THE RELATIONSHIP BETWEEN FISCAL DEFICIT, MONEY GROWTH AND INFLATION: THE CASE OF ZIMBABWE

BY

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DEDICATION

To my late father Friday Zuze
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ABSTRACT

The aim of the study is to investigate the relationship between budget deficit, money growth and inflation in Zimbabwe for the period 1980-2007. This study stands as a basis of building blocks for future policy analysis by reflecting errors of the past. The study employs Vector Auto Regression (VAR) model coupled with variance decomposition and impulse response functions to analyze the relationship. Before estimation is done the variables are tested for unit root using the Augmented Dickey-Fuller (ADF) test. The ADF test results reveal that budget deficit is integrated of order one whilst money supply growth and inflation are integrated of order two. The regression results reveal that there is a positive relationship between budget deficit and money growth and also a positive relationship between money growth and inflation. This supports the Sargent and Wallace (1981) hypothesis. The policy recommendations comprise of elements of both the fiscal policy and the monetary policy. The fiscal authorities should strengthen fiscal framework, display a high sense of transparency in the fiscal operations and enhance strategies for better government expenditure. Also the central bank should use a tight monetary policy to compliment fiscal policy.
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LIST OF ACRONYMS

ADF Augmented Dickey Fuller
ARDL Autoregressive Distributive Lag Model
CGE Computable General Equilibrium
DRC Democratic Republic of Congo
ESAP Economic Structural Adjustment Program
FTPL Fiscal Theory of the Price Level
GDP Gross Domestic Product
IMF International Monetary Fund
MH Monetarist Hypothesis
RBZ Reserve Bank of Zimbabwe
SVAR Structural Vector Autoregressive
VAR Vector Autoregressive
VECM Vector Error Correction Model
ZIMPREST Zimbabwe Program for Economic and Social Transformation
ZIMSTAT Zimbabwe Statistics Agency
CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Introduction

Fiscal policy plays a fundamental role in an economy as economies all over the world seek to influence the level of aggregate demand with the intention of achieving macroeconomic objectives of price stability, full employment and economic growth. The effectiveness of fiscal policy is measured by the magnitude of total government expenditure and total government revenue. Fiscal deficit arises when total government expenditure exceeds its total revenues.

Government expenditure consists of current expenditure and capital expenditure. Current expenditure includes government consumption and transfers to the population. Capital expenditures are expenditures that create future benefits and these include expenditures on fixed assets like infrastructure and expenditures that add value to existing fixed assets. Government revenues include tax collection and other levies. Fiscal deficits can be financed through domestic borrowing, foreign borrowing and by seigniorage (printing money). Financing of fiscal deficit by printing money can create inflationary pressure in the economy, bond financing of fiscal deficit leads to a rise in interest rates and in turn crowding out private investment and the external financing of fiscal deficit can cause balance of payments crisis (Mohanty, 2012). This study will solely focus on monetary financing of fiscal deficits.

The relationship between fiscal deficit, money growth and inflation is a widely debated issue and remains inconclusive given the conflicting results of empirical studies. Some researchers argue that monetary financing of budget deficit is inflationary and these include Bakare et al (2014), Ahmed and Chaudhary (1995), Anorou (2003) and Makochekanwa (2008). While other researchers such as Hoang (2014), Barnhart and Darrat (1988), Mukhtar and Zakaria (2010) and Ashra et al (2004) argued that monetary financing of budget deficit is not inflationary. Also theoretical underpinnings convey different views on the relationship between budget deficit, money growth and inflation. These include the monetarist hypothesis, based originally on the quantitative theory of money which postulates that inflation is always and everywhere a
monetary phenomenon (Friedman, 1963) and the Fiscal Theory of the Price Level (FTPL) also known as the quantitative theory of government debt which links fiscal and monetary policy through the government budget constraint such that the price level is determined by the government debt and fiscal policy alone with monetary policy playing an indirect role. Thus, there is no role for money in the determination of price (Woodford, 1995). In contrast, the New Keynesian Theory with is based on dynamic general macroeconomic models with imperfect competition argues that there is no relationship between budget deficit, money growth and inflation.

Developing countries particularly in Africa face high fiscal deficits due to expenditures directed on investment in the economy as well as increases in recurrent expenditures, unbudgeted spending and a reliance on the budget to finance election activities. For example Zimbabwe’s budget deficit escalated to 23.8% in 1998 due to its involvement in the Democratic Republic of Congo (DRC) war with the funds not budgeted for. Efforts to reduce fiscal deficits through fiscal adjustment programmes mostly implemented in line with the International Monetary Fund’s (IMF) recommendation have helped some countries to reduce their deficits. Zimbabwe has been experiencing high budget deficits since independence in 1980 as a result of policies aimed at social reconstruction, infrastructure and economic development and drought induced expenditures. The rising magnitude has become the central issue to many researchers as they view that high budget deficits fuel inflation particularly in the absence of external budgetary support and declining non-banking budget financing. This study seeks to investigate the relationship between fiscal deficit, money growth and inflation in Zimbabwe for the period 1980 to 2007 using Vector Autoregressive (VAR) approach.

1.1. Background to the study

The trends in Zimbabwe’s economic performance from 1980 to 2007 can be analysed by focusing on three economic periods. The three phases include the post-independence era (1980 - 1990), economic reforms era (1990 -1999) and the crisis period of (2000-2007) (Zimbabwe Report, 2009). These three periods have different characteristics depending on the social, economic and political environments adopted during each period.
Post-independence Period: 1980-1990

The new government after Zimbabwe gained its independence in 1980 undertook massive capital expenditure on infrastructure development like roads, schools and hospitals. The purpose of this was to address the lack of these basic facilities to the majority of Zimbabwe as most of these services were previously available to the small white minority. Total expenditure reached 42% against total revenue of 31% in 1984. These expenditures generated high budget deficits in that same year of 11%. Also the continued increase in public investment with the purpose of paving the way for sustained growth through the provision of infrastructure led to increases in deficits.

Figure 1: Budget Deficit as a % of GDP

![Budget Deficit Chart]

Source: Author’s own computation using data from RBZ

The budget deficit was on an increasing trend from 1980 to the highest point of 11.1% in 1984. The average budget deficit for the first decade of the post-independence era was 7.4%. From the period 1980 to 1983 inflation was on an increasing trend. As from 1983 inflation stated fluctuating till the end of the first decade after independence. Inflation in this decade was high but relatively stable ranging from 7.0% to 18%. Financing of budget deficits which was solely done through non-bank financing and foreign financing constituted over 50% and this minimized potential inflationary impact of fiscal deficit from monetization with inflation averaging 12% during this decade. The growth rate of money supply was relatively stable within the range of
10% - 25% and was largely in line with the growth rate of the economy as shown in figure 2. The average money supply growth for the period was 18.4%.

**Figure 2: Money Growth as a % of GDP and Inflation (1980-2007)**

Source: Author’s own computation using data from World Bank

**Economic reforms era (1990 -1997)**

The Zimbabwean government in 1991 embarked on the Economic Structural Adjustment Program (ESAP) as a result of pressure from the Bretton Woods institutions IMF and World Bank which among other things emphasized fiscal policy reforms. Under ESAP, some state enterprises were privatized and trade was liberalized, it was an objective of the policy to reduce the high rising budget deficit and inflation to single digits. Also the reform was mainly aimed at reducing government expenditure particularly the recurrent expenditures and redirecting resources to the productive sectors. As a result budget deficit was targeted to reach 5% of GDP by 1994/1995.

Inflation, however, still spiraled upwards contrary to the reform program’s plan as the budget deficit remained high. The program faced challenges of drought in 1992 which caused an increase in budget deficit due to increased imports to supplement supply for the nation that was
hit by the natural disaster. ESAP was a five year plan and after its life cycle elapsed the government introduced another economic blue print which was the Zimbabwe Program for Economic and Social Transformation (ZIMPREST) which was aimed at fulfilling the objectives of ESAP. Fiscal deficits after ESAP were non-developmental as they were not to the interest of the country. Massive unbudgeted expenditures were experienced in this period and these include unbudgeted government expenditures of 1997 to pay for the war veteran gratuities. This caused the local currency to depreciate by more than 15% to the US dollar on Friday 14 November 1997 popularly known in Zimbabwe’s history as the black Friday. Another unbudgeted expenditure which created severe fiscal pressure and shock in business confidence was Zimbabwe’s involvement in the DRC war in 1998. This caused deficits to reach a peak of 24% by 2000 as shown in figure 1. To cause more harm these unbudgeted deficits were financed by seignorage and money supply growth started to increase as from 1998. According to Cagan (1956) a country is said to be in hyperinflation if the month on month rate of inflation equal or exceeds 50%. In March 1999 Zimbabwe entered into hyperinflation with rate of 52.5% (RBZ, 2000).

