EFFECTIVENESS OF MONETARY POLICY ON INFLATION TARGETING IN KENYA

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DECLARATION

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

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This Research Project has been submitted for examination with my approval as the Supervisor.

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Abstract

This study evaluates the feasibility of inflation targeting in Kenya by analyzing the effectiveness of monetary policy instruments in inflation targeting. The study uses a VAR analysis approach to assess the importance of the relationship between the monetary policy variables and inflation. Results show that the linkages between monetary policy instruments and inflation are not quite strong. Therefore Kenya ought to improve its monetary policy system in order to incorporate a fully-fledged inflation targeting framework within the economy.

List of Abbreviations

CBK -Central Bank of Kenya

CPI- Consumer Price Index

FIFT- Flexible Inflation Forecast Targeting

GDP-Gross Domestic Product

IT - Inflation Targeting

OECD- Organization for Economic Corporation and Development

VAR -Vector Autoregression

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CHAPTER 1: Introduction

1.1 Background

Monetary policy plays a vital role in the economic development within a country. The Central Bank of Kenya's (CBK) main objective is geared towards the formulation and implementation of monetary policies aimed at achieving stability in general price levels. It is also concerned with ensuring liquidity, solvency and proper functioning of a stable; market based financial system (CBK, 2014). This is aimed at stimulation of economic growth within the country and meeting the desired target goals stipulated by the Central Bank. Monetary stability is a primary focus of many countries across the world as central banks are mandated with ensuring efficiency within the money market and tackling of major problems affecting the economy.

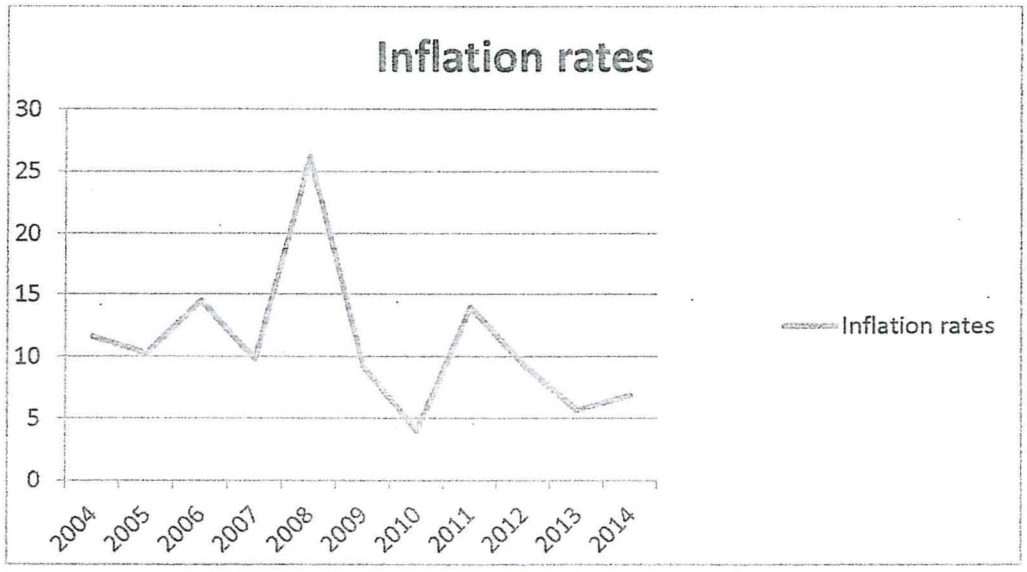
Over the years many countries have been subjected to various forms of economic instability. In line with this, countries strive to take the initiative by taking precautionary measures aimed at averting great repercussions that might be brought about by such scenarios. Governments therefore make efforts to come up with the most sensible form of monetary policies that would be feasible within their economic framework (Friedman, 2014). Effectiveness of the monetary policies tools implemented by a country solely relies on the circumstances faced within an economy. These may vary in different countries and may include regimes, development stage, economic structures and capital markets which are major determinants that form a basis of the criteria of the instruments to be used in the achievement of economic stability (Dabrowski, Smiech, & Papiez, 2013).

Developing countries such as Kenya face difficulties in establishing the most effective and efficient form of monetary policy tools that can be implemented to help in ensuring a stable economy. The Central Bank ought to ensure that all the objectives set are aligned in such a way that all key players within an economy are working towards a common goal. Conflicts of interest also tend to be an impeding factor that may cause hindrance to the success of the various policies instituted within an economy (Niemann, Pichler, & Sorger, 2013). These discrepancies may alter the economic performance and hence the country becomes bombarded with financial crisis as a result of such problems faced with regard to monetary policy implementation.

One of the major concerns of monetary policies is ensuring price stability within the economy. Inflation is a sustained increase in the general price level of goods and services in an economy over a period of time (Ungewitter, 2012).When the price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money signifying a loss of real value in the medium of exchange and unit of account within the economy. The level of inflation varies across countries depending on the structure of the economy. It is a pivotal issue in many countries as it has significant economic costs that may affect it adversely. Monetary policies ought to be revised in a bid to create a stance that is aimed at fostering a stable financial environment (Adam, 2009).

Inflation is an undesired phenomenon that poses major setbacks and therefore it is a primary objective enlisted in the monetary policy framework. A number of implications are brought about by persistent inflation in a country. Firstly, there may be major budget deficits whereby expenditure surpasses the revenues obtained within a country thus causing major challenges in the flow of income in the financial market. Secondly tax distortions may also be an inherent factor which may cause a ripple effect to future generations. Thirdly, the purchasing power of the currency reduces as its real value has declined substantially (Hall, 1982). Kenya has been faced with a series of high inflation rates over the years. Figure 1 below shows the inflationary trends in Kenya over the years (KNBS, 2014).

Figure 1-Inflation Rates from 2004-2014



Inflation targeting (IT) has been seen as a vital technique that can help solve the problem of in inflation among many techniques given the appropriate framework is implemented (Bernanke and Mishkin, 1997). It was first implemented in New Zealand in 1990 where it has shown quite a success as levels of inflation have been quite stable and low over the years. These remarkable long run outcomes are as a result of its accountability and transparency. Numerous benefits have been acclaimed to using inflation targeting in the monetary policy framework. Firstly, it helps in lowering inflation and reducing its volatility thus increasing the stability of inflation levels. Secondly, costs attached to disinflation are greatly reduced as the targets act as nominal anchors that help steer the economy towards a given direction. Thirdly, long run inflation expectations are able to be matched quite closely to the target announced hence less deviations are expected as monetary goals are aimed at reaching a certain target. Therefore it is one policy that can boost the growth of a countries economy if adopted and implemented efficiently within a given economy (Kadioglu, Ozdemir, & Yilmaz, 2000).

