AN EMPIRICAL INVESTIGATION INTO THE EFFECT OF MONETARY POLICY ON INFLATION IN GHANA

By

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DECLARATION

I hereby declare that this dissertation is the result of my original work towards the Master of Science degree in Economics and to the best of my knowledge, it neither contains material published by another person nor materials which have been accepted for the award of any other degree of the University, except where due acknowledgments have been made in the text.

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DEDICATION

This dissertation is dedicated to my family and William Bediako-Tandoh for their support and prayers.

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ABSTRACT

This study investigated the effect of monetary policy on inflation in Ghana using a modeling technique of the Autoregressive Distributed Lagged Model (ARDL) over a period of 1980 to 2014. The monetary variables considered for the study include $M1, M2$, $M2+$ and monetary policy rate. Furthermore, interest rate and exchange rate were also included. The stationarity test results showed a mix order of integration among the variables understudy. Hence offering support for the use of the bounds test approach to cointegration. The study finds a stable long-run relationship amongst the variables and also finds evidence of long-run and short-run dynamics. The results show that there's a statistically significant positive short-run and long-run relationship between money supply and inflation in this study. An expected statistically significant negative relationship between monetary policy rate and inflation according to conventional banking practice was confirmed. Furthermore, this study revealed a statistically significant positive relationship between inflation and interest rate in Ghana in both the long-and short-run. Economic growth was also found to have a negative impact on inflation in the long-run. An expected positive relationship between government expenditure and inflation in both short-run and long-run was revealed. Trade openness has a negative impact on inflation in the long-run and short-run.The study recommends that immediate measures need to be adopted by the Central Bank to reduce money supply. Thus, Bank of Ghana should sell more government securities in order to reduce the total amount of money in the economy. However, this will be more effective if the size of the securities market is large. Hence, more financial institutions and non-financial institutions should be motivated in participating in the activities of government securities. Fiscal discipline is also required to reduce excess money supply emanated from large scale financial deficit.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Up until 2006, the monetary policy framework of Ghana targeted monetary aggregates by using money supply as the monetary instrument in controlling the objective variable inflation. In 2007, Ghana formally adopted the inflation-targeting framework thereby using the monetary policy rate as the key instrument in controlling inflation. Since then, significant progress has been made in developing the policy framework to influence the economic and financial situation of the country.

According to Irfan and Ume (2011), monetary policy of a country is the process whereby the Central Bank of the country tries to attain its set objective by regulating the supply of money or interest rate. By controlling inflation through the use of money supply and interest rate, the Central Bank achieves its official goal which is to contribute to economic growth and sustainability. In Ghana, monetary policies have evolved from the use of direct instruments to the market-based approach mainly targeting money supply. The use of direct controls to regulate money supply was eliminated as reforms began. The regulation of money supply using indirect tools was introduced by the market based system (Kwakye, 2012). Bank of Ghana now uses various tools to manipulate money supply in the country in order to achieve its goals or targets. These tools include Open Market Operations, reserve requirement and monetary policy rate. One of Bank of Ghana's main monetary instruments is foreign exchange operation. Accounts of commercial banks are debited when they buy foreign currency from Bank of Ghana. All the above tools obligate immediate targets, intermediate targets and final targets which includes inflation.

Pigou (1947) defines inflation as the continues or persistent tendency for the price level of goods and services to rise. Inflation is therefore measured using Consumer Price Index (CPI) of goods and services. Consumer Price Index measures changes in the price level of a market basket of consumer goods and services purchased by households. Inflation in Ghana increased from 25.2% in 2000 to 32.9% in 2001. This occurred because in the last quarter of 2000, money supply growth was excessive. There was also a shortage of local food stocks and an increase in petroleum prices in 2001. Remarkably, inflation reduced from 32.9% to 14.8% in 2002. In the month of September, 2011, inflation in Ghana was 8.40% and in the month of November, 2013, it had risen to 13.20%. In May, 2015 the inflation rate of Ghana rose to 16.9% (Ghana Statistical Service). According to the Bank of Ghana Act 616, 2002 section 3, sustaining price stability is the primary objective of Bank of Ghana. Inflation diminishes purchasing power hence, decreasing the standard of living of Ghanaians. Inflation targets have therefore rarely been achieved. This is evidenced by the history of high rate of inflation in Ghana.

Monetary policy is one of the major economic policies often used to stabilize any economy of the world with its vital tool being money supply. This study examines how effective monetary policy is in curtailing high inflation in Ghana.

1.2 Problem Statement

In Ghana, the continuous rise in the general price level is one of the most publicly discussed economic indicators when it comes to the economic welfare and standard of living of Ghanaians. The high level of inflation causes instability in an economy since money does not hold its value for a long time. High rate of inflation is a serious macroeconomic problem and therefore creates complications for economic measurement. This brings uncertainty when we try to look into the future (Asquo, 2012).

According to Gyebi and Boafo (2013), high and persistent inflation undermines public confidence in the economy with potentially adverse effects on risk-taking, investment and other productive activities. The effect of high inflation has made it difficult for some households to obtain basic necessities such as foods, cloths etc. Thus, they resort to borrowing from other people to supplement their income. In the end, the lender will lose because by the time the borrower pays, that same amount would have lost its purchasing power due to inflation. In the long run, high inflation leads to high interest rate. This discourages business borrowing and investment in capital. Furthermore, when domestic prices rises, imports become cheaper hence more goods will be imported. This affects the Balance of Payment and also depreciates the Ghana cedi. In effect inflation declines exports, output and employment.

Monetarists strongly believe that inflation is a monetary phenomenon and also monetary policies largely influence economic activities. Anyawu and Oackhenan (1995) emphasized that monetary policy measures are used to control inflation and other macro-economic variables in order to ensure economic stability. Even though, the Bank of Ghana tries to curtail inflation using monetary policy, high inflation still persists. The failure of monetary policy to curb price

instability has caused growth instability and thus poor development. Questions that follow are; why is high inflation still persistent in Ghana despite government effort to curb it? How effective is monetary policy in controlling inflation in Ghana? Has monetary policy failed in curbing high inflation in Ghana since it has worked in some other countries?

In this regard, this study was appropriate in seeking to critically analyze how different variables of monetary policy are manipulated to affect inflation and how effective they are in controlling inflation. This will help policy makers, as well as the Central Bank to adopt stringent approach or methods that will help in the effectiveness of monetary policies targeting inflation.

1.3 Objectives of the Study

General Objective

The aim of this research is to investigate the effect of monetary policy on inflation in Ghana.

Specific Objectives

i. To analyze trends in monetary policy indicators and inflation in Ghana
ii. To determine the long and short run relationship between the various monetary policy indicators used by Bank of Ghana and inflation in Ghana.
iii. To examine other non-monetary determinants of inflation in Ghana.

1.4 Research Hypotheses

In order to examine the relationship between monetary policy indicators and inflation as well as the determinants of inflation, below are hypotheses stated for testing;

1. Ho: Monetary Policy Rate has no significant impact on inflation

   H_1: Monetary Policy Rate has a significant impact on inflation

2. Ho: Money supply has no significant impact on inflation

   H_1: Money supply has a significant impact on inflation

3. Ho: Exchange rate has no significant impact on inflation

   H_1: Exchange rate has a significant impact on inflation

4. Ho: Interest rate has no significant impact on inflation

   H_1: Interest rate has a significant impact on inflation

5. Ho: Economic growth has no significant impact on inflation.

   H_1: Economic growth has a significant impact on inflation

6. Ho: Government expenditure has no significant impact on inflation.

   H_1: Government expenditure has a significant impact on inflation

7. Ho: Trade openness has no significant impact on inflation.

   H_1: Trade openness has a significant impact on inflation

1.5 Significance of the Study

Evidence shows that Ghana has had a long history of high rates of inflation and still remains high by comparison with many other countries in the sub region and the world in general. Fiscal and monetary policies are used to control inflation and interest rate by the government of a

country. Consequently the, much literature has given attention to the causes and effects of inflation caused by expansionary fiscal policy and monetary policy shocks in other developing and developed countries. However, the effectiveness of monetary policy management on inflation in Ghana has not been adequately investigated. The purpose of this research was to contribute to literature and to also find out whether monetary policy has so far been able to achieve its target in Ghana.

1.6 Scope of the Study and delimitation.

Monetary policy shocks affect so many macroeconomic variables such as real GDP (output), employment, investment, consumption and inflation. This study is limited to an investigation into the effect of monetary policy on inflation in Ghana. Again, data covering the period of 1980 to 2014 was used in this research. This period of study was chosen due to the non-availability of data. Although the numbers of observations are smaller (35 in this case) an appropriate model was chosen to address this limitation. The relationship between monetary variables; money supply (M1,M2 and M2+), monetary policy rate and inflation in Ghana was analyzed. Exchange rate, interest rate, trade openness, government expenditure and real GDP were other non-monetary determinants that were examined in this study.

1.7 Organization of the Study

This dissertation consists of six chapters. Chapter 1 comprises of the background of this study and briefly presents the statement of the problem, objectives of the study, hypotheses of the study, data sources, significance of the study, scope of the study and organization of the study. Chapter two includes a review of theoretical and empirical literature on relationship between

inflation and monetary policy. The research methods, data sources, empirical design including model specification and analysis techniques used in this study are addressed in Chapter three. Chapter four provides an overview of trends in monetary policy indicators and inflation in Ghana. Also, the empirical results, analysis and discussions of the findings are presented here. Chapter five concludes the study. It summarizes the main findings of the study and discusses policy lessons which emanate from the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on reviewed literature on the effects of monetary policy on inflation. It is presented in three sections: the first section presents a review of theoretical literature on economic theories deemed appropriate for this study. The second section also presents a review of empirical studies various researchers have done in relation to this study.

2.3 Theoretical Review

2.3.1 Quantity Theory of Money

According to monetarists, inflation is always and everywhere a monetary phenomenon. This monetarist assertion is based on the quantity theory of money which states that price level is determined by the quantity of money available. This theory can be written as $MV = PY$, where M is nominal quantity of money supplied, V is the velocity of money, P is price level and Y is real output.

The above approach is based on the assumptions below:

1. V which is velocity of money is constant: V^*
2. Real output is constant since physical capital, human capital, labour and technology determine the level of output: Y^*

Rewriting the quantity theory taking into consideration the above assumptions gives $MV^* = PY^*$. Thus, $M = P$. This suggests that both quantity of money supplied (M) and price level (P) move in the same direction. Price level rises as a result of an increase in the quantity of money

supplied whereas a fall in the quantity of money supplied reduces price levels. Thus, they are positively related.

According to Pigou (1947), money is just a veil on which the real variables are concealed. Therefore, changes in money supply are transmitted into price movements.

2.3.3 Taylor Rule

According to Alvarez et al (2001), the use of interest rate as the key monetary policy instrument is chosen by several Central Banks these days leaving the determination of the supply of money to the economy. Usually, inflation is kept at a predetermined target level by Central Banks. The Central Bank will raise interest rate if inflation rises above the target level.

The general form of the Taylor Rule which supports the use of interest rate as the operating monetary policy tool can be stated as:

$$i = i^* + c(\pi - \pi^*) + d(y - y^*) \quad c \succ 0 \quad d \succ 0$$

Where i is the real rate of interest set by the Central Bank, i^* is the real rate of interest consistent with long run equilibrium in the economy. π is the target inflation rate. $(\pi - \pi^*)$ is the deviation of actual rate of inflation from the target inflation rate weighted by an amount c. Conversely y is real output, y^* is full employment and $(y - y^*)$ is the output gap weighted by d

When the output gap is positive $(y - y^*)$ or when $(\pi - \pi^*)$ is positive that is when inflation is above its target, the interest rate will be raised by the Central Bank and this amount depends on the values both c and d. Central Banks choose parameters c and d directly depending on their

aversion to inflation and output instability. The need for Central Banks to move inflation and output to their target levels through a steady adjustment pattern is the main objective of manipulating the interest rate using the Taylor Rule.