The crisis period: 2000-2007

The implementation of the land reform program in 2000 adversely affected the supply side of the economy as it resulted in output declining from the commercial sector leading to a decline of about 30% in the value of exports. Further deterioration of the economy was reflected by the government’s fiscal deficit which continued to increase reaching 24% of GDP in 2000. Money growth and inflation were over 100% by the end of 2001 as shown by the increasing trend in figure 2. The economy faced economic challenges and economic decline characterized by hyperinflation resulting in a decline of 44.4% in economic activities during the period 2000 to 2007 (Chakanya, 2008). One of the major factors which contributed to the continued decline in the economy was the continuation by government to run budget deficits, largely financed by domestic borrowing and the monetization which lead to high money supply growth and inflation.

Fiscal expenditure continued to increase after 2003 as interactions put in place by the central bank actually raised quasi fiscal expenditure to levels exceeding the budget. Expenditures on elections and introduction of senators, land reform program, were the main factors influencing high expenditure overruns in 2000 to 2007.
From figure 1 and figure 2 it is clear that inflation, budget deficit and money supply growth were on a fluctuation trend from 1980-1997. As from 1999 the crisis period money supply and inflation started to skyrocket with budget deficits continuing with the fluctuating trend up to 2007. However this simple trend analysis cannot give detailed inference on the relationship between these variables hence the use of Granger causality and VAR.

1.2. Statement of the Problem

The relationship between budget deficit, money growth and inflation is a long standing debate in both theoretical and empirical literature. It is centered on four theories. The Monetarist Hypothesis argues that inflation is always and everywhere a monetary phenomenon thus an increase in money growth increases inflation. Fiscal Theory of the Price level and Sargent and Wallace (1981) hypothesis which are based on the intertemporal government budget constraint postulates that both the fiscal and the monetary side have an effect on inflation. In contrast, the New Keynesian Theory argues that there is no relationship at all between these variables.

Empirical literature also argued on different dimensions. According to Serban (2002) the dispute on the subject is based on which of the two equations between money demand equations or government budget constraint determines the price level. On the contrary Ekannayake argued that the link of the variables becomes weaker in the absence of sector wage expenditure and thus posited that wage expenditure is a key factor in explaining deficit-inflation relationship. Nevertheless both studies found a positive link from budget deficit to money growth to inflation. There are some other extreme cases in which budget deficit, money growth are inversely related to inflation. Tiwari and Tiwari (2011) argued that the inverse relationship between money supply and inflation can be caused by deficient and inefficient social programs or disequilibrium between public budget and budget deficits which result from government’s wrong policies.

Zimbabwe since independence has been facing high budget deficits which have derailed the growth of the economy because of the way they are financed. Specifically, fiscal deficits in Zimbabwe for the years 1997 have been financed through money printing which has caused high rates of inflation. Rising inflation causes dislocations in the economy and strains social and political relationships as people scrambled to maintain their standards of living. The search for
an effective anti-inflation policy lies in the correct diagnosis of the underlying causes of inflation.

Given the arguments that have followed the challenges with deficit financing and its implications for the economy, the critical question is whether government’s overspending which causes budget deficit necessarily creates inflationary pressure in Zimbabwe through money supply growth. Also this has brought about a concern on whether budget deficits really cause inflation or it is how they are financed that increases inflation. The analysis can only be done by econometrically investigating the relationship between these variables. Thus, there is need to investigate whether the trivariate relationship holds in Zimbabwe and also to establish the direction of causality.

1.3. Objectives of the study

The broad objective:

- To empirically investigate the relationship between fiscal deficit, money growth and inflation in Zimbabwe.

Specific objectives:

- To examine whether fiscal deficit leads to inflation in Zimbabwe.
- To find out the nature of the relationship between fiscal deficits and money growth in Zimbabwe.
- To investigate the relationship between money growth and inflation in Zimbabwe.

1.4. Research Questions

- Does fiscal deficit lead to inflation in Zimbabwe?
- What is the relationship between fiscal deficit and money growth in Zimbabwe?
- What is the relationship between money growth and inflation in Zimbabwe?

1.5. Hypothesis of the study:

- Fiscal deficit has a significant and positive effect on inflation in Zimbabwe.
- Money supply increases with increase in fiscal deficit in Zimbabwe.
- Money supply growth positively affects inflation in Zimbabwe.
1.6. Justification of the study

The return of the Zimbabwean dollar in future cannot be refuted. Also the three decades Zimbabwe was in after independence cannot be ignored mainly due to the loss of value of the Zimbabwean dollar in 1997. This caused inflation to increase when the government started printing money which caused dislocations in the economy and strained social and political relationships people try to maintain their living standards. This study stands as a basis of building blocks for future policy analysis by reflecting errors of the past analysis. Thus, the study investigates the relationship between budget deficit, money growth and inflation in Zimbabwe using annual data for the period 1980-2007.

Although a number of studies have been done on the topic especially in developing countries, empirical evidence on the relationship between budget deficit, money growth and inflation is limited in Zimbabwe. The financing of budget deficit and its impact on the economy is an important issue to investigate for analyzing the monetary policy effects and fiscal policy effects on an economy. Also by analyzing the effects of fiscal deficit on inflation the study will be significant to policy makers in strengthening fiscal framework and enhancing strategies for better government expenditure.

1.7 Organization of the rest of the study

The study consists of five chapters. Chapter two consists of an analysis of the theoretical and empirical literature. In chapter three the empirical model is formulated while chapter four consists of the empirical results and economic interpretation. The last chapter gives a conclusion and possible policy recommendations.
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The relationship between the budget deficit, money growth and inflation has attracted great interest in theoretical and empirical literature in both developing and developed countries. This chapter seeks to provide a review of both theoretical and empirical literature carried out by other scholars on the trivariate relationship.

2.1 Theoretical Literature Review

The theoretical literature review of the trivariate relationship between budget deficit, money growth and inflation is based on four hypotheses which consist of the Monetarist Hypothesis, Fiscal Theory of the Price Level, Sargent and Wallace Hypothesis and The New Keynesian Hypothesis. In order to understand the relationship between budget deficit, money supply and inflation it is of great importance to first analyse the transmission mechanism of inflation before looking at the four controversial theories.

2.1.1 The transmission mechanism of inflation

Figure 3 postulates the transmission mechanism of inflation. If public sector deficits are financed through seignorage, money supply in the country will increase. Assuming an open economy with flexible exchange rates and imperfect capital mobility, rational economic agents will forecast that monetary financing of budget deficit will be inflationary. Thus, they will sell local currency and this will cause depreciation of the exchange rate. The depreciation of the exchange rate will cause an increase in prices of imported products thus leading to an adjustment process of wages and of prices. This will cause an increase in the consumer prices of local products attributable to the increase of production costs in turn leading to acceleration in inflation.
2.1.2 Monetarist Hypothesis (MH)

The monetarist hypothesis is based on the quantity theory of money. It postulates that real economic activities require a certain desired level of real money balances and price level which is controlled by the nominal money supply. Given that the nominal money supply is determined exogenously, the price level is determined as the unique level of prices that will make the purchasing power of money supply equal to the desired level of real money balances (Bakare et al, 2014). This means that inflation will not be rigid and has to be exogenously influenced by non-adjusted money supply. Thus, the central bank seeks to ensure the quantity of money that agents need for their transactions. In the case that the nominal money supply differs from the desired real balances at a given price level, this will translate to changes in that price level. Hence, the price level has to be fully flexible and determined exclusively by the exogenous nominal money supply.

The MH hypothesis posits that the nominal money supply could change if seignorage is used to finance budget deficit or when the central bank purchases interest bearing government debt. The
budget deficit and its financing through printing money are assumed to be exogenously determined by monetary authority. This therefore means that money supply growth would be dominated by the government’s financing requirements. Thus the MH hypothesis holds when money supply growth and government budget deficit are weakly exogenous. The hypothesis implies that inflation is expected to be positively correlated to money supply growth.

2.1.3 The Sargent and Wallace (SW-UMA) Hypothesis

Sargent and Wallace (1981) explained the “Unpleasant Monetary Arithmetic” using the government’s intertemporal budget constraint. They postulated that under certain circumstances monetary authority’s control of inflation may be limited and their argument was that budget deficits need to be weakly exogenous in the long term money growth equation. Thus, monetary policy plays a passive role and the central bank may not be able to control the price level. They argued that inflation is due to fiscal policy since the fiscal authorities compel the monetary authorities to finance its deficits through seigniorage. The hypothesis postulates that tight monetary policy is not feasible under the regime of fiscal dominance.