1.2 Problem Statement

Monetary policies implemented within a country are subject to specific certain objectives as stated by the Central Bank. Firstly, they are aimed at promoting high rate of employment as it increases the level of output within a country. Secondly, stability in the level of prices is a main focus as fluctuations may tend to bring uncertainty and instability in the economy. Thirdly, it aims at ensuring economic growth that fosters development and increases the real per capita income. Lastly, the policies are aimed in ensuring equilibrium in the balance of payments (Miles, 2014).

Despite countries embracing monetary policy objectives inflation has proven to be one of the major challenges especially in developing countries (Calvo, 1999). Inflation comes with various challenges to the economy. It results in devaluation of the currency thus creating an imbalance of payment and decline in economic growth. This has a twofold effect as it results in numerous budget deficits and tax dispositions which are reflected in prices.

Kenya has been faced by a number of periods whereby inflation proved to be a major problem facing our economy. The Post-Election Violence in 2007-2008 in Kenya brought detrimental effects in the economy that led it to spiral downward. Inflation rates were extremely high and

reached an annual average of 26.2 per cent (CBK, 2008). The purchasing power of commodities declined steeply as there was a major financial turmoil. In 2011 Kenya was also faced by high volatility in the exchange rates which resulted to high inflation rates within the country.

The Central Bank having put an inflation target of 5% per cent and various policies over the years has been faced by major challenges in controlling this phenomenon thus attaining this target can prove to be cumbersome as a result of inappropriate monetary policy. The aim of this study is to investigate how effective monetary policies using inflation targeting as a framework has been able to reduce the inflationary pressures sustained in our economy.

1.3 Research Objectives

The objective of this study is to analyze the applicability of inflation targeting as a key monetary policy framework in a bid to ensure inflation stability within the country. The major areas of concern would be:

1. To investigate the effectiveness of monetary policy to instruments employed by Central Bank of Kenya on inflation targeting.

1.4 Research Questions

1. Is inflation targeting a feasible monetary policy framework in Kenya?

1.5 Significance of the study

This study would be of value to scholars, academicians and also the government through its which is the main body that makes policies in Kenya. This study would increase knowledge on the monetary policy transmission in the Kenyan context and its efficiency overtime. The study will also be able to point out on key areas which may need further research with regard to monetary policies.

This study would be of great help especially to the Ministry of Finance as it would help them iin making monetary policy decisions more effectively and efficiently. This is because they are mandated with ensuring financial stability and be able to meet the monetary goals set in the

country. It would also help to ensure monetary policy transmission is efficient in ensuring stability in the price levels of the country.

CHAPTER 2: Literature Review

2.1 Introduction

This chapter looks at theoretical and empirical literature on monetary policies and inflation done by scholars in the previous years. It is slightly over two decades since inflation targeting monetary policy was first adopted. Theory and practice have developed together over this period, resulting in a large body of academic literature on IT. In recent years, a growing body of literature has provided insights on the empirical assessment of IT.

2.2 Theoretical Review

Bernanke and Mishkin (1997) in the paper aimed at analyzing how IT can help foster a system of monetary policy that will have positive impact on countries that adopted the structure. They found that by countries incorporating it to their monetary policy framework would result into numerous advantages such as transparency and coherent policy making, increased accountability and would also make major contributions on policy debates and decision making.

Mishkin (2000) went a step further to identify the benefits of IT to a country. He claims that IT has been able to ensure that the Central Bank have put their main focus on domestic considerations and also enabled them to tackle and respond to various forms of shocks within the economy. He states that the IT framework is also geared towards determining the best setting of monetary policy instruments in order to ensure efficiency within the economy. It is also advantageous as it is easily understood by the public. Moreover by setting an inflation targeting it helps in fostering accountability and transparency within the monetary policy system.

In line with the above findings, Khalid (2005) points out that there are two ways in which the Central Bank could implement inflation targeting, namely 'strict' or 'flexible' IT. With regard to the 'strict IT regime' the sole priority of the Central Bank is to find ways in which they can achieve the inflation target. Slight deviations from the target results in movements of monetary policy instruments aimed at reverting back the inflation rates to the targeted figure. Under the 'flexible IT regime' the Central Banks main concern is ensuring that there is stability of output and exchange rates within the economy. Whenever inflation rates are not within the targeted figure the 'flexible IT regime' takes a gradual approach to return it to the desired figure. A

flexible IT regime tends to give discretionary power to the central banks in order to make some adjustment in monetary instruments.

Ball (1997) argues that income targeting is an unnatural variable to target as it is the sum of inflation level and output growth. Moreover monetary policies tend to affect these variables with lags. Therefore he expresses the preference of countries to implement inflation targeting as opposed to income targeting as it proves to be difficult to implement from a data point of view and may also cause variability on both output and inflation overtime. He proposes that countries should strive to follow IT as it poses favourable results in the long run thus encouraging financial stability within the economy.

In addition, Freedman and Laxton (2009) also found out that the use of other means such as (exchange rate and monetary targeting) to avert inflation have led to unfavourable experiences over the years in a number of countries. Therefore many countries opted to switch to inflation targeting in order to lower inflation rates and also be able to anchor inflation rates expectations. Therefore it proved to offer better results with regard to achieving the monetary policy goals thus being the better option.

Basing his study on the financial crisis that occurred in 2008, Issing (2011) found that ensuring price stability is a key mandate of the Central Bank. He states that asset prices played a major role in giving forecasts of the economy and therefore they tend to have an influence on both inflation and output within a country. Monetary policies implemented should therefore strive to place their focus on ensuring price stability. This will ensure aversion of the consequences brought about by a decline in asset prices in the financial sector which may tend to have a ripple effect in the economy.

2.3 Empirical Literature Review

Mishkin and Posen (1998) examined the effectiveness of IT in the first four countries that adopted the policy: New Zealand, Canada, United Kingdom and Germany which adopted several elements of the policy. They all found out that it had positive effects to their economies. It led to an increase in transparency in the implementation of monetary policies to the public. The level of inflation rates also declined drastically and they were able to stabilize it hence stimulating economic growth.