2.3.4 Neo-fisherism Theory

According to the neo- fisherian proposition, a persistent contractionary monetary policy that is an increase in interest rate will lead to higher inflation in the long run. This contradicts the conventional banking wisdom or conventional banking practice. Principle of conventional banking is to increase nominal interest rate target when inflation is high and to decrease the nominal target when inflation is low. This is because an increase in interest rate reduces investment spending as well as inflation whereas a fall in interest rate increases investment and inflation. This view states that the Central Bank should decrease interest rate when it wants to reduce inflation and increase interest rate in order to increase inflation.

According to the Neo-fisherians prediction of inflation has been difficult recently. This is as a result of inflation being heavily influenced by factors that are not mainly determined by monetary policy. Such factors include oil prices, the dollar rate, rents and cost of healthcare. The above factors suggest that inflation could increase even as Central Banks raises the interest rate.

2.3.5 Monetary Policy Transmission Mechanism

Samuelson and Nordhaus (2010) defined monetary policy transmission mechanism as the route by which monetary policy gets transmitted into the economy. In other words, it is the process through which the actions of the monetary policy affects or gets transmitted to the real economy. Since prices are determined by the demand and supply of many goods and services, Central Banks cannot directly control prices. However, monetary policy can help Central Banks attain their inflation target by influencing the price determination process. Therefore, it is important for Central Banks to understand the monetary policy transmission particularly, the price determination process. Monetary policy influences inflation through the following channels.

2.3.5.1 The Interest Rate Channel

A policy induced fall in interest rate by the Central Bank will directly affect the interbank rate which is the rate at which banks borrow from each other. This also affects the retail market interest rate that is the lending rate. Thus, a fall in the lending rate will increase aggregate demand since saving is discouraged and borrowing as well as spending is encouraged. This will eventually lead to an increase in prices. In other words, the cost of credit declines and the demand for credit rises when the Central Bank reduces interest rate. In effect, investment and consumption rises leading to an increase in aggregate demand consequently, higher inflation (Mishkin, 2004).

This analysis can be presented schematically as follows:

$$Me \uparrow \rightarrow r \downarrow \rightarrow I \uparrow \rightarrow AD \uparrow \rightarrow P \uparrow$$

Where Me is an expansionary monetary policy, r is interest rate, I is investment, AD is aggregate demand and P is price levels.

2.3.5.2 Credit Channel

According to Bernanke and Gertler (1995), monetary policy does not only affect interest rates but also the size of external finance premium. This can be explained by the credit channel. The credit channel may be enlightened by two possible linkages; the bank lending and the balance sheet channel. The bank lending channel emphasizes on the effects of monetary policy on inflation through banks' supply of loans. An expansionary monetary policy for instance, a reduction in reserve requirement will lead to an increase in bank reserves hence increasing the quantity of bank loans available. As a result, aggregate demand will rise due to an increase in investment and spending hence, higher inflation.

The effect of monetary policy can be shown schematically as follows:

$$Me\uparrow \rightarrow \text{Bank loans} \uparrow \rightarrow I\uparrow \rightarrow AD\uparrow \rightarrow P\uparrow$$

How monetary policy affects the net worth of firms of borrowers can be shown in the balance sheet channel. This is based on the balance sheets of borrowers and income statements. Equity prices of borrowers may fall as a result of a decrease in money supply which is induced by a contractionary monetary policy (Mc). In effect, lending will decline since lenders will get less collateral from borrowers for their loans. Moral hazard problems and an increase in adverse selection are expected to occur due to a fall in investment spending and aggregate demand. Adverse selection occurs when a decline in net worth leads to a decrease lending to finance

investment. This is because they are likely to pay a higher premium or interest on loans since there is a loss in the value of collateral. However, moral hazard problems arise when firms have lower net worth which gives them the incentive to riskier portfolios which are likely to be defaulted (Bernanke and Gertler 1995). Ultimately, inflation will fall as a result of a decline in aggregate demand.

This process is summarized schematically as follows:

$Mc \downarrow \rightarrow Pe \downarrow \rightarrow$ Adverse Selection $\uparrow$ and Moral Hazard $\uparrow \rightarrow$ lending $\downarrow \rightarrow I \downarrow \rightarrow AD \downarrow \rightarrow P \downarrow$

2.3.5.3 Exchange Rate Channel

Domestic financial assets become more attractive to investors relative to investments in other currencies when interest rate is increased by the Central Banks. This contractionary monetary policy move appreciates the exchange rate. Imports however become cheaper hence more goods will be imported. Consequently, fewer goods will be exported since the value of domestic goods will be expensive to foreign countries. This weakens the demand for domestic products thereby easing inflationary pressure.

This analysis can be presented in the following mechanism:

$Mc \downarrow \rightarrow r \uparrow \rightarrow E \uparrow \rightarrow$ Imports $\uparrow \rightarrow$ Exports $\downarrow \rightarrow P \downarrow$

2.4 Empirical Literature

Numerous studies have been done in many countries on the impact of monetary policy instruments and macroeconomic variables such as inflation. Few of these researches are considered relevant and hence reviewed here:

Amarasekara (2009) examined the impact of monetary policy on inflation and economic growth in Sri Lanka. The impact of money supply growth, changes in exchange rate and interest rate on inflation and economic growth was analyzed using a vector autoregressive (VAR) framework using two lags. The study adopted a quarterly, seasonally adjusted data from 1978 to 2005 on variables such as interest rate, money supply, inflation and real GDP in Sri Lanka. Results from the study indicated that inflation in Sri Lanka does not fall after contractionary changes in monetary policy. Furthermore, inflation reduced immediately exchange rate appreciated and the rate of interest also rose following a contractionary reserve shock.

Gul et al (2012) studied how monetary instruments influence macroeconomic variables such as, inflation, interest rate, real GDP, exchange rate and money supply in Pakistan. OLS was used to analyze and explain the relationship between the above mentioned variables. Secondary source of data from 1995 to 2010 was used. Results from the study showed that money supply has a strong positive correlation with inflation whereas a negative correlation with output. Exchange rate also has a negative impact on output in Pakistan. A tightening monetary policy is expected to reduce inflation but in the case of Pakistan, a positive interest rate shock (contractionary monetary policy) led to an increase in price level.

Dalhatu (2012) investigated the impact of monetary policy on price stability in Nigeria. He examined shocks in monetary policy and its responses on inflation, market interest rate and exchange rate. Monetary policy rate was used as a proxy for monetary policy indicators. Secondary sources of data were collected from December, 2006 to February, 2012. 2006 was chosen because this was when the monetary policy rate was introduced. Structural VAR framework was used to estimate the model. Results from the study revealed that market interest rate and exchange rate are more responsive to shocks in monetary policy rate than inflation in Nigeria. Furthermore, expected changes in inflation cannot be guaranteed by variations in the monetary policy rate. Other instruments mainly reserve requirement and open market operation used along with the monetary policy rate can effectively reduce inflation in Nigeria.

Ahiabor (2012) focused mainly on the effect of monetary policy on inflation in Ghana. Variables such as interest rate, inflation, money supply and exchange rate were studied. The research adopted secondary data source from 1985 to 2009 and critically analyzed the variables quantitatively. Findings from the study confirmed a theoretically expected long-run positive correlation between inflation and money supply, an inverse relationship between inflation and interest rate as well as a positive relationship between inflation and exchange rate in Ghana.

Quartey and Afful-Mensah (2014) reviewed recent monetary and financial policies pursued as well as the possible inter-relationships in Ghana. They posited that any effective monetary policy should be accompanied by fiscal discipline to ease monetary difficulties associated with huge budget deficits. Data on money supply, exchange rate, inflation and lending rates were compiled from Ghana Statistical Service and Bank of Ghana statistical bulletin from 1997 to 2012. They concluded that the key monetary indicators improved during the period of study. However, fiscal imbalance in the country has restricted these results.

The effectiveness of monetary policy in controlling inflation in Nigeria was examined by Ngerebo (2016). Relationship between variables such as inflation, savings rate, monetary policy rate, prime lending rate, maximum lending rate, treasury bill rate, growth of narrow money supply, net domestic credit, growth of broad money supply, net credit to government and credit to private sector were analyzed and tested using OLS. Secondary source of data from 1985 to 2012 was collected from the statistical report of the Central Bank of Nigeria. The study revealed that monetary policy rate, maximum lending rate, prime lending rate, net domestic credit and treasury bill rate are not statistically significant while growth of broad money supply, credit to private sector, growth of narrow money supply, savings rate, net credit to government are statistically significant in explaining how they affect inflation in Nigeria. Findings indicate that some monetary policy instruments in Nigeria are effective in managing inflation while others are not.

All the above studies mainly focus on studying the interactions of monetary policy shocks on inflation and real GDP by researchers in different countries. However, little has been conducted in Ghana. This study seeks to analyze specifically how effective monetary policy has so far been able to control inflation in Ghana due to increased focus for Ghana to attain single digit inflation. Also, non-monetary factors which may render monetary policy ineffective in Ghana were investigated.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter describes the methodology employed in conducting the study. The chapter consists of model specification, data description, unit root tests, data sources, and analysis techniques of this study.

3.2 Model Specification

Following Laryea and Sumaila (2001), Ubide (1997) and Adu et al (2011), this study uses general formulation of inflation in Ghana:

$$INF_t = (M_t, ER_t, INT_t, Y_t, GEX_t, TO_t) \quad (3.1)$$

Where INF represent inflation, M represents monetary variables which is a combination of three monetary aggregates [$M1, M2, M2+$ and Monetary Policy Rate (MPR)], INT represents interest rate, Y represents economic growth, GEX represents government expenditure and TO represents trade openness. t=1, 2, 3 which represent the time period.

The estimable form of the model in logarithm is given as:

$$LnINF_t = \gamma_o + \gamma_1 LnM_t + \gamma_2 LnER_t + \gamma_3 LnINT_t + \gamma_4 LnY_t + \gamma_5 LnGEX_t + LnTO_t + \mu_t \quad (3.2)$$

Where Ln presents natural logarithms and μ represents the Gaussian error tem. Each monetary variable is separately included in the model.

3.2 Definition and Measurement of variables

Inflation Rate

This is the persistent rise in the general price level of goods and services. Inflation rate can either be measured using the GDP deflator or Consumer Price Index (CPI). However, Ghana Statistical Service uses annual CPI as the main inflation measure. The CPI measures changes in the price level of market basket of consumer goods and services. In this study inflation is the dependent variable.

Monetary Variables

For this monetary policy rate, money supply, real exchange rate and interest rate are used are various monetary indicators. Monetary policy rate is the rate at which the Bank of Ghana grants loans to commercial banks. It serves as a reference rate or benchmark for commercial banks to set their lending rate. There is an expected negative relationship between monetary policy rate and inflation according to conventional banking practice. A contractionary monetary policy such as increasing monetary policy rate by the Central Bank is expected to decrease inflation. Therefore, $\gamma_1 \prec 0$

Money supply is the total amount of money available in an economy within a period of time. Narrow money supply is currency held by the public. This is represented by $M1$. Broad money supply which is represented by $M2$ can be measured as $M1$ plus all public deposits in commercial banks. $M2+$ is $M2$ plus deposits at trust and mortgage loan companies. All three measures are quoted as percentages of GDP. A positive relationship is expected between

inflation and money supply in this study. This is according to the quantity theory of money which states that as money supply increases, inflation also increases. Hence, $\gamma_1 \prec 0$.