Following Daniel (2004) the SW-UMA hypothesis is given by:

\[
(1 + i_{t-1})b_{t-1} = \sum_{t=0}^{\infty} \left( s_t + \frac{\mu_t}{1+\mu_t} m_t \right) R_{0,t} + \lim_{T \to \infty} b_T R_{0,T} \]

\[
R_{0,t} = \prod_{0}^{t-1} \left( \frac{1}{1+i_j} \right) \]

\[
1 + r_j = \left( 1 + i_j \right) \frac{P_j}{P_{j+1}} = \frac{1+i_j}{1+\pi_{j+1}} \]

\[
\frac{\mu_t}{1+\mu_t} m_t \]

where equation (4) represents seignorage.

\( m_t \) represents money balances, \( b_T \) represents bonds, \( P_j \) is the price level, \( i_{t-1} \) is the nominal interest at the end of period \( t-1 \).

Without fiscal adjustment, a decrease in the growth rate of money now requires higher seignorage revenue in the future to stabilize growing public debt. SW also posits that tight monetary policy now in the form of a reduction in the rate of growth of money supply will lead to less inflation now but more inflation later. The SW hypothesis thus posits that causality runs from government budget deficit to money supply and then from money supply to price level.
2.1.4 The Fiscal Theory of the Price Level (FTPL)

Like the SW hypothesis, FTPL links fiscal and monetary policy through the government budget constraint such that the price level is determined by the government debt and fiscal policy alone with monetary policy playing an indirect role. However the only difference between the two is that in the FTPL government bonds are assumed to be nominal instead of real.

The government budget constraint can be expressed in real terms as

\[ m_t + b_t = (1 + i_{t-1}) \left( \frac{p_{t-1}}{p_t} \right) (m_{t-1} + b_{t-1}) - s_t - i_{t-1} \left( \frac{p_{t-1}}{p_t} \right) m_{t-1} \]  

(5)

The government budget constraint is satisfied when the discounted value of government’s future primary surplus is greater or equal to the current nominal value of public debt. The government budget constraint is assumed to be an equilibrium condition and future path of revenue and primary expenditure is decided exogenously by the fiscal authority. If the discounted value of primary surplus is lower than the current nominal value of public debt the price level has to increase to equalize the government budget constraint condition.

Following Daniel (2004) and imposing \( \lim_{T \to \infty} (m_t + b_T) R_{0,T} = 0 \) yields the FTPL given by

\[ \frac{(1+i_{t-1})^{R_{t-1}+M_{t-1}}}{p_0} \sum_{t=0}^{\infty} \left( S_t + \frac{i_{t}}{1+i_{t}} \right) R_{0,t} + \lim_{T \to \infty} (m_T + b_T) R_{0,T} \]  

(6)

The FTPL concentrates on the effect of surplus reduction on the price level (Chukwu, 2013). The price level therefore becomes the exclusive adjustment variable to maintain the condition. There is virtually no role for money in the determination of prices in a non-Ricardian world. In this non-Ricardian world, inflation is a symptom of too much money chasing too few goods (Lazano, 2008). The FTPL postulates that causality runs from government budget deficit to change in price level and then to change in money growth.

2.1.5 The New Keynesian Theory

The relationship between budget deficit, money supply and inflation is derived from a system of aggregate supply and aggregate demand equations. The demand equation is the forward looking IS curve whilst the supply equation relates to the Phillips curve based on the maximization of the firm’s profits. This model assumes a money growth equation which is dependent on inflation that
is weakly exogenous. The theory argues that there no relationship between budget deficit, money growth and inflation.

2.2 Review of Empirical Studies

The empirical literature on the inflationary effects of budget deficits has been subject to extreme controversy with different researchers around the world producing mixed results. There are some remarkable papers that found no relationship at all between budget deficit, money growth and inflation. As postulated in theoretical literature above, this is consistent with the New Keynesian approach. Several other papers found that there is a positive relationship between inflation and budget deficits. There are also few studies that produced contradicting results thus budget deficit being negatively related to inflation, an argument postulated in the “Tanzi effect.” In light of these different empirical views, this study will divide the empirical literature into three general schools of thought.

The Monetarist Hypothesis mostly postulates that deficits are inflationary when monetized. The hypothesis posits that if the growth rate of money supply is faster than the growth of real output then inflation rises. A number of empirical researches were in support of the monetarist hypothesis that inflation is everywhere a monetary phenomenon.

Using quarterly data for the period 1995-2012, Hoang (2014) concluded that money growth has a positive impact on inflation while budget deficit has no impact on money growth and therefore inflation. Similar results were produced by Mukhtar and Zakaria (2010) who did a study for Pakistan using quarterly data for the period 1960-2007. They argued that there is lack of empirical support for the accommodation hypothesis in Pakistan. The results show that financing budget deficit with other non-monetary instruments will reduce its impact on inflation as empirically investigated in Pakistan which used non-bank debt instrument to finance deficit.

Insah and Ofori-Boateng (2013) did a study in Ghana on model of price determination and fiscal policy. The study found significant effect of money supply and deficit on inflation in Ghana. However, to the contrary deficit was found to exert a negative effect on inflation which supports the Patinkin (1965) effect. In support was a study done by Tiwari and Tiwari (2011) who argued that the inverse relationship between money supply and inflation was because of deficient and inefficient social programs or disequilibrium between public budget and budget deficits which
result from government’s wrong policies (Tanzi, 2000). The divergent views show that the relationship between budget deficit, money growth and inflation is yet inconclusive. This study seeks to contribute also to the debate by establishing which theory holds in the Zimbabwean case.

The second division of empirical literature is grouped under the Fiscal Theory of the Price Level and the Sargent and Wallace (1981) hypothesis which postulates that deficits cause long term inflation with money growth playing a passive role. In support, the Sargent and Wallace unpleasant monetarist hypothesis posits that the relationship runs from budget deficit to money growth and from money growth to inflation with monetary policy playing a passive role.

Catão and Terrones (2003) found a strong positive relationship between fiscal deficits and inflation among high inflation and developing countries, but not among low-inflation economies. They argued that the limited success of empirical studies in explaining the deficit-inflation nexus is because of the failure to take into account the nonlinearity of the correlation between fiscal deficit and inflation. They also argued that scaling deficit by GDP is empirically relevant since it introduces nonlinearity in the model thus allowing a given change in the deficit to GDP ratio to have strong impact in higher inflation economies. Also their argument for the use of ARDL model was based on the fact that it mitigates any contemporaneous causation from the dependent to the independent variable since all right hand side variables enter in the equation with a lag Ekanayake (2012), Anayochukwu (2012) and Afrin (2013) were of the same view and further posit that ARDL is logical to use in the case of finite sample as it provides precise estimators and valid t values.

Koyuncu (2014) did a study on the causality network between budget deficit, money growth and inflation in Turkey using quarterly data for the period 1987-2013. He found a bi-directional causality between budget deficit and inflation with money supply playing a positive passive role to cause inflation. Favero and Spinelli (1999) did a study in Italy with the objective of investigating the fiscal dominance model of the monetary history of Italy which was proposed by Spinelli and Fratianni (1996). They estimated a small structural linear econometric model for the period 1862-1994. Their results confirmed the existence of a link between government deficit and money growth and a long run relationship between the quantity of money and the price level thus the fiscal dominant hypothesis holds in Italy. Also in support of the fiscal dominance
hypothesis was a study done by Ammama et al (2011) in Pakistan for the period 1960-2010. They further objected that supply side factors such as import price inflation and wage growth also play an important role. Afrin (2013) also concluded that both the demand side and supply side policies are important to control inflation in the long run.

Studies also based their arguments on the proxies to use for money growth and inflation. For example, Favero and Spinelli (1999) used M2 as a proxy for money supply and they argued that inflation has a more stable relationship with wider monetary aggregates such as M2. Also Hallman et al (1991) was of the same opinion. However, Kasarawoglou and Katrakilidis (1993) argued for the use of high powered money because if the central bank monetizes the deficit it expands high powered money which has to be highly correlated with M1 if the money multiplier is stable. Due to lack of data this study however will be constrained to using M2.

