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Assessing the Optimal Inflation Rate for the Kenyan Economy

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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ABSTRACT

This study seeks to estimate the optimal level of inflation for the Kenyan economy that is favorable for its economic growth by using time-series dataset for the period 1981 to 2014. The study adopts a model proposed by Ademola & Aiwo (2006) to examine the existence of threshold level effects in the inflation-growth relationship. The estimated model suggests a 4 percent optimal level of inflation above which inflation retards economic growth.

Key words: inflation, optimal inflation rate, economic growth

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GDP	–	Gross Domestic Product
NAIRU	–	Non-Accelerating Inflation Rate of Unemployment
CPI	–	Consumer Price Index

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CHAPTER ONE

INTRODUCTION

1.1 Background information

Inflation is a persistent tendency for the general price level to rise; where the general price level may be rising continuously over a fairly long period of time (Mishkin, 2007). High inflation rates have proved to have adverse effects in the economy. Some of these effects include; uncertainty of future prices, fall in the purchasing power of consumers, decrease in investments and savings, and decrease in the value of money. As a result of its effects, countries around the world are coming up with mechanisms that can help tame prices in order to achieve price stability. The aim of most countries is to maintain a stable inflation rate and keep the economy growing at the same time. Central banks are now placing greater emphasis on maintaining low inflation, and this raises the question of what the optimal rate of inflation should be.

According to Bernanke (1997) an optimal inflation rate is a numerical value of a central bank's long run inflation goal that it announces to the public. In addition, this rate should be consistent with the mandate to achieving price stability and high employment, having less harmful effects to the economy. Schott (2005) seems to have a similar view on the optimal inflation rate. It is one that is low and stable and helps promote economic growth. Getting the right inflation target is therefore crucial for the health of an economy. Policy makers are therefore required to maintain a stable price level as a goal of economic policy (Mishkin, 2007). Price stability as a result, is viewed as one of the most important roles of the central banks.

Some of the strategies that policy makers can use to achieve price stability include monetary targeting and inflation targeting. According to Mishkin (2007) a monetary target is achieved when a central bank announces that it will achieve a certain target of the annual growth rate of a monetary aggregate, for example, a 5 percent growth rate of M1(narrow money) or 6 percent growth rate of M2 (broad money). Although monetary

targeting has the key advantage of sending almost immediate signals to the public about monetary policy and the intentions to keep inflation in check, it is limited by the fact that there must be a strong and reliable relationship between the goal variable (inflation) and the targeted monetary aggregate. Mishkin (2007) goes on to add that if the relationship between the goal variable and the monetary aggregate is weak, monetary targeting will not work.

Another strategy that Mishkin (2007) brought out was inflation targeting, which is becoming more popular after New Zealand adopted it in 1970 and saw a remarkable decrease in its inflation rate and an increase in growth rate. Formlet (2010) defines inflation targeting as a framework for monetary policy, characterized by public announcement of official quantitative numerical target for the inflation rate or target range over one or more time horizons. It provides a rule-like framework on which the private sector can anchor its expectations about future inflation. It has proved to be more reliable because of its high level of transparency in making the central banks more accountable as well as reducing the time inconsistency problem. However, critics outline its major shortfall as delayed signaling (Mishkin, 2007). A change in the announcement of a new monetary policy may take a while before it effects are actually felt in the economy since the public may be initially unsure of what its implications are.

1.2 Kenya's profile

Kenya has experienced fluctuating growth rates over the past five decades. In 1970 the Kenyan economy was hit by world oil price shocks and balance of payments problems that negatively affected the economy and reduced the growth rate to -4.7 percent. The shortage of oil therefore caused prices to escalate increasing the inflation rates. The following period, 1971-1975 Kenya experienced a commodity boom in its major export crops which were tea and coffee. This increased Kenya's economic output and boost GDP rate to 23 percent (Dunne & Asaly, 2005)

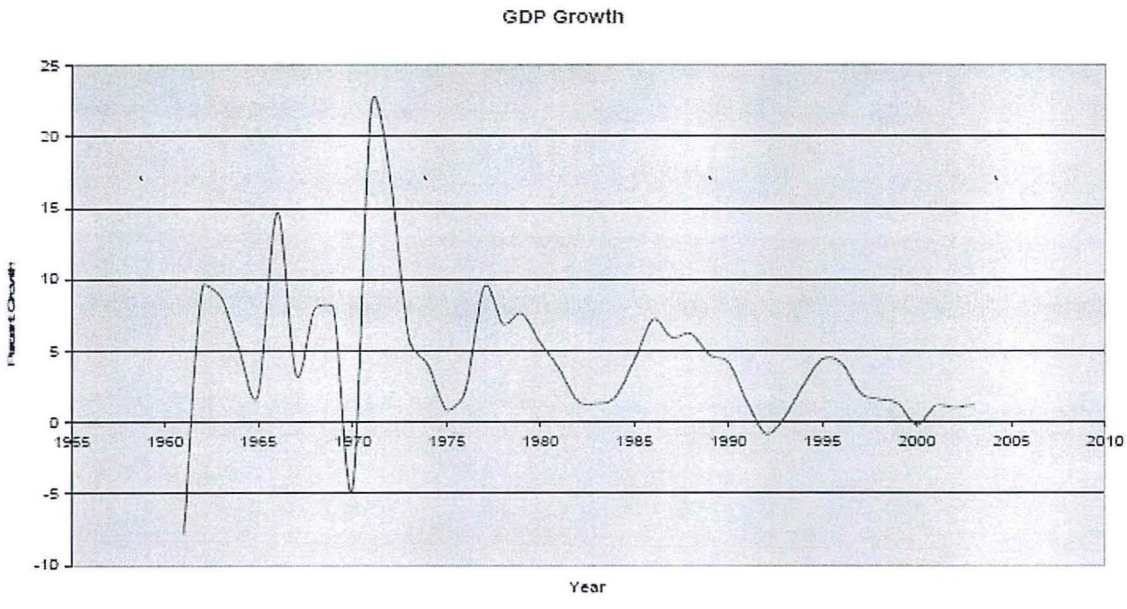
A spike in inflation occurred in the early 1990's. This was mainly a result of monetary expansions coupled with relaxation of rules governing the exchange of the Kenyan shilling with other currencies. As a result, there was a flood of Kenyan shillings into the domestic market causing the Kenyan shilling to depreciate translating to a drastic increase in inflation.