Exchange Rate

Exchange Rate is the price of foreign currency in terms of the domestic currency. An increase in real exchange rate shows a depreciation of the cedi whereas a decrease in exchange rate indicates an appreciation of the currency under consideration (Ghana cedis). According to Nzekwe (2006), a fixed exchange rate strongly increases the readiness to hold domestic currency thereby reducing inflation. There is an expected positive relationship between inflation and exchange rate. Depreciation of the cedi makes imports expensive and discourages purchases of imported goods. This stimulates demand for domestically manufactured goods thereby leading to high price levels. Hence, $\gamma_2 > 0$. Exchange rate was measured using the GH/US$ official exchange rate at the end of the period.

Interest Rate

Interest rate is the proportion of an amount loaned which a lender charges to the borrower. The relationship between interest rate and inflation is expected to be negative. This is because a fall in interest rate leads to a rise in investment and consumption resulting in an increase in aggregate demand consequently, higher inflation. Hence, $\gamma_3 < 0$. The study uses lending rate as a measure of interest rate.

Economic Growth

The growth of an economy is usually measured using its GDP. This is the total value of all goods and services produced in a country over a period of time, usually a year. This is equal to total consumption, investment and government spending plus net exports. Real GDP is inflation-corrected GDP or constant price GDP. The relationship between Real GDP and inflation is expected to be negative. An increase in GDP means an increased supply of goods and services (surplus). Excess supply of goods and services leads to a fall in prices. Hence, low inflation. Hence, $\gamma_4 < 0$. The study uses real GDP as a measure of economic growth.

Government Expenditure

This is the expenditure by the government sector on individual and collective consumption of goods and services. This can be incurred by subsectors of the government sector such as the central and local government. Thus the coefficient of government expenditure is expected to be positive since increased government expenditure puts spending money into the pockets of consumers. As a result, aggregate demand rises hence, higher inflation. Therefore, $\gamma_5 > 0$. Government expenditure was measured as a percentage of GDP.

Trade Openness

Trade openness is the sum of exports and imports as a percentage of GDP. According to conventional view, trade openness is expected to be negatively related with inflation. Trade openness reduces inflation the positive influence on output through increased foreign investment and better allocation of resources. The greater the openness, the higher the level of integration and benefits (Jin, 2000). Hence, $\gamma_6 > 0$.

3.3 Data Sources

Secondary sources of data collected from the period of 1980 to 2014 consisting of thirty-five (35) annually observations for each variable. The data set contains the following variables of interest; money supply (MI, M2 and M2+) and monetary policy rate and inflation. Five control variables which were included in the model are exchange rate, interest rate, economic growth, government expenditure and trade openness. Except for government expenditure and the various measures of money supply all other variables were obtained from World Development Indicators (2015). Data on government expenditure was obtained from the International Monetary Fund (IMF), International Financial Statistics (2015) whereas all money supply variables were obtained from Bank of Ghana, Statistical Bulletins.

3.4 Estimation Strategy

3.4.1 Unit root test

To avoid misleading results, it is important to first determine the stationary state of the data. The unit root test is a test conducted to ascertain if the variables under consideration are stationary. Inferences of non-stationary or spurious data are likely to be invalid because test statistics will no longer follow the‘t or F’ distribution. Preliminary tests using Augment Dickey Fuller (ADF) Test was used to establish the absence of stochastic process.

The null hypothesis is $\rho=0$ and the alternative hypothesis $\rho<0$. Thus, the null hypothesis is rejected when the data is stationary and a non-stationary time series data in the case where the null hypothesis is not rejected. The Augment Dickey Fuller (ADF) test is greater than the critical

value either at 1%, 5% or 10% level of significance at the order of zero, one, or two. It shows that variables under consideration are stationary otherwise they are not.

3.4.2 Autoregressive Distributed Lagged Model

This study uses Autoregressive Distributed Lag (ARDL) bounds testing approach to examine the presence of a long run relationship between the variables. In the case of a mixed order integration of variables provided such series are not *I*(2) or more; the ARDL cointegration technique is the appropriate method. By cointegration, a long run relationship between independent and dependent variables can be examined in this study. The test procedure adopts the error correction model (ECM) framework and also makes use of the Wald/F-statistic. In order to avoid spurious results, the ECM framework is used. This is because it accounts for previous disequilibrium is corrected in current periods. .

The ARDL model is stated as:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta Y_{t-i} + \sum_{i=0}^{k} \beta_n \Delta X_{t-i} + \tau_1 Y_{t-1} + \tau_n X_{t-1} + \mu_t \qquad (3.3)$$

The regress and a vector of a series of explanatory variables in equation (3.3) are given by X_t and X_t respectively. *n* represents the number of regressors and *k* implies the lag order. ε_t is the error term and Δ is the difference operator. X_{t-1} and Y_{t-1} are the lags of the independent and the dependent variables. β_n represents the coefficient of the vector of independent regressors.

The null hypothesis of no cointegration is tested against the alternative hypothesis of the presence of cointegration relationship. Lower bounds of the cointegration test are integrated of order zero {I (0)}.

3.5 Diagnostic and stability

The study conducts various diagnostic and stability test to ensure if the estimations are free of any econometric problem. The autocorrelation and heteroskedasticity tests are conducted. The study also conducts the Ramsey's RESET test to examine the functional form correctness. This is done in order to ensure the reliability and robustness of estimations. Skewness and kurtosis of the residuals are adopted to determine normality. Furthermore, Lagrange multiplier test and the regression of squared residuals on squared fitted values were used to investigate the serial correlation and heteroscedasticity respectively. Stability is also tested using the CUSUM and the CUSUMQ.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents and discusses the results of the study. It first presents trend analysis of inflation and the monetary policy indicators used in the model. It then discusses the long-run and short-run dynamics of the variables included in the model.

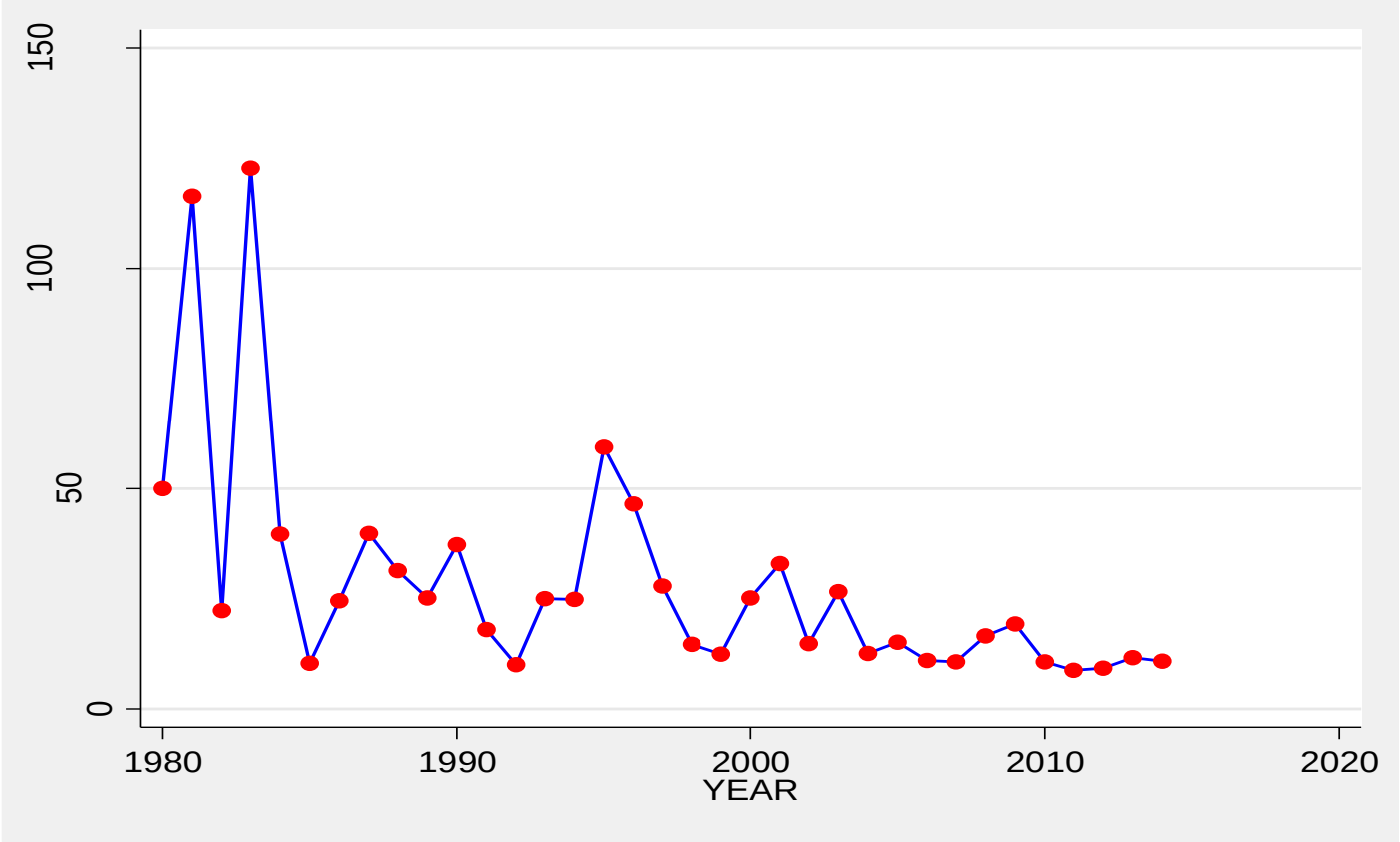
4.2 Trend Analysis

In order to achieve the first objective, the subsection presents the trends in the variables of interest which include inflation, $M1$, $M2$, $M2+$ and monetary policy rate from 1980 to 2014.

4.2.1 Trends in Inflation

According to Canette and Greene (1991), high inflation has always been a significant problem for many Sub-Saharan African countries in the past. During the thirty-five year period under review that is, from 1980 to 2014, Ghana has experienced very high rates of inflation. Ghana recorded a single-digit inflation of 8.7% in 2011 and 9.2% in 2012. This was due to the conscious effort of the Central Bank to control inflation by putting in place measures such as stabilizing the exchange rate. Also, reduced government expenditure, declining oil prices and stable utility prices as well as low world inflation due to the global recession is said to have contributed to the single-digit inflation in 2011 and 2012 (Kwakye, 2012).

