A STUDY ON THE IMPACT OF MACROECONOMIC POLICY ON OUTPUT GAP IN KENYA

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DECLARATION

I, the undersigned, declare that this research paper is my original work and has not been submitted to any other college, institution or university for the award of a degree or any other award.

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DEDICATION

I dedicate this work to my beloved family; my wife Esther Nduta Murimi, daughter Princess Grace Wambui and son FrankSteve Munene. My Father Stephen Ngatia Gitimu, Mum Grace Wambui Ngatia and my Brothers William Muriuki and Zachary Mureithi for their love, encouragement, caring, financial and moral support that served as an endless source of energy, motivation and strength that inspired me to reach this far. Thank you and God bless you all abundantly.

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My appreciation also goes to the Kenya National Bureau of Statistics (KNBS) for their valuable information which greatly helped me in carrying out the research project. The data enabled drawing the analysis on the impact of macroeconomic policies on output gap in Kenya.

LIST OF ABBREVIATIONS

HP	-	Hodrick - Prescott
GDP	-	Gross Domestic Product
OECD	-	Organization of Economic Corporation Development
CBK	-	Central Bank of Kenya
VAR	-	Variance auto regression
PEV	-	Post Election Violence
IMF	-	International Monetary Fund
NAIRU	-	Non-accelerating Inflation Rate of Unemployment
CPI	-	Consumer Price Index
OLS	-	Ordinary Least Squares
ADF	-	Augmented Dickey Fuller

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ABSTRACT

In developing countries serious output challenges persist to date. Most countries operate far below the optimal output path. This can be rationalized by the nature of the macroeconomic policies in place. This study reviews the impact of macroeconomic policies on output gap in Kenya. The study focuses is on the various methods of generating the output gap with bias towards output gap obtained using the Hodrick-Prescott filter. Estimation of an output gap model helps inform the importance of both the fiscal and monetary policy and which one among them is dominate the other. The study finds that monetary policy appears to be more effective in reducing output deviations from its potential levels. However, fiscal policy on the other hand appears to increase the output gap. The study thus recommends the need to have increased coordination of both the fiscal and monetary policy. In addition, the policy makers should utilize expansionary monetary policies to lower the output gap. Further, regulation of the government expenditure could ensure that funds are only channeled towards productive investments.

The data was gathered from secondary sources and mainly from Kenya National Bureau of Statistics

(KNBS). E-views statistical software was used to generate and estimate an output gap regression model and results presented using tables and figures to make interpretation easier and give clear picture of the findings. The knowledge generated will, among others aid in solving similar ouput gap challenges and pave way for further research work. The researcher therefore recommends that further research be undertaken to precisely widen the scope of the study and address the impact of macroeconomic policy on output gap.

CHAPTER ONE
INTRODUCTION

Background information

The basic conventional definition of Output gap is simply the difference between the potential and actual output (Branson 2005) or the variance (either positively or negatively) of the actual output from the potential in a given year. Potential output determines the maximum production level that an economy can attain in a given year with full employment of resources and without leading to rise in inflation (De Masi 1997). When actual output exceeds potential output, then excess demand pushes inflation upwards. This requires policy interventions, in this case, by monetary policy tightening or cut in government expenditure and vice versa in the case of excess capacity.

Output gap can be measured using five different techniques which includes; Hodrick-Prescott (HP) filter, Unobserved Components Method (Univariate Beveridge-Nelson Method and Multivariate Beveridge-Nelson Method), Linear method, Structural Vector Auto Regression method and Production Function method (Njuguna et al 2005).

1.1.1 Description of potential output and output gap

Measuring potential output and output gap involves the process of business cycle decomposition techniques of separating or splitting the trend (permanent component of a series) from its transitory or cyclical component (Stock and Watson 1991). Output gap is the transitory (cyclical component) that is usually either expansion or contraction from the trend (potential output also referred to as the permanent component).

Potential output is usually a projected estimate since it's not directly observable and its trend helps in determining the pace of sustainable growth. Output gap represents transitory movements from the potential output and its estimates provide a key yardstick against which to assess inflationary or disinflationary pressures as well as the cyclical position of the economy. Excess demand in an economy occurs when actual output exceeds the potential output. This is usually viewed as a source of inflationary pressures and requires appropriate policy interventions that reduce aggregate demand for instance, reduced government spending and a tight monetary policy. When potential output is greater than actual output there is excess capacity in the

economy and this requires easing of monetary conditions and application of other policies that can stimulate demand (De Masi 1997). The excess capacity implies unemployment of resources and by extension the higher the output gap (negative) the higher the unemployment rate in the economy (Branson 2005) Okun's law refers.

According to Donders and Kollau (2002), potential output and output gap have a direct impact on government fiscal policy. This is so because government revenues and expenditures usually depend on the actual cyclical state of the economy. In an upturn, there will be a budget surplus as a result of higher revenues and lower growth of expenditure. In a downturn, a budget deficit occurs as a result of low revenues and high expenditures. In this case, potential output and output gap can be used to determine cyclically adjusted budget balance. A cyclically adjusted budget balance can be defined as; the actual budget balance corrected for divergences of actual from potential output, and thus provides a measure of the government structural fiscal position.

1.1.2 Measurement of the potential output and output gap.

Estimating the level of a country's potential output and output gap is critically important in identifying a sustainable non-inflationary growth. Potential output is usually viewed as utmost alternative indicator of the aggregate supply side capacity of an economy making it important for adequate knowledge of its content to be sought by research. (Mc Morrow et al 2002).

According to Njuguna A. E. et al 2005, various techniques for measuring potential output and output gap have been developed. However, among them (techniques) none seem to be perfect as observed by the many researchers that had had interest in this field. Empirical results from the studies previously carried out show that, different methodologies and assumptions used in estimating potential output and output gap of an economy give varied results (among them are; de Brouwer 1998; Dupasquier, Guay and St-Amant 1999; Scacciavillani and Swagel 1999; and Cerra and Saxena 2000). In particular, from their conclusions, on the Case of Kenya, they found out that each method has prons and cons. They also observed, from their estimation results, that potential output level as well as its growth, together with the output gap, when various measurement methods were used, differed from one method to the other. Moreover, it was found that there is some consistency in the results from most of the methods implying that there can be a consensus on how the Kenyan economy and its potential capacity and its growth has been

performing over the years. However, they favoured the results derived from the HP method from their conclusions and argued that the results were a better reflection of the reality, less data used and fewer assumptions made while using the method. Therefore their study believed that there were fewer errors in the HP Filter results.

The challenge encountered is usually due to the fact that none of either the potential output or output gap is directly observable. Moreover, these estimates can only be derived from their hypothesized determinants and other additional information and variables that are observable and that are perceived to be correlated to the potential output and output gap (Laxton and Tetlow 1992). This difficulty of unobservable component has been compounded by the fact that there had been increasing evidence suggesting that output series are best characterized as integrated series. In this regard, potential output cannot simply be treated as a deterministic component due to the presence of a stochastic component (Nelson and Plosser 1982).

Comprehensive discussion of some of each method is provided under chapter two.

1.1.3 Fiscal and Monetary policy Mix Application

Fiscal-monetary policy mix or interactions theory arose from the Tobin-Mundell debate regarding the proper mix after higher taxes and faster money growth that caused stagflation during the post-war period in the United States of America. According to Reynolds 2001, the stagflation phenomenon prompted macroeconomists to join together a Keynesian-neoclassical synthesis in which James Tobin's 'funnel' theory tried to demonstrate how both fiscal and monetary policies could be used by government to shape the economy. This argument implies that the government could either employ fiscal or monetary policy stimulus to accelerate growth of aggregate demand (output) to fasten the growth of real GDP in case the economy is operating below full employment level and vice versa in case the economy is operating full employment level.

The monetary-fiscal policy mix is as a result of the fact that both types of policies have an impact on key macroeconomic variables which in turn creates interdependencies in the pursuit of policy objectives. Although monetary and fiscal policies employ different policy instruments, they are closely related in terms of achieving certain objectives by affecting the levels of output in the

economy. The policy mix could consist of various combinations of expansionary and restrictive policies. A coordinated monetary-fiscal policy mix is mutually reinforcing and therefore more effective and lack of proper coordination of these policies is potentially dangerous as it may lead to slow growth of the economy and surges in inflation (Swanepoel, 2004).

Monetary and Fiscal Policy Interactions in Kenya and their behaviour around the output gap (business cycle) demonstrated that the policies do not always exhibit the expected behaviour (sample period 1979-2007). The expectation being that when the economy is experiencing a downswing the fiscal policy is expected to enlarge and vice versa. Monetary policy on other hand, did not meet the expected pattern during some of the years but mostly it was found that the government usually pursued monetary policy in countercyclical version by tightening or loosening though pro-cyclical monetary policy loosening and tightening was evident. On fiscal – monetary policy mix, presence of policy coordination (on average) over the sample period was evident though monetary policy was found to be more dominant in Kenya. The CBK (for policy purposes) focusing on macroeconomic stability, should be more vigilant on the accurate business cycle dating mechanism that is critical in monitoring the events of the economy. This would enhance full knowledge of the business cycles which is vital in helping monetary policy on how to respond to these economic shocks (output gap) (Morekwa et al 2008).