Growth rates declined and averaged between 4 percent and -0.8 percent (Dunne & Asaly, 2005). During the same period, there was an acute food shortage of major staple foods which included maize and sugar that caused their prices to rise. The monetary policy responded to the crisis by abandoning financial liberalization and opting for use of monetary instruments. It therefore targeted the interest rates and directly controlled the prices of goods. The economic environment was able to stabilize in the beginning of 1995 though the growth rate was sluggish.

Other historical events that negatively affected the economic outlook of Kenya included the 2007-2008 post-election violence, the global financial crisis in 2008 as well as terrorist attacks in 2013. The harmful impact was mainly felt in the investment and tourism sectors that later resulted to a decrease in the country's output.

The growth rate of the past ten decades has generally been high compared to the 1990's period mainly due to the prudent monetary policy mechanisms that the country put in place after forming the Monetary Policy Committee in 2008. Among its major objectives was maintaining price stability. Therefore it aimed at keeping inflation low at an allowable margin of 2.5 percent points on either side of the targeted medium inflation rate of 5 percent. Although the Monetary Policy Committee has managed to keep inflation low at the allowable margin, it is yet to achieve Kenya's vision 2030 that targeted an annual growth rate of 10 percent per annum.

Figure 1: GDP Growth Rates Since 1960



Source: World Bank

1.2 Problem statement

There has been notable research done regarding the relationship between inflation and economic growth and the effects it has on development. However, major emphasis has been laid on the debate of which level of inflation is most optimal other than obtaining the rate using economic variables. This study aims to contribute to the discussion further by doing an empirical analysis in the Kenyan context by incorporating population growth, investment growth as well as looking at the relationship between relative price variability with inflation in order to obtain the optimal inflation rate for the Kenyan economy. This study also aims to provide more information on whether the 5 percent inflation target set by the Monetary Policy Committee of Kenya is favorable for the Kenyan economy.

1.3 Research Questions

1. What is the optimal inflation rate for the Kenyan economy?
2. What is the relationship between inflation and economic growth in Kenya?

1.4 Research objectives

1. To determine the efficient optimal inflation rate for Kenya
2. To establish the relationship between inflation and economic growth in the Kenyan context.

1.5 Significance of the research

This study aims to contribute to existing literature by providing more information on the identification of the efficient optimal inflation rate for the Kenyan economy. It will also shed more light on the relationship between inflation and growth in Kenya. Hence it will be of value to policy makers and the Monetary Policy Committee of Kenya on making decisions regarding an inflation target that will see the country achieve its vision 2030 goal of economic sustainability

The study is also beneficial to researchers and academicians as it will be a useful guide for future researchers interested in undertaking a study on a similar topic.

CHAPTER TWO

LITERATURE REVIEW

2.1Theoretical literature

2.1.1 Phillips curve

The rationale behind the Phillips curve is that inflation and unemployment are inversely related. The concept of Phillips curve therefore hypothesizes that high inflation positively affects the economic growth by contributing creation of a low unemployment rate (Datta & Chandan, 2011). The rise of its popularity after Phillip proposed it in 1958 led to its use for forecasting inflation. Many economists such as (Mallik & Chowdhury, 2001) argue that Phillips curves should continue to play such a role because they summarize empirical relationships critical for policymaking. In its simplest form, Atkeson & Ohanian (2001) used the NAIRU Phillips curve to forecast inflation. For the exercise, Atkeson & Ohanian used the GDP deflator as the measure of inflation. The naive model predicted that inflation over the next four quarters is expected to be equal to inflation over the previous four quarters:

Equation 1

$$E_t = (\pi_{t+4} - \pi_t) = 0$$

In equation 1, π_t represents the percentage change in the inflation rate between quarter's t to 4 and t.

The forecasts from the NAIRU model specify that the expected change in the inflation rate over the next four quarters is proportional to the unemployment rate, u_t minus the NAIRU, $\bar{u}$:

Equation 2

$$E_t(\pi_{t+4} - \pi_t) = \beta(u_t - \bar{u})$$

In equation 2, u_t is the unemployment rate in quarter t,$\bar{u}$ is the model's NAIRU (where the change in inflation will be zero), and β is the slope of the Phillips curve. To construct the forecast for each quarter from the NAIRU Phillips curve, Atkeson & Ohanian estimated the parameters β and $\bar{u}$ with ordinary least squares, using the data for the unemployment rate and changes in the inflation rate from the first quarter of 1970 up to the specific forecast quarter. (Atkeson & Ohanian, 2001)

But arguments against the Phillips curve state that the two major goals of interest to economic policy makers being low inflation and low unemployment quite often conflicted under this framework (Umaru, 2012)

Economists such as Friedman (1969) asserted that the Phillips curve was only applicable in the short run. In addition, inflationary policies would not decrease unemployment in the long run because both inflation and unemployment would decrease.