Figure 4.1: Inflationary trends in Ghana



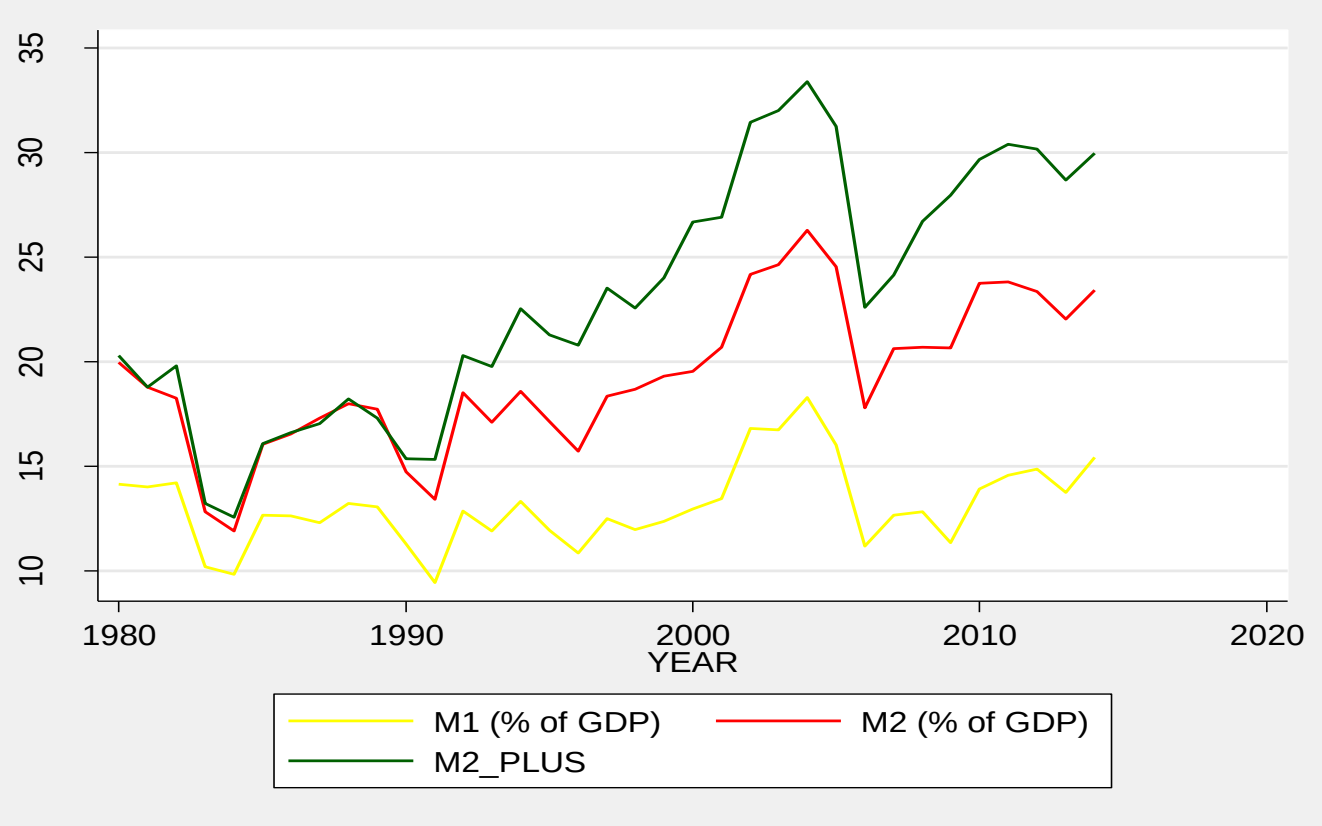
Source: Author

In the period studied, inflation rates averaged 28% which is very high by any standard. The maximum inflation rate was experienced 1983. However, the minimum inflation rate was 8.73 % and was obtained in 2011. Ghana again experienced single digit inflation of 8.73% in 2011 and 9.2% in 2012.

4.2.2 Trends in Money supply (M1, M2 and M2+)

Money supply is one of the key instruments used by the Bank of Ghana to control inflation. This shows a combination of $M1$, $M2$ and $M2+$. The period under review Ghana has experienced very the high money supply. This can be seen in Figure 4.2

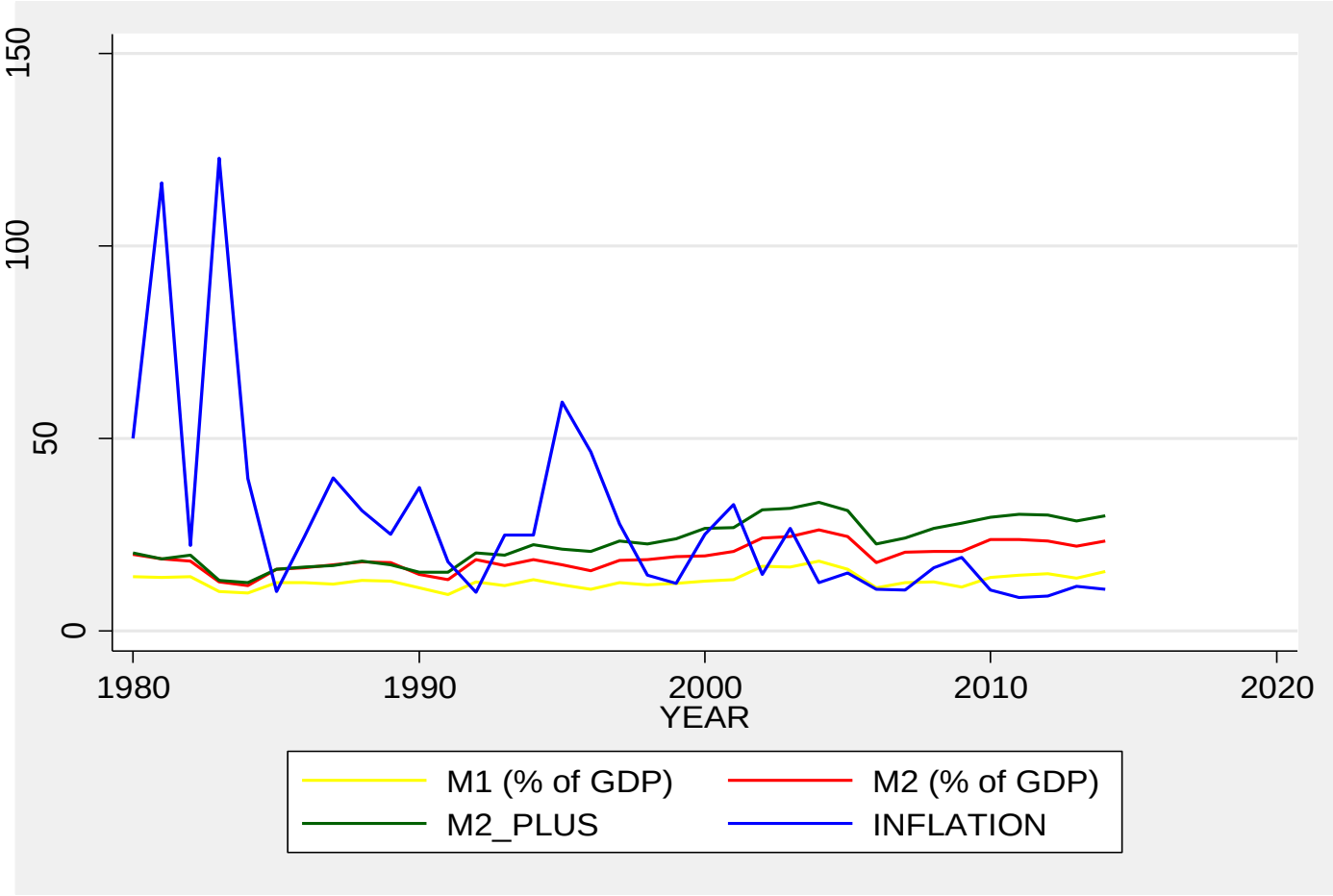
Figure 4.2: Trends in Money Supply



Source: Author

4.2.3 Trends in Inflation and Money Supply

Figure 4.3: Combined Trend Analysis of Inflation and Money Supply



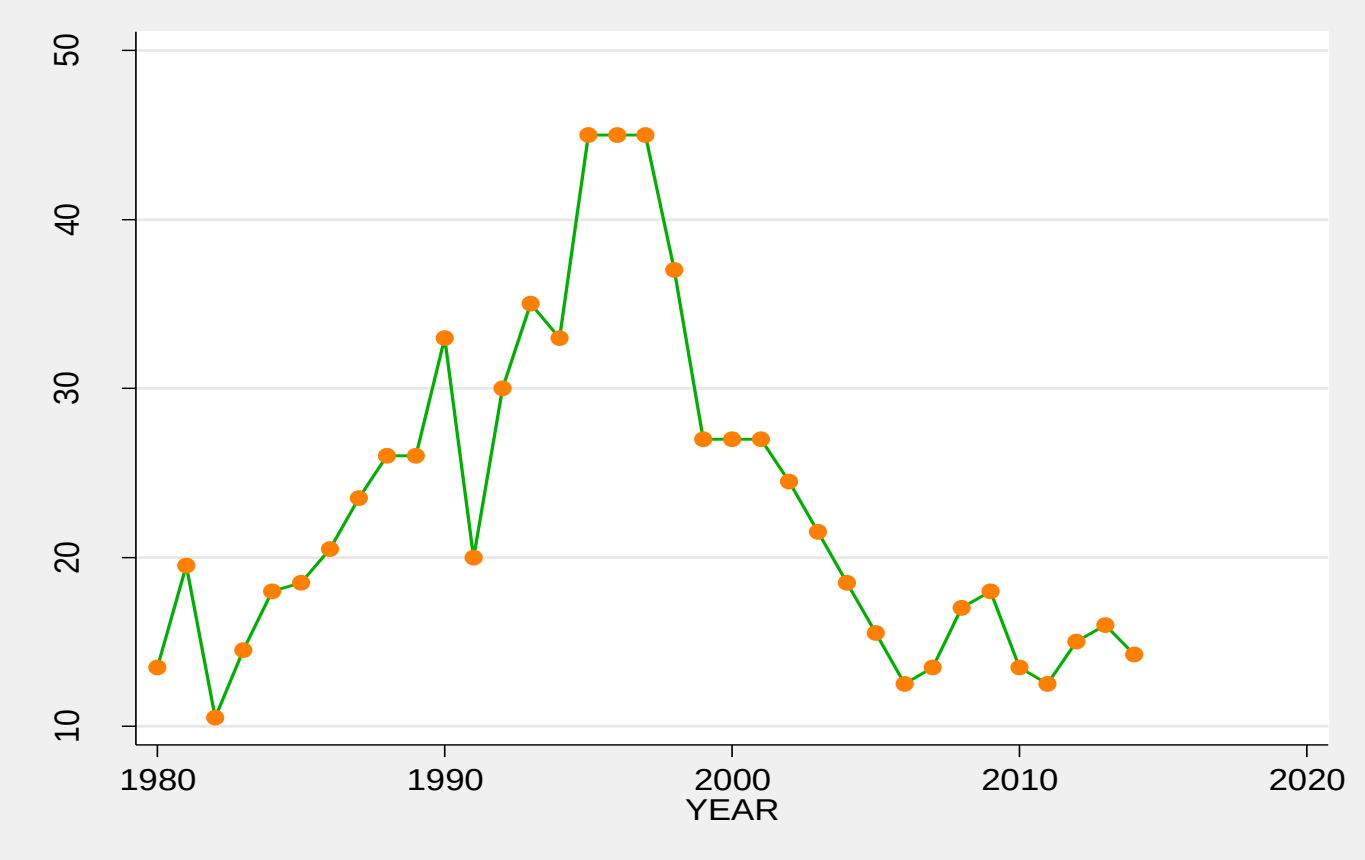
Source: Author

Theoretically, high money supply growth is expected to lead to high rate of inflation if the monetarists' view holds but this is generally not the case by looking at Figure 4.3. The lack of significant causation of money supply and inflation rate suggests that monetary growth alone does not explain the variability in inflation in Ghana. Inflation in 1995 was 59.5% whereas broad money supply (M2) was about 17.2% in the same year. This shows that other factors apart from money supply led to an increase in inflation. Factors such as exchange rate depreciation and rising fuel and utility prices have contributed to high inflation during that year (Kwakye, 2010).

The above factors weakened the link between money supply and inflation therefore rendering monetary policy ineffective during the Open Market Operation era where money supply was the key intermediate target. Ghana recorded its highest money supply in 2002. However, money supply growth has slowed down recent years. Single-digit inflation of 8.7% and 9.2% was attained in 2011 and 2012 respectively. This is because items of Consumer Price Index such as fuel and utility prices enjoyed subsidies which kept their prices below market prices (Kwakye, 2012). This was however not sustained and therefore continues rising.

