THE DETERMINANTS OF INFLATION IN KENYA (1970 – 2013)

By

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DECLARATION

I declare that this is my original work and has not been presented to any other university for the award of any degree.

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X50/60414/2013

This research paper has been submitted for examination with our approval as university supervisors.

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DEDICATION

In memory of my late father Julius Kirimi and my Grandma Monica, if you were here you would be proud of the person I have become but I know you watch and smile from up there. To my mum Teresia Kirimi, you are my true hero and I wouldn't have come this far without your selfless and endless love and support.

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With that said however, any errors and omissions in this paper are solely my responsibility.

LIST OF ABBREVIATIONS AND ACRONYMS

ADB	African Development Bank
CBK	Central Bank of Kenya
IMF	International Monetary Fund
KIPPRA	Kenya Institute of Public Policy and Research Analysis
KNBS	Kenya National Bureau of Statistics
SSA	Sub Saharan Africa
WB	World Bank
WBDI	World Bank Development Indicators

ABSTRACT

This paper sought to establish the main determinants of inflation in Kenya for the period 1970-2013 by using both theoretical and empirical literature reviewed to explain the process of inflation causation in Kenya.

The study used ordinary least squares for estimation of time series data covering the period 1970-2013. One equation was regressed and the following variables were regressed on the annual inflation rate that is the money supply, Central bank rates, Exchange rates, wages, food prices, oil price, Political instability and corruption.

The study revealed that, there was a negative relationship between food price and inflation level, Central bank rates was found to be statistically significant at 5% level of significance in causing the variation in inflation rate. Money supply (M2) and exchange rate had a positive relationship with the inflation rate while GDP growth rate and the corruption perception had a negative relationship with inflation. Wage rate coefficient was found insignificant in causing the changes in inflation with political instability having no effect on inflation.

CHAPTER ONE

INTRODUCTION

This paper sought to study how the government of Kenya has managed inflation in the recent past and aims to draw lessons to inform policy on how to manage inflation in the future. The paper further examined the determinants of inflation that contribute to inflation causation in Kenya by enumerating the effects of various macro-economic variables in the economy and further evaluate the policy response to the inflation problem.

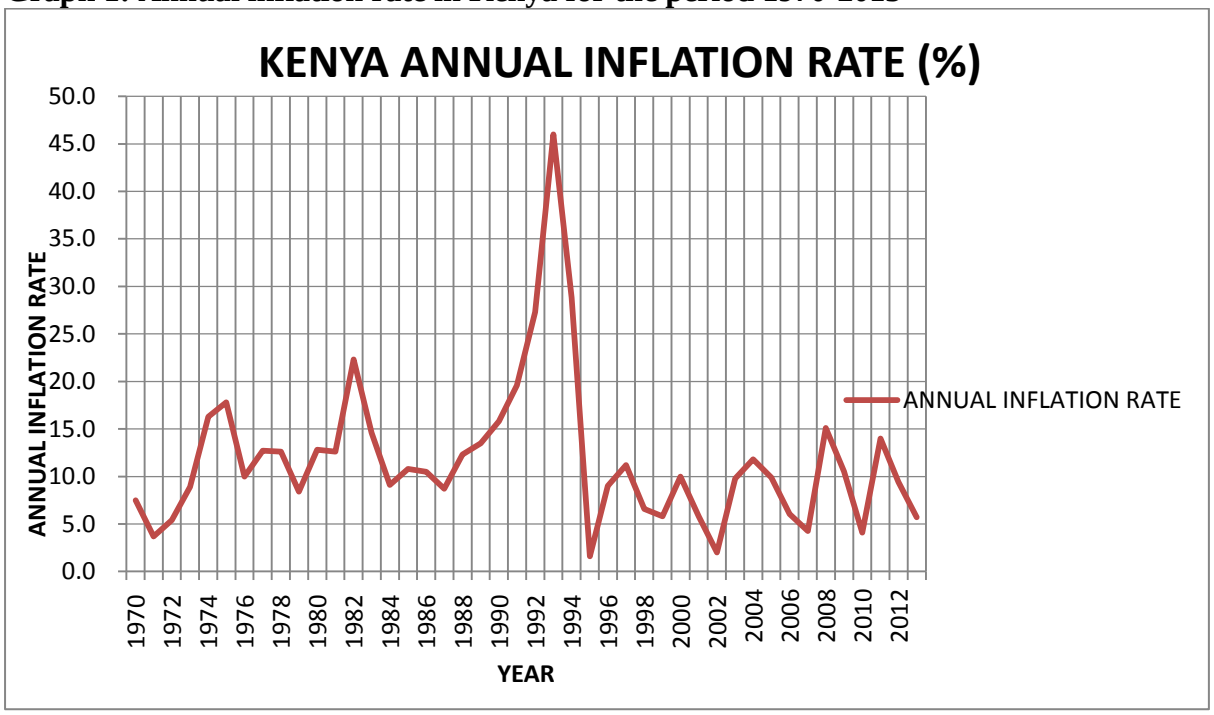
The country has experienced inflation swings since 1970-2013 and this paper sought to explain the causes of these swings and how they were later controlled to attain lower rates of inflation in the subsequent years.

There are many definitions of inflation, World Bank (2007) defines inflation rate as "*an annual increase in the price of a basket of goods and services that are purchased by consumers in an economy*" while the London oxford economic dictionary (2009) defines inflation as "*the consistent tendency for nominal prices to increase which leads to a decline in the purchasing power in a country's currency*". Inflation rate therefore measures the changes over time of the consumer prices or the GDP deflator which takes into account prices of goods and services produced in the country. This percentage cost of living is calculated using the consumer price index in Kenya.

Basu (2011) in his paper 'understanding inflation and controlling it' defines inflation as a sustained rise in prices across the board as opposed to relative changes in price of goods and services. It refers to a phenomenon where the average price of goods is on rising trajectory for a period of time. In economics there are peculiarities that are specific to different regions

and nations depending on their stages of development. Inflation can be ascribed to a general increase in money supply, excess demand, rises in public expenditure, changes in labour market, changes in costs and oil price increases also lead to inflation.

Graph 1: Annual inflation rate in Kenya for the period 1970-2013



Source: IMF Database

Kenya experienced low inflation rates, with a relatively stable economic growth rate until when the inflation rate in the year 1974 and 1975 rose to 16.3% and 17.8 % respectively (Economic Survey, 1975). This rise was mainly attributed to poor rainfall, global world recession and the oil crisis due to increasing oil imports as the oil prices rose. This crisis led to an accelerating inflation and a severe recession was experienced in the industrial countries. The government of the day had therefore to come up with policies that would try to bring down the inflation rate or control it (Economic Survey, 1975).

The government intervened by raising import duties and sales taxes on certain luxury consumer goods and raising duties on petroleum products so as to reduce consumption. The inflation reduced in 1976 which has been attributed to increasing incomes in rural areas

caused by a good rise in value of coffee exports as a result of good yield in the Agricultural sector (Economic Survey, 1975, 1976 and 1977).

The spike in 1982 was attributed to an oil shock, attempted military coup in the country leading to a worsening in terms of trade (Economic Survey, 1983) and led to reduced investor confidence hence fall in investment and some capital flight (Mwega, 1990). This was also attributed to the adjustment of the external value of the shilling in 1981 and this led to a deflationary monetary policy with money supply increasing moderately so as to contain inflation (Economic survey, 1984).

The highest inflation rate ever recorded in Kenya was in 1993 at 46%. The high inflation rate was attributed to an excessive money supply, low aggregate demand, depreciation of the Kenyan shilling with a low investor confidence due to tumult surrounding transition to plural politics (Economic Survey, 1994). The devaluation of the Kenya shilling was seen as one of the causes of inflationary pressures, coupled with excessive money supply in 1992 and early 1993,decontrol of prices and poor weather conditions. A prolonged drought further made the government to divert large amount of funds to famine relief imports to attain food security (Economic Survey, 1993).

The GDP growth rate had averaged 5.6% in the period of the 70's and took a downward trend in the period of the 80's and the 90's (Mwega, 1990).This could be explained by the favourable world coffee prices between 1976-1977 that led to increased foreign exchange earnings and hence a growth in the economy due to the trickle-down effect to the other sectors in the economy. The drop in the growth rate in the 1980's could be explained by a drought that affected the agricultural productivity and the unfavourable political climate at the time due to the attempted coup of 1982 (Mwega, 1990).

The year 1994 however, was characterised by a GDP growth rate of 3% coupled with a decline in the inflation rate to 28.8% and this was achieved because the government adopted a tight monetary policy, liberalized foreign exchange rate and trade regimes with de-regularized cereal marketing activity and the petroleum industry further led to a decrease in inflation in the year 1994 (Economic Survey, 1995).

