SELECTED MACROECONOMIC DETERMINANTS OF INFLATION IN KENYA

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DECLARATION

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DEDICATION

I dedicate this thesis to my sister Jackline Okara and my entire family for their moral support as well as financial support they gave towards successfully completing this thesis

ABBREVIATIONS AND ACRONYMS

AD	Aggregate Demand
ADF	Augmented Dickey Fuller
AFDP	African Development Bank
AGOA	African Growth and Opportunity Act
ARMA	Auto regressive Moving Averages
ASAL	Arid and Semi Arid Areas
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residuals
EPZ	Export Processing Zones
DF	Degree of Freedom

DF-GLS	Dickey Fuller Generalized Least Square
DGS	Data Generating Process
GDP	Gross Domestic Product
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
KPSS	Kwiatkowski - Philips - Schmidt - Shin
LM	Langragian Multiplier Test
NKPC	New Keynesian Philips Curve
OLS	Ordinary Least Square
PP	Philips Perron
PROB	Probability
SAPs	Structural Adjustment Programmes
VAR	Vector Auto Regression
VARMA	Vector Autoregressive Moving Average
VECM	Vector Error Correction Model
WBR	World Bank Report
ZA	Zivot Andrew

ABSTRACT

Despite an improved macroeconomic performance in Kenya for nearly a decade, inflation rates have averaged a double digit in recent past. A sharp increase in inflation could reduce the rate of economic growth and worsen poverty levels. High and volatile inflation is a threat to good economic performance. Economic growth took off in 2004 in Kenya, but alongside higher growth, there has been rapid inflation and large inflation volatility. In 2011, the country faced substantial inflationary pressure that was exacerbated by high international oil prices, drought conditions and exchange rate depreciation. As a result, the rate of inflation increased to 19.72 per cent in November 2011, prompting the Central Bank of Kenya to adopt a tight monetary stance. Despite the tight monetary stance and improved economic growth rate during the second quarter of 2012, inflation peaked at over 20 per cent. The study thus sought to establish the determinants of inflation in Kenya. Specifically the study focused on the effect of unemployment, narrow money supply, wide money supply and level of GDP on inflation in Kenya. The hypotheses tested under this study were that unemployment, narrow money supply, wide money supply and level of GDP did not determine inflation in Kenya. The study sought to provide an empirical groundwork on Kenya's inflation trends upon which prudent monetary and fiscal policies would be formulated. It sought to identify the determinants of inflation, which when properly understood, documented and captured in relevant models would make it possible to estimate accurately the inflation levels within a specified period of time. The study relied on secondary annual time series data of 1980 to 2011. The sources of the secondary data were the Kenya Bureau of Statistics and World Bank. The study employed the use of a Vector Autoregression (VAR) model due to its robustness in forecasting. The collected data was first subjected to unit root test at levels using Augmented Dickey Fuller, Kwiatkowski–Phillips–Schmidt–Shin (KPSS) and Philips Perron methods. The data was found to be non stationary at level but stationary at first difference. The data was then tested for cointegration using Johansen procedure. Modeled variables were found to have long term relation. The Vector Error Correction Model (VECM) was used to determine short term relations among the variables. It was established that GDP and unemployment had a negative impact on inflation while narrow money supply had a positive effect on inflation both on the short run and long run. It was equally established that broad money supply had a negative effect on inflation. Modeled variables passed stability test as well as diagnostic tests thus were fit for analysis. Study highly recommends that the government should use broad money supply (M2) to control inflation and unemployment.

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its resource

CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

The Kenyan economy registered improved economic performance in 2012 with an annual growth of 4.6 per cent in GDP compared to 4.4 per cent in 2011. The macroeconomic environment witnessed improved price and exchange rate stability. However, per capita income growth, which is largely explained by labour market dynamics, has been relatively slow at 1.7 per cent in 2012. The Kenyan labour market is characterized by a large share of informal sector employment, which partly explains the low levels of income per capita and productivity. The informal sector is generally characterized by low productivity (KIPPRA, 2013).

Macroeconomic stability remains a top policy priority for the government as there are potential risks emanating from internal and external imbalances. These include: fiscal pressure arising from implementation of Medium Term Plan programmes, the 2010 Constitution and demands for higher wages and salaries, a growing current account deficit and the investment-savings resource gap. The government should be ready to respond effectively to these changing economic conditions in order to ensure that inflation rates are remain within expected limits.

Since the great depression, the world has continued to experience high inflation. In 1981, the Gallup Organization conducted an opinion poll asking what was the most important problem facing USA. With the inflation rate in double digits, a majority named inflation

as the most important problem (Rudd and Whelan, 2005).

Inflation is the persistent rise in the general price level. The overall general upward price movement of goods and services in an economy (often caused by an increase in the supply of money), is usually measured by the Consumer Price Index and the Producer Price Index. There are two main types of inflation, which is demand pull inflation and cost push inflation. Demand pull inflation is inflation where the basic cause comes from the demand side. The constant increase in demand is due to factors such as increase in money supply, increase in government purchase, increases in exports and so on. When demand is increased and cannot be met by an equivalent increase in supply, the general price level will increase and inflation will happen (Laryea and Sumaila, 2001).

Cost push inflation, which is also called supply push inflation, occurs because of rising cost of production, for example an increase of price of raw materials and an increase of wage rate. The general price level of goods and services will rise when there is an increase of production costs in the industries (Backhouse, 2000).

1.1.1. Inflation Trend in Kenya

Kenya is not exempted from experiencing inflation. A particular turn of events in the 1990s is the slowdown in Kenyan economic growth, rapid rise in inflation levels, money growth and interest rates and depreciation on the Kenyan currency in relation to other currencies. The 1990s contrast sharply with inflation rates in Kenya during independence when inflation rates averaged at 3%. During this period inflation was not a policy problem. In the 1970s, with first ever oil shock and balance of payment problem, the rate if inflation started increasing. Expansionary monetary and fiscal policies along with

balance of payment crises led to economic crisis in Kenya in mid 1979s (Njuguna & Durevall, 2000).

Within the years of 1976 and 1977 there was commodity boom in major export commodities that is coffee and tea. This eased the difficulties faced in the 1970s. This boom led to appreciation of exchange rate, fiscal expansion and expansion of domestic credit and expansion of non bank financial institutions. Despite the boom the country's in debtness was rising and so was the level of fiscal deficit.

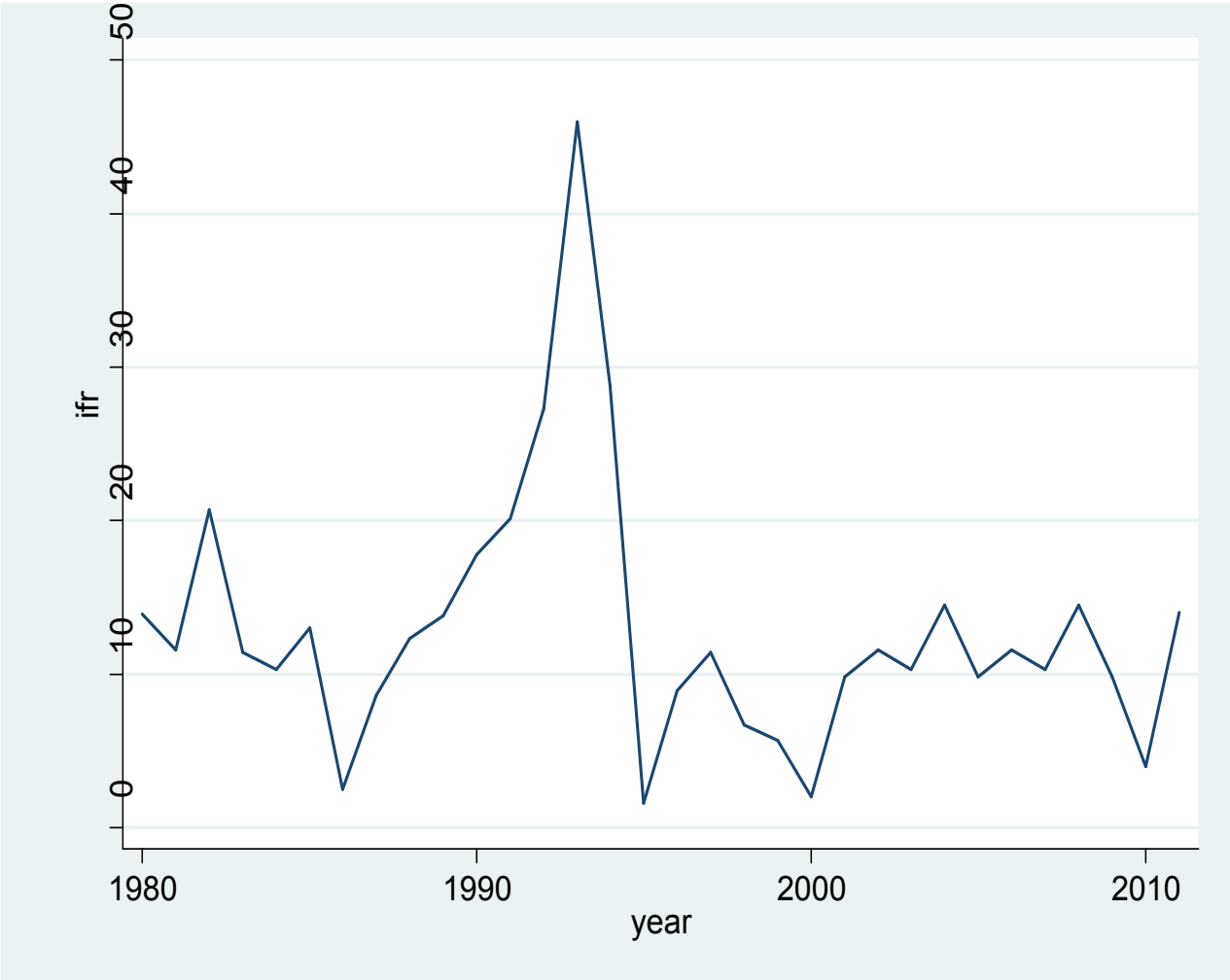
The 1980s opened with major macroeconomic disequilibrium calling for revision of policy options .The macroeconomic policies pursued in the previous years were not effective and sustainable and thus drastic changes were inevitable. Hence the first policy was to change from fixed exchange rate system to floating. After the change in exchange rate regime other policies that followed included interest rate adjustment and reduction in fiscal deficit. These policies helped to slow down inflation to a great deal.

In 1990s inflation and monetary expansion rose rapidly, the indebtness and nominal exchange rate depreciation also decreased. During this period the exchange rate regime had changed to dual system and thus there was market exchange rate and official exchange rate exchange rate. Moreso, in 1992 there was foreign exchange retention in commercial banks. This meant relaxation and control in foreign exchange transactions. These policies were implemented in a period when there was excess money supply in circulation, severe shortage of foreign exchange and increasing in spending in the run up towards 1992 general elections. Hence this raised inflation significantly. Besides the above issues money supply was equally influenced by the embargt the time and also the escalating fiscal deficit had to be financed from money printing. In an attempt to remove

excess liquidity from the economy, Treasury bill discount rate short up, pushing the rate of inflation. This was followed by massive private capital inflow that led to build up of foreign exchange reserves and appreciation of exchange rates. Treasury bill discount rate gradually came down and inflation rates equally started to decline (Njuguna & Durevall, 2000).

The cost of living in Kenya has continuously risen at an alarming rate over the years. The problem is clearly getting worse, and it now presents the appearance of becoming uncontrollable. The following table shows the inflation rates of selected years KIPPRA, 2013).

Figure 1.1: Summary of Annual Inflation



Source: Kenya National Bureau of Statistics, 2014

From figure 1.1, it is evident that the annual inflation rate has remained high in the recent

years averaging a double digit in the past decade and reaching highest 26.2% in the year 2008.This however was be attributed to the shortage of goods and resources following the 2007 post election violence. Generally the annual inflation rate in the 1990s declined because there was little money in the economy. The foreign donors had reduced their funding to Kenya. Annual inflation decreased from 14.0 per cent in 2011 to 9.4 per cent in 2012.The decline in inflation was largely attributed to better food supply resulting from favorable weather conditions.

1.1.2. Unemployment, Money supply and GDP Situation in Kenya

Unemployment refers to a situation in which the factors of production are willing and capable of being employed at the ruling market wage but are involuntarily unutilized or underutilized (Laryea and Sumaila, 2001). Unemployment can also be defined as a state where by people are unable to contribute to the economic growth due to lack of jobs. These people must however be qualified and constantly looking for a job without any success. They therefore fail to secure an opportunity that can enable them to earn them a living. Unemployment is notably present in Kenya with most of the citizens living under the poverty line. It is also evidenced by the high crime rate and high turnover during mass recruitment. The high unemployment situation has been worsened by the negative effects of the structural adjustment programs and globalization. The unemployment rate contains the percent of the labour force that is without jobs. Substantial underemployment is rampant in Kenya (Leheyda, 2005).

In Kenya, the labour force was estimated to be 11.5 million in 1996. Between 1986 and 1996, the average growth rate in the labour force was 4.1% per year. The growth in

employment required to absorb this growing labour force was about 492,000 new jobs annually, yet employment increased only between 2 and 2.5% annually from 1986 to 1995. As a result, more than two million Kenyans were unemployed, and even among those counted as employed, a significant proportion was underemployed particularly in small-scale agriculture and the informal sector in both rural and urban area (KNBS, 2010).

Unemployment in Kenya has therefore become a serious problem. The average unemployment is currently 23%, and is even higher for youth that drop out of school and for women, averaging 25% in both cases (KIPPRA, 2013).

The small-scale agricultural sector is the single largest source of employment in Kenya, absorbing 51% of the labour force. The urban informal sector is the next largest source of employment, comprising over 10% of the labour force, followed by the urban formal sector, at 7% in 1994 (Maturu, 2007).

The recent African Growth and Opportunities Act (AGOA) enacted by the government of the United States of America have led to an increase in employment especially in the textile industry. It is estimated that between October 2000 and December 2001, two hundred thousand jobs had been created. However, the government of Kenya is still struggling to meet the conditions of AGOA especially in labour standards and good governance. Moreover, AGOA does not promote quality employment and the conditions in AGOA industries resemble those in the export-processing zones (EPZs) (Maturu, 2007).

A lot of effort has been put in place by the government and other agencies in order to curb unemployment. This has, however, not completely taken care of the unwanted

situation. In the 1970s, the national poverty rate was 29%. Poverty has grown considerably in subsequent decades. A recent study by the Kenya National Bureau of Statistics shows that the level of absolute poverty had increased to about 57% in 2000. Between 1996 and 1999, the number of people living below the poverty line increased from about 11.5 million to about 15 million. The major problems now facing the Kenyan economy are poverty and a high level of unemployment.

According to Heather (1997), Phillips formulated the relationship between unemployment and inflation and came up with a statistical representation which he referred to as the Phillips Curve. The curve sloped down from left to right and seemed to offer policy makers with a simple choice of accepting inflation or unemployment.

Philips further argued that governments have the power to regulate the volume of aggregate demand in the economy. If they believe the costs of inflation to be high, they can prevent the inflation by tightly controlling aggregate demand. The price they must pay is a high level of unemployment. If the government feels that the costs of inflation for an economy are low, it can gain the advantages of fuller employment via a higher volume of aggregate demand. The government can assess the costs and benefits of inflation control and act accordingly (Jenkinson, 1996).

In summary, the Phillips curve depict that an increase in inflation will lead to a decrease in the unemployment level in the economy. In the contrally, Milton Friedman in his theory on natural unemployment stated that an increase in the inflation level will lead to an increase in unemployment level, this is because the economy has to have that portion of unemployment which is referred to as natural unemployment (Hardwick, 2004).

Kenya was not only hit by the commodity-price hike and the financial crisis, but also

post-election violence in 2008. As a result, real GDP growth dropped from over 7% in 2007 to below 1.5% in 2008 while inflation increased to over 30%. The monetary policy response was to reduce interest rates to stimulate economic growth. In spite of lax monetary policy, inflation declined from 2009 until late 2010. Inflation then rose again, but the authorities continued to maintain loose monetary conditions. This resulted in rapid depreciation of the Kenyan shilling (KES); its value dropped from about 80 shilling per US dollar in early 2011 to over 100 shilling per US dollar in October 2011. To prevent further deprecation of KES and rise in inflation, the monetary authorities increased the Central Bank rate sharply, pushing up the interbank rate to about 17%, from less than 2% in January 2011. The response seems to have been an appreciation of the KES and decline in inflation. The tight monetary policy stance was maintained during the first half of 2012. The relatively high rates of inflation in Kenya consequently raise questions about monetary authorities' control over inflation.

GDP and inflation are both considered important economic indicators. It is widely believed that there is a relationship between the two. The problem is that there are disagreements as to what that relationship is or how it operates. As a result, when governments make decisions based on these pieces of information, the outcome often cannot be guaranteed. Exploration of the relationship between GDP and inflation is best begun by developing an understanding of each term individually. GDP is an acronym for gross domestic product, which is the value of a nation's goods and services during a specified period. This figure is generally regarded as an important indicator of an economy's health. Inflation refers to a situation where price level increase on average or

when the amount of currency increases. As a result, money has less purchasing power. In the past decade, Kenya's economy grew at an average of 3.8 percent. This is better than in previous decades, but below its potential, its ambition, and its peers. While an increasing number of African countries have already reached Middle Income status, Kenya has lagged behind. Today, out of 48 sub-Saharan African countries, 22 countries have reached a per-capita income of US$ 1025 the official threshold of middle income. At about US$ 820, Kenya's GDP per capita, ranks 24th and only represents about half the sub-Saharan Africa (SSA) (KIPPRA, 2013).

According to this belief system, prices are pushed up when people are competing for a limited supply of items. This means that an increase of GDP, or growth in the amount of goods and services, should equate to a reduction in the level of prices for those items, or that deflation should occur. GDP and inflation are often associated with one another because governments and central banks often make decisions based on these figures and they attempt to manipulate them. If an economy is not growing or is not growing fast enough, a Central Bank may lower interest rates to make borrowing more attractive. The logic behind this is that it will encourage spending, which will lead to a rise in GDP. The drawback of this move is that, according to many popular beliefs, it will also prompt inflation.

If an economy is growing too fast, which could lead to shortages because people are demanding products and services faster than they can be supplied, moves may be made to slow GDP. This may be done by increasing interest rates, which is considered a means of making money harder to come by because borrowing is more expensive. According to many, this should help to control inflation because the effect should be less demand for

goods and services. Problems tend to arise, however, because actions focusing on manipulating GDP and inflation may not produce the intended effects, which tend to fuel the debate regarding their relationship.

Kenya has been following, not leading Africa's growth momentum. Part of the problem has been a series of exogenous shocks that have periodically set back the economy. In this study GDP will be investigated to determine its effect on inflation. There have been droughts, oil price spikes and the blow back from the recession in the European Union, a major trading partner. Kenya's neighboring countries have experienced most of the same shocks, yet managed more robust growth. Why has Kenya lagged? This study thus sought to establish whether the fluctuations in GDP determine the level of inflation in Kenya (WBR, 2013).

1.2. Statement of the Problem

Macroeconomists, Central Bankers and policymakers have often emphasised the costs associated with high and variable inflation. Inflation imposes negative externalities on the economy when it interferes with an economy's efficiency. Examples of these inefficiencies are not hard to find, at the theoretical level. Inflation can lead to uncertainty about the future profitability of investment projects especially when high inflation is associated with increased price variability. This leads to more conservative investment strategies, ultimately leading to lower levels of investment and economic growth. Inflation may also reduce a country's international competitiveness, by making its exports relatively more expensive, thus impacting on the balance of payments. Moreover, inflation can interact with the tax system to distort borrowing and lending decisions. Firms may have to devote more resources to dealing with the effects of inflation for

example, more vigilant monitoring of their competitors' prices to see if any increases are part of a general inflationary trend in the economy or due to more industry specific causes. Thus Inflation raises the price level in a country, creates financial problems in raising the prices of commodities, services and other factors (Amisano & Fagan, 2010). It is, therefore, found that inflation is one of the major reasons of raising the price level of different commodities. The role of inflation in the economies is found to be the cause of decline in the value of money. Therefore, inflation is creating problems in the form of raising the price level and declining the value of money. Confusion remains on what the role monetary policy should play in reducing inflation. The last two decades witnessed several monetary policy regime shifts. Hence, low inflation still remains a challenge in Kenya and it raises the question on the significance of monetary policy on the inflation. To what extent does inflation vary in response to monetary policy shocks? This question is one of the most important and controversial in macroeconomics. The inflation rate that is considered unharmful to the economy is that of 3% and below. The Central Bank in Kenya has always kept an inflation target of 5% since the year 2000. Inflation rate in Kenya has remained high in the past decade averaging a double digit. Despite relative weight the central bank is supposed to place on deviations of inflation from target and output from potential, the agreement between the government and the Monetary Policy Committee has been left incomplete. Thus, this study examines whether changes in monetary policy can account for the changes in inflation in the Kenyan economy. This is done by adopting a Vector Error Correction model that allows simultaneous determination of the long run and short run relationship between dependent variable and independent variables in a model.

The rising inflation with the passage of time was examined in relation to unemployment, money supply and GDP growth rate to determine the phenomenon relationship statistically. The study was done to examine the macroeconomic determinants of inflation with the passage of time in the economy.

1.3. Objectives of the Study

The general objective of this study was to establish the selected macroeconomic determinants of Inflation in Kenya.

The specific objectives of this study were:

i. To establish the relationship between unemployment and inflation in Kenya.
ii. To determine the relationship between narrow money supply and inflation in Kenya
iii. To investigate the relationship between Broad money supply and inflation in Kenya.
iv. To determine the relationship between GDP growth rates and inflation in Kenya.

1.4. Hypotheses Tested

The following hypotheses were tested;

Ho_1: There is no relationship between unemployment and inflation

$H_{O2:}$ There is no relationship between narrow money supply and inflation

$H_{O3:}$ There is no relationship betweenbroad money supply and inflation

Ho_4: There is no relationship between GDP growth rate and inflation

1.5. Significance of the Study

The study provided an empirical groundwork on Kenya's inflation trends upon which prudent monetary and fiscal policies could be formulated. It identified the determinants of inflation, which when properly understood, documented and captured in relevant models would make it possible to estimate accurately the inflation levels within a specified period of time. This will make planning easier for the government and the central bank.

It is also hoped that this research study will provide some contribution to investors and private sector firms. The research findings will help investors in their investment strategies. For the firms, the findings are helpful in their business strategies including price and output decisions. The main contribution of this study differentiating it from other studies of inflation in Kenya is that the period of this study is until the latest year, which is 2011. Besides that, the econometric procedure used in this study is different from the statistical test procedure used by other researchers in Kenya.

This study filled the knowledge gap that existed about the relationship between inflation and unemployment, narrow money supply, wide Money Supply money supply and the level of GDP in Kenya.

1.6 Scope and Limitations of the Study

The study was carried out using time series data of the Kenyan economy focusing mainly on the determinants of inflation. The study selected the past 31 years (the minimum and sufficient items required in time series) from 1980 to 2011. The study involved the use of secondary data. Although this study could assist in determining the trends inflation in

Kenya, there was limitation in the approximation of the figures, especially data on unemployment from 1980 to 1985. The unemployment figures that were used ranged from 1980 to 2011. The unavailability of data on unemployment during these periods was attributed to lack of sound census policies and statistical programs during that time.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This part of the thesis is organized as follows, Theoretical literature, Empirical Literature, Critique of the literature and the Theoretical Framework.

2.2. Theoretical Literature

2.2.1. Inflation and Unemployment

2.2.1.1. The Keynesian Philips Curve

The Philips curve shows an inverse relationship that exists between inflation and unemployment. A.W. Philips the British Economist. He observed an inverse relationship that existed in the British Economy up to 1958. As depicted on the graph, when inflation is drawn on the Y axis and unemployment on the X axis, the relationship between them show a downward sloping curve i.e. the Philips curve. Philips curve perfectly described the behaviours of money wages (Robert, 1996).

Many Economist after the year 1958 in developed and industrial rich countries believed that the Philips curve depicted a stable relationship between inflation and unemployment. The policy implication was therefore that governments should tolerate high rates of inflation as this keep unemployment rate low and therefore there existed a trade-off between inflation and unemployment. Monetary and fiscal policies could therefore be used to stimulate the economy and thus raising Gross domestic product and lower unemployment rates (Hardwick, 2004).

According to Fumikata (2007), the best way to understand unemployment is to define the meaning of full employment. Full employment exists when everyone who is willing and able to work at the prevailing wage rate can find a job in the line of work for which he or she is qualified.