4.2.4 Trends in Monetary Policy Rate

Figure 4.4: Trends in Monetary Policy Rate



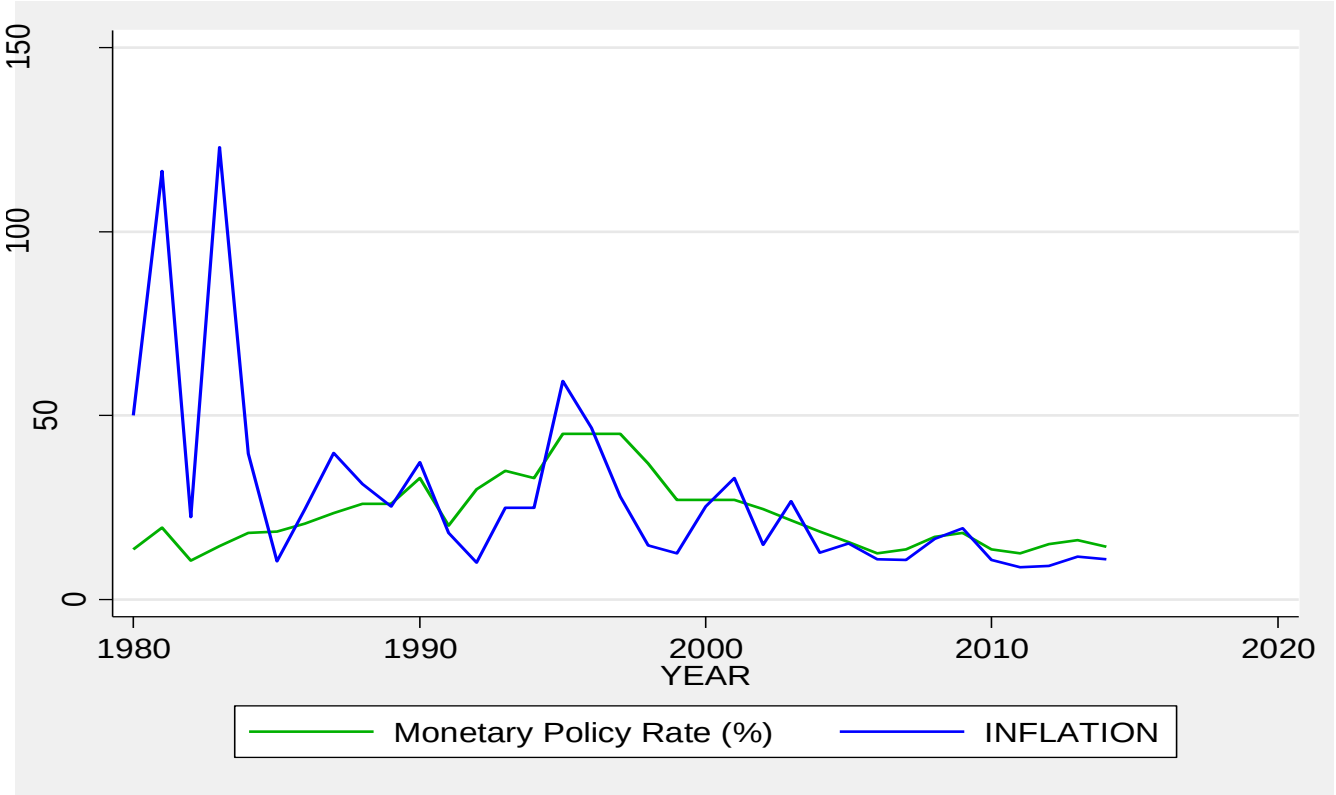
Source: Author

The monetary policy is the major operating tool or instrument of Bank of Ghana in controlling inflation. Highest monetary policy rate under the period under review was 45%. This rate was used from 1995 to 1997 by the Central Bank. Minimum rate was 10.5% and was used in 1982.

4.2.5 Trends in Inflation and Monetary Policy Rate

The government adopted Inflation Targeting framework (IT) in 2002 as a stabilization policy pursued with the aim of controlling inflation. It can be seen from figure 4.5 that inflation rose from 14.8% in 2002 to 26.7% in 2003. Thus, there was a weak impact of monetary policy rate to inflation, a year after the adoption of the inflation targeting framework. Although, the IT framework was not very effective in the early years of implementation, it can be considered as very effective since 2010. It is worth noting that inflation rate of 8.6% in 2011 was below the target rate of 9.2% (Ghana Statistical Service, 2012).

Figure 4.5: Combined Trend Analysis of Inflation and Monetary Policy Rate



Source: Author

4.3 Stationarity test

The unit root analysis for this study is summarized in the Table 4.1. The Augment Dickey Fuller (ADF) test was used to test the stationarity process of the data.

Table 4.1 Augmented Dickey Fuller Test

VARIABLES	LEVELS		FIRST DIFFERENCE	
	CONSTANT	CONSTANT AND TREND	CONSTANT	CONSTANT AND TREND
LnINF	-3.520010**	-5.377989***	-	-
*LnM*1	-3.072583**	-3.548490**	-	-
*LnM*2	-1.188743	-3.250776	-3.646342***	-5.677511***
*LnM*2+	-1.238474	-3.197232	-5.740278***	-5.650835***
LnMPR	-1.756168	-2.015202	-7.468023***	-7.528002***
LnER	-3.485233**	-1.325052	-	-4.428889***
LnINT	-1.761841	-1.327566	-5.616200***	-5.842483***
LnY	4.032435***	-2.107258	-	-2.289358
LnGEX	-2.107353	-4.409794***	-5.402872***	-
LnTO	-1.418575	-1.442757	-4.711105***	-4.975854***

Note: *, ** and *** represent 10%, 5% and 1% level of significance respectively
Source: Author

From Table 4.1, it is evident that inflation is stationary at the levels. Specifically, the study finds that with a model with only constant, inflation was stationary at 5% level of significance. Again with a model with both constant and trend it was found to be stationary at 1% level of significance. Hence, integration of order zero [I (0)]. At the levels, for a model with only constant, exchange rate and economic growth were found to be stationary at 5% and 1% level of significance respectively. Hence, I(0). In addition, for a model with both constant and trend, government expenditure was found to be stationary at the levels at 1% level of significance, thus I(0). All the other variables where found to be non-stationary at the levels.

At first difference, with regards to the model with constant and both constant and trend M1, M2 and M2+, monetary policy rate, interest rate and trade openness were found to be stationary at 1% level of significance. Hence, integrated of order one I(1). Again, with the model with constant and trend, exchange rate was found to be stationary at first difference, thus, I(1). Lastly,

at first difference for a model with only constant, government expenditure was found to be stationary at 1% level of significance.

From the stationary results in Table 4.1, there is a mix results of order I (0) and I (1) variables. Therefore the Autoregressive Distributive Lagged framework (ARDL) is the appropriate estimation method due to the stationarity properties of the variables.

4.4 Bounds Test Approach to Cointegration

The bounds testing approach proposed by Pesaran et al (2001) is used to test for cointegration within the ARDL framework. This was used to test if a long run equilibrium relationship exists among the variables. The co-integration results can be shown in Table 4.2.

The study adopted the Schwarz Information Criterion (SIC) for the selection of ARDL (1, 1, 0, 0, 0, 2, 2), ARDL (2, 2, 0, 0, 0, 2, 1), ARDL (2, 2, 0, 0, 0, 2, 1) and ARDL (1, 3, 0, 0, 2, 0, 3) models.

Table 4.2: Co-integration Results

MODEL	F-STATISTICS	LOWER BOUND (5%)	UPPER BOUND (5%)
MODEL 1	7.333272**	2.45	3.61
MODEL2	5.898491**	2.45	3.61
MODEL 3	5.779907**	2.45	3.61
MODEL 4	5.336513**	2.45	3.61

Note: ** represent 5% level of significance
Source: Author

For model 1, results from Table 4.2 shows that the F-statistics is greater than the upper bound. Hence, the null hypothesis of no co-integration is rejected at 5% level of significance. This means that there is a long-run equilibrium relationship among the variables. It is also evident that there is a long-run equilibrium relationship among the variables in Model 2, 3 and 4. This is because the F-statistics exceeds the upper bound in all three cases. Hence, at 5% level of significance, the null hypothesis of no co-integration is also rejected. This implies that there exists a stable long-run relationship among the variables included in each model.

4.4 Long-run results

In order to achieve the long-run relationship between the dependent and independent variables, the long-run analysis was investigated and the results are presented in Table 4.3.

Table 4.3: Long-run results

Variables	Model 1	Model 2	Model 3	Model 4
*LnM*1	1.966867***			
	(0.608364)			
*LnM*2		0.384177**		
		(0.524580)		
*LnM*2+			0.395948**	
			(0.521354)	
LnMPR				-2.277237**
				(0.827771)
LnER	0.466764**	0.261610**	0.270269**	-0.756895**
	(0.221228)	(0.225480)	(0.225208)	(0.310108)
LnINT	1.258722***	0.557301	0.582252	3.903837***
	(0.433620)	(0.515253)	(0.515082)	(1.267163)
LnY	-1.837887***	-1.554811**	0.703495**	-0.051983*
	(0.630459)	(0.703495)	(0.703495)	(0.640672)
LnGEX	1.461848**	1.053311**	1.050367**	1.242830
	(0.608792)	(0.653175)	(0.651511)	(0.728168)
LnTO	-1.578128**	-0.782300	-0.811068	1.403247*
	(0.603636)	(0.540041)	(0.538505)	(0.784121)
Constant	9.353750**	6.508019**	7.123118**	5.247094
	(5.083882)	(7.062468)	(7.018610)	(6.564525)

Note: *, ** and *** represent 10%, 5% and 1% level of significance respectively; In parenthesis are the standard errors.
Source: Author

The results show that all money supply indicators were positively related to inflation. Specifically, the results showed that a 1% increase in $M1$ leads to about 1.97% increase in inflation at a 1% significance level for Model 1. Model 2 and 3 stipulates a 0.38% and 0.40% increase in inflation as a result of a 1% increase in $M2$ and $M2+$ respectively at 5% level of significance. This confirms a statistically significant positive long-run relationship between

money supply and inflation. This is consistent with the a priori expectation which was based on the quantity theory of money. This positive relationship can be explained by an increase in government expenditure over the years. Increased government expenditure pumps more money into the economy. As a result, aggregate demand rises hence, higher inflation. Thus, an increase in monetary base. Previous studies such as Adu and Marbuah (2011) and Gul et al. (2012) in Ghana and Sri Lanka respectively confirm result in Model 1. Results of Model 2 and 3 are also consistent with studies done in Ghana by Bawumia and Abradu-Otoo (2003) and Abdul (2014).

Furthermore, a 1% increase in monetary policy rate leads to a 2.28% decrease in inflation at a 5% significance level. This is specified in Model 4. Thus, an expected negative relationship between monetary policy rate and inflation according to conventional banking practice was confirmed. Increasing monetary policy rate by the Bank of Ghana which is a contractionary monetary policy decreases inflation. However, this is not evident in Ghana. This is because although Bank of Ghana has adopted a contractionary monetary policy, high inflation still persists. This is because of other non-monetary factors such increased government expenditure and utility bills which have rendered the monetary policy rate ineffective thereby leading to high inflation. Ngerebo (2016) also confirmed that there is a negative relationship between monetary policy and inflation in Nigeria. However, results of Amarasekara (2009) and Gul et al. (2012) from Sri Lanka and Pakistan respectively differ from this result.

The results further showed that exchange rate has a statistically significant positive relationship with inflation in model 1, 2 and 3. Specifically, it was shown that a 1% increase in exchange rate causes a 0.47%, 0.26% and 0.27% increase in inflation in the long-run at 5% level of significance as shown in model 1, 2, and 3. Depreciation of the cedi makes imports expensive

and discourages purchases of imported goods. This stimulates demand for domestically manufactured goods thereby leading to high price levels.This explains the positive coefficient of exchange rate in model 1, 2 and 3. This is consistent with previous studies done in Ghana such as Bawumia and Abradu-Otoo (2003) and Ahiabor (2012). However, in model 4, it was found that a 1% increase in exchange rate causes a 0.76% decline in inflation at 5% level of significance. Adu and Marbuah (2011) shared this result in Model 4.

