my academic journey.

ACKNOWLEDGEMENT

I am thankful to God for the endowment of life and great well-being during the research undertaking. Through Him, all are conceivable.

I wish to recognize my family's considerable support, who persevered through numerous days of my nonappearance attempting to complete my research. I also acknowledge the support of my parents, siblings, and colleagues. I am grateful for your support. I also recognize the unending and constructive support of Dr. Julius Korir, who helped me acquire more knowledge. I am also obliged to him for his direction, support, and opportune remarks to this paper. To the Kenyatta University team, your uplifting statements and suggestions were highly pivotal.

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ACRONYMS AND ABBREVIATIONS

ADF: Augmented Dickey-Fuller

ANOVA: Analysis of Variance

ARDL: Autoregressive Distributed Lag Bounds

ASFR: Age-Specific Fertility Rates

DTT: Demographic Transition Theory

GCT: Granger Causality Test

GDP: Gross domestic product

GRR: Gross Reproduction Rate

HDI: Human Development Index

JCT: Joahnsen Cointegration Test.

KPSS: Kwiatkowski Phillips Schmidt-Shin

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LEB: Life Expectancy at Birth

NCPD: National Council for Population and Development

NRR: Net Reproduction Rate.

OECD: Organization of Economic Cooperation and Development.

PIC: Posterior Information Criterion.

rGDP: Real Gross domestic product.

TFR: Total Fertility Rate.

VECM: Vector Error Correction Model.

WDI: World Development Index.

OPERATIONAL DEFINITION OF TERMS

Economic growth: connote change in the real gross domestic product over time. It is measured using GDP per capita

Labour productivity: refers to real economic output GDP per labour.

Life expectancy: describes the life span of a person from birth to death with consideration of other demographic elements.

Total Fertility rate: refers to the average lifetime births for each woman as suggested by specified fertility rates. Average children within the fertility age group of women

ABSTRACT

In Kenya, the total fertility rate is constantly changing, which affects per capita income. And the results on the impact of fertility on economic growth are even more different. The debate about the positive and negative impacts of high fertility on economic growth remains controversial. Rising fertility leads to population growth, putting pressure on domestic savings and the growth of public institutions. At the same time, due to the high birth rate, the larger the population, the greater the market for goods and services. The general purpose was to investigate the relationship between fertility and economic growth. The specific goals are: To study how fertility affects Kenya's economic growth, determine how economic growth affects Kenya's fertility, and investigate the causal relationship between fertility and Kenya's economic growth. Longitudinal study designs were selected during the period 1977-2019. This study was based on two theoretical models; Neoclassical theoretical model and Malthus's theoretical model. Data from secondary sources such as World Development Indicators and KNBS Economic Surveys were used in the survey. The findings show that capital stock growth had a positive impact on economic growth, and the total fertility rate had a negative impact on economic growth. Employment growth did not affect economic growth. The overall fertility rate was unaffected by economic growth. The study concludes that capital and fertility are important predictors of economic growth, and that economic growth is an important factor influencing changes in the total fertility rate. The implications of this study are that governments need to further emphasize population control through measures such as expanding the provision of family planning services. In addition, incentives such as investment subsidies need to promote capital growth in the economy.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Total fertility rate (TFR) defines the number of children a female may have after total reproductive age. TFR is an important component of economic growth (Coale & Hoover, 2015). Higher fertility rates have been observed in most developing countries, but lower fertility rates have been observed in most developed societies (Hartmann, 2010).

At the national level, we can see that most countries have population control policies. For example, China has a one-child policy. This is a carefully drawn system of economic incentives. It rewards families with one child and imposes penalties and negative incentives on larger families (Weeks, 2008). In addition, while most developing countries recognize that fertility rates are too high, some developed countries are concerned about low fertility rates (Hartmann, 2010). Very low fertility rates are fueling the aging trend of the population. As the fertility rate declines, the age distribution changes and the demographic dividend occurs (Ross, 2004). The demographic dividend is important for all countries, especially developing countries in Asia, as the birth and mortality rates drop sharply at the same time. The demographic dividend is one of the reasons for studying birth dynamics.

The world's population was 1 billion in the 18th century, but increased to 2.5 billion in the 1950s. The world population in 2013 was 7.2 billion, which is expected to increase to 9.3 billion by 2060, which is expected to increase significantly in developing countries (Mahmud, 2015). The global TFR is estimated to drop from 5 offspring per female in the 1950s to 2.6 in 2012 to 2.1 by 2060 (UN, 2013). There are 33 countries with the highest fertility rates, 29 of which are in sub-Saharan Africa.

From 1950 to 1998, the world's population increased from 2.525 billion to 5,908 million, of which 63.1% were Asian and 15.7% were African (Wang,). Zhai, Yang, Chen, 2007). Rapid and unsustainable population growth in developing countries has attracted the attention of local governments and countries around the world (Wang et al., 2007).

The uncontrolled childbirth causes health problems for children and their mothers, hinders investment in human capital and slows economic growth. Some studies have shown that fertility has a positive impact on economic growth (Bloom & Canning, 2008; Barro, 1991).

Throughout the 20th century, it was often observed that places with high economic growth rates represented countries with low fertility rates compared to areas with high fertility rates and low economic benefits (Auzina Emsina, 2014). New empirical results shows that the relationship between economic growth and fertility can change from negative to positive in high income countries. Gallor (2012) found that at high socioeconomic growth rates, for example, the relationship between economic growth and female fertility changes from negative to positive, as predicted by the Human Development Index (HDI). .. Luci Greulichand Thévenon (2014) established a negative correlation between average income and fertility when investigating the income situation of economic growth in OECD countries.

On the other hand, a rising population may be beneficial to a country. According to the neoclassical theory, a high population means that a nation can generate and expend more goods and services, resulting in the growth of the economy. However, this can only happen if jobs rise at least as quickly as the labour force, with the population accessing relevant educational services and training. Moreover, the neo-classical growth approach argues that

growth in population is useful to the economy since the rise in population stimulates technological growth. Growing population stimulates technological growth so as to meet the growing demand for goods and services (Baliamoune- Lutz, 2017; Hartmann, 2010; Mason, Lee & Lee, 2010; Ryabov, 2015).

1.1.1 Kenya Policies on Population and their Relation to Economic Growth

The Government of Kenya has developed several policies and programmes on population. The country established the National Family Planning Programme in 1967 to manage population growth through the provision of family planning services. This was followed by the establishment of the National Council for Population and Development (NCPD) in 1982 as a government entity advising the government on population. The Sessional Paper No. 4 of 1984 was developed. One of the aims of this session paper was to reduce the rate of population growth as a means of promoting social-economic growth. In the same spirit, the Sessional Paper No. 1 of 2000 on National Policy for sustainable development was aimed at controlling population as one of the ways of promoting a sustained rate of economic growth (Republic of Kenya 1984, 2012).

Kenya's Vision 2030 also recognizes that rapid population growth could be an impediment in making Kenya a middle-sized income country characterized by good quality of life. The Population Policy for National Development Sessional Paper No. 3 of 2012 identified fast-growing population might pose a serious setback to the quick realization of the visions enshrined in Kenya's Vision 2030. Thus, the sessional paper outlines policies for managing the population in making sure that the population correlates with public services and is adequate enough to enhance the quality of life by 2030. One of the expected outcomes of the

implementation of the policies is the reduction in fertility and mortality rates (Republic of Kenya 2007, 2012).

1.1.2 Trends in Fertility and Economic Growth in Kenya

Population growth in Kenya keeps on exerting pressure on public resources. High fertility, coupled with reducing child mortality rate and improved maternal care, leads to a rising population cited in Figure 1.1. The figure shows the total fertility and economic growth rate in Kenya from 1977-2018.

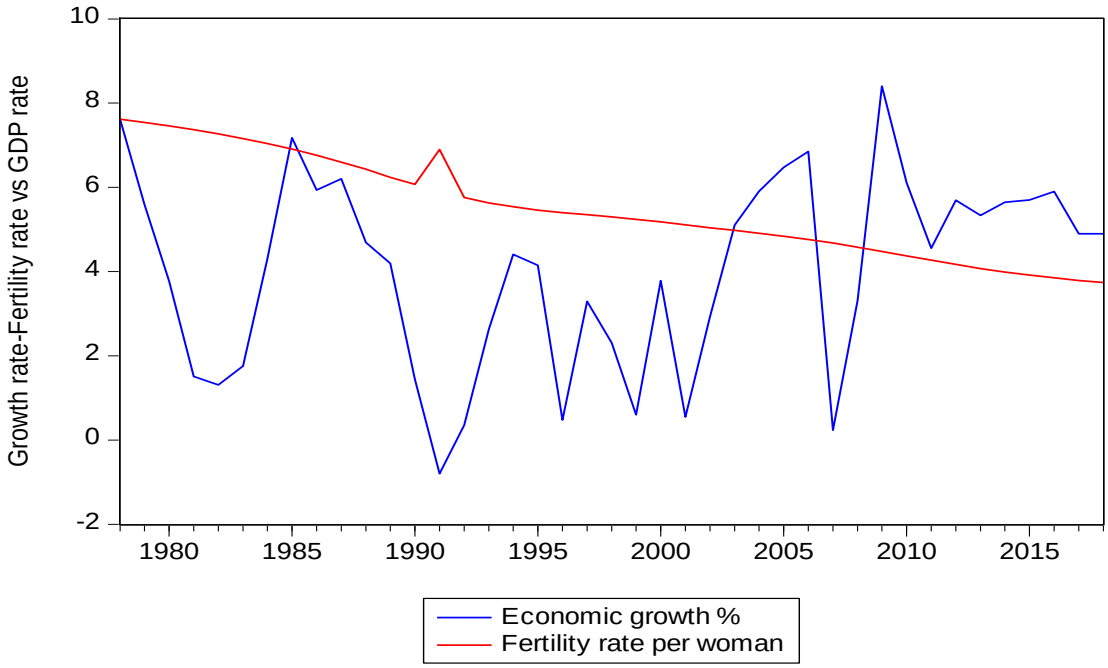

Figure 1.1: Graph of fertility and economic growth indicators

Figure 1.1 shows that in the years 1975-2018, TFR in Kenya was 7.62 children per woman. The fertility rate reduced to 6.7 between 1982 and 1988 and later dropped further to 5.4 between 1990 and 1992. In the years between 1995 and 1997, the fertility rate was 4.7. Overall, the TFR had been declining over the years, and currently, it is estimated at 3.9 (the Republic of Kenya, 2015). Most of this fertility decline can be attributed to increased contraceptive use.