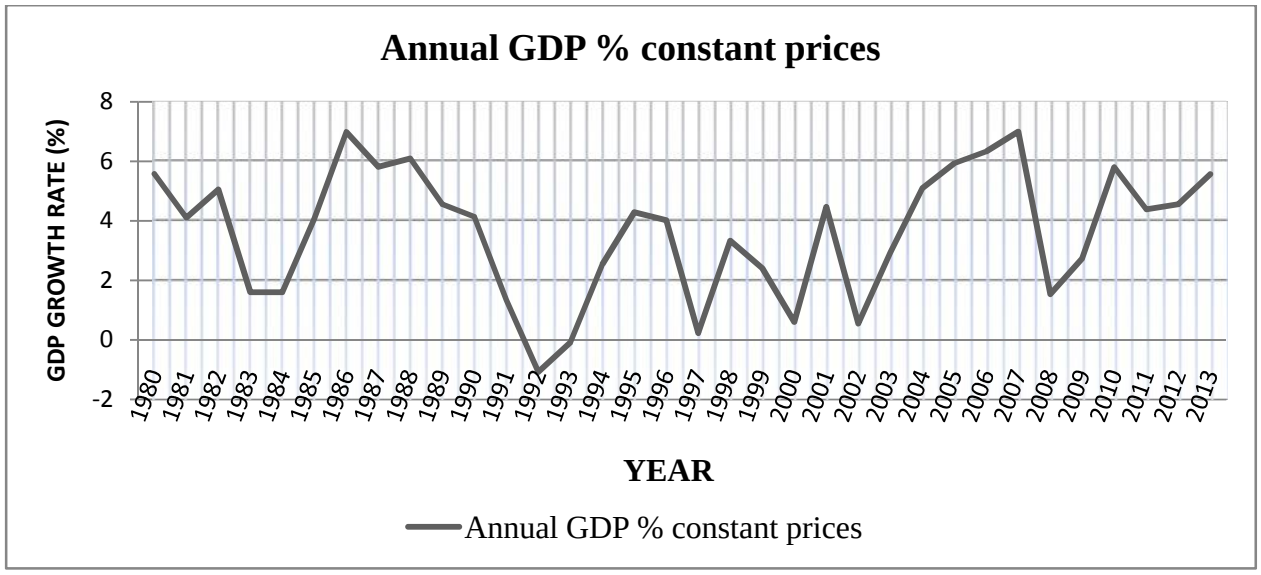
1.1.4 Kenyan Real GPD Trend and Implications to Output

The growth in Kenyan real GDP is characterized by more or less regular fluctuations or cycles. The Kenyan economy is contracted in four distinct periods (from our sample period) that is in 1984, 1992-1993, 2000 and 2008 as shown in the figure 1.2. These periods correspond to the drought, macroeconomic instabilities in the economy characterized by high inflation and another protracted drought, and the post election violence (PEV) respectively. From 2003 to 2007 Kenyan economic growth was on the right track of increasing growth rate, this was due to change of political regime that highly advocated for institutional reforms, more accountable and transparent governance and ideological economic development. This was implemented through the adoption of the economic recovery strategy (ERS) from the year 2003, introduction of the medium term expenditure framework (MTEF) and the Vision 2030 among others for economic growth and development (Morekwa et al 2008). The economy suffered a serious shock during

2007/2008 due to PEV that led to political instability that drastically reduced the economic growth rate to 1.5 % in 2008 from 7.0 % in 2007 at constant prices.

The economy started a new recovery path after the PEV shock of 2008 and managed to achieve a growth rate of 5.8% in 2010. A slight decline of the GDP growth rate occurred in 2011 due to global economic recession as a result the western (developed) countries – especially USA economic meltdown that affected many economies both developed and developing. The same period the inflation rate also rose from 4.1% in 2010 to 14% (average annual data) in 2011. The same year 2011, inflation hit 19.2% in December (average quarterly data) and this was the highest inflation rate experienced recently in Kenya since 1994.

Figure 1.1 The Kenyan GDP trend over years in percentage (%)



Sources: Kenya National Bureau of statistics, IMF & World Bank

1.1.5 The Kenya Vision 2030 and the enactment of the new constitution (2010) implication to potential output and output gap.

The Kenyan GDP trend or growth rate, considering the Blue Print (Vision 2030), is expected to be increasing every year and the economy to operate at potential level. This implies that the ambition will be zero output gap or as minimal as possible to achieve this objective. The study on output gap measurements and ways that would enhance reduced gaps and high levels of both actual and potential output comes in handy. Kenyan economy would also benefit a lot from a

clear framework that would be targeting to achieve this objective and this study intends to come up with findings that would provide that information that can be utilized by the Kenyan government and other interested users.

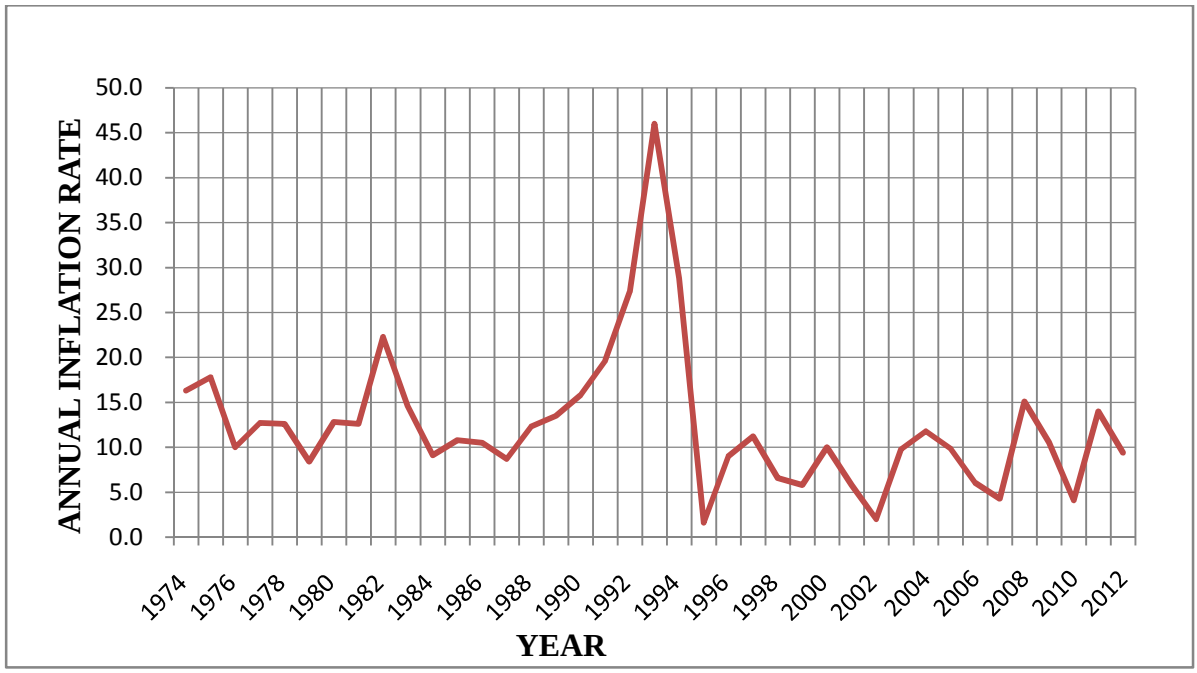
The Promulgation of the new constitution in 2010, initiated a roadmap towards higher economic developments and expectation that realization of fully implementation in five year time together with the Kenyan Vision 2030 would really enhance big milestone for Kenyan economy's development. It is no doubt that the Kenyan government's objective would be for the economy to operate at full employment (potential) level with minimal output gap as possible. This means that the relevant macro economic variables that affect positively or negatively on this objective needs to be assessed.

1.1.6 Kenyan inflation in relation to potential output and output gap

The potential output has a very close relationship with inflation and observation of this relationship will clearly help understand Kenyan inflation trend in a better way. Figure 1.2 shows persistent fluctuations even rising as high as 46% (average annual data) in 1993. Reviewed literature from several scholars has explained this hyperinflation to be caused by excessive money supply growth as a result of introduction of multiparty elections in Kenya. This was the Kenyan highest inflation rate (within our sample period) and the least was 1.6% in 1995 as indicated from the trend in figure 1.2. In the year 2010, the inflation rate rose from 4.1% to 14% (average annual data) in 2011. The same year 2011, inflation hit 19.2% in December (average quarterly data) and this was the highest inflation rate experienced recently in Kenya since 1994.

Its key to note that a simple comparison from figure 1.1 and 1.2 in the year 1993, the GDP growth rate was at its lowest level while inflation rate was at highest level (from the sample period). By intuition this simply implies that there is an inverse relationship between output growth and inflation. On the other hand, when inflation rate dropped to 1.6% (average annual data) in 1995, the GDP growth rate was rising confirming this inverse relationship.

Figure 1.2: Kenya annual inflation rate in percentage (%)



Sources: Kenya National Bureau of statistics, IMF & World Bank,

The recent decline of inflation rate (up to single digit) is encouraging though compared to output growth there is a mismatch since the latter is not growing at a higher rate as expected. This implies that there is a lot in terms of proper macroeconomic policies, from an informed perspective, that is required to be employed and to check the macro variables that are hindering this expected faster growth.

Intuitively, this decline in inflation - that implies higher growth and vice versa - when compared to level of output gap it simply infers that the relationship is direct i.e. positive. This is because a decreasing actual output widens the gap and an increase closes or minimizes the gap. In this regard, the objective of the government would be to minimize the gap meaning that the correct policy to employ in order to achieve this objective will be that of lowering inflation as much as possible. This study undertook to investigate the impact of inflation among other macro variables on output gap that may be contributing to either decline or increase of the output compared to the potential output thus widening or reducing the gap though with a bias to one that reduces the gap.

1.2 Problem statement

Measurement of the level of an economy's potential output and output gap comes in handy in the efforts to assess macroeconomic policies of an economy and in identifying a sustainable non-

inflationary growth. The growth in Kenyan real GDP and Inflation trend is characterised by irregular and persistent fluctuation (figure 1.1 and 1.2 refers). However the recent decline of inflation rate (to single digit) is encouraging though compared to output growth there is a mismatch since the latter is not growing at a higher rate as expected. This implies that there is a lot in terms of proper macroeconomic policies, from an informed perspective, that is required to be employed in order to check the macroeconomic variables that are hindering this expected faster growth.