2.2.1.2. Types of Inflation

i) Demand-pull Inflation

Demand pull inflation refers to a situation where the aggregate demand for goods exceeds the aggregate supply at the prevailing price level. During the period of a boom factories hire more workers and these workers end up producing more and more goods .However these workers as a result of earning more money they end up increasing their aggregate demand for the same goods and services even those they could not afford previously. This causes the demand for these products to increase faster than their supply hence causing their prices to increase. This causes demand pull inflation (Amisano & Fagan, 2010).

ii) Cost Push Inflation

Cost push inflation occurs when the cost of production of commodities increases causing the supply curve to shift to the left as depicted on figure 2.2. This occurs when there is an increase the cost of factor inputs (Blanchard, 2000). When firms' cost of production increases they are bound to increase their prices in order to maintain their real value of profits. As result real income of owners of factors of production e.g wages to fall. In order to maintain this high wages, labour demands higher money wages and this in turn again raises costs.

Cost push inflation may be caused by:

a) Increases in factor prices e.g. oil price increase.
b) An increase in wage settlements in excess of any increase in productivity.
c) A devaluation or depreciation of currency leading to an increase in import prices.
d) Interest rate increases will increase the cost of borrowing.
e) Indirect taxation or the removal of subsidies

iii) Pricing Power Inflation

Pricing power inflation occurs when both businesses and industries increase the price of their respective commodities in order to increase their profit margins. Pricing power inflation usually does not occur in periods of financial crisis during the times of economic depression and financial crisis. It is also called oligopolistic inflation simply because oligopolies have the power of pricing their goods and services (Benatia, 2008).

iv) Sectoral Inflation

Sectoral inflation occurs when there is an increase in prices of goods produced by certain sector of the economy. An increase in price of crude oil for instance directly affects all other sectors of that are directly related to oil industry (Blanchard, 2000).

The Philips curve depicts a relationship that exists between inflation and unemployment as put forward by Professor A.W. Phillips. The statistical relationship was based on the observations made by Professor Phillips on unemployment and wage levels during the period of 1861 to 1957. He found out that there appeared to be a trade off relationship between inflation and unemployment and thus any attempts made by the governments to reduce unemployment could likely lead to high rates of unemployment (Blanchard, 2000).

In period of 1970s the curve appeared to fail as the economy faced both unemployment and rising inflation (Keynes, 1964).

The downward sloping depicted by the Phillips curve showed that there is a trade off relationship between inflation and unemployment in the short run and hence to lower the rate of unemployment in the economy inflation is inevitable (Woodford, 2008).

Phillips agreed to the fact that the lower the unemployment rates the tighter the labour market and hence firms should raise their wages to attract the scarce labour force. And thus the Phillips curve represents the average relationship between unemployment and wage behavior over the business cycles (Hardwick, 2004).

The long run Phillips curve is a vertical line above the natural rate of unemployment. The original concept of the Philips curve could therefore apply only to brief, transitional periods and would shift with any persistent change in the average rate of inflation. These long-run and short-run relations can be combined in a single augmented Phillips curve.

2.2.2. Inflation and Money Supply

2.2.2.1. Quantity Theory of Money

The classical economists' view of monetary policy is based on the quantity theory of money. According to this theory, an increase in the quantity of money leads to a proportional increase in the price level and vice versa. All markets for goods continuously clear and relative prices adjust flexibly to ensure that equilibrium is reached. Therefore, the economy is assumed to be always at full employment level, except for temporary deviations caused by real disturbances. The role of money is simply to serve as the unit to express prices and values. Money facilitates the exchange of goods

and services. Its use satisfies double coincidence of wants, that is, it acts as medium of exchange.

Money is neutral; it does not influence the determination of relative goods prices, real interest rates and aggregate real income. The role of money as a store of value is regarded as limited under the classical assumption of perfect information and negligible transaction costs. The classical economists, still, recognized that some particular quantity of real money holdings would be needed by the economic entities under certain special circumstances. This consequently led to the formulation of the quantity theory of money. The quantity theory of money explains the role of money as a medium of exchange. In the classical work, it is stated that money affects nothing but the price level. The theory postulates a direct and proportional relationship between the quantity of money and the price level.

The clearest exposition of the classical quantity theory approach is found in the work of Irving Fisher in his influential book: The Purchasing Power of Money, published in 1911. He examined the relationship between the total quantity of money M (the money supply) and the total amount of spending on final goods and services produced in the economy $P \times Y$, where P is the price level and Y is aggregate income for the economy. Velocity (V) of money provides a link between M and $P \times Y$. It simply represents the average number of times per year that a unit currency is spent in buying the total amount of goods and services produced in the economy. The linkage is shown below.

$$V \equiv \frac{PY}{M} \quad \text{.....2.1}$$

In this expression, *P* denotes the price level, and *Y* denotes the level of current real GDP. Hence, *PY* represents current nominal output; *M* denotes the supply of money over which the Central Bank has some control; and *V* denotes the velocity of circulation, which is the average number of times a dollar is spent on final goods and services over the course of a year. The classical economists believe that the economy is always at or near the natural level of real output. As a result, classical economists assume that the equation of exchange is fixed, at least in the short-run. Furthermore, classical economists argue that the velocity of circulation of money tends to remain constant so that can be regarded as fixed. They believe that causation runs from money to price. Assuming that both *Y* and *V* are fixed, it follows that if the Central Bank were to engage in monetary policy, the effect of an increase in money supply can only increase the price Y V level. An increase in *M*, only affects an increase in the price level *P* in direct proportion to the change in *M* and the opposite is true with a decrease in *M*. In other words, expansionary monetary policy can only lead to inflation.

Contractionary monetary policy can only lead to the deflation of the price level. Thus, as far as the stabilization policy is concerned, fiscal policy has no role. It has no influence whatsoever on the price level. The only effect is felt on the interest rate and real magnitudes. The role of monetary policy is also limited. It has no influence on the real side of the economy but it exerts influence on the price and nominal magnitudes (Tsheole, 2006).

However, the quantity theory has a number of weaknesses. Firstly, the quantity theory does not explain unemployment because it assumes away adjustment problems. It assumes that production is determined by resources, and since money is not a resource, changes in money should not change production. It is widely accepted that a well anticipated monetary changes has no effect on unemployment but only affect prices. While in actual fact the adjustment process of monetary disturbances also affect unemployment not just prices.

Secondly, the classical quantity theory assumes that there is a correlation between changes in the amount of money and changes in spending. In this case, the changes in money supply are the cause of spending. Critics of the quantity theory have suggested that this correlation exists because changes in the amount of money in circulation are caused by, rather than the cause of, changes in business activity. In other words, the critics argue that changes in money are the effect, not the cause. Finally, the quantity theory assumes that changes in the amount of money in circulation do not alter velocity. The assumption was dismissed by the Keynesians, who instead, come out with an alternative assumption, that changes in money tend to be offset by changes in velocity (Tsheole, 2006).

2.2.2.2. Keynesian Theory

The original Keynesian model comprises of the aggregate demand and aggregate supply curves. The curves illustrate the inflation and growth relationships. From this model, in the short run the aggregate supply curve is upward sloping other than vertical. This

implies that changes in aggregate demand curve only influences prices. When the curve is upward sloping changes in aggregate demand affects prices and output, (Dornbusch *et al*, 1996).

This holds true due to the fact that many factors drive inflation rate and the level of output in the short run including changes in expectations, labour force, prices of other factors of production as well as fiscal and monetary policies.

The dynamic adjustment of the short-run AD and AS curves yields an 'adjustment path' which exhibits an initial positive relationship between inflation and growth, however, turns negative towards the latter part of the adjustment path. The initial positive relationship between output and inflation usually happens due to the 'time-inconsistency problem'. According to this concept, producers feel that only the prices of their products have increased while the other producers are operating at the same price level. However in reality, overall prices have risen. Thus, the producer continues to produce more and output continues to rise.

Faria & Carneiro (2001), also believe that the positive relationship can be due to agreements by some firms to supply goods at a later date at an agreed price. Therefore, even if the prices of goods in the economy have increased, output would not decline, as the producer has to fulfill the demand of the consumer with whom the agreement was made. In moving from the short-run to the hypothetical long-run, the above-mentioned factors, and its shock on the steady state of the two further features of the adjustment process are also important to note. Firstly, there are times when the output decreases and

the inflation rate increase. This negative relationship between inflation and growth is important, as it quite often occurs in practice, as ascertained by empirical literature. This phenomenon is stagflation, when inflation rises as output falls or remains stable. Secondly, the economy does not move directly to a higher inflation rate, but follows a transitional path where inflation rises then falls. Under this model, there is a short-run trade-off between output and the change in inflation, but no permanent trade-off between output and inflation. For inflation to be held steady at any level, output must equal the natural rate. Any level of inflation is sustainable; however, for inflation to fall there must be a period when output is below the natural rate.

2.2.2.3. Money and Monetarism

Monetarism has several essential features, with its focus on the long-run supply-side properties of the economy as opposed to short-run dynamics. Friedman (1995) who coined the term Monetarist emphasized several key long-run properties of the economy, including the Quantity Theory of Money and the Neutrality of Money. The Quantity Theory of Money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money in existence. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy. Friedman also challenged the concept of the Phillips Curve. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services, but they don't mind, because their wages are also twice as large, Individuals anticipate the rate of future inflation and incorporate its effects into their behaviour. As

such, employment and output is not affected. Economists call this concept the neutrality of money. Neutrality holds if the equilibrium values of real variables -including the level of GDP – are independent of the level of the money supply in the long-run. Super neutrality holds when real variables - including the rate of growth of GDP - are independent of the rate of growth in the money supply in the long-run. If inflation worked this way, then it would be harmless. In reality however, inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can adversely impact a country's growth rate. In summary, Monetarism suggests that in the long-run, prices are mainly affected by the growth rate in money, while having no real effect on growth. If the growth in the money supply is higher than the economic growth rate, inflation will result.

2.2.1.3. Types of Unemployment

a) Disguised Unemployment

Disguised unemployment refers to a situation where people engage in jobs that do not fully utilize their abilities. Such people can be laid off without lose of output .Official employment data hide the fact that some people are registered as unemployed. This type of unemployment may take the form of people who take early retirement or women who

stop work temporary to have families. This underemployment phenomenon as well as discouraged worker effect contributes to disguised unemployment and causes the official unemployment statistics understate official employment problem (Blanchard, 2000).

Fumikata (2007) asserts that full employment or unemployment as used in context of macroeconomics refers to people other than capital. The employment of human beings is tied with employment of capital. This is evident by the increase in unemployment brought about by closing of factories.

Unemployment refers to a situation where the factors of production are willing and capable of being employed at the ruling market wage but are involuntarily unutilized or underutilized (Backhouse, 2000).

b) Cyclical Unemployment

This is unemployment that is related to trade cycles. During the periods of a recovery and boom the demand output and labour is quite high and thus unemployment is low. During the period of recession the demand for labour and output is quite low and hence unemployment is quite high. Cyclical unemployment can therefore be defined as the negative relationship that exists between Gross Domestic Product and Unemployment (Heather, 1997).

During the period of a recession the aggregate demand for goods and services is quite low and equally aggregate consumer expenditure is equally low. Production becomes low to much low aggregate demand. As result of reduced level of production the work force is significantly down sized. It can therefore concluded that when business cycles are their peak ,cyclical unemployment is quite low , when economic output falls as measured by the Gross domestic product, the business cycles is low and hence cyclical unemployment rises (Blanchard, 200).

c) Structural Unemployment

Structural unemployment refers to a situation where there is mismatch between the jobs available and the job seekers. Job seekers in this case may be generally skilled but lack a specific skill required for a particular job opening. Any disparity between the abilities of available workers and the requirements for open positions can be considered structural unemployment (Jenkinson, 1996).

d) Frictional Unemployment

Frictional unemployment refers to the situation where one is between jobs. This situation ia common in situations where craftsmen are being laid off between projects or where fresh graduates are seeking for their first jobs or where people quit their current jobs to seek for new better jobs. Such individuals are always prepared brief periods of unemployment and do not stay unemployed for a long period of time as long as the economy and job market is stable (Backhouse, 2000) .

Friction unemployment is quite common in even developed and highest performing economies. This type of unemployment is viewed as beneficial to the economy. Existence of both frictional and structural unemployment means that unemployment rate cannot drop to zero in a nation.

(Blanchard, 2000)

Inflation has been generally known to be the persistent rise in the general price level. However, according to Blanchard (2000), defining inflation as a rising price level is ambiguous. He supports his argument by stating that we must specify what is meant by price level. The average of the prices of goods and services produced in the aggregate

economy. In a theoretical sense, the price level is the price of aggregate production. In a practical sense, the price level is measured by either of two price indexes, the Consumer Price Index (CPI) or the GDP price deflator. The CPI is the price index widely publicized in the media and used by the general public. The GDP price deflator, in contrast, is less well-known, but is usually the price index of choice among economists (Blanchard, 2000).

The inflation rate is calculated as the percentage change in the price level. Keynes (1964) defines inflation as a persistent and appreciable rise in the general price level. Principal inflation theories may be classified as either demand or supply theories or, what is the same but in more familiar terminology, as demand-pull or cost-push theories (Blanchard, 2000).

2.3. Empirical Literature

2.3.1. Inflation and Unemployment

Phillips curve in Malaysia for the period 1973 to 2004. The most interesting finding of this paper is the existence of a long-run and trade-off relationship and also a causal relationship between the unemployment rate and the inflation rate in Malaysia. In other words, this paper has provided an empirical evidence to support the existence of the Phillips curve in the case of Malaysia.

Shansuddin (1997), conducted both the co integration test of the monetary theory of inflation and the Granger-causality test between the variables in the system. They

developed a univariate and multivariate time series models to forecast inflation rates using quarterly time series data for Pakistan, from 1972-2 to 1993-4 for empirical investigation. The results suggest no co integrating or long-run relationship between the variables in the monetary model and that there is some evidence of Granger-causality running from inflation to output growth. Comparison of out-of-sample quarterly forecasts for the 1988-1 to 1993-4 period is made for univariate and Vector Auto Regressive Moving Average (VARMA) models of inflation. The results state that the forecasting accuracy of the multivariate ARMA model is not statistically different from that of the univariate ARMA model.

Karanossou (2007), showed that the New Keynesian Phillips Curve (NKPC) approach is an empirical failure by every measure ranging from methodological failure in time-series econometrics to the absence of a wage equation in New Keynesian Phillips Curve (NKPC). They despised the reliance on the New Keynesian Phillips Curve (NKPC) by literature and most other research on inflation dynamics on measures of goodness of fit, which can be misleading when most of the explanatory power is contributed by the lagged dependent variable. To this end, they suggest that the NKPC can be nested within the mainstream approach, and that its empirical validity can be assessed both by statistical exclusion tests on the significance of mainstream variables that are omitted from the NKPC, and also by post-sample dynamic simulations. In a similar study Gordon (2003), supported the view that the NKPC approach is an empirical failure by every measure. In dynamic simulations, its error over the 1962-2002 sample periods is between three and ten times that of the mainstream model.

Fumikata(2007), empirically examined the relationship between inflation rate and

unemployment rate using the Vector Error Correction Model (VECM) analysis to test the existence of the

However, the Phillips curve has the inability to explain developments and trends in inflation among several countries. It would be expected that high levels of economic activity are accompanied with correspondingly high levels of inflation as the economy's operations approach the full employment level of income. That most countries report low levels of real economic activity while experiencing low inflation does not vindicate the Phillips curve (Maturu, 2007). For instance, Kenya has a high level of unemployment which has always been accompanied by high rates of inflation. The study was, therefore, undertaken to close the knowledge gap as to why the Phillips curve is not practical in most countries and Kenya in particular through first establishing the relationship between inflation and unemployment.

Wolfer (2009) carried out a research on inflation and unemployment and concluded that inflation is a continual rise in the price level it took the price index's measurement of time over a year to calculate inflation. He also considered the economic impact of the main points in the article on the economy and society's feeling toward unemployment. The financial insecurity has had a negative effect on the economy because of job uncertainties. Since people were saving their money, the prices did not increase, keeping inflation from increasing. The research showed that people felt more stressed when they could not find a job than when prices were rising.

Kelly (2009), who also carried out a study on inflation and unemployment, Phillips curve depicts that an increase in inflation will lead to a decrease in the unemployment level in

the economy. He further concluded that Milton Friedman in his theory on natural unemployment implied that an increase in the inflation level will lead to an increase in unemployment level; this is because the economy has to have that portion of unemployment which is referred to as natural unemployment. The Phillips curve is a facade of the real world, as inflation and unemployment have continued to happen in most developing countries. The real world is more complicated than the Phillips curve shows (Maturu, 2007).

2.3.2. Inflation and Money Supply

Several studies have been conducted examining the impact of money supply on inflation. A review of these empirical studies from the viewpoint of developed, developing countries and Kenya are briefly exposed.

Sims (1972), applied statistical techniques for causality testing by first separating the variations in money and money income into the part that can be predicted from the past values of that variable, and the remainder which cannot. Using US data, Sims reached the conclusion that causality is unidirectional from money to income rejecting the hypothesis that causality is from income to money.

Another causality study was undertaken by Sargent & Wallace (1973), investigating the direction of causality between money and prices during periods of hyperinflation, for certain European countries using an approach similar to that of Sims. They show that there is evidence to suggest that the causality was running from prices to money.

A similar model was employed for Ghana by Chibber and Shafik, (1990) covering 1965 to 1988. Their results suggest that growth in money supply is one principal variable that explains the Ghanaian inflationary process. Such variables as official exchange rate and

real wages could only exert negligible influence on inflation. The study by AfDB (2011), also reports that monetary expansion is a key driver of inflation in Kenya, but it only accounts for 30% of the variation in the long run. In fact, the exchange rate seems to explain a large part of the variation according to its coefficient, but no details are provided.

Since October 2002, consumer price inflation in Guinea has been on a progressively increasing trend, reaching a peak of 16 percent year-on-year in May 2003. The importance of monetary developments in determining rates of consumer price inflation is often disregarded in light of the importance of exogenous factors such as the supply of food products.

Roman & Bohdan (1999), and Doroshenko, (2001) consider relations between both money supply and inflation and between money supply and GDP. Their findings confirm a long-run relationship between money growth and inflation. The period of money expansion and high inflation in the decade of the 1990's was accompanied by contraction of output. Novoseletsaka and Myhaylychenko (2004), also discusses this issues taking note of the break point in the statistical relationship. In a more recent period of financial stability (1999-2003) rising monetary aggregate were accompanied by falling inflation and a rebound of output.

Dmyto (2000), explores the identified vector autoregression to model the relationship between CPI, money supply and exchange rate in Ukraine. The study found that money supply responds to positive shocks in price level. The study contributes to the sizable literature on IT using overly sophisticated vector error correction model with complex

identification structure. There is however an element of data mining in the generation of impulse response functions.

Nicolleta and Edward (2001), updates and extends Friedman (1972), evidence on the lag between monetary policy actions and the response of inflation. Their evidence is based on UK and US data for the period 1953-2001 on money growth rates, inflation and interest rates, as well as annual data on money growth and inflation. Their findings reafirm the result that it takes over a year before monetary policy actions have their peak effect on inflation. There is a relatively large literature dealing with relations between monetary indicators and other macroeconomic variables.

Bleaney (2001), asserts that there has been stronger monetary policy response to inflation shocks in recent decades. He finds that monetary growth in the United States was strongly accommodative of immediate past inflation in the Bretton Woods period, but has been much less so under floating rates. Comparing floating-rate countries with members of the European Monetary System (EMS) for the 1980s and 1990s, according to him, estimates of inflation persistence are highly sensitive to shifts in mean inflation during exchange rate regimes. The impact of exchange rate regimes and exchange rate movements on inflation and growth has also been discussed in many empirical studies of developing countries. But the findings of these studies differ and cannot be generalized. As to inflation, there is a broad consensus about the role of monetary growth either as a main driving force behind inflation or, otherwise, as a necessary element in accommodating inflation triggered by other factors.

Mahamadu and Abradu-Otoo (2003), explore the relationship between monetary growth, exchange rates and inflation in Ghana using Error Correcting Mechanism. The empirical result confirms the existence of a long run equilibrium relationship between inflation, money supply, exchange rate and real income. In line with theory, the findings demonstrate that in the long-run, inflation in Ghana is positively related to the money supply and the exchange rate, while it is negatively related to real income. Elsewhere, several authors have been pre-occupied with the factors determining inflation, especially in the last few years. In this regard, the work by Chibber *et al*, (1989) is revealing. These authors employed a highly disaggregated econometric model that considers both monetary and structural factors in the cause of inflation in Zimbabwe. Findings from this study indicate that monetary growth, foreign prices, exchange and interest rates, unit labour cost and real outputs are the determinants of inflation in this country.

Marta et al (2004), examines monetary policy in Albania during the transition period. Estimates from a vector Auto Regression Model (VAR) of key macroeconomic variables which include money growth, inflation, exchange rate, remittances and the trade balance, demonstrate the weak link between money supply and inflation up to mid 2000. They conclude that exchange rate stability has played a key role in keeping inflation low for most of the transition period, and that the range of monetary policy instruments available to the authorities has widened in recent years and this has been associated with more stable and predictable changes in money supply and the price level. The result demonstrates that Albania has come a long way in terms of controlling inflation,

liberalizing financial markets and improving the predictability of inter-relations among key macroeconomic variables.

However, recent monetary developments suggest that increases in the money supply may indeed foster a resurgence of high inflation. Against this background, a study was therefore carried out to develop stylized facts about the inflationary process in Guinea, focusing particularly on the relationship between money growth and inflation. It examined the influences of changes in money supply on consumer price index (CPI) inflation using quarterly data for the period September 1991–March 2003.

Owing to the lack of consistent time series, applications of long-run equilibrium models of inflation have been scarce in sub-Saharan Africa. The main contribution of the paper was to partly fill this gap by focusing specifically on Guinea for which no systematic study of the determinants of inflation is available. Data limitations suggest caution in interpreting the results. Recent developments in the country stressed the relevance of the investigation. To provide evidence on the links between inflation and money growth, the study tend to build a bivariate inflation model containing monetary growth and CPI inflation. The results point to a significant long-run relationship between money growth and consumer price inflation during the past ten years. There is also supporting evidence that the long-run relationship between the two variables has been reinforced in recent years. Using an error correction model and impulse response analysis, the studies also find that a monetary shock has an immediate impact on inflation. The results support the argument in faviour of an active monetary policy in order to maintain inflation at low

levels. The analysis, by including, alternatively, broad money and reserve money variables, suggests that monetary policy may act in two related ways: (i) by direct liquidity management, to contain reserve money growth; and (ii) by a policy mix that does not lead to excessive broad money expansion in the economy.

The study may be useful for understanding the determinants of consumer price inflation in other African countries. In particular, the results show that, even with statistical weaknesses in the computation of the CPI and the large weight of food in the index, episodes of high money supply growth have a significant impact on CPI inflation, even if this impact is limited, given the role of exogenous factors, such as rainfall.

The monetarist approach, that money supply growth causes inflation, can be tested by observing the correlation between the rate of inflation and the rate of monetary growth. Causality can be determined by statistical analysis and institutional evidence. The direction of causality can be detected by examining the timing of the relationship between changes in monetary growth and changes in inflation. By plotting the monetary growth rate and inflation against time on a graph one can observe whether the turning points in the monetary growth precede, follow or are contemporaneous with turning points in inflation.

A review of the literature of inflation on Kenya reveals a variety of conclusions, (Killick, 1984) for instance states that no single factor could be taken as major course of inflation in Kenya. On the other hand Killick, (1989) conclude that despite variation in model tests all studies in Kenya are unanimous in finding monetary expansion the most important

variable explaining inflation. Ndung'u, (1994) Get result that indicates that money supply drives inflation. However, according to Ndung'u there is only a short run relationship between these variables. Deviation from equilibrium in the money market does not enter the model and thus money does not determine the price level in the long run. Another result is obtained by Ryan (1994), who found that exchange rate movement and changes in oil prices are the most important factors determining inflation while the contribution from monetary variables is small. The study thus was undertaken to establish if there exists both the short run and long-term relationship between inflation and money supply.

2.3.3. Inflation and GDP

While few doubt that very high inflation is bad for growth, there have been mixed empirical studies presented, as to their precise relationship. Is the empirical inflation-growth relationship primarily a long run relationship across countries, a short-run relationship across time, or both? Among the first authors to analyse the inflation-growth relationship included Kormendi and Meguire (1985) who helped to shift the conventional empirical wisdom about the effects of inflation on economic growth: from a positive one, as some interpret the Tobins (1965), effect to a negative one, as Stockman's (1981) cash-in-advance economy with capital, has been interpreted. They found a significant negative effect of GDP on. In pooled cross-section time series regressions for a large set of countries Fischer (1993), and Gregorio (1996), De Gregorio found evidence for a negative link between inflation and growth. This was also confirmed by Barro (1997), Barro's studies also found that the relationship may not be linear. Studies by Levine and Zervos (1993), suggested that inflation was not a robust determinant of economic growth.

Inflation's significance declined, as other conditioning variables are included. The next round of cross-country studies mainly focused on the nonlinearities and threshold effects of inflation on growth. These studies included papers by Andres and Hernando, (1997) and Ghosh (2000), who found a negative effect of inflation on output, not on the growth rate of output.