According to Serban (2002) the way in which fiscal deficits affect inflation differs according to theory one chooses, that is either monetarist or the fiscal theory of the price level. He further argued that the dispute on the subject is also based on which of the two equations determines the price level, either money demand equation or government budget constraint. For this reason he did a study to confirm these two propositions using quarterly data for the period 1991-2001 and an error correction model. He concluded that an increase in the budget deficit leads to increase in inflation as postulated by the fiscal theory of the price level. Like Catão and Torrenes (2003), Serban (2002) was also in support of the nonlinear relationship between budget deficit and inflation as he argued that real money supply shrinks with rising inflation as a result of reduced confidence in national currency. However, Pekarski (2008) argued that the relationship between budget deficit, seignorage and inflation may not always be strong and positive because the economy maybe operating either in the efficient side of the inflation Laffer curve where an increase in the budget requires a high steady state rate of inflation or the economy may be operating on the wrong side where a high budget deficit is associated with a lower steady state rate of inflation. In line with this proposition the study concluded that recurrent outbursts of extreme inflation are explained by the hysterics effect of public finance were shifts between moderately high and extremely high inflation (hyperinflation) often occur without a visible deterioration in public finance.
Ekannayake (2012) employed an ARDL model for the period 1959-2008 in studying the link between fiscal deficit and inflation in conjunction with public sector wages in Nigeria. He concluded that a one percentage change in fiscal deficit to narrow money is associated with an 11% increase in inflation. He argued that the link becomes weaker in the absence of sector wage expenditure and thus posited that wage expenditure is a key factor in explaining deficit-inflation relationship. In support, Buffie (1999) concluded that public sector wage may underlie the weak empirical correlation of the deficit and inflation. However, Lozano (2008) argued that the relationship between the variables could vary on the degree of independence of the central bank and the type of monetary policy regime. Kliem et al (2013) also justified this by postulating that the low frequency relationship is strongly related to the conduct of monetary policy and its interaction with fiscal policy.

Awe and Shina (2012) empirically analyzed the nexus between deficit and inflation for the Nigerian economy. The study employed a multistage VAR for the period 1980-2009. They argued that the best method to examine the nexus is to employ a single equation model for money growth and inflation, treating deficits as independent. Other studies which supported this include Makochekanwa (2008) and Solomon and de Wet (2004). The study concluded that there is a unidirectional causality between budget deficit and inflation. Same results were produced by Anayochukwu (2012) using ARDL for the period 1970-2009 in Nigeria.

For studies done in Zimbabwe, Makochekanwa (2008) examined the impact of a budget deficit on inflation using a four variable single equation model for the period 1980-2005. The results revealed that there is a positive relationship between inflation and budget deficit. The study concluded that when budget deficit is monetized, there will be an extremely high correlation between budget deficit and money supply. Jenkins (1997) also did a study on Zimbabwe with the intention of determining how the deficits affected macroeconomic stability during the 1980s. He also intended to determine the impact that the large permanent deficits faced by the nation then, had on the economy in general and on the poor more specifically. Using a Computable General Equilibrium (CGE) real-effects model deficits were found to positively affect inflation when they are monetized.

Acknowledging the works of Jenkins (1997), was Mashakada (2013) who carried a comparative study of Zimbabwe and selected African countries – Botswana, Ghana, Morocco and Zambia.
For the period 1980 to 2008, he examined the macroeconomic effects of fiscal deficits and the contribution of bad governance to macroeconomic instability in the country. He concluded that cumulative fiscal deficits in Zimbabwe since 1980 precipitated macroeconomic instability and fiscal unsustainability thus causing hyperinflation.

Nhavira (2009) analyzed a stable relationship between monetary aggregates and macroeconomic variables such as output and prices in Zimbabwe. The relevancy of monetary target M3 for policy formulation was tested using the Granger causality test on annual data for the period 1991-2005. The empirical results suggest that there is a bi-directional causality between inflation and money supply.

Another study in Zimbabwe was done by Sunde (2000). The removal of price controls resulted in the surge in inflation. In response, the policy makers used excessive tight monetary policy to combat inflation, but they failed to reduce it to the desired levels of less that 10%. According to the author, this was an indication that inflation may not always be and everywhere a monetary phenomenon. In other words monetary growth was not the only cause of inflation in Zimbabwe during that time, budget deficits were also a cause of inflation.

Karasawoglou and Katrakilidis (1993) did a study in Greece with the objective of testing whether the accommodation hypothesis holds for the period 1958-1990. They focused on the three broad definitions of money that is high powered money, M1 and M2. The results of the study showed that there is a stable positive long run relationship between deficit, price level and money no matter the definition of money. The results therefore were in support of the accommodation hypothesis and provide evidence that deficits are inflationary when monetized. Further studies were done in Greece by Hondroyamis and Papapetrou (1997) but their results did not find any relationship between inflation and budget deficit. However in contrast, Darrat (2000) reconsidered the inflationary effects of budget deficit using a different model from the one used by Hondroyamis and Papapetrou (1997). He used the Johansen-Juleus cointegration approach and argued that the previous model used by Hondroyamis and Papapetrou (1997) was mis-specified. He pointed out problems associated with the previous study results that prices were second difference stationary but when undertaking the cointegration test did with first difference. Darrat (2000) results were similar to the one by Kasarawoglou and Kitrakilidis (1993) as he found that besides money, higher deficits played a significant role in Greek inflation.
In Pakistan, Chaudhary and Ahmad (1995) investigated the relationship between budget deficit, money growth and inflation using the two stages least square methodology for three different periods, which are 1973-92, 1973-82 and 1982-92. Firstly they tested the relationship for the whole period of 1973-92 and found that there is a positive relationship between budget deficit, money supply and inflation which supports the accommodation hypothesis. The model was further tested for two different periods 1973-82 and 1982-92. The reason for the division of the period was the assumption that when there is a balance of payments deficit the only remedy is to adjust foreign reserves. Both periods showed that there was a long run positive relationship between budget deficit, money supply and inflation in Pakistan. They further noted that money supply is not exogenous but it depends on the position of reserves. According to the results of the study it is clear that execution of monetary policy may be determined by the central bank but overall formulation of policy is heavily dependent on the fiscal policy. Thus there is a low impact of budget deficit on inflation in a country with central bank independency.

Chukwu (2013) examined the relationship between budget deficit, money growth and price level in Nigeria for the period 1971-2008. The study found a unidirectional causality running from budget deficit to money supply and then from money supply to price level. In conclusion the study revealed that the Sargent and Wallace (1981) “Unpleasant Monetarist Arithmetic” hypothesis holds in Nigeria. Bakare et al (2014) did a similar study in Nigeria using an Error Correction Model for the period 1975-2012 and concluded that money growth positively affects inflation in the long run. Furthermore, the coefficient of determination of 0.468 indicated that there is a positive linear relationship between inflation (used as the dependent variable) and money growth and budget deficit (independent variables).

Akcay et al (1996) examined budget deficit, money supply and inflation from low and high frequency data for Turkey using both VAR and VEC for the periods 1948-1994 using annual data and 1987-1995 using quarterly data. They found that 1 unit increase in budget deficit increases inflation by 1.59 units. They also investigated whether deficits had a greater impact on inflation during the pro bond financing period of 1948-1985 than during the pre-bond period. The results were that a 1 unit increase in budget deficit under money neutrality will increase long run inflation by 5.67 units. They concluded that in Turkey there was a greater impact of deficit on inflation during pre-bond financing period. This shows that monetary financing of budget
The deficit is inflationary as shown by the pre bond financing period which portrayed a higher impact of budget deficit on inflation.

The last category of the empirical work is based on the New Keynesian hypothesis which contradicts the other three in that there is no relationship between budget deficit, money growth and inflation. There are however a handful of studies in this category.

Tekin-Keru and Ozmen (2003) tested two trivariate relationships one with narrow money and the other with broad money (M2) for the period 1983-1999 using quarterly data. Their results concluded that budget deficit plays no significant role in causing inflation. The study rejected the quantity theory of money which postulates that money growth is exogenous for the evolution of inflation. In contrast they revealed an economy in which money (narrow money) growth and inflation are jointly determined. They further concluded that seignorage is the result of a passive monetary policy of nominal income accommodation rather than cause of inflation. They noted that active contractionary monetary policy may not be feasible in a high inflationary economy because effective monetary control can increase the cost of domestic debt financing.

Srivyal and Venkata (2004) did a study on budget deficits and other macroeconomic variables in India for the period 1970-2002 and found that there is no significant relationship between budget deficit, money supply and CPI. Also Onuorah and Odita (2013) found that there is no significant relationship between budget deficit, money growth and inflation. In support was the study done by Saysombath and Kyophilavong (2014) using the ARDL cointegration method in conjunction with the SVAR whose findings supported the exchange rate led budget deficit hypothesis in Laos.

2.3 Conclusion

Literature review on the trivariate relationship reviews the following points. First, there is inconclusive evidence across countries and time on the relationship between budget deficit, money growth and inflation. Second, budget deficit growth and money supply growth could be inflationary if not properly managed meaning that they are monetary phenomena. Third, there are no previous studies done on the trivariate relationship between budget deficit, money growth and inflation in Zimbabwe, studies focused mostly on bidirectional relationships.
Chapter Three

Research Methodology

3.0 Introduction

This chapter outlines the econometric estimation techniques adopted in this study in investigating the relationship between budget deficit, money growth and inflation. Theoretical and empirical models are presented in this chapter. Justification of variables, including sources of data is also specified in this chapter.

