MONETARY POLICY IN THE MONETARY APPROACH TO THE BALANCE OF PAYMENTS: THE CASE OF ZAMBIA (1980-2011).

By

Yenda Goodwell Shamabobo

Computer #: 513803085

A Dissertation Submitted to the University of Zambia in Partial Fulfillment of the Requirements of the Master of Arts Degree in Economics

THE UNIVERSITY OF ZAMBIA

2015

DECLARATION

I (**Yenda Goodwell Shamabobo**) hereby declare that this dissertation:

1. Represents my bona fide work;

2. Has never been done by another researcher at this, or any other institution; and

3. Does not incorporate any other previous work without acknowledgement.

Signature: …….

Date: ……..

COPYRIGHT

CERTIFICATE OF APPROVAL

This dissertation of Yenda Goodwell Shamabobo has been approved as partial fulfilment of the requirements for the award of Master of Arts Degree in Economics by the University of Zambia;

Signature: …….. Date: ……

Signature: …….. Date: ……

Signature: …….. Date: ……

ABSTRACT

The Zambian economy has been grappling with Balance of Payment (BoP) problems since the mid-1970s. This led the country to resort to seeking support from multilateral institutions and subsequently, the adoption of the IMF's structural adjustment programmes as a solution. The Monetary Approach to the Balance of Payments (MABP) as an alternative to the Elasticities and Absorption approaches, was generated by the Chicago School in the late 1960s and adopted by the IMF in the 1970s as a means of solving BoP problems. Therefore, the IMF prescribed policy solutions for BoP problems to Zambia and other countries were largely based on the MABP. This study tried to establish the relevance and significance of the MABP theory in the Zambian economy during the period 1980 to 2011. The research tested the MABP in Zambia by estimating the Reserve Flow Equation (RFE) using OLS regression and joint hypotheses testing of the preconditions outlined by the MABP using the F-Statistic. The research also investigated the implications of monetary variables in the MABP in Zambia by employing the SVAR model and estimating the underlying impulse reaction functions (IRF). The hypothesis testing of both estimations, based on annual data for the period 1980-2011 and monthly data for 1995 to 2011, led to the conclusion that the MABP did not hold in Zambia for the study period. This implies that the Zambian BoP is not purely a monetary phenomenon. It is worth noting that the domestic price level (CPI) and domestic credit were found to be highly significant in both the monthly and annual data regressions. The IRF analysis revealed that changes in the domestic price level (CPI), domestic credit, and income (real GDP) had significant impact on the BoP. A 1 percent shock in the CPI led to a positive response from the BoP in the first 2 months then negative by the 5^{th} month, while a 1 percent shock in domestic credit resulted in a negative shock in the BoP in the first 3 months, then positive by 5^{th} month and negative by the 7^{th} month. It was also revealed that interest rates and the money multiplier did not have significant impact on the BoP. Therefore, the research recommends that monetary authorities in Zambia should consider using domestic credit as a tool for inducing stability in the BoP, alongside other policies. This could be done through increased credit to the private sector for production purposes at a lower cost as one of the strategies for restoring (stabilising) positive performance of the BoP. The study also recommends that the domestic price level could be used as an anchor not only in managing domestic performance of the economy but also external performance.

DEDICATION

To my father, Mr. Goodwell Shamabobo, who has given me unflinching support throughout my education and my son, Kelvin Shibeu Bob Shamabobo, who was born on the first day of classes of my Master's Degree.

ACKNOWLEDGEMENTS

I would like to sincerely thank my Principle Supervisor, Dr. Chiselebwe Ng'andwe, for the invaluable input and guidance rendered to me during this study. My sincere gratitude also goes to my Econometrics mentor and Co-Supervisor, Dr. Chrispin Mphuka, for the advanced analytical techniques he imparted in me through the Master's training and his immense contribution towards this study.

I would also like to thank my Supervisor at work, Mr. Kelvin Mpembamoto, Assistant Director-Research and Planning Department at the Zambia Revenue Authority for allowing me time to pursue my study amidst a busy work schedule. In addition, I would like to thank the entire staff in the Research and Planning Department at Zambia Revenue Authority for the support they rendered during the time of my study.