In addition, a 1% increase in interest rate increases inflation by 1.26% and 3.9% in model 1 and 4 respectively at 1% significance level. Although, inflation was increased by 0.56% and 0.58% as a result of a 1% increase in interest rate in model 2 and 3, it is statistically insignificant. A long-run negative relationship was expected, however this study revealed a positive relationship between inflation and interest rate in Ghana. This means that although the lending rate is high, more people are still able to borrow to invest and consume. As a result, aggregate demand will rise due to an increase in spending. Hence, higher inflation. Previous studies in Ghana such as Adu and Marbuah (2011) and Ahiabor (2012) confirm the results of this study.

Furthermore, a 1% increase in GDP leads to a 1.84%, 1.55% and 0.05% decrease in inflation in Model 1, 2, 4 at 1%, 5% and 10% level of significance respectively. This is consistent with results of studies done in different countries such as Gul et al, (2012), Barro (1996) and Fischer et al. (1994). Also, inflation was increased in Model 3 by 0.07% due to a 1% increase in GDP at 5% level of significance. This implies that GDP is negatively related with inflation in Model 1, 2 and 4 but has a positive coefficient in model 3. An increase in GDP means an increased supply of goods and services. Excess supply of goods and services leads to a fall in prices. Hence, low

inflation. This explains the negative coefficient in model 1, 2 and 4. This result confirms the findings of Abdul, (2014).

From the results in Table 4.3 it is evident that government expenditure has a statistically significant positive relationship with inflation. A 1% increase in government expenditure increases inflation by 1.46%, 1.05% and 1.05% at 5% level of significance in Model 1, 2 and 3. Increased government expenditure puts spending money into the pockets of consumers. As a result, aggregate demand rises hence, higher inflation. Studies such as Drukker et al (2005) and Abdul (2014) have demonstrated that government expenditure has a positive impact on inflation in USA and Ghana. However, the effect in model 4 was insignificant.

Finally, a 1% increase in trade openness decreases inflation by 1.58% at 5% significance level in Model 1. This is because trade openness reduces inflation by the positive influence on output through increased foreign investment and better allocation of resources. Also, at 10% significance level, a 1% increase in trade openness increases inflation by 1.4% in Model 4. Previous studies such as Zakaria (2010) and Munir and Kiani (2014) have demonstrated a positive impact of trade openness on inflation in their results.

4.5 Short-run results

The study further proceeds to investigate the short-run dynamics amongst the variables. The results are presented in Table 4.4

Table 4.4 Short- run results

Variables	Model 1	Model 2	Model 3	Model 4
$\Delta \ln INF_{-1}$		0.266610**	0.266836**	0.082616
		(0.116588)	(0.116784)	(0.158706)
$\Delta \ln M1$	-0.275846			
	(0.536483)			
$\Delta \ln MS2$		-1.466880**	-1.466758**	
		(0.593776)	(0.597698)	
$\Delta \ln MS2_{-1}$		1.309956*	1.290085*	
		(0.703471)	(0.703674)	
$\Delta \ln M2+$		-1.466758**		
		(0.597698)		
$\Delta \ln M2+_{-1}$			3.153387***	
			0.754666	
$\Delta \ln MPR$				0.127377
				(0.434706)
$\Delta \ln MPR_{-1}$				0.774782**
				(0.360837)
$\Delta \ln MPR_{-2}$				0.972875**
				(0.368698)
$\Delta \ln ER$	0.465791**	0.260944	0.270677	-0.694363**
	(0.222031)	(0.208110)	(0.207829)	(0.239452)
$\Delta \ln INT$	1.256098**	0.555883	0.583130	3.581316***
	(0.463293)	(0.554313)	(0.557497)	(0.949862)
$\Delta \ln Y$	-1.834055***	-1.550854**	-1.583301**	0.420565
	(0.622237)	(0.618092)	(0.614562)	(3.533053)
$\Delta \ln Y_{-1}$				-9.503965**
				(3.367790)
$\Delta \ln GEX$	-0.268216	0.064356	0.090045	1.140152*
	(0.469809)	(0.504717)	(0.508622)	(0.583549)
$\Delta \ln GEX_{-1}$	-1.478092**	-1.141596**	-1.115946**	
	(0.544583)	(0.453339)	(0.454739)	
$\Delta \ln TO$	0.316525	0.753454	0.716324	-0.168261
	(0.591120)	(0.523774)	(0.527118)	(0.689298)
$\Delta \ln TO_{-1}$	0.717997*			0.122783
	(0.410973)			(0.564447)
$\Delta \ln TO_{-2}$				-1.143050**
				(0.41741)
ECM_{-1}	-0.797915***	-0.767455***	-0.691508***	-0.717384***
	(0.142201)	(0.195093)	(0.195306)	(0.158706)

Note: *, ** and *** represent 10%, 5% and 1% level of significance respectively; In parenthesis are the standard errors
Source: Author

The error correction mechanism measures the percentage of correction of any deviation in the long run equilibrium. In other words, the speed or how fast these deviations are corrected at a single period. The results prove that in a single period, there is a speed of approximately 80%, 77%, 69% and 72% adjustment to long-run equilibrium after a shock in the short-run in Model 1, 2, 3 and 4 respectively. The negative coefficient shows stability of the model at 1% level of significance.

The short-run results in Table 4.4 show that a 1% increase in inflation lag one increases inflation by 0.27% at 5% significance level in Model 2 and 3. However, the result in Model 4 is not statistically significant. This implies that by increasing the lag of inflation by 1% inflation rose by 0.08%.

Furthermore, a 1% increase in M1 decreases inflation by approximately 0.28%. However, this is statistically insignificant in Model 1. A 1% rise in M2 also decreases inflation in the short-run by 1.47% in Model 2 and 3 at 5% statistical significance level. In addition, a 1% rise in M2 lag one at a 10% level of significance increases inflation by approximately 1.3% in Model 2 and 3. At a 5% significance level, inflation decreases by 1.47% due to a 1% increase in M2+ in Model 2. Inflation increases by 3.15% as a result of a 1% increase in the lag of $M2+$ at a 1% significance level. A 1% increase in monetary policy rate also increases inflation by 0.13%. However, this is statistically insignificant in Model 4. At a 5% significance level, a 1% increase in the lag and second lag of MPR increases inflation by 0.78% and 0.97% respectively in Model 4.

It is demonstrated from Table 4.4 that the exchange rate has a positive relationship with inflation. Further, 1% increase in exchange rate leads to an increase of 0.46% in inflation in model 1 at 5% significant level. However, in model 4 there is a negative relationship between exchange rate and

inflation. Increase in exchange rate by one percent at 5 % significant level causes a decrease of 0.69% in inflation. It is observed in model 2 and 3 that the result is not significant.

The result in Table 4.4 proved that when interest rate increases by 1%, inflation increases by 1.26% in model 1 and 3.58% in model 4 at 5% and 1% level of significance respectively. However, in model 2 and 3, the result is not statistically significant.

There is a negative relationship between GDP and inflation. An increase of 1% in GDP implies a decline in inflation of respectively 1.8%, 1.6% and 1.6% in model 1, 2 and 3 at 1% significant level in model 1 and 5% in model 2 and 3. However, in model 4, there is a positive relationship but not statistically significant. GDP lag one has a negative relationship with inflation. A 1% increase in GDP lag one implies increase of 10% in inflation at 10% significant level in model 4.

From Table 4.4, it is also proved that 1% increase in government expenditure implies an increase in inflation at 10% significance level in model 4. However, a 1% increase in the lag of government expenditure implies a decrease of 1.48%, 1.14%, and 1.11% respectively in model 1, 2 and 3 at 5% significant level.

A 1% increase in the lag of trade openness increases inflation by 0.7% at 10% significant level in model one. However, an increase in trade openness by 1% decreases inflation by 1.14% in model 4 at 5% significant level.

4.6 Diagnostic and Stability test

The study conducts various diagnostic and stability test and the results are presented in Table 4.5.

Table 4.5 Model diagnostics and stability tests

Test Statistic	Model 1	Model 2	Model 3	Model 4
Serial correlation	1.045978	0.128190	0.129769	0.803172
	(0.3718)	(0.8805)	(0.7803)	(0.4675)
Normality	0.660957	0.435767	0.489628	0.110647
	(0.718580)	(0.435767)	(0.782850)	(0.946179)
Heteroscedasticity	1.028160	1.112852	1.125024	2.467759
	(0.4616)	(0.4054)	(0.3972)	(0.2414)
Functional Form	1.700689	1.374750	1.398613	0.751239
	(0.1053)	(0.1861)	(0.1789)	(0.4641)
CUSUM	Stable	Stable	Stable	Stable
CUSUMQ	Stable	Stable	Stable	Stable

Note: values in parenthesis are probability values
Source: Author

The diagnostic test result showed that all models are free of autocorrelation, heteroscedasticity, functional and normality problems. Specifically as shown in Table 4.5, all the p-values of the coefficients of the various diagnostic tests were greater than one, leading to the non-rejection of the null hypothesis of each test. It is also observed that all the models are stable as the CUSUM and CUSUMQ residual lies between the 5% critical value bounds.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter presents a brief overview of the major findings covered in this study. It further provides policy recommendations as well as conclusion on the entire study.

5.2 Summary of findings

The study analyzed the effect of monetary policy on inflation in Ghana for the period 1980-2014 using the Autoregressive Distributed Lag (ARDL) estimation method. Specifically, it presented a trend analysis on the various monetary variables and inflation over the sample period. Again, the study investigated the long-run and short-run impact of the various monetary policy indicators on inflation. Finally, the study investigated the effect of other determinants of inflation.

The short and long-run results obtained from the estimated models showed that money supply ($M1, M2$ and $M2+$) is positively related to inflation. The implication is that an increase in money supply leads to high inflation in Ghana.

The results further indicated a statistically significant negative relationship between monetary policy rate and inflation hence confirming the conventional banking practice.

Increasing monetary policy rate which is a contractionary monetary policy is supposed to decrease inflation. However, this is not evident in Ghana. This is because although Bank of Ghana has adopted a contractionary monetary policy, high inflation still persists. This is because of other non-monetary factors such increased government expenditure and utility bills which have rendered the monetary policy rate ineffective thereby leading to high inflation.

Nevertheless, a positive short-run relationship between monetary policy rate and inflation was revealed in this study.

In addition, there was a long-run positive relationship between exchange rate and inflation in Ghana. The short-run results therefore showed a negative and positive relationship between exchange rate and inflation in model 1 and 4 respectively.

The results also revealed a statistically significant positive relationship between inflation and interest rate both in the long-and short-run in Ghana. Economic growth was found to have a negative impact on inflation in the long-run and short-run. A positive relationship between government expenditure and inflation in both short-run and long-run was revealed. Trade openness has a negative impact on inflation in the long-run and short-run.

5.3 Recommendations

From the results obtained money supply is an important variable in influencing inflation in Ghana. Therefore, to reduce inflation in the economy, immediate measures need to be adopted by the Central Bank to reduce money supply. It is therefore recommended that Bank of Ghana sells more government securities in order to reduce the total amount of money in the economy. However, this will be more effective if the size of the securities market is large. Hence, more financial institutions and non-financial institutions should be motivated in participating in the activities of government securities.

Although, the Bank of Ghana has already adopted contractionary monetary policy, inflation still persists in Ghana due to other non-monetary factors such as high government spending and utility prices. Therefore, fiscal discipline is required to reduce excess money supply emanated from large scale financial deficit.

The current monetary contractionary position of Bank of Ghana is a step in the right direction but should be used with caution. This is because high monetary policy rate leads to high lending rate. Considering the dual objective of Bank of Ghana, the monetary policy should be tailored to promote real sector lending while trying to achieve low and stable inflation.