Walsh (2009) examines the effect of IT on macroeconomic performance on countries which have adopted the policy as their nominal anchor in dealing with inflation. He found that it helped in reducing the inflation rate mean in those countries as compared to those who haven't adopted the policy. Moreover the drop in average inflation was coupled by a substantial drop in inflation volatility both by standard deviation and as measured by the coefficient of variation.

Montes (2010) sought to find out how inflation targeting central banks can be able to be successful in their endeavors of implementing monetary policies despite the setbacks which they face. These may include uncertainties which may affect the implementation of the policies and also problems associated with financial instability. He suggested that countries should make use of Flexible Inflation Forecast Targeting (FIFT) which would be able to effectively deal with uncertainties and also minimize fluctuations in both output and price.

Corbo, Moreno and Schmidt-Hebbel (2002) conducted a wide empirical research on the rational of the consequences of adopting IT. They compared policies and outflows in full-fledged IT countries on two control groups of potential targeters and non targeters. They found that output sacrifice ratios, inflation forecast errors and inflation persistence displayed a great decline in countries which had implemented IT. Indeed this structure has proven to influence the price and output shocks on the behavior of inflation and output gaps in these countries.

Similarly, Neumann and Hagen (2007) conducted an empirical research on group of six industrial IT countries and three non-IT countries using data from 1978-2001 a pre IT period and post IT period. They sought to investigate stability of inflation rates by analyzing how stable they were over the periods and also long run and short run effects on interest rates to supply shocks.

Results show that IT countries reduced inflation and interest rates thus increasing their level of credibility thus proving to be an effective strategy for monetary policy.

In the same light, Mishkin and Schmidt-Hebbel (2007) also carried out a study to investigate the effectiveness of inflation targeting as an anchor for conducting monetary policy. The study was based on empirical evidence from a panel of IT and a control group of high income non-IT countries. Statistics showed that inflation performance on inflation targeters reduced their inflation rates from 12.6 per cent before the adoption to 4.4 per cent. This concluded that IT helped countries who adopted the policy to lower their inflation rates as opposed to those who did not.

Johnson (2002) did a comparison of five IT countries to six that have not implemented the policy all that have developed economies. He found that after the announcement of the IT policy there was a significant decline in the levels of expected inflation. However with regard to absolute average forecast errors he found that the framework did not have a significant effect as to the countries without IT strategy.

During the commodity price shock between 2006 and 2008 Roger (2010) evaluated the performance of both IT and non IT countries. He found that an increase in inflation rates was to a greater extent in low income economies, non IT countries as compared to high income IT countries although their gross domestic product (GDP) growth rates fell by the same amount. Moreover the former had a smaller growth decline compared to the latter during that period of economic turmoil.

Wu (2004) using 22 OECD industrial countries applied the multi-period differences-in-differences estimation to the quarterly CPI inflation rates for the period 1986-2002. Inflation rates declined drastically for those countries with IT policies and that this effect persists in the long run. He also found that despite controlling the level of interest rates, there was still a causal effect on the inflation rates in IT countries. This evidenced that the two variables moved in a unidirectional manner after implementation of the regime. He also rejected that the improvement of performance was as a result of an aggressive monetary policy but rather supports that IT played a significant role

Moreover, based on the same criteria Ball and Sheridan (2004) examined the effects of inflation targeting on macroeconomic performance using 20 Organization for Economic Corporation and Development (OECD) countries, 7 that adopted during the 1990's and 13 that did not. They refuted the belief that IT helps in improvement of inflation levels in a country. In their study they suggest that improvements in economic performance may have been as a result of other factors other than inflation targeting. They postulate that through their study they find strong evidence of generic regression to the mean. This means that inflation will fall faster in countries that start with high inflation than in countries with an initially low inflation rate. The decline in countries that adopted IT reflects merely a tendency of all countries to achieve low inflation levels during the 1990's period when the policy was adopted.

However we find that their study faced numerous disputes from other research papers that gave different results. Hyvonen (2004) explored the inflation convergence concept brought about by (Ball and Sheridan, 2004). He claims that the convergence of inflation rates occurred in a much larger sample within the same period that they carried out their study. Tests done across OECD countries failed to show convergence as it occurred inconsistently. On the contrary, studies on the US metropolitan regions showed convergence over the 1990's period. This indicated that this occurrence was brought about by similar microeconomic policies across countries. Thus we could conclude that the adoption of inflation targeting contributed partly to this convergence.

Vega and Winkelried (2005) also argued against the claims brought about by (Ball & Sheridan, 2004). They claim that their conclusion was drawn due to the methodology implemented when carrying out their study. In their view, a country which had initial poor inflation performance before implementing IT, should have been compared to a country without the policy that share similar initial poor performance. In their study they evaluated the inflation dynamics such as mean, variance and persistence brought about by the adoption of the policy and inflation performance on those that did not adopt the strategy. Their results show that inflation targeting is beneficial as it delivers low inflation mean and volatility. Moreover it has contributed immensely in the control of inflation in developing countries.

Sabbán, Rozada and Powell (2003) did a Vector Autoregression (VAR) analysis in 5 industrialized and 4 emerging countries that have adopted IT. They analyzed how the policy affected the behavior of nominal and real exchange rates. Results showed that IT was quite a

success in most of the countries. This is in the sense that the benefit ratios became more positive while the sacrifice ratios more negative. This implied that IT indeed played an important role in fostering improvement of the economy to a large extent.

Choi, Jung, and Shambora (2003) made use of a Markov switching model with a onetime permanent break to investigate the effectiveness of IT policy in New Zealand's economy. They found positive results as the policy had greatly improved inflation dynamics in the country. There was a structural change in the GDP growth rate and its volatility greatly declined after the break date. Adoption of the policy helped in stabilizing inflation and output growth rates in the country.

Kontonikas (2004) used British data from 1972-2002 to examine the relationship between inflation uncertainty and the impact of IT in their economy. Results show that the level of inflation and its persistence declined substantially in the period of study. Moreover expected inflation rates were made quite easier to predict thus reducing uncertainty. Major benefits were brought about by the adoption of the IT framework in the UK economy.

A bigger sample of 21 countries was employed by Pétursson (2004) in his study to show the effectiveness of monetary policies based on IT.He evaluated the performance of various macroeconomic outcomes and found that inflation helped in reducing the level, persistence and variability of inflation in the selected countries. It also helped in improving the credibility and transparency of Central Banks with regard to monetary policy issues.