The year 2002 registered the lowest inflation rate of 2% in the decade of the 2000's which was attributed to sustained implementation of the monetary policy, the stability of the Kenyan shilling, low food prices, low demand for imports, stable world petroleum prices and investor confidence due to a new government that was in place and taking office through a democratic and peaceful transition (Economic Survey, 2003).

The inflation rate increased significantly to 15.1% in 2008 and this was attributed to post-election violence, a rise in exchange rates, and rising of overall food prices in the country (Economic Survey, 2008).

The average annual inflation rate however registered a decline from the year 2011 to the year 2012.This was accredited to monetary policy tightening, falling of international oil prices, good and abundant rainfall further removed the absence of food and fuel shocks. Abundant rainfall reduced the electricity prices and bumper harvests eased food inflation. (World Bank Report, 2013). The year 2011 was characterised by high inflation rates and the Kenyan currency depreciated in a big way, with the inflation target set at 5% but averaged between 12.9% in January to 19.7% in November. This was attributed to high food prices, non-alcoholic beverages prices and transport charges. The central bank had in turn to counter this

through an increase in the Central Bank rates which were raised from 6% in January 2011 to 18% in December 2011. (African Economic Outlook, 2012)

1.1 Measuring inflation in Kenya

There are mainly three methods of measuring inflation; the GDP deflator, the Consumer Price Index (CPI) and the Wholesale price index (WPI). According to (Mburu, 2002) inflation is easy to spot but tricky to measure and the choice of the method of measurement is influenced by information available

Kenya adopted use of CPI in 1961 and it has continued to be accepted as the most practical measure. The CPI method has weaknesses and biases such as not taking into account the change in the quality of goods and new products entering the market as well as the failure to capture the fact that relative prices change at different rates (Mburu, 2002).

1.2 Problem Statement

Inflation can impose a real cost on society in terms of the efficiency with which the exchange mechanism works and thereby distorting the incentives to save, invest, and work, and by providing incorrect signals that alter production and work effort. Inflation has been seen as the worst tax to the poor by reducing their purchasing power. Because of this, policymakers should be concerned with the on-going rate of inflation and any tendency for it to accelerate. An additional reason for concern arises because efforts to reduce the rate of inflation have often been associated with economic downturns (Kaushik, 2011).

High inflation rates being a sign of economic imbalances could reduce economic growth and lead to a reduction of the implementation of sustainable development goals. Moreover, the government aims at maintaining a sustained growth rate of 10% (ADB, 2007) to achieve the vision 2030 and this will be possible only if the inflation levels are kept on check. Macro-

economic policies are aimed at having a low inflation rate and stable economic growth rate and inflation plays a major role as an indicator, therefore there is need to keep these rates stable even when they are low.

1.3 Research question

What determines the level of inflation in Kenya?

1.4 Research Objectives

- Establish the determinants of inflation in Kenya between 1970-2013.
- To draw lessons for the future and further suggest policy recommendations based on this study findings.

1.5 Organization of the Study

In the first chapter an introduction of the study is presented, giving the background of the Kenyan Economy. The chapter also provides the problem statement, objectives and the research questions. Chapter Two discusses the literature written in that field which includes theoretical and empirical literature, an overview of the literature review is also provided in this chapter. The research methodology is discussed in chapter three which includes the econometric tests that will be used in the study while chapter four presents the data analysis and a summary and recommendations given in chapter five.

CHAPTER TWO

2.0 Literature Review

In this chapter, both the theoretical and empirical literature were reviewed which were related to the field of study. Empirical literature included that which has been tested using statistical and econometric analysis.

2.1 Theoretical Literature

Thirwal (1974) defines inflation as a rise in the general price level due to increased demand or due to increased import prices or cost push. He adds that there are various mixed causations that may bring about inflation.Thirwal (1974) identifies five major categories as models of inflation and these include monetarists, pure cost models, hybrid models which contain demand and cost elements, structural models and expectation models. He asserts that it is very difficult to discriminate between these models in analysing a particular inflation experience as it becomes as a result of several forces interacting with one another. It is indeed difficult to isolate one phenomenon and conclude it is the one causing inflation.

2.1.1 Monetarism

This theory was put forward by Cagan (1956) who viewed inflation as being caused by monetary growth and focussed on the demand for money during hyperinflation and asserted that expectations of future inflation rates depended on past inflation rates.

The theory on monetarism was brought forward by Friedman (1982) and in his theory he looks at the quantity theory of money and linked spending to the total amount of money in the economy. His theory asserts that inflation was as a result of an increase in the supply of money in the economy. He concludes that inflation occurs if the growth of money supply in the economy supersedes the economic growth.

The monetarist theory explains demand pull inflation as being caused by excess demand for goods and services which causes a positive output gap, whereby businesses respond by raising prices to increase their profit margin. This is attributed to increases in the money supply in the economy, depreciation of the exchange rate and reduction in the tax rates in an economy.

Monetarism maintains the view that inflation is as a result of higher rate of growth of money supply from the rate of growth in the economy, aimed at regulating the quantity, cost and allocation of money and credit in the whole economy. Moreover it aims at achieving a set of objectives to maintain growth and stability in the economy. Therefore any monetary policy seeks to stabilize both the exchange rates and prices, raise the level of employment, stable economic growth and interest rate smoothing.

2.1.2 Structural Perception of Inflation

This holds the view that inflation is brought about by structural rigidities in the economy as a natural consequence. According to Ndebbio (1993) these rigidities results mainly from imbalances in public finance where the government is unable to raise enough revenue to match with the expenditures increasing.An increase in food demand with a low growth of agricultural production and rigidity in foreign trade where exports do not raise revenues to match the increasing import demand also contributes to these rigidities.They insist that as long as these rigidities remain in place, inflation will be hard to reduce as these rigidities affect the relative price structure and hence the absolute or general price level.

2.1.3 Cost Push View

This came into being mainly in the 1950's and 1960's and asserts that pressure in wages and monopoly pricing policies cause inflation. They argue that with strong trade unions nominal

wages keep going up once the price level goes up. The adjustment in wages should match up the price index so as to check inflation levels; however the commodity shortages and crop failures coupled with high oil prices also cause inflation.

Cost push inflation is brought about by factors that make costs to go up, which include wages, exchange rates and costs of inputs that activate inflation through the supply side by causing costs of production and hence lower output. These costs are hence passed on to the consumers through higher prices. This is also referred to as wage push inflation since wages take the largest part of the total production cost (Zahoo & Shama, 2010) Supply shocks lead to a sudden change in the price of a commodity and this may be due to the shortage of a particular good. A good example of this would be oil prices and when used as an input the price further goes up due to the high exchange rate in the international market.

2.1.4 Phillips Curve Model

It shows the short-run relationship between inflation and unemployment. Phillips showed that the nominal wage growth was negatively correlated with unemployment and later in 1960 Samuelson and Solow found a negative correlation between inflation and unemployment and further referred it to the Phillips Curve. (Romer and Chow, 1996)

The model asserts that the rate of money wages has an inverse relationship with the rate of unemployment. This means that as wages go up the rate of unemployment goes down, the model suggests that the policy makers could choose between different unemployment and inflation rates. (Friedman, 1968)

Phillips observed that in the short run there was no trade-off between inflation and unemployment but in the long run inflationary policies would not increase or decrease unemployment. In the long run the Phillips curve is vertical at the natural rate of

unemployment where the rate of inflation has no effect on unemployment. A similar pattern were found in other countries and therefore this means that fiscal and monetary policies could be used to stimulate the economy, raise the gap and lower unemployment. However this view was disputed since in the 1970's countries experienced both high inflation and unemployment (stagflation) and Friedman was of the view that it was a short run phenomenon.

There is usually a trade-off between unemployment and inflation and monetary policy together with fiscal policy could be used as a variable to bring down the unemployment at certain inflation levels. The relationship was found to be unstable, however as people would anticipate inflation then policies were not able to lower unemployment and therefore leading to an outward shift on the Phillips curve due to high levels of unemployment and high inflation(Friedman, 1976).

Friedman together with Phelps argued that the Phillips curve would shift up when inflationary expectations rise and came up with the expectations augmented Phillips curve. However in the long run, monetary policy cannot affect unemployment and therefore adjusts back to its natural rate called the non-accelerating inflation rate of unemployment also known as the long run Philips curve.