2.1.2 Friedman rule

According to Friedman, the optimal rate of inflation must be negative to equalize the marginal cost and benefit of holding money (Olivier, Gorodnichenko, & Wieland, 2011). The Friedman rule states that, to avoid any social waist in economizing on real balances, nominal interest rates should be brought down to zero (Antinolfi, Azariadis, & Bullard, 2014). This implies in particular that the optimal rate of inflation is a constant but moderate rate of price deflation. As per the rule, a positive nominal interest rate generates inefficiency losses for society as there stands a gap between the private marginal cost of holding money, which is nominal interest rate, and the social marginal cost of producing money (Friedman, 1969). However this rule has been criticized by a number of scholars. There is evidence on negative impact of deflation to the economy. For instance, in the 1970's Japan's economy was hard hit by persistent deflation that saw its economy experience a period of stagnation as well as fall into a deflation trap. There was also a tendency of consumers delaying to make purchases in anticipation of falling prices causing them to fall further, worsening the situation. As a result its central bank adopted quantitative easing to pump money directly into the economy in order to stimulate the

economy by kick-starting growth and getting prices to rise again (Nishizaki, Sekine, & Ueno, 2012).

In the long run some economists such Wang & Xie (2013) argue that the optimal inflation rate should be higher to give more room for real interest rates to fall when are hit by negative shocks.

2.2.3 New Keynesian View

According to Umaru, (2012) the New Keynesian approach considers changes in public expenditure or the nominal money supply and assumes that expected inflation is zero. Olivier et al. (2011) Share a similar view. They point out that New Keynesian models rely on the assumption of zero steady inflation, especially in welfare analysis. Furthermore, it implies that the optimal weight on the variance of the output gap in the welfare loss function is small. Umaru, (2012) notes that as a result of its assumptions, aggregate demand increases the real money balances and therefore decreasing with the price level. The neo-Keynesian theory focuses on productivity. This is because declining productivity signals diminishing returns to scale and induces inflationary pressures, resulting mainly from over-heating of the economy and widening output gap (Olivier, Gorodnichenko, & Wieland, 2011).

2.2.4 Monetarist view

The monetarists view on inflation is based on the quantity theory of money (Umaru, 2012). This implies that the quantity of money is the main determinant of price level such that change in the quantity of money produces an exactly direct and proportionate change in the price level. The relationship between price level and supply of money is given by the following equation of exchange:

Equation 3

$$MV = PQ$$

Where M represents the quantity of money; V represents the velocity of money; P is the price level and Q represents the volume of transactions.

Since price level in the economy increases in the same proportion as the quantity of money increases, the rate of inflation is therefore given by:

Equation 4

$$P = M$$

Contrary to the monetarists, the Keynesians view an indirect and non-proportional relationship between quantity of money and price level in the economy.

2.3 Empirical literature

Mallik & Chowdhury (2001) found a positive relationship between GDP and inflation in a study carried out in south Asian countries that included Bangladesh, India, Pakistan and Sir Lanka. They used cointegartion and Error Correction Models (ECM) to examine the extent to which economic growth is related to inflation. Their results showed that growth rate and inflation rates were cointegrated and there existed a long-run relationship between growth rates and inflation rates in all four countries. In addition, Mallik & Chowdhury (2001) argued that attempts to reduce inflation to lower rates by policy makers would likely adversely affect economic growth. Diebold et al. (2006) share a similar view. They note that higher inflation is associated with moderate gains in domestic product.

Ademola & Aiwo (2006) studied the existence of threshold effects in the inflation and growth relationship in the Nigerian economy. They found that there exists a threshold level of 6 percent. Below this level, there existed a significant positive relationship between inflation and economic growth, while above this threshold level inflation diminishes growth performance. The study suggested that bringing down the optimal inflation rate to a low digit should be the goal of the monetary policy. This is contrary to Mallik & Chowdhury's (2001) proposal of higher optimal inflation rates.

Billi & Kahn (2008) note that policy makers and economists still seem to disagree on how much the central bank should aim to keep inflation. Their argument for not keeping inflation too low was that nominal rates may approach zero, limiting the central banks'

ability to stabilize the economy by lowering the policy rate. Furthermore, they found that the incidence of hitting a zero rate bound falls quickly as the inflation objective rises from 0 percent to roughly 4 percent. The variation of output and inflation falls steadily but a t a decreasing rate as the inflation objective rises (Billi & Kahn, 2008).

Since the 2008 global financial crisis, debates have risen to question on the effectiveness of the optimal inflation rates set by central banks'. Contrary to most economists, Blanchard (2010) argues that getting high optimal inflation rates thus high average nominal interest rates is more effective especially in periods when the economy is hit by a crisis. In addition Blanchard justifies that higher inflation rates before a crisis would give more room for monetary policy to be eased during the crisis and will result in less distortion of fiscal positions.

Olivier et al. (2011) examined the effects of positive steady state inflation in New Keynesian models subject to the zero-bound on interest rates. In an attempt to solve for the optimal inflation rate, they derived a utility based welfare loss function, taking into account the effects of positive steady state inflation. Their findings revealed a 2 percent optimal inflation rate even after considering variety of extensions that included optimal stabilization policy, price indexation, state dependent price stickiness, capital formation and downward nominal rigidities (Olivier, Gorodnichenko, & Wieland, 2011). In a similar study carried out by Barro (2013), there was evidence that adverse effects of inflation came from the experience of high inflation. For instance the study revealed that the decrease in GDP lowered the standards of living over long run periods.

Caraballo & Dabús (2013) took a different approach in analyzing inflation by studying the relationship between inflation and relative price variability (RPV) in Spain during the 1987 to 2009 period. Their results revealed a U-shaped profile and that the optimal inflation rate that minimized the RVP was 4 percent. This was higher than the 2 percent inflation target proposed by the European Monetary Union.