The Kenyan GDP trend or growth rate, considering the Blue Print (Vision 2030), is expected to be increasing every year and the economy to operate at potential level. This implies that the ambition will be zero output gap or as minimal as possible to achieve this objective. The study on output gap measurements and ways that would enhance reduced gaps and high levels of both actual and potential output would really suffice to help and enhance macroeconomic stability in the economy.

It is no doubt that the Kenya government's expected objective would be for the economy to operate at full employment (potential) level with minimal output gap as possible. This means that the relevant macro economic variables that affects positively or negatively on this objective needs to be assessed. These macroeconomic variables that may be contributing to either decline or increase of the output compared to the potential output thus widening or reducing the gap require adequate empirical analysis in order to inform policy makers the best macroeconomic policies (fiscal and monetary) to employ to enhance minimal output gap and high output growth.

Other studies analyzing monetary and Fiscal Policy Interactions in Kenya and their behaviour around the output gap (business cycle) demonstrated that the policies do not always exhibit the expected behaviour. Hence, the CBK focusing on macroeconomic stability, should be more vigilant on the cyclical behaviour of the economy and full knowledge of the business cycles would be vital in helping monetary policy on how to respond to the business cycle (output gap). Knowledge of output gap is important in informing on the cyclical behaviour between fiscal and monetary policies as well as countering the inflationary trends that characterize most developing economies.

However, from the various studies previously done and reviewed on output gap, none focused on some of the key variables that may be contributing to this unexpected behaviour of the macroeconomic policies and this study undertook to attempt addressing the problem by empirically analyzing the impact of macroeconomic policy on output gap in Kenya.

Reviewed literature on output gap reveals that there has been no in depth study that had sought to estimate Kenya's potential and output gap hence crucial to do more study in this area for better understudying of the Kenyan economy. Therefore the study's intuition, clearly identified a problem that needed to be tackled. In this regard, it sought to add some value to this area by examining the impact that macroeconomic policy has on the output gap in Kenya using Kenyan current and recent data

1.3 Research questions

The research questions guiding the study were:

i. What techniques are used to measure Kenya's potential output and output gap?
ii. Is it possible to formulate a model for evaluating the relationship between the Kenya output gap and macroeconomic variables?
iii. What impact(s) (if any) do the various key macroeconomic variables have on output gap in Kenya?
iv. What policy implications and recommendations can we draw from the findings of this study?

1.4 Research objectives

The study sought to establish the impact of macroeconomic policies on output gap in Kenya.

Specifically, the study sought:

- To review the various methods of measuring the level of output gap in Kenya.
- To formulate a model for examining the relationship between the Kenya output gap and macroeconomic variables.
- To establish the impact of the key macroeconomic variables on output gap in Kenya.
- To prescribe policy implications and recommendations from the results of the study.

1.5 Significance of the study

This study sought to exploits knowledge of output gap and potential output analysis to analyze the behaviour of both fiscal and monetary policies in Kenya. The results therefore demonstrate the impact macroeconomic policies have on output gap in Kenya. An information gap exists on impact of macroeconomic policy on output gap in Kenya and this study contributes to the understanding of the nature of the macroeconomic policy (variables) and their impact(s) on output gap in Kenya. Policy makers will apply the research findings to be able to make sound economic decisions. There are only a few studies that have been undertaken in this area using Kenyan data.

1.6 Scope of the study

This study focused strictly on the macroeconomic policy variables and their impact on output gap in Kenya, ceteris paribus. In this regard, its findings cannot be used as a generalization on the overall impact to any other macroeconomic variable not captured by the study or to the economy as a whole but strictly to output gap. The data used was also restrictive to the sample period in the Kenyan economy.

1.7 Limitations of the study

The techniques of measuring the level of potential output and output gap mostly use smoothening of data to get projections since data on potential output and output gap are not directly observable. There is no adequate literature from Kenyan data on output gap since very few studies had ventured in this area. Access to various sources of data or literature is also restrictive and a lot of searching for this information is really challenging.

1.8 Organization of the study

The rest of the study is organized as follows; chapter two presents literature review; theoretical, empirical and a summary of the literature reviewed, chapter three presents the methods of the study. Chapter four provides the data analysis and interpretation of results while chapter five is the conclusion, summary of the findings and policy prescription or recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This literature review is based on - output gap from global and the Kenyan perspective, where the views of eminent scholars in this field are reviewed. The dependent variable (output gap) estimation techniques and macroeconomic theories on output growth stabilization policies were briefly discussed under theoretical review subsection 2.2 and 2.3.

The empirical literature review (subsection 2.3) in this study discusses the application of output gap measurement methods to different economies including Kenya by different scholars and the independent macroeconomic variables that impacts on output gap.

A brief summary or overview of both the theoretical and empirical review is also discussed under subsection 2.4.

2.1 Theoretical literature

2.1.1 Theories on output gap, potential output and the key macroeconomic variables

Post Keynesian macroeconomic analysis of 1950-70s. The analysis mainly focused exclusively on employment fluctuations that were caused by fluctuations in the aggregate demand. It was demand-oriented analysis though modern macroeconomic analysis (of past 1970s) integrated supply side to this analysis and enhanced a clear understanding of how these fluctuations should be prevented and enable the economy to operate at or near full employment level. The understanding helped many developed economies and precisely the US economy, to maintain a reasonably near full employment level with exceptions of 1954, 1958, 1961 and 1970. The supply side shocks was experienced in 1975 and 1982 when developed economies experienced deep recessions due to oil price increases (inflation) that led to high unemployment rate hence further widening of the (negative) output gap. Branson 2005

The Okun's law; the law generally implies that the larger the output gap is, the greater the unemployment rate will be. It's a rule of thumb that was developed by Arthur Okun that characterizes the direct relationship that exists between the output gap and the unemployment rate. The law states that a 3% increase in real GDP will yield a 1% decrease in unemployment

rate. This on the other hand indicates the existence of an inverse relationship between GDP growth rate and the unemployment rate.

The trend growth in a static model*;* the economy is expected to operate at (to grow along) full employment path and the government's monetary and fiscal policy variables are supposed to be directed in manner that addresses the changes in aggregate demand. The US economy in the 1980s was presumed to be moving along full employment path while sustaining unemployment rate of 6%. The condition that the economy moves along the full employment trend was explained by the assumptions that; interest rate fluctuate around the same mean level, the labour force growth rate and average labour productivity are fairly steady, the capital – output ratio K/y is roughly constant and the relative shares of labour and capital in output are roughly constant. These assumptions are consistent with historical facts (Branson 2005).

The Stabilization policy theory; This theory analyzes the argument on what measures need to be taken to close the output gap and maintain actual output near its potential level. Fiscal and monetary variables such as government spending, tax rate, investment and consumer expenditure as well as money supply, interest rate and exchange rate among others can be manipulated in some way and help close the output gap and at the same time check on inflation. When the government successfully manages to keep the economy growing at or near the potential output trend line and eventually makes it possible for the aggregate demand to shift from the trend line, it can be argued that the government had reacted well and achieves that goal, with say a reasonable period of one year. But on average, the macroeconomic policy in the long run usually exhibits certain trend characteristics as the economy grows along the potential output trend line (Branson W. 2005).

The Harrod - Domar growth theory model; the major assumption of the theory is that both the capital stock and labour force should be fully employed as the economy grows. Rising unemployment of these variables automatically violates the growth assumption and would definitely result to output gap in the economy either positive or negative. In the case of negative gap it implies excess capacity in the economy and positive output gap implies underutilization of capital stock this leads to lower demand for output and discourages investments. The level of investment is linked to the rate of economic growth through the multiplier effect and the changes in the capital stock. For capital to be fully utilized, output must grow at a warranted growth rate;

$$Q = \frac{S}{V} \quad \ldots\ldots(1)$$

For labor to be fully employed output must grow at the natural rate;

$$Q = gL + \text{a} \quad \ldots\ldots(2)$$

For both capital and labour to be fully employed as the economy grows, the Harrod – Domar condition applies;

$$gL + \text{a} = \frac{s}{v} \quad \ldots\ldots(3)$$

When natural rate $gL + \text{a}$ exceeds the warranted growth rate $\frac{s}{v}$ there would be higher unemployment levels of labor. This violate the initial assumption and if $gL + \text{a} < \frac{s}{v}$ excess capacity develops and this discourages investments and also shifts the economy away from the potential level

Where; s = fixed saving ratio

v = constant capital output ratio

Q = Potential output

$gL + \text{a}$ = the natural rate of employment

$\frac{s}{v}$ = the warranted growth rate of investment.

2.2 Review of output gap and potential output measurement techniques

There are usually two types of approaches used in estimating potential output. They can be classified into statistical detrending and estimation of structural relationships. The difference between the two is that; statistical detrending approach attempts to separate the process into permanent and cyclical components while the estimation of structural relationships isolates the

effects of structural and cyclical influences on output using economic theory. Statistical detrending methods used under this category include; The Hodrick-Prescott filter method and Unobserved Components Method (Univariate Beveridge-Nelson Method and Multivariate Beveridge-Nelson Method). On the other hand, the approaches used in estimating structural relationships are; linear method, structural vector auto regression method and production function method (Njuguna Et al 2005).

This study opted to briefly discuss, two methods only which are; the HP Filter method that falls under statistical detrending category, and the Production function method that falls under the structural relationship estimation approach category. This is because the Production function Method has been found to be more applicable to the Kenyan economy, widely used and reflecting the real scenario in Kenya in the measurement of output gap - Production function method (Kiio P. M. 2003). On the other hand, Njuguna et al 2005 empirically applied all the methods using Kenyan data and after analyzing all the methods, recommended for the results derived from the HP method arguing that the results were a better reflection of the reality, widely used due to its flexibility, less data required and fewer assumptions made while using the method. Therefore their study believed that there are fewer errors in the HP results.