Friedman therefore provided an explanation for the shift and concluded that in the long run unemployment rate could not be affected by monetary policy because there was no trade-off between the wage rate and unemployment. This gave rise to the natural rate of unemployment and concluded that inflation had no impact on unemployment rate once individuals had expectations on the level of inflation. The authorities can influence unemployment through the supply side by providing information to the labour market. (Friedman, 1968)

With expectations the faster the prices are expected to rise, the faster money wages demand will rise for a given level of unemployment. It asserts that in the long run the wage earners

will anticipate inflation and this leads to the Phillips curve being a straight line this gave rise to the augmented Phillips curve (Friedman, 1976)

The rational expectations on the other hand, imply that the short run Phillips curve is vertical and that systematic, fiscal and monetary policies have no impact on unemployment. Only unanticipated policies affect the real side of the economy and agent can forecast then there is no impact. It assumes that people make expectations on inflation depending on all information economically available about the given variable. This led to the long run Phillips curve collapsing in the short run and in this case any inflation brought about by a government policy are anticipated and therefore influence unemployment when they first appear. Under adaptive expectations, people form expectations about the future and are adaptive since they look at the previous behaviour of inflation and the expected inflation is a weighted average of current and past inflation rates. (Friedman, 1976)

2.2 Empirical Literature

According to Hume (1980) an increase in the money supply in the economy increases the general price level through a different transmission mechanism. This may occur because when the money supply increases,the volume of goods and services demanded also increases. The increase in nominal cash balances of economic units initially results in higher expenditures for goods, and therefore in higher production. Then, under the assumption of underemployment, prices start to adjust to a rise in money supply.

Killick & Mwega (1990) in their paper monetary policy in Kenya, notes that inflation in Kenya has never gone above 25% with moderate price increases after independence. They assert that monetary policy plays a crucial role to the performance of the Kenyan Economy.

Chhibber (1991) after analysing economies of some African countries concludes that inflation is caused by four main factors; cost push factors emanating from currency devaluations, demand pull forces created by excessive credit expansion in the economy, balance of payment problems and controlled prices that deviate from the prevailing market prices and the readjustment of these prices cause inflationary shocks.

Easterly & Schimdt-Hebbel (1991) assert that inflation has mainly been caused by seigniorage revenue especially during economic and political crisis, whereby the government prints more money to be in circulation.

Cardoso (1992), Powers (1995), Ravallion (1998), and Braumann (2004) find that there is a positive correlation between inflation and poverty. Chaudhry & Chaudhry (2008) found that food price inflation increases poverty in Pakistan.

Sowa & Kwakye (1993) explained that inflation in Ghana could be explained more by the monetary factors and formulated a model showing the sources of inflation as monetary factors, real factors and expectations i.e. $P=f(M,Y,E,P^e)$. Inflation is seen as dependent on both the growth of money and output and rate of exchange that is the domestic price of foreign currency and price expectations. They found out that monetary pressure was a strong force in Ghana's inflation and exchange rate devaluations have an effect on inflation but supply factors constituted a much stronger inflationary force than monetary factors but exchange rate adjustments did not show a strong influence on inflation therefore a multifaceted issue with many causes.

Kallon (1994) uses a structural equation for inflation and estimates using the two stage least squares with variables including growth of narrow money growth, growth of real government expenditure, real GNP growth, import price inflation, percentage in the treasury bill rate,

change in interest rate differential and inflation expectations. In his analysis, he found out that money growth raise inflation and that a one per cent increase in money growth leads to a 0.5 per cent in the increase in inflation over four quarters and 1.3 per cent in the long run. Real GDP growth was found to lead to a higher inflation and expectations. Inflation was found to be insensitive to import price inflation or increases in government expenditure and concludes that authorities should use monetary restraint and aggregate demand policies to counter inflation.

Bowa (1994) in his paper the determinants of the inflationary process in Zambia observes that the inflationary process in Zambia was attributed to monetarists and structuralist's schools of thought and changes in money supply and exchange rate adjustments were found to be significant determinants of inflation. Tightening of monetary and fiscal policies was essential to reduce money supply changes. His findings revealed that an increase in money supply led to a 1 per cent rise in the rate of inflation within two years.

Ndungu (1996) in his paper on inflation in Kenya asserts that inflation emanates from cost push factors, due to currency devaluation, demand pull forces where excessive credit expansion causes excess demand, balance of payments crisis and controlled prices which deviate from market prices causing shocks. He observes that the monetary base, exchange rate, real income growth and interest rate have an effect on the rate of inflation in a country and concludes that exchange rate is more important than monetary factors in explaining the inflationary process in Kenya and that inflation and money supply leads to the depreciation of the nominal exchange rates.

Bernanke & Mishkin (1997) in their paper inflation targeting, 'A new framework for monetary policy' observes that inflation targeting involves the announcement of an official

target ranges for the inflation rate and therefore conclude that monetary policy aims at having a low and stable inflation. They observe that it involves the announcement by the government's central bank that in the future it will strive to hold inflation at some numerically specified level. They are often in ranges rather than single numbers and cover a period of years and their view on inflation targeting offers transparency of policy by making their intentions known to the public and moreover increasing central banks accountability and coherent policy making.

Romer & Chow (1996) found out that a prudent monetary policy which aims at low inflation and steady growth, may lead to an improved life for the poor in the long run and reduce the value of the cash holdings and therefore making the poor more poorer.

While analysing the effect of political stability on inflation, Aisen & Veiga (1999) asserts that inflation leads to the reduction of the welfare of people in the society and economic growth and found out that political instability can lead to higher inflation levels especially in developing nations. Moreover political instability has an effect on the efficiency of the tax system and hence government revenues used due to tax evasion and people holding the government responsible for economic outcomes and a rising demand for public expenditure which may end up being financed by inflation tax.(Edward, Tabbellini & Cukierman 1992)

Mburu (2002) argues that the inflationary pressure in Kenya in the decade of 1970's was mainly supply side due to changes in external prices, he also observes that in the 1980's there was excessive deficit financing which resulted to seigniorage and in the 90's there was excess liquidity leading to rise in prices due to monetary expansion in the economy. He explains the inflation trend and concludes that inflation targeting has succeeded in bringing inflation rates

down in Kenya; however he adds that inflation control measures should be undertaken together with other policies.

Bernanke & Reinhart (2004) is of the view that the consumer price index portrays the increase in price for poor households and is mostly confined on food, fuel, medicine, and some essential commodities .This would therefore mean inflation for the poor is the increase in price of the most essential commodities.

It is observed that with higher levels of inflation, the perception of corruption levels increased in a developing nation and as the level of prices increased corruption went high (Belasen & Peyton, 2006).

Gottschalk et al (2008) in their paper on analysing determinants of inflation when there are data limitations in the case of Sierra Leone, they use the structural vector auto regression approach to help forecast inflation and find out that domestic inflation increases with higher oil prices, higher money supply and leads to nominal wage depreciation.

The purchasing power of the poor may shrink if commodities rise and makes it harder for the poor who may be surviving on a limited budget. This would be due to the fact that their incomes do not increase in the same rate as prices increase. (Wilson, 2011).

In analysing inflation in Uganda, Kabundi (2012) uses the error correction model to analyse the dynamics of inflation and found out that in the short run and long run external and domestic factors contribute to inflation causation with the agricultural sector being affected by the demand and supply of it commodities.

Hachicha et al (2013) on inflation uncertainty and output in Tunisia, concludes that recession in an economy may be brought about by inflation uncertainty in an economy. Inflation rate

being a monetary and a fiscal phenomenon and coupled with other internal and external factors is influenced by deficit financing depending on whether government decides to borrow internally or externally or resulting to seignorage to finance its budget especially in developing countries and expectations on how the price level may change in the future may make residents to speculate (Kallon, 1994)

Devarajan & Fengler (2013) observes that inflation hurt the poor especially in the developing countries who have to cut on their spending when faced by inflation. This would lead down to cutting on the expense of vital items like education and healthcare, in his opinion this makes inflation the worst tax to the poor. Inflation is a serious concern for the common people,Cambell & Shiller (2001) found that there may be a difference between how common people and economists perceive inflation and non-economists see that inflation may lower the people's standard of living. Easterly & Fischer (2001) found out that inflation affects the poor more than the rich.

According to Kiptui (2013) Kenya's inflation rate is driven by domestic developments in the medium to long-term but in the short term other factors come into play and contribute to the inflationary pressure. He asserts that movements in inflation are as a result of price developments abroad and real exchange rate changes. He uses the p-star model to explain the effect of policy change in a timely manner making it possible to achieve price stability and consistency between monetary policy decisions and the macro environment.