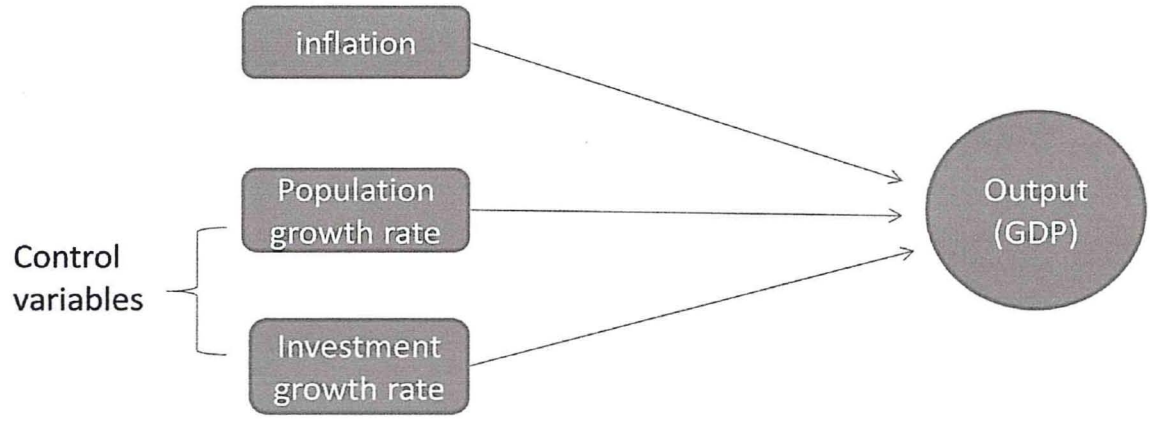
2.4 Gap in Literature

From the above discussions, there is evidence that scholars seem not to agree on the optimal inflation rate that central banks and policy makers should adopt. While Mallik & Chowdhury (2001) as well as Blanchard (2010) and Caraballo & Dabús (2013) find a higher optimal inflation rate more effective, Ademola & Aiwo (2006) and Friedman (1969) seem to prefer a lower rate, one that tends toward a zero bound. This therefore calls for further research on the topic and in particular to investigate the optimal rate that would be most effective for the Kenyan economy.

2.5 Conceptual Framework

The study analyzes the relationship between inflation and economic growth as depicted in the diagram below.

Figure 2



GDP represents the dependent variable while inflation, population growth rate and investment growth rate are the independent variables. The control variables will be held constant in order to assess the relationship between inflation and GDP.

CHAPTER THREE

METHODOLOGY

3.1 Research design

This research adopts an explanatory study. This is because the research seeks to assess the relationship between inflation and growth in the Kenyan economy, as well as finding the optimal inflation rate.

3.3 Sampling design

The study analyses the growth and inflation rates in Kenya using annual data between 1981 and 2014. This period was selected because it captures the periods in which Kenya just gained independence and experienced changes in its monetary and fiscal policy. It was also marked by high inflation rates in 1980's, a change in governance in 2002, economic recession in 2007 famine and acute food shortage in the late 1990's. This would enable the assessment of the economy and finding the optimal inflation rate.

3.4 Data Analysis

To achieve the objectives of this study, the method proposed by Ademola & Aiwo (2006) is used. In order to examine the relationship between inflation and growth rate, the research will first study this relationship during the 1981 to 2014 period using Granger Causality Test to find out causality between inflation and GDP. Secondly, the optimal inflation rate will be estimated by running a Least Squares regression of a four-variable model consisting of economic growth, inflation rate, population growth rate and investment growth rates. Here, the optimal inflation rate will be defined as one that minimizes the sum of residual squares (RSS).

3.4.1 Model Specification

The model requires the growth rate of all variables constructed at the first difference of logarithmic transformation. According to Eliot & Timmermann (2008), this will help eliminate partially the strong asymmetry that is usually associated with inflation distributions. The scholars used the following model:

Equation 5

$$d\log(Y_t) = \beta_0 + \beta_1 \log(\pi_t) + \beta_2 D_t^{\pi^*}[\log(\pi_t) - \log(\pi^*)] + \eta\chi_t + \varepsilon_t$$

$$D_t^{\pi^*} = \begin{cases} 1: \pi_t > \pi^* \\ 0: \pi_t < \pi^* \end{cases}$$

In equation5,

$d\log(Y_t)$: represents growth rate of real GDP

π_t : represents inflation rate based on CPI

π^*: is the threshold level of inflation

$D_t^{\pi^*}$: is a dummy variable defined as value one for inflation levels greater than the threshold level of inflation and zero otherwise

χ_t: is a vector of control variables that consists of population rate and investment growth rate.

The choice of variables is guided by empirical literature. In a research carried out by Solow (1956), he proposed a neo-classical model of growth by taking the rate of growth of population as one of the exogenous variables in the model to show that the faster the population growth, the poorer the country. Ademola & Aiwo (2006) use inflation in their model to show that inflation reduces growth by reducing investment and productivity growth.

In equation 5, the term $[\log(\pi_t) - \log(\pi^*)]$ makes the relationship between growth and inflation continuous at the threshold level π^*. The value of π^* is given arbitrarily for estimation purposes. Ademola & Aiwo (2006) further point out that the parameter π^* has the property that the effect of inflation on GDP growth is given by β_1 when inflation is less or equal to π^* percent, and $(\beta_1 + \beta_2)$ when inflation rates are higher than π^* percent.

Identifying the value of threshold inflation level and its impact on growth performance involves estimating equation 5 and computing residual sum of squares (RSS) for the threshold level of inflation ranging from π_1 to π_h. The optimal level, π^* is one that minimizes the sequence of RSS's (Ademola & Aiwo, 2006)

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter looks at the research findings, interpretation and discussions. It is presented as follows; section 4.1.2 gives a brief review of descriptive statistics of the variables which include growth rate and inflation rate, section 4.1.3 outlines the stationarity test analysis of each of the included variables in the model. The final section provides the estimated model results and the diagnostic tests.