2.2.1 The Hodrick - Prescott filter method

This method (Hodrick and Prescott 1997), usually abbreviated as HP method, is a simple smoothing procedure that assumes prior knowledge on variation of growth component overtime. It operates on a framework that a given time series, may be expressed as the sum of a growth component or potential output and a cyclical component or output gap. The measure of the smoothness of potential output is the sum of the squares of its second difference. The assumption is that average deviation of output gap from potential output will be near zero over a long period of time. The HP method is usually considered to be more robust given the manner in which it minimizes the variance of actual output (y_t) around the potential output (y_t^*) subject to a constraint of the second difference $(y_t)^*$. As a result of this, it has been used in a number of empirical studies due to its flexibility in tracking the characteristics of the fluctuations in trend output. The other advantages of the HP filter is that it renders the output gap stationary over a wide range of smoothing values and it allows the trend to change overtime. This method is frequently used since it requires less data (De Masi 1997).

One of the weaknesses of this method is that changing the smoothing weight affects how potential output responds to movements in actual output. The lower the smoothing factor the smaller the estimate of the gap. For high smoothing factor, the estimate indicates output above potential, but for moderate or low smoothing, the estimate suggests output below potential. Also, the cycles in output are sensitive to the smoothing weight. Thus, it is difficult to identify an appropriate smoothing parameter (de Brouwer 1998).

The HP method also suffers another shortcoming due to the high end-sample biases, which reflect the symmetric trending objective of the method across the whole sample and the different constraints that apply within the sample and its edges. This mainly occurs when the focus of interest is on recent observations in the sample for purposes of drawing conclusion for policy implementation and projections for the immediate future. To counter this problem, researchers use output projections to augment the observations. The reliability of the measured potential output and output gap depends on the accuracy of the forecasts used to avoid the end-sample bias

2.2.2 The production function method

This approach relates potential output to the availability of factors of production and technological change (Denis et al. 2002). The level of potential output can be defined as the level of output consistent with existing population, unemployment rates and participation, levels of marginal product of labour and output share of labour. A long-run relationship between the marginal product of labour and producer wages help to show the trend level of marginal product of labour. To obtain the potential output, assumption on the potential employment needs to be made. However, the main concern is to find the level of employment that is consistent with non-accelerating inflation or the NAIRU (non-accelerating inflation rate of unemployment). In Denis et al. (2002), potential employment is generated from a smoothed labour force series, which is generated by applying a HP filtered participation rate to the working age population figures. The smoothed participation rate leads to a less volatile labour force series.

According to Denis et al. (2002), the production function approach provides useful information on the determinants of potential growth. Although it is difficult to estimate, this approach is intuitively appealing and is widely used. The main advantage of this approach is that it is capable of highlighting the close relationship between the potential output and NAIRU concepts. This

approach requires estimates of normal or equilibrium rates of unemployment to be provided. Another advantage of this approach is that it provides possibility of making forecasts or building scenarios of possible future growth prospects by making assumptions on the future evolution of demographic, institutional and technological trends.

The production function method has several weaknesses. It is difficult to use because there is a wide range of assumptions made on potential capital and labour when deriving the variables. This approach also requires significant amount of data. According to Laxton and Tetlow (1992), the data on capital stock are of poor quality. They also pointed out that there has been no useful model for estimating the productivity thus estimates are based on trend. Moreover, the problems of trend elimination for GDP are shifted to the trend estimates of the inputs.

2.3 Empirical literature review

2.3.1 Review on output gap and potential output level measurement

Kenya's output gap measurement review

Njuguna, Karingi and Kimenyi 2005, study on measuring output gap and potential output and macroeconomic policy for Kenya, precisely focusing more on various estimation techniques or methodologies found that each method has merits and demerits. Observations from their estimation results revealed that potential output level as well as its growth, together with the output gap, when various measurement techniques were used, differed from one method to the other. However they recognized that there is some consistency in the results from most of the methods implying that there can be a consensus on how the Kenyan economy and its potential capacity and its growth has been performing over the years. Finally they also acknowledged that, in justifying their study, there has been no in-depth study that had sought to estimate Kenya's potential and output gap hence crucial to do more study in this area for better understudying of the Kenyan economy.

Kiio 2003 in a study on estimating a time varying NAIRU and the Output gap for developing countries a case of Kenya estimated output gap using the Production function approach and found Kenyan output gap in the year 2003 to be - 4.29, and the potential output growth to be

10.4%. These results indicated presence of excess capacity in the economy and structural analysis from the study suggested that output gap was determined by the labour market gaps. The study also suggested combination of policies for instance expansive fiscal policy; well directed government spending and a loose monetary policy in efforts to boost the employment and achievement of a sustainable non-inflationary economic growth. The study finally recommended further studies on output gap using different estimation methods and data set for Kenya.Morekwa, Sichei & Mutai 2008; Study investigating Monetary and Fiscal Policy Interactions in Kenya over the period 1979-2007. The study estimated the output gap using the HP Filter method since this is believed to be a major contribution in explaining the cyclical behaviour of the macroeconomic policy (fiscal and monetary policies) in Kenya. The results indicates that; the periods 1979-1991 and 1998- 2002 experienced downswing (troughs occurred in1992 and 2003). On other hand, economic upswings were experienced in periods 1993-1996 and 2006-2007 (peak occurring in 1997).

Global output gap measurement review

Garrat, Lee, Mise and Kalvinder 2007 study on Real time representation of output gap for US data $1964q_4$-$2004q_4$ observed that measurement of output gap though essential element of many decisions is usually done with considerable uncertainty especially in real time decision making measures. In their conclusion, they suggested that uncertainty involved can be mitigated by modeling the output process alongside the revision process, making use of forecasts of current and future post revision output levels to obtain more precise estimated measures of the gap for use in real time decision making.

Papell 2012 studied the (Un) reliability of real – time output gap estimates with revised data and found that the importance of output gap in the design and formulation of monetary policy by central banks is usually faced with the difficulty of reliability on either actual or revised output gap. This was because the policy maker could not easily be able to assess the available information regarding the accurate position of either current or ex-post data estimates. Using various output measures and detrending techniques for 10 OECD countries, and a sample data from Germany, UK and USA, the study found out that correlations between real time and revised output gap estimates tends to differ. The study concluded that for policy evaluation purposes, researchers usually prefer actual output gap that reflects the available information to policy

makers though real time data required for constructing real time output gaps is hardly available to many countries. They advised that revised data can only be suitable for estimating the trend in order to construct reliable data

2.3.2 Review of impact of the key macroeconomic variables on output growth and output gap

Global review

Fatas and Mihov (2003) conducted a study that estimated how growth in government spending affected growth in GDP while controlling for the lagged growth in government spending separately for 91 developed and developing countries. The results exhibited a strong positive correlation between spending and output fluctuations. Public investment was politically perceived as an easier target for cut-backs during times of fiscal stringency rather than cuts in current expenditure. Most countries prefer to offset increase in public consumption, interest rates and social security transfers through reduction in public investment. Therefore, an expenditure policy is more of a source of shocks rather than shock absorber.

Carl Walsh (2001) studied the output gap and optimal monetary policy. The study concluded that policy objective should consider using change in output gap rather than output gap itself in designing the macroeconomic policy. In other words, policy aimed at stabilizing the change in the output gap (together with inflation) imparts socially optimal. This meant that the output gap change targeting proved superior to other regimes as opposed to the former literature that had implicitly assumed the targeting of output gap level itself rather than the gap change in justifying policy action.

Donders and Kollau (2002), posit that the potential output and output gap have a direct impact on government fiscal policy. This is so because government revenues and expenditures usually depend on the actual fluctuations of the economy. In an upturn, there will be a budget surplus as a result of higher revenues and lower growth of expenditure. In a downturn, a budget deficit occurs as a result of low revenues and high expenditures. In this case, potential output and output gap can be used to determine cyclically adjusted budget balance. A cyclically adjusted budget balance can be defined as; the actual budget balance corrected for divergences of actual from potential output, and thus provides a measure of the government structural fiscal position.

Taylor (2001) argued that monetary policy significantly impacts on changes in wages and property prices though limited in terms of its effects on real variables through financial markets. This is attributed to the fact that these markets are less developed in nature. In this regard, for the monetary policy to improve on its transmission and effectiveness to emerging economies, it's vital for the Central bank to have predictable behaviour.

Reinhart and Sack (2000) estimated the effects of fiscal policy in 19 OECD countries using annual fiscal projection from the countries. The study revealed that 1% increase in the budget deficit to GDP leads to increased interest rates by 9 points. This was because, in times of inflationary pressures, fiscal prudence tends to reduce the need to increase interest rates. However they did not consider the level debt in these countries as well as the fact that they did not have control on the global factors. Depending on how the public deficit is corrected there will be different impacts on investment.

Heller (2005) studied the issues of fiscal sustainability within two broad policy spheres. First, to create a fiscal policy there is need to consider the scope for increased public savings through tax reform and expenditure rationalization. Secondly, fiscal sustainability is determined by additional resources that can be mobilized from borrowing and grants, which are consistent with maintaining macroeconomic stability and debt sustainability. To increase the revenue share of GDP should be the first option for countries with low tax shares. For low-income countries, raising the tax share to at least 15 percent of the GDP would be a minimum objective. Raising tax revenue beyond this level, however, is not an easy option since it has some political implications and economically hard to justify.

Ball (1999) suggested the use weighted average, in an open economy by the central bank, of the nominal interest rate and exchange rate as the appropriate instrument for developing economies. He stated that depending on the specific nature of markets in developing countries, both short-term interest rate and monetary base or some other monetary aggregate could be used as policy instruments. By extension, the importance of exchange rates in the pursuit of setting a monetary policy rule for developing countries was emphasized. He concluded that the central bank's objectives are not contradicted by the inclusion of the exchange rate in its reaction function. This is because, to the emerging economies, exchange rate stabilization is viewed as a precondition for output stabilization and deflation.