Figure 1.1 further indicates that Kenya's GDP growth was high between the years 1963 and 1973. This was attributed to intense public investment, growth in agriculture, and private investments. There was a conspicuous drop in Kenya's economic performance from 1974 to 2004 when GDP grew below 10 percent. The worst years being between 1974 and 2000. The poor economic performance in these years could be attributed to both internal and external factors. For instance, in the 1974-1990 period, Kenya was pursuing import substitution (IS) policy, and the time was also concurrent with high oil prices that rendered Kenya's manufacturing industry uncompetitive.

Moreover, in the early 1990s, the government failed to implement correct macroeconomic policies; the structural reforms that had begun in the 1980s had slacked off, coupled with problems related to bad governance. In 1991, bilateral and multilateral agencies suspended aid to Kenya. In the years 1994-1996, there was a slight improvement in economic growth since in 1993, Kenya began implementing major economic reforms (sources of all these reasons).

Figure 1.1 shows that while the TFR has had a declining trend, there have been fluctuations in the GDP growth rate, suggesting no apparent relationship between the two variables. However, an in-depth analysis would provide a clear picture of the relationship.

1.2 Statement of the Problem

The relationship existing between economic growth and fertility rate remains contentious. Some studies have found that economic growth and fertility are negatively related. For instance, reduced fertility may result in increased savings causing greater investments in physical resources leading to economic growth. At the same time, other studies suggest a reversal relationship existing where expansion in economic growth leads to a decline in the fertility rate. As a result, it may also happen that changes in fertility growth and economic growth may result in a causal relationship between elements.

The above notwithstanding new empirical results for high-income nations, the nexus existing between fertility rate and growth of the economy may turn from being negative to positive. Furthermore, a two-direction linkage exists between fertility and growth of the economy in some societies (Ashraf *et al.*, 2013; Auzina-Emsina, 2014; Baliamoune-Lutz, 2017; Bongaarts and Sobotka, 2012; Fox, Hartmann, 2010; Jemna, 2015; Karra, Canning and Wilde, 2017; Klüsener and Myrskylä, 2015; Lacalle-Calderon *et al.*, 2017; Li, 2016; Ryabov, 2015).

In Kenya, policies on population have been aimed at reducing the rate of fertility and hence population growth. The promotion of reduction in TFR had hinged on the assumption that this reduction would improve economic development.

1.3 Research Questions

Specifically, the study sought to answer the following questions:

i. How does the fertility rate affect economic growth in Kenya?
ii. What is the effect of the economic growth rate on the fertility rate in Kenya?

iii. What is the causality relationship between economic growth and fertility rate in Kenya?

1.4 Objectives of the Study

To determine the relationship between economic growth and fertility rate in Kenya for the period between 1977-2019.

The specific objectives include to:

a) Determine the effect of the fertility rate on economic growth in Kenya.
b) Establish the effect of economic growth on the fertility rate in Kenya.
c) Establish the causality relationship between economic growth and fertility rate in Kenya

1.5 Significance

The results of this research may be important to the government agencies in planning for her people. The investigation findings may be significant to the policy-makers in providing institutions with essential findings concerning the existing linkage between the rate of fertility and economic growth and suggest policy interventions to avert the situation.

1.6 Scope and Limitation of the Study

The research investigated the linkage existing between economic growth and fertility rate in Kenya. This study focused on the relationship between the growth rate of the economy and the fertility rate for the period 1977-2019. Therefore the study employed the data running

from the year 1977 to 2019. The period was chosen since data on the total fertility rate was readily available within the time scope.

1.7 Organization of the study

This project comprises five chapters. Chapter one outlines the background, statement of the problem, objectives of the study, significance, scope, and study organization. Chapter two includes; theoretical framework and empirical review. The design, empirical model, theoretical structure, data types and sources, diagnostic tests, and analysis methods are outlined in chapter three. Chapter four presents the results and discussion of results, while chapter five summarises the study, outline the policy implications and areas for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter outlines the theoretical underpinning and empirical studies that support the study. The theoretical literature outlines the theories that guided the research. The chapter also include the empirical studies of other scholarly work conducted in the same field and finally, empirical studies are evaluated and critiqued to identify the research gaps.

2.2 Theoretical Literature

2.2.1 Demographic Transition Theory

The Demographic Transition Theory (DTT) was hypothesized by Thompson (1929). The DTT describes the transition from high fertility and mortality to declining fertility and mortality over the course of national industrialization. Thompson (1929) observed changes in fertility and mortality in developed countries. Economically highly developed countries experience demographic changes and are characterized by low fertility rates, but most developing countries experience this demographic change (Galor, 2012).

The DTT theory predicts that birth rates will reduce as nations grow economically wealthy; however, some demographic information conflicts and shows that after a particular level of economic growth, birth rates rise once more (David & Baudelle, 2006). According to Weeks (2007), there exists a well-established linkage in reducing fertility to social and economic growth. It is highly discussed if rapid economic changes and growth of incomes result in a smaller population or if smaller populations result in rapid economic transformation and

growth of incomes (Caldwell, 2007). In the Demographic Transition Theory, there are four to five stages of population growth which is dependent on the fertility rate at each of the stages.

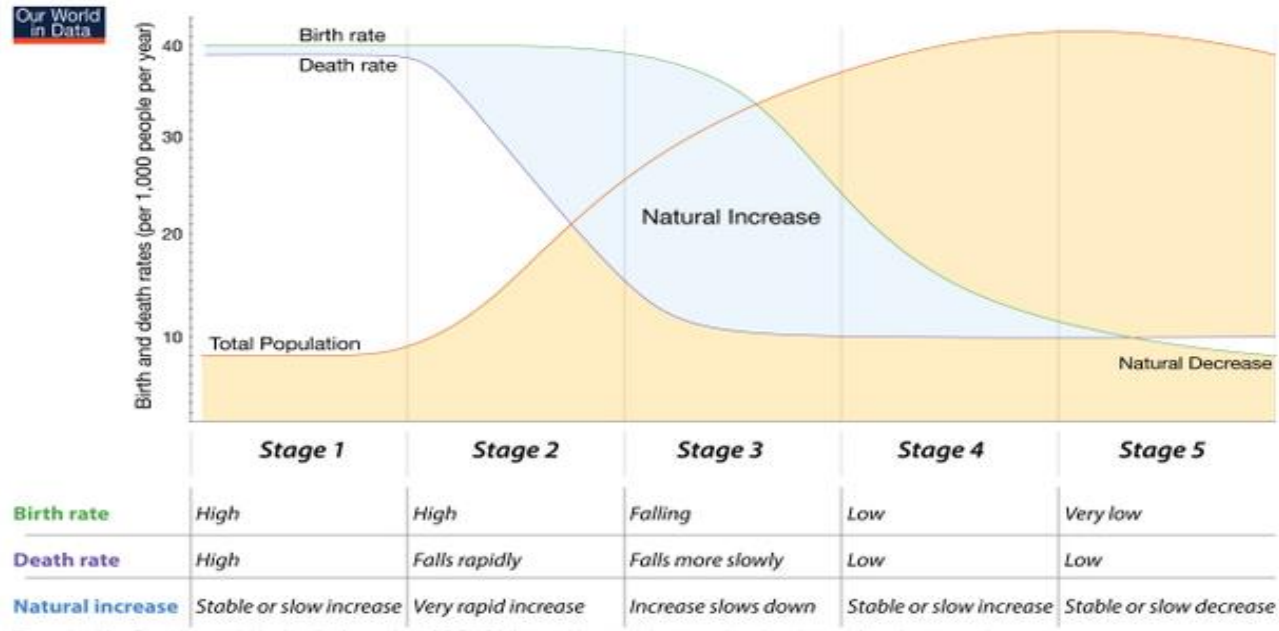

Figure 2.1: Stages of Fertility Rate and Economic Growth

Source: Thompson (1929)

In level one, before the industrial revolution, the rates of deaths and births are significantly big. Both birth and death rates are high in this stage. Since deaths and birth rates are almost balancing during this stage, population rise is generally low in stage one.