3.1 Theoretical Specification

In order to choose appropriate variables, one may use the long run government budget constraint. The study will follow Solomon and de Wet (2004) framework as presented by Makochekanwa (2008). The framework starts from the government budget constraint as portrayed below:

\[
\frac{B_{t-1}}{p_t} = \sum \frac{1}{r_j} \left( \tau_{t+j} - g_{t+j} + M_{t+j} - \frac{M_{t-1-j}}{p_{t+j}} \right) \]

(1)

where: \( \frac{B_{t-1}}{p_t} = \) Government debt

\( r_j = \) the discount rate

\( \tau_{t+j} = \) total tax revenue

\( g_{t+j} = \) total government expenditure

\( M_t = \) broad money supply

Considering the case where public debt cannot grow implies that the entire budget is ultimately financed through seignorage. Imposing this restriction on public debt obtains the following short run budget constraint:
\[
\frac{B_{t-1}(t)}{p_t} = \tau_t - g + \frac{M_t - M_{t-1}}{p_t} \tag{2}
\]

This can be rewritten as:

\[
\frac{B_{t-1}(t)}{p_t} - \tau_t + g = \frac{M_t - M_{t-1}}{p_t} \tag{3}
\]

The left hand side represents budget deficit formed from fiscal deficit and repayment of public debt with maturity period \(t\) and the right hand side represents seignorage.

Seignorage \((S)\) can be written as a function of inflation and real money supply:

\[
S = f(\pi_t)\frac{M_t}{p_t} \tag{4}
\]

where \(f(\pi_t)\) is reduced form money demand equation.

Considering that seignorage is increasing with the inflation rate and combining equation (3) and (4) one obtain the equation estimated by Catao and Terrones (2001) that explains the inflation rate by the budget deficit and money supply

\[
\pi_t = \beta d_t P_t / M_t^\beta \tag{5}
\]

\(\beta\) is the inverse linear multiplier

\(d_t\) is the budget constraint which is

\[
d_t = T_t - B_{t-1}
\]

\(M/P\) is money supply

3.2 Empirical model specification

In this study, the model specification mirrors the work of Catao and Terrones (2001) and Bakare (2014) with little modification. The specification of the model considers the following variables, rate of Inflation \((INF)\); Budget Deficit \((BD)\), money supply growth (broad money supply, \(M2\)) and per capita real GDP as a control variable. Before estimating the model diagnostic tests like unit root tests, cointegration tests and lag length selection criteria will be done.
3.3 Unit Root Tests

Since it is a time series analysis variables to be used are usually non-stationary. If the variables are not stationary this will lead to spurious regressions in which the estimates are biased and standard errors are large thus leading to high values of $R^2$ statistic. Augmented Dickey Fuller (ADF) unit root testing procedure is to be used to test for stationarity. If the Dickey Fuller statistic is less than the critical value, we may not reject the null hypothesis that the data has a unit root ($\sigma=0$) and conclude that variables are not stationary. On the other hand, if the calculated statistic is greater than the critical value, we conclude that the variable is stationary. If the variables are stationary in levels they are said to be integrated of order 0. If they become stationary after first differencing they are said to be integrated of order 1. In general, if a (non-stationary) time series has to be differenced $d$ times to make it stationary, that time series is said to be integrated of order $d$.

3.4 Granger Causality Test

The concept of causality was proposed by Granger (1969) and Sims (1972) who postulated that the purpose of Granger causality is to identify which variable causes the other. For example given two variables $X$ and $Y$, there is causality between the two variables if lagged values of $X$ predict $Y$. A bi-directional causality exists if lagged values of $Y$ predict $X$ and simultaneously lagged values of $X$ predict $Y$. The rejection of null hypothesis which states that one variable does not Granger cause the other indicates that causality exists between the variables.

3.5 The Vector Autoregressive Model

The study will use a Vector Autoregressive (VAR) model to establish the dynamic relationship between budget deficit, money growth and inflation in which all these variables will be treated as endogenous. The vector autoregressive methodology does not have sound theoretical framework, but nevertheless it can be used to test interdependence relationships among variables (Sims, 1972). Interdependence relationships can be analyzed through the Variance Decomposition and impulse response functions which further support the granger causality tests. After testing for unit root and we find that the variables are integrated of the same order, for example, I(1) then there is need to estimate a Vector Error Correction Model (VECM) and if they are not co-integrated an unrestricted VAR model will be estimated. The results of VAR could be highly
sensitive to the number of lags included for the endogenous variables. This calls for the
determination of an appropriate optimal lag length which can be found by Akaiki Information
Criterion (AIC), the Schwarz Information Criterion (SIC) and the Hannan-Quinn Information
Criterion (HQ)

The VAR model is specified thus:

\[ X_t = \beta_0 + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \ldots + \beta_p X_{t-p} + \mu_t \] (14)

where

\[ X_t = (\text{Budget Deficit}_t, \text{Money Growth}_t, \text{per capita real GDP}, \text{Inflation}_t) \] is a 4×4 vector of
variables, \( \beta_1 \ldots \ldots \beta_p \) are 4×4 matrices of coefficients and \( \mu_t \) is a vector of error terms

3.5.1 Variance Decomposition.

The variance decomposition approach measures the variation in a variable that is attributable to
its own innovations and to shocks to other variables. Thus it will provide additional information
concerning how budget deficit, money growth and inflation are linked. According to Enders the
forecast-error variance decomposition permits inferences to be drawn concerning the proportion
of the movements in a particular time-series due to its own earlier shocks vis-a-vis shocks
arising from other variables in a VAR model. Thus variance decomposition approach breaks
down the variance of the forecast error for each variance following a shock to a particular
variable thus in turn identifying which variables are strongly affected and those that are not.

3.5.2 Impulse Response Functions.

The impulse response functions are used to investigate the interrelationships between the
variables and assess adjustments to long-run equilibrium. The impulse response functions traces
over time the effects on a variable of an exogenous shock to another variable. They trace the time
path of effects of one variable on another, for example how inflation responds over time to a
shock budget deficits and comparing this response to shocks from other variables.

3.6 Definition and Justification of variables

From both the theoretical and empirical literature that has been reviewed in the previous
chapter the model will use four variables that is budget deficit, money growth and inflation. The
variables are derived from the government budget constraint framework presented by Solomon and de Wet in (2004). The fourth variable is per capita real GDP which will be a control variable.

3.6.1 Budget Deficit

Budget deficit occurs when government expenditure is greater than government revenue. The study will use budget deficit as a percentage of GDP (Bakare, 2014; Hoang, 2014). Budget deficit is expected to relate positively and significantly with money supply and inflation. The positive relationship is expected since monetization of budget deficit increase money supply thereby causing an increase in inflation.

3.6.2 Money Supply Growth (M2)

Money supply growth (M2) is defined as a measure of notes and coin in circulation plus bank accounts. M2 is a key statistic because it illustrates the underlying strength of economic activity. Favero and Spinelli (1999) argued that that inflation has a more stable relationship with wider monetary aggregates such as M2 hence it is the best proxy to use for money supply growth in this study.

3.6.3 Inflation

Inflation can be defined as a sustained increase in the general price level of goods and services, within a given period of time. The study will use the Consumer Price Index (CPI) as a proxy for inflation (Karasawoglou and Katrakilidis, 1993; Makochekanwa, 2008; Bakare, 2014; Chukwu, 2013). Inflation is expected to be positively related with both money growth and budget deficit.

3.7 Data sources and limitations

The study will use a time series analysis for empirical testing for the period from 1980 to 2007. This is the time when data for all the variables are available. Data on money supply growth and inflation will be from the World Bank whilst that of budget deficit will be from Ministry of Finance. The study is further limited to using data up to 2007 since in July 2008 ZIMSTATS stopped publishing meaningful data for budget deficit, inflation and money supply as the rates kept on spiraling.
3.8 Conclusion

This chapter has explained the variables to be used as derived from the government budget constraint and also the form of the model which is going to be used in this study. In addition the chapter also explained diagnostic tests to be carried out in the next chapter, definition of explanatory variables and their proxies as well as justification as to why the variables have been included in the model. The next chapter discusses the findings of regression results.
CHAPTER FOUR

ESTIMATION, PRESENTATION AND INTERPRETATION OF RESULTS

4.0. Introduction

This chapter will follow an outline of chapter three in estimation, presentation and interpretation of empirical results. Descriptive statistics will be presented first followed by stationarity results and optimal lag length selection. After finding a suitable optimal lag length then Granger causality tests and estimation of VAR will be done. Lastly variance decomposition and impulse response analysis will follow. All the estimations will be done using E-views 7 statistical package.