4.2 Descriptive Statistics

Figure 3 shows the trend of population growth rate from 1981 to 2014. As shown, there has been a decreasing downward trend over the period covered in the study.

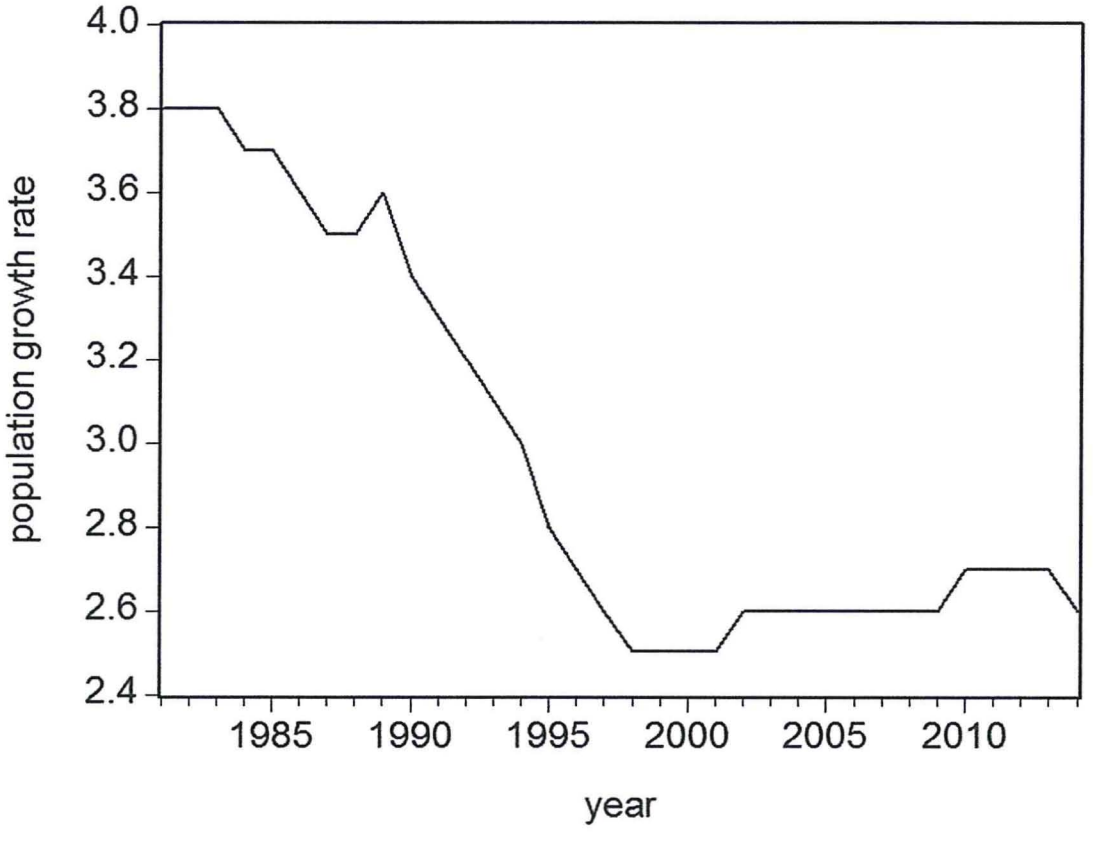


Figure 3: Trending annual population growth rate from 1981 to 2014

Source of the data: World Bank

Population dropped sharply in1990 and continued to decrease in the following years. This was mainly attributed to the introduction of birth control and family planning awareness. Growth rates later peaked slightly in 2003.

Inflation rates exhibited a highly volatile trend characterized by major shocks in 1994 and 2008 as shown in figure 4. The cause of the 1994 shock was mainly by the increase of oil prices in the early 1990's that caused world food prices to go up. As for the peak in 2008, the increase of inflation rates in the country was attributed to the post election violence and the global financial crisis.