In the second stage of an economic growth society, the birth rate is high and the mortality rate drops sharply. This is a phenomenon resulting from improved food and hygiene, which increases life expectancy and reduces mortality from illness. Improved access to adequate food is due to improved plant and animal reproduction and modernization of agricultural mechanisms. Growth in technical skills, health care and education will also grow at this stage.

In level three, birth rates slow down as a result of access to fertility management methods, improvement in wage-earning, growth of urban centres, a decline in basic agricultural activities, more women gain access to education, a decline in the need for more children, growing need for education for offspring and other social services (Caldwell, 2007). The growth of the population starts to flatten. Improving contraceptive usage helps reduce fertility, but the use of birth control was discussed in 19th period Myrskylä, Kohler & Billari, 2009). It is important to note that lower fertility rates can be due to changes in values, not necessarily due to the use of contraceptives.

In level four, rates of births and deaths in the population are both low. Birth rates can decline so much as they occurred in nations like Germany and Japan, resulting in a declining population that threatens industrial growth, which depends on the population for the market of its goods and services. As the populations born in stage two grow old, it develops an economic weight onto the declining productive population. Death rates can remain reliably low or rise moderately because of the rise in lifestyle diseases resulting from inadequate body exercise, rise in the number of obese persons, and an ageing working population in nations that advanced economically. In the 20th century, birth and death rates in nations that grew economically string flattened at lower rates, with economic growth being high during this stage. The model is a generalization that applies to developing countries as a group and may not accurately describe all individual cases. The extent to which it applies to less-developed societies today remains to be seen. The Demographic Transition Theory enhances better understanding of underlying growth rate of the economy, structural productivity growth, living standards, savings rates, consumption, and investment.

2.2.2 Economic Growth Models

According to Malthus's model, the growth of an economy is linked to a particular value of average income. As the average income surpasses the equilibrium point, death rates slow down as the rate of fertility rises and conversely. Nonetheless, excluding some very poor nations, there's little empirical evidence that supports the model (Du, 2001). Notwithstanding, the model profoundly establishes vital links between average income, wages, educational growth, and fertility rate, growth of urban centres, and death rate (Du, 2001). The comprehension of fertility matters is outlined in the economic growth theories. The Economic Growth Models helps in crystallizing our thinking about the interplay between the location of economic activity and the growth rate of economic activity.

2.2.3 Endogenous Model

The endogenous model was created by Smith (1776). The endogenous model states that there are various factors that catalyze economic growth. Smith (1776) argued that economic growth was related to the division of labor by creating a direct link between labor and economic growth (King & Rebelo, 1990). Malthus (1798) created a model to explain the dynamic growth phenomenon in which countries achieve high average incomes (Sun, 2013). Endogenous models show that when income levels exceed the equilibrium point, mortality rates decrease and conversely, fertility rates increase.

Endogenous growth economists believe that increased productivity can directly lead to faster innovation and more investment in human capital. That's why they advocate government and private sector institutions that promote innovation initiatives and provide incentives for individuals and businesses to become more creative, such as research and development (R & D) funding and intellectual property rights. In the knowledge economy, the idea is that the spillover of technology and investment in people will continue to generate profits. Influential

knowledge-based industries such as telecommunications, software, and other high-tech industries play a special role here.

2.3 Determinants of Fertility Rate

This section presents some critical concepts while defining the terms measuring the various factors predicting a rise in population. In the demographic model formulated by Hinde (2009), population P_t of a nation is utilized, predicting the size of the population a year after as:

$$P_{t+1} = P_t + B_t - D_t + I_t - E_t$$

Where Bt and Dt are separately the quantities of childbirth and passing happening in the populace between period t and t + 1. It is the number of migrants; it is the quantity of exiled people over the same period. Bt − Dt is individually characteristic increment. Populace development is estimated as the change between the childbirth rate and mortality rate. The TFR is frequently the greatest normally utilized proportion of the dimension of fruitfulness and is greatest broadly utilized since it alludes to childbirths for each lady. It demonstrates the capability of populace change in a locale. As demonstrated by Weeks (2008), TFR employs the manufactured partner procedure and estimates knowing what number of kids ladies delivered on the whole during the child delivering stage by utilizing the ASFR at a specific time to anticipating what can occur later on if all ladies experienced their lives bearing youngsters at a similar rate. The TFR demonstrates the normal number of offspring that can be delivered by a woman on condition she lives up to last childbearing years and bears kids as indicated by a given ASFR (Hinde, 2009). The equation for the count is

$$ASFR = \frac{birth\ in\ year\ to\ womenn\ aged\ x\ lastbirthday\ at\ the\ time\ of\ birth}{mid - yar\ population\ of\ women\ aged\ x\ lats\ birthday}$$

SFR=birth in year to women aged x last birthday at the time of birth population of women with age x last birth time

$$\sum_{15}^{45} ASFR_1$$

Here, the model assumes that the ASFR speaks to ages somewhere in the range of 15 and 45 (in Kenya) as of the final birth time and gauges the all-out number of youngsters a woman can during their lifetime (Gallor, 2012). TFR is famous as a pointer since it predicts a nation's absolute richness and afterwards consolidates the age-explicit rates of birth with the age dissemination of a nation (Hartmann, 2010). Be that as it may, TFR can't be utilized to make forecasts with respect to future populace patterns (Gallor, 2012).

Rather, the net propagation rate (NRR) is regularly utilized to foresee future populace patterns (Hartmann, 2010). The NRR alludes to the normal number of little girls that would be destined to a lady on the off chance that she lived as far as possible of her child delivery years balanced for the death rate of a particular year (Gallor, 2012). NRR is in every case marginally lower than GRR since certain women may die earlier, delivering for the first time or even completing the childbearing period. Something else, the NRR will not be exactly 50% of the TFR.

$$NRP = \sum_{X=15}^{45} f_x^d \, L_x$$

Here, f_x^d Shows the normal number of girls that one lady has while she survives the whole years of to live between definite ages x and x + 1. The L_x demonstrates the quantity of lady years lived between accurate age x and x + 1 by a birth accomplice of size 1 (Hinde, 2009).

The NRR and TFR predict growth in population; however, is utilized for marginally various purposes. The TFR, for instance, gives a sign of populace development (Hinde, 2009). As

opposed to the TFR, as indicated by Hinde (2009), the NRR is more qualified to foresee populace development and is just the gross generation rate balanced for mortality. Along these lines, it is basic to comprehend that monetary development is influenced more than fruitfulness and to get the entire picture of populace development; in this manner, more factors may be considered (Hartmann, 2010).

2.4 Empirical Review

Li and Zhang (2007) investigated how birth rate impacts the growth of the economy in China. The study employed provincial-level time-series data from China from 1978 to 1998. The independent concepts were birth rate, annual population growth rate, secondary level school enrolment rate, rate of immigration, investment share, labour force participation rate, old dependency ration, youth dependency ratio, expenditures by government, and trade share. A regression model was employed to model the influence of birth rates on the growth of the economy in China. The investment share and trade share positively impacted the growth of the economy. Immigration rates, youth dependency ratio, old dependency ratio, and government spending share were not statistically significant with economic growth. The coefficient of secondary level-school enrolment rate did not significantly impact the growth of the economy at 10%. The investigation revealed that the birth rate negatively impacted economic growth. The findings supported the results of Malthus that population growth decreases the per capita output.

Ludwig et al. (2010) conducted a study on fertility, mortality, educational attainment, and capital formulation in a simple Overlapping Generation (OLG) model. The mortality rate was operationalized as deaths size per 1000 population, fertility as births size per woman,

education as a percentage of females ages 15 and above, and capital accumulation measured using percentage of capital stock growth. The regression model showed that declining birth rates result in rising capital per worker, though the impact from survival rates is ambiguous and inconclusive. Falling fertility rate and old-age dependency resulted in rising in capital formation.

Jajri and Ismail (2010) investigated how the quality of labour impacts the growth of the economy and labour productivity. The independent variables of the study were the money stock-real GDP ratio, the quantity of effective labour, capital stock ratio, and capital-labour ratio. The study employed time-series data from 1981-2007. A regression model based on time series data was estimated. It was found that the capital-labour ratio and capital stock positively influence the growth of the economy and labour productivity in Malaysia.

Using multiple regression and cointegration tests, Khattak, Khan, Tariq, Naeem, Tasleem, and Tahir (2011) investigated how education impacts TFR in Pakistan (1981to 2008). The study opined to determine how educational attainment impacts TFR in Pakistan. Total Fertility rate (births per woman), education (percentage literacy of both men and women), female and males age at marriage. Study results revealed that the age of females and males ta marriage, educational qualification impact TFR. Women with high educational qualifications are less likely to bear more children compared to women with primary and no education.

Açikgöz (2012) conducted a study on fertility, employment, and capital accumulation in Turkey. The fertility rate was measured as the number of live births per woman, employment measured if one was employed or unemployed, and capital accumulation as a percentage of

capital stock growth. The study found that the rising fertility rate resulted in to increase labour supply. Employment availability and increase in capital stock resulted in lower fertility rates.

By focusing on 26 African countries, Longwe, Huisman, and Smits (2012) conducted a study on how knowledge regarding the use of contraceptives impacts fertility rate and household wealth. This was a panel study, and so a regression model was used to analyses relationship knowledge (percentage of women were aware of at least one type of contraceptive), acceptance and contraceptives use (percentage of women using any form of modern contraceptives), and household wealth measured using annual income. Results of the research indicated that knowledge about contraceptives, educational level, and contractive use resulted in to fall in the number of children born by women.