Genc & Balcilair (2010) carried out an empirical research by doing a comparison of pre IT levels to the actual ones and whether there was a structural change following the adoption of the policy in Turkey. They modelled inflation using the Box Jenkins approach. They found that using IT did not have a significant effect on the inflation levels as the figures were quite similar over the two periods. Moreover there were no structural breaks present during the period of study. Therefore no major difference was brought after the change as the policy failed in the Turkish economy.

2.3.1 Studies Against Inflation Targeting

Ameer & Freeman (1994) examined the progress of inflation targeting in 3 countries namely New Zealand, Canada and United Kingdom. They found positive results with regard to the adoption of IT in each of the countries. However the results also presented some setbacks with the implementation of the policy. They argue that none of the countries achieved long term credibility for their announced inflation targets. There was also lack of evidence supporting a reduction in expected inflation as a result of setting targets.

Using the same countries, Honda (2000) carried out a VAR analysis to measure the impact of IT on macroeconomic variables. He argued that IT had no significant impact in the stabilization of macroeconomic variables in the three countries. He therefore suggests that more studies ought to be done in order to validate the efficiency of IT as a monetary policy framework.

Lin and Ye (2007) evaluated the implementation of IT in seven industrialized countries that adopted the policy in the 1990s. The self-selection problem had been ignored in previous empirical studies and was able to be addressed. They made use of a variety of propensity score matching methods. However they had opposing results in that the study carried out did not favour IT as it had insignificant effect on it and its variability. In line with that nominal; interest rates and income were affected to a lesser extent.

Cecchetti & Ehrmann (1999) investigated whether inflation targeting increases the volatility of output in selected countries. Preferences of policy makers was examined in light with the fact that during short run disturbances, inflation and output levels tend to move away from their long run levels. Results showed that aversion to inflation variability increased in both IT and non IT countries. However, volatility of inflation rates tends to be minimal in IT countries.

Siklos (1999) did a comparison of inflation performance of IT countries and set a benchmark using countries deemed to have an efficient inflation performance in the long run namely US, Canada and Switzerland. He argues that despite these countries having not implemented inflation targeting they were able to attain stable inflation levels in the long run. In addition he states that setting an inflation target is not sufficient enough in ensuring stability of inflation rates or having major impact on their future expectations.

Hu (2003) studied the factors a country considers before implementing inflation targeting as its monetary framework. These factors include the economic condition, structure and institutional variables. Priority is given to the level of GDP and interest rates as they are key determinants of the monetary policy to be put in place. However he argues that inflation and output performance had an improvement in IT and non IT countries. Therefore he asserts that the implementation of the policy does not necessarily imply that it was the major contributor that led to this improvement.

2.3.2 Studies on the relationship between monetary policy instruments and inflation

Disyatat and Vongsinsririkul (2003) carried out an empirical study to show the effectiveness of monetary policy transmission in Thailand. They used a VAR approach with data spanning from 1993 to 2001. The variables incorporated in the study included the fourteen day repurchases rate, real output and the price level assuming that they were a measure of monetary policy. The study shows that the consumer price index responded very little to monetary policy shocks but showed a decline after one year.

A VAR analysis was also used by Agha, Ahmed, Mubarik and Shah (2005) to analyze the efficiency of monetary policy transmission in Pakistan. They state that the monetary policy effects is a gradual process in that, at first there is a fall in domestic demand which is then followed by a reduction in price pressures then eventually a decline in overall prices but with a lag. This shows existence of a relationship between inflation rates and monetary policies in the long run in Pakistan.

The same analysis was carried out by Onyeiwu (2012) in the Nigerian economy. He employed the use of Ordinary Least Squares (OLS) using data from 1981 to 2008. His analysis showed that the monetary policies implemented in Nigeria had a negative impact on the inflation rates. However monetary policies which were presented by money supply caused a positive effect in the balance of payments and also GDP growth over the years of study.

Another factor was added in the paper by Folawewo & Osinubi (2006) carried a study to analyze the efficiency of monetary policy, which was exchange rate instability. They made use of a rational expectations framework that incorporated the fiscal role of exchange rates. Quarterly data was used from 1980 to 2000. By using time series tests they were able to conclude that the

use of monetary policies through the determination of the inflation and tax rate affects both inflation and exchange rates causing volatility in their rates.

Bawumia, Abradu-Otoo and Amoah (2003) investigated the effectiveness of monetary policy transmission using Structural Error Correction in Ghana. They used data from the periods1962 to 2002. The study made use of money supply M2 as the shock variable. Their results revealed that both inflation and output rates were significantly influenced by monetary policy instruments in the long run. Therefore monetary policies had a stable relationship with the level of output and inflation within the Ghanaian economy.

2.4 Summary

Quite a number of authors tend to support the use of inflation targeting framework within their economies to ensure price stability in the long run and avert negative effects brought about by inflation. However the magnitude to which inflation targeting has been of benefit to the various countries in which the policy has been implemented is where disagreement tends to arise. We have seen many countries which have shown a sustainable improvement in sustaining the stability of inflation levels and reducing its variability.

Studies which have been done also shown a relationship between monetary policy instruments and inflation. However the effects tend to vary from country to country depending on the structure of the economy. This relationship tends to accelerate the effectiveness of implementing monetary policies within a country. Therefore in as much as inflation targeting has been successful it may not be favourable if implemented in others. Therefore the gap aimed to be filled by this paper is to investigate how effective monetary policies using inflation targeting as a framework has been able to reduce the inflationary pressures sustained in our economy and whether it is a feasible framework within the Kenyan economy.

CHAPTER 3: Research Methodology

3.1 Introduction

This chapter describes the procedures and methodologies that will be used in conducting the study to arrive at conclusions regarding the effectiveness of monetary policies on inflation targeting in Kenya.

3.2 Research Design

This study will make use of a regression analysis research design. The study will employ time series empirical data on the variables to examine the effectiveness of inflation targeting as a monetary policy framework in Kenya by establishing impact coefficients between the inflation and the monetary policy instruments used in our Kenyan economy.

3.3 Data Collection

The research will make use of secondary data retrieved from the Kenya National Bureau of Statistics (KNBS) and also the Central Bank of Kenya (CBK). The variables which will be included in the models are the money supply (M3), real GDP, inflation (CPI), nominal exchange rate (ER) and the three months Treasury bill rate (IR). Exchange rate would be relative to the dollar as it is mostly used as a benchmark by the CBK.