2.3 An Overview of the Literature

Inflation has been seen to be attributed to monetary, structural and cost factors by the different theories documented. Empirical literature reviewed seems to borrow the same concepts in explaining the inflation causation. However it is important to note that inflation

causation cannot be attributed to one factor and isolate it as the main cause of inflation. (Sowa & Kwakye, 1993)

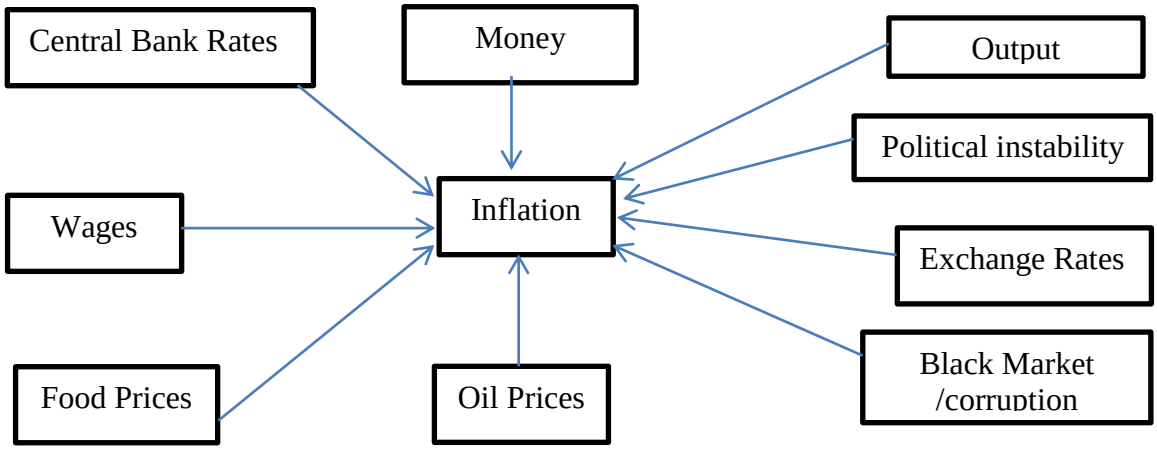
An interaction of forces as been found to cause inflation, with a number of factors such as exchange rates, money supply,wages,food and oil prices leading to a rise in the general price level. However it is important to note that the role of political instability as a shock in the economy in accentuating the inflationary process in Kenya is lacking, more over governance issues and the perception of how corrupt a country is may have an effect on inflation. This research therefore seeks to fill this gap. A more recent analysis on inflation in Kenya is significant so as to ascertain the significance of the variables because there is a lack of consensus on the factors contributing to inflation causation.

CHAPTER THREE

3.1 METHODOLOGY

3.1.1 Conceptual Framework.

This section aimed at giving a description between inflation, prices of oil and food items, exchange rate, money supply, output central bank rates and money wages. Moreover activities in the black market, corruption perception and political instability have also contributed to inflation causation. Inflation in Kenya has been attributed to an expanded monetary policy and further causing an increase in money supply, price shocks both internal and external have also led to a rapid increase in price in the economy. The factors have been shown in the diagram below.



Source; own representation from previous literature reviewed.

The study aimed at analysing these factors by using both econometric analysis and descriptive evidence, where inflation as the dependent variable is regressed on the independent variables or the explanatory variables.

The research makes use of the Ordinary Least Squares (OLS) for estimation and this is because it is easy to use, straight forward and it is able to give us the best linear unbiased estimates. It is also preferred because of its ability to explain the effects of one variable

resulting from changes of other several variables. This regression is done using stata version 12 as it is the most preferred and recent econometric software.

3.1.2 Data Type and Source

The research made use of secondary data, time series data extracted from the Kenya National Bureau of Statistics and the World Bank World Development Indicators and the Central Bank will be utilized in the research from 1970-2013.This is because of the fact that no other empirical analysis has been done in the recent past and because of the consistency of the variables.

3.1.3 Model Specification, Estimation Techniques and Basic results.

The study adopts a model used to analyse inflation in Tanzania in 2001 by Laryea and Sumalia where they observe that in the short run output and monetary factors influence inflation while in the long run exchange rate, output and monetary factors do.

$P_t = f(M_t, Y_t, E_t, P_{t-1}, P_t^f)$ ……..Equation 1

Where;

P_t - Inflation rate

M_t – Money supply

Y_t – Nominal output

E_t– Nominal exchange rate

P_{t-1} - prices for the previous years

P_t^f - prices of goods determined by the foreign Market

However to analyse the Kenyan case, the study sought to add the following variables to the equation.

Central Bank Rates-CBR

Wage Rate-W_r

Political Instability-D

Corruption Perception-CP

Error term- ε

The model therefore takes the following functional form.

$P_t = f(M_t, Y_t, E_t, P_{t-1}, P_t^f, CBR_t, Wr_t, PI_t, CP_t)$ ……Equation 2

$P_t = a_0 + a_1M_t + a_2Y_t + a_3E_t + a_4P_{t-1} + a_5P_t^f + a_6CBR_t + a_7Wr_t + D_t + \varepsilon$

……Equation 3

Assuming that the price of non tradables depend on the money market equilibrium while prices of tradables depends on foreign prices and are therefore determined in the world market.

Political instability was a dummy variable that took the value 0 or 1 and corruption perception was an index.

3.1.4 Description of Variables and their expected signs.

- **Inflation Rate**

  This refers to an annual increase in the price of a basket of goods and services that are purchased by consumers in an economy leading to the decline of the purchasing power of a country's currency.

- **Food Prices**

Food prices both locally and internationally may have an effect on inflation, moreover food is an essential commodity and changes in the prices affect the whole economy. Shocks in the agricultural sector such as the prevalence of famine and droughts have contributed to shocks in this sector. Imports may be too expensive and this may have an effect on the exchange rate in the country. This was expected to have a positive sign (Mwega, 1990).

- **Oil Prices**

Oil is a major import in the country since it is not locally produced; any changes in the prices in the international market have a multiplier effect as it affects more than one sector. A change in fuel and energy prices may result to higher prices in the transport industry and a higher production cost to industry that rely on it as a source of power. This was expected to have a positive sign. (Economic Survey, 1975)

- **Wages**

The formation of trade unions for collective bargaining aims at demanding an increase in wages due to expectation of higher inflation and unless the government is involved in bringing industrial peace between employers and employees the wage rates will keep changing to counter inflation. This translates to a higher purchasing power leading to a further increase in price. This was expected to have a positive sign. (Chhibber, 1991)

- **Monetary Growth**

Growth in money, M2 in the economy has a direct effect in the demand of commodities in the economy which further leads to an increase in prices resulting to inflation. This was expected to have a positive sign (Gottschalk et al, 2008)

- **Exchange Rates**

The exchange rate has a direct impact on the price of exports and imports in the country and increased money supply leads to the depreciation of the nominal exchange rate. This was expected to have a negative sign. (Sowa & Kwakye, 1993)

- **Central Bank Rates**

  The monetary policy set by the central bank may have an effect on the money supply in the economy by making credit cheaper and accessing money easier and therefore boosting the demand for commodities in the economy. This may ultimately lead to inflation and this variable was expected to have a negative sign (Ndungu, 1996).

3.2 Analysis and Data Exploration Techniques

3.2.1 Pre-Estimation Tests

- **Stationarity tests**

For data to be valid, the data sets must be stationary, that is the mean and the variance of the data set is time independent and they are constant over time, to test for stationarity the study made use of the order of integration. If a series is integrated of order (0) i.e. I (0) then it is stationary but if otherwise it is non-stationary and to test for stationarity, the research made use of the Dickey Fuller Unit Root Test. (Gujarati, 1995).

- **Augmented Dickey Fuller Unit Root Test**.

This test is derived from the Dickey Fuller test and it is an appropriate method of checking whether a variable is integrated of orders one which was proposed by Dickey & Fuller (1979). However, due to the fact that the dickey fuller test may suffer autocorrelation in the residual process if OLS is applied we made use of the augmented dickey fuller test.This is because the errors may not be normally and identically distributed and the residual variance may be biased. The test can be used to test the order of integration for a variable generated with a drift from and a deterministic trend. The null hypothesis may be taken to mean prices follow a random walk and future prices cannot be predicted while the alternative may mean economic agents may predict future prices and the do not follow a random walk(Gujarati, 1995).

- **Multicollinearlity**

When Multicollinearlity exists among explanatory variables, it is impossible to get unique estimate of all parameters. The explanatory variables should not be correlated, this is because if they are correlated the determinant will be zero and the variance cannot be found.

This therefore makes it difficult to draw statistical inference about them from a given sample. The Ordinary least squares remain the best linear unbiased estimator as long as there is no multicollinearlity.

The problem of multicollinearlity may lead to large variances and standard errors of the OLS estimators, wider confidence intervals, insignificant t ratios, high values of t ratios and high values of R^2.It also makes the OLS estimators and their standard errors to be sensitive to small changes in the data.