According to Lowell (2006), financial innovation reduces the output gap. This can be explained by arguing that financial innovation increases the efficiency with which money is transmitted in the economy. With increased efficiency, institutions and households are able to access finances easily since interest rate is reduced and transaction costs are minimized as a result of innovation. Therefore people will be able to consume and invest more which in turn will increase output thereby creating excess demand in the economy. This shows that as financial innovation intensifies it is more likely that the output gap will be positive. The implication of these results is that with financial innovation, the effectiveness of the interest rate channel in monetary policy transmission is weakened since the relationship between the interacted term and output gap is positive. Turkmen. & Ozturkler (2012) investigated the comparison of the recent crises in Turkey in terms of output gap found that output gap and the growth rate compared to actual GDP have a strong correlation. This implies that for government to formulate counter cyclical macroeconomic policies, timely measures of output gap are critically important. It was also found out that public investment decision making should consider output gap measures. This was informed from the estimation results that revealed that the correlation of coefficient between the fixed investments and GDP gap to be 0.62 using data from Turkey.

Debbrun and Kapoor (2010) posit that fiscal policy and macroeconomic stability automatic stabilizers, data on 49 developing and advanced economies spanning the last 40 years, they proposed that more research be done to address the impact of fiscal – monetary policy conflicts on macroeconomic volatility as this would have important implications for the design of macroeconomic fiscal framework. This means that alternative measures of the quality of monetary policy should be envisaged. In this regard to assess the impact of macroeconomic policy on output gap particularly fiscal policy is very critical.

Du Plessis (2006) conducted a study attempting to make explicit allowance for the lags in monetary policy transmission when judging the cyclicality of monetary policy. He used the business cycle technique to identify expansionary and contractionary monetary policy periods and compared these phases with the South African business cycle. He compared the business cycle and the monetary policy cycle, taking into account a 4 to 6 quarter lag for the transmission mechanism yielded striking results. Prior to 1990 there was no relationship between the business

cycle and the monetary policy cycle. However, after 1990 a clear cut countercyclical relationship emerged.

Kenya's review

Rotich, Kathanje and Maana (2007 studied the monetary policy reaction function for Kenya. The study found out that Kenya central bank had been targeting inflation in the attempt to ensure stability in the economy while using monetary policy. Results also revealed that during high inflation or excess demand (implying positive output gap) in the economy, the Kenya central bank usually lowers the money supply to check the shock. In this way it had managed to control inflation for a longer period (within the sample period covered by the study; 1997-2006). The study in their conclusion also suggested that a backward looking specification argued by Taylor (1993 & 2001) appeared to be appropriate for Kenya implying that, for the central bank to implement monetary policy effectively, past inflation should be considered.

From, among others findings, Kiptui (2009) in his study on Oil price - pass through into inflation in Kenya, estimation results indicate that changes or fluctuations in aggregate demand conditions as captured by the output gap significantly affected inflation. This implies that there exists a relationship between output gap and inflation though from his conclusion it's the output gap that affects the inflation.

Morekwa et al (2008) investigated monetary and fiscal policy interactions in Kenya for the period 1979 - 2007 using HP Filter approach. Empirical results analysis of the behaviour of fiscal and monetary policy around the output gap (business cycle) revealed the following; one, that the fiscal policy did not behave as expected. The expectation being that when the economy is experiencing a downswing the fiscal policy is expected to enlarge and when it is experiencing an upswing the fiscal policy is expected to decline. Two, Monetary policy as well did not meet the expected pattern during some of the years but mostly it was found that the government usually pursued monetary policy in countercyclical version by tightening or loosening though pro-cyclical monetary policy loosening and tightening was evident. Three, study also tested the fiscal-monetary policy mix and found that on average there was policy coordination over the sample period though monetary policy was found to be more dominant in Kenya. Finally the study recommended that for policy purposes the CBK focusing on macroeconomic stability,

should be more vigilant on the cyclical behaviour of the economy and full knowledge of the business cycles would be vital in helping monetary policy on how to respond to the business cycle (output gap). This calls for accurate business cycle dating mechanism to monitor the events of the economy.

Berg et al (2013) on their study on "forecasting and monetary policy analysis in low income countries, case on Kenyan inflation, provided a blue print of a forecasting and policy analysis system with an application to Kenya. From their model they did decomposition of macroeconomic series to obtain trend and the gap from the Kenyan data in an attempt to examining quantitative significance of monetary policy and international shocks as well assessing the performance of their model. They also tried to identify the right policy direction during high inflationary pressures that should be taken and proposed monetary policy tightening. Their findings indicated that accommodative monetary policy was very crucial and justified that the central bank tightened the monetary policy in 2011 in support of their propositions though they acknowledged the uncertainties surrounding the analysis of monetary policy in Kenya and low income countries. They suggested that these low income countries and Kenya in particular, need to employ forward-looking monetary policy in the context of a flexible exchange rate regime. Acting more systematically about monetary policy and focusing on more innovative research on other significant macroeconomic variables is very crucial in promoting the development.

2.4 Overview of the literature review

In summary, the general observation from both the theoretical and empirical review indicates that there is an obvious challenge in the output gap measurement. It is also clear that, there is no adequate literature of output gap measurement and the impacts of macroeconomic policy on output gap in Kenya. The HP method of output gap measurement seems to be more realistic for use in Kenya and this study opted to use it for that reason.

This study undertook to measure the output gap in Kenya and investigate the impact of macroeconomic policy (variables) on output gap and formulate a macroeconomic policy model that can be used for evaluating the relationship between key macroeconomic variables and output gap in Kenya. This is backed up by the stabilization policy theory among other theoretical

concepts. The stabilization policy theory and empirical review identifies six macroeconomic variables that are thought to be having significant impact on output gap either positively or negatively and this study sought to examine that impact. These include; the Inflation, Money supply growth, Investment, Interest rate (Treasury bill 91days), Exchange rate (Ksh - US Dollar), and Total government expenditure. These variables definitely inform on how fiscal and monetary policies should be employed and hence aid in assessing the general impact of the macroeconomic policy on output gap.

Finally the literature reviewed clearly identified a gap in literature that needs to be filled and this study undertook to do that by examining the impact of macroeconomic policy on output gap in Kenya using quarterly data from 1996 to 2013.

CHAPTER THREE
METHODOLOGY

3.1 Model specification

This study adopted Hodrick-Prescott (HP) filter (1997) in carrying out the analysis. This method assumes that the growth component varies smoothly over time. The other main assumption is that on average, the output gap (C_t) variance from the potential output (y^*_t) is usually near zero over a long period of time (the concept of full employment path/level).

Output (y_t) in this case is expressed as the sum of trend y^*_t (potential output) and c_t (cyclical component or the output gap).

$$y_t = y_t^* + c_t \quad \ldots\ldots(3.1)$$

Therefore $C_t = y_t - y_t^* \Rightarrow Y_t^c$ and $y_t^* \Rightarrow Y_t^g$ $\ldots\ldots(3.2)$

HP Filter is considered to be robust due to its flexibility in tracking the characteristics of fluctuations in trend output. Given that the potential output is unobservable, construction of output gap is not easy. HP is therefore quite instrumental in estimating the potential output. The HP filter is able to decompose aggregate demand (GDP) into growth and cyclical components presented as follows.

$$Y_t = Y_t^g + Y_t^c \quad \ldots\ldots(3.3)$$

Where; Y_t is the natural log of GDP, Y_t^g the growth and Y_t^c is the cyclical component. The HP minimizes the variance of Y_t^c subject to a penalty for variations in the second difference of the growth term.

The filter is expressed as follows.

$$\min_{Y_t^g} = \sum_{t=1}^{T}\left[\left(Y_t - Y_t^g\right)^2 + \mathtt{a}\sum_{t=1}^{T}\left(Y_{t+1}^g - Y_t^g\right) - \left(Y_t^g - Y_{t-1}^g\right)\right]^2 \quad \text{.....(3.4)}$$

Parameter $\mathtt{a}$ controls for smoothness of Y_t^g. The minimization process provides a mapping from Y_t to Y_t^g with Y_t^c determined residually. A zero $\mathtt{a}$ corresponds to an extreme real business cycle model with all fluctuations in real output being caused by technology shocks. A $\mathtt{a}$ tending towards infinity corresponds to a deterministic time trend. The optimal $\mathtt{a}$ often assumed by researchers is 1600 used on quarterly data. In this regard, since the study will use the optimal $\mathtt{a}$ =1600 recommended for quarterly data, the study measured and analyzed output gap with quarterly data from 1996-2013 since this would be sufficient for analysis of the Kenyan case as it captures some of the major incidences or shocks that had been witnessed within that period. The other justification for the sample choice was due to the fact that it was more relevant and recent and since HP Filter method was adopted and started to be used from 1997 in Kenya.

3.2 Measurement of potential output

Estimating the level of a country's potential output and output gap is critically important in identifying a sustainable non-inflationary growth. Potential output is usually viewed as the utmost composite indicator of the aggregate supply side capacity of an economy making it important for adequate knowledge of its content to be sought by research (Mc Morrow et al, 2002).

The challenge encountered was usually due to the fact that none of either the potential output or output gap is directly observable. Moreover, these estimates could only be derived from their hypothesized determinants and other additional information and variables that are observable and that are perceived to be correlated to the potential output and output gap (Laxton and Tetlow, 1992). This difficulty of unobservable component had been compounded by the fact that there had been increasing evidence suggesting that output series are best characterized as integrated series. In this regard, potential output cannot simply be treated as a deterministic component due to the presence of a stochastic component (Nelson and Plosser, 1982).