Phillips (1998), and Andres & Hernado (1997), found a significant negative effect of inflation on economic growth. They also found that there exists a nonlinear relationship. Their main policy message stated that reducing inflation by 1 percent could raise output by between 0.5 and 2.5 percent (Sarel, 1995).

Mohsin and Abdelhak (2001), analysed the inflation and growth relationship separately for industrial and developing countries. What made this investigation particularly interesting from a methodological point of view is the use of new econometrical tools. The authors re-examine the issue of the existence of "threshold" effects in the relationship between inflation and growth, using econometric techniques initially developed by Chan and Tsay (1998), and Hansen (2000). Their papers specifically focused on the following questions:

Is there a statistically significant threshold level of inflation above which inflation affects growth differently than at a lower rate? Is the threshold effect similar across developing and industrial countries? Are these threshold values statistically different? How robust is

the Bruno-Easterly finding that the negative relationship between inflation and growth exists only for high-inflation observations and high-frequency data.

The data set included 140 countries (comprising both industrial developing countries) and generally covered the period 1960-98. The authors stated that some data for some developing countries had a shorter span. As such, analysis had to be conducted by them using 'unbalanced panels'. The data came primarily from the World Economic Outlook (WEO) database, with the growth rate in GDP recorded in local currencies at constant 1987 prices and inflation measured by the percentage change in the CPI index.

Zafar and Zahid (1998), prove a statistically positive relationship between macro factors for the economic growth of the Pakistani economy. They find that budget deficit negatively affects the GDP of the economy and at the same time it influences positively the inflation of the economy. The research examines the private and public investments raises control on the inflations and employment opportunities that aid values as a control mechanism for unemployment. Therefore it is found that economic prosperity rises with proper guidelines, supporting strategies, and effective initiatives for the development and control of inflation and for the control of unemployment. Zenneth (2007), investigated the economy of Nigeria. He found that unemployment alleviation influences economic factors such as inflation, deficit economy, and unemployment low GDP growth rate. The same study examines role of fiscal policy in alleviating unemployment. Angelo & Sousa (2009), Documented the role of high inflation associated with economic problems for deficit GDP ratio, and financial instability. These variables influence the impact as

response on the economic problems for community as it raises unemployment.

Using co-integration and error correction models, Malik & Chowdhury (2001), found a long-run positive relationship between GDP growth rate and inflation for four South Asian countries. Supporting the Structuralisms view, their results also suggest that moderate inflation is helpful to faster economic growth and feed back into inflation. Thus the authors recommend moderate inflation for the growth of the economies of Bangladesh, India, Pakistan and Sri Lanka.

Gokal and Haniff (2004), reviewed several different economic theories to develop consensus on the inflation and growth relationship for the economy of Fiji. Their results show that a weak negative correlation exists between inflation and growth, while the change in output gap bears significant bearing. The causality between the two variables ran one-way from GDP growth to inflation.

2.4. Critique of the Empirical Literature

While most previous studies focus more on the Macroeconomic determinants of inflation, using explanatory variables, this study deviated by adopting the Vector Error Correction Mechanism (VECM) which eliminates the need to develop explicit economic models and thus impose a priori restrictions on the relationships among variables, VECM analysis permits a more general test of causation among different economic variables than is possible in conventional econometric analysis.

Majority of the studies made use of regression analysis, unfortunately diagnostic tests, stationarity test, and cointegration which are very crucial in modeling were glaringly missing. This could put to question reliability of the models so developed. This study employed four stationarity tests to ensure that the relationship established from the regression analysis were not spurious. In addition co- integration test was done to verify if the relationship hold in the long run. Various diagnostic tests namely autocorrelation, normality and stability tests were done to ensure that the model conforms to the rules of regression analysis.

From the various studies that have been conducted, there are conflicting results on the effect of GDP, Wide money supply, Narrow money supply and Unemployment on Inflation. Most of these studies have been done on the western countries and few African countries; the countries have got different government structures and even political administrations. Few studies have been conducted in Kenya and have reported contradicting results as depicted in above literature review. Therefore one becomes inquisitive to study the Kenya case.

2.5. Conceptual Framework

The level of inflation in Kenya is a function of a number of factors such as unemployment money supply and GDP growth rate. As more and more people work, the level of output increases causing the wage rate to go up. This therefore increases the purchasing power of consumers causing producers to increase the price of commodities, thus the lower the level of unemployment the higher the inflation rates.

An increase in Money supply through an expansionary monetary policy if unmonitored is likely to be inflationary. Assuming the economy is at full employment of resources, an increase in money supply is not directed to productive activities and thus will be inflationary. The increased money supply increases the purchasing power of consumers thus making producers to increase the market prices to meet the increased demand.

Inflation is necessary for economic growth, whereas the monetarists argue the opposite. An empirical study suggested a negative and nonlinear relationship, an increase in inflation reduces labour supply and this leads to a decrease in economic production. Inflation does not affect real output in the long run, but in the short-run inflation negatively affects output. Similarly, there is no causal relationship between inflation and economic growth. There is a nonlinear relationship between inflation and economic growth. On the other hand inflation may also cause misperception of the relative price levels and lead to inefficient investment plans and therefore affects productivity inversely. Inflation may distort price signals and reduces the ability of economic agents to operate efficiently. The interaction of the above variables may be summarized in figure 2.4 below.

Independent variables Dependent variable

Figure 2.4: Conceptual framework

Source: Author's conceptualization, 2014

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the following; research design, area of study, methods of data collection, data sources, method of analysis and model specification.

3.2. Research Design

Descriptive and explanatory research design was adopted to investigate the macroeconomic determinants of inflation in Kenya. Empirical econometric approach was used in analyzing data. The relevant time series data were extracted from the Kenya Bureau of Statistics and World Bank. Based on the perceived causal relationship between the identified variables of the research, Vector Error Correction Method was used to establish the statistical relationship among the variables.

3.3. Types and Sources of Data

Secondary data was utilized in the study. Secondary data was obtained from Kenya Bureau of statistics, World Bank Publications and Central Bank of Kenya. The set of data for this study was time series data from 1980 to 2011.

3.4. Data Analysis

Both Descriptive explanatory and inferential statistics were employed. Stata Software was used to analyse the data. The process started by giving the general characteristics of time series data. Stationarity of the data was tested using the Augmented Dickey Fuller, KPSS and Philips Perron. Unit root test with structural breaks was equally tested using

Zivot Andrew test. Johansen procedure was employed in determining the cointegration rank and cointegration relation. Optimum lag length was determined using Final Prediction Information Criteria, Hannan and Quinn Information Criteria, Alkaike Information Criteria and Schwarz Bayesian Information Criteria. Langragian Multiplier test was used to test for residual Autocorrelation; Lominicki Jacque-Bera was used to test for normality. The modeled macroeconomic variables were tested for stability using eigen stability condition. Granger Causality was also performed to establish the direction of causation of the variables. Finally the modeled variables were tested for structural stability using the CUSUM and CUSUM squared to determine the robustness of the VAR model for forecasting.

3.4.1. Choice and Specification of the Model

The VAR model that was estimated is shown in equation 3.1 below. The model contained five variables (inflation, Narrow Money supply, Wide Money Supply, Unemployment and Gross Domestic Product). The error term ε_{it} denote independent identically distributed disturbances, C_i represent constants and Y_{it} denote the five variables in the model at time t. The model parameters $A_{ij}(L)$ take the form, $\sum_{k=1}^{p} a_{ij} L^k$, where `$L$ is the lag operator defined by $L^k Y_t = Y_{t-k}$, and p is the lag length specified by using information criteria (Lesage, 1999).

$$\begin{bmatrix} Y_{1t} \\ Y_{2t} \\ Y_{3t} \\ Y_{4t} \\ Y_{5t} \end{bmatrix} = \begin{bmatrix} A_{11}(\square) & \square & A_{1n}(\square) \\ \square & \square & \square \\ A_{n1}(\square) & \square & A_{nn}(\square) \end{bmatrix} \begin{bmatrix} Y_{1t} \\ Y_{2t} \\ Y_{3t} \\ Y_{4t} \\ Y_{5t} \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{bmatrix} + \begin{bmatrix} \square_{1t} \\ \square_{2t} \\ \square_{3t} \\ \square_{4t} \\ \square_{5t} \end{bmatrix} \quad \text{..... (3.1)}$$

The VAR model posited a set of relationships between past lagged values of all variables in the model and the current value of each variable in the model. For example, if the Y_{it} represent unemployment in Kenya at time t, the VAR model structure allows employment variation to be explained by past employment variation in the Kenya itself, Y_{it}; $k = 1, 2, \ldots 5$ as well as past unemployment variations. This is attractive since regional differences in business cycle activity suggest lead/lag relationships in employment of the type set forth by the VAR model structure. The model was estimated using ordinary least-squares (Lesage, 1999).

With inflation as a dependent variable the model was specified as follows,

$IFR = \beta_o UEM^{\beta_1}. MSN^{\beta_2}. MSW^{\beta_3}. GDP^{\beta_4}.e^{\mu_t}$ ..... (3.2)

Where;

IFR= Level of inflation

UEM= Unemployment level

MSN = Narrow Money supply (M1)

MSW= Wide Money Supply (M2)

GDP = Gross Domestic Product growth levels

μ = Error term

The linear form of the model is as follows;

$\ln IFR_t = \ln\beta o + \beta_1 \ln UEM_t + \beta_2 \ln MSN_t + \beta_3 MSW_t + \beta_4 \ln GDP_t + \mu_t$………………………….... (3.3)

3.4.2. Definition and Measurement of Variables

Table 3.1: Definition and Measurement of Variables

Name of the variable	Abbreviation	Definition	Expected Sign
Inflation	IFR	Annual percentage change in consumer price compared with previous year	Percentage (%)
Unemployment	UEM	Number of people willing and able to work but have no place or opportunity to work	Percentage (%)
Narrow Money Supply	MSN(M1)	Currency plus demand deposits, traveler's checks, and other checkable deposits	Billion Kenyan Shillings (B Ksh)
MSW(M2) Wide Money Supply	MSW(M2)	*M*1 plus retail money market mutual fund balances, saving deposits (including money market deposit accounts), and small time deposits	Billion Kenyan Shillings (B Ksh)
Gross Domestic Product	GDP	Monetary value of goods and services produced within the boundaries of a country by both nationals and foreigners	Billion Kenyan Shillings (B Ksh)
Error term	μ_t	Factors that affect inflation but not captured in the model	

Source: Author's Conceptualization, 2014

3.4.3. Stationarity Test

One of the assumptions on classical regression is that both the dependent and the independent variables are stationary and that the errors term has a zero mean and finite variance. The results obtained from non stationary variable may be spurious characterized by a very high R^2. In this thesis stationarity was tested using Augumented Dickey Fuller Fuller, Phillips Perron and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) methods. These tests are based on the following formulae;

Augmented Dickey–Fuller (ADF) Tests

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{j=1}^{p-1} \gamma_j^* \Delta Y_{t-j} + \varepsilon_t \quad \text{..... (3.4)}$$

Fuller (1976) and Davidson & MacKinnon (1993).

Phillips-Perron Unit Root Test

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{j=1}^{p-1} \gamma_j^* \Delta Y_{t-j} + \varepsilon_t \quad \text{..... (3.5)}$$

(Phillips and Perron, 1988).

(Kwiatkowski, Phillips, Schmidt and Shin) KPSS Test

$$KPSS = \frac{1}{T^2} \sum_{t=1}^{T} S_T^2 / \hat{\sigma}_\infty^2 \quad \text{..... (3.6)}$$

(Kwiatkowski et al, 1992).

3.4.4. Model Diagnostic Checks

3.4.4.1 Normality Test

Another important assumption of classical linear regression is that the residuals are expected to be normally distributed with zero mean and constant variance. A way of identifying misspecification problem is observing regression residuals. Normality test checks for skewness and excess kurtosis using the third moment and fourth moment respectively (Verbeck, 2003).

In this thesis Normality was tested using Lominic Jacque Bera test. Jarque-Bera normality test compares the third and fourth moments of the residuals to those from the normal distribution under the null hypothesis that residuals are normally distributed. A significant Jarque-Bera statistic, therefore, points to non-normality in the residuals. The test is based on the following formulae, Lomnicki (1961) and Jarque and Bera (1987).

$$JB = \frac{T}{6}\left[T^{-1}\sum_{t=1}^{T}(\hat{\varepsilon}_t)^3\right]^2 + \frac{T}{24}\left[T^{-1}\sum_{t=1}^{T}(\hat{\varepsilon}_t)^4 - 3\right]^2 \quad \text{.....(3.7).}$$

3.4.4.2. Autocorrelation

In this thesis residual autocorrelation was tested using Langrange Multiplier test. The relationship between two or more series of observation ordered in time that may arise in the case where two or more consecutive error terms are related may make the model to become inefficient and hence its standardized errors may be estimated in the wrong way

.Autocorrelation arises as a result of either excluded variables or the use of incorrect functional form (Gujarati , 2003).

The Lagrange Multiplier (LM) test the null hypothesis H_0: ρ1 = ρ2= ……. =ρ_ρ = 0, against the alternative hypothesis $H_{1:}$ at least one of the ρs is not zero, thus serial correlation (Lutkepohl, 2002).

3.4.5. Cummulative Sum of Recursive Residuals (CUSUM) Tests

Macroeconomic time series variables are frequently affected by events such as changes in fiscal or monetary policy and hence it's important to test parameter constancy of the modeled variables. In this thesis CUSUM test was used to test the structural stability of the modeled macroeconomic variables. Stability is rejected at 5% if the CUSUM crosses the lines. $\pm 0.948\ [\sqrt{T \square K \square 2\ (\square \ \square\ K)}\ \sqrt{T\ \square\ K}$: …….(3.8)

If the CUSUM wanders off too far from the zero line, this is evidence against structural stability of the underlying model Kramer and Sonnberger (1986), Kramer et al (1988), or Granger and Terasvirta (1993).

3.4.6. Cointegration Tests

A regression of one non stationary variable on another is likely to give impressive results that may be spurious. If two time series variables are non stationary at level but stationary at first difference then they are said to be integrated of order 1 i.e I(1). There could be a linear relationship between them that is stationary I(1) and as such all the series of interest should be integrated of the same order, preferably I(1).The two time series variables that

satisfy this requirement are considered to be cointegrated. Variables are cointergrated with one another if the residuals from the levels regression are stationary, a vector error correction model (VECM) is formulated to reintroduce the information lost in the differencing process, thereby allowing for long-run equilibrium as well as short-run dynamics (Ang and McKibbin, 2006).

The next stage involves estimating the Vector Error Correction Model (VECM). It contains information on both the long run and short run relationship between variables.

In this study Johansen and Juselius test (1990) was used test for co integration. This is predicted on the notion that two or more economic variables are cointegrated if the residuals from the regression or the variables exhibit stationarity i.e. if the residuals are integrated of the order zero I (0). Therefore, the Johansen test was used to establish whether the error term ε_t is I (0). The null hypothesis is that the variables are not cointegrated, i.e. the residuals from the regression are not I (0). The null hypothesis that the residuals ε_t are not I (0) is rejected if the computed statistic is less than the critical value by taking absolute values.

The Johansen cointegration test is admired because in the VAR framework the test result does not depend on which variable is normalize with regards to, and it is possible to include more cointegration relationships. In this test, we exploit that the number of non-zero eigenvalues is at most the rank of the matrix, meaning that we can interpret the number of significant eigenvalues as the number of cointegration relations, (Alemayehu and Ndung'u, 2012).

Cointegration test and vector error correction in this study took the following representation respectively

$$Y_t = D_t + X_t \quad \text{.....(3.9)}$$

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_{t-j} + \varepsilon_t \quad \text{.....(3.10)}$$

3.4.7. Determination of Optimum Lag Length

The Johansen test can be affected by the lag length employed in the VECM, thus it is important that the lag length is optimally selected. Finding the optimal (appropriate) lag length is very important because we want to have Gaussian error terms (standard normal error terms that do not suffer from non-stationarity, autocorrelation and non-normality). Introducing too many lags wastes degrees of freedom, while too few lags leave the equations potentially miss specified and are likely to cause autocorrelation in the residuals (Asteriou and Hall, 2007).

In this study the optimal lag length was determined using Akaike Information Criteria, Hannan and Quinn Information Criteria, Schwarz Bayesian Information Criteria and Final Prediction Information Criteria for confirmation of the optimum lag. The criterions are based on the formulae put forward by, Akaike (1981), Hannan and Quinn (1979), Quinn (1980), and Schwarz (1978), or by the final prediction error (L¨utkepohl, 2006).

Akaike Information Criteria

$$AIC(n) \; \square \; LogDet(\tilde{\sum}_{\square}(n)) \; \square \; \left[\frac{2}{T} nK^2\right] \quad \text{(3.11)}$$

Hannan and Quinn Information Criteria

$$HQ(n) \; \square \; LogDet(\tilde{\sum}_{\square}(n)) \; \square \; \frac{2LogLogT}{T} nK^2 \quad \text{(3.12)}$$

Schwarz Bayesian Information Criteria

$$SBIC(n) \; \square \; LogDet(\tilde{\sum}_{\square}(n)) \; \square \; \frac{LogT}{T} nK^2 \quad \text{(3.13)}$$

Final Prediction Information Criteria

$$FPE(n) \; \square \left(\frac{T \; \square \; n^*}{T \; \square \; n^*}\right)^K Det(\tilde{\sum}_{\square}(n)) \quad \text{(3.14)}$$

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Introduction

This section of the thesis starts by giving the important characteristics of time series variables, it then discusses the unit Root Test Results, Cointegration Analysis, Diagnostic Tests, Granger Causality, Stability Test, Impulse Response Function and finaly gives empirical discussion.

4.2. Characteristics of Time Series Variables

The first step in building dynamic econometric models entailed a detailed analysis of the characteristics of the individual time series variables involved (Lutkepohl and Kratzig, 2004). Hamilton (1994) states that such an analysis is important because the properties of

the individual time series have to be taken into account in modeling the data generation process (DGP) of a system of potentially related variables.

Some important characteristics of inflation and GDP at level and first difference are depicted on the plots of time series in figures 4.1 – 4.3 below.

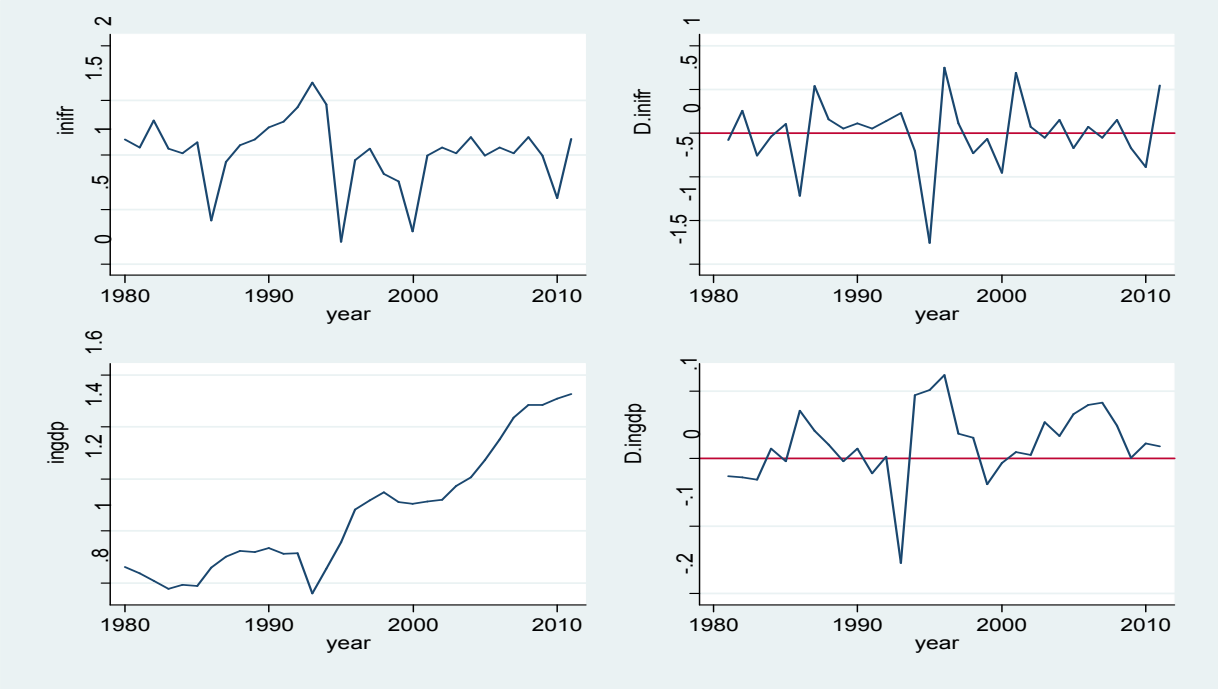


Figure 4.1: Plot of Logs of Inflation Rate and Gross Domestic Product in Levels and First Differenced Equations

Source: Data Analysis Results, 2014

The first series consists of changes in seasonally adjusted inflation rate. The left upper column represents the plot in levels while right column represents the plot in first difference. The inflation rate appeared to fluctuate randomly around a constant mean, and its variability is homogeneous during the observation period. Some correlation between consecutive values seems possible.

The second series consist of changes in GDP. Lower left column reveal the plot in levels of seasonally adjusted Gross Domestic Product while lower left shows plots in first difference .The GDP appeared to revolve around a deterministic polynomial and moreover it has a distinct seasonal movement. In addition there is a level shift in the third quarter of 1990. This shift is due to a redefinition of the series, which refers to adoption of Structural Adjustment Programmes (SAPs) until the second quarter of 1990 and to the SAPPs afterwards. Although SAPPs took place officially in October 1990, many economic time series were adjusted already on 1 July of that year.

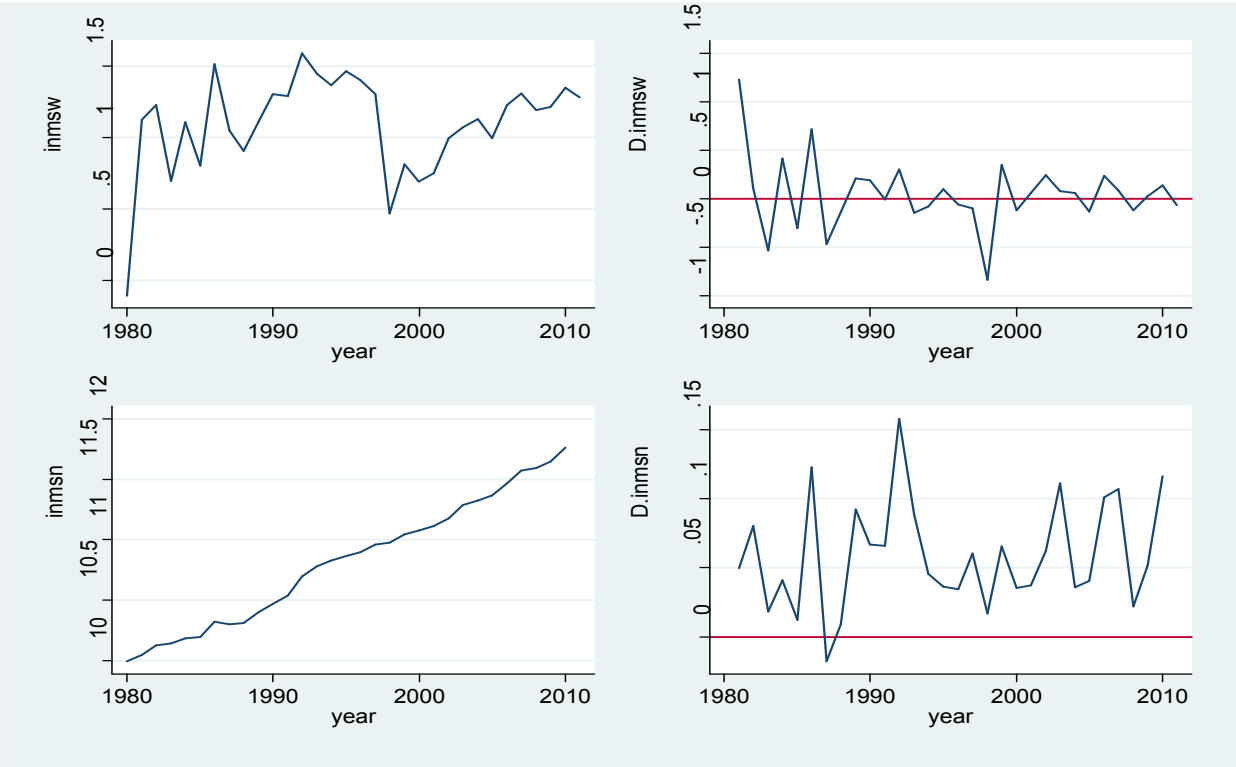

inmsw
0
.5
1
1.5
1980
1990
2000
2010
year
D.inmsw
-1
-.5
0
.5
1
1.5
1980
1990
2000
2010
year
inmsn
10
10.5
11
11.5
12
1980
1990
2000
2010
year
D.inmsn
0
.05
.1
.15
1980
1990
2000
2010
year

Figure 4.2: Plots of Logs of Narrow Money Supply and Wide Money Supply in Levels (left Columns) and First Differenced Equations (right columns)

Source: Data Analysis Results, 2014

Finally, the last series in Figure 4.2b represents the log of money supply narrow 1980 to 2010. The INMSN is a Kenya money supply index. It moves around a fixed mean value. The variability is quite dissimilar in different parts of the sample period. Furthermore, there is an unusually long spike in late 1994. Such an unusual value is sometimes referred to as an outlier.