3.4 Data analysis

3.4.1 Vector Autoregression model

The econometric model employed on this research is based on the paper by Gottschalk & Moore (1999) that made use of a VAR analysis to find the relationships between monetary policy instruments specifically short term interest rates and inflation in Poland.

A VAR analysis enables one identify interrelationships among variables. A VAR model can be defined as reduced form of an unidentified structural model, which gives further details of the dynamic behavior of the economy (Woglom, Inflation Targeting in South Africa: A VAR Analysis, 2000). Thus a structural VAR can be written as:

$$Y_t = A(L)X_{t-1} + \varepsilon_t \qquad (1)$$

Where Y_t is the dependent variable, Xt includes the independent variables, A is a matrix of reduced-form coefficients to be estimated and ε_t is a vector of innovations, impulses or shocks. We estimate the reduced-form VAR and identified monetary policy shocks through the liquidity, interest rate and exchange rate channels. The endogenous variables in the model include inflation rates, real gross domestic product, consumer price index, interest rates, money supply and nominal exchange rates.

$$Y_t = CPI_t \qquad (2)$$

$$X_t = (GDP_t, M3_t, IR_t, ER_t) \qquad (3)$$

Where GDP = gross domestic product

CPI= consumer price index

M3= broad money supply

IR= treasury bill rate

ER= nominal exchange rate

The variables are arranged according to the order of endogeneity. In a VAR model, none of the variables is exogenous, that is, each variable potentially influences all other variables. Each variables current value is expressed as a function of the lagged values of the selected variables.

Therefore in order to determine the importance of variables in the model we would use the forecast error variance decomposition and the impulse response function. For example, the forecast error variance decomposition of the inflation rates would be able to measure the response of the inflation rates over time in response to a VAR shock to the variables in the model. The equation above is helpful as we are able to identify the strength and predictability of monetary policy linkage and changes in the inflation rates. If the results predict a strong relationship between the monetary policy instruments and the inflation rates we could say that the variables are statistically significant in explaining inflation rates.

3.4.3 Granger Causality Test

It examines whether lagged values of one variable help predict another variable. They are based on the null hypothesis on whether "X granger causes Y." It is a method which is useful in determining whether one time series is significant in forecasting another (Granger, 1969).

3.4.4 Impulse Response Function

An informative way of understanding the relationship of the monetary policy instruments and inflation rates using VAR is by using impulse response functions (IRF). An impulse response function can be used to trace the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables within the variables of study. In our study IRF will be able to show us how inflation responds to shocks and innovations in the other endogenous variables as specified by the VAR model.

3.4.5 Variance Decomposition

Variance decompositions are used in order to explore the dynamic structure of the system. It measures the contribution of each type of shock to the forecast error variance. It is used as an indication of the amount of information each variable contributes to the other variables within the autoregression. In our study it would help us depict the share of fluctuations in prices.

CHAPTER 4: Data Analysis and Presentation of Results

4.1 Introduction

This chapter presents the empirical results of this study. The sections will be divided based on the tests carried out with the subsequent results obtained in the study in a bid to answer the specific research objective.

4.2 Time Series Property Results

4.2.1 Stationarity Tests

The test for the presence of a unit root in each variable was carried out using the Augmented Dickey Fuller approach (ADF) in order to determine stationarity of the data. The null hypothesis of "Unit root present" was rejected based on whether the absolute value of the test statistics is greater than the absolute critical value at 5% level of significance in all the tests run. Based on the ADF results all the variables except treasury bill rate and gross domestic product are integrated of order one I(1). The results are shown in appendix 1.

4.2.2 Granger Causality Test

Granger causality is a preliminary analysis which is aimed at establishing whether the monetary policy instruments cause inflation. This test examines whether lagged values of one variable help predict another variable within the model. The results suggest that the null hypothesis of "No Granger Causality" is rejected for all the variables except for the foreign exchange rate. These macroeconomic variables cause an impact on the variation of prices within the Kenyan economy. The results of the Granger Causality are shown in appendix 2.

4.3 VAR Model

In this section, four different VAR models will be estimated in order to assess the effect of adding an additional variable in the VAR model. The analysis will start with a two variable model including consumer price index and gross domestic product and adding other variables such as the money supply, foreign exchange and the interest rate. The variations caused by the

variables will be depicted using variance decompositions and impulse response function through the dynamic structure of the VAR.

4.3.1 Two Variable VAR Model including CPI and GDP

A two variable model is specified in order to shed more light into the relationship between the variables. This helps in assessing the extent to which the variables cause variations on the level of prices and whether their impact is significant enough to provide predictive information about the prices.

This VAR model aims at assessing the proportion of movements in the price level that are due to its shocks and also caused by innovations by GDP. The variance decomposition test provides the output as shown in table 1 below.

Table 1-Variance Decomposition for the VAR Models of CPI and GDP

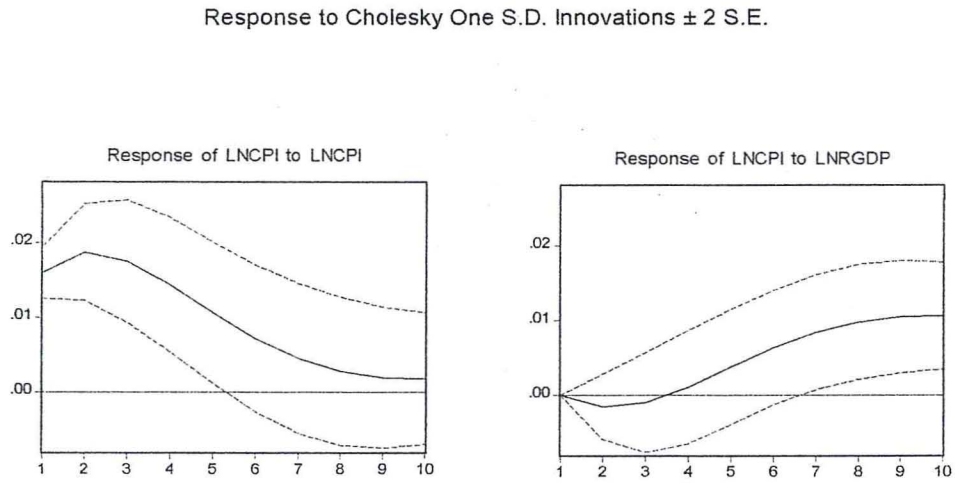
Variance Decomposition of LNCPI:			
Period	**S.E.**	**LNCPI**	**LNRGDP**
1	0.015997	100	0
2	0.024697	99.60543	0.394568
3	0.030283	99.63286	0.367139
4	0.033537	99.59494	0.405059
5	0.035386	98.50397	1.496033
6	0.036662	95.60531	4.394685
7	0.037885	90.94177	9.058232
8	0.03923	85.311	14.689
9	0.040655	79.66223	20.33777
10	0.04206	74.61914	25.38086