When multicollinearlity exists there could be wrong signs of the regression coefficients and in the presence of serious multicollinearlity problem. This could be solved by having prior information on the parameters, transformation of variables acquisition of new data, dropping one of the variables in the model or rethinking the model all together. (Gujarati, 1995).

- **Heteroscedasticity**

This problem occurs when the variances of the population are not constant or unequal. The problem of heteroscedasticity is tested using the Breusch-Pagan test.

If the chi-square value obtained exceeds the critical chi-square value, the null hypothesis of no heteroscedasticity is rejected. (Gujarati, 1995).

- **Autocorrelation**

For the ordinary least squares to work there must be no autocorrelation that is the current error term must not be correlated with the previous error term. There should not be correlation between observations ordered in time. When there is no autocorrelation, it simply means;

$E(U_i, U_j) = 0$ where $i \neq j$

The expected value of the two error terms U_i and U_j is zero. This means that the disturbance term relating to any observation is not influenced or related by the disturbance term relating to another observation.

Autocorrelation may occur due to various reasons and one such cause is due to inertia or sluggishness. Time series such as price indices and GNP may experience business cycles where there are fluctuations in the economic activities causing interdependence.

This phenomenon autocorrelation may also occur due to error in the model specification either by being stated in the wrong functional form or some important variables being omitted in the model. Data manipulation may also cause autocorrelation and here the Durbin Watson test is used to check for autocorrelation. (Gujarati, 1995).

- **Normality Tests**

This test seeks to prove that the error term is normally distributed and is based on the assumption that U_i is normally distributed. The research will make use of the Shapiro-wilk test for testing for normality (Gujarati, 1995).

- **Testing for structural stability of regression models.**

This test is used when dealing with time series data and there may be a structural change between the dependent variable Y and the explanatory variables the X's.This will be achieved by dividing the data into two sets, and for the purpose of this research investigate whether shocks in the economy had an impact on the inflation rate.

The data set is divided into two, from 1970-1990 and 1991-2013 since having a pooled regression of the whole data set may disregard some possible differences between the two sub periods (Gujarati, 1995).

- **Testing for Endogeneity**

Endogeneity occurs in a multiple regression model when variables are omitted or an error in measurement occurs. It occurs when the error term and the explanatory variables become correlated.i.e

Cov (X_i, E_i) $\neq$ 0 Thehausman test for endogeneity can be used to test for the presence of endogeneity (Gujarati, 1995).

CHAPTER FOUR

RESEARCH ANALYSIS AND FINDINGS

4.1 Introduction

This chapter consists of descriptive statistics, Multicollinearity test, test for stationarity, normality test, autocorrelation test, structural breaks, regression coefficient results and interpretation of the regression coefficient findings.

4.2 Descriptive Statistics

Summary of the variables used in the study was presented in table 4.1 below.

Table 4.1: Summary Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Inflation	44	12.35615	8.310769	1.554328	45.97888
FoodPrice	44	108.5097	22.58626	77.8	169.9291
OilPrice	43	102.34	27.70246	69.57578	188.0652
CBR	44	16.61227	7.071829	8	36.24
M2	43	16.5896	9.993615	0.782664	48.89955
Corruption~x	43	0.212093	0.064533	0.03	0.33
Wagerate	44	2747.886	172.3036	2250	3134
GDPRate	44	4.367857	4.300934	-4.65545	22.17389
Exchange	44	97.01555	21.95111	56.174	147.41

Source: Authors computation

Table 4.1 above indicates that the average inflation rate during the study period was 12.35 per cent with standard deviation of 8.3107. Kenya recorded a high level of inflation of 45.97 per cent and a minimum inflation of 1.554 percent between the years 1970 to 2013. High inflation could have been attributed to an increasing disposable income and low production of

agricultural output. On the average, food price had a mean of 108.50 units with standard deviation of 22.586. Central banks rate had a mean of 16.6122 percent with standard deviation of 7.0718. High CBR was 36.24 percent with a minimum rate of 8 percent. M2 registered a mean of 16.5896 percent with maximum money supply at 48.899 percent. Corruption index on the average was 0.2120 with a low of 0.0645. The economy recorded a maximum GDP growth rate of 22.1738 per cent and a minimum GDP growth rate of -4.65545 per cent. On the average real exchange rate was 97.0155 with a maximum of 147.41 during the study period.

4.3 Diagnostic test

Unit root test

The result below is from Dickey-Fuller test to examine unit root. The null hypothesis that the variable x is non-stationary ($H_{0:}\ \beta = 0$) is rejected if β is significantly negative, when compared with the Augmented Dickey-Fuller (1979), critical values. Variables with p values (z-scores) less than 0.005 are stationary while variables with p values greater than 0.005 are non-stationary. The result was presented in table 4.2 below. Stationarity test reveals that inflation, M2, Corruption index, wage rate and GDP growth rate are integrated of order zero. That is inflation, M2, Corruption index; wage rate and GDP growth rate are stationary. Food prices, oil price, CBR and exchange rate were established to be non-stationary. Food prices, oil price, CBR and exchange rate were integrated of order one and were therefore differenced once to become stationary.

Table 4.2: Unit root result

Variable	test statistics	5% critical value	P value z=(t)	Stationary
Inflation	-3.905	-2.95	0.002	Stationary
Food Price	-1.393	-2.95	0.5856	Non-Stationary
Oil Price	-1.701	-2.95	0.4303	Non-Stationary
CBR	-1.612	-2.95	0.4768	Non-Stationary
M2	-4.88	-2.95	0	Stationary
Corruption Index	-3.136	-2.95	0.024	Stationary
Wage rate	-3.103	-2.95	0.0264	Stationary
GDP rate	-5.223	-2.95	0	Stationary
Exchange Rate	-1.903	-2.95	0.3306	Non-Stationary

Cointegration test

Since food prices, oil price, CBR and exchange rate are non-stationary at level but stationary at first difference a cointegration test was conducted using Engel-Grange Test.

Table 2.3 Cointegration test

```
. reg FoodPrice OilPrice CBR M2
```

Source	SS	df	MS	Number of obs	=	43
				F(3, 39)	=	38.98
Model	14423.4391	3	4807.81303	Prob > F	=	0.0000
Residual	4809.77743	39	123.327626	R-squared	=	0.7499
				Adj R-squared	=	0.7307
Total	19233.2165	42	457.933727	Root MSE	=	11.105

FoodPrice	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
OilPrice	.6542322	.0619285	10.56	0.000	.52897	.7794943
CBR	.0911968	.240891	0.38	0.707	-.3960512	.5784449
M2	.3007193	.1725154	1.74	0.089	-.0482261	.6496647
_cons	33.85802	7.884086	4.29	0.000	17.91095	49.80509

```
. predict ehat, residual
(1 missing value generated)

. regress D.ehat L.ehat L.D.ehat
```

Source	SS	df	MS		
Model	2842.25847	2	1421.12923	Number of obs	= 41
Residual	3716.1916	38	97.7945159	F(2, 38)	= 14.53
				Prob > F	= 0.0000
				R-squared	= 0.4334
				Adj R-squared	= 0.4036
Total	6558.45007	40	163.961252	Root MSE	= 9.8891

D.ehat	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ehat						
L1.	-.9037178	.1850248	-4.88	0.000	-1.278281	-.5291547
LD.	.150588	.150559	1.00	0.324	-.1542028	.4553787
_cons	.8488616	1.546282	0.55	0.586	-2.281422	3.979145

The t-ratio on the lagged value of residuals is -4.88. The 5% critical value for a cointegrating regression containing an intercept is 10.56, 0.38 and 1.74 and that t-ratio is less than this. The null hypothesis of no cointegration is rejected when $t \leq t_{c,}$ and not rejected when $t \geq t_c$. Since in this case t-statistics is -4.88 < 10.56, 0.38 and 1.74 and the null hypothesis that the least square residuals are non-stationary is rejected; the residuals are stationary. This implies that food prices, oil price, CBR and exchange rate are cointegrated.

Multicollinearity test

Test for multicollinearity on all the independent variables did not indicate any serious collinearity between variables, except between food price and oil price (R= 0.8535). This illustrates that food price has a strong and positive relationship between oil price such that an increase in oil price will result to an increase in food price and vice versa.