My sincere gratitude also goes to members of staff of the Economics Department at Bank of Zambia in particular, Mr. Joe Sichalwe, Statistical Assistant, Mr. Chungu Kapembwa, Senior Researcher, and Mr. Peter Zgambo, Assistant Director-Research, for the immeasurable support offered to me during data collection. Let me also thank Mr. Litia Simbangala, Head-National Statistics at the Central Statistics Office, for all the help rendered during the study.

The list would not be complete without thanking my parents for the moral support during the Master's programme. Special thanks to my wife, Mrs. Diana M. Shamabobo, for the understanding and unquantifiable support rendered to me during the entire duration of my study. Let me take this opportunity to also thank my young brother, Hambweka Kelvin Shamabobo and cousin, Gideon Nsando as well as the rest of the family for their moral support during the study.

I would like to convey my heartfelt gratitude to the Department of Economics at the University of Zambia for hosting me as their student for the 2 year Master Degree Programme. My acknowledgement would be incomplete if I did not thank all the people that I have not mentioned as their part was critical to the success of this study.

Above all, I would like to thank the Almighty Jehovah God for the guidance, direction and good health that I have enjoyed throughout my entire academic life, and for bringing close all those I have cited and those I have not cited (as the list is endless) in this acknowledgement.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

BoP	Balance of Payments
BoZ	Bank of Zambia
CPI	Consumer Price Index
CSO	Central Statistics Office
DC	Domestic Credit
FEMAC	Foreign Exchange Management Committee
GDP	Gross Domestic Product
IIP	Index of Industrial Production
IMF	International Monetary Fund
LDCs	Least Developed Countries
MABP	Monetary Approach to The Balance of Payments
NTEs	Non-Traditional Exports
OGL	Open General Licence
OLS	Ordinary Least Squares
RCCs	Reserve Currency Country
RFE	Reserve Flow Equation
SAPs	Structural Adjustment Programmes
SDR	Special Drawing Rights
SSA	Sub-Saharan Africa
SVAR	Structural Vector Auto- Regression
WALBR	Weighted Average Lending Base Rate
ZCCM	Zambia Consolidated Copper Mines
ZRA	Zambia Revenue Authority

CHAPTER 1

BACKGROUND AND INTRODUCTION

1.0 Overview

The International Monetary Fund (IMF) attaches a great deal of attention to the stability of the balance of payments (BoP) for its member countries (Fleermuys 2005). Many developing countries, Zambia inclusive, have been facing overall BoP problems. This is a cause of concern because any country should aim at maintaining a stable equilibrium in the balance of payments as one of the core objectives of macroeconomic policy. Several factors account for the persistent balance of payments disequilibrium including: poor export performance, huge service account deficits, external debt amortization, low inflow of foreign direct investment, misappropriation of external funding support, excessive domestic monetary and credit expansion, large fiscal deficits, price distortions and a deterioration in the terms of trade (Ogiogio 1996; Obioma 1998).