The variance decomposition results presented in table 2 for 10 quarter head show that the innovations to gross domestic product explain a small percentage of the variances in prices. Only 25% of the forecast error variances account for the variations. A similar result was obtained in a study by Aliyu and Englama (2009) whereby 24% of the variances in GDP account for variances in CPI. Therefore do not have very strong predictive power of future price levels. In the case of

CPI, about 75% of their forecast error variances are explained by their own innovations during the whole period. Therefore insights on CPI are to be explained more elaborately by its own shocks.

The model's qualitative features are able to be depicted as shown in figure 2 below by the impulse response functions.

Figure 2-Impulse Response Functions for the VAR Models of CPI and GDP



The results indicate that the responses of CPI to its own shocks are to be very strong especially in the short and medium term. However the persistence of the shocks declines afterwards within the time horizon. Shocks to GDP result to small changes in variation of prices in the short run. However, around the medium term period, a positive effect is noted which persists with the same trend up to the 10 quarter head. This implies that inflationary pressures tend to build up within the economy when the general productivity within the economy increases.

4.3.2 Three Variable VAR Model including CPI, GDP and M3

An extra variable is included in the model which now comprises of consumer price index, gross domestic product and money supply. This helps to assess whether there will be a significant change compared to the results obtained in the two-variable model due to a change in innovations caused by the third variable.

Variance decomposition results give a better comprehension of the relationship between CPI, GDP and money supply. The results in table 2 show that at the 10 quarter horizon 0-19% of the variances in the level of prices are accounted for by innovations by gross domestic product. This suggests that gross domestic product affects the price levels to a smaller extent as compared to money supply and would therefore bring lesser impact when used as a monetary policy instrument to aid an inflation targeting framework. About 40% of the shocks in money supply cause variations in prices especially from the 8 quarter head. A similar percentage is also captured by the variances in prices brought about by its own shocks. A study by Mohamed (2006) in Tunisia also showed that money supply shocks contributed about 30% of variances in the level of prices. This implies that it is an important monetary policy instrument in explaining inflation in economy.

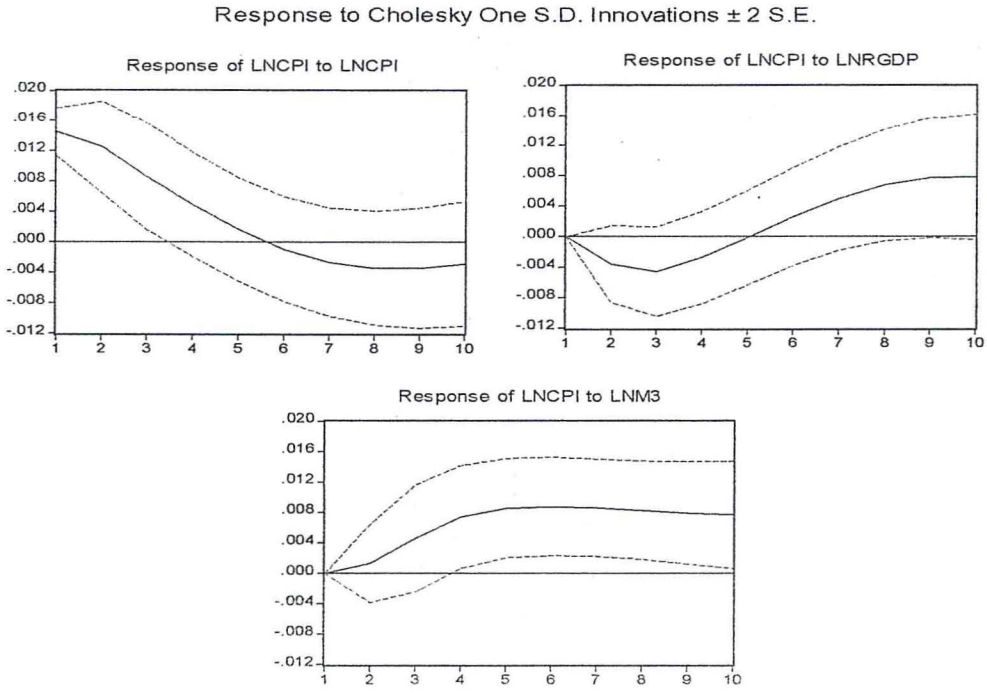
Table 2-Variance Decomposition for the VAR Models of CPI,GDP and M3

Variance Decomposition of LNCPI:

Period	S.E.	LNCPI	LNRGDP	LNM3
1	0.014503	100	0	0
2	0.019531	96.14404	3.389382	0.466578
3	0.0223	88.49112	6.857108	4.651768
4	0.024162	79.49093	7.114637	13.39443
5	0.025696	70.69119	6.293359	23.01545
6	0.027305	62.72578	6.501278	30.77294
7	0.029198	55.672	8.662823	35.66518
8	0.031298	49.64825	12.25287	38.09887
9	0.033384	44.69578	16.12426	39.17995
10	0.035272	40.70487	19.42991	39.86522

In figure 3 below, the impulse response function present a similar result as in the first case. The response of CPI is strong in the first periods but reduce in the long run. Shocks to GDP also cause a positive effect on the level of prices. Money supply shocks give a positive and significant boost to the price levels which end up stabilizing around the sixth quarter in the time horizon. The result is consistent with the variance decomposition results as the effect to price levels is quite significant due to the incorporation of money supply in the model. If money supply grows at a faster rate than the economy, inflation ensues within the country.

Figure 3-Impulse Response Functions for the VAR Models of CPI, GDP and M3



4.3.3 Four-Variable VAR Model including CPI, GDP, M3 and Treasury Bill Rates

This section entails a four variable model in order to assess the impact of interest rates to the price levels within the Kenyan economy.