Table 4.4: Correlation matrix

	Inflat~n	FoodPr~e	OilPrice	CBR	M2	Corrup~x	Wagerate	GDPRate	Exchange	
Inflation	1.00000									
FoodPrice	-0.0244	1.0000								
OilPrice	-0.077	0.8535	1.0000							
CBR	0.2543	0.0712	0.0308	1.0000						
M2	0.2348	0.1774	0.0399	0.1037	1.0000					
Corruption~x	0.1124	-0.1229	-0.3188	0.418	-0.059	1.0000				
Wagerate	-0.0204	0.5708	0.55	-0.163	-0.028	-0.131	1.0000			
GDPRate	-0.2923	-0.0582	0.0878	-0.343	-0.098	-0.1231	0.1049	1.0000		
Exchange	0.1877	0.1069	-0.083	0.6714	-0.079	0.6342	-0.011	-0.3305	1.000	1.00000

Source: Authors computation

Heteroscedasticity test

The study used Breusch-Pagan test to test for heteroscedasticity and the result presented below.

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of D.ehat

         chi2(1)      =     1.71
         Prob > chi2  =   0.1909
```

The chi-square value was small indicating heteroschedasticity was probably not a problem.

Shapiro–Wilk Normality

The study used Shapiro–Wilk test to test for the normality of the variables used in the study. The null-hypothesis of this test is that the population is normally distributed. Thus if the p-value is less than the chosen alpha level, then the null hypothesis is rejected and there is

evidence that the data tested are not from a normally distributed population. In other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population cannot be rejected. In other words the value above 0.05 indicates normality, if the test is significant (less than), then the variable is non-normal. Result from table 4.5 indicates that M2 and wage rate are from normal distribution while inflation, food price, oil price, CBR, corruption index, GDP rate and exchange rate are not normally distributed.

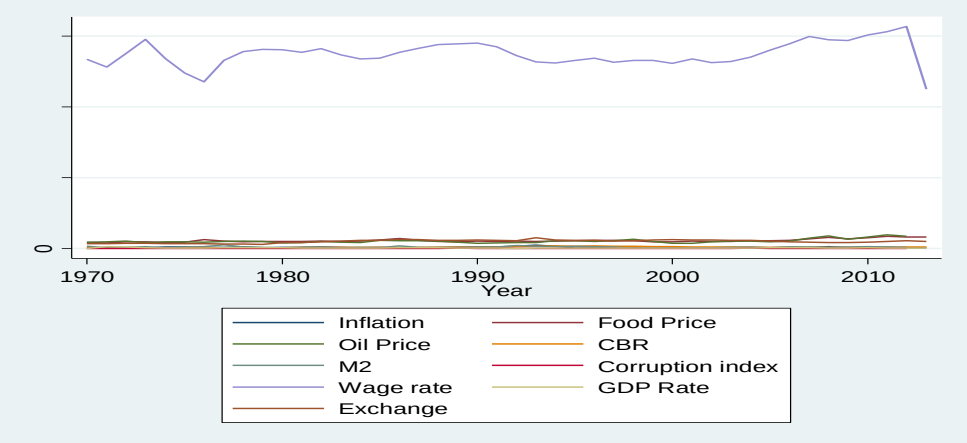
Table 4.5: Shapiro-Wilk test for Normality

```
. swilk Inflation FoodPrice OilPrice CBR M2 Corruptionindex Wagerate GDPRate Exchange

                    Shapiro-Wilk W test for normal data

    Variable |   Obs        W           V          z       Prob>z
-------------+--------------------------------------------------
   Inflation |    44    0.85911      5.995      3.791     0.00008
   FoodPrice |    44    0.84914      6.419      3.935     0.00004
    OilPrice |    43    0.82510      7.311      4.205     0.00001
         CBR |    44    0.87068      5.503      3.609     0.00015
          M2 |    43    0.94974      2.101      1.569     0.05832
Corruption~x |    43    0.87648      5.163      3.470     0.00026
   Wagerate |    44    0.96676      1.414      0.734     0.23160
    GDPRate |    44    0.81572      7.842      4.359     0.00001
   Exchange |    44    0.93770      2.651      2.063     0.01954
```

Structural breaks for the variables

Kenya has experienced both external and internal shocks during the study period. Therefore the study tried to establish an unexpected shift in the variables during the period of the study. Figure 4.1 below indicates that both external and internal shock had no impact on the variables used in the study.

Figure 4.1: Structural breaks



4.4 Regression Analysis

Table 4.6: Regression coefficient