4.1 Stationarity

As previously stated in chapter three, Augmented Dickey Fuller Test (ADF) is used to test for unit root. The null hypothesis that there is unit root was tested against an alternative that the variables are stationary. The variables firstly were tested in levels and those which were not stationary in this stage were differenced until they became stationary. Natural logarithms of money growth and inflation has been taken in order to make the series of less order of autoregressive, thus to minimize fluctuations in the series as suggested by Tiwari and Tiwari (2011). Table 2 shows the stationarity results.

Table 2: ADF Unit Root Test results

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Test Stat</th>
<th>1% Critical Value</th>
<th>5% Critical Value</th>
<th>10% Critical Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD</td>
<td>-5.333780</td>
<td>-2.674290</td>
<td>-1.957204</td>
<td>-1.608175</td>
<td>Stationary (1)</td>
</tr>
<tr>
<td>logM2</td>
<td>-5.382793</td>
<td>-2.674290</td>
<td>-1.957204</td>
<td>-1.608175</td>
<td>Stationary (1)</td>
</tr>
<tr>
<td>logINFL</td>
<td>-5.646332</td>
<td>-2.660720</td>
<td>-1.955020</td>
<td>-1.609070</td>
<td>Stationary (2)</td>
</tr>
</tbody>
</table>

All the variables were not stationary in levels because the ADF test statistic was greater than the critical values. The variables became stationary after differencing. Budget deficit became stationary after differencing once meaning to say it is integrated of order 1 whilst money growth
and inflation are integrated of order 2 since they became stationary after second differencing. This therefore means that the variables cannot be co-integrated since they are integrated of different levels thus we can employ the unrestricted VAR model.

4.2 VAR Lag length selection criteria and diagnostic tests

The generated estimates are only reliable if the model being estimated represents the true relationship generating the data. Before the Granger Causality test and the Unrestricted VAR model are estimated, there is need to choose an optimal lag length based on the lowest values of Akaike Information Criteria (AIC) (Enders, 1995). Thus using the AIC, the appropriate lag length was found to be 2 (see Appendix II). To find out if a suitable lag length was chosen the lag exclusion test was done. From the lag exclusion test joint results for two lags, the null hypothesis that the restricted model is valid (model without lags) was rejected thus accepting model with lags at all convenient levels of significance.

The VAR residual diagnostic tests were done so as to avoid running spurious VAR regressions. Residual tests on serial correlation using lag order 2 were carried out and there was no presence of serial correlation found. Since the Durbin-Watson statistic has a weakness of providing inconclusive evidence on the test of serial correction the LM test is used. The LM test probability value of 0.4936 indicates that we may not reject the null hypothesis that there is no serial correlation. For normality test a Jarque-Bera joint probability of 0.4136 shows that we fail to reject the null hypothesis that the residuals are multivariate normal at all levels of significance whilst for heteroskedasticity a probability of 0.1814 indicates that we failed to reject the null hypothesis that the residuals are homoscedastic. Therefore having satisfied the major diagnostic tests, the VAR model can be used for interpretation of the results using the impulse response and variance decomposition functions. For detailed results of diagnostic tests see Appendix II.

4.3 Granger Causality tests

The Granger causality test is used to determine whether one variable can help to improve the forecast of another. The results of the test are shown in Table 2.
### Table 2: Results of Granger Causality Test

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>obs</th>
<th>F Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDlogM2 does not Granger cause DFD</td>
<td>24</td>
<td>0.71662</td>
<td>0.5011</td>
</tr>
<tr>
<td>DFD does not Granger cause DDlogM2</td>
<td></td>
<td>13.3217</td>
<td>0.0002</td>
</tr>
<tr>
<td>DDlogINFL does not Granger cause DFD</td>
<td>24</td>
<td>0.51230</td>
<td>0.6072</td>
</tr>
<tr>
<td>DFD does not Granger cause DDlogINFL</td>
<td></td>
<td>0.94439</td>
<td>0.4069</td>
</tr>
<tr>
<td>DDlogINF does not Granger cause DDlogM2</td>
<td>24</td>
<td>0.03653</td>
<td>0.9642</td>
</tr>
<tr>
<td>DM2 does not Granger cause DDlogINFL</td>
<td></td>
<td>3.23308</td>
<td>0.0619</td>
</tr>
</tbody>
</table>

Basing on the probability outcome of the Granger Causality test of 0.0002, we reject the null hypothesis that fiscal deficit does not Granger cause money growth and conclude fiscal deficit does granger cause money growth. Money growth however does not Granger cause fiscal deficit. This implies that fiscal deficit can help improve forecast of money growth, as past values of fiscal deficits have an effect on current values of money growth. Central bank’s printing money to finance the budget deficit will lead to an increase in the money supply.

The Granger causality test results show that money supply growth Granger causes inflation, as we fail to accept the null hypothesis basing on the probability of 0.0619. This result may imply that current money supply growth may have a causal effect on future price changes. The causality is unidirectional as inflation does not Granger cause money growth. In case of increase of the money supply; consumption will increase and the prices will rise as the aggregate supply will not be able to meet the aggregate demand.

The Granger causality test results in Table 2 also reveal that fiscal deficit does not Granger causes inflation, neither does inflation Granger cause fiscal deficit given the probability values of 0.4069 and 0.6012 respectively.
Thus overall according to these results, it can be noted that changes in budget deficits and supply of money cause inflationary effects. The results support the Sargent and Wallace (1981) hypothesis as found by Chukwu (2013) in Nigeria which postulates that budget deficits only cause inflation through an indirect effect, that is, from budget deficit to money growth then from money growth to inflation.

4.4 Interpretation of VAR model

The best way to interpret a VAR model is by using variance decomposition and impulse response functions rather than concentrating on individual coefficients of VAR (Blanchard, 1986). Furthermore, Variance Decomposition analysis gives valid inferences on the system of equations.

4.5. Variance Decomposition (VD) Analysis

In this section, we discuss variance decomposition of the three endogenous variables to examine how their variations depend on other variables” shocks and their own innovations. The Variance Decomposition breaks down the forecast error variance into components that can be directly attributed to each of the endogenous variables.

4.5.1 Variance Decomposition of Budget deficit

Table 3 shows that the sole source of variations of budget deficit growth is its own shocks (approximately 79.6% percent over time) while other variables perform an insignificant role. Zimbabwe has been in the transition stage of development and needs to establish and develop its infrastructure. The government has targeted high economic growth as a primary goal for many years. Hence, the fiscal policy must have served as a key instrument of the government to boost the economy. This could be a reason explaining why budget deficit growth is unlikely to be affected by market forces such as inflation or money supply growth.
Table 3: Variance Decomposition of Budget Deficit (DBD)

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>S.E</th>
<th>DFD</th>
<th>DDlogM2</th>
<th>DDlogINFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.411879</td>
<td>100.0000</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td>2</td>
<td>9.310821</td>
<td>98.21068</td>
<td>0.014696</td>
<td>1.774620</td>
</tr>
<tr>
<td>3</td>
<td>10.65433</td>
<td>84.87849</td>
<td>5.683880</td>
<td>9.437628</td>
</tr>
<tr>
<td>4</td>
<td>11.58829</td>
<td>81.60826</td>
<td>5.652064</td>
<td>12.73968</td>
</tr>
<tr>
<td>5</td>
<td>11.66743</td>
<td>80.67807</td>
<td>5.797292</td>
<td>13.52464</td>
</tr>
<tr>
<td>6</td>
<td>11.75461</td>
<td>79.72030</td>
<td>6.844628</td>
<td>13.43507</td>
</tr>
<tr>
<td>7</td>
<td>11.75949</td>
<td>79.68661</td>
<td>6.839320</td>
<td>13.47408</td>
</tr>
<tr>
<td>8</td>
<td>11.87937</td>
<td>79.89252</td>
<td>6.741303</td>
<td>13.36617</td>
</tr>
<tr>
<td>9</td>
<td>11.97038</td>
<td>80.07592</td>
<td>6.640100</td>
<td>13.28398</td>
</tr>
<tr>
<td>10</td>
<td>12.01468</td>
<td>79.78448</td>
<td>6.804220</td>
<td>13.41130</td>
</tr>
</tbody>
</table>

4.5.2 Variance Decomposition of Money Growth

Table 4 presents the variance decomposition of money growth. As can be seen from the table, the variations of money growth in the first period are mainly explained by its own innovations, which is approximately 96.2%. The contribution of its own shocks to its variations is decreasing over time, which is around 38.1% in the sixth period.