5.4 Conclusions

The main purpose of this research was to investigate the effect of monetary policy on inflation in Ghana for the period 1980-2014. Specifically, the study analyzed trends in inflation and monetary indicators. In addition, it examined the long and short-run effects of monetary variables on inflation. It also examined the long and short run of government expenditure, trade openness and GDP on inflation in Ghana.

The results show that there's a statistically significant positive short-run and long-run relationship between money supply and inflation in this study. An expected statistically significant negative relationship between monetary policy rate and inflation according to conventional banking practice was confirmed. Furthermore, this study revealed a statistically significant positive relationship between inflation and interest rate in Ghana in both the long-and

short-run. Economic growth was also found to have a negative impact on inflation in the long-run. An expected positive relationship between government expenditure and inflation in both short-run and long-run was revealed. Trade openness had a negative impact on inflation in the long-run and short-run.

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APPENDIX

MODEL 1

Dependent Variable: LNINF
Method: ARDL
Date: 09/15/16 Time: 11:57
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (2 lags, automatic): LNM1 LNER LNINT LNY LNGEX LNTO
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(1, 1, 0, 0, 0, 2, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNINF(-1)	0.002085	0.142201	0.014663	0.9884
LNM1	-0.275846	0.536483	-0.514174	0.6128
LNM1(-1)	2.238612	0.460838	4.857697	0.0001
LNER	0.465791	0.222031	2.097858	0.0488
LNINT	1.256098	0.463293	2.711237	0.0134
LNY	-1.834055	0.622237	-2.947520	0.0080
LNGEX	-0.268216	0.469809	-0.570905	0.5744
LNGEX(-1)	0.248924	0.596023	0.417641	0.6807
LNGEX(-2)	1.478092	0.544583	2.714172	0.0134
LNTO	0.316525	0.591120	0.535466	0.5982
LNTO(-1)	-1.173365	0.576843	-2.034115	0.0554
LNTO(-2)	-0.717997	0.410973	-1.747065	0.0960
C	39.27170	15.15847	2.590742	0.0175

R-squared	0.864318	Mean dependent var	3.007747
Adjusted R-squared	0.782909	S.D. dependent var	0.617562
S.E. of regression	0.287741	Akaike info criterion	0.633591
Sum squared resid	1.655897	Schwarz criterion	1.223124
Log likelihood	2.545747	Hannan-Quinn criter.	0.831951
F-statistic	10.61697	Durbin-Watson stat	1.456693
Prob(F-statistic)	0.000003		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 09/15/16 Time: 12:00
Sample: 1982 2014
Included observations: 33
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	7.333272	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

ARDL Cointegrating And Long Run Form
Dependent Variable: LNINF
Selected Model: ARDL(1, 1, 0, 0, 0, 2, 2)
Date: 09/15/16 Time: 12:04
Sample: 1980 2014
Included observations: 33

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNM1)	-0.275846	0.536483	-0.514174	0.6128
D(LNER)	0.465791	0.222031	2.097858	0.0488
D(LNINT)	1.256098	0.463293	2.711237	0.0134
D(LNY)	-1.834055	0.622237	-2.947520	0.0080
D(LNGEX)	-0.268216	0.469809	-0.570905	0.5744
D(LNGEX(-1))	-1.478092	0.544583	-2.714172	0.0134
D(LNTO)	0.316525	0.591120	0.535466	0.5982
D(LNTO(-1))	0.717997	0.410973	1.747065	0.0960
CointEq(-1)	-0.797915	0.142201	-7.017612	0.0000

Cointeq = LNINF - (1.9669*LNM1 + 0.4668*LNER + 1.2587*LNINT -1.8379 *LNY + 1.4618*LNGEX -1.5781*LNTO + 39.3538)

Long Run Coefficients

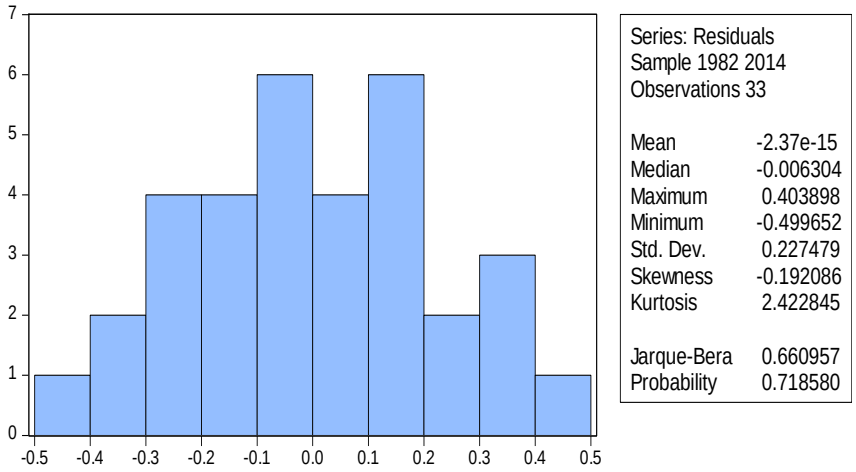
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM1	1.966867	0.608364	3.233045	0.0042
LNER	0.466764	0.221228	2.109881	0.0477
LNINT	1.258722	0.433620	2.902822	0.0088
LNY	-1.837887	0.630459	-2.915159	0.0086
LNGEX	1.461848	0.608792	2.401226	0.0262
LNTO	-1.578128	0.603636	-2.614372	0.0166
C	9.353750	5.083882	2.608993	0.0168

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.045978	Prob. F(2,18)	0.3718
Obs*R-squared	3.435929	Prob. Chi-Square(2)	0.1794

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.028160	Prob. F(12,20)	0.4616
Obs*R-squared	12.59052	Prob. Chi-Square(12)	0.3995
Scaled explained SS	3.290057	Prob. Chi-Square(12)	0.9931



Ramsey RESET Test
Equation: UNTITLED
Specification: LNINF LNINF(-1) LNM1 LNM1(-1) LNER LNINT LNY LNGEX LNGEX(-1) LNGEX(-2) LNTO LNTO(-1) LNTO(-2) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.700689	19	0.1053
F-statistic	2.892344	(1, 19)	0.1053

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.218772	1	0.218772
Restricted SSR	1.655897	20	0.082795
Unrestricted SSR	1.437125	19	0.075638

MODEL 2

Dependent Variable: LNINF
Method: ARDL
Date: 09/15/16 Time: 12:57
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (2 lags, automatic): LNMS2 LNER LNINT LNY LNGEX LNTO
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(2, 2, 0, 0, 0, 2, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNINF(-1)	0.269155	0.158203	1.701322	0.1052
LNINF(-2)	-0.266610	0.116588	-2.286764	0.0339
LNMS2	-1.466880	0.593776	-2.470426	0.0231
LNMS2(-1)	3.160036	0.753858	4.191817	0.0005
LNMS2(-2)	-1.309956	0.703471	-1.862133	0.0781
LNER	0.260944	0.208110	1.253872	0.2251
LNINT	0.555883	0.554313	1.002832	0.3285
LNY	-1.550854	0.618092	-2.509096	0.0213
LNGEX	0.064356	0.504717	0.127509	0.8999
LNGEX(-1)	-0.155322	0.625121	-0.248467	0.8064
LNGEX(-2)	1.141596	0.453339	2.518195	0.0209
LNTO	0.753454	0.523774	1.438508	0.1666
LNTO(-1)	-1.533762	0.403129	-3.804643	0.0012
C	36.41510	15.08036	2.414736	0.0260

R-squared	0.865615	Mean dependent var	3.007747
Adjusted R-squared	0.773667	S.D. dependent var	0.617562
S.E. of regression	0.293802	Akaike info criterion	0.684596
Sum squared resid	1.640074	Schwarz criterion	1.319478
Log likelihood	2.704173	Hannan-Quinn criter.	0.898214
F-statistic	9.414188	Durbin-Watson stat	2.143916
Prob(F-statistic)	0.000010		

*Note: p-values and any subsequent tests do not account for model

ARDL Bounds Test
Date: 09/15/16 Time: 12:10
Sample: 1982 2014
Included observations: 33
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.898491	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

ARDL Cointegrating And Long Run Form
Dependent Variable: LNINF
Selected Model: ARDL(2, 2, 0, 0, 0, 2, 1)
Date: 09/15/16 Time: 12:15
Sample: 1980 2014
Included observations: 33

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINF(-1))	0.266610	0.116588	2.286764	0.0339
D(LNMS2)	-1.466880	0.593776	-2.470426	0.0231
D(LNMS2(-1))	1.309956	0.703471	1.862133	0.0781
D(LNER)	0.260944	0.208110	1.253872	0.2251
D(LNINT)	0.555883	0.554313	1.002832	0.3285
D(LNY)	-1.550854	0.618092	-2.509096	0.0213
D(LNGEX)	0.064356	0.504717	0.127509	0.8999
D(LNGEX(-1))	-1.141596	0.453339	-2.518195	0.0209
D(LNTO)	0.753454	0.523774	1.438508	0.1666
CointEq(-1)	-0.767455	0.195093	-5.112709	0.0001

Cointeq = LNINF - (0.3842*LNMS2 + 0.2616*LNER + 0.5573*LNINT
-1.5548*LNY + 1.0533*LNGEX -0.7823*LNTO + 36.5080)

Long Run Coefficients

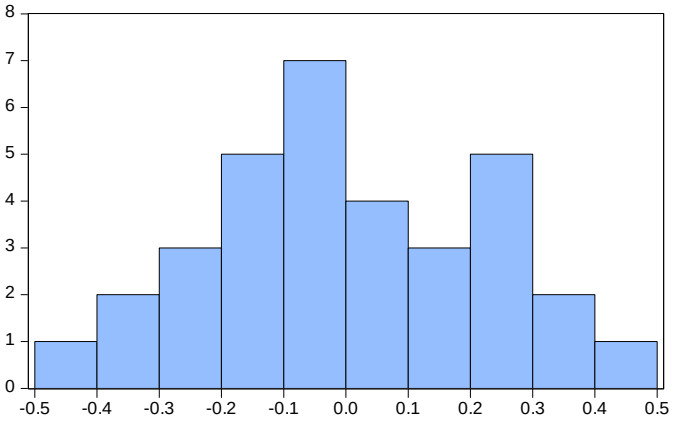
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNMS2	0.384177	0.524580	0.732352	0.0429
LNER	0.261610	0.225480	1.160236	0.0500
LNINT	0.557301	0.515253	1.081607	0.2930
LNY	-1.554811	0.703495	-2.210124	0.0396
LNGEX	1.053311	0.653175	1.612602	0.0233
LNTO	-0.782300	0.540041	-1.448592	0.1638
C	6.508019	7.062468	2.139668	0.0456

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.128190	Prob. F(2,17)	0.8805
Obs*R-squared	0.490287	Prob. Chi-Square(2)	0.7826

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.112852	Prob. F(13,19)	0.4054
Obs*R-squared	14.26517	Prob. Chi-Square(13)	0.3554
Scaled explained SS	3.571684	Prob. Chi-Square(13)	0.9950



Series: Residuals
Sample 1982 2014
Observations 33

Mean	-4.08e-15
Median	-0.022467
Maximum	0.495486
Minimum	-0.462411
Std. Dev.	0.226390
Skewness	0.139104
Kurtosis	2.510591
Jarque-Bera	0.435767
Probability	0.804219

Ramsey RESET Test
Equation: UNTITLED
Specification: LNINF LNINF(-1) LNINF(-2) LNMS2 LNMS2(-1) LNMS2(-2) LNER LNINT LNY LNGEX LNGEX(-1) LNGEX(-2) LNTO LNTO(-1) C
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	1.374750	18	0.1861
F-statistic	1.889939	(1, 18)	0.1861