Given that the potential output is unobservable, construction of output gap is not easy. Various techniques for measuring potential output and output gap have been developed. However, among

them (techniques) none seem to be perfect as observed by the many researchers that had had interest in this field (Njuguna et al, 2005)**.** HP is therefore quite instrumental in estimating the potential output. The HP filter is able to decompose aggregate demand (GDP) into growth and cyclical components presented as follows.

Output (y_t) in this case is expressed as the sum of trend y^*_t (potential output) and c_t (cyclical component or the output gap). $y_t = y_t^* + c_t$ .....(3.5)

$C_t = y_t - y_t^* \Rightarrow Y_t^c$ and $y_t^* \Rightarrow Y_t^g$ .....(3.6)

$Y_t = Y_t^g + Y_t^c \Rightarrow Y_t^g = y_t - y_t^c$ .....(3.7)

Where; Y_t is the natural log of GDP, Y_t^g the growth and Y_t^c is the cyclical component. This means that potential output is output gap subtracted from the natural output/ GDP considering that output gap can be either positive or negative.

3.3 The theoretical concept and the general model formulation

The Stabilization policy theory; This theory analyzes the argument on what measures need to be taken to close the output gap and maintain actual output near its potential level. Fiscal and monetary variables such as government spending, investment and consumer expenditure as well as money supply, interest rate and exchange rate among others can be manipulated in some way and help close the output gap and at the same time check on inflation. When the government successfully manages to keep the economy growing at or near the potential output trend line and eventually makes it possible for the aggregate demand to shift from the trend line, it can be argued that the government had reacted well and achieves that goal, with say a reasonable period of one year. But on average, the macroeconomic policy in the long run usually exhibits certain trend characteristics as the economy grows along the potential output trend line (Branson 2005).

Since the main thrust of this paper was to establish the impact of macroeconomic policy on output, a time series approach was adopted to factor in macroeconomic variables (Total Government expenditure, inflation, Treasury Bills 91days for interest rates, exchange rates,

money supply and investment) on the right hand side to assess their impact on output gap both in the short run and long run. This can be expressed as follows;

$$C_t = f\left\{MS, \bar{I}, TBR, ®, ExR, G_0\right\} + £ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.8)$$

This can also be expressed as;

$$C_t = \sim + \quad {}_1MS + \quad {}_2\bar{I} + \quad {}_3TBR + \quad {}_4® + \quad {}_5ExR + \quad {}_6G_0 + £ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.9)$$

And this equation can be transformed into natural logarithmic function as follows; **N/B** this transformation helps in making the estimation less sensitive to extreme observations when using ordinary least squares (OLS).

$$LnC_t = \sim + \quad {}_1LnMS + \quad {}_2\bar{LnI} + \quad {}_3LnTBR + \quad {}_4Ln® + \quad {}_5LnExR + \quad {}_6LnG_0 + £ \ldots\ldots\ldots\ldots(3.10)$$

Where; α and β (s) are the constant parameter and coefficient parameters respectively

- C_t is the Output gap
- MS is the money Supply
- TBR is the Treasury Bill 91days for Interest rate
- Ī is the gross Investment (public and private investment)
- π is the inflation rate
- ExR is the exchange rate (Ksh. – US Dollar)
- G_0 is the total Government expenditure ;
- ε is the error term (disturbance)

3.4 Table 1: Summary of hypothesis and the expected signs of the relationship (output gap being the dependent variable)

No.	Independent variables	Expected sign	Remarks	Source
1	Inflation (π)	positive	High inflation rate implies low levels of output and vice versa. Lower level of actual output caused by high inflation rate means a wide gap and vice versa hence positive relationship	Author's intuition
2	Money Supply (MS)	Unknown	This will be revealed by the results findings	Author's intuition
3	Treasury Bill 91days Interest rate (iR)	positive	Innovation brings about efficiency in the economy hence lowering the interest rate. This increase the output thus reducing the gap therefore positive relationship	Lowel (2006) financial innovations reduces the output gap -author's intuition also support this
4	Investment ($\bar{I}$)	negative	Increase in investment leads to increase in output making the economy to operate almost near full employment. This leads to decrease in output gap. Also public investment is usually perceived as politically easier cut backs than other spending categories	Silimano (1989) and De Haan et al (1996) - Author's intuition not sure of this so neither supports nor objects

5	Total Government expenditure (G_0)	negative	Increase in Government's purchases/spending leads to high levels of output and vice versa. This eventually reduces/widens the gap thus negative relationship.	Author's intuition
6	Exchange Rate (ExR) Ksh.-US Dollar	Unkown	This will be revealed by the results findings	Author's intuition

Note:

- The general hypothesis assumes that there exists relationship between the output gap and the key macroeconomic variables as listed in table 1, second column, above. However it's not clear or certain what kind of relationship exists, whether positive or negative.
- More specifically macroeconomic policy (Fiscal and Monetary) has either positive or negative impact on Output Gap in Kenya. H_0 $X \pm C_t = 0$; (eqn3.6) where C_t is the Output Gap in Kenya (which can be either positive or negative) and X represents the macroeconomic policy in Kenya.
- The study would reveal the realistic or certain relationship after the data analysis in the next chapter
- Output Gap could either be positive or negative depending on whether the actual output is above or below the potential output.

- However, when examining the relationship between the output gap and the key macroeconomic variables, (in the model and the hypothesis summary table 1 above) we ignore the sign of the output gap and focus on the relationship between output gap and the explanatory variables i.e. whether direct or inverse relationship exists between the dependent (output gap) and the independent variables.

- We also ignore the magnitude or size of the explanatory variable coefficients and just concentrate on the sign.

The author's assumptions/propositions (by intuition) are subject to scrutiny and the results findings after data analysis and interpretation will either lead to upholding or rejecting these propositions (intuition).

3.5 Model estimation

The model was estimated using Ordinary Least Squares (OLS) estimation technique since it gives the Best-Unbiased estimates of the parameters and it is practically easier to apply in the time series data used. Furthermore, many of the explanatory variables are in fact components of y (output). This is factored in by the explanatory variables that are measured as shares of GDP.

3.6 Data sources and measures

The model was estimated using time series (quarterly) data from Kenya for the period (1996-2013), adopted the HP Filter method to measure the output gap and potential output, and carried out various tests and regression analysis (by use of recent versions of Eviews presented in Excel application) for establishing the impact of macroeconomic policy (variables) on output gap. All the data was drawn from the Kenya National Bureau of Statistic's various publications (Economic Surveys, economic indicators and Statistical abstracts), World Bank economic development indicators and IMF financial statistics.

Due to unavailability of reliable private investment data and in quarterly form, the study used annual gross investment data extrapolated to quarterly form. All variables are measured in real terms, deflated using the consumer price index - CPI (2001=100).

3.7 Testing for stationarity

The study used time series data and therefore, one needs to determine whether the variables were stationary. The use of OLS to estimate relationships of variables of a non-stationary series is likely to have misleading inferences which leads to spurious and inconsistent regressions. Consequently, this study first tested the order of integration of the individual series by conducting unit root tests for stationarity using the Augmented Dickey Fuller (ADF) test on each variable in the model.

3.8 Testing for cointegration

Cointegration is a technique used to estimate equilibrium or long run parameters in relationships with variables that are non-stationary series. Cointegration allows us to capture the equilibrium relationship between non-stationary series if such equilibrium relationship exists but between a stationary series.

Where there is evidence of cointegration, even though the series are non-stationary, there exists a linear combination that is itself stationary.

CHAPTER FOUR
PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents the empirical findings or results of the study. We first start by presenting the descriptive statistics for all the variables used in econometric analysis also referred to as summary statistics of all variables used. Section 1 gives the descriptive statistics while section 2 and 3 give the empirical results. Section 3 presents the regression results of the model that could explain the impact of the key variables on output gap. Reliable and quality Data on both potential output and the output gap both adjusted (through HP Filter Computation) and unadjusted (ordinarily mere subtraction of natural output from the potential output) was readily obtained from networking with KNBS staff and used for this analysis.

4.2 Summary statistics

4.2.1 Normality tests

Normality tests are very important since they help inform on the distribution of the error term. This forms the basis for the identification of an appropriate estimation technique. Measures of central tendency which include; mean, median; skewness and kurtosis are used to describe the data. For a normal distribution, the mean and the median are equal. However, the most appropriate test on whether the distribution of the variable is normal is carried out using the Jarque-Bera statistical test. Table 4.1 below presents the summary statistics for the variables under study.

Table 4.1 Descriptive statistics of variables

	Output Gap	Money Supply	Investment	Inflation	Total expenditure	Interest Rate	Exchange Rate
Mean	0.040	0.029	0.003	-0.002	0.043	0.011	0.003
Median	0.157	0.031	0.006	-0.025	0.411	0.003	0.001
Maximum	2.796	0.074	0.080	1.010	0.875	1.173	0.124
Minimum	-2.875	-0.012	-0.145	-0.675	-1.581	-1.285	-0.106
Std. Dev.	0.964	0.019	0.030	0.432	0.860	0.387	0.041
Skewness	-0.301	-0.031	-2.329	0.347	-1.099	0.000	0.293
Kurtosis	5.937	2.771	15.021	2.407	2.404	6.875	4.592
Jarque-Bera	16.852	0.106	311.611	1.562	9.722	28.148	5.399
Probability	0.000	0.948	0.000	0.458	0.008	0.000	0.067
Sum	1.789	1.309	0.141	-0.105	1.948	0.480	0.121
Sum Sq. Dev.	40.849	0.016	0.040	8.196	32.547	6.605	0.072
Observations	45.000	45.000	45.000	45.000	45.000	45.000	45.000

From table 4.1, for most of the variables used in the study, the mean and the median are fairly equal indicating that they are normally distributed. Only the output gap and total expenditure present a bigger discrepancy hence may be highly non normal. Only the Treasury bill rate passes the skewness test of zero under normal distribution. Kurtosis which measures whether the distribution is peak or flat relative to a normal distribution should average 3 and given it oscillates around that, it could be normally distributed. This may require statistical evaluation to identify the distribution. The mean is typically lower than the median in the negatively skewed distributions for all other variables except Treasury bill rate and exchange rate while it's higher than the median in the positively skewed distributions. The Jarque–Bera statistic test used to test for the normality of the series indicates that money supply, inflation and exchange rates series is normally distributed going by the p values which lead us to fail the null of normality. The statistics indicated assume a chi-square distribution. The probability of committing a type 1 error i.e. rejecting a true null is significantly different from zero and therefore we fail to reject the null hypothesis that the distribution is normal.