```
. reg Inflation M2 Corruptionindex Wagerate GDPRate PD2 D1EXCH D1CBR D1OILPRICE D1FP
```

Source	SS	df	MS
Model	1694.15504	9	188.239449
Residual	1121.64057	32	35.0512678
Total	2815.79561	41	68.6779418

Number of obs	= 42
F(9, 32)	= 5.37
Prob > F	= 0.0002
R-squared	= 0.6017
Adj R-squared	= 0.4896
Root MSE	= 5.9204

Inflation	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
M2	.1117339	.1012627	1.10	0.278	-.0945314	.3179993
Corruptionindex	.8037688	17.44342	0.05	0.964	-34.72732	36.33486
Wagerate	-.0070542	.0061595	-1.15	0.261	-.0196007	.0054923
GDPRate	-.7388727	.2394016	-3.09	0.004	-1.226518	-.2512276
PD2	-1.436536	2.13464	-0.67	0.506	-5.784656	2.911584
D1EXCH	.0910636	.0971991	0.94	0.356	-.1069245	.2890518
D1CBR	1.687907	.3462655	4.87	0.000	.9825871	2.393227
D1OILPRICE	.0937037	.0577842	1.62	0.115	-.0239988	.2114062
D1FP	-.0920739	.0845082	-1.09	0.284	-.2642114	.0800636
_cons	33.634	18.28622	1.84	0.075	-3.613814	70.88182

Therefore the regression equation is given as:

INF = 33.634 + 0.1117M2 + 0.804CP – 0.007Wr – 0.7388Y-1.4365PD2 + 0.0937D1OIP – 0.0920D1FP+0.091D1EXR+1.688D1CBR

Regression result in table 4.6 indicates R-squared of 0.6017 implying that 60.17% of the total variation in inflation level is attributed to the changes in the independent variables used in the

model. The variables included in the model explain only 60.17% of the changes of inflation in Kenya. This implies that there is other determinant of inflation which were not captured in the study model. The F statistic (5.37) is greater than 0.05 therefore the explanatory variables do not jointly explain the variation in inflation in Kenya.

The regression coefficient showed there is a negative relationship between food price and inflation level (a_1=-0.09207). This means that when the price of food increase by a unit, inflation will decrease by 0.092. However, at 5% level of significance, food price was established to be statistically insignificant (t=-1.09, p=0.284, p>0.05) in causing a variation in inflation.

Central bank rates is statistically significant at 5% level of significance in causing the variation in inflation rate (t=4.87, p=0.000, p<0.05). A unit increase in central bank rate will cause inflation to increase by 1.6879 units. Money supply (M2) has a positive relationship with the inflation rate. A unit increase in money supply will result to inflation rate increasing by 0.112. GDP growth rate has negative relationship with inflation. A unit increase in GDP growth rate will cause inflation to decrease by 73.88percent. GDP is also statistically significant at 5% level of significance (t=-3.09, p=0.004, p<0.05) in causing a change in inflation. Corruption index confirm our expected sign of positive relationship with inflation. Corruption index coefficient is positive implying that an increase in corruption index by one unit will lead to 0.8037 unit increase in inflation rate. However, corruption index is insignificant in determining inflation level in Kenya. Wage rate coefficient is insignificant in causing the changes in inflation. A negative relationship between wage rate and inflation does not conform to the expected sign of positive relationship. The relationship between exchange rate and inflation has been established to be positive. This implies that a unit increase in the depreciation of exchange rate will cause inflation to increase by 0.091. Moreover, exchange rate is insignificant factor in determining inflation (t=0.94, p=0.356, p>0.05)

Both political instability and political stability are negatively related with the inflation and are insignificant in explaining the variation in inflation. Political instability is negatively correlated with inflation because Kenya has not witnessed political instability over the years with the exception of 1982 and 2007 and only sporadic ethnic tension.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The main objective of the study was to establish the determinants of inflation in Kenya from 1970 to 2013 while the specific objective was to draw lessons for the future and further suggest policy recommendations. Based on this study, findings indicate that the average inflation rate during the study period was 12.35 percent with a high level of inflation of 45.97 percent and a minimum inflation of 1.554 percent. On the average, food price had a mean of 108.50 units with standard deviation of 22.586. Central banks rate had a mean of 16.6122 percent while CBR had a maximum rate of 36.24 percent with a minimum rate of 8 percent. M2 registered a mean of 16.5896 percent with maximum money supply at 48.899 percent. Corruption index on the average was 0.2120 with a low of 0.0645. The economy recorded a maximum GDP growth rate of 22.1738 per cent and a minimum GDP growth rate of -4.65545 per cent. Real exchange rate was on the average 97.0155 with a maximum of 147.41 during the study period.

The regression coefficient showed there was a negative relationship between food price and inflation level, Central bank rates is statistically significant at 5% level of significance in causing the variation in inflation rate, Money supply (M2) has a positive relationship with the inflation rate, GDP growth rate has negative relationship with inflation, Corruption index is negatively related to inflation, Wage rate coefficient is insignificant in causing the changes in inflation and the relationship between exchange rate and inflation was established to be positive.

5.2 Conclusions and Policy Recommendations

Central bank rate and economic growth are the main instruments policy makers should aim at in controlling the inflation rate. According to the result, central bank rates and GDP growth rate are significant determinants of inflation rate during the study period. According to the result, an increase in CBR will lead to an increase in inflation. Therefore policy makers should adopt policies that cushion an increase in central bank rates. Interest rate is the major tool used by the central bank to achieve inflation target. Changes in this interest rate affect various kinds of economic activity and thereby, over time, inflation. Interest policy is effective in reducing the supply of money thereby reducing the rate of inflation. Economic growth has a negative impact on the rate of inflation. This implies that an increase in economic growth reduces the level of inflation. Therefore policy makers should embrace fiscal policies that spur economic growth in order to contain an increase in inflation.

5.3 Limitations of the study

This study faced a challenge of data availability and reliability due to inconsistency of data from various data sources and there is therefore the need for the government to synchronize all these data sources that emanate from the country.

5.4 Areas for further research

The study used time series data using OLS as a method of estimation, a similar study can therefore be done using panel data, another comparing inflation between different regions in the country and yet another one may utilize data from the black market as a contributing factor to inflation in the country.

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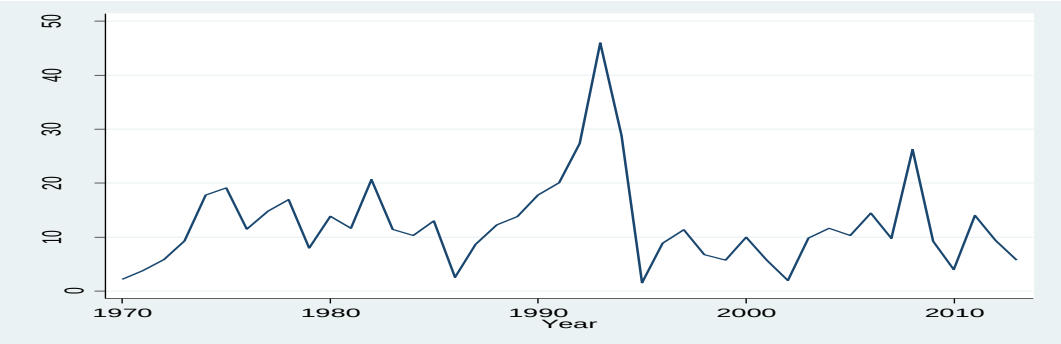
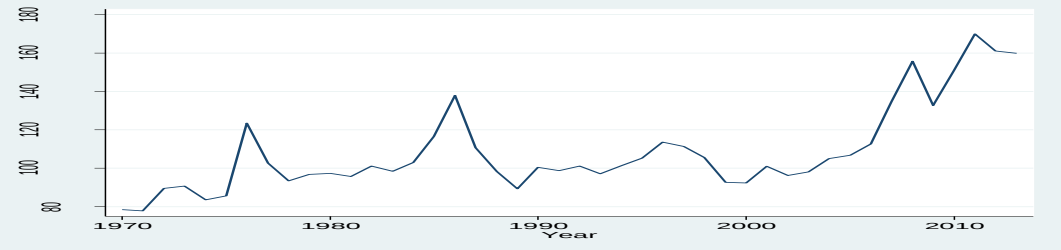
APPENDICES

Appendix I: Graph for variable time trend

Inflation

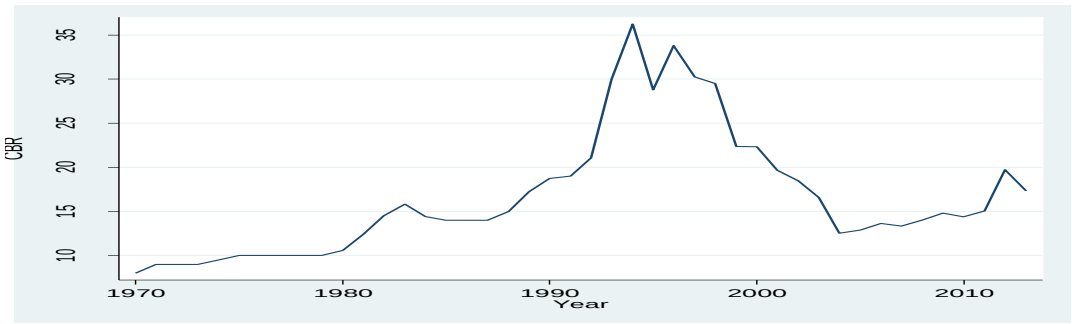


Food price

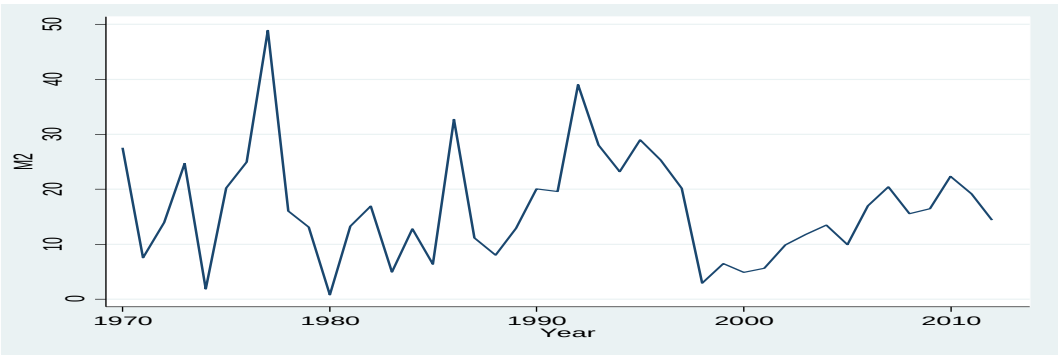


Oil price

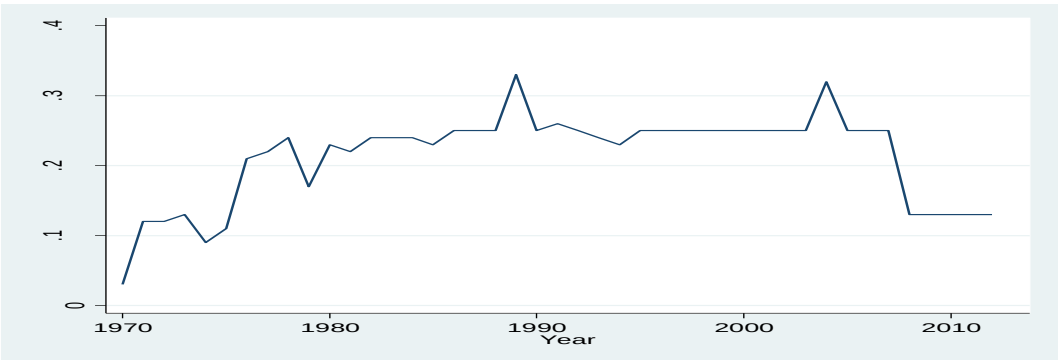
CBR



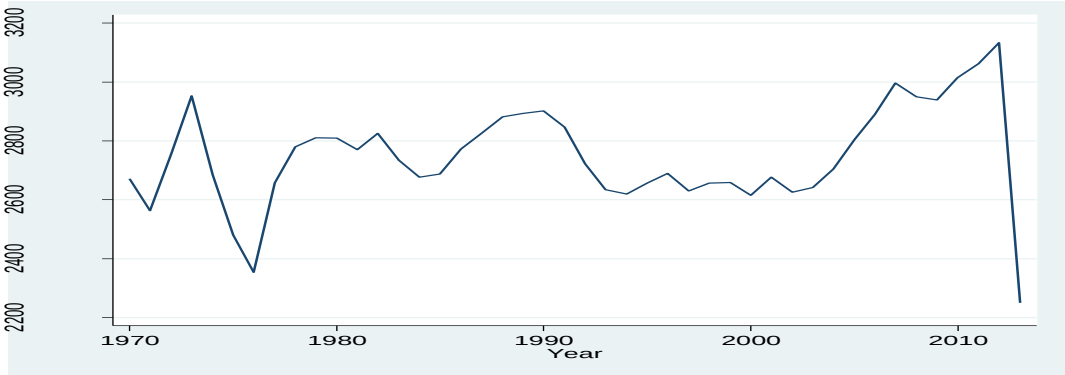
M2



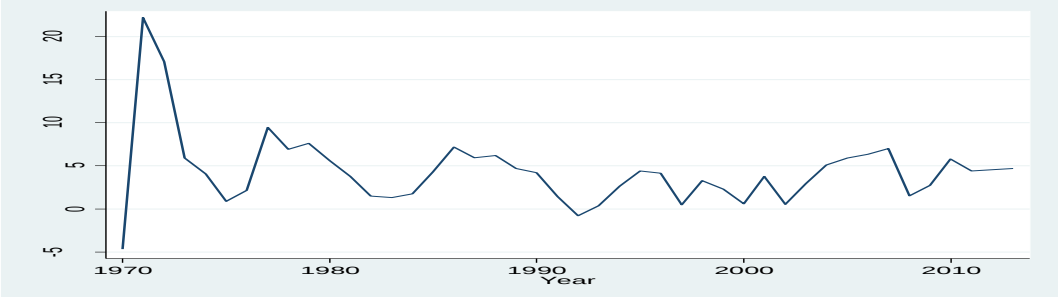
Corruption index



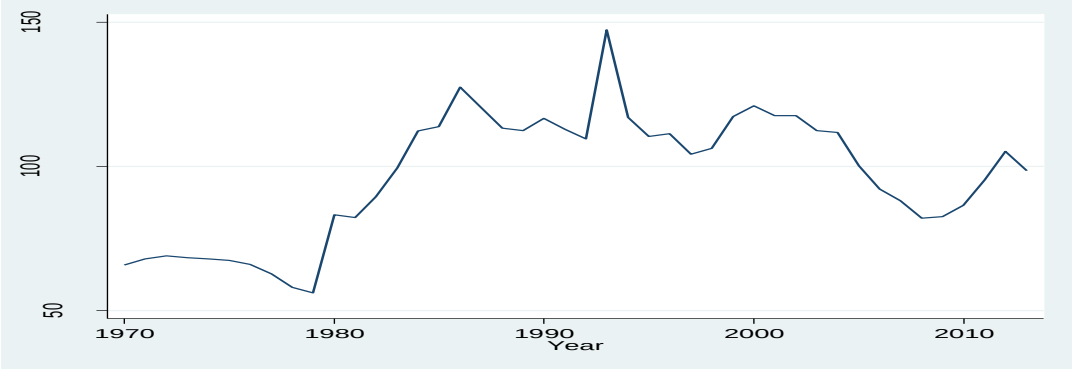
Wage rate



GDP growth rate



Exchange rate



Appendix II:Data

Year	Inflation	Food Price	Oil Price	CBR	M2	Corruption index	Wage rate	GDP Rate	Exchange Rate
1970	2.188527	78.5	83.6	8	27.58199	0.03	2671	-4.65545	65.80
1971	3.780206	77.8	93.51	9	7.532599	0.12	2563	22.17389	67.97
1972	5.831645	89.5	100.2	9	13.94596	0.12	2755	17.08243	68.98
1973	9.281194	90.7	79.5	9	24.69984	0.13	2953	5.89658	68.41
1974	17.80995	83.5	89.5	9.5	1.831754	0.09	2684	4.065617	67.93
1975	19.12018	85.6	93.6	10	20.21312	0.11	2480	0.882203	67.41
1976	11.44903	123.5	87.3	10	24.9573	0.21	2354	2.153965	66.05
1977	14.82096	102.7	95.5	10	48.89955	0.22	2658	9.453798	62.78
1978	16.93178	93.4	100.5	10	16.03152	0.24	2780	6.912494	58.05
1979	7.979353	96.8	98.5	10	13.10929	0.17	2811	7.615226	56.17
1980	13.85818	97.3	75.8	10.58	0.782664	0.23	2810	5.591976	83.22
1981	11.60305	95.8	80.8	12.42	13.26362	0.22	2770	3.773544	82.26
1982	20.66671	101.1	96.5	14.5	16.92618	0.24	2825	1.506478	89.52
1983	11.39778	98.4	85.6	15.83	4.942042	0.24	2734	1.30905	99.46
1984	10.2841	103.0	83.3	14.42	12.7862	0.24	2677	1.755217	112.37
1985	13.00657	116.6	112.6	14	6.346286	0.23	2687	4.300562	113.86
1986	2.534276	137.9	108.7	14	32.69897	0.25	2772	7.177555	127.48
1987	8.637673	110.7	106.2	14	11.13019	0.25	2826	5.937107	120.51
1988	12.26496	98.3	99.4	15	8.039237	0.25	2882	6.203184	113.32
1989	13.78932	89.3	85.8	17.25	12.92083	0.33	2893	4.690349	112.49
1990	17.78181	100.4	69.6	18.75	20.05728	0.25	2902	4.192051	116.69
1991	20.0845	98.7	75.1	19	19.57273	0.26	2847	1.438347	112.82
1992	27.33236	101.1	79.8	21.07	39.02143	0.25	2723	-0.79949	109.59
1993	45.97888	97.1	80.2	29.99	28.03344	0.24	2634	0.353197	147.41
1994	28.81439	101.3	106.8	36.24	23.17787	0.23	2619	2.632785	117.05
1995	1.554328	105.3	108.1	28.8	29.00048	0.25	2657	4.406217	110.48
1996	8.864087	113.7	98.6	33.79	25.32506	0.25	2690	4.146839	111.38
1997	11.36185	111.3	106.0	30.25	20.19466	0.25	2630	0.474902	104.28
1998	6.722437	105.6	130.5	29.49	2.931252	0.25	2657	3.290214	106.25
1999	5.742001	92.6	94.2	22.38	6.487695	0.25	2659	2.305389	117.29
2000	9.980025	92.4	70.4	22.34	4.907898	0.25	2615	0.599695	121.05
2001	5.738598	101.0	71.7	19.67	5.640363	0.25	2677	3.779906	117.6

2002	1.961308	96.2	93.9	18.45	9.88881	0.25	2626	0.54686	117.62
2003	9.815691	98.1	101.0	16.57	11.7873	0.25	2642	2.932476	112.44
2004	11.62404	105.0	104.4	12.53	13.47166	0.32	2704	5.1043	111.79
2005	10.31278	106.8	92.9	12.88	9.908372	0.25	2804	5.906666	100.25
2006	14.45373	112.7	99.9	13.64	16.97191	0.25	2890	6.330633	92.18
2007	9.75888	134.6	143.4	13.34	20.42305	0.25	2997	6.993285	88.14
2008	26.23982	155.7	175.6	14.02	15.54884	0.13	2950	1.526949	82.04
2009	9.234126	132.8	126.6	14.8	16.45732	0.13	2939	2.735286	82.62
2010	3.961389	150.7	158.3	14.37	22.36167	0.13	3014	5.802908	86.53
2011	14.02155	169.9	188.1	15.05	19.15205	0.13	3062	4.420654	95.38
2012	9.378396	161.0	169.0	19.72	14.39232	0.13	3134	4.552554	105.26
2013	5.718274	159.9		17.31			2250	4.687291	98.51

Apendix III: Unit root test result output