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	0.155840	1	0.155840
Restricted SSR	1.640074	19	0.086320
Unrestricted SSR	1.484234	18	0.082457

MODEL 3

Dependent Variable: LNINF
Method: ARDL
Date: 09/15/16 Time: 12:31
Sample (adjusted): 1982 2014
Included observations: 33 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Schwarz criterion (SIC)

Dynamic regressors (2 lags, automatic): LNM2_ LNER LNINT LNY LNGEX LNTO
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(2, 2, 0, 0, 0, 2, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNINF(-1)	0.265328	0.158280	1.676325	0.1101
LNINF(-2)	-0.266836	0.116784	-2.284870	0.0340
LNM2_	-1.466758	0.597698	-2.454010	0.0239
LNM2_(-1)	3.153387	0.754666	4.178523	0.0005
LNM2_(-2)	-1.290085	0.703674	-1.833357	0.0825
LNER	0.270677	0.207829	1.302402	0.2083
LNINT	0.583130	0.557497	1.045977	0.3087
LNY	-1.583301	0.614562	-2.576309	0.0185
LNGEX	0.090045	0.508622	0.177037	0.8614
LNGEX(-1)	-0.154040	0.626345	-0.245935	0.8084
LNGEX(-2)	1.115946	0.454739	2.454034	0.0239
LNTO	0.716324	0.527118	1.358943	0.1901
LNTO(-1)	-1.528614	0.405032	-3.774056	0.0013
C	37.17909	15.01218	2.476594	0.0228

R-squared	0.865180	Mean dependent var	3.007747
Adjusted R-squared	0.772936	S.D. dependent var	0.617562
S.E. of regression	0.294276	Akaike info criterion	0.687821
Sum squared resid	1.645373	Schwarz criterion	1.322703
Log likelihood	2.650950	Hannan-Quinn criter.	0.901440
F-statistic	9.379164	Durbin-Watson stat	2.139277
Prob(F-statistic)	0.000011		

*Note: p-values and any subsequent tests do not account for model

ARDL Bounds Test
Date: 09/15/16 Time: 12:32
Sample: 1982 2014
Included observations: 33
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.779907	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

ARDL Cointegrating And Long Run Form

Dependent Variable: LNINF
Selected Model: ARDL(2, 2, 0, 0, 0, 2, 1)
Date: 09/15/16 Time: 12:32
Sample: 1980 2014
Included observations: 33

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINF(-1))	0.266836	0.116784	2.284870	0.0340
D(LNM2_)	-1.466758	0.597698	-2.454010	0.0239
D(LNM2_(-1))	1.290085	0.703674	1.833357	0.0825
D(LNER)	0.270677	0.207829	1.302402	0.2083
D(LNINT)	0.583130	0.557497	1.045977	0.3087
D(LNY)	-1.583301	0.614562	-2.576309	0.0185
D(LNGEX)	0.090045	0.508622	0.177037	0.8614
D(LNGEX(-1))	-1.115946	0.454739	-2.454034	0.0239
D(LNTO)	0.716324	0.527118	1.358943	0.1901
CointEq(-1)	-0.691508	0.195306	-5.127900	0.0001

Cointeq = LNINF - (0.3959*LNM2_ + 0.2703*LNER + 0.5823*LNINT
-1.5809*LNY + 1.0504*LNGEX -0.8111*LNTO + 37.1231)

Long Run Coefficients

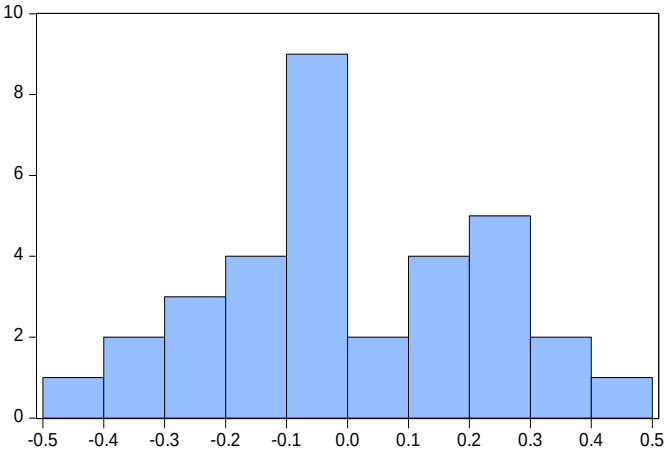
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM2_	0.395948	0.521354	0.759460	0.0469
LNER	0.270269	0.225208	1.200085	0.0449
LNINT	0.582252	0.515082	1.130406	0.0724
LNY	-1.580918	0.701348	-2.254114	0.0362
LNGEX	1.050367	0.651511	1.612200	0.0234
LNTO	-0.811068	0.538505	-1.506148	0.1485
C	7.123118	7.018610	2.181325	0.0419

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.129769	Prob. F(2,17)	0.8792
Obs*R-squared	0.496232	Prob. Chi-Square(2)	0.7803

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.125024	Prob. F(13,19)	0.3972
Obs*R-squared	14.35333	Prob. Chi-Square(13)	0.3494
Scaled explained SS	3.501955	Prob. Chi-Square(13)	0.9954



Series: Residuals
Sample 1982 2014
Observations 33

Mean	4.21e-16
Median	-0.024903
Maximum	0.490780
Minimum	-0.458446
Std. Dev.	0.226755
Skewness	0.139025
Kurtosis	2.472002
Jarque-Bera	0.489628
Probability	0.782850

Ramsey RESET Test
Equation: UNTITLED
Specification: LNINF LNINF(-1) LNINF(-2) LNM2_ LNM2_(-1) LNM2_(-2) LNER LNINT LNY LNGEX LNGEX(-1) LNGEX(-2) LNTO LNTO(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.398613	18	0.1789
F-statistic	1.956118	(1, 18)	0.1789

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.161281	1	0.161281
Restricted SSR	1.645373	19	0.086599
Unrestricted SSR	1.484092	18	0.082450

MODEL 4

Dependent Variable: LNINF
Method: ARDL
Date: 09/15/16 Time: 12:36
Sample (adjusted): 1983 2014
Included observations: 32 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (3 lags, automatic): LNMPR LNER LNINT LNY LNGEX LNTO
Fixed regressors: C
Number of models evalulated: 12288
Selected Model: ARDL(1, 3, 0, 0, 2, 0, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*

LNINF(-1)	0.082616	0.158706	0.520563	0.6098
LNMPR	0.127377	0.434706	0.293018	0.7733
LNMPR(-1)	-0.468820	0.413506	-1.133768	0.2736
LNMPR(-2)	-0.774782	0.360837	-2.147182	0.0474
LNMPR(-3)	-0.972875	0.368698	-2.638673	0.0179
LNER	-0.694363	0.239452	-2.899797	0.0104
LNINT	3.581316	0.949862	3.770355	0.0017
LNY	0.420565	3.533053	0.119037	0.9067
LNY(-1)	-9.972218	5.096964	-1.956501	0.0681
LNY(-2)	9.503965	3.367790	2.822018	0.0123
LNGEX	1.140152	0.583549	1.953825	0.0684
LNTO	-0.168261	0.689298	-0.244106	0.8103
LNTO(-1)	0.435310	0.617971	0.704419	0.4913
LNTO(-2)	-0.122783	0.564447	-0.217528	0.8305
LNTO(-3)	1.143050	0.417419	2.738378	0.0146
C	-10.31790	14.76357	-0.698876	0.4947

R-squared	0.892588	Mean dependent var	3.004727
Adjusted R-squared	0.791888	S.D. dependent var	0.627196
S.E. of regression	0.286122	Akaike info criterion	0.642058
Sum squared resid	1.309855	Schwarz criterion	1.374926
Log likelihood	5.727077	Hannan-Quinn criter.	0.884983
F-statistic	8.863900	Durbin-Watson stat	1.936349
Prob(F-statistic)	0.000041		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 09/15/16 Time: 12:37
Sample: 1983 2014
Included observations: 32
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	5.336513	6

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

ARDL Cointegrating And Long Run Form
Dependent Variable: LNINF
Selected Model: ARDL(1, 3, 0, 0, 2, 0, 3)
Date: 09/15/16 Time: 12:38
Sample: 1980 2014
Included observations: 32

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNMPR)	0.127377	0.434706	0.293018	0.7733
D(LNMPR(-1))	0.774782	0.360837	2.147182	0.0474
D(LNMPR(-2))	0.972875	0.368698	2.638673	0.0179
D(LNER)	-0.694363	0.239452	-2.899797	0.0104
D(LNINT)	3.581316	0.949862	3.770355	0.0017
D(LNY)	0.420565	3.533053	0.119037	0.9067
D(LNY(-1))	-9.503965	3.367790	-2.822018	0.0123
D(LNGEX)	1.140152	0.583549	1.953825	0.0684
D(LNTO)	-0.168261	0.689298	-0.244106	0.8103
D(LNTO(-1))	0.122783	0.564447	0.217528	0.8305
D(LNTO(-2))	-1.143050	0.417419	-2.738378	0.0146
CointEq(-1)	-0.717384	0.158706	-5.780392	0.0000

Cointeq = LNINF - (-2.2772*LNMPR -0.7569*LNER + 3.9038*LNINT
-0.0520*LNY + 1.2428*LNGEX + 1.4032*LNTO -11.2471)

Long Run Coefficients

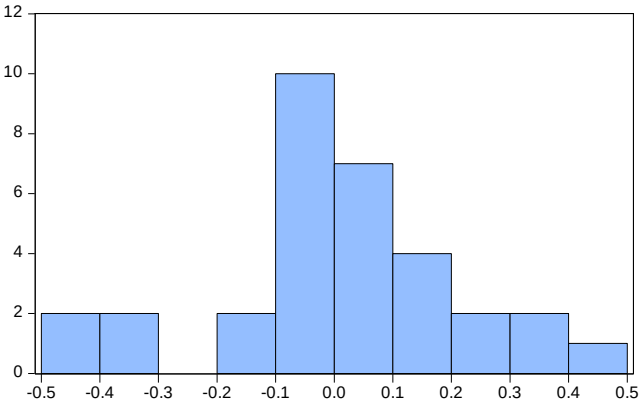
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNMPR	-2.277237	0.827771	-2.751048	0.0142
LNER	-0.756895	0.310108	-2.440747	0.0267
LNINT	3.903837	1.267163	3.080770	0.0072
LNY	-0.051983	0.640672	-0.081138	0.9363
LNGEX	1.242830	0.728168	1.706791	0.1072
LNTO	1.403247	0.784121	1.789580	0.0925
C	5.247094	6.564525	-0.678987	0.0268

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.803172	Prob. F(2,14)	0.4675
Obs*R-squared	3.293726	Prob. Chi-Square(2)	0.1927

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.467759	Prob. F(15,16)	0.2414
Obs*R-squared	22.34261	Prob. Chi-Square(15)	0.4991
Scaled explained SS	5.761254	Prob. Chi-Square(15)	0.9835



Series: Residuals
Sample 1983 2014
Observations 32

Mean	-1.78e-14
Median	0.000116
Maximum	0.407990
Minimum	-0.449704
Std. Dev.	0.205556
Skewness	-0.140563
Kurtosis	3.062876
Jarque-Bera	0.110647
Probability	0.946179

Ramsey RESET Test
Equation: UNTITLED
Specification: LNINF LNINF(-1) LNMPR LNMPR(-1) LNMPR(-2) LNMPR(-3) LNER LNINT LNY LNY(-1) LNY(-2) LNGEX LNTO LNTO(-1) LNTO(-2) LNTO(-3) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.751239	15	0.4641
F-statistic	0.564361	(1, 15)	0.4641

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.047495	1	0.047495
Restricted SSR	1.309855	16	0.081866
Unrestricted SSR	1.262360	15	0.084157