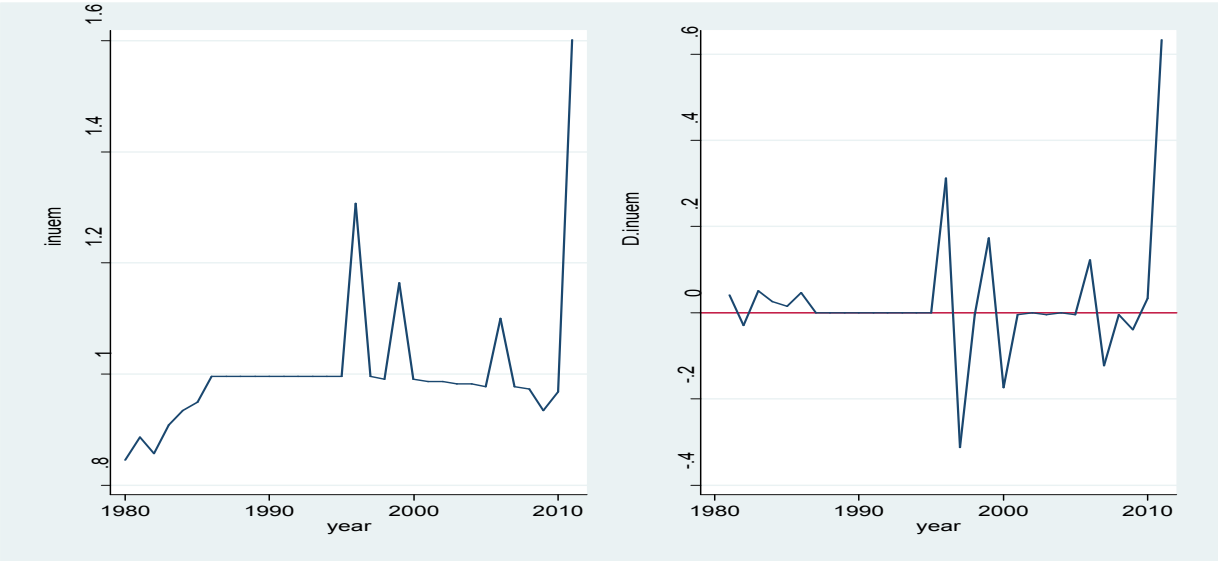


Figure 4.3: Plot of Logs of Unemployment in Levels (left column) and First Differenced Equations (right column)

Source: Data Analysis Results, 2014

4.3. Unit Root Test Results without Structural Breaks

4.3.1. Unit Root Test results in Level allowing for Trend

The results of unit root test for variables in their levels are shown in table 4.1.

Table 4.1: Unit Root Test at Level

Variable	ADF	Prob	PP	Prob	DF-GLS	KPSS	Remarks
INIFR	-4.256	0.0050	-4.212	0.0043	-3.050	0.058	No unit root
INGDP	0.712	0.9901	-2.243	0.4656	-1.681	0.177	Unit root
INMSW	-5.494	0.0000	-5.147	0.0001	-1.468	0.110	No unit root
INMSN	0.830	0.9921	-2.190	0.4952	-2.705	0.079	Unit root
INUEM	-2.745	0.0666	-3.235	0.4786	-2.400	0.091	Unit root

Source: Data Analysis Results, 2014

The critical values for interpolated ADF tests are -4.325, -3.576 and -3.226 at 1%, 5% and 10% respectively. The critical values for Philip-Perron test are -23.268, -18.356 and -

15.888 at 1%, 5% and 10% respectively. The critical values for DF-GLS test are -3.770, -3.428 and -3.076 at 1%, 5% and 10% respectively. The critical values for KPSS test are 0.216, 0.146 and 0.119 at 1%, 5% and 10% respectively.

All the above methods revealed that inflation and broad money supply were stationary at level. However, GDP, Narrow Money Supply and Unemployment were all non stationary at level implying that the series had to be differenced once to avoid the tendency of having spurious regression problem in the estimated equation.

4.3.2. Unit Root Test results First Difference

Table 2.2: Unit Root Test for Differenced Series

Variable	ADF	Prob	PP	Prob	DF-GLS	KPSS	Remarks
INIFR	-7.385	0.0000	-33.738	0.0000	-3.050	0.0621	No Unit root
INGDP	-4.107	0.0009	-20.768	0.0012	-1.681	0.266	No Unit root
INMSW	-8.869	0.0000	-34.491	0.0000	-1.468	0.147	No Unit root
INMSN	-5.440	0.0000	-28.952	0.0000	-2.359	0.112	No Unit root
INUEM	-5.155	0.0000	-34.087	0.0001	-2.400	0.0856	No Unit root

Source: Data Analysis Results, 2014

The critical values for interpolated ADF tests are -4.325, -3.576 and -3.226 at 1%, 5% and 10% respectively. The critical values for Philip-Perron test are -23.268, -18.356 and -15.888 at 1%, 5% and 10% respectively.

The first test that was done was to find out if the time series variables had unit roots. These results are reported in the tables 4.2. The results from ADF, PP, DF-GLS and KPSS show that there were unit roots. P-values were all > 0.05 except for inflation and wide money supply that were stationary at level. The results further show that the differenced time series variables were stationary .The p-values were all < 0.05 with the Mackinnon were all 0.0000. This show that the time series variables were not stationary in levels but their first difference was stationary. Therefore it was concluded that the time series variables were integrated of order one, denoted I (1).

4.3.3. Unit Root Test with Structural Breaks in Intercept

Table 4.3: Unit Root Test with Structural Breaks in Intercept

Variable	ZA	Year
INIFR	-5.984*	1995
INGDP	-3.679	1991
INMSW	-10.119*	1998
INMSN	-2.560	2006
INUEM	-4.305	2001

Source: Data Analysis Results, 2014

The critical values for interpolated Zivot Andrews test were -5.43 at 1% and -4.80 at 5%. The next test that was performed was Zivot Andrews test to find out if there were structural breaks. The results are reported in table 4.3 for Zivot Andews test for break in intercept. The results show that inflation rate had a significant break in the intercept in the year 1999. The t value -5.984. This was attributed to excessive inflation in the year 1995.It may also have been as a result of change from fixed exchange regime to floating exchange rate regime.

The results also shows that GDP had a structural break in the year 1991 but it was not significant at 5%. This may be as results of implementation of Structural Adjustment Programmes.

The result further depicted a structural break in wide Money supply in the year 1998. This may be attributed to the aftermath of massive injection of money into the economy during 1997 elections.

The results equally showed a structural break in narrow money supply in the year 2006. However the identified structural break was not significant at 5%. This can be attributed to the decline in Net Domestic Asset (NDA) of the Central Bank followed a build up in Government deposits at the Central Bank by Ksh 5.0 billion from Ksh 47.9 billion in April 2006 to Ksh 52.9 billion in April 2007, reduction in Government borrowing from the Bank by Ksh 10.5 billion from Ksh 49.8 billion in April 2006 to Ksh 39.3 billion in April 2007 and, reduction in the repo holdings by commercial banks in April 2007 compared with April 2006.

The results further show a structural break in unemployment in the year 2001. The identified break was not significant at 5% level. This can be attributed to the situation in early 2000 where the government employment interventions targeted enhancing the acquisition and promotion of efficient use of labour market information, reliance on market forces to mobilise resources for sustained growth, provision of public infrastructure, industrial policy, enhancement of private sector investment and participation in the economy, promotion of industrial harmony and productivity and liberalization of the labour market. The summary of the plots for structural breaks in the intercept are reported in figure 4.4 - 4.8. below.

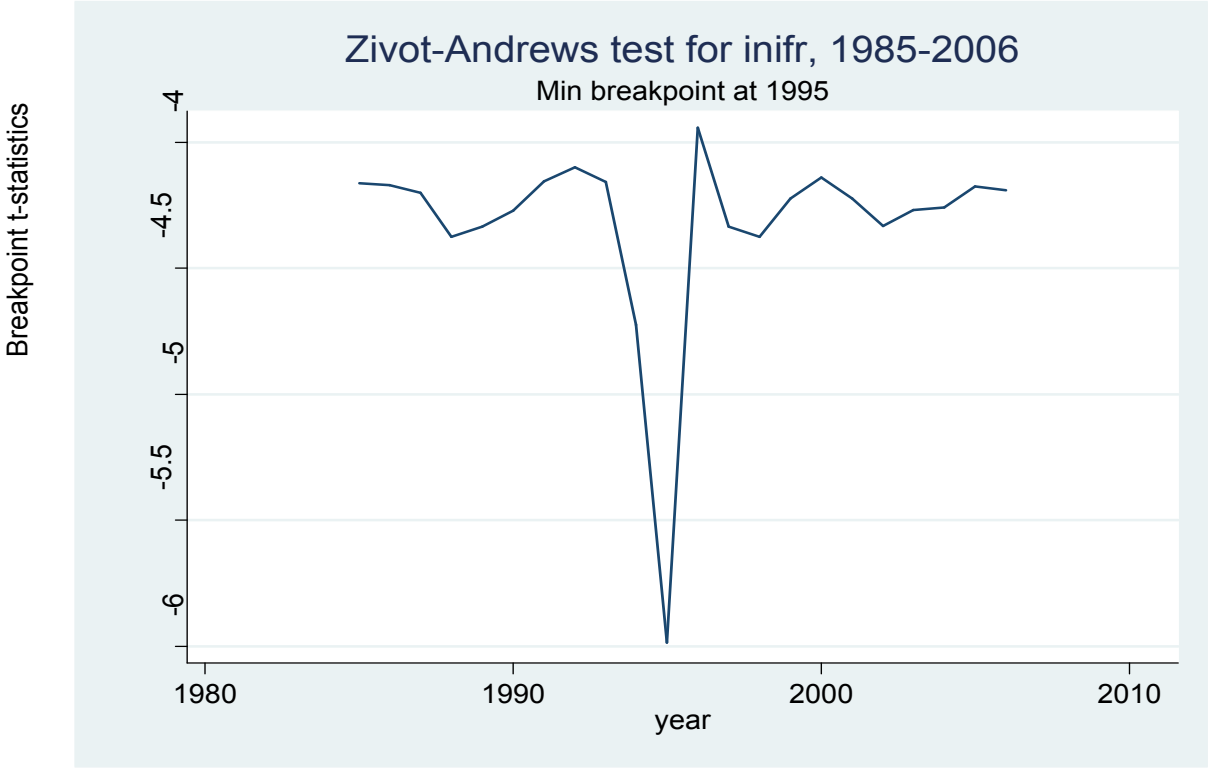


Figure 4.4: Inflation, Structural Breaks in Intercept

Source: Data Analysis Results, 2014

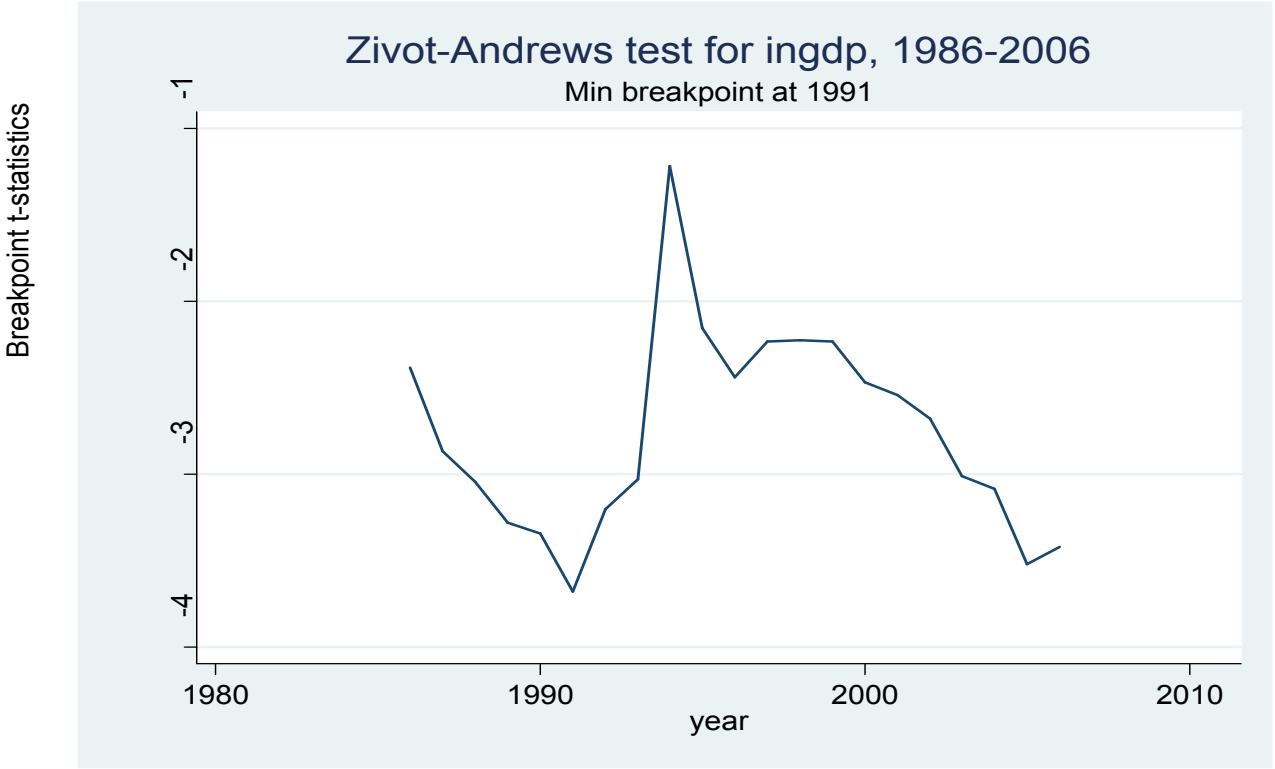


Figure 4.5: GDP Structural Break in Intercept

Source: Data Analysis Results, 2014

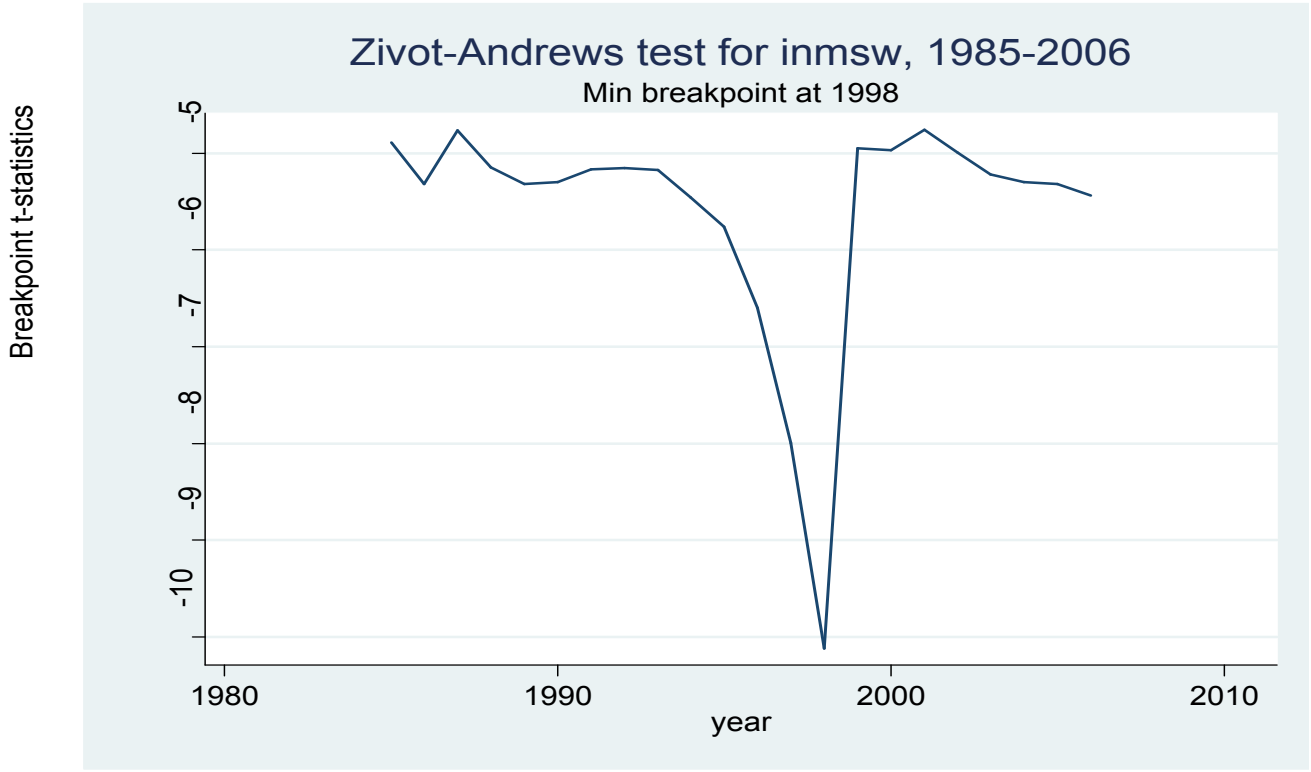


Figure 43.6: Wide Money Supply, Structural Break in Intercept

Source: Data Analysis Results, 2014

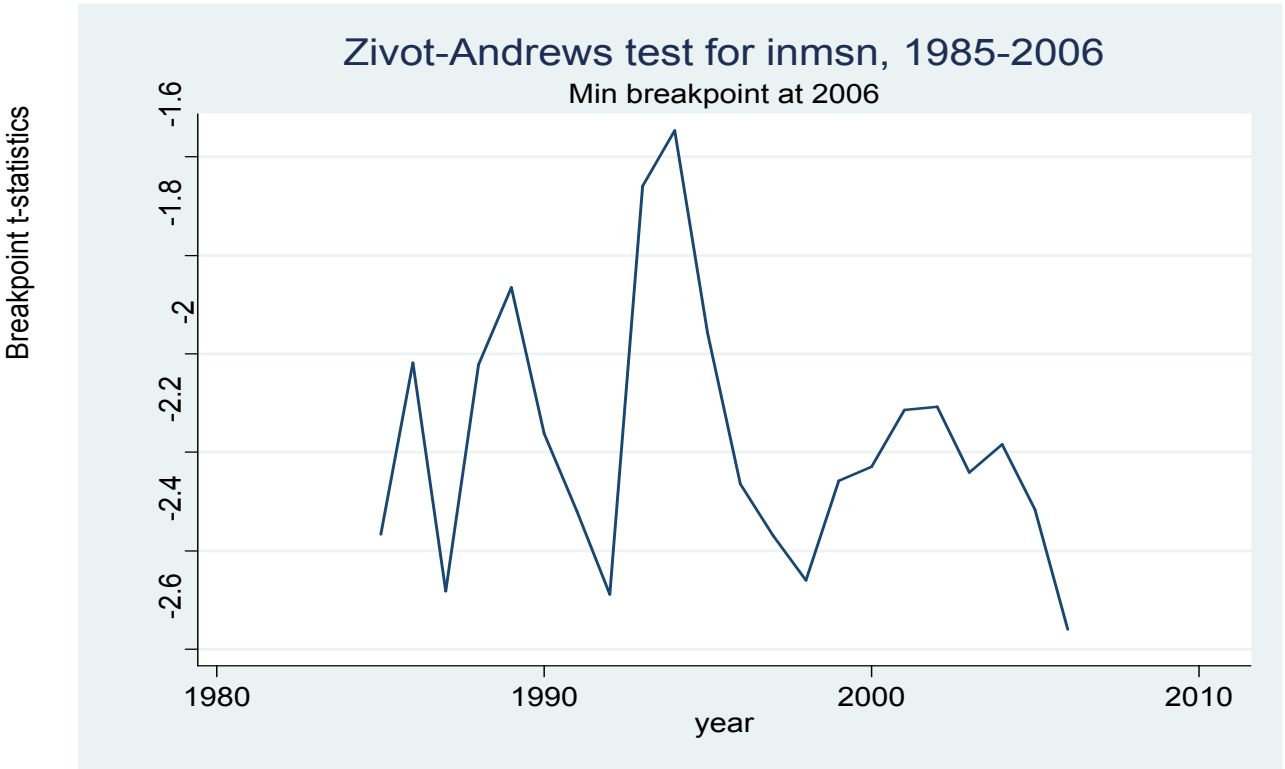


Figure 4.7: Narrow Money Supply, Structural Break in Intercept

Source: Data Analysis Results, 2014

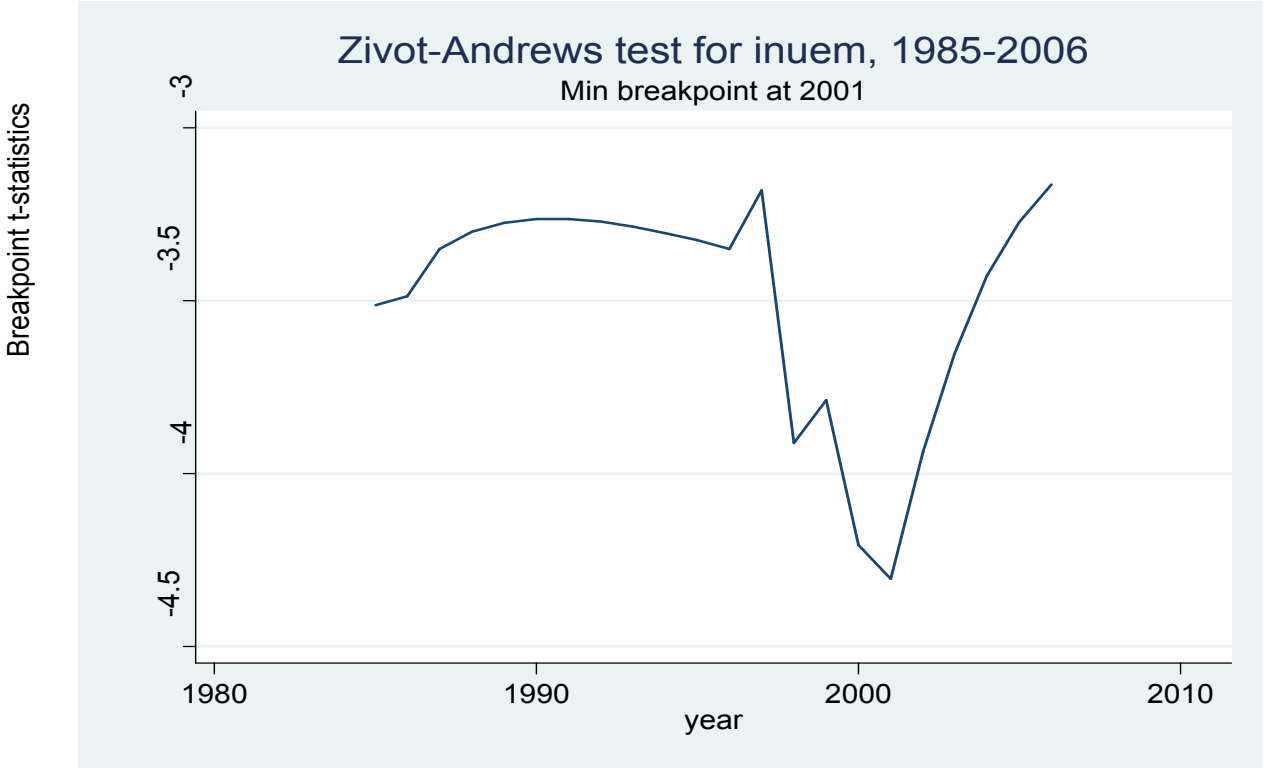


Figure 4.8: Unemployment, Structural Breaks in Intercept

Source: Data Analysis Results, 2014

4.3.4. Unit Root Test with Structural Breaks in Trend

Table 4.4: Unit Root Test with Structural Breaks in Trend

Variable	ZA	Year
INIFR	-4.241	2001
INGDP	-3.765	1994
INMSW	-5.429*	2003
INMSN	-2.591	2006
INUEM	-3.547	1987

Source: Data Analysis Results, 2014

The critical values for interpolated Zivot Andrews are -4.93 for 1% and -4.42 for 5%. * Shows that the structural break is significant at 5% level.