1.1 About the Zambian Economy

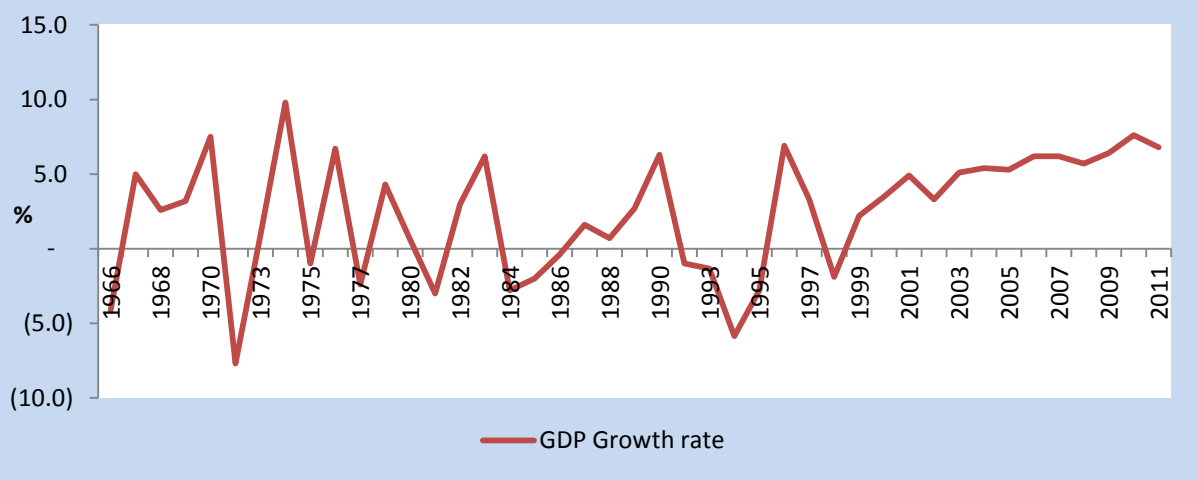
The Zambian economy has gone through several cycles since independence which can be categorized into six stages namely the pre-colonisation stage, colonization stage, post-independence boom, economic decline of the 1970s and 1980s, economic reforms of the 1990s, and the most recent economic adjustments in the 2000s (World Bank, 2004). Following independence Zambia adopted a Socialist economic model within an African context. There was large-scale nationalisation of the mining industry and the creation of large state owned conglomerates such as the Zambia Consolidated Copper Mines (ZCCM). A considerable degree of central planning involving the setting up of a large civil service followed as the government aimed to ensure self-sufficiency coupled with industrial diversification. This period was relatively prosperous as the earnings from mineral exploitation grew due to favourable copper prices. In the ten years following

Independence the level of real Gross Domestic Product (GDP) grew at an annual average of 4.1 percent.

During the mid-1970s, a number of external factors adversely affected Zambia's economy. The fall in world price of copper coupled with a rise in the world price of oil and energy exposed the country's over-dependence on copper and on imported manufactured goods. This pushed up the price of capital imports, further deteriorating Zambia's balance of payments position. In the period between 1975 and 1990 the level of real GDP per capita declined by 40.01 percent. This saw the deterioration of the external standing of Zambia, with a downwards trend emerging in the Zambian balance of payments.

The 1990s saw a move to a more outward oriented economy centered on a market based system. The newly elected Movement for Multi-Party Democracy government in 1991 adopted a structural adjustment programme agreed with the International Monetary Fund (IMF) and the World Bank which was aimed at restoring macroeconomic stability and facilitating private sector growth through reducing the role of the state in controlling prices, restricting foreign trade and foreign currency transactions. Most of the parastatals were privatised, interest rates completely deregulated, the role of directed credit deemphasized, and in general the economy was substantially liberalised.

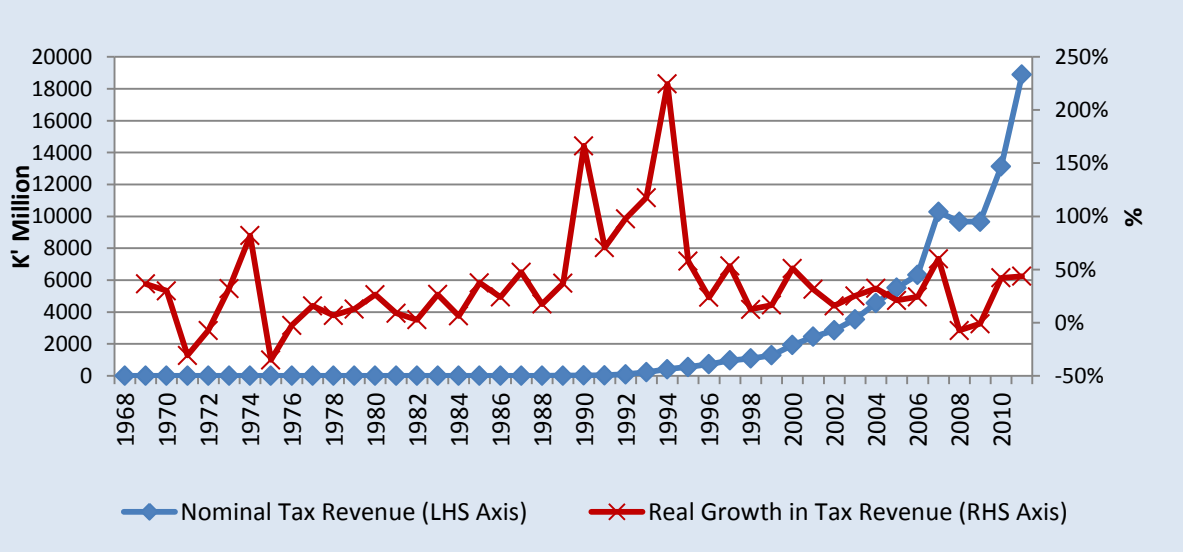
Figure 1: Real GDP Growth Rate in Zambia, 1966 to 2011