From the variance decomposition results in table 3, it is evident that the interest rates and the gross domestic product cause a small impact on the price innovations. From about the 7th quarter about 8% of the variances in prices are accounted for by interest rate shocks whereas gross domestic product accounts for about 12%. The two variables give minimal predictive information about prices. In the long run variations in prices due to its own innovations reduced to 48%. On the other hand, only 30% of the variations in money supply contributed to shocks in the level of prices within the model. (Aliyu and Englama, 2009) carried out the same test in the Nigerian economy and found that innovations to consumer price index are explained mostly by its own shocks which were about 42%. Interest rate also provided little predictive information about prices accounting for about 3% of the variances and therefore their links were not very strong.

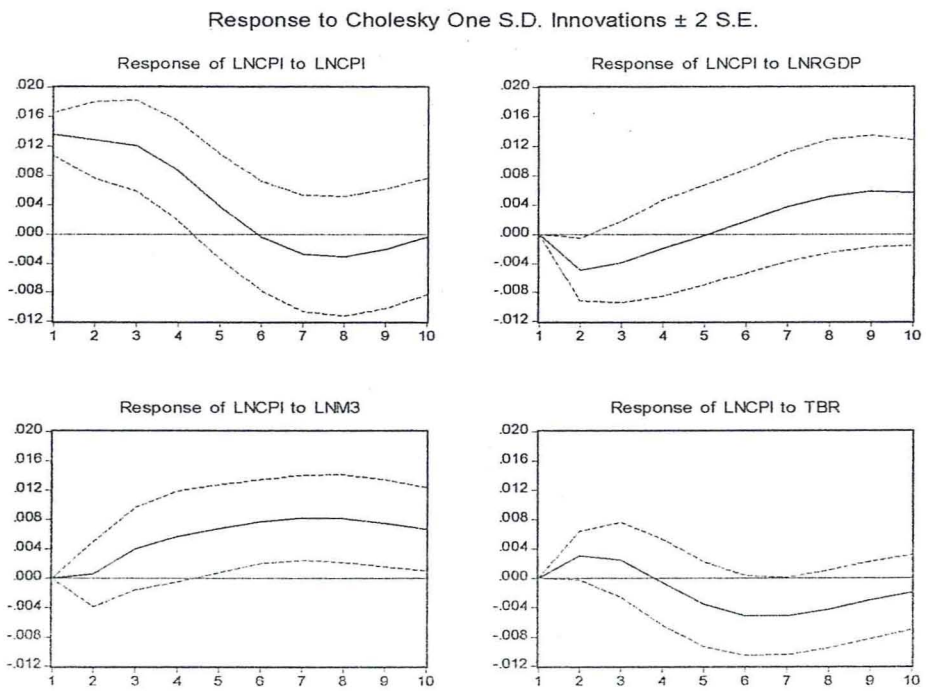
Table 3 Variance Decomposition for the VAR models CPI, GDP, M3 and Treasury Bill Rates

Variance Decomposition of LNCPI:

Period	S.E.	LNCPI	LNRGDP	LNM3	TBR
1	0.013581	100	0	0	0
2	0.019543	91.19864	6.25815	0.085993	2.457213
3	0.023741	87.43774	6.85835	2.927884	2.776024
4	0.025955	84.0844	6.295335	7.248606	2.371657
5	0.027312	77.83784	5.689289	12.65025	3.822616
6	0.028892	69.57366	5.462623	18.42141	6.542313
7	0.030828	61.86924	6.254354	23.3197	8.556712
8	0.032721	55.81088	8.054027	26.86432	9.270772
9	0.034261	51.26943	10.22866	29.28809	9.213819
10	0.035411	48.00473	12.109	30.96334	8.92292

The impulse response function results in figure 4 indicate that shocks to interest rates cause a negative effect on price levels in the across the time horizon. However, the negative impact gradually declines after the seventh quarter as it asymptotes upwards to zero.. This fluctuation around the mean implies that its effect is not high compared to the other variables within the model. Similar to previous findings, money supply and GDP shocks are positive within the long run. Innovations to price by its own shocks are also persistent in the short run but decline in the long run.

Figure 4-Impulse Response Functions for the VAR Models of CPI, GDP, M3 and Treasury Bill Rates



4.3.4 Four-Variable VAR Model including CPI, GDP, M3 and Foreign Exchange Rate

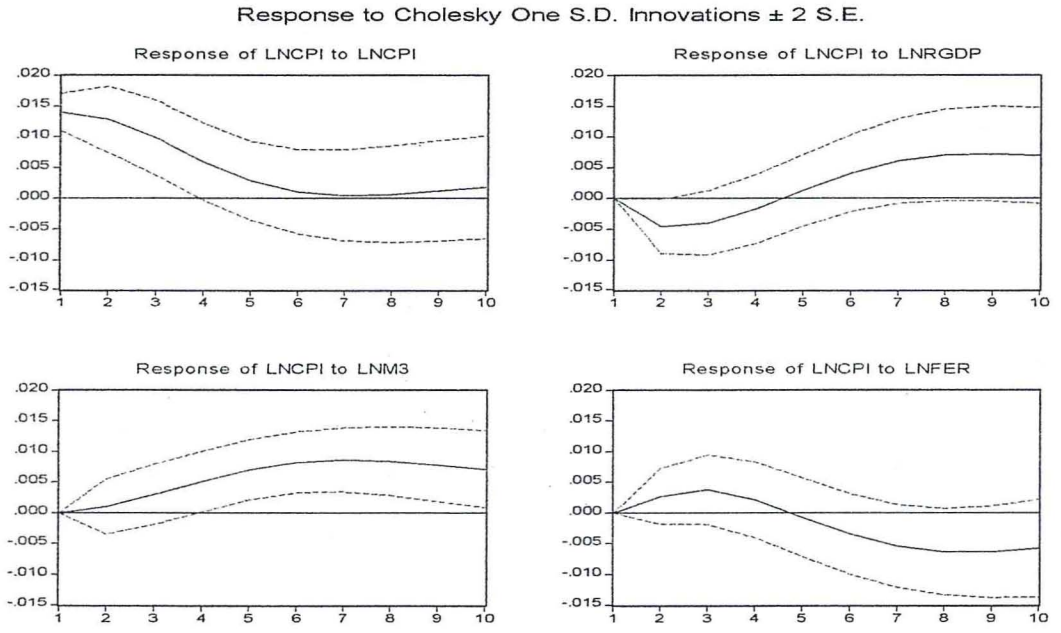
A four variable model was also estimated in this section to give insights on the effects of foreign exchange to variations in prices. The table 4 below shows the results of the variance decomposition of the model.