The results on unit root test with structural breaks showed that wide money supply had a negative and significant break in the year 2003. Change in government policy of massive investment brought significant break in both trend and intercept. In the year 2003 the National Rainbow coalition (NARC) government came up with a five year development programme (Economic Recovery Strategy for Wealth and Employment Creation 2003-2007).This strategy was anchored on the principles of democracy and empowerment. The strategy put empowerment to people through creation of employment, income earning opportunities and Rapid Industrialization for Sustainable Development. These significantly affected the money supply. The above results were summarised in figures 4.9-4.13 below.

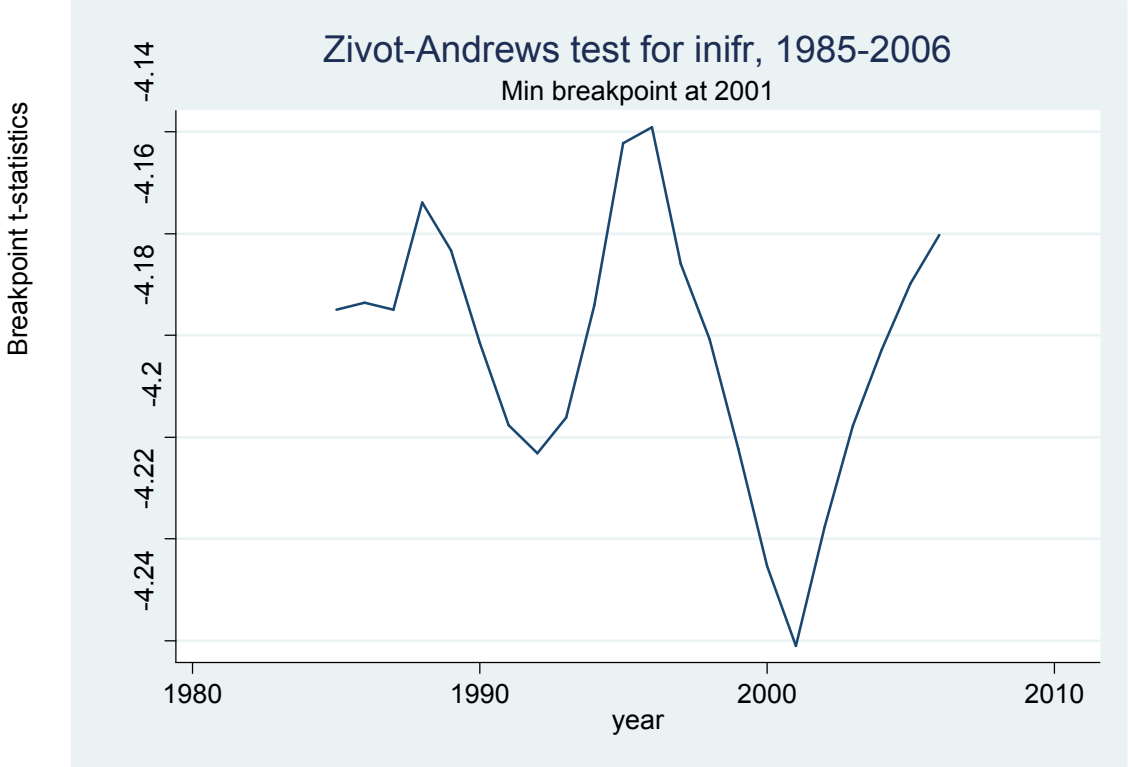


Figure 4.9: Inflation, Structural Breaks in Trend

Source: Data Analysis Results, 2014

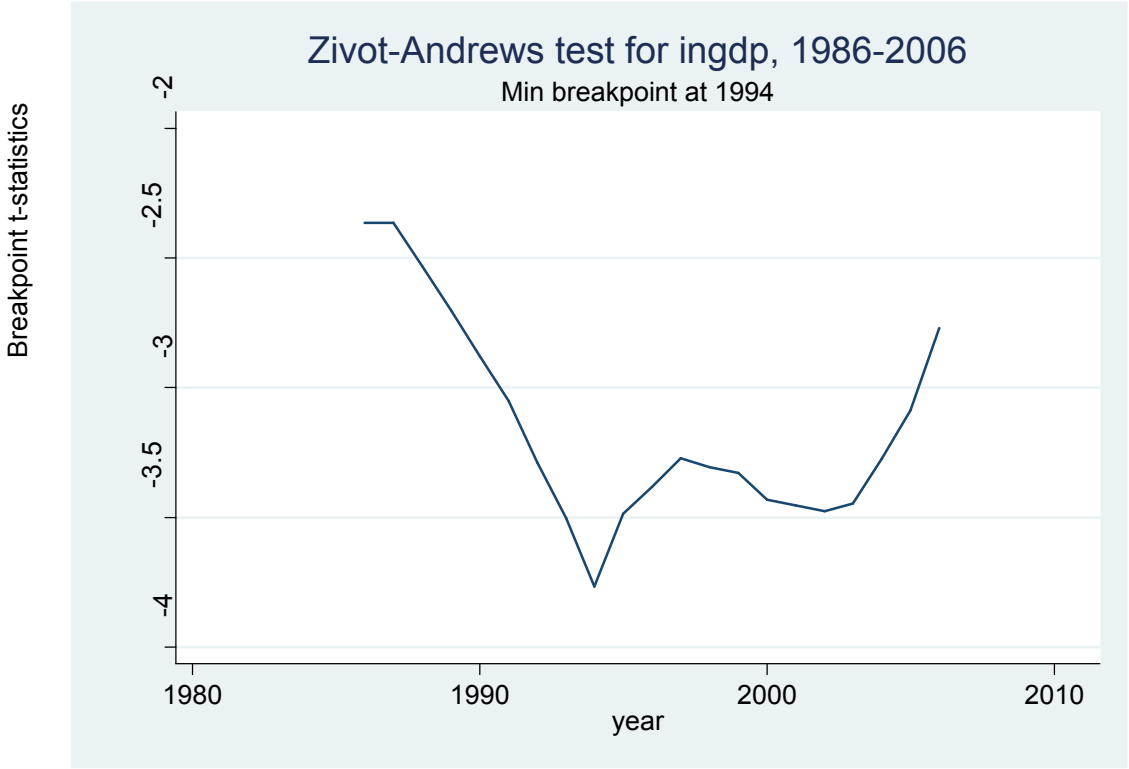


Figure 4.10: GDP Structural Breaks in Trend

Source: Data Analysis Results, 2014

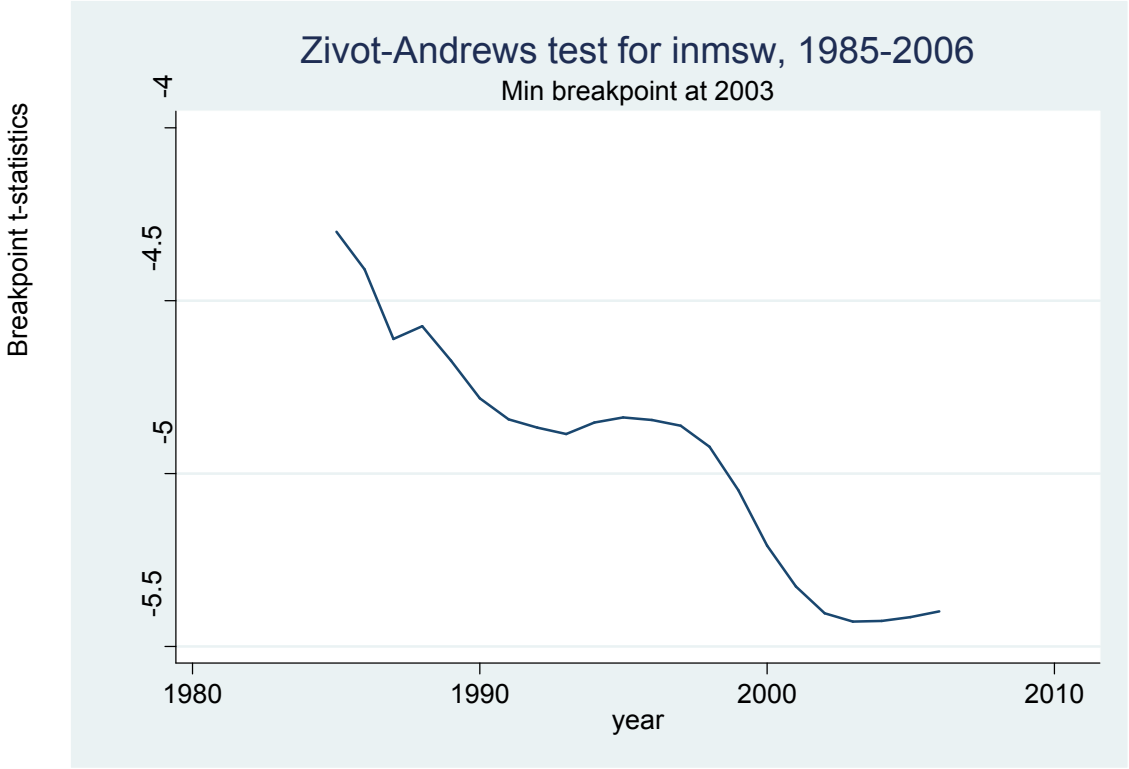


Figure 4.11: Wide Money Supply, Structural Breaks in Trend

Source: Data Analysis Results, 2014

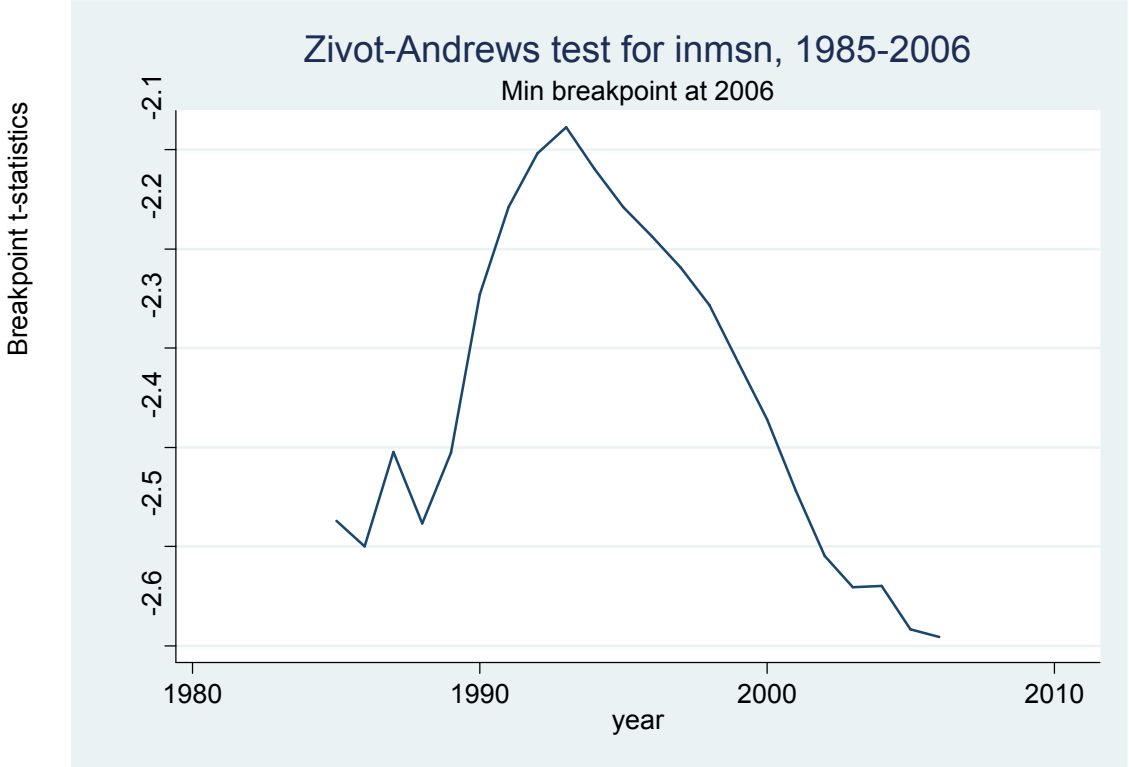


Figure 4.12: Narrow Money Supply, Structural Breaks in Trend

Source: Data Analysis Results, 2014

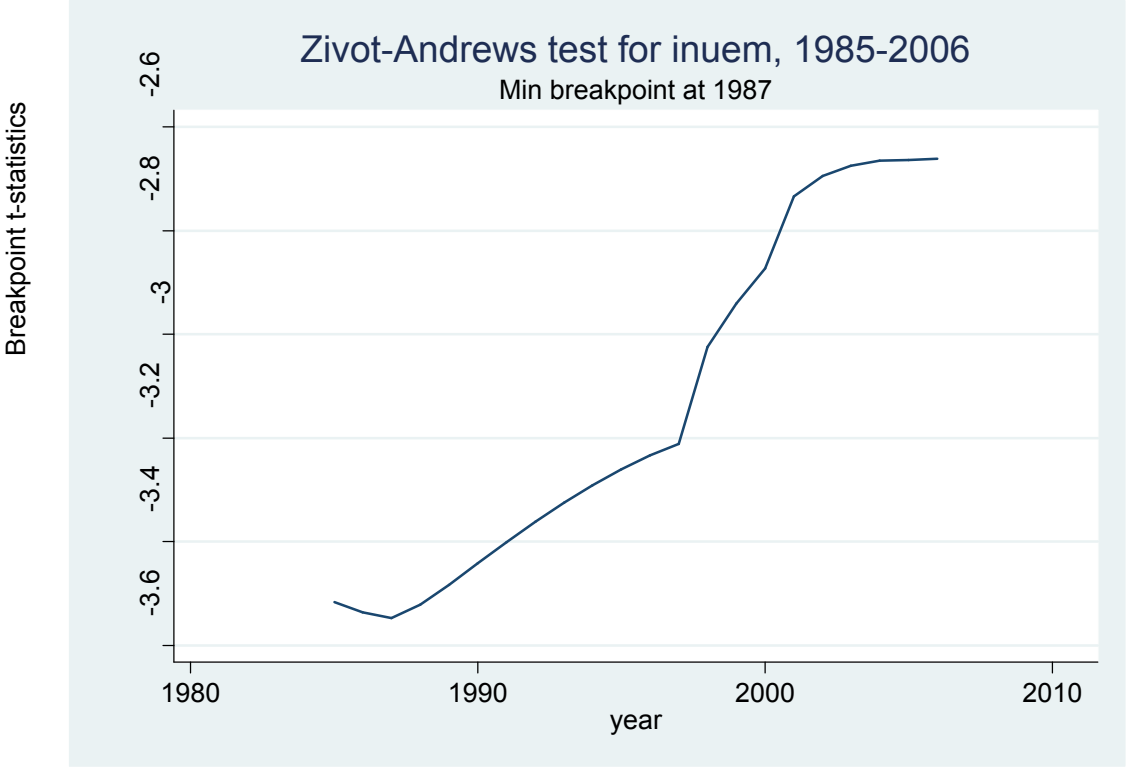


Figure 4.13: Inflation, Structural Breaks in Trend

Source: Data Analysis Results, 2014

4.3.5. Unit Root Test with Structural Breaks in both Intercept and Trend

Table 4.5: Unit Root Test with Structural Breaks in Intercept and Trend

Variable	ZA	Year
INIFR	-5.953	1995
INGDP	-4.190	1993
INMSW	-10.280*	1998
INMSN	-2.791	1992
INUEM	-3.612	2001

Source: Data Analysis Results, 2014

The critical values for the Zivot Andrew test are -5.57 at 1% and -5.08 at 5%.The result showed that wide money supply had a significant break in both intercept and trend in the

year 1998. Inflation, narrow money supply unemployment and GDP all had structural break at both intercept and trend but were not significant at 5% level. The result for unit root test with structural breaks in both intercept and trend are reported in figure 4.14 - 4.18 below