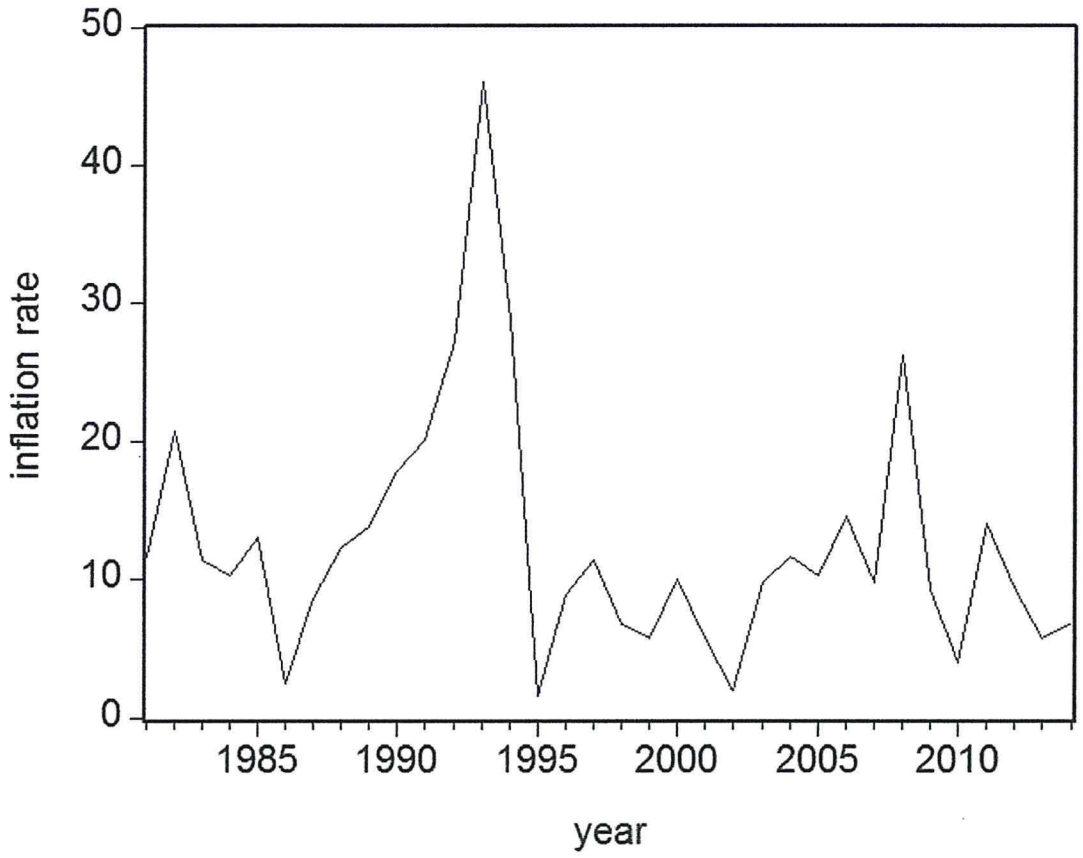


Figure 4: Trending annual inflation rate from 1981 to 2014

Source of the data: World Bank

Figure 5 shows the trend in investment growth rate that appears to be volatile as well. The period 2005 to 2014 showed an upward trend indicating an increase in investment activity in the country which was mostly done in the construction sector.

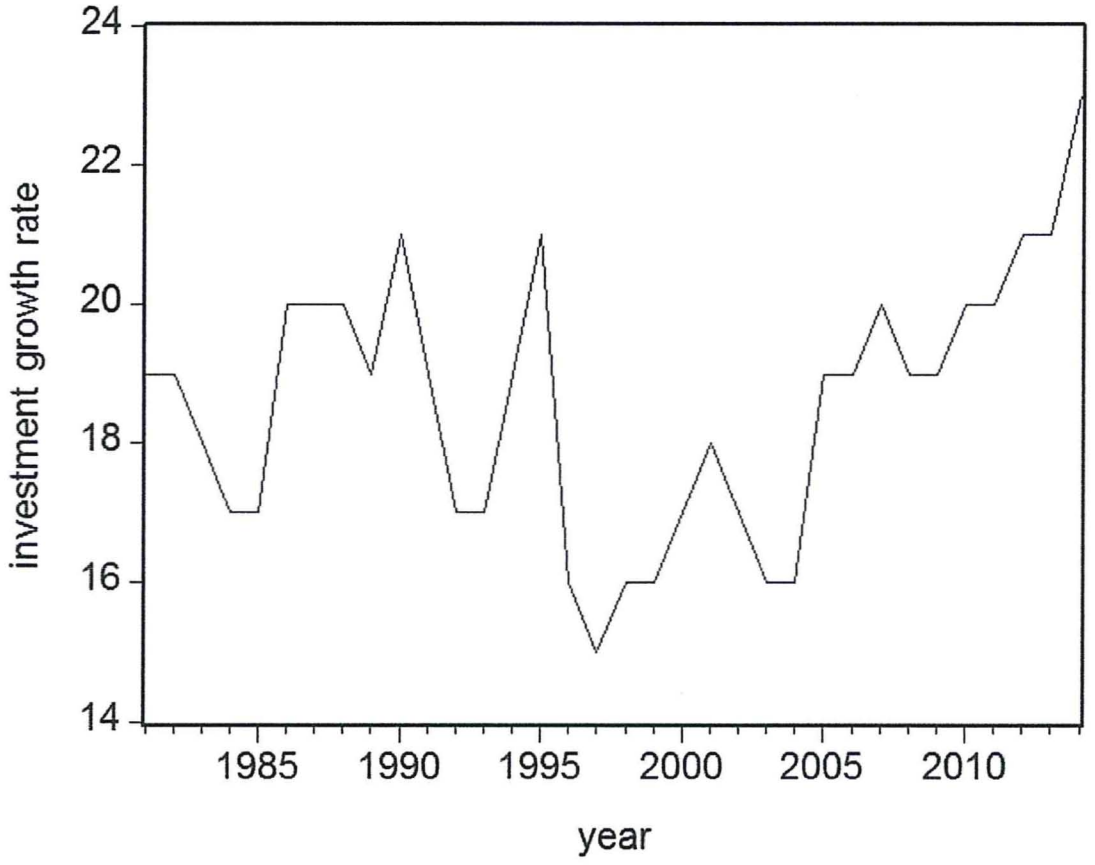


Figure 5: Trending annual investment growth rate from 1981 to 2014

Source of the data: World Bank

GDP growth rates also exhibited high volatility during the period under study characterized by high growth rate periods followed by sharp decreasing periods. Growth rates were also adversely affected by macro-economic events that included the early 1990's increase in oil prices, 2008 post-election violence and the credit crisis. Growth rates maintained a stable trend of 4 to 6 percent in the period 2011 to 2014 due to improved macro-economic policies.