Data Source: National Accounts, CSO

Although the privatization programme was largely successful, it had a mixed record. Real GDP growth was sustained at an average of 0.77 percent in the decade following the privatization era but annual GDP per capita growth recorded a decline of 2.0 percent. Trade liberalisation exposed manufacturing industries, such as textiles that used to produce import substitutes, paid employment as well as government revenues fell (See Table 1 and Figure 2 below).

Figure 2: Nominal Tax Revenue and Revenue Growth in Zambia, 1968 to 2011 (K' Million)



Data Source: Zambia Revenue Authority and CSO

In the recent past, Zambia has recorded sustained favourable macroeconomic performance assisted by improved copper prices on the international market, IMF's external debt relief of 2003, as well as largely favourable weather conditions which have complemented increased agricultural output. During the past decade, real GDP has been growing at an annual average of 5.5 percent (See Figure 1 above), while GDP per capita has been sustained at an average of 2.7 percent. In addition, inflation has substantially reduced and the external sector recorded favourable balance of payments with months of prospective imports standing at 6 months in 2010.

Table 1: Zambia's Per Capita Growth in Comparison with Average of SSA, 1961-2000

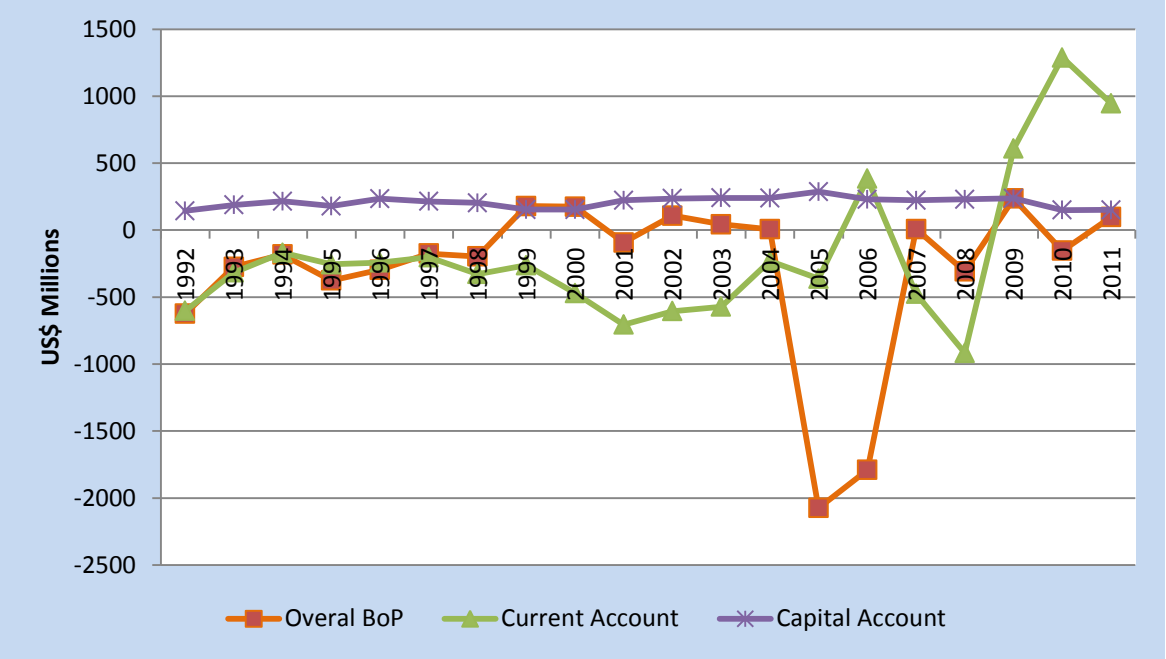
Regional, Country & Ranking	1961-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	95-2000
SSA Average (%)	2.2	1.5	3.3	0.9	-0.5	0.5	-1.4	2
Zambia (%)	0.7	0.8	0.5	-4.4	-2.2	-0.8	-2.7	-0.2
Zambia Ranking	**16/26**	**20/31**	**22/32**	**30/32**	**29/36**	**26/40**	**32/41**	**34/41**