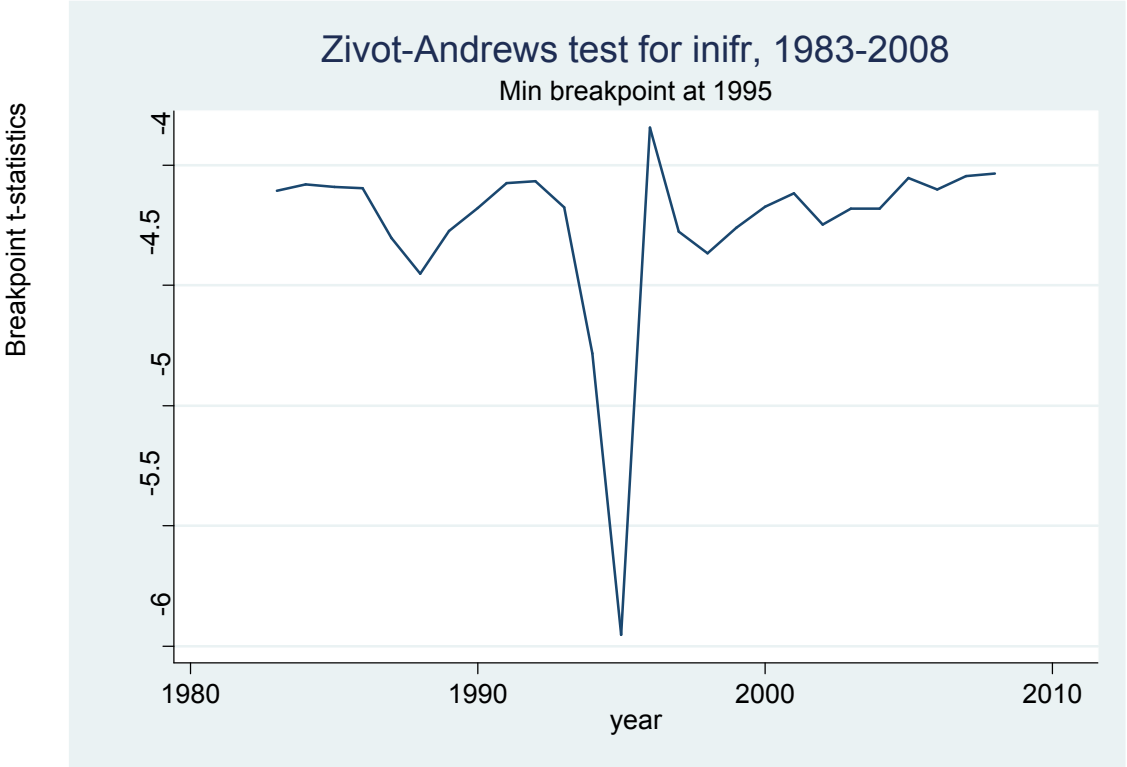


Figure 4.14: Inflation, Structural Breaks in Trend and Intercept

Source: Data Analysis Results, 2014

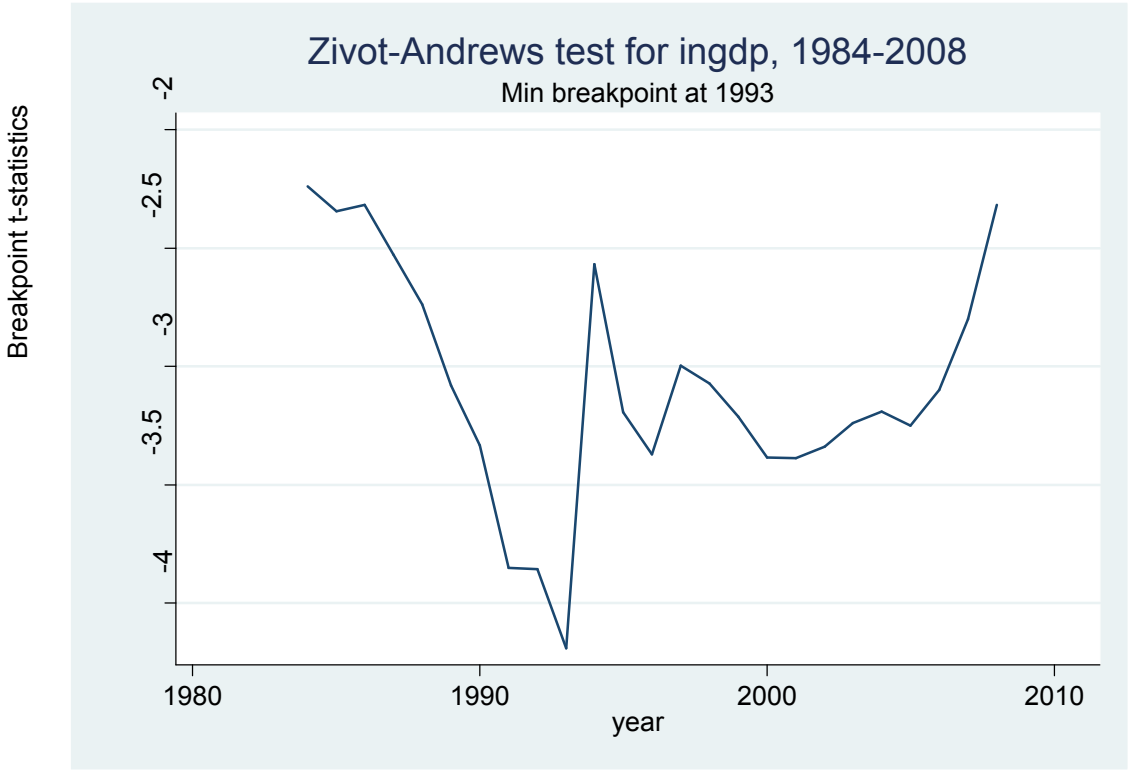


Figure 4.15: GDP Structural Breaks in Trend and Intercept

Source: Data Analysis Results, 2014

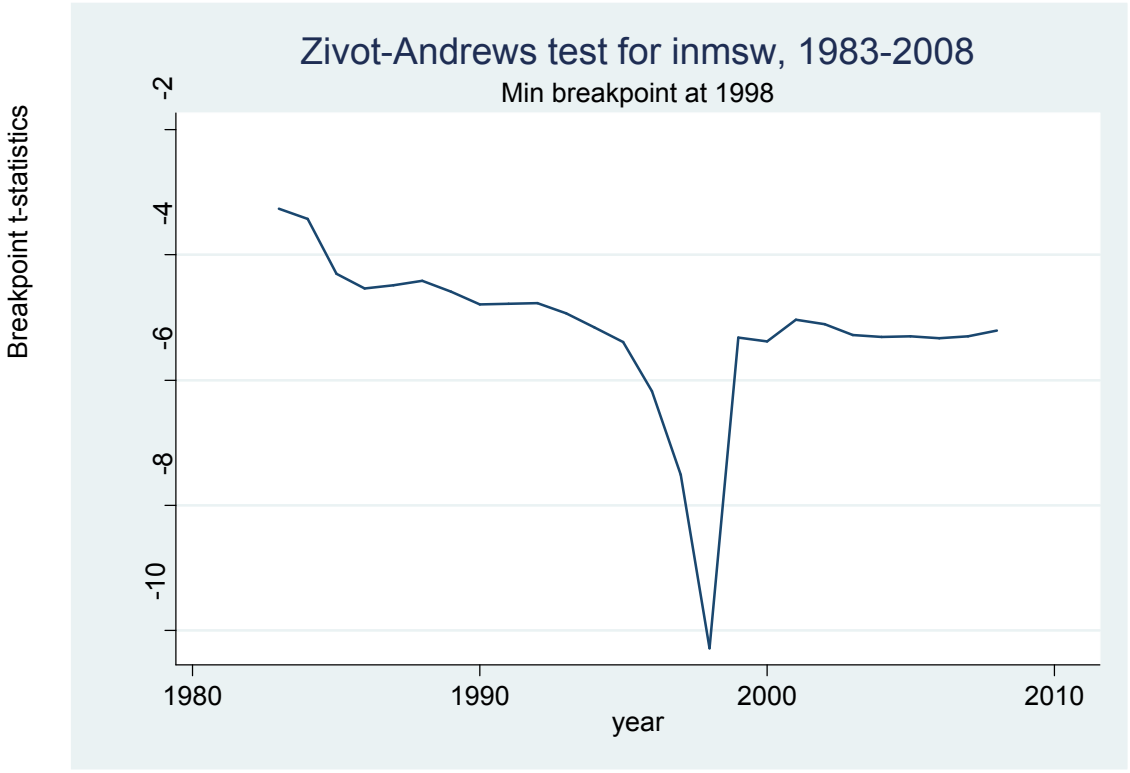


Figure 4.16: Wide Money Supply, Structural Breaks in Trend and Intercept

Source: Data Analysis Results, 2014

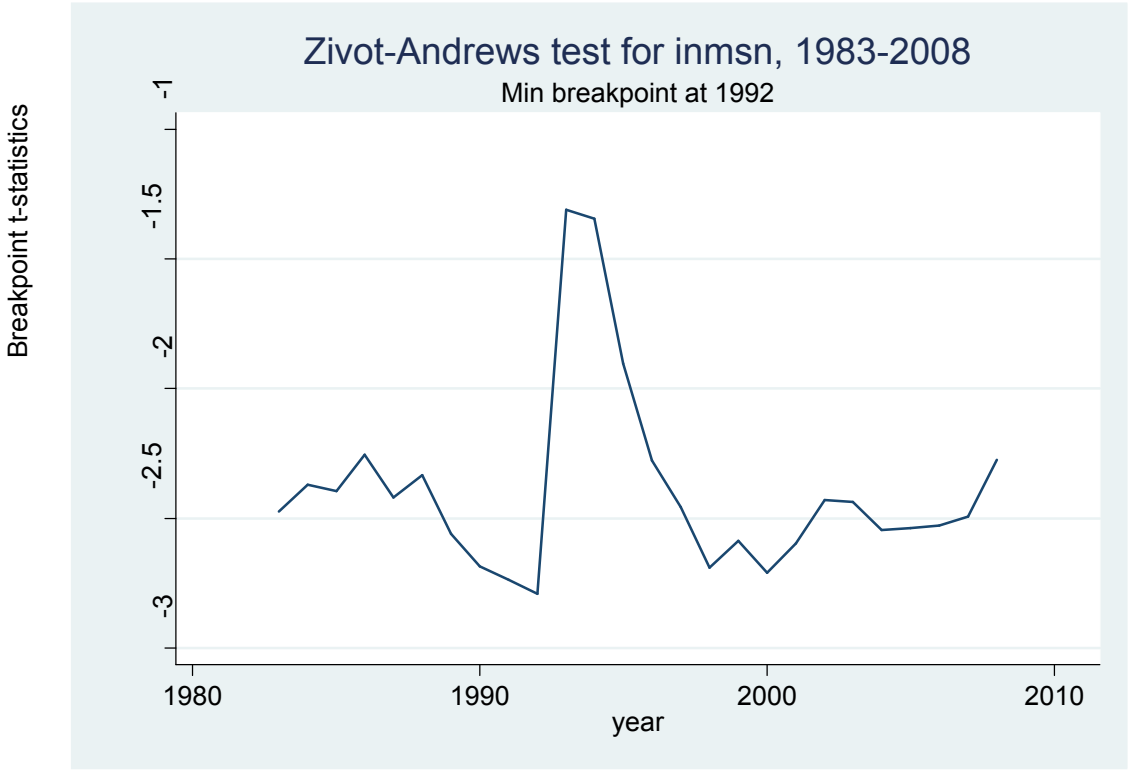


Figure 4.17: Narrow Money Supply, Structural Breaks in Trend and Intercept

Source: Data Analysis Results, 2014

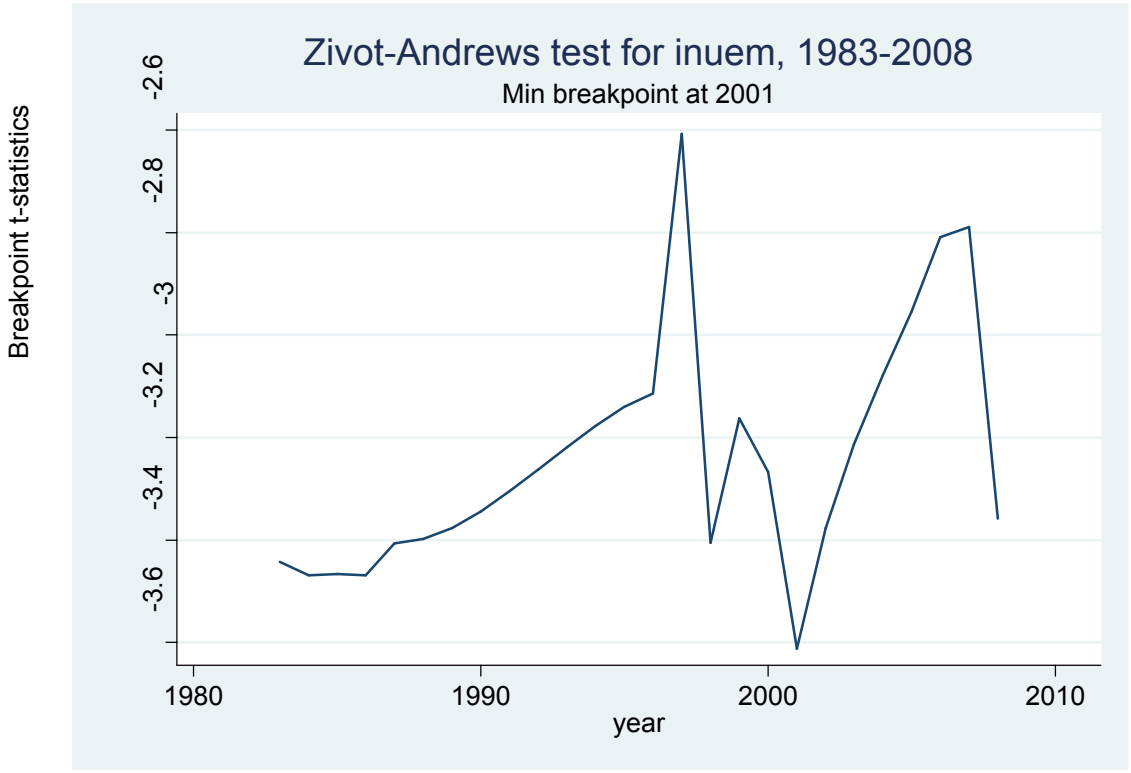


Figure 4.18: Unemployment, Structural Breaks in Trend and Intercept

Source: Data Analysis Results, 2014

4.4. Cointegration Analysis M1 Channel

If the hypothesis of non stationarity is established for the underlying variables, it is desirable and important that the time series data are examined for cointegration. Toda and Philips (1993) showed that ignoring cointegration when it exists, can lead to serious model misspecification. We use the maximum likelihood procedure of Johansen (1991, 1995) because it is based on well-established maximum Likelihood procedure. Johansen's method uses two test statistics for the number of cointegration vectors: the trace test (λtrace) and maximum eigenvalue (λmax) test. λtrace statistic tests the null hypothesis (H_0) that the number of distinct cointegration vectors is less than or equal to r against the alternative hypothesis of more than r cointegration vectors. The second

statistic tests Ho that the number of cointegration vectors is r against the alternative of r +1 cointegration vectors (Charemza and Deadman, 1997).

Since Johansen approach has become standard in the econometric literature, the procedure requires that the optimum lag length be determined. If there is some "true'' lag length, choosing fewer lags will lead to the "omission of relevant variable bias,'' whose consequences, can be very serious, on the other hand, choosing more lags than necessary will lead to the "inclusion of irrelevant variable bias,'' whose consequences are less serious; the coefficients can be consistently estimated by OLS, although their variances may be less efficient (Gujarati, 2004).

4.4.1. Determination of Optimum Lag length M1 Channel

The optimum lag length results for M1 channel are reported in table 4.6. The Log likelihood Ratio test identified the lag length to be four (4). However, Akaike Information Criteria, Hannan and Quinn Information Criteria, Schwarz Bayesian Information Criteria and Final Prediction Information Criteria all identified the lag length to be one (1) hence the lag length was taken to be one (1).

Table 4.6: Summary of Optimum Lag Length M1 Channel

Sample	1984-2011						Obs	28
Lag	LL	LR	DF	P	FPE	AIC	HQIC	SBIC
0	21.4606				3.4e-06	-1.2472	-1.1890	-1.0569

1	117.309	191.7	16	0.000	1.1e-08*	-6.9506*	-6.6597*	-5.9991*
2	127.73	20.842	16	0.185	1.8e-08	-6.5521	-6.0285	-4.8393
3	144.328	33.197	16	0.007	2.2e-08	-6.5949	-5.8385	-4.1208
4	159.913	31.17*	16	0.013	3.6e-08	-6.5652	-5.5761	-3.3299

Source: Data Analysis Results, 2014

4.4.2. Plot of Multivariate Time Series Variables M1 Channel

The first step was to plot the multivariate time series variables. These plots are presented in figure 4.19. The figure shored that there is clear long term relationship along the density scale one with maximum peak of about 0.3. The minimum peak is about 0.1.The results further showed that narrow money supply lay above all the other variables. However there was clear long term relationship.

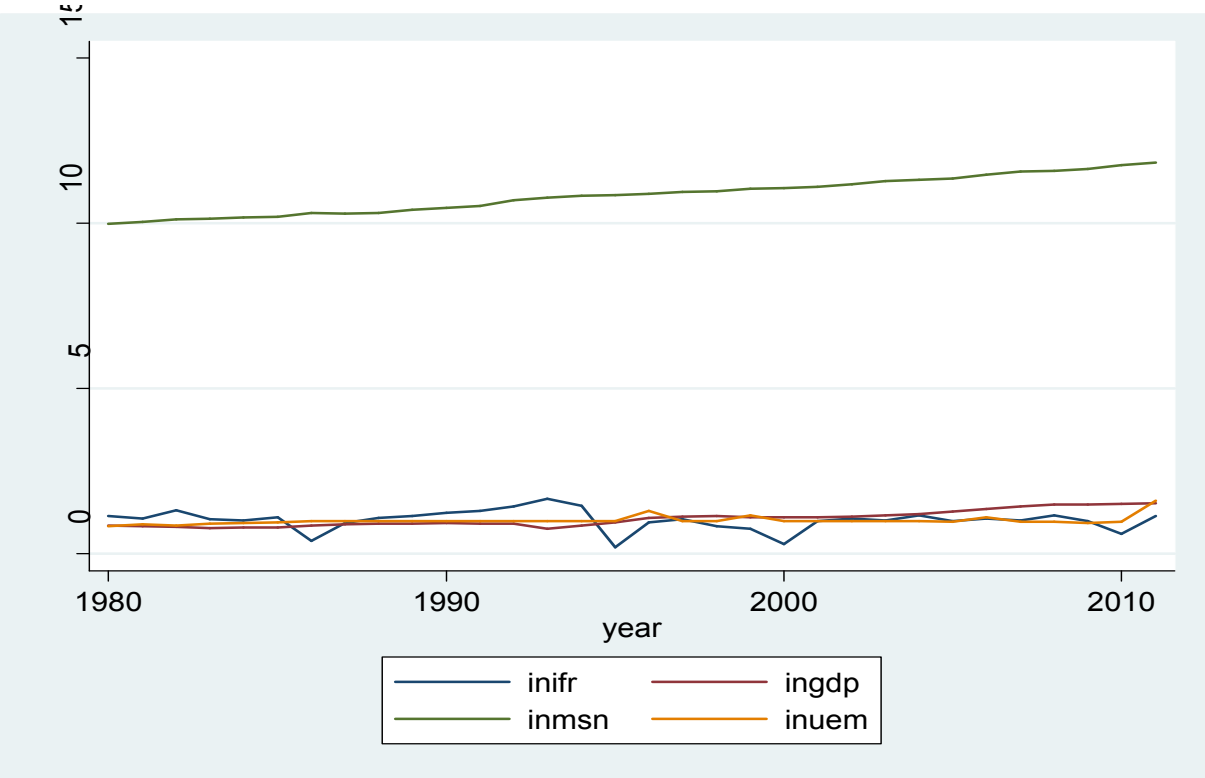


Figure 4.19: Plot of Multivariate Time Series

Source: Data Analysis Results, 2014

4.4.3. Cointegration Rank M1 Channel

The next test that was performed was Johansen's Cointegration test. The results are reported in Table 4.7. The results of both the trace statistics and eigen-value showed that there was one Cointegrating equation. This showed the long run relation was explained by one cointegration relation.

Table 4.7: Summary results for Johansen Cointegration Test M1 Channel

Trend	Constant			Obs	31
Sample	1981-2011			Lags	1
Maximum rank	Parms	LL	Eigen value	Trace statistics	5% critical value
0	4	108.6579	*	50.5218	47.21
1	11	123.0502	0.6049	21.7372*	29.68
2	16	129.3335	0.3335	9.1584	15.41
3	19	132.9950	0.2101	1.8477	3.76
4	20	133.9188	0.0579		

Source: Data Analysis Results, 2014

4.4.4. Cointegration Parameter M1 Channel

Table 4.8: Summary Statistic results of Vector Error-Correction Model

Sample: 1981-2011	Obs.	31		AIC	-7.229
LOG LIKELIHOOD	123.0502			HQIC	-7.0631
DET(SIGMA_ML)	4.19Ee-09			SBIC	-6.7202
EQUATION	PARMS	RMSE	R-SQ	$\square^2$	P> $\square^2$
D_INIFR	2	0.0521	0.1955	7.2257	0.0270
D□□_INGDP	2	0.3355	0.2826	11.4240	0.0033
D_INMSN	2	0.0380	0.7289	77.9823	0.0000
D_INUEM	2	0.1244	0.3565	16.0664	0.0003

Source: Data Analysis Results, 2014

If the series are cointegrated, they move together in the long run. A VAR in first differences, although properly specified in terms of covariance-stationary series, will not capture those long run tendencies. Accordingly, the VAR concept may be extended to the vector error-correction model (VECM), where there is evidence of cointegration among two or more series. The model is fit to the first differences of the nonstationary variables,

but a lagged error-correction term is added to the relationship. In the case of multiple variables, there is a vector of error-correction terms, of length equal to the number of cointegration relationships, or cointegration vectors, among the series. When variables are cointegrated there is long term or equilibrium relationship between them .However in the short run there may be disequilibrium. These disequilibriums can be expressed as vector error correction model (Gujarati, 2009).

The results for the vector error correction model are reported in table 4.9. The result showed that 4.78% of the disequilibrium can be corrected by lagged inflation within one year. However, this was not significant since 0.161 > 0.05. Further the result showed that 74.19% of the disequilibrium in GDP can be corrected within one year. This is significant at 5% since the p value 0.001 < 0.05. Equally the result depicted that 0.72% of the disequilibrium in the constant term can be corrected by inflation within a year.

The result also showed that 4% of the disequilibrium in the short run can be corrected by narrow money supply within one year. This was not significant at 5% as the p value 0.108 > 0.05. However, 5.97% of the disequilibrium in the constant term is corrected by narrow money supply within a year. This was significant at 5% level since the p value 0.000 < 0.05

The result finally showed that 31.37% of the disequilibrium can be corrected by unemployment within a year and this was significant at 5% level since the p value 0.000 < 0.05.Also 2.13% of the disequilibrium in the constant tem can be corrected by unemployment within a year and this was not significant at 5% p value 0.340 > 0.05.

Table 4.9: Summary for Vector Error Correction Model M1 Channel

	COEF	STD ERR	Z	P > |Z|	95% CONF	
D_INIFR						
_CE1 L1.	-0.0478	0.0341	-1.40	0.161	-0.1146	0.0190
_CONS	0.02099	0.0094	2.24*	0.025	0.0022	0.03933
D_INIGDP						
_CE1 L1	-0.7419	0.2195	-3.38*	0.001	-1.1720	-0.3117
_CONS	-0.0072	0.0603	-0.12	0.905	-0.1254	0.1110
D_INMSN						
_CE1 L1	0.0400	0.0249	1.16	0.108	-0.0088	0.08871
_CONS	0.05970	0.0068	8.74*	0.000	0.0463	0.0731
D_INUEM						
_CE1 L1	-0.3137	0.8135	-3.86*	0.000	-0.4731	-0.1543
_CONS	0.0213	0.0223	0.96	0.340	-0.0225	0.0651

Source: Data Analysis Results, 2014

Table 4.10: Summary statistics of Cointegration Equations M1 Channel

Equation	Parms		χ^2	P > χ^2		
_CEQ:1	3		89.3923	0.0000		
Beta	Coef	STD ERR	Z	P>|Z|	[95% Interval]	Confidence
CEQ: 1						
INIFR	1	.	.	.	.	.
INGDP	-1.2577	0.6491	-1.94	0.053	-2.5299	0.0146
INMSN	0.7107	0.2866	2.48	0.013	0.1490	1.2724
INUEM	-1.6176	0.9390	-1.72	0.085	-3.4579	0.2227
_Cons	-5.5583	.	.	.	.	.

Source: Data Analysis Results, 2014

Cointegrating Relation M1 Channel

$$INIFR_t = -5.5583 - 1.2577 INGDP_t + 0.7107 INMSN_t - 1.6176 INUEM_t + \varepsilon_t \quad \text{.....(4.1)}$$
$$(0.6491) \qquad (0.2866) \qquad (0.9390)$$

The results of cointegration relation are presented in Equation 4.1 above. The results showed that GDP had a negative effect on of inflation. The results showed that a unit increase in GDP caused inflation to decrease by 1.25771. This change is not significant at 5% P – Value = 0.053 > 0.05. The results further showed that a unit increase in narrow

money supply could cause inflation to increase by 0.7107.This was quite significant at 5% since a unit P value 0.013 < 0.05.Unemployment had a negative effect on inflation in the long run. A unit increase in unemployment causes inflation to decrease by 1.61761.However this was not significant at 5% since P values 0.085 > 0.05.These results are consistent with the findings of Nivoseletsaka and Myhaylychenko (2001). The result finally depicted that the level of inflation was -5.5583 when Inflation money supply and unemployment were all zero.

4.5. Diagnostic Tests M1 Channel

The next test that were performed were the diagnostic test of Langragian Multiplier test for residual autocorrelation,Lominique-Jackie Bera test for normalityand stability tests. The results are reported below.

4.5.1. Lagrangian Multiplier Test for Residual Autocorrelation

The results from from lagrangian multiplier tests are presented in table 4.11. These showed that there was no residual autocorrelation among the modeled variables since the p values were all > 0.05 hence the null hypothesis was accepted. Following Lutkephl (2005), the result were interpreted to imply that there were no linear dependencies among the modeled variables.

Table 4.11: Results of Langragian Multiplier Test M1 Channel

LAG	χ^2	DF	Prob > χ^2
1	10.8130	16	0.8209
2	14.0726	16	0.5933

H_0: No autocorrelation

Source: Data Analysis Results, 2014

4.5.2. Lominick-Jacque Bera Test for Normality

The result for Lominick-Jacque Bera test for normality are reported in table 4.12.The result showed that the univariate time series variables for Gross Domestic Product, Inflation rate and narrow money supply were normally distributed. The result of unemployment rate however was not normally distributed (p-value 0.000 < 0.05). The result further showed that the multivariate modeled variables were both skewed and kurtotic (p –value 0.0000 < 0. 05).

Table 4.12: Results of Lominick-Jacque Bera Test M1 Channel

EQUATION	χ^2	DF	Prob > χ^2

D_INGDP	0.754	2	0.6861
D_ININFR	2.554	2	0.2789
D_INMSN	1.177	2	0.5551
D_INUEM	85.502	2	0.0000
ALL	89.986	8	0.0000

Source: Data Analysis Results, 2014

4.5.3 Test for Normality Based on Skewness

The results for test for normality based on skewness are reported in table 4.13. The result revealed that the univariate time series variables for Gross Domestic Product, Inflation rate and narrow money supply were normally distributed. The result of unemployment rate was not normally distributed p-value ($0.000 < 0.05$). The result also showed that the multivariate modeled variables non-normally distributed p –value ($0.0000 < 0.05$).

Table 4.13: Normality Test Based on Skewness

EQUATION	SKEWNESS	χ^2	DF	PROB > χ^2
D_INGDP	-0.2987	0.431	1	0.5117

D_ININFR	-0.7086	2.427	1	0.1193
D_INMSN	0.4541	0.997	1	0.3180
D_INUEM	2.0307	19.932	1	0.0000
ALL		23.786	4	0.0000

Source: Data Analysis Results, 2014

4.5.4. Test for Normality Based on Kurtosis Test

The results for normality based on Kurtosis are reported in table 4.14. The result showed that the univariate time series variables for Gross Domestic Product, Inflation rate and narrow money supply were normally distributed. The result of unemployment rate was not normally distributed p-value (0.000 < 0.05). The result further showed that the multivariate modeled variables did not follow a normal distribution (p –value 0.0000 < 0.05).

Table 4.14: Normality Test Based on Kurtosis

Equation	Kurtosis	χ^2	DF	PROB > χ^2
D_INIFR	3.5168	0.323	1	0.5700
D_INGDP	3.324	0.127	1	0.72175

D_INMSN	2.6136	0.180	1	0.6710
D_INUEM	10.366	65.570	1	0.0000
ALL		66.200	4	0.0000

Source: Data Analysis Results, 2014

4.5.5. Stability Test

We know a VAR (1) is stable, if the eigenvalues are less than 1 in modulus. For the condition of stability of the VAR models, the stability of models was measured to find out whether the eigen values in this model lie within the unit circle and how VAR model satisfies stability conditions. The results in Table 4.15 showed that all the eigen values of the short-run and long-run restrictions model lie inside the unit circle, which tells us that structural VAR satisfies stability conditions. Since the model tested positive for residual autocorrelation it was necessary to test the model for stability to identify if there was misspecification of the modelled variables. Since the model was found to be stable it was concluded that the modelled variables were sufficient.

Table 4.15: Eigen Stability Condition M1 Channel

Eigenvalue	Modulus
1	1
1	1

1	1
-0.2650	0.2650

The VECM specification imposes 3 unit moduli

Source: Data Analysis Results, 2014

The roots of the companion matrix are presented in figure 4.20. The figure showed that all the roots of companion matrix lay inside the unit circle. The result showed that the model was stable and therefore suitable for interpretation and forecasting.

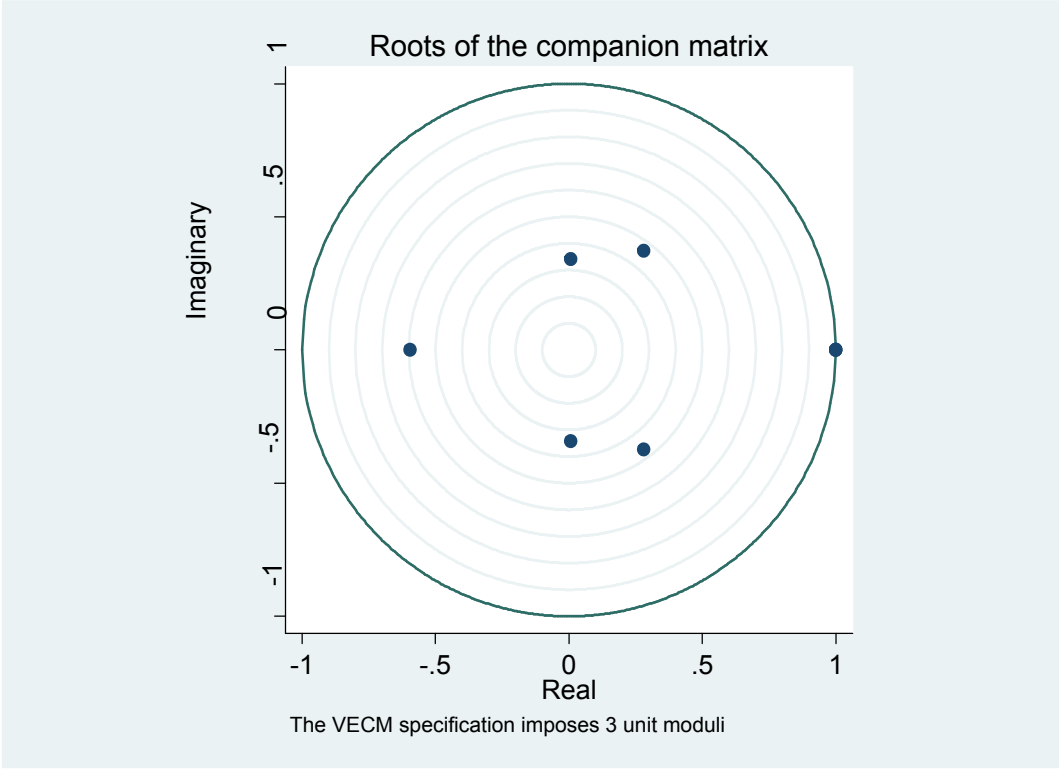


Figure 4.20: Roots of the Companion Matrix M1 Channel

Source: Data Analysis Results, 2014

4.6. Granger Causality M1 Channel

A common diagnostic test from a VAR is the set of block F tests, or Granger causality tests, that consider whether each variable plays a significant role in each of the equations. These tests may help to establish a sensible causal ordering.

The results of short term relationship are represented in form of Granger Causality in table 4.16.