4.2.2 Correlation tests

The test for correlation presents the degree of association between independent variables. The test however does not imply causality but informs on the magnitude with which a variable changes due to a one percent change in another variable. Table 4.2 below presents the correlation matrix for the variables under study.

Table 4.2 Correlation matrix for the variables

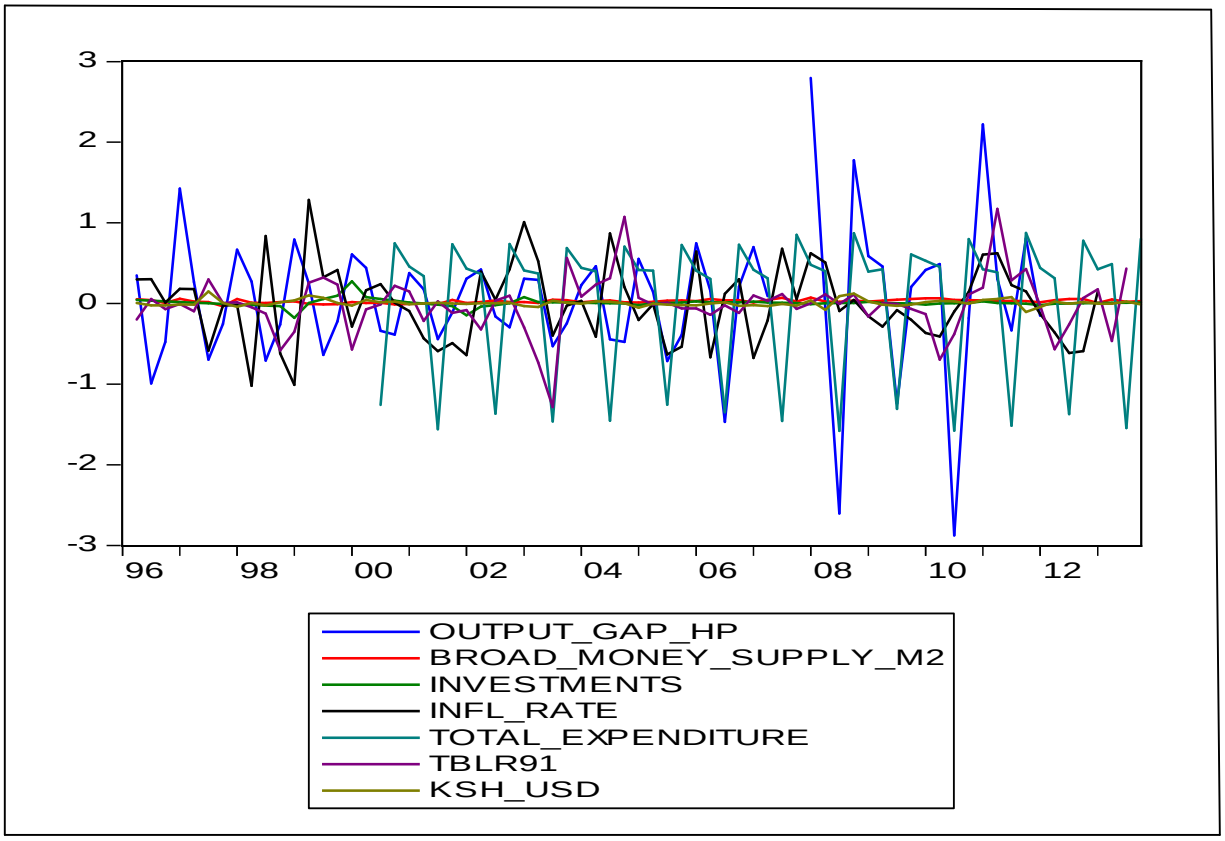
	Output Gap	Money Supply	Investment	Inflation	Total expenditure	Interest Rate	Exchange Rate
Output Gap	1.000	-0.698	-0.495	0.063	-0.341	-0.054	-0.268
Money Supply	-0.698	1.000	0.777	0.190	0.671	0.098	0.470
Investment	-0.495	0.777	1.000	0.268	0.538	0.236	0.233
Inflation	0.063	0.190	0.268	1.000	0.168	0.318	0.179
Total expenditure	-0.341	0.671	0.538	0.168	1.000	0.067	0.234
Interest Rate	-0.054	0.098	0.236	0.318	0.067	1.000	0.257
Exchange Rate	-0.268	0.470	0.233	0.179	0.234	0.257	1.000

Test for correlation is crucial in establishing whether there is presence of multicollinearity or not. Multicolinearity only becomes a serious problem if the pair wise or zero-order correlation coefficient between two regressors is in excess of 0.8 (Gujarati (2003). A correlation coefficient which is close to 1 predicts a strong positive or negative relationship for a positive and a negative sign respectively which may affect the normality of the residuals which constitute the long-run relationship. In this case, we don't have multicollinearity problem since none of the variables has a correlation coefficient in excess of 0.8.

4.3 Unit root tests

When using time series data, testing for unit root test is an important exercise which helps avoid running spurious regressions on non stationary variables. This study used both a graphical approach where the trend assumed by the variables was observed to check whether it is uniform and a statistical unit root test using Augmented Dickey fuller test. Graph 4.1 below reflects the graphical illustration of the time series variables used in the analysis;

Figure 4.1 Graphical Representation



Source: KNBS Statistics

A closer look at the graph shows the presence of fluctuations in the variables over time with the output gap having the biggest deviations. Such fluctuations could signal non stationarity in the series. This calls for the need to test for unit root using the Augmented Dickey Fuller (ADF) test. This test is initially done at levels after which the series is differenced incase it's found to be non stationary. The null hypothesis of a unit root is rejected if the calculated t- statistic (ADF) is less than the critical t value. Differencing a variable however, leads to the loss of long run time series properties which can be recaptured in an error correction model for as long as the series is

cointegrated i.e. a linear combination two I(1) variables (non stationary) becomes I(0) i.e. stationary. Choice of the optimal lag length is based on the Schwatz information criterion which maximizes the number of lags as opposed to the Akaike Information Criteria which advocates for a parsimonious model with fewer lags.

Table 4.3 Unit root tests at levels

Variable	**ADF Statistics**	**1% critical value**	**5% critical value**	**10% critical value**	**comments**
Output Gap	0.790708	-4.0969	-3.4759	-3.1651	Non stationary
Money Supply	1.51012	-4.0969	-3.4759	-3.1651	Non stationary
Investment	-1.96348	-4.0969	-3.4759	-3.1651	Non stationary
Inflation	-0.23396	-4.0969	-3.4759	-3.1651	Non stationary
Total expenditure	-1.54418	-4.0969	-3.4759	-3.1651	Non stationary
Interest Rate	-2.6354	-4.0969	-3.4759	-3.1651	Non stationary
Exchange Rate	-2.08996	-4.0969	-3.4759	-3.1651	Non stationary

None of the variables of interest is stationary at levels. We therefore correct for the non stationarity using the differencing technique and test for unit root again. Table 4.4 below presents the unit root test results upon differencing once.

Table 4.4 Unit root test on first difference

Variable	**ADF Statistics**	**1% critical value**	**5% critical value**	**10% critical value**	**Comments**
Output Gap	-4.87069	-4.0969	-3.4759	-3.1651	Stationary
Money Supply	-3.75558	-4.0969	-3.4759	-3.1651	Stationary
Investment	-3.99339	-4.0969	-3.4759	-3.1651	Stationary
Inflation	-0.46166	-4.0969	-3.4759	-3.1651	Non stationary
Total expenditure	-9.27859	-4.0969	-3.4759	-3.1651	Stationary
Interest Rate	-6.47448	-4.0969	-3.4759	-3.1651	Stationary
Exchange Rate	-5.49886	-4.0969	-3.4759	-3.1651	Stationary

The test reveals that all the variables except inflation are stationary after first differencing. A second difference on inflation is necessary. Table 4.6 below represents the results for second difference unit root test.

Table 4.5 Unit root test on second difference

Variable	**ADF Statistics**	**1% critical value**	**5% critical value**	**10% critical value**	**Comments**
Output Gap		-4.099	-3.4769	-3.1657	Stationary
Money Supply		-4.099	-3.4769	-3.1657	Stationary
Investment		-4.099	-3.4769	-3.1657	Stationary
Inflation	-6.02201	-4.099	-3.4769	-3.1657	Stationary
Total expenditure		-4.099	-3.4769	-3.1657	Stationary
Interest Rate		-4.099	-3.4769	-3.1657	Stationary
Exchange Rate		-4.099	-3.4769	-3.1657	Stationary

After differencing inflation twice, all variables are now stationary and can be used in analysis without running the risk of obtaining spurious regression results.

4.4 Regression analysis

Given that all the variables were found to be non stationary at levels, a cointegration test is performed to establish whether a linear combination of non stationary series is I (0). This will also help inform as to whether a long run path exists or the effect fizzle out. This is carried out on the predicted residuals obtained using Engle-Granger two step procedures from the long-run equation of the non-stationary variables and is tested for unit root using the ADF test.

The table below represents the long run model for the co integrating equation.