According to Karra, Canning, and Wilde (2017), the early stage of economic growth leads to population growth; later, the fertility rate will start to decrease. Malthus (1798) emphasized a crucial linkage between the rate of fertility and economic growth (Weil, 2013).

According to Li (2016) who conducted a study on the linkage between fertility rate and economic growth found that fertility growth and economic growth have a causal relationship.

High fertility rate results in lower economic growth indicating that total fertility rate and economic growth are negatively related. Moreover, a study by Jemna (2015) while examining the causality relationship existing between fertility and economic growth in Romania, revealed a bi-dimensional causality relationship between fertility and economic growth. However, a study by Mahmud (2015) on increase in population and growth of the economy

in India is a unidirectional relationship, running from economic growth to fertility rate. Likewise, Anudjo (2015) while linkage the relationship between the growth of population and economy in Ghana covering the years 1980-2013 revealed that population growth and economic growth are negatively related in the short run and one-directional causality in the long run between them.

The results also differ with Nwosu, Dike and Okwara (2014) who predicted a unidirectional causality between fertility rate and economic growth. Causality results reveal a bidirectional association between fertility rate and economic growth in Kenya. However, Chang, Chu, Deale and Gupta (2014) while studying a linkage between economic growth and population growth over 1870-2013 revealed one-way causality running from the growth of population the growth of the economy for Sweden, France, Finland and Portugal one-way causality running from economic growth to population growth for Norway, Germany, Switzerland, Canada and Japan, and no causal relationship between population growth and economic growth is found in Uruguay, UK, New Zealand, Belgium, Spain, Sri Lanka, USA, Denmark, Brazil and Netherlands. Further, Thuku, Gachanja and Almadi (2013) reveal unidirectional determining the impact of population growth on the growth of an economy.

Further, Thuku, Gachanja and Almadi (2013) established that the rise in population usefully impacts the growth of the economy in Kenya. According to Ashraf, Weil and Wilde (2013), a decline in fertility increases income per capita by an amount that some would consider economically significant and that a decline in fertility would not, by itself, lead to remarkable economic growth. The results are also in line with Karra, Canning, and Wilde (2017) in a research on the impacts of fertility drop on the growth of the economy in Africa that smaller

fertility enhances female educational attainment reduces the fertility of the succeeding generation producing multiplier effect emanating from some changes in fertility inducing a remarkable useful impact on the growth of the economy. Likewise, Baliamoune- Lutz (2017) while research on the linkage between fertility and growth of the economy of four North Africa Countries illustrated the significant importance of smaller fertility in the growth of the economy in the case of economically growing nations. The results are also in line with Li (2016) that the total fertility rate has an undesirable impact on the growth of the economy.

Bongaarts and Sobotka (2012) suggested a negative linkage between the growth of the economy and the rate of fertility resulting from the expansion in economic growth and the successive decline in the fertility rate. It may also happen that changes in fertility growth and economic growth may result in a causal relationship between the elements (Jemna, 2015). However, analyzing the group fertility growth shows not less than a segment of the fertility rises in economically well-endowed nations is not linked to such effects, but a kind of actual rise in the actual state of fertility (Fox, Klüsener & Myrskylä, 2018).

Studies have shown mixed results with respect to the linkage between economic growth and fertility rate. Some studies have found that the rate of fertility has a negative impact on economic growth (Barro 1991; Jemna, 2015; Ryabov, 2015). Some of the reasons for the negative relationship include fast population growth hinders savings contribution. It hinders the accumulation of economic resources per working person, and population growth may strain foreign exchange by exerting huge pressure on the balance of payment (Hartmann, 2010; (Taylor *et al.,* 2016).

By focusing on Phillipine, Macan, and Deluna (2013) investigated the relationship between labour and income variation on the rate of fertility. The scope of the study was 1985-2009. OLS method was employed to determine the impact of labour and income variation on the rate of fertility. It was found that labour productivity and income variation negatively impacted the fertility rate in Philippines.

Thuku et al. (2013) investigated population change impacts the growth of the economy in Kenya over the period 1964-2011. The particular objectives include investigating how expenditures by the government on economic growth. The variables were measured as education (total expenditure on education), infrastructure (total expenditure on infrastructure), health (health expenditures), defense expenditures on the growth of the economy (percentage rate of change of the GDP). Educational expenditures by the government positively impacted economic growth. The study also found that population growth positively correlates with economic growth; and that a rise in population positively impacts the growth of the economy. Government spending on defense negatively impacted the growth of the economy. Health expenditure and transport positively impacted the growth of the economy. This was a unidirectional study, establishing how population growth impacts the growth of the economy. The current research wishes to establish the direction between the growth of the economy and the fertility rate in Kenya.

Güneş (2013) investigated how female education impacts fertility: Evidence from Turkey. Female education was measured as a percentage of women who attained compulsory schooling law, while fertility was measured using the number of births per woman. This was a cross-sectional study, and simple OLS was used to model how educating women impact the

level of fertility. It was found that more educational attainment by women results in to decline in the fertility rate.

In Tanzania, Ayoub (2014) determined how women's education and use of contraceptives affect the fertility rate. Two variables were used: fertility and contraceptive use, and OLS was employed to model the nexus between females' education on contraceptive use and fertility. The use of contraceptives was measured as the percentage of women using any form of contraceptives, while the fertility rate was measured based on the number of children born by a woman during the children-bearing period. It was found that women education and use of contraceptives resulted in a fall in the number of children born per woman.

In Nigeria, Nwosu, Dike, and Okwara (2014) did an investigation regarding how growth population impacts the growth of the economy. The investigation employed yearly data covering 1960 and 2008. Population growth was measured as an annual population growth rate and growth of the economy as a percentage of annual economic growth. The findings were based on the ADF stationarity test and Granger causality, and Johansen cointegration tests. It was found that population growth spurred the growth of the economy by providing a market for goods and services. The findings supported the argument that the rise in population is related to the growth of the economy. It was also established that there existed a long-run stable linkage between population rise and growth of the economy. Unidirectional causality also existed between population rise and growth of the economy.

Osundina and Osundina (2014) conducted a study on savings, capital accumulation, and growth of the Nigerian economy. Capital accumulation was measured as percentage capital

stock growth, savings as total annual savings, and economic growth as annual percentage economic growth. The study covered the period 1980 - 2012. The regression model was employed in the study to establish a relationship among variables. Results revealed that that savings and capital accumulation positively impacted the growth of the economy in Nigeria.

Ryabov (2015) conducted an investigation on the growth of the economy that impacts fertility rates in the United States for the years between 2010 and 2014. Economic growth was measured using percentage annual economic growth, fertility rate as the number of births per woman, and human development measured using three indicators wealth (percentage below the poverty threshold), health (life expectancy), and education (percentage of women who attained an undergraduate degree and above). The study employed a cross-sectional analysis to predict the linkage that exists between TFR and human development indicators. The study predicted that economic growth negatively impacts the fertility rate. The study, however, measured economic growth using Human Development Index (HDI). The indicator may not be very suitable for a small-medium economy like Kenya. The study chooses to measured economic growth using real GDP growth.

Jemna (2015) explored the nature of causality between fertility and growth of the economy in Romania, employing the data gathered covering the period 1993 and 2010. The fertility rate was measured using the number of births per woman, while economic growth was measured using the annual percentage economic growth rate. By employing the VAR model and the Granger model, the study highlighted the nature of the causal linkage between fertility rate and growth in the economy. The study findings revealed a bi-dimensional causality linkage between fertility rate and growth in the economy. This research investigated the linkage

between fertility rate and growth of the Kenyan economy by introducing labour productivity as a control variable.

Fox, Klüsener, and Myrskylä (2015) conducted a study to establish whether the fertility rate positively impacts economic growth in Europe covering the period 1990- 2012. The fertility rate was measured using the number of births per woman, while economic growth was measured using the annual percentage economic growth rate. A fixed-effect model was used to determine the linkage between fertility and the growth of the economy. The research presented a weak negative impact of fertility on the growth of the economy for most nations but also with a positive relationship in some countries. The results seem not to be explained by postponement impacts alone. However, there were considerable variations in the fertility and economic growth at which the propensity approaching a reversal is seen. There seemed to be inconsistent findings with other studies.

Tartiyus, et al. (2015) investigated the impact of growth in population on the growth of the Nigerian economy from 1980 - 2010. Secondary data were gathered from the WDI covering the years 1980 to 2010. Data analysis involved descriptive and regression techniques. The findings showed that the growth of the economy (proxied by GDP growth) and population (measured as annual population growth rate) had a positive relationship. In contrast, a negative relationship was established between the growth of the economy and life expectancy predicted by the expected number of years.

In India, Mahmud (2015) investigated how growth in population impacts the growth of the economy from 1980 to 2013. Population growth was measured as a percentage of annual

population growth, while economic growth was measured using percentage economic growth. The study employed the VECM and Johansen test to determine the linkage that exists between growth in population and growth in the economy. A positive linkage exists between population growth and economic growth. Unidirectional relationships exist with the growth of the economy have a significant effect on growth in population.