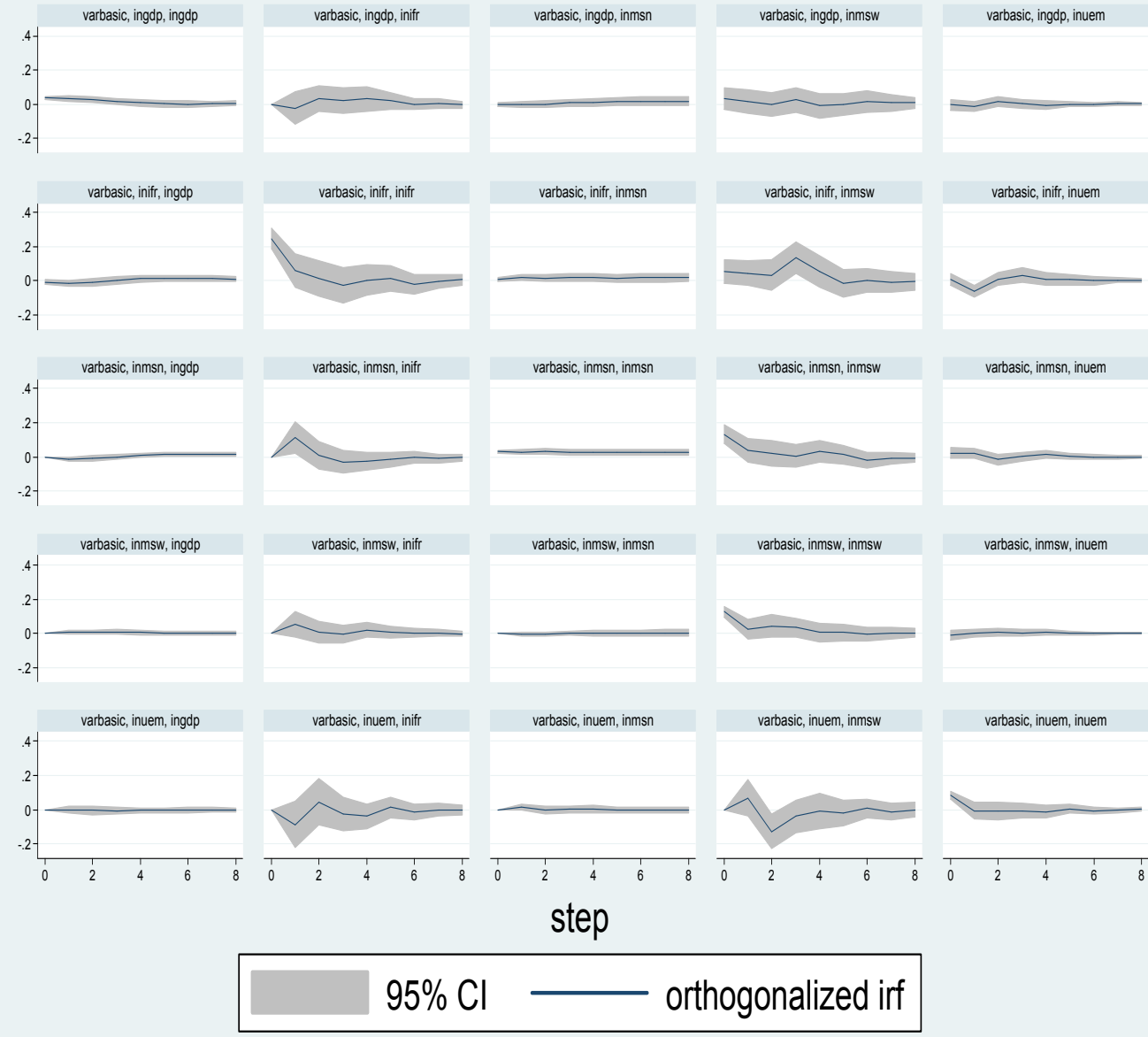
The results showed that there was bi-direction Granger Causality between gross domestic product and inflation. The result also showed that there was uni-directional Granger Causality running from narrow money supply to inflation. Further there is bi-directional Granger Causality between Gross domestic product and unemployment. Finally the result depicted that there was bi-directional Granger Causality between Gross domestic product and all the variables since the null hypothesis was rejected at 5% level.

Table 4.16: Summary Results of Granger Causality M1 Channel

Hypothesis	χ^2	DF	Prob	Remarks
INGDP does not Granger cause INIFR	1.8049	1	0.179	Reject Null
INGDP does not Granger cause INMSN	8.1328	1	0.004	Accept Null
INGDP does not Granger cause INUEM	0.0057	1	0.940	Reject Null
INGDP do not Granger cause ALL	9.9764	3	0.019	Reject Null
INIFR does not Granger cause INGDP	0.1158	1	0.734	Reject Null
INIFR does not Granger cause INMSN	0.2329	1	0.629	Reject Null
INIFR does not Granger cause INUEM	0.141	1	0.707	Reject Null
INIFR does not Granger cause ALL	0.7039	3	0.872	Reject Null
INMSN does not Granger cause INGDP	1.0724	1	0.300	Reject Null
INMSN does not Granger cause INIFR	4.4589	1	0.035	Reject Null
INMSN does not Granger cause INUEM	0.1595	1	0.690	Reject Null
INMSN does not Granger cause ALL	4.756	3	0.191	Reject Null
INUEM does not Granger cause INGDP	1.0712	1	0.301	Reject Null
INUEM does not Granger cause INIFR	8.7148	1	0.003	Accept Null
INUEM does not Granger cause INMSN	3.3545	1	0.067	Reject Null
INUEM does not Granger cause ALL	16.067	3	0.001	Accept Null

Source: Data Analysis Results, 2014

4.7. Impulse Response Functions M1 Channel



Graphs by irfname, impulse variable, and response variable

Figure 4.21: Impulse Response Function M1 channel

Source: Data Analysis Results, 2014

Impulse response functions showed the effects of shocks on the adjustment path of the variables. As the estimated VAR appeared stable, we can produce IRFs in a tabular or graphical form. More generally, an impulse response refers to the reaction of any dynamic system in response to some external change. The results are presented in figure 4.24.

Shocks on GDP were found to have a negative effect on the adjustment path of inflation. This shock was found to furnish after three years making the adjustment path a straight path. Inflation lagged once was found to have significant negative effect on the adjustment path of current inflation rates. A shock on previous period inflation causes current inflation to decrease for a period of three years, increase slightly in the 4th year and furnishes in the 5th year. Shocks on narrow money supply had no effect on the adjustment path of inflation. Impulses on inflation had a negative effect on inflation causing inflation to decrease over a period of one year, increase slightly in the second period and this furnishes after two years.

4.8. CUSUM Test

4.8.1. CUSUM Test M1 Channel

The CUSUM's Test and CUSUM's squared test for structural stability among the modeled variables were estimated. The results showed that there was no structural shift in both tests in the modeled variables hence the variables were stable. These results are

presented in figure 4.24 and 4.25 below. The figure showed that CUSUM wanders within the zero line. This implied that there was no structural instability in the modeled macroeconomic variables.

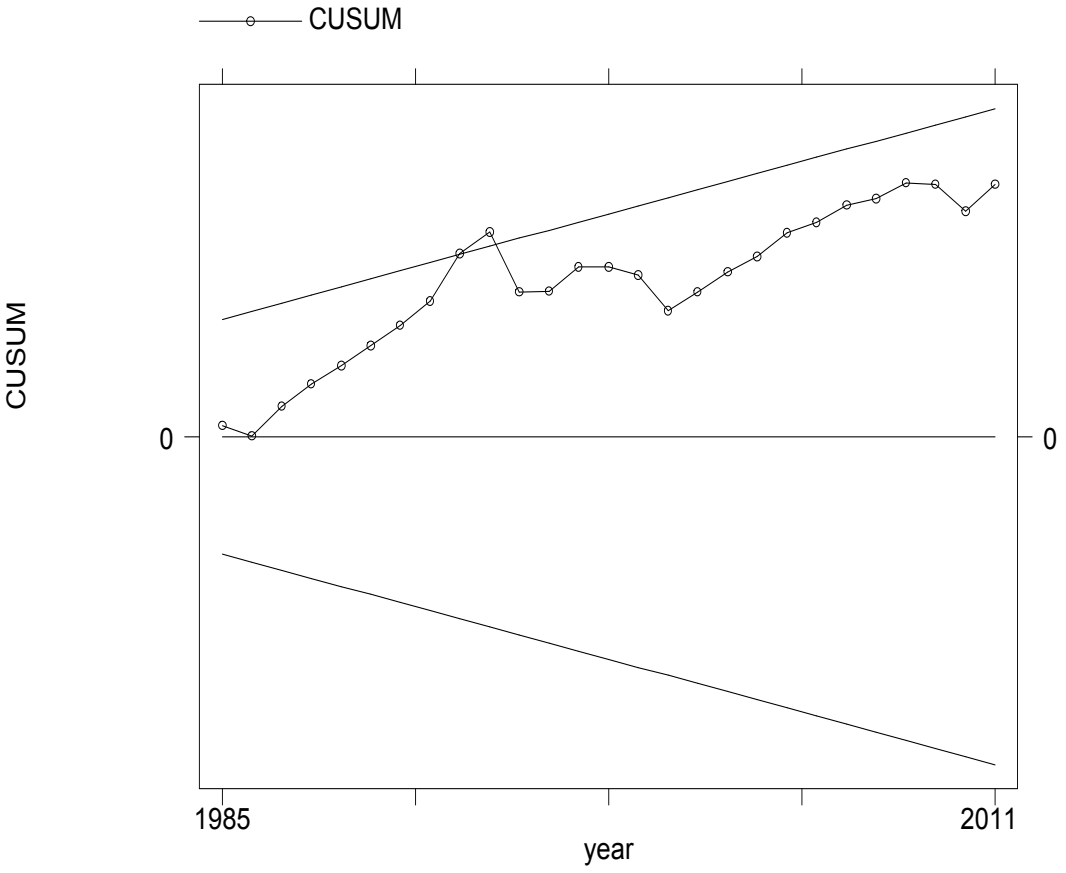


Figure 4.22: CUSUM Test M1 Channel

Source: Data Analysis Results, 2014

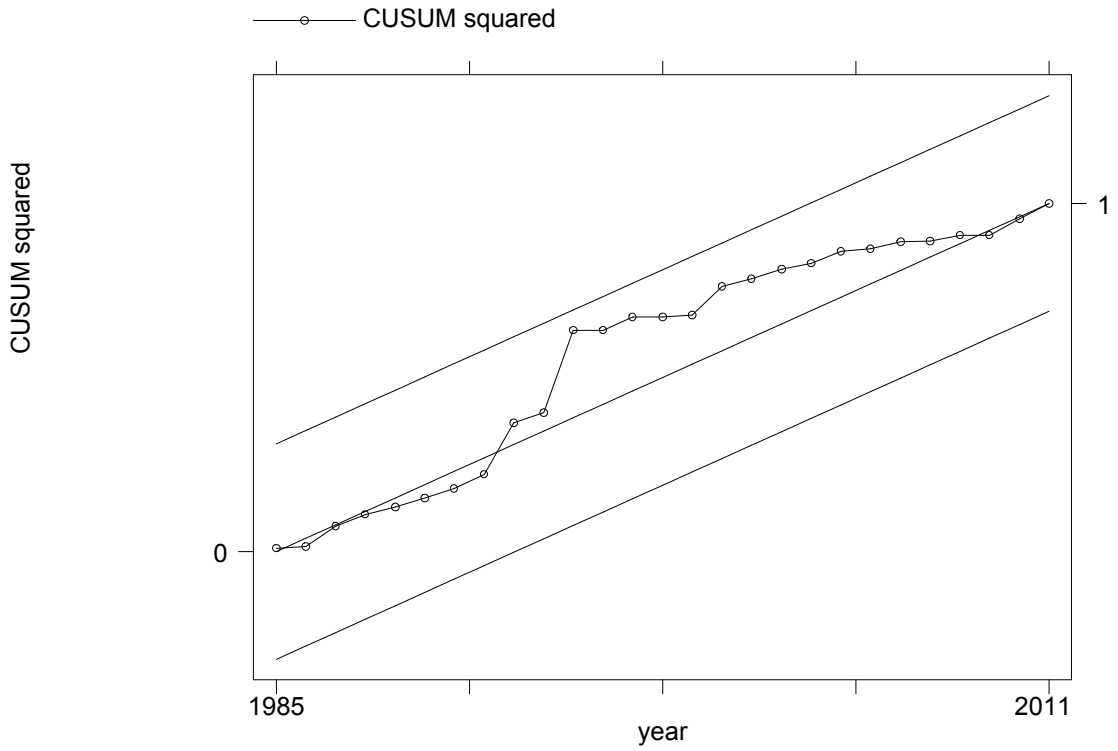


Figure 4.23: CUSUM Squared Test M1 Channel

Source: Data Analysis Results, 2014

4.9. Discussion of Empirical Results M1 Channel

The Vector Error Correction Model (VECM) was estimated. The model contains information on both the long run and short run relationship between variables. The Johansen (1988) and Juselius (1990) approach was used which combine both the short run and long run properties, and which at the same time maintain stationarity in all variables.

To check for the long term relationship amongst the dependent and independent variables, the number of cointegration relationships obtained, the number of lags and the deterministic trend assumption used in the cointegration test were all used to specify a VECM. The general-to-specific modeling strategy was used. Insignificant variables were sequentially eliminated, leading eventually to parsimonious specifications. The results show that the VAR characterizes the data generating process fairly well, as the model passes the normality, functional specification and stability tests. The model does not suffer from omitted variables and lags as reported by the information creterion value. Thus, the model is free from instability and non-normal distributed disturbances. The model thus can be useful for forecasting purposes. The scaled residuals show that they are white noise. In other words, the test generally confirms the adequacy of the restricted error correction specification.

4.9.1. Discussion of the Short Term Error Correction Results M1 Channel

The previous total GDP (GDP_{t-1}) exerts a negative effect on the current inflation but it is not significant at 5%. This may be due to the fact that an increase in GDP, or growth in the amount of goods and services, should equate to a reduction in the level of prices for those items and if uncontrolled deflation may occur.Thus with more investment in the industrial sector arising from reduced borrowing interest rate, production of goods and services increases that is likely to lower prices of goods and services. This finding was similar to those of Mohsin and Abdelhak (2001).

Previous narrow money supply (msn_{t-1}) positively affects current inflation. This equally is not significant at 5%. This may be attributed to the fact that previous year's increase in money in circulation has the tendency of increasing the production capacity of industries but not to the same level as the increased money supply and raises price of goods in the current year. This finding was in line with those of Dymto (2000) and Nicolleta and Edward(2001) who found similar results in Ukraine.

Unemployment (UEM_{t-1}) has its lagged values significantly affecting inflation negatively at 5% which may be due to the fact that as governments devote more and more resources in terms of budgetary allocations to tackle the problem of unemployment, if these resources are not channelled to the right use they may cause inflation in an economy. The government of Kenya over time has consistently increased funds for industrialisation as well as the most recent Uwezo fund with the aim of curbing unemployment. These may have an effect of causing inflation in an economy owing to the corrupt practices exhibited in the country. 31.37% of the disequilibrium in inflation in the short run are corrected by unemployment. These findings were similar to those of Fumikata (2007) who found a similar result in Malaysia.

Previous inflation (IFR_{t-1}) is significant at 5% but negatively signed. This could be evident from the fact that policies taken to curb inflation become effective after one year thus a reduction in the level of inflation. 74.19% of the disequilibrium in inflation in the short run is corrected by previous inflation levels.

4.10. Cointegration Analysis of M2 Channel

4.10.1. Optimum Lag Length M2 Channel

The optimum lag length results for M2 channel are reported in table 4.17. The lag length was found to be four by Log likelihood. However, the lag length was found to be one by Akaike Information Criteria, Hannan and Quinn Information Criteria, Schwarz Bayesian Information Criteria and Final Prediction Information Criteria. Hence the lag length was taken to be one.

Table 4.17: Summary of optimum lag length M2 Channel

SAMPLE	1984-2011						Obs	28
LAG	LL	LR	DF	P	FPE	AIC	HQIC	SBIC
0	10.2646				7.5e-06	-0.4475	-0.3893	-0.2572
1	67.4273	114.33	16	0.000	4.0e-07*	-3.3877	-3.0968*	-2.4361*
2	81.8021	28.75	16	0.026	4.9e-07	-3.2716	-2.7490	-1.5586
3	93.9383	24.272	16	0.084	8.0e-07	-2.9956	-2.2392	-0.5215
4	120.214	52.552*	16	0.000	6.1e-07	-3.7296	-2.7405	-0.4943

Source: Data Analysis Results, 2014

4.10.2. Cointegration Rank M2 Channel

Also the Johansen's Cointegration test for M2 channel was tested. The results are reported in Table 4.18. The results from both the trace statistics and eigen-value showed that there was one Cointegration equation using M2 channel. This showed the long run relation using M2 was explained by one cointegration relations.

Table 4.18: Summary Results for Johansen Cointegration Test M2 Channel

Trend	Constant			Obs	31
Sample	1981-2011			Lag	1
Maximum rank	Parms	LL	Eigen-value	Trace Statistic	5% critical Value
0	4	39.4641	*	69.6414	47.21
1	11	60.6923	0.7458	27.1850*	29.68
2	16	69.2460	0.4241	10.0775-	15.41
3	19	74.1160	0.2896	0.3376	3.76
4	20	74.2848	0.0108		

Source: Data Analysis Results, 2014

4.10.3. Plot of Multivariate Time Series Variables M2 Channel

The results of the plots of multivariate time series are reported on figure 4.21. The figure shored that there is clear long term relationship along the density scale one with maximum peak of about 1.7 and the minimum peak is about 0.2.


2
1.5
1
.5
0
1980
1990
2000
2010
year
inifr
ingdp
inmsw
inuem

Figure 4.24: Plot of Multivariate Time Series Variable M2 Channel

Source: Data Analysis Results, 2014

4.10.4. Cointegration Parameter M2 Channel

Table 4.19: Summary Results of Vector Error-Correction Model

Sample:1981-2011		Obs	31	AIC	-3.2060
LOG LIKELIHOOD	60.6923			HQIC	-3.0401
DET (SIGMA_ML	2.34e-07			SBIC	-2.6971
EQUATION	PARMS	RMSE	R-SQ	CHI2	P>CHI2
D_INIFR	2	0.0521	0.1930	6.9354	0.0312
D□□_INGDP	2	0.3296	0.3079	12.9028	0.0016
D_INMSW	2	0.2962	0.0.3741	17.3297	0.0002
D_INUEM	2	0.1398	0.1872	6.6790	0.0355

	COEF	STD ERR	Z	P>|Z|	95% CONF.INTERVAL

D_INIFR						
_CE1 L1	0.0032	0.0024	1.31	0.190	-0.0016	0.0080
CONS	0.0225	0.0094	2.38	0.017	0.0040	0.0409
D_INGDP						
_CE1 L1	0.0552	0.0154	3.59	0.0000	0.0251	0.0854
_CONS	0.0178	0.0594	0.30	0.765	-0.0987	0.1342
D_INMSW						
_CE1 L1	-0.0563	0.0138	-4.08	0.0000	-0.0834	-0.0292
CONS	0.0269	0.0534	0.50	0.615	-0.0778	0.1314
D_INUEM						
_CE1 L1	0.0156	0.0065	2.39	0.017	0.0028	0.0284
CONS	0.0294	0.0251	1.17	0.243	-0.020	0.0788

Source: Data Analysis Results, 2014

The result for the vector error correction model for M2 channel are reported in table 4.19.The result showed that 0.3% of the disequilibrium can be corrected by lagged inflation within one year. However, this was not significant since at 5% (p value 0.19 > 0.05).

Further the result showed that 5.52 % of the disequilibrium in the short run can be corrected within one year by Gross domestic Product. This was significant at 5% since the p value 0.000 < 0.05.

The result also showed that 5.63 % of the disequilibrium in the short run can be corrected by wide money supply within one year. This was significant at 5% as the p value 0.000 < 0.05. The result finally showed that 1.56% of the disequilibrium can be corrected by unemployment within a year and this was significant at 5% level since the p value 0.017 < 0.05.Also 2.94 % of the disequilibrium in the constant tem can be corrected by unemployment within a year and this was not significant at 5% p value 0.243 > 0.05.

Table 4.20: Summary Statistics of Cointegration Equations

Equation	Parms		χ^2	P > χ^2		
_CEQ:1	3		82.8120	0.0000		
BETA	COEF	STD.ERR	Z	P>|Z|	95% CONF.INTERVAL	
_CEQ:1						
INIFR	1	.	.	.	.	.
INGDP	0.0129	0.1475	0.09	0.930	-0.2763	0.3020
INMSW	-0.8296	0.1304	-6.36	0.000	-1.0851	-0.5741
INUEM	0.7185	0.5399	1.33	0.183	-0.3396	1.7767
Cons	-0.8436	.	.	.	.	.

Source: Data Analysis Results, 2014

Cointegration equation

$$INIFR_t = -0.8436 - 0.0129INGDP_t - 0.8296INMSW_t - 0.7185INUEM_t + \varepsilon_t \quad \text{.....(4.2)}$$
$$(0.1475) \qquad (0.1304) \qquad (0.5399)$$

The results of cointegration relation are presented in Equation 4.2 above. The results showed that GDP had a positive effect on inflation. The results showed that a 1 unit increase in GDP caused 0.0129 increases in inflation. This change is not significant P – Value = 0.93 > 0.05.Wide money supply played a stabilization role to correct any disequilibrium in unemployment and GDP. Wide money supply had a significant effect on inflation .A unit increase in broad money supply causes inflation to decrease by 0.8296. This change was significant at 5% p value 0.0000 < 0.05 Unemployment had appositive insignificant effect on inflation. A 1% increase in unemployment will cause inflation to increase by 0.7185. This effect was not significant at 5% P – Value 0.183 > 0.05.The result finally depicted that the level of inflation was -0.8436 whe GDP, wide money supply and unemployment were all zero.

4.11. Diagnostic Tests M2 Chanel

4.11.1. Langrangian Multiplier Test for Residual Autocorrelation

Table 4.21: Results of Lagrangian Multiplier Test M2 Channel

LAG	χ^2	DF	Prob > χ^2
1	14.0472	16	0.5952
2	14.0981	16	0.5914

H_0: No Autocorrelation at lag order

Source: Data Analysis Results, 2014

The results from from Lagrangian multiplier tests are presented in table 4.21. The results showed that there was no residual autocorrelation among the modeled variables (Lutkephl, 2005). The Lagrange multiplier (LM) test is conducted to confirm that disturbances were not autocorrelated in post analysis of VAR and models (Johansen, 1995). One of the assumptions upon which inference and post analysis after VAR are predicted is that the errors are not autocorrelated. The obtained LM statistics for residual autocorrelation after the structural VAR model show that there is no autocorrelation at tested lag order 1. Since we can accept the null hypothesis, this test does not provide any hint of model misspecification. The above test results are summarized in Table 4.21.

4.11.2. Lominick-Jacque Bera Test for Normality M2 Channel

The result for Lominick-Jacque Bera test for normality is reported in table 4.22. The result showed that the uni-variate time series variables were normally distributed with exception of Gross domestic product and unemployment. However, the multivariate time series variables were all non-normally distributed.

Table 4.22: Results of Jacque-Bera Test for Normality

Equation	χ^2	DF	Prob > χ^2
D_INGDP	10.748	2	0.0046
D_INIFR	1.828	2	0.4010

D_INMSW	3.300	2	0.01920
D_INUEM	20.829	2	0.0000
ALL	36.704	8	0.0000

Source: Data Analysis Results, 2014

4.11.3. Test for Normality Based on Skewness M2 Channel

The result for Lominick-Jacque Bera test for normality based on skewness is reported in table 4.23. The result showed that the univariate time series variables were all normally distributed except unemployment. The result further showed that the multivariate modeled variables were non-normally distributed (p –value 0.0334 < 0.05).

Table 4.23: Normality Test Based on Skewness

Equation	SKEWNESS	χ^2	DF	Prob > χ^2
D_INGDP	-0.7020	2.382	1	0.1228
D_INIFR	-0.5933	1.701	1	0.1921
D_INMSW	0.6557	2.078	1	0.1495
D_INUEM	0.9432	4.300	1	0.0381
ALL		10.460	4	0.0334

Source: Data Analysis Results, 2014

4.11.4. Test for Normality Based on Kurtosis Test M2 Channel

The result for normality based on Kurtosis is reported in table 4.24. The result showed that the univariate time series variables for Gross Domestic Product, inflation rate and narrow money supply were normally distributed. The result of unemployment rate was normally distributed (p-value 0.000 < 0.05). The result further showed that the multivariate modeled variables followed not normally distributed (p –value 0.0000 < 0.05).

Table 4.24: Normality Test Based on Kurtosis M2 Channel

Equation	KURTOSIS	χ^2	DF	Prob > χ^2
D_INGDP	5.6312	8.366	1	0.0038
D_INIFR	2.6767	0.126	1	0.7223
D_INMSW	4.0058	1.222	1	0.2689
D_INUEM	6.6986	16.529	1	0.0000
ALL		26.244	4	0.0000

Source: Data Analysis Results, 2014

4.11.5. Stability Test M2 Channel

Eigen Value Stability Condition

For the condition of stability of the VAR models, the stability of models was measured to determine out whether the eigen values in this model lie within the unit circle and how VAR model satisfies stability conditions. The results in Table 4.25 showed that all the

eigen values of the short-run and long-run restrictions model lie inside the unit circle, which showed that structural VAR satisfies stability conditions.