Table 4.6 Long run estimation

Dependent Variable: OUTPUT_GAP_HP				
Method: Least Squares				
Sample (adjusted): 2000Q2 2012Q1				
Included observations: 47 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Money Supply	-1.7977	0.3499	-5.1375	0
Investment	-2.9141	1.5939	-1.8282	0.075
Inflation	0.3129	0.1326	2.3594	0.0233
Total expenditure	0.81157	0.1599	5.0723	0
Interest Rate	0.1107	0.1337	0.8279	0.4126
Exchange Rate	3.7027	1.1869	3.1194	0.0034
C	2.6989	5.5396	0.4871	0.6288
R-squared	0.6671	Mean dependent var		-2.6523
Adjusted R-squared	0.6171	S.D. dependent var		0.9336
S.E. of regression	0.5777	Akaike info criterion		1.8770
Sum squared residuals	13.3486	Schwarz criterion		2.1526
Log likelihood	-37.1099	Hannan-Quinn criter.		1.9807
F-statistic	13.3591	Durbin-Watson stat		1.8685
Prob(F-statistic)	0.0000			

The long-run estimation of output gap reveals that all the regressors significantly explain its variation except the Treasury bill rate. The output gap appears to decrease with increase in money supply and level of investments. Inflation, government expenditure and exchange rate contribute positively to the output gap. These relationships are supported by the F statistic which shows that the variables are jointly significant in explaining the variation in output gap. The estimated model explains 61.72% (Adjusted R squared) of the variations in output gap. The

regression results also rule out the presence of autocorrelation as reflected in the Durbin Watson statistic which is close to the cutoff point of 2.

Table 4.7 Summary of hypothesis, the expected and estimated result signs of the relationship (output gap being the dependent variable)

No.	Independent Variables	Expected Sign	Estimated results sign	Remarks	Source and comparison with results
1	Inflation (π)	positive	positive	High inflation rate implies low levels of output and vice versa. Lower level of actual output caused by high inflation rate means a wide gap and vice versa hence +ve relationship	Previously Author's intuition now upheld
2	Money Supply (MS)	Unknown	negative	Regression results revealed meaning that increase in money supply leads to a decline in output gap and vice versa	Previously Author's intuition now upheld
3	Treasury Bill 91days Interest rate (iR)	positive	positive	Innovation brings about efficiency in the economy hence lowering the interest rate. This increase the output thus reducing the gap therefore positive relationship	Lowel (2006) financial innovations reduces the output gap....supported by results of this study too. -author's intuition

					now upheld.
4	Investment ($\bar{I}$)	negative	negative	Increase in investment leads to increase in output making the economy to operate almost near full employment. This leads to decrease in output gap. Also public investment is usually perceived as politically easier cut backs than other spending categories	Silimano (1989) and De Haan et al (1996)..supported by results of this study too - Previously Author's intuition was uncertain neither supports nor objects. now ascertains its negative
5	Total Government expenditure (G_0)	negative	positive	Increase in Government's purchases/spending leads to high levels of output and vice versa. This eventually reduces/widens the gap thus negative relationship. From regression result the opposite is empirically true	Previously Author's intuition now objected.

6	Exchange Rate (ExR) KEsh.- US Dollar	Unkown	positive	Regression results revealed +ve relationship	Previously Author's intuition was uncertain, now ascertained its +ve relationship.

4.4.1 Cointegration Test

Table 4.8 Cointegration test based on the predicted residuals

Cointegration test			
Null Hypothesis: ECT has a unit root			
Exogenous: None			
Lag Length: 0 (Automatic based on SIC, MAXLAG=9)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.16976	0
Test critical values:	1% level	-2.61736	
	5% level	-1.94831	
	10% level	-1.61223	
*MacKinnon (1996) one-sided p-values.			

The ADF based cointegration test revealed that the residuals were stationary at 1%, 5% and 10% levels of significance. This implies that despite all variables being I (1) at levels, a linear combination makes them, I(0) hence cointegrated. This also implies that a long run relationship exists. An error correction model using I(0) variables and a lagged error correction term from the predicted residuals is necessary to inform on the speed of adjustment to the long run path.

4.5 Short Run Model

Table 4.9 Error correction model

Dependent Variable: OUTPUT_GAP_HP				
Method: Least Squares				
Sample (adjusted): 2000Q3 2012Q1				
Included observations: 45 after adjustments				
Variable	Coefficient	Std. error	t-statistic	Prob.
Money Supply	7.5338	3.7953	1.9851	0.0546
Investment	-2.5151	2.5292	-0.9944	0.3265
Inflation	0.1596	0.1861	0.8577	0.3966
Total expenditure	0.6297	0.0891	7.0682	0
Interest Rate	0.0661	0.1998	0.3308	0.7426
Exchange Rate	-1.0651	1.9471	-0.5471	0.5876
ECT(-1)	-1.1270	0.1407	-8.0103	0
C	-0.2190	0.1304	-1.6792	0.1015
R-squared	0.8024	Mean dependent var		0.0397
Adjusted R-squared	0.7650	S.D. dependent var		0.9635
S.E. of regression	0.4671	Akaike info criterion		1.4751
Sum squared resid	8.07155	Schwarz criterion		1.7963
Log likelihood	-25.1901	Hannan-Quinn criter.		1.5949
F-statistic	21.4649	Durbin-Watson stat		1.5654
Prob(F-statistic)	0			

The short-run model portrays that money supply and government expenditure significantly explains variations in output gap. The regressors explain 76.50% of the variation in the dependent variable. Just as was the case with the long run estimation model, the variables are jointly significant in explaining the model as depicted by the F-statistic. The lagged error correction term (ECT), for capturing the long run dynamics between the co-integrating series is

negative and statistically significant. It indicates that the speed of adjustment from one period to another is negative. Deviations from the stationary relationship are therefore corrected by decreases in output gap with each period accounting for 1.12 percent annually.

4.6 Model representation

$$LnC_t = \sim + {}_1LnMS + {}_2\bar{L}nI + {}_3LnTBR + {}_4Ln® + {}_5LnExR + {}_6LnG_0 + £$$

Estimation Command:

==========

LS OUTPUT_GAP_HP BRD_MS_M2 INVESTMENTS INFL_RATE TOTAL_EXPENDITURE TBLR91 KSH_USD ECT(-1) C

Estimation Equation:

==========

OUTPUT_GAP_HP = C(1)*BRD_MS_M2 + C(2)*INVESTMENTS + C(3)*INFL_RATE + C(4)*TOTAL_EXPENDITURE + C(5)*TBLR91 + C(6)*KSH_USD + C(7)*ECT(-1) + C(8)

Substituted Coefficients:

==========

OUTPUT_GAP_HP = 7.53385327718*BRD_MS_M2 - 2.51510743964*INVESTMENTS + 0.159615967071*INFL_RATE + 0.62977069541*TOTAL_EXPENDITURE + 0.0661094007495*TBLR91 - 1.06514171164*KSH_USD - 1.12704432974*ECT(-1) - 0.218979080413

CHAPTER FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Conclusions

The focus of the study was to establish the impact of macroeconomic policy on output gap in Kenya. Expansionary monetary policy and increase in the investment portfolio appear to shrink the output gap. This signals the high degree of effectiveness of monetary policy in addressing deviations in output. Changes in money supply have a direct effect given that it regulates the amount of money available to the commercial banks for lending purposes. A small change in the reserve requirements has a very big effect on the economy. Fiscal policy which in this case is proxied by government expenditure appears to increase the level of output gap. This could be rationalized by the nature of allocation i.e. whether the allocation is directed towards recurrent expenditure or development expenditure. The effects of development expenditure is likely to be felt with a lag but may in the long run tilt towards a reduction in output gap as the economy converges to the long run path. A significant proportion of the government budget allocation goes to servicing Kenya's external debt leaving inadequate resources to be divided amongst domestic consumption and investment hence explaining the escalation of the output gap. A good chunk of the resources that should be used for effective public investment to improve people's living standards are instead diverted to debt servicing. Wide fluctuations in inflation, interest rates and Kenya shilling dollar exchange rates also appear to raise the output gap. For an economy to thrive there is need to have some stability in various economic fundamentals. This is because they influence the investment climate which can either attract or distract foreign and local investors.

5.2 Policy recommendations

Having focused on the impact of Kenya's macroeconomic policy on output gap a careful application of monetary and fiscal policy is critical. In particular there is need for both fiscal and monetary policy coordination to enhance its effectiveness. This is especially so because gains made in the monetary policy front could be eroded by poor management of fiscal policy which deals with the real sector of the economy.

Management of fiscal policy is key and especially debt management to avoid wasting many resources on debt servicing. Even with debt servicing, the state should ensure that a good proportion is directed towards development projects such as infrastructure alongside investment in human capital in the education and health sectors. Investment in productive public investments acts as a catalyst for future accelerated growth hence a reduction in output gap as the economy moves closer to its long run path.

The government through the monetary policy regulatory authority should also sustain the credibility of the monetary policy in order to increase its effectiveness. Expansionary monetary policy was found to be instrumental in lowering the output gap. Increase in inflation, and depreciation of the exchange rate makes imports more expensive. This negatively affects the trade balance especially because Kenya is a net importing country. Net export values turn negative since returns from exports cannot match the cost of imports. The deterioration in terms of trade leads to balance of payments deficits exposing the country to even more debt and higher debt service costs. The monetary regulatory authority should therefore ensure that formulated policies maintain low and stable inflation and exchange rate prices.

5.3 Recommendations for further studies

It is possible that the impact of macroeconomic policy on output gap will differ depending on the policy environment. It's therefore important to conduct a similar study both before and after debasing the economy.

5.4 Limitations of the study

Data posed a very serious challenge for this study with some of the variables such as investment having to be extrapolated from annual figures to quarterly data to match the quarterly values of output gap. However, despite these challenges, the author through networking with Kenya National Bureau of Statistics staff was able to gather some good quality and reliable data which has been used for the analysis.

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