Source: Adapted from the Domestic Revenue Mobilisation Report, Zambia, 2013

Zambia's BoP problems can be traced back to between early to mid-1970s. According to IMF (1998), in 1975, there was a virtual collapse of international copper prices and until about 1991, copper prices kept fluctuating at low levels. Amidst the major slide in copper prices, there was the nationalization of the mining enterprises, and the ensuing political interferences in the management of the enterprise served to exacerbate the market problems in the predominant sector of the economy. In addition to these adverse external and internal developments in the mining industry, international oil prices drastically increased in 1973, which heralded the destabilization of leading economies and slow-down of international trade, and compounded the external shocks on Zambia's economy. Faced with the global economic shocks, and reduced earnings from copper, the economy was rapidly contracting. In order to sustain the social welfare and patronage benefits, in the initial years, the Government of the Republic of Zambia (GRZ) resorted to external borrowing and thus the country's external debt started accumulating. This resulted in the country's debt growing so rapidly over the decade that, by 1999, it had one of the highest debt figures on a per capital basis in Sub-Sahara Africa (SSA) (Rakner et al., 1999).

In later years (late 1980s), when foreign financing dwindled, the GRZ resorted to domestic money printing, which created high inflationary pressures. In the intervening years, Zambia sought and intermittently received financial support from the IMF, commencing in 1973 (Szeftel, 2000). Figure 3 below shows Zambia's overall BoP , the current and capital account between 1992 and 2011. To solve BoP problems, many countries seek balance of payments support from outside sources mainly the IMF and debt relief from creditors in the framework of a planned adjustment process. Exchange rate adjustment (devaluation) is essentially part of this adjustment process.

Figure 3: Balance of Payments Developments in Zambia, 1992 to 2011 (US$ Millions)



Data Source: Bank of Zambia

There are three key approaches followed in prescribing solutions for balance of payments problems, namely, the Elasticities Approach, the Absorption Approach and the Monetary Approach. This research concentrates on the latter approach but will also briefly discuss the first two in the subsequent chapters. The origin of what has come to be known as the Monetary Approach to the Balance of Payments (MABP) may be traced back to Hume's specie flow mechanism which was rediscovered, revived and popularised in the 1960s as an alternative approach to the BoP adjustment mechanisms. The approach is usually used in financial programming as a *sine qua non* for the diagnosis of macroeconomic problems, for example in the design and implementation of stabilization programmes pursued under the auspices of the IMF (Khan, Montiel and Haque, 1986). Therefore, the IMF support and prescribed solutions to the BoP problems that Zambia began facing in the mid-1970s were somewhat based on the MABP.