Anudjo (2015) assessed the empirical linkage between growth in economy and population in Ghana, covering 1980-2013. Population growth was measured as a percentage of annual population growth, while economic growth was measured using percentage economic growth. The paper utilised the ARDL technique of estimation strategy. The investigation revealed that the growth of the economy and population rise was negatively related in the short run and one-directional causality in the long run between them. The study showed that population density and labour force impacted positively, whereas the unemployment rate in the long run impacted negatively the growth of the economy.

Martin and Juarez (2015) investigated how women's education impacts fertility in Latin America using a regression model. Women's education was measured as a percentage of women who attained a tertiary level of education, while growth in the economy was operationalized using a yearly percentage economic growth rate. It was found that women's education resulted in to decline in the fertility rate.

Oztunc, Oo, and Serin (2015) conducted research on how educational attainment by women impacts the growth of the economy by focusing on Asian pacific countries over the period 1990-2010. The countries studied included Vietnam, China, Bangladesh, Myanmar,

Indonesia, Lao PDR, Thailand, Philippines, India, and Cambodia. Women's education was measured as a percentage of women who attained a tertiary level of education, while economic growth was measured as the percentage annual economic growth rate. It was found that educating women resulted in improvement in the economy.

Ewubare and Ogbuagu (2015) investigated the impact of capital formation on the growth of the Nigerian economy. Capital accumulation was measured as a percentage of capital stock growth, while the growth of the economy was measured and operationalized as a percentage annual economic growth rate. ARDL was employed to determine the short-run and long-run nexus in the model. Capital formation had a positive effect on the growth of the economy.

Li (2016) investigated the linkage between fertility rate growth of the economy in developing nations from 1970-2014. The fertility rate was measured as the number of births per woman, while economic growth was measured as the percentage annual economic growth rate. The panel research design was employed. Data were gathered from WDI. Fertility growth and economic growth had a causal relationship. The rising fertility rate results in slower economic growth, indicating that TFR and economic growth were negatively related. It was also found that economic growth at the start was associated with high rates of fertility; however, with subsequent growth in the economy, the fertility rate reduces.

By focusing on Egypt, Algeria, Morocco, and Tunisia, El Alaoui (2016) investigated how education attainment by women impact the economic growth of those countries from 1960-2012. The study used a panel research design. Women's education was measured as a percentage of women who attained the tertiary level of education, while economic growth

was operationalized as a percentage yearly growth rate in the economy. Tertiary educational attainment by women positively impacted economic growth while the primary and secondary levels of education had a negative impact on the economy.

Baliamoune-Lutz (2017) investigated the linkage between fertility and growth of the economy of four North Africa Countries (Algeria, Morocco, Tunisia, and Egypt) for the period 2010-2016. The Granger causality test was estimated between the growth of the economy and fertility. The fertility rate was measured as the number of births per woman, while economic growth was measured as the percentage annual economic growth rate. Findings indicated that the rate of fertility granger causes income growth, and the causality is two-directional only in Algeria and Morocco, whereas fertility rate granger-caused investment in physical resources only in Tunisia and Morocco. The findings were in agreement with Becker's postulation that smaller fertility results in both higher investments in physical resources and economic growth, but only to two North African countries out of four. The findings illustrate the significant importance of smaller fertility in economic growth in the case of economically growing nations.

Nweke, Odo, and Anoke (2017) conducted a study on how capital accumulation impacts the growth of the economy in Nigeria. Capital accumulation was measured as a percentage of capital stock growth, while the growth of the economy was measured as the annual growth rate in the economy. VECM and VEC Granger causality test was utilized to check short run and long run linage between the variables. Capital accumulation has an insignificant effect on the growth of the economy both in the short and long run. A bidirectional relationship exists between gross capital formation and the growth of the economy.

Karra, Canning, and Wilde (2017) conducted a study on how a decline in fertility impacts the growth of the economy in Africa. The fertility rate was measured as the number of births per woman, while economic growth was measured as the percentage annual economic growth rate. It was found that lower fertility positively impacts the growth of the economy. Lower fertility implies more women are offering labour to the economy.

By focusing on selected OECD countries, Korkmaz et al. (2017) investigated the effect of labour productivity on the growth of the economy. The countries include Finland, Spain, Belgium, UK, Italy and France over the period 2008 to 2014. Labour productivity was measured as a percentage of total employment growth, while economic growth was measured as the percentage annual economic growth rate. A long-run relationship was established between labour productivity and growth of the OECD countries during the study period. There was a unidirectional causality link from economic growth to labour productivity.

Karra, Canning, and Wilde (2017) investigated the impacts of fertility drop on the growth of the African economy utilizing a panel approach for the years 2010 to 2100. , The macro simulation model, predicted bigger positive impacts of fertility reduction that contributed to quick economic growth. During the short all to medium run, the significant explanation for the bigger income impacts in the model is the bigger portion of the labour force pumped to the economy when the fertility rate is small. In long run, smaller fertility enhances female educational attainment, reduces the fertility of the succeeding generation, producing a multiplier effect emanating from some changes in fertility.

Bongaarts (2017) conducted a study on how the use of contraceptives affects the fertility rate in SSA countries. The study used DHS survey data from 40 developing countries. Contraceptive use was measured as a percentage of women using contraceptives of any method (percentage of women ages 15-49) while fertility rate was measured as the number of births per woman. It was found that the use of contraceptives resulted in a drastic decline in the fertility rate.

2.5 Summary of Literature

Though there are many studies on the fertility rate and economic growth there is contentious on the result findings. The linkage existing between fertility rate and economic growth remains contentious. Some studies have revealed that the growth of the economy and fertility is negatively related while other studies show that reduced fertility results in greater investments in physical resources and economic growth. Other studies suggest a reversal relationship existing between economic growth and the rate of fertility growth because of the major expansion of the economy and the successive decline in the fertility rate.

Empirical studies show negative effects while others show positive effects of fertility rate and economic growth. Further, the indicators for economic growth varied with some scholars proposing use percentage GDP growth while others measured economic growth using per capita GDP growth. Understanding the direction of linkage existing between fertility rate and economic growth is vital especially for policy formulation (Economic policies, Population policies, Family planning policies). The inconsistency of results in various studies presents a knowledge gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter highlights the research methodology of the study consisting of the research design, the framework, empirical model, data type and source, diagnostic tests and analysis.

3.2 Research Design

A longitudinal research design was utilised in the research. This design was appropriate given the time-series data that were employed, where data covering the period 1977 to 2019 were collected and used. The data n fertility was only available;e from 1977.

3.3 Theoretical Framework

The research was based on two theoretical models; the neo-classical theoretical model (exogenous model) and Malthus's theoretical model (endogenous model).

3.3.1 Neo-classical Theoretical model

Neo-classical Theoretical model (Exogenous model**)** attaches significant criticality to the effect of investing in physical resources on the growth of an economy. It predicts a significant linkage between the effect of fertility rate and economic growth. Neo-classical models state that the rate of fertility acts as an exogenous element during economic growth (Du, 2001). The neo-classical model argues that population growth (TFR) impacts economic growth. The theoretical model is structured as:

$realGDP_t = f(TFR_t)$……..……..…….....3.1

Where $realGDP_t$ shows the economic growth rate measured as real GDP, and TFR_t is the total fertility rate at time *t*,

But according to the Solow growth model, economic growth is also related to the capital stock formation and labour productivity (Ewubare & Ogbuagu, 2015; Açikgöz, 2012). Thus, capital stock formation and labour productivity formed the control variables of this model.

3.3.2 Malthus's Theoretical model

Malthus' l model premises that economic growth affects the total fertility rate. Malthus (1978) presented a model to simulate a growth pattern on how countries attained stable average income in the population (Becker *et al.,* 1990). The model reveals that when income surpasses the equilibrium point, rates of death drop, and fertility increases conversely. Economic growth influences the total fertility rate, meaning that the rate of fertility is an endogenous element in the economic model.

$TFR_t = f(realGDP_t)$……..……3.2

Where;

$realGDP_t$ = real Gross Domestic Product

TFR_t = Total Fertility Rate

However, from the literature, the fertility rate is also affected by the use of contraceptives and female literacy (Martin, & Juarez, 2015; Bongaarts, 2017). Thus, the use of contraceptives and female literacy comprised the control variables of this model.

3.4 Model Specification

Relating theoretical models (Neo-classical Theoretical model and Malthus's Theoretical model) to the study, the equations to be estimated in this study were;

$RealGDPgrowth_t=\alpha+\beta_1 TFR_t+\beta_2 CAPSTOCKgrowth_t+\beta_5 LABORgrowth_t+\mu_t$……..……3.3

$TFR_t=\alpha+\beta_1 realGDPgrowth_t+\beta_3 CONTRACEPT_t+\beta_4 FEMALITERACY_t+\mu_t$.....3.4

Where;

$realGDPgrowth_t$ = growth of real Gross Domestic Product at time t

TFR_t = Total Fertility Rate per woman (TFR) at time t

$CAPSTOCKgrowth_t$= growth of Capital stock at time t

$CONTRACEPT_t$= use of contraceptive prevalence at time t

$FEMALITECY_t$=Female literacy at time t

TFR= Total Fertility Rate (per woman)

$LABOURgrowtht_t$= Labour force, female (percentage of total labour force)

μ = Error term

In the equation, β_0 is the constant coefficient, coefficient $\beta_i i$= 1 is employed to predict the sensitivity of economic growth ($realGDPgrowth_t$) to a unit change in the fertility rate (TFR_t).