Table 4: Variance Decomposition of Money Growth (DDlogM2)

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>S.E</th>
<th>DFD</th>
<th>DDlogM2</th>
<th>DDlogINFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.518995</td>
<td>3.719861</td>
<td>96.28014</td>
<td>0.000000</td>
</tr>
<tr>
<td>2</td>
<td>0.640273</td>
<td>35.91948</td>
<td>64.01808</td>
<td>0.062439</td>
</tr>
<tr>
<td>3</td>
<td>0.759732</td>
<td>53.84148</td>
<td>45.53859</td>
<td>0.619937</td>
</tr>
<tr>
<td>4</td>
<td>0.820632</td>
<td>57.73094</td>
<td>41.56486</td>
<td>0.704196</td>
</tr>
<tr>
<td>5</td>
<td>0.851996</td>
<td>53.81840</td>
<td>42.83110</td>
<td>3.350504</td>
</tr>
<tr>
<td>6</td>
<td>0.907155</td>
<td>56.40365</td>
<td>38.12797</td>
<td>5.468378</td>
</tr>
<tr>
<td>7</td>
<td>0.910374</td>
<td>56.23958</td>
<td>37.99504</td>
<td>5.765373</td>
</tr>
<tr>
<td>8</td>
<td>0.919328</td>
<td>55.54667</td>
<td>38.65788</td>
<td>5.795449</td>
</tr>
<tr>
<td>9</td>
<td>0.921927</td>
<td>55.79301</td>
<td>38.44347</td>
<td>5.763519</td>
</tr>
<tr>
<td>10</td>
<td>0.925215</td>
<td>55.95284</td>
<td>38.27330</td>
<td>5.773860</td>
</tr>
</tbody>
</table>

Budget deficits also play an important role in explaining the variations of money growth. Specifically, budget deficit explains approximately 55% of the variation in money growth over time. This result implies that budget deficit has played a more important role than inflation did in
designing and implementing monetary policy for the past three decades after independence. This also clarifies why Zimbabwe has experienced high inflation periods in the past.

4.5.3 Variance Decomposition of Inflation

Table 5 shows that variations of inflation in the first period are only due to its own shock. Since the second period, the role of inflation in explaining its own variations starts to decrease while the variation of money growth and budget deficit increases. Specifically, in the third period, approximately 83% of the variations of inflation are due to its own shocks while money growth and budget deficit account for about 12 percent and 4 percent, respectively. The contributions of the two variables to the variations of inflation become gradually unchanged since the tenth period. Specifically, on average budget deficit and money growth account for 21% and 14% respectively. These figures indicate that the importance of budget deficit and money growth in explaining innovations of inflation is fairly trivial.

Table 5: Variance Decomposition of Inflation (DDlogINFL)

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>S.E</th>
<th>DFD</th>
<th>DDlogM2</th>
<th>DDlogINFL</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0.714449</td>
<td>0.016059</td>
<td>4.219421</td>
<td>95.76452</td>
</tr>
<tr>
<td>2</td>
<td>0.823831</td>
<td>3.741853</td>
<td>12.64927</td>
<td>83.60888</td>
</tr>
<tr>
<td>3</td>
<td>0.834711</td>
<td>4.358543</td>
<td>12.49263</td>
<td>83.14883</td>
</tr>
<tr>
<td>4</td>
<td>0.909590</td>
<td>14.63219</td>
<td>14.11392</td>
<td>71.25388</td>
</tr>
<tr>
<td>5</td>
<td>0.947340</td>
<td>21.09942</td>
<td>13.11347</td>
<td>65.78711</td>
</tr>
<tr>
<td>6</td>
<td>0.965580</td>
<td>21.18086</td>
<td>13.24103</td>
<td>65.57811</td>
</tr>
<tr>
<td>7</td>
<td>0.971252</td>
<td>20.93456</td>
<td>13.36773</td>
<td>65.69771</td>
</tr>
<tr>
<td>8</td>
<td>0.973905</td>
<td>20.86083</td>
<td>13.64922</td>
<td>65.48995</td>
</tr>
<tr>
<td>9</td>
<td>0.980944</td>
<td>21.62449</td>
<td>13.53542</td>
<td>64.84009</td>
</tr>
<tr>
<td>10</td>
<td>0.981311</td>
<td>21.61069</td>
<td>13.53017</td>
<td>64.85914</td>
</tr>
</tbody>
</table>

4.6. Impulse response analysis

Impulse response functions trace the effect of a one standard deviation shock of one innovation on current and future values of the endogenous variables. Table 6 shows impulse response graphs.
4.6.1 Impulse response of Budget Deficit

Figure 6 shows impulse responses of budget deficit to positive shocks of inflation and money growth. Accordingly, shocks to money growth have no impact on budget deficit in the first and last three periods whilst shocks to inflation have no impact in the first period and last five periods. According to Lozano (2014) if inflation occurs, borrowers would gain and lenders would lose because an unexpected increase in inflation will lower the real value of money. Thus, a positive shock to inflation increases budget deficits because the government is the borrower when issuing bonds. However this is only the case for a short period of time that is period two and period four. A positive shock to money growth leading to an increase in budget deficit for the period four and five could be due to the reduction of interest rate which is the cost of
borrowing. In Zimbabwe, the interest rates fell in 1996 in line with the Millennium Economic Recovery Program’s objectives resulting in an explosion in money supply.

4.6.2 Impulse response of Money Growth

Figure 6 reveals that money growth decreases in response to a positive shock to inflation from period three to period five. In high inflation periods, a rise in inflation rate is usually expected to have a negative impact on money growth because central banks lower money growth to combat inflation (Chukwu, 2013). The growth rate of money supply declines most significantly in the fifth and seventh period since the occurrence of the shock, implying that the RBZ fully recognizes and responds to inflation shocks in the fifth and seventh period. This also implies that monetary policy is relatively slow in responding to inflation shocks. Figure 8 indicates that a positive shock to budget deficit has an immediate effect of increasing money growth as shown from period one to period two.

4.6.3 Impulse response of Inflation

An increase in the growth rate of money supply accelerates inflation. Specifically, inflation is accelerated from period 1 to 2 due to the rise in the growth rate of money supply. More importantly, the effect of money growth on inflation becomes strongest in the second period since the occurrence of the shock, implying that the transmission mechanism of the credit channel into inflation works quite quickly. The effect of money growth on inflation turns to be negative from period 3 to period 6. Figure shows that a positive shock of fiscal deficit causes inflation to go up for four periods and the shock fuels inflation most significantly in the fourth period.

The analysis of variance decomposition and impulse response functions has shown some contradicting results in comparison of Granger Causality. This could have been caused by data distortions in Zimbabwe especially for the period 2002-2007 which may not be regarded as a short period of time considering the scope of the study.
4.5 Conclusion
This chapter focused on the estimation of VAR and also interpretation of the results using the variance decomposition and impulse response function. The granger causality results confirm the Sargent and Wallace hypothesis that financing budget deficit through printing money is inflationary. The variance decomposition and impulse response results also supported this hypothesis.
CHAPTER FIVE:
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1. Conclusion

This chapter presents a summary and conclusion of the study’s findings. The chapter also provides policy recommendations derived from the findings. Limitations of the study and areas for further research will be discussed in the last section of the chapter.

5.2. Summary of main findings

This study examined the relationship between budget deficit, money growth and inflation in Zimbabwe for the period 1980-2007. Granger Causality and Vector Autoregressive estimation techniques were applied in order to identify the causality and relationship between these variables. In order to assure the reliability of the estimation results, the diagnostic tests were conducted. The estimation results reveal the following key findings.

First, similar to empirical results by Favero and Spinelli (1999); Nhavira (2009) and Hoang (2014) money growth has positive impact on inflation in Zimbabwe. Specifically, inflation will go up from period one to period two in response to a positive shock to money growth. Furthermore, the strongest effect of a positive shock to money growth on inflation is in the second period since the occurrence of the shock. However, money growth has no effect on budget deficit as shown by results of Granger Causality.

Second, despite the fact that Solomon and de Wet (2004); Catao and Terrones (2005) and Makochekanwa (2008) found a strong positive relationship between fiscal deficits and inflation among high inflation and developing countries, empirical results of this study reveal that shocks to budget deficit growth have no effect on inflation. This finding, however, shares a conclusion with Barnhart and Darrat (1988), Ahmed and Chaudhuri (1995) and Chukwu (2014) in which budget deficits only affect inflation when they are financed through seignorage. Hence in terms of direction of causality this study supports the Sargent and Wallace (1981) hypothesis.
Third, positive shocks to inflation negatively affect money growth. It takes two years for the RBZ to fully realize and react to a positive shock to inflation. Generally, RBZ implements tightening monetary policy by lower money growth for two years to curb inflation. However some of the results of the Granger causality were in contradiction with the variance decomposition and the impulse response functions. This was mainly caused by data distortions in Zimbabwe for the period 2002-2007 which may not be regarded as a short period considering the scope of the study.