Table 4.25: Summary of Eigen Value Stability Condition

EIGENVALUE	MODULUS
1	1
1	1
1	1
-0.2390	0.2390

Source: Data Analysis Results, 2014

4.11.6. Roots of Companion Matrix M2 Channel

The roots of the companion matrix are presented in figure 4.22.The figure showed that all the roots of companion matrix lied inside the unit circle. Therefore the result showed that the model was stable and therefore suitable for interpretation and forecasting.

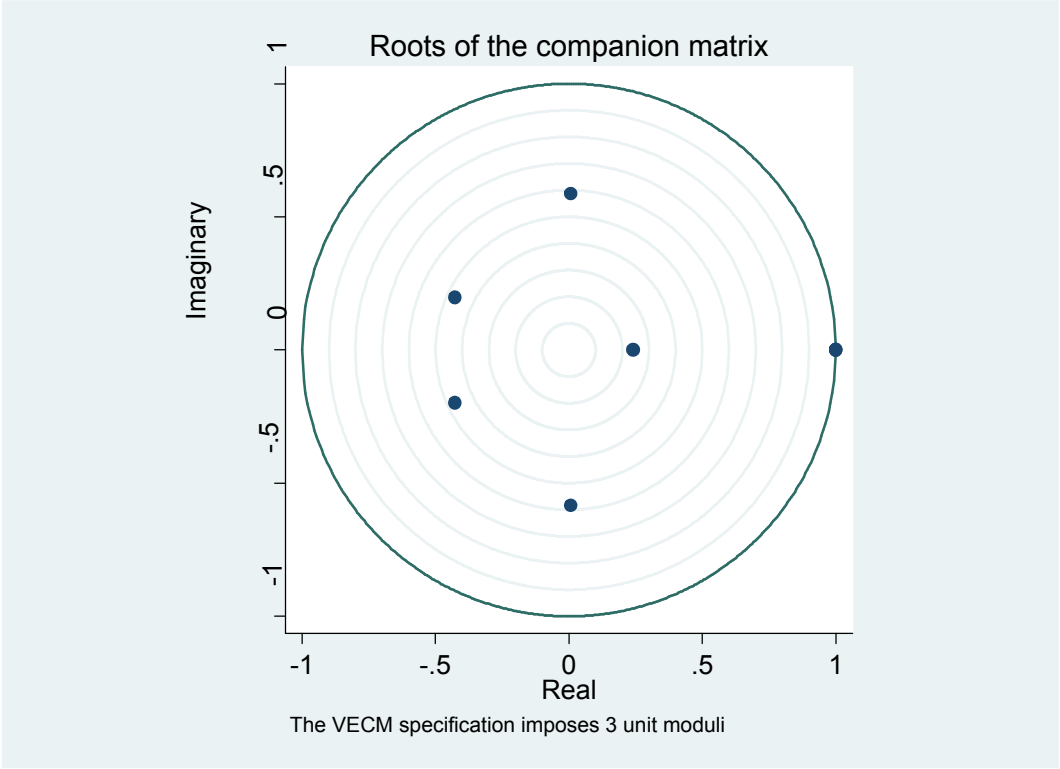


Figure 4.25: Roots of companion Matrix M2 Channel

Source: Data Analysis Results, 2014

4.12. Granger Causality M2 channel

The results of short term relationship are represented in form of Granger Causality in table 4.26.

The results showed that there was bi-direction Granger Causality between gross domestic product and inflation. The result further showed that there is bi-directional Granger Causality between wide money supply and inflation. The result further showed that there is bi-directional Granger Causality between Gross domestic product and unemployment. Finally the result depicted that there is bi-directional Granger Causality between Gross domestic product and all the variables since the null hypothesis was rejected at 5% level.

Table 4.26: Granger Causality Results M2 Channel

Null Hypothesis	χ^2	DF	Prob > χ^2	Remarks
INGDP does not Granger cause INIFR	0.8680	1	0.352	Reject Null
INGDP does not Granger cause INMSN	0.8269	1	0.363	Reject Null
INGDP does not Granger cause INUEM	0.2817	1	0.596	Reject Null
INGDP does not Granger cause ALL	2.3263	3	0.508	Reject Null
INIFR does not Granger cause INGDP	0.1525	1	0.696	Reject Null
INIFR does not Granger cause INMSW	2.6395	1	0.104	Reject Null
INIFR does not Granger cause INUEM	1.1144	1	0.291	Reject Null
INIFR does not Granger cause ALL	3.1468	3	0.370	Reject Null
INMSW does not Granger cause INGDP	0.0142	1	0.905	Reject Null

INMSW does not Granger cause INIFR	2.2473	1	0.134	Reject Null
INMSW does not Granger cause INUEM	0.0012	1	0.972	Reject Null
INMSW does not Granger cause ALL	2.3626	3	0.501	Reject Null
INUEM does not Granger cause INGDP	2.4071	1	0.121	Reject Null
INUEM does not Granger cause INIFR	8.3104	1	0.004	Accept Null
INUEM does not Granger cause INMSW	3.5772	1	0.108	Reject Null
INUEM does not Granger cause ALL	15.002	3	0.002	Accept Null

Source: Data Analysis Results, 2014

4.13. Impulse Response Function M2 Channel

A shock on Gross Domestic Product causes inflation to drop slightly over a period of one year. This shock furnishes after two years. An impulse on lagged inflation cause a negative effect on current inflation causing it to drop drastically over a period of one year. It then increases in slightly in the by the second year, decreases in the third year and furnishes after three years.

A shock on wide money supply causes inflation to increase over a period of one year. It then decreases in the next period and furnishes after two years. Finally an external shock on unemployment causes inflation to decrease sharply over a year and then increase in the next period. This shock disappears after three years.

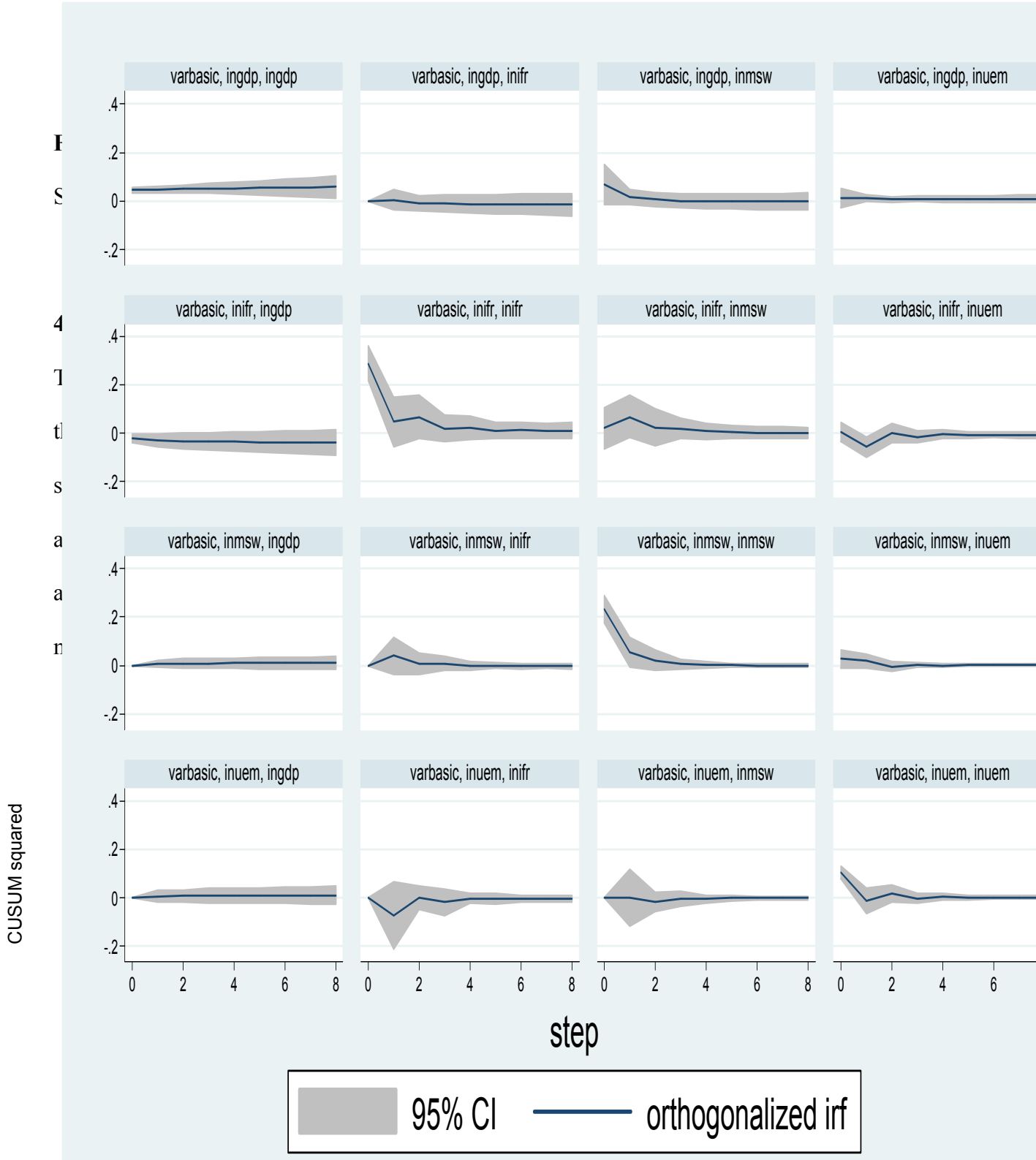

varbasic, ingdp, ingdp
varbasic, ingdp, inifr
varbasic, ingdp, inmsw
varbasic, ingdp, inuem
varbasic, inifr, ingdp
varbasic, inifr, inifr
varbasic, inifr, inmsw
varbasic, inifr, inuem
varbasic, inmsw, ingdp
varbasic, inmsw, inifr
varbasic, inmsw, inmsw
varbasic, inmsw, inuem
varbasic, inuem, ingdp
varbasic, inuem, inifr
varbasic, inuem, inmsw
varbasic, inuem, inuem
CUSUM squared
.4
.2
0
-.2
0
2
4
6
8
step
95% CI
orthogonalized irf
Graphs by irfname, impulse variable, and response variable

Figure 4.27: CUSUM Test M2 Channel

Source: Data Analysis Results, 2014

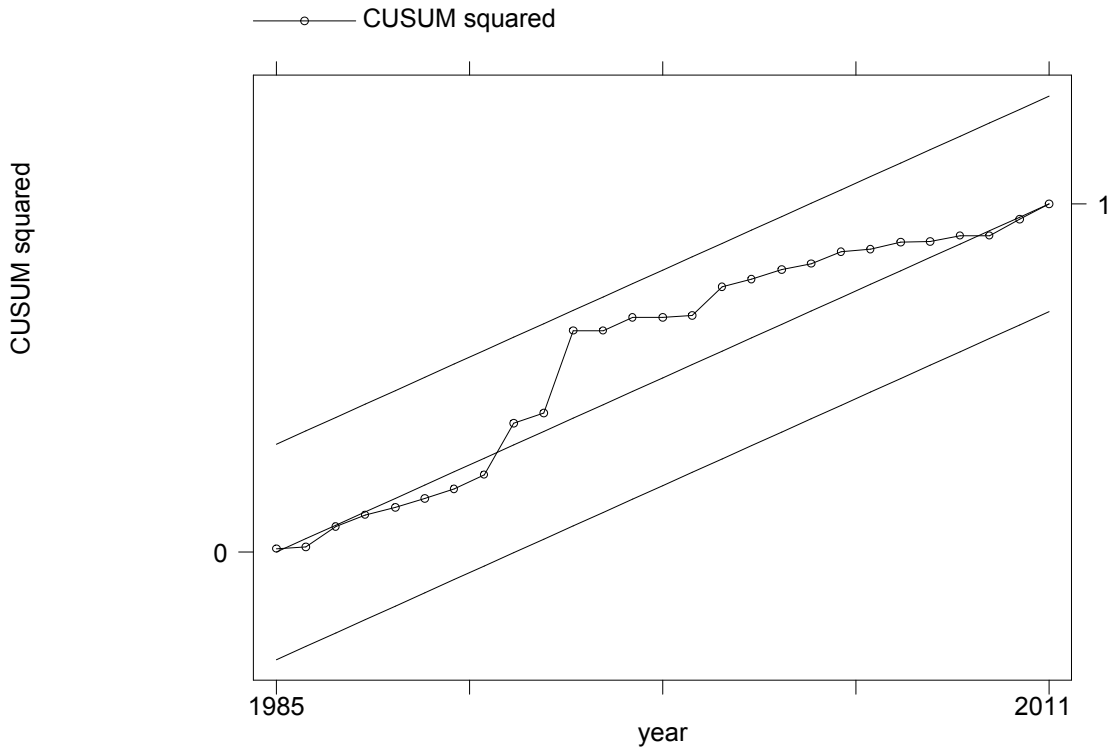


Figure 45.28: CUSUM Squared M2 Channel

Source: Data Analysis Results, 2014

4.15. Discussion of the Short Term and Long Term Error Correction Results M2 Channel

The previous GDP growth levels (GDP_{t-1}) exert a positive effect on the current inflation but it is not significant at 5%. 0.3% of the disequilibrium in the long term equilibrium in inflation are corrected by past GDP.This may be due to the fact that an increase in GDP, or growth in the amount of goods and services, should equate to a reduction in the level of prices for those items and if uncontrolled may deflation occur.Thus with more investment in the industrial sector arising from reduced borrowing interest rate, production of goods and services increases that is likely to lower prices of goods and services. This finding was similar to those (Mohsin and Abdelhak, 2001).

Previous wide money supply (msw_{t-1}) negatively affect current inflation this is significant at 5%. This can be explained that the increased money supply was followed by equal production and investments that subsequently increased the production of goods and services that finally lowered the general price levels of goods and services hence lowering inflation rates. Any Short term disequilibrium from long term equilibrium in inflation is corrected by narrow money supply at a rate of 5.6% within one year. This finding inconsistent with those of Dymto 2000 and Nicolleta and Edward 2001 who found contradicting results in Ukraine.

Unemployment (UEM_{t-1}) has its lagged values significantly affecting inflation positively at 5% which may be due to the fact that as governments devote more and more resources in terms of budgetary allocations to tackle the problem unemployment, if these resources are channelled to the right use they may reduce inflation in an economy. The government of Kenya over time has consistently increased funds for industrialisation as well as the most recent Uwezo fund. If these resources are well invested they may subsequently increase production of goods and services since more and more people work and these will finally lower inflation. Any disequilibrium from long term equilibrium in inflation is corrected by Unemployment at a rate of 1.56%. These findings were inconsistent with those of Fumikata (2007) who found a contradicting result in Malaysia.

Previous inflation (IFR_{t-1}) is significant at 5% and positively signed. This could be evident from the fact that policies taken to curb inflation does not become effective after one year thus a escalating the already high inflation. 5.5% of the disequilibrium from long term equilibrium in inflation is corrected by previous inflation.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATION

5.1. Introduction

This section of the thesis is organized as follows. Section 5.1 gives summary of the study, 5.2 gives the conclusions, 5.3 discusses the contribution to knowledge, 5.4 policy implications and finally 5.5 identifies areas of further research.

5.2. Summary of the Study

The aim of study was to determine the macroeconomic determinants of inflation. The study began by giving an overview of the evolution of Kenya's inflation and the underlying economic framework. This was followed by a discussion on the economic effects of inflation. Thereafter, the various factors that are thought to determine inflation

that is (GDP, wide money supply, narrow money supply and Unemployment) were examined. The study employed an empirical model of Vector Autoregression (VAR). The variables included in the model, as potential determinants of inflation included GDP wide money supply, Narrow money supply and unemployment. The time series data spans from 1980 to 2011.

In order to determine both the long and short run properties of the models, the Johansen cointegration and error correction methods were preferred to the other techniques. These techniques were chosen because of the advantages they have over those alternative techniques. In applying these methods, the time series was subjected to both informal and formal tests for stationarity. The variables in the cointegration regression were found to be first difference stationary, that is, each series is characterized as integrated of order one I(1). Johansen cointegration tests provided evidence that there was cointegration between inflation and its determinants, which were included in these models. Evidence of cointegration allowed the estimation of VECMs, which simultaneously provided the parameter estimates for both the long and short run. In both cases, the estimated models were robust and passed all the relevant diagnostic and stability tests. The results conform to theoretical literature reviewed for the study. The VEC estimates have an error correction parameter which is very important. The parameter measures the speed of adjustment in inflation following a shock to the system. The model converges quickly to equilibrium, with over 73% of the discrepancy corrected in each period. This means any deviation from inflation long run equilibrium is fully adjusted in one year's time. The findings of this study from the vector error correction shows that its lagged inflation,

wide money supply and unemployment that are likely to determine current inflation rates in the short run and the rate of adjustment to long term equilibrium was found to be significant at 5%.

5.3. Conclusions

Findings of this study suggest that in the short term the factors that significantly determine the inflation rates in Kenya include lagged inflation narrow and wide money supply. The level of GDP was found to have insignificant effect on inflation in the short run. However, it is worth noting that the variables had the long run relationship in both M1 and M2 channels that is explained by the cointegration relations. In both channels, money supply (wide and narrow) was found to be the key determinant of inflation in Kenya since the coefficients were statistically significant at 5%. It was established that wide money supply acted as a stabilizer to control any deviations in unemployment and GDP. Based on this study it can therefore be concluded that appropriate application of the monetary policy can to a great extent help to curb inflation in Kenya. The study finally concludes that variables considered in this study are important in determining inflation in Kenya.

5.4. Contribution to Knowledge

The study made massive contribution to knowledge as follows;

First the study demonstrated the practicality of the Philips curve in Kenya hence clearing the doubt on the statistical relationship between inflation and unemployment in Kenya. This is shown by the negative coefficient of unemployment using the M1 channel.

The study equally demonstrated that narrow and wide money supplies influence the level of inflation differently. Narrow money supply was found to have a positive effect on inflation where as wide money supply was found to have negative effect on inflation in the long run.

5.5. Policy Implications

Results from the research has revealed that broad money supply significantly determine inflation rates in Kenya. It's therefore highly recommended that the government employs the monetary policy instruments to curb inflation. The study reveals that a monitored expansionary monetary policy aimed at increasing money supply is likely to reduce inflation since broad money supply was found to have a negative significant coefficient. This can be explained that if increased money supply is put into viable investments it will lead to increased production of aggregate goods and services and thus stabilising prices and hence lowering inflation rates.

The result further reveals that narrow money supply equally had a positive and significant effect on inflation in the long run. And hence narrow money supply determines significantly inflation rates in Kenya. To curb inflation therefore, policy makers have to reduce narrow money supply since the coefficient is positive and significant. This can be explained that since narrow money supply entirely comprises of money in the central bank that is currency plus demand deposits, traveler's checks, and other checkable deposits, a reduction in this will imply that central banks will have less resources to extend to commercial banks in terms of loan and this will make commercial banks to raise interest rates discouraging borrowing. Increased interest rates is one method of

contractionary monetary policy that will end up reducing volume of money circulation and hence ensuring that price levels are stabilised.

The study finally recommends that the government should use wide money supply to curb unemployment and inflation in Kenya. This is evidenced by the large negative and significant coefficient of wide money supply using M2 Channel. Wide money supply acts as a stabilizer for unemployment and Gross Domestic Product.

5.6. Areas of Further Research

Further research can be carried out in this area incorporating exchange rates, imports and exports in order to try and eliminate autocorrelation and to establish if in the long run they significantly determine inflation rates in a country.

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APPENDIX

Summary Result of the Vector Autoregression

Vector Autoregression M1 Channel

Sample:1981-2011		Obs	31	AIC	-7.3496
LOGLIKELIHOOD	113.9188	FBE	7.64e-09	HQIC	-7.0480
DET(SIGMA_ML)				SBIC	-6.4244

Equation	PARMS	RMSE	R-SQ	χ^2	Prob > χ^2
INIFR	5	0.0490	0.9643	837.9358	0.0000
INGDP	5	0.3246	0.0743	2.4899	0.6465
INMSN	5	0.03857	0.9956	6955.922	0.0000
INUEM	5	0.1168	0.3496	16.6654	0.0022

		COEF	STD.ERR	Z	P>|Z|	95% CONF.INTERVAL	
INGDP	*INIFR*						
	L1	0.7597	0.0970	7.83	0.0000	0.5696	0.9498
	INGDP						
	L1	-0.0369	0.0275	-1.34	0.179	-0.0909	0.0170
	INMSN						
	L1	0.1209	0.0424	2.85	0.004	0.0378	0.2039
	INUEM						
	L1	-0.0081	0.1074	-0.08	0.940	-0.2187	0.2024
	_CONS	-0.9887	0.3424	-2.89	0.004	-1.6599	-0.3176
INIFR	*INIFR*						
	LI	0.2186	0.6425	0.34	0.734	-1.0407	1.4780
	INGDP						
	LI	0.2177	0.1821	1.20	0.232	-0.0706	0.2287
	INMSN						
	L1	-0.1354	0.2606	-0.48	0.629	-0.6853	0.4146
	INUEM						
	LI	-0.2671	0.7114	-0.38	0.707	-1.6615	1.1272
	_CONS	2.2959	2.2674	1.01	0.311	-2.1482	6.740
INMSN	*INIFR*						
	L1	0.0790	0.0763	1.04	0.300	-0.0706	0.2287
	INGDP						
	L1	0.0457	0.0216	2.11	0.035	0.0033	0.0881

	INMSN						
	L1	0.9831	0.0333	29.48	0.0000	0.9177	1.0485
	INUEM						
	L1	0.0338	0.0845	0.40	0.690	-0.1319	0.1994
	_CONS	0.7946	0.2694	0.29	0.768	-0.4486	0.6075
INUEM	*INIFR*						
	L1	-0.2393	0.2312	-1.04	0.301	-0.6925	0.2139
	INGDP						
	L1	-0.1935	0.0655	-2.95	0.003	-0.3219	-0.0650
	INMSN						
	L1	0.1849	0.1010	1.83	0.067	-0.0130	0.3829
	INUEM						
	L1	-0.1661	0.2560	-0.65	0.516	-0.6679	0.3357
	_CONS	-0.3760	0.8159	-0.46	0.645	-1.9752	1.2232

Vector Autoregression M2 Channel

Sample:1981-2011		Obs	31	AIC	-3.5022
LOGLIKELIHOD	71.2848	FBE	-3.58e-07	HQIC	-3.2007
DET(SIGMA_ML)=	9.4e-08			SBIC	-2.5771

Equation	PARMS	RMSE	R-SQ	χ^2	P > χ^2
INIFR	5	0.0544	0.9561	675.7097	0.0000
INGDP	5	0.3128	0.1406	5.0704	0.2801
INMSW	5	0.2647	0.1698	6.3424	0.1750
INUEM	5	0.1181	0.3346	15.587	0.0036

		COEF	STD.ERR	Z	P>|Z|	95% CONF.INTERVAL	
INGDP	*INIFR*						

	L1	1.0121	0.0418	24.20	0.0000	0.9301	1.0940
	INGDP						
	L1	-0.0284	0.0305	-0.93	0.352	-0.0882	0.0314
	INMSW						
	L1	0.0252	0.0277	0.91	0.363	-0.0291	0.0794
	INUEM						
	L1	-0.0625	0.1177	O.53	0.596	-0.1682	0.2932
	_CONS	-0.0516	0.1223	-0.42	0.673	-0.2913	0.1881
INIFR	*INIFR*						
	LI	-0.0940	0.2406	-0.39	0.696	-0.5656	0.3776
	INGDP						
	LI	0.1554	0.1754	0.89	0.375	-0.1884	0.4993
	INMSW						
	L1	0.2585	0.1591	1.62	0.104	-0.0534	0.5705
	INUEM						
	LI	-0.7150	0.6773	-1.06	0.291	-2.0425	0.6125
	_CONS	1.3827	0.7037	1.96	0.049	0.0035	2.7619
INMSW	INIFR						
	L1	0.0243	0.2037	0.12	0.905	-0.3749	0.4234
	INGDP						
	L1	0.2226	0.1485	1.50	0.134	-0.0684	0.5136
	INMSW						
	L1	0.2298	0.1347	1.71	0.088	-0.0342	0.4938
	INUEM						
	L1	0.0201	0.5733	0.04	0.972	-1.1035	1.1437
	_CONS	0.6130	0.5956	1.03	0.303	-0.5544	1.7803
INUEM	*INIFR*						
	L1	0.1410	0.0910	1.55	0.121	-0.0371	0.3191
	INUEM						
	L1	-0.1911	0.0663	-2.88	0.004	-0.3209	-0.0611
	INMSW						

L1	0.0965	0.0601	1.61	0.108	-0.0213	0.2143
INUEM						
L1	-0.1327	0.2559	-0.52	0.604	-0.6341	0.3688
_CONS	1.088	0.2658	4.08	0.0000	0.5648	1.6068