3.5 Definition and Measurement of Variables

Table 3.1 shows how the study variables are defined and measured.

Table 3.1: Measurement of Variables

Variable	Definition	Measurement
Real GDP	Economic growth	Real GDP growth (percentage)
TFR	Total fertility rate	Number children that a woman would give birth to through her reproductive age
CAPSTOCK	Capital stock	Percentage capital stock formulation to GDP
CONTRACEPT	Use of contraceptives	Contraceptive use, any methods (percentage of women ages 15-49)
FEMALITECY	Female literacy	Adult female (percentage of females of 15 years and above)
LABOUR	Total labour force	Total employment growth (percentage)

CAPSTOCK=Capital stock, CONTRACEPT= Contraceptive prevalence, any methods (percentage of women ages 15-49), ECON=Economic growth percentage of GDP, FEMALITECY=Female literacy, adult female (percentage of females ages 15 and above), TFR= Total Fertility rate per woman and LABOR= total employment in millions

3.6 Data Types and Sources

This research made use of secondary data covering the years 1977 and 2019. The period is chosen since data on the total fertility rate were readily available within this time scope. The main sources of these data were the World Bank development Index (WDI), Eurostat electronic database, Kenya National Bureau of Statistics reports, Household surveys and Economic Surveys.

3.7 Data Analysis

According to Greener (2008), data analysis uses scientific analysis tools to determine data collected for research purposes, show observed trends, and objectively summarize and draw conclusions from information. It is included. Betring (2015) requires variables to be presented and analyzed in numerical form and presented in graphs, tables, and other indicators such as correlation, mean, and variance. Analysis of encoded data by SPSS. Highlights from descriptive statistics indicate the achievement of central tendency. The person's correlation coefficient used to determine the strength of the linear relationship between variables. The F-test and T-test determined the possibility of the relationship shown by the analysis. The modified R^2 tested the existence of moderation in the model. The model uses Person's r and Spearman's rho to show the strength of the variable relationship.

3.8 Diagnostic Tests

3.8.1 Autocorrelation/Serial correlation

Autocorrelation implies a situation where the error function relates to its preceding value. The presence of autocorrelation, nonetheless, may not influence the unbiasedness of the parameters, linearity and asymptotic behaviour but renders hypothesis testing invalid (Gujarati, 2004). Autocorrelation is often common in longitudinal data as the data takes a particular trend as time changes. The resultant challenge is that it breaches the best features of OLS, making the conclusion of the hypothesis testing inaccurate. This study employed the Breusch-Godfrey test to test for serial autocorrelation.

3.8.2 Normality Assumptions

The normality assumptions for the error term was conducted so as to estimate single or joint hypothesis tests concerning the model estimates (Brooks, 2008). The null hypothesis is that error variance in data is not normally distributed. Normality test was conducted using the

Jarque-Bera test. A calculated p-value>0.05 implies data is normal while a p-value<0.05 implies that data is not normal.

3.8.3 Unit Root Test

Since the data collected are time-bound in nature, there was a need to test for stationarity. Unit root tests are employed to check the non-stationarity of data. When data is non-stationary, there is a possibility of the parameters changing over time leading to invalid results. Thus, if variables are established to be non-stationary, subsequent differencing is employed until the bias is mitigated. The null hypothesis was that the element in consideration was non-stationary. Augmented Dickey-Fuller (ADF) test was utilised to check for stationarity (Gujarati, 2004).

3.8.4 Heteroscedasticity

The classical linear model (CLRM) assumes that the error term is homoscedastic, that is, it has constant variance. If the error variance is not constant, then there is heteroscedasticity in the data. Running a regression model without accounting for heteroscedasticity would lead to unbiased parameter estimates. To test for heteroscedasticity, the Breusch-Pagan/Godfrey test was used. The null hypothesis of this study was that the error variance is Homoscedastic.

If the null hypothesis is rejected and a conclusion made that heteroscedasticity is present in the longitudinal data, then this would be accounted for by running a feasible generalised least squares (FGLS) model. When p-value<0.05, there is Heteroscedasticity; when p-> 0.05, there is no Heteroscedasticity.

CHAPTER FOUR

RESEARCH RESULTS AND DISCUSSION

4.1 Introduction

Results and discussion of research outcomes are presented in this chapter. It is divided into the following sections consisting of descriptive statistics, diagnostic tests, regressions, results and discussions.

4.2 Descriptive Statistics

The descriptive statistics included median, standard deviation, means, maximum and minimum values, of the study factors. These statistics are as shown in Table 4.1.

Table 4.1: Descriptive Statistics Results

Variable	Description	Mean	Maximum	Minimum	Std. Dev.
CAPSTOCK	Capital stock growth (percentage)	3.87	13.21	1.14	2.12
CONTRACEPT	Contraceptive prevalence, any methods (percentage of women ages 15-49)	35.35	66.30	4.90	16.39
ECONOMIC GROWTH	GDP growth (annual percentage)	4.26	9.453798	- 0.80	2.45
FEMALE LITERACY	adult female (percentage of females ages 15 and above)	60.11	79.05	31.17	15.05
TFR	Total fertility rate	5.51	7.70	3.47	1.19
LABOUR	Total employment growth (percentage)	7.02	35.01	0.07	5.22

Descriptive results in Table 4.1 show an average capital stock growth of 3.87 percent in Kenya from 1977 to 2019. The minimum and the maximum of capital stock growth between the years 1977 and 2019 were 1.14 percent and 13.21 percent, respectively. Its standard deviation was 2.12 percent, which showed that capital stock differed throughout the measurement period.

The average use of contraceptive rate among women ages 15-49 was 35.35, with a minimum and a maximum of 4.9 percent and 66.3 percent respectively, and a standard deviation of 16.39 percent.

The results showed that the overall mean of GDP growth was 4.19 percent in the period under consideration. GDP growth rate varied between a minimum -0.80 percent and a maximum of 9.45 percent between the years 1977 and 2019 were and respectively, with a standard deviation of 2.41 percent.

Further, female literacy was 60.11 percent with a standard deviation was 15.05 percent. Besides, the results show a total fertility rate of 5.6 children per woman with a. standard deviation was 1.17 children during the period. Lastly, the average growth of total employment in both informal and formal sectors was 7.02 percent. The minimum and the maximum of total labour growth between the years 1977 and 2019 were 0.07 percent and 35.01 percent respectively, but with a standard deviation was 5.22 percent.

4.3 Diagnostic Tests

Diagnostic tests were done including. stationarity test, normality test, autocorrelation test, heteroscedasticity test, autocorrelation test and multicollinearity test before regression analysis

4.3.1 Stationarity test (unit root test)

Unit root test was done by using the ADF, test to check the stationarity of data. The unit root output is illustrated in Table 4.2.

Table 4.2: Stationarity test output

Variable		**ADF test**	**Sig.**	**Comment**
ECONOMIC GROWTH	Constant	-3.524450	0.0122**	Stationary at level
	Trend and intercept	-3.708505	0.0330**	
CAPSTOCK	Constant	-4.254253	0.0017**	Stationary at level
	Trend and intercept	-5.356354	0.0004**	Stationary at level
TFR)	Constant	-1.112635	0.7009	Non-stationary at level
	Trend and intercept	-4.862140	0.0021**	Stationary at level
Labor	Constant	-5.510268	0.0000***	Stationary at level
	Trend and intercept	-5.450795	0.0003**	Stationary at level
FEMALITERACY	Constant	-1.491338	0.5279	Non-stationary at level
	Trend and intercept	-2.061226	0.5513	Non-stationary at level
CONTRACEPT	Constant	-1.326411	0.6082	Non-stationary at level
	Trend and intercept	-3.238404	0.0920	Non-stationary at level

* sig at 10%, ** sig at 5%, *** sig at 1%

Table 4.2 show ADF statistics for all the factors at levels. The results showed that three variables consisting of economic growth, capital stock growth and labour employment growth were stationary at level and at five percent level. However, total fertility rate, female literacy and contraceptive prevalence rate were non-stationary at five percent level. These non-stationary variables became stationary at first difference as shown in Table 4.3.

Table 4.3: Unit root tests at first difference

Variable		**ADF test**	**Sig.**	**Comment**
TFR	Constant	-3.895672	0.0048**	Stationary at first difference
	Trend and intercept	-3.988528	0.0176**	Stationary at first difference
FEMALITERACY	Constant	-7.647064	0.0000***	Stationary at first difference
	Trend and intercept	-7.678452	0.0000***	Stationary at first difference
CONTRACEPTIVE	Constant	-3.689167	0.0083**	Stationary at first difference
	Trend and intercept	-3.792785	0.0279**	Stationary at first difference

4.3.2 Normality Test

Normality test was undertaken by employing the Jarque-Bera. The Jarque-Bera statistic was issued with 2 freedom degrees under the null hypothesis of a normal distribution as shown in Figure 4.1 and Figure 4.2.

Figure 4.1: The Jarque-Bera Normality Graph, GDP growth as the dependent variable

Figure 4.1 indicates that data follows a normal distribution. The Jarque-Bera statistic was 1.110 and probability of 0.57 which was greater than 0.05. The null hypothesis of normality of the residual values was not turned down at five percent level.