```
. dfuller Inflation

Dickey-Fuller test for unit root                  Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.905           -3.628            -2.950           -2.608
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0020
```

```
. dfuller FoodPrice

Dickey-Fuller test for unit root                  Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.393           -3.628            -2.950           -2.608
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5856
```

```
. dfuller OilPrice

Dickey-Fuller test for unit root                   Number of obs   =        42

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic          Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.701           -3.634            -2.952           -2.610
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.4303


. dfuller CBR

Dickey-Fuller test for unit root                   Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic          Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.612           -3.628            -2.950           -2.608
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.4768
```

```
. dfuller M2

Dickey-Fuller test for unit root                   Number of obs   =        42

                                     ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -4.880           -3.634            -2.952           -2.610
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.0000

. dfuller Corruptionindex

Dickey-Fuller test for unit root                   Number of obs   =        42

                                     ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.136           -3.634            -2.952           -2.610
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.0240
```

```
. dfuller Wagerate

Dickey-Fuller test for unit root                   Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic          Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.103           -3.628            -2.950           -2.608
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.0264

. dfuller GDPRate

Dickey-Fuller test for unit root                   Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic          Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -5.223           -3.628            -2.950           -2.608
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.0000
```

```
. dfuller Exchange

Dickey-Fuller test for unit root                   Number of obs   =        43

                                 ---------- Interpolated Dickey-Fuller ---------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic         Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -1.903           -3.628            -2.950           -2.608
------------------------------------------------------------------------------

MacKinnon approximate p-value for Z(t) = 0.3306
```