The MABP basically explains the elimination of payments disequilibrium in terms of factors bringing the demand and supply of money into equality. It treats the supply of money as endogenous by assuming a feedback from the balance of payments through

changes in international reserves to changes in the monetary liabilities of the central bank and government (IMF, 1997). One of the important questions of monetary policy is the extent to which the monetary authority (central bank) of an open economy can affect the price level or the other arguments of the demand for money, such as the level of real output and the interest rate. If it were the case that these could not be changed, then any increase in monetary liabilities of the authority would be met by an equal and offsetting outflow of international reserves (or an equi-proportionate rise in the price of home goods and foreign exchange), and one would have to argue that monetary policy had no influence on the real responses of the system.

Policy makers and scholars usually argue that the major cause of external imbalance that Zambia has been experiencing for some time now is the adverse external development in the international economy of the mid 1970s which saw the drastic drop in copper prices, steep rise in oil prices and recession in western industrialised economies. It is also argued that the socialist era between 1973 and 1985 in the country accounted for a significant share of the BoP problems. It is however, noted that less empirical argument has been forwarded on the extent to which valuation of the price level, the Kwacha exchange rate, growth in domestic credit and other monetary variables in Zambia have explained the external imbalance.

The aim of this study is therefore to establish the relevance of MABP in the Zambian context during the period 1980 to 2011 and to study the significance of the roles of the domestic price level, the money multiplier and credit policies in the determination of balance of payments within the MABP by applying the Structural Vector Auto-Regression (SVAR) method.

1.2 Statement of Problem

Zambia's BoP problems emanated during the world economic recession of the mid-1970s which saw the slump in copper prices and a sharp increase in oil prices on the international market. In order to help curb these problems, Zambia resorted to seeking

policy and financial support from the IMF. Since the 1960s, the IMF BoP policies and solutions have been monetary based (MABP) (IMF, 2004). Therefore, the BoP policy solutions that there were prescribed to Zambia and other countries by the IMF were based on the MABP. Hence, it was expected that after following these policies, Zambia's BoP would improve and stabilise and in the long-run reduce the occurrence of these problems. However, for most of the period that the country was actively pursuing the MABP policies, Zambia's BoP was negative (See Figure 3 above). This discrepancy of the validity of the MABP in solving Zambia's BoP problems forms the motivation of this research.

In literature, many arguments have been advanced as to why the country was still having problems even after implementing the MABP policies; common among these are that the long term effects of the 1970s world economic recession and those of the country's socialist era that existed between 1973 and 1985, still accounted for a significant share of the Bop problems. Nevertheless, it is noted that less empirical studies have been carried out to ascertain the extent to which the MABP has helped in alleviating Zambia's BoP problems, let alone to examine the extent to which movements of the price level, growth in domestic credit, interest rates and other monetary variables in Zambia have explained the external imbalance.

1.3 Study Objectives

1.3.1 General objective

The study aims at establishing the relevance of MABP in Zambia. This is done by investigating the significance of the roles of the domestic price level and monetary policy in the determination of balance of payments within the MABP in the Zambian context and consequently,

1.3.2 Specific Objectives

1. To investigate the role of the domestic price level in the MABP in Zambia
2. To assess the impact of interest rates in the MABP in Zambia.
3. To establish the effect of domestic credit in the MABP in Zambia.
4. To establish the role of income in the MABP in Zambia.

1.4 Hypotheses

1. The domestic price level has no impact on the BoP in the MABP in Zambia.
2. Interest rates have no effect on the BoP in the MABP in Zambia.
3. Domestic credit has no impact on the BoP in the MABP in Zambia.
4. Income has no effect on the BoP in the MABP in Zambia.

1.5 Significance of Study

From around the 1970s, most least developed countries (LDCs), those in Africa inclusive, implemented and continue to implement the IMF supported programmes such as the Structural Adjustment Programmes (SAPS) and other financial system monitory strategies (World Bank, 2004). Most of these programmes are based on MABP. Although extensive studies to assess the relevance and significance of the MABP have been done in other LDCs especially those in Latin America, little or no studies have been conducted in the context of SSA.

A large research gap still exists in evaluating the approach against the African experience. It should however be noted that, over the past decade, studies have emerged in countries like Ghana, Nigeria, Malawi and Zimbabwe which have analysed the MABP in the context of the respective economies. Similar empirical work on