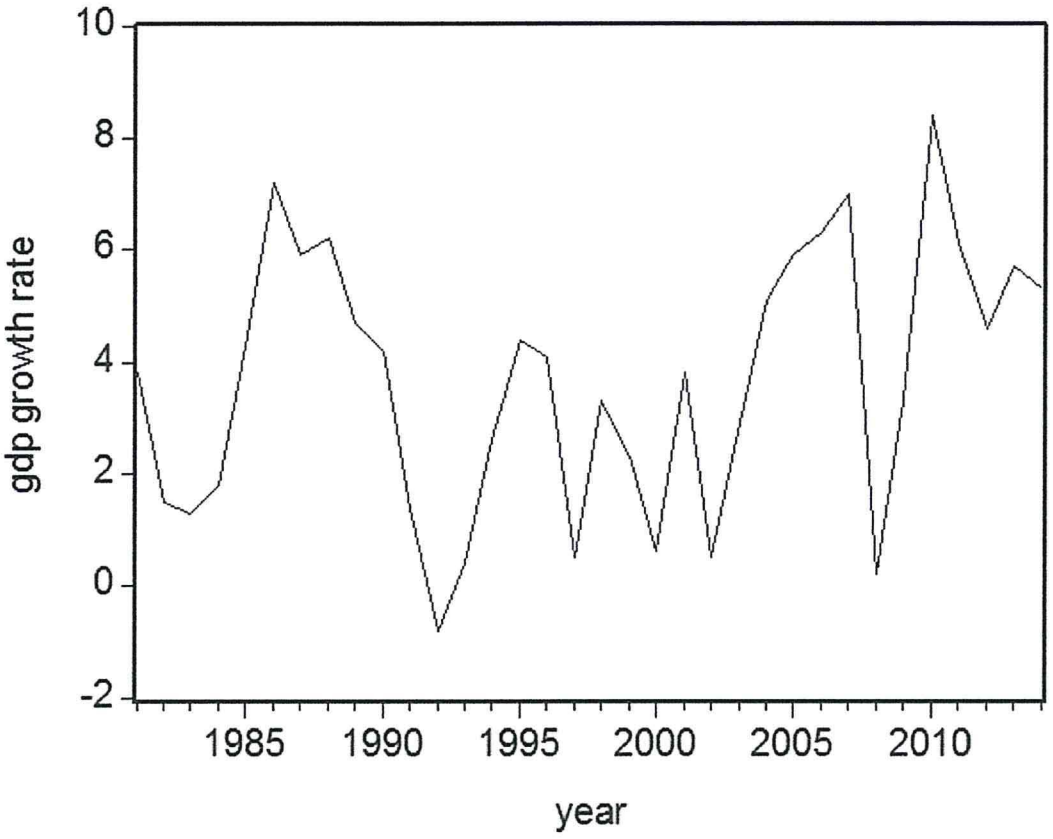


Figure 6: Trending annual gdp growth rate from 1981 to 2014

Source of the data: World Bank

4.3 Stationarity Test Analysis

Before caring out regression of the model, the data is required to be stationary since non-stationary data leads to spurious results. This implies that although the diagnostics which include R-squared and F-statistic may look attractive, the results will yield no meaningful relationship between the variables. In addition, Gujarati & Porter (2009) also note that the statistics from such a spurious regression are misleading and therefore cannot be used for testing hypotheses about the parameters.

Results of the unit root test on the model variables are summarized as shown in the tables.

Table 1: Stationarity test results at level

Variables	ADF Test		Conclusion
	Test statistic	Critical value At 5 percent	
Log GDP	-5.276	-2.960	Stationary with five lags
Log Inflation rate	-4.428	-2.954	Stationary with eight lags
Log Population rate	-1.838	-2.960	Non-stationary
Log Investment growth rate	-2.075	-2.950	Non-stationary

Log GDP and Log inflation variables were found to be stationary at level but the rest of the variables were found to be non-stationary at level hence the need to determine the order of integration of the variables.

Table 2: Stationarity test results at 1st difference

Variables	ADF Test		Conclusion
	Test statistic	Critical value At 5 percent	
Log GDP	-5.276	-2.960	Stationary with five lags
Log Inflation rate	-7.013	-2.960	Stationary with eight lags
Log Population rate	-3.535	-2.957	Stationary with eight lags
Log Investment growth rate	-5.491	-2.960	Stationary with eight lags

All the variables were stationary at first difference as shown in the table above. This meant that the variables are integrated of order I (1).

4.4 Cointegration Test

After conducting the unit root tests, Cointegration test using Johansen Cointegration Test was carried out to determine whether there existed long run relationships between the variables.

The results are shown in table 3.

Table 3: Johansen Cointegration Test Results

Series: LGDP LINV LINF LPOP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegartion Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.741950	67.48667	47.85613	0.0003
At most 1	0.482891	28.20319	29.79707	0.0755
At most 2	0.204507	9.077627	15.49471	0.3583
At most 3	0.080779	2.442634	3.841466	0.1181

The results obtained showed that there is at most one cointegration relation between GDP growth rate, inflation rate, investment growth rate and population growth rate. Thus implying a long run association among the variables since the null was rejected at 5 percent. (0.0755>0.05)

4.5 Granger Causality Test

In order to achieve the second objective of finding out the relationship between inflation and economic growth in Kenya, a Granger Causality Test was carried out.
The results are shown in table 4.

Table 4: Granger Causality Test results

Sample: 1981 2014
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
LINF does not Granger Cause LGDP	29	0.12153	0.88610
LGDP does not Granger Cause LINF		6.16051	0.00693

The results in table 4 show that the first null hypothesis was not rejected, which means that inflation rate does not Granger-Cause GDP growth. However, the second null hypothesis was rejected, implying that GDP growth Granger-Causes inflation therefore the relationship between inflation rate and GDP growth is unidirectional.