Figure 4.2: The Jarque-Bera Normality graph, Total fertility rate as the dependent variable

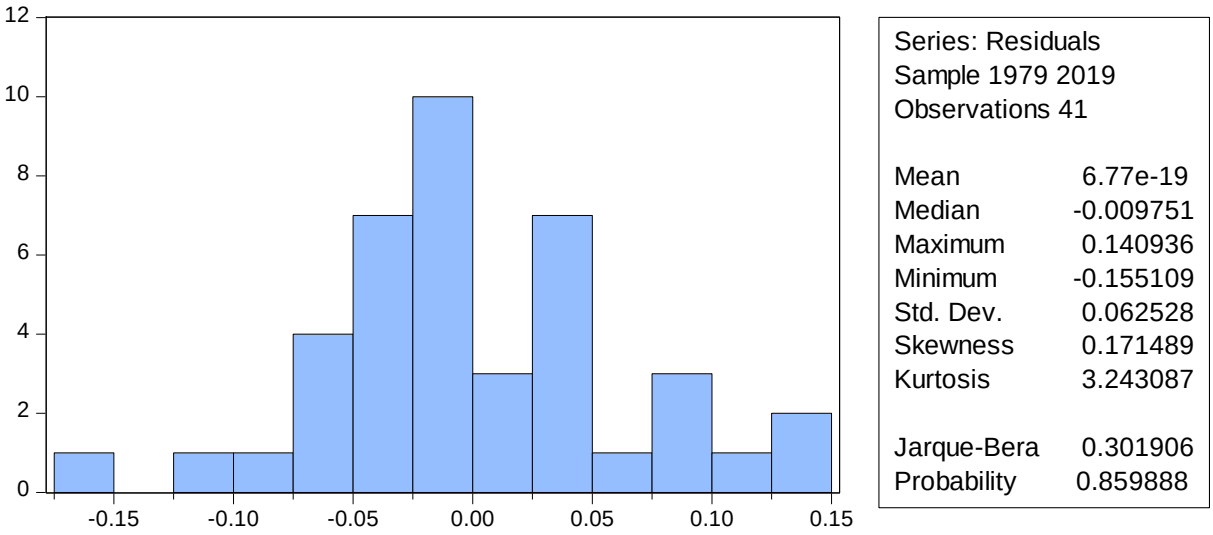

Figure 4.2 also shows that the normality assumption for the residual was satisfied for the TFR equation as upheld by a Jarque-Bera statistic of 0.301 and a p-value of 0.85 which was greater than 0.05.

4.3.3 Heteroscedasticity Test

The error terms from a regression model must have a constant variance called homoskedastic. Thus, to make sure whether the residuals meet this criterion, the research applied the

Breusch-Pagan test for heteroskedasticity, where the null hypothesis under this test was that residuals were homoskedastic. The heteroskedasticity test output is presented in Table 4.3.

Table 4.4: Heteroskedasticity Test Results

Economic growth as a dependent variable

F-statistic	0.127764	Prob. F (3,37)	0.9430
Obs*R-squared	0.420374	Prob. Chi-Square (3)	0.9360
Scaled explained SS	0.276527	Prob. Chi-Square (3)	0.9644

Total fertility rate as a dependent variable

F-statistic	0.773756	Prob. F (3,37)	0.5161
Obs*R-squared	2.420370	Prob. Chi-Square (3)	0.4899
Scaled explained SS	2.210719	Prob. Chi-Square (3)	0.5298

Table 4.4 above shows the null hypothesis of homoscedasticity was not turned down as an important p-value of 0.05 was less the accounted rate was 0.9360 for the GDP growth equation and 0.4899 for the TFR equation.

4.3.4 Autocorrelation Test/ Serial correlation tests

A serial correlation was undertaken to detect if error terms are consistent cross time. Breusch-Godfrey technique was used to confirm the serial correlation in data. The null hypothesis was that no first-order serial/correlation is there. Table 4.5 shows the serial correlation test output.

Table 4.5: Serial correlation output

: Dependent variable: Economic growth			
Obs*R-squared	5.299547	Prob. Chi-Square (2)	0.0707

: Dependent variable: Lagged Total Fertility rate			
Obs*R-squared	4.111458	Prob. Chi-Square (2)	0.1280

Serial correlation results show the absence of correlation of error terms across time periods since 0.0707 > 0.05 for the first equation where economic growth was the dependent variable. However, serial correlation existed in the model when the first difference of total fertility rate was treated as the dependent variable. Therefore, the lag value of economic growth (G (-1)) was used where there was no autocorrelation.

4.3.5 Test of exogeneity of Economic growth (G) and total fertility rate (TFR)

Table 4.6: Test of exogeneity of TFR

Dependent Variable: G

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TFR)	-18.71167	9.375880	-1.995724	0.0534
K	53.69737	13.02381	4.123017	0.0002
L	-10.13088	6.486395	-1.561867	0.1268
FITTEDTFR	-7.864009	11.64043	-0.675577	0.5035
R-squared	0.265599	Mean dependent var		4.068922
Adjusted R-squared	0.206053	S.D. dependent var		2.331884
S.E. of regression	2.077795			
Sum squared resid	159.7376			
Log likelihood	-86.05566			

The outcomes in Table 4.6 show that the value of the fitted value of TFR (FITTEDTFR) was not statistically remarkable at five percent level. Brooks (2008) shows that if a coefficient of a fitted value is not statistically significant, the variable of the fitted should be taken as exogenous and the equation should be estimated on its own sing OLS. However, Table 4.7 below shows that the coefficient of the fitted value of economic growth (FITTEDG) was statistically significant and hence economic growth was an endogenous variable. Two-stage least squares was applied to the estimation TFR equation since economic was endogenous.

Table 4.7: Test of exogeneity of lagged TFR

Dependent Variable: D(TFR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
G	-0.001080	0.002421	-0.446040	0.6581
D(CPR)	-0.000789	0.005967	-0.132267	0.8955
FITTEDG	-0.024107	0.003623	-6.654713	0.0000
R-squared	0.141149	Mean dependent var		-0.103659
Adjusted R-squared	0.095946	S.D. dependent var		0.036671
S.E. of regression	0.034868	Akaike info criterion		-3.804158
Sum squared resid	0.046199	Schwarz criterion		-3.678775
Log likelihood	80.98524	Hannan-Quinn criter.		-3.758501

4.4 Regression Results

4.4.1 Impact of total fertility rate on economic frowth

The results of estimation of the growth equation, where total fertility rate was one of the explanatory variables, are shown in Table 4.8. The ordinary least squares method was used since the test of exogeneity indicated that the growth rate was exogenous.

Table 4.8 A model for economic growth as a dependent variable.

Dependent Variable: Economic growth
Method: Least Squares
Sample (adjusted): 1979 2019
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
capital stock	0.498788	0.159296	3.131195	0.0034
labour	-0.097632	0.063088	-1.547561	0.1302
D(TFR)	-0.187117	0.093759	-1.995724	0.0534
C	0.009342	0.013829	0.675577	0.5035

R-squared	0.265599
Adjusted R-squared	0.206053
S.E. of regression	0.020778
Sum squared resid	0.015974
Log likelihood	102.7563
F-statistic	4.460404
Prob(F-statistic)	0.009009

In Table 4.8 results, the adjusted R-squared was 20.6 percent. The F- tests associated with R squared was given as 4.46, which was statistically remarkable at 5 percent. The significant of the F-statistic suggests that the overall regression was significant and that the explanatory variables jointly explained 20.6 percent of the total variation in economic growth.

Results in the table show that the coefficient of the growth rate of capital stock is 0.4988 which means that when capital stock increased by 1 percent, the growth rate of GDP increased by 0.4988 percent. This coefficient is shown to be statistically significant at 5 percent, which means that the growth of capital influenced the growth of GDP during the period under consideration.

Capital formation is crucial for getting long term, short term economic growth, rapid or persistent growth. Its availability for growth and development relies on investment spending which intern is impacted by the level of savings in the economy. An increase in the rate of capital formation raises the level of national income. This process of capital formation helps in raising national output (GDP).

The results show that the coefficient of labour was negative, given as -0.0976. This coefficient was not statistically significant at 5 percent level implying that the growth of labour was not an important variable in influencing economic growth during the period under consideration.

Additionally, the variable of interest which was the total fertility rate is shown to have a negative coefficient as expected. This coefficient was statistically significant 10 percent level. This coefficient can be interpreted to mean that increase in the total rate of fertility negatively affected economic growth during the period under.

These results agreed with Li (2016) who did research on the linkage between fertility rate and economic growth in developing nations and realized that total fertility rate and growth of economy were negatively related. The findings also supported the results of Malthus that population growth decreases the per capita output.

As the population increase, the government spends more money to feed the population and budgets little money for development. The high growth of population reduce public and

private capital formation, creates pressures on limited natural resources and diverts additions to capital resources to maintaining rather than raising the stock of capital per worker.

The rate of fertility is an important factor in the growth of the economy. The beginning stage of economic growth leads to some level of population growth, later, the fertility rate will start to decrease. Moreover, there is continued divergence of results in regard to the effects of the uncontrolled rate of fertility on economic growth. The discourse relating to the positive effects and negative effects of high fertility rates on economic growth remains contentious. A high population growth resulting from high fertility inflicts pressure on the growth of domestic savings and public facilities. At the same time, a higher population due to the high rate of fertility offers a huge market for goods and services. Malthus (1798) emphasized a crucial linkage between the rate of fertility and economic growth (Weil, 2013). Unregulated fertility presents health problems for children and their mothers, hinders human capital investment while the slowing rate of growth of the economy. However, it is also crucial to note that higher fertility implies a sufficient labour force and the availability of a huge market for products and services.