Table 4-Variance Decomposition for the VAR Models of CPI.GDP, M3 and Foreign Exchange

Variance Decomposition of LNCPI:					
Period	**S.E.**	**LNCPI**	**LNRGDP**	**LNM3**	**LNFER**
1	0.014029	100	0	0	0
2	0.019788	92.58084	5.2486.7	0.297535	1.872947
3	0.022965	87.00911	6.854551	1.992539	4.143795
4	0.024422	82.86895	6.554633	6.132299	4.444115
5	0.025625	76.53087	6.220672	13.14143	4.107033
6	0.027478	66.7151	7.694935	20.46945	5.120523
7	0.029943	56.21262	10.64586	25.59534	7.54618
8	0.03253	47.66879	13.77162	28.38938	10.17021
9	0.034849	41.66607	16.36223	29.79459	12.17711
10	0.036756	37.70239	18.31426	30.57991	13.40344

The results suggest that innovations of foreign exchange rates and the gross domestic product account for only a small percentage of variations in prices. This was also shown in the results by Bakradze and Billmeier (2007) in their study in Georgia as only 7% accounted for the variances in prices. In the 10 quarter heads only 13% of their shocks cause an effect in prices whereas GDP accounts for only 18%. Therefore its impact is not quite high, thus it gives little predictive information about future prices. Most of the innovations are explained by variations in prices itself while about 30% being contributed by the money supply.

Figure 5-Impulse Response Function for the VAR Models of CPI, GDP, M3 and Foreign Exchange Rate



Impulse response function results give similar results as the previous models. Most of the variations in the price levels are caused by their own shocks. Responses of CPI to money supply are positive and significant over the time horizon. Both foreign exchange and GDP account for a small percentage in the variation in prices and therefore tend to cause a minimal response to CPI.

CHAPTER 5: Conclusion

5.1 Summary and Conclusions

This paper studies the effectiveness of monetary policy instruments on inflation targeting in Kenya for the period January 2004 and December 2014. The study estimated the relationship between monetary policy instruments and inflation which is a major pre-condition for a successful inflation targeting framework. In addition to that, effectiveness of the variables in attaining the recommended inflation target set by the Central Bank of Kenya was also examined.

The causality relationship between the macroeconomic variables and inflation was explored using Granger Causality tests. Exploration of the dynamic interactions between the variables was done using a VAR model which incorporated variance decomposition and impulse response functions as they tend to give better forecasts than other structural models.

Assessment of the relationship between macroeconomic variables and inflation using Granger Causality tests indicated that all variables except the foreign exchange rate affected inflation rates. This implies that variables such as money supply, interest rates and the gross domestic product can play a major role in ensuring feasibility of an inflation targeting framework within the Kenyan economy.

Variance decomposition results indicate that a large percentage of the forecast variance of inflation is explained by its own shocks. With contrast to the other variables, money supply accounted for the greatest percentage of the variations in inflation. Less than 20% of the variances in inflation are driven GDP, foreign exchange rates and the interest rates.

Analysis of the impulse response functions validates results of the variance decompositions. The response of inflation to its own shocks is very strong but become less persistent in the long run. Money supply has a positive and significant effect to the level of inflation. Shocks to GDP and the interest rates were less significant and did not cause great variations.

The study finds that the linkages between monetary policy instruments and inflation are not very strong as was found in the study by (Woglom, 2000). The variables do not pose to be efficient determinants to be able to deal with inflationary pressures within the economy. Therefore the Central Bank should find ways in which it can improve the design of its monetary policy in order

to meet the pre conditions for a fully-fledged inflation targeting framework to boost its effectiveness in the Kenyan economy as was the case for Egypt in the study by (Ghalwash, 2010). Changes have to be incorporated into the system in order to strengthen the links between monetary policy instruments and inflation to ease its adaptability as a choice of curbing price instability.

5.2 Policy Implications and Recommendations

The Central Bank should strive to eradicate the effects of fiscal dominance inherent within the economy as they cause a surge in inflation rates. This is an important precondition for an effective monetary policy framework. Proper reforms have to be made to ensure that the government does not lose its control over the quantity of money supplied and inflation in a bid to prevent defaulting on its public debt. If monetary policy is conducted within such an environment, its objectives would be cumbersome to meet. Therefore the Central Bank should find appropriate measures such as reduction in excessive government expenditure in order to reduce inflationary pressures in the economy.

5.3 Limitations and areas of further research

There was difficulty in obtaining quarterly data for the study. Moreover the review of the basket of goods making up the consumer price index have varied over the years with the variations in inflation rates and therefore the relationship between CPI and the independent variables may be distorted.

The scope of the study can be improved by adding more variables such as fiscal expenditure to determine its impact on the model. Moreover, a longer period of study would also be able to give better insights of the study. Other monetary policy mechanisms such as exchange rate targeting and monetary targeting could also be investigated to determine their feasibility in adapting it within the Kenyan economy.

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Appendices

Appendix 1: Results on Stationarity Tests

Table 5-Augmented Dickey Fuller

Variable	Level	First Difference	Order of Integration
Consumer Price Index	-2.836	-4.483*	I (1)
Foreign Exchange Rate	-1.971	-5.513*	I (1)
91 day treasury bill	-4.099*	-	I (0)
M2	-2.665	-5.596*	I (1)
Gross Domestic Product	-4.401*	-	I (0)

An asterisk (*) indicates reject null hypothesis at the 0.05 significance level.

Appendix 2: Results on Granger Causality Tests

Table 6-Granger Causality Test

Pairwise Granger Causality Tests
Date: 11/1/15 Time: 00:34
Sample: 2004Q1 2014Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
LNRGDP does not Granger Cause LNCPI	42	3.21265	0.05170*
LNCPI does not Granger Cause LNRGDP		4.18138	0.02306*
LNM3 does not Granger Cause LNCPI	42	7.21641	0.00226*
LNCPI does not Granger Cause LNM3		0.10771	0.89817
TBR does not Granger Cause LNCPI	42	3.48198	0.04116*
LNCPI does not Granger Cause TBR		2.71189	0.07961
LNFER does not Granger Cause LNCPI	42	0.95690	0.39338
LNCPI does not Granger Cause LNFER		3.05518	0.05915