4.6 Model Results and Diagnostic Tests

4.6.1 Regression Analysis

To find the optimal level of inflation, equation 5 was estimated and the RSS was computed for the threshold level of inflation ranging from π_1 (2 percent) to π_{15}(15 percent)

Table 5: Optimal Inflation Rate Estimation Results

π^*	variable	coefficient	t-stat	Prob.	RSS
2	L INF D_2*(INF-2) LINV2 LPOP2	0.929 -0.115 4.123 -3.322	6.906 -4.798 2.379 -0.557	0.000 0.000 0.024 0.581	18.07
3	L INF D_3*(INF-3) LINV2 LPOP2	0.871 -0.112 4.097 -3.391	7.069 -4.840 2.373 -0.570	0.000 0.000 0.024 0.572	17.93
4	L INF D_4*(INF-4) LINV2 LPOP2	0.816 -0.109 4.110 -3.501	7.203 -4.863 2.863 -0.590	0.000 0.000 0.024 0.559	17.85
5	L INF D_5*(INF-5) LINV2 LPOP2	0.764 -0.106 4.161 -3.320	7.246 -4.820 2.407 -0.557	0.000 0.000 0.023 0.581	18.00
6	L INF D_6*(INF-6) LINV2 LPOP2	0.716 -0.104 4.218 -3.112	7.269 -4.776 2.430 -0.521	0.000 0.000 0.021 0.606	18.14
7	L INF D_7*(INF-7) LINV2 LPOP2	0.676 -0.103 4.298 -2.902	7.271 -4.738 2.469 -0.484	0.000 0.000 0.019 0.631	18.28
8	L INF D_8*(INF-8) LINV2 LPOP2	0.640 -0.102 4.420 -2.951	7.265 -4.714 2.535 -0.491	0.000 0.000 0.017 0.626	18.37
9	L INF D_9*(INF-9) LINV2 LPOP2	0.603 -0.101 4.525 -3.050	7.199 -4.657 2.583 -0.505	0.000 0.000 0.021 0.617	18.56
10	L INF D_{10}*(INF-10) LINV2 LPOP2	0.571 -0.100 4.517 -3.291	7.019 -4.508 2.542 -0.536	0.000 0.000 0.016 0.596	19.08
11	L INF D_{11}*(INF-11) LINV2 LPOP2	0.551 -0.102 4.575 -3.426	6.947 -4.472 2.567 -0.556	0.000 0.000 0.015 0.582	19.21
12	L INF D_{12}*(INF-12)	0.535 -0.105	6.937 -4.509	0.000 0.000	19.08

	LINV2 LPOP2	4.616 -3.668	2.598 -0.597	0.014 0.555	
13	L INF D_{13}*(INF-13) LINV2 LPOP2	0.523 -0.111 4.631 -3.912	6.932 -4.557 2.618 -0.639	0.000 0.000 0.014 0.527	18.91
14	L INF D_{14}*(INF-14) LINV2 LPOP2	0.512 -0.113 4.645 -4.015	6.886 -4.560 2.626 -0.655	0.000 0000 0.013 0.517	18.90
15	L INF D_{15}*(INF-15) LINV2 LPOP2	0.504 -0.117 4.647 -3.783	6.774 -4.464 2.604 -0.613	0.000 0.000 0.014 0.544	19.24

Table 5 represents the results estimated of the model from π^*=1 to 10 percent to search for the value of the optimal inflation rate. The results obtained show that 4 percent is the level that minimizes the RSS.

The estimated equation at this level of inflation is given by;

$$LGDP = 0.235 + 0.816(LINF) - 0.120D_4 * (INF - 4) + 4.110(LINV2) - 3.501(LPOP2)$$

R squared 0.3912 RSS_{min} 17.85

4.6.2 Diagnostic Tests

In order to determine whether the model was best suitable for regression, tests for the following features were carried out on the residuals;

a) Serial correlation
b) Heteroskedasticity
c) Normality

The results are summarized in the following table

Table 6: Diagnostic tests results

Test for residuals	P value	Conclusion
Serial correlation (LM Test)	0.6839	Residuals are not serially correlated
Heteroskedasticity		
White Heteroskedasticity (no cross terms)	0.9603	Residuals are not heteroskedastic
White Heteroskedasticity (cross terms)	0.7613	Residuals are not heteroskedastic
Normality (JB Test)	0.0985	Residuals are normally distributed

The tests were carried out at $\pi^*= 4$, and showed that the model was fit because all the three features were fulfilled and can therefore be used for forecasting. However, the model had a low R-squared of 39.12 percent that made it less significant.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter comprises of the summary and conclusions made from the study, limitations of the study, recommendations for policy and practice, and areas for further research.

5.2 Summary and Conclusions

This study aimed at finding the optimal inflation rate for the Kenyan economy, as well as the relationship between inflation and economic growth in Kenya. The results, using the model proposed by Ademola & Aiwo (2006) suggested that the optimal inflation rate for the Kenyan economy is 4 percent, which is lower than the 5 percent target set by the Monetary Policy Committee. This implies that any inflation rate above this optimal level seems to affect economic growth negatively. The study also found a unidirectional causality from economic growth to inflation.

Investment growth rate was found to have a positive relationship with economic growth while population growth did not have a significant influence on inflation rate as the results failed the significant test.

5.4 Limitations of the Study

A major limitation of the study was the unavailability of data from 1970 to 1980, as this was the initial plan for the study to perform the analysis. The use of data from 1981 therefore meant that the number of observations would reduce.

5.3 Recommendations for Policy and Practice

This finding suggests that bringing inflation down to a single digit should be the goal of the Monetary Policy Committee in Kenya while the optimal inflation target for economic growth should be set at 4 percent.

The government can also put in place policies that encourage investment activities in the country since it has been shown to have a positive impact on economic growth.

5.4 Areas for Future Research

Future research can build up on the model by increasing the list of control variables in order to gather more determinants of inflation rates in Kenya. This will help increase the information sources from the variables therefore aid policy makers on making decisions concerning what factors they need to control to keep inflation rates low and GDP growth rates high.

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