4.4.2 Effect of economic growth on total fertility rate

The study employed Two-Stage Least Squares to estimate the model equation of the study. Two-Stage Least Squares is appropriate since it can provide consistent estimates of a regression equation when controlled experiments are not possible. The 2Stage Least Squares with the first difference of total fertility rate as a dependent variable is illustrated in Table 4.9.

Table 4.9 Equation for Total Fertility Rate as a dependent variable

Dependent Variable: D(Total Fertility Rate)
Method: Two-Stage Least Squares
Sample (adjusted): 1979 2019
Included observations: 41 after adjustments
Instrument specification: K L D(CPR1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
G1	2.720726	9.517032	0.285880	0.7766
D(CPR1)	-2.123082	2.184057	-0.972082	0.3373
G(-1)	-0.013049	0.095509	-0.136627	0.8921
C	-0.129293	0.054323	-2.380081	0.0226

The lag value of g was used to correct for autocorrelation.

Results in Table 4.9 shows that the value of economic growth is 2.7207. This coefficient is shown to be statistically not significant at 5 percent level which means that economic growth does not influence the total fertility rate during the period under consideration.

The results also show that the coefficient of contraceptive prevalence rate was negative, given as -0.0212. This coefficient was not statistically significant at 5 percent level which means contraceptive use did not influence the total fertility rate during the period under consideration.

Some scholars posit that in a developing country reduced fertility only raises income per capita. It should also be noted that a high fertility rate may imply a sufficient labour force that

is expected to boost economic growth. This is a special case in China where a large population drives economic growth. The association between economic growth and the rate of fertility may turn from being negatively related to positively related. For instance, Gallor (2012) noted that at high rates of socio-economic growth, as predicted by HDI, the linkage in between economic growth and women's fertility turns from negative to useful.

Further, Ashraf, Weil, and Wilde (2013) noted that greater useful impacts of the decline of fertility which, in turn, leads to quicker growth of the economy. According to Dominiak, Lechman, and Okonowicz (2015), the future effect of economic growth on fertility trends is sensitive to in-time variations and ambiguous. The growth of the economy has caused many countries to a remarkable decrease in total fertility rates and that economic growth to a certain point constitutes a channel of reversing ways paths in relation to total fertility rates in countries with high-income homes. Further, Li (2016) established that the growth of the economy emerges at the start of the high fertility rate; with the acceleration of economic growth, the fertility rate reduces. However, Fox, Klüsener, and Myrskylä (2015) in their research to determine if there exists a useful impact of fertility on economic growth in Europe covering the period 1990- 2012 presented a weak undesirable linkage between fertility and growth of economy most nations but also with a positive relationship in some countries.

CHAPTER FIVE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.1 Summary of Findings

The linkage existing between fertility rate and economic growth remains contentious. In Kenya total fertility rate keeps on changing impacting per capita income. Moreover, there is continued divergence of results in regard to the impacts of the uncontrolled rate of fertility on the growth of the economy. The discourse relating to the positive effects and negative effects of high fertility rates on economic growth remains contentious. An increase in population is due to a high fertility rate. High population inflicts pressure on the growth of domestic savings and public facilities. At the same time, a higher population resulting from high fertility rates offers a huge market for goods and services. The general objective was to establish a relationship existing between economic growth and the fertility rate in Kenya. Particular objectives are; investigate how fertility rate affects economic growth in Kenya, determine how economic growth affects fertility rate in Kenya, and to determine the causality association between fertility rate and economic growth in Kenya.

The first objective sought to investigate if the fertility rate affects economic growth in Kenya. The objective was accomplished by running OLS regression where total fertility rate was one of the explanatory variables. The results provided evidence of the negative effect of fertility on economic growth in Kenya during the period under consideration. The results also showed that capital growth was an important variable influencing economic growth in Kenya. However, it was that labour growth did not have any impact on economic growth.

The second objective investigated the impact of the economic increase in the fertility rate in Kenya. The results showed that economic growth did not influence fertility in Kenya for that period.

5.2 Conclusions

From the findings, it can be concluded that overall fertility is an important factor in Kenya's economic growth. This conclusion was supported by the result that the total fertility rate has a negative relationship with economic growth. Another conclusion that can be drawn from the results is that capital is the most important variable for Kenya's economic growth.

The study also concluded that labor growth does not seem to be a significant factor in economic growth. The study also concluded that fertility does not grow the economy and that economic growth does not lead to birth.

5.3 Policy Implications

The government should continue emphasizing the control of the population. Population control results in a reduction in the total fertility rate. As the results showed, a reduction in the total fertility rate increases economic growth. The policies to reduce population control include family planning services.

Another implication from the findings is the need to promote the growth of capital in the economy. This can be achieved through the lowering of interest rates on borrowing. However, given that bank rates are no longer controlled by the government, the government can give subsidies on capital investment to forms and individuals which simply reduces the price of capital for the investors.

5.4 Suggestions for further research.

This study established a link between Kenya's economic growth and fertility. However, there are many other birth-related factors that affect economic growth. Factors include the age structure of the population and life expectancy of the population. Further research is needed to determine the impact of population age composition and life expectancy on economic growth.

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APPENDICES

Appendix I: Data collection sheet

year	CAPSTOCK in USD	%CAPSTOCK	Total Labor	%Labor	%FEMALITE	%CONTRA	FRPW	GDP growt
1977	75839257813	4.000	1063000	2.000	31.174	4.900	7.695	9.454
1978	80164046875	5.703	1085000	2.070	33.043	7.000	7.618	6.912
1979	83577414063	4.258	1157000	6.636	34.831	7.900	7.538	7.615
1980	86768203125	3.818	1191000	2.939	33.880	8.300	7.455	5.592
1981	90086468750	3.824	1244000	4.450	36.183	10.100	7.365	3.774
1982	91871312500	1.981	1280000	2.894	36.077	13.200	7.268	1.506
1983	93084726563	1.321	1339000	4.609	45.215	16.500	7.160	1.309
1984	94337015625	1.345	1340000	0.075	48.098	17.000	7.042	1.755
1985	95665312500	1.408	1423000	6.194	44.576	19.890	6.911	4.301
1986	97703734375	2.131	1537000	8.011	43.725	20.020	6.763	7.178
1987	99856804688	2.204	1615000	5.075	44.896	21.970	6.599	5.937
1988	102100000000	2.246	1736000	7.492	48.164	24.050	6.425	6.203
1989	104437921880	2.290	1796000	3.456	52.509	26.900	6.244	4.690
1990	107064132810	2.515	1894000	5.457	49.126	28.930	6.066	4.192
1991	109256359380	2.048	2557000	35.005	48.961	29.040	5.901	1.438
1992	111085656250	1.674	2753000	7.665	53.208	30.070	5.755	-0.799
1993	112353945310	1.142	2998000	8.899	57.929	32.700	5.633	0.353
1994	114623085940	2.020	3356000	11.941	55.663	34.300	5.535	2.633
1995	117881312500	2.843	3859000	14.988	66.308	35.100	5.459	4.406
1996	133456656250	13.213	4314000	11.791	58.821	36.400	5.400	4.147
1997	137310562500	2.888	4707000	9.110	61.300	37.100	5.348	0.475
1998	142973062500	4.124	5100000	8.349	69.822	39.000	5.296	3.290
1999	147646187500	3.269	5493000	7.706	70.463	39.010	5.239	2.305
2000	152961484380	3.600	5912000	7.628	77.893	39.150	5.178	0.600
2001	158159265630	3.398	6367000	7.696	76.364	39.310	5.112	3.780
2002	162332781250	2.639	6852000	7.617	74.936	39.370	5.045	0.547
2003	166050687500	2.290	7330000	6.976	72.893	39.300	4.979	2.932
2004	170516640630	2.690	7999000	9.127	71.197	40.020	4.913	5.104
2005	177885390630	4.321	8505000	6.326	70.762	41.200	4.843	5.907
2006	186664187500	4.935	8993000	5.738	68.054	41.600	4.767	6.472
2007	196768515630	5.413	9479000	5.404	66.863	43.900	4.682	6.851
2008	206269515630	4.829	9946000	4.927	68.067	45.010	4.587	0.232
2009	215996359380	4.716	10400000	4.565	68.751	45.500	4.482	3.307
2010	228498656250	5.788	10960000	5.385	70.019	48.070	4.369	8.406
2011	241457906250	5.671	11475000	4.699	71.204	49.530	4.248	6.108
2012	256840921880	6.371	12761000	11.207	71.846	51.700	4.123	4.563
2013	271860812500	5.848	13517000	5.924	72.512	56.800	3.999	5.879
2014	289096906250	6.340	14356000	6.207	74.006	58.000	3.879	5.357
2015	304855531247	5.451	14758500	2.804	75.013	66.300	3.765	5.719
2016	320983523432	5.290	15565600	5.469	76.018	61.600	3.663	5.879
2017	337111515617	5.025	16471400	5.819	76.927	60.545	3.572	4.863
2018	353239507802	4.784	17296000	5.006	78.189	55.800	3.440	6.320
2019	369367499987	4.566	18427000	6.539	79.047	58.060	3.368	5.700