5.3. Policy Recommendations

The return of the Zimbabwean dollar can never be ignored in future. This study focused on the period 1980-2007 for possible policy recommendations that can be implemented to Zimbabwe as a way of correcting past mistakes in case the country enters the same crisis in future.

The policy recommendations of this study are based on the SW-UMA (1981) hypothesis which postulates that monetization of high budget deficits is inflationary. The study found a trivariate relationship from budget deficit inducing an increase in money supply through seignorage leading to high inflation. According to Sargent and Wallace (1981) inflation is due to fiscal policy since the fiscal authorities compel the monetary authorities to finance its deficits through seignorage. Thus the recommendations are both for the fiscal and the monetary authorities who should act such that budget deficit is reduced and that money supply is not excessive, as that will lead to inflation.

Based on the fiscal side, the government should strengthen fiscal framework, display a high sense of transparency in the fiscal operations and enhance strategies for better government expenditure. These include avoiding unbudgeted spending and also reducing recurrent expenditures thus redirecting resources to the productive sectors.

Insufficient monetary policy control when RBZ was forced to be the government’s banker to print money resulted in hyperinflation when deficits were monetized. In line with this the central bank should be independent and have autonomy in monetary policy formulation. Thus the only effective way to curb inflation is when the central bank uses tight monetary policy to complement fiscal policy.
5.4. Suggestions for future research

The relationship between budget deficit money growth and inflation as it was argued in a vast number of empirical literatures can be done comparing different proxies of money supply growth to get a clear understanding of the impact of budget deficit on money supply and in turn that of money supply on inflation.
References


Makochekanwa, A. (2008). The Impact of Budget Deficit on Inflation in Zimbabwe, University of Pretoria, South Africa

Mashakada, T. L. J. (2013). Macroeconomic Consequences of Fiscal Deficit in Developing Countries: A Comparative Study of Zimbabwe and Selected African Countries, University of Stellenbosch, September. (Stellenbosch University http://scholar.sun.ac.za)


APPENDIX

APPENDIX I: DATA

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<thead>
<tr>
<th>year</th>
<th>inflcpi</th>
<th>M2 %</th>
<th>FD</th>
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<td>18.11</td>
<td>2.77</td>
</tr>
<tr>
<td>1981</td>
<td>13.15</td>
<td>17.47</td>
<td>7.16</td>
</tr>
<tr>
<td>1982</td>
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<tr>
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<td>20.15</td>
<td>29.05</td>
<td>11.11</td>
</tr>
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<td>8.49</td>
<td>38.54</td>
<td>7.61</td>
</tr>
<tr>
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<td>23.34</td>
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<td>5.39</td>
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<td>101.41</td>
<td>5.50</td>
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<td>2007</td>
<td>24411.03</td>
<td>40418.7</td>
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APPENDIX II: UNIT ROOT TESTS

Null Hypothesis: D(FD) has a unit root
Exogenous: None
Lag Length: 4 (Automatic - based on SIC, maxlag=6)

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<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
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<td>Augmented Dickey-Fuller test statistic</td>
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</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-2.674290</td>
</tr>
<tr>
<td>5% level</td>
<td>-1.957204</td>
</tr>
<tr>
<td>10% level</td>
<td>-1.608175</td>
</tr>
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Null Hypothesis: D(LOGM2,2) has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=6)

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</tr>
</thead>
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<td>Test critical values:</td>
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</tr>
<tr>
<td>1% level</td>
<td>-2.674290</td>
</tr>
<tr>
<td>5% level</td>
<td>-1.957204</td>
</tr>
<tr>
<td>10% level</td>
<td>-1.608175</td>
</tr>
</tbody>
</table>


Null Hypothesis: D(LOGINFL,2) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td>Augmented Dickey-Fuller test statistic</td>
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</tr>
<tr>
<td>Test critical values:</td>
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<tr>
<td>1% level</td>
<td>-2.660720</td>
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<td>5% level</td>
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<td>10% level</td>
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</table>

APPENDIX III: VAR Diagnostic tests

VAR Lag Order Selection Criteria
Endogenous variables: DFD DDLOGM2 DDLOGINFL
Exogenous variables: C
Date: 04/27/15 Time: 11:10
Sample: 1980 2007
Included observations: 21

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<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
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<td>0</td>
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<td>24.14071</td>
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* indicates lag order selected by the criterion

VAR Lag Exclusion Wald Tests
Date: 04/27/15 Time: 11:12
Sample: 1980 2007
Included observations: 24

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

<table>
<thead>
<tr>
<th>Component</th>
<th>Jarque-Bera</th>
<th>Df</th>
<th>Prob.</th>
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<tbody>
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<td></td>
<td></td>
</tr>
<tr>
<td>DDF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDDLOGM2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDDLOGINFL</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Joint</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

VAR Residual Normality Tests
Orthogonalization: Residual Correlation (Doomik-Hansen)
Null Hypothesis: residuals are multivariate normal
Date: 04/27/15 Time: 11:27
Sample: 1980 2007
Included observations: 24
<table>
<thead>
<tr>
<th></th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>2</td>
<td>0.0794</td>
</tr>
<tr>
<td>2</td>
<td>0.41131</td>
<td>2</td>
<td>0.8141</td>
</tr>
<tr>
<td>3</td>
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<td>2</td>
<td>0.7380</td>
</tr>
<tr>
<td>Joint</td>
<td>6.08607</td>
<td>6</td>
<td>0.4136</td>
</tr>
</tbody>
</table>

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares) Date: 04/27/15 Time: 11:30
Sample: 1980 2007
Included observations: 24

Joint test:

<table>
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<tr>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
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</thead>
<tbody>
<tr>
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<td>72</td>
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</table>

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 04/27/15 Time: 11:34
Sample: 1980 2007
Included observations: 24
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<th>Lags</th>
<th>LM-Stat</th>
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<tr>
<td>2</td>
<td>5.689167</td>
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</table>

Probs from Chi-square with 9 df
APPENDIX IV: GRANGER CAUSALITY TESTS

Pairwise Granger Causality Tests
Date: 04/27/15  Time: 11:41
Sample: 1980 2007
Lags: 2

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<th>Obs</th>
<th>F-Statistic</th>
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<tr>
<td>DFD does not Granger Cause DDLOGM2</td>
<td>13.3217</td>
<td>0.0002</td>
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<tr>
<td>DDLOGINFL does not Granger Cause DFD</td>
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<td>0.51230</td>
<td>0.6072</td>
</tr>
<tr>
<td>DFD does not Granger Cause DDLOGINFL</td>
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<td>0.4064</td>
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<tr>
<td>DDLOGINFL does not Granger Cause DDLOGM2</td>
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<tr>
<td>DDLOGM2 does not Granger Cause DDLOGINFL</td>
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</table>
APPENDIX V: VECTOR

AUTOREGRESSION ESTIMATES

Date: 04/27/15  Time: 11:10
Sample (adjusted): 1984 2007
Included observations: 24 after adjustments
Standard errors in ( ) & t-statistics in [ ]

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<th></th>
<th>DFD</th>
<th>DDLOGM2</th>
<th>DDLOGINFL</th>
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</thead>
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<tr>
<td></td>
<td>(0.23641)</td>
<td>(0.01655)</td>
<td>(0.02279)</td>
</tr>
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<td></td>
<td>[-3.14379]</td>
<td>[3.11218]</td>
<td>[1.28409]</td>
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<tr>
<td>DFD(-2)</td>
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<td>0.012720</td>
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<tr>
<td></td>
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<td>(0.01800)</td>
<td>(0.02478)</td>
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<tr>
<td></td>
<td>[-0.75238]</td>
<td>[4.82162]</td>
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</tr>
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<td>DDLOGM2(-1)</td>
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<tr>
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<td>(0.19590)</td>
<td>(0.26967)</td>
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R-squared       0.517436  0.584995  0.416166
Adj. R-squared  0.347120  0.438523  0.210107
Sum sq. resids  933.9112  4.579041  8.677442
S.E. equation   7.411879  0.518995  0.714449
F-statistic     3.038084  3.993901  2.019644
Log likelihood  -77.99045  -14.17575 -21.84660
Akaike AIC      7.082538  1.764646  2.403883
Schwarz SC      7.426137  2.108245  2.747482
Mean dependent  -0.291006  0.107434  0.096905
S.D. dependent  9.173002  0.692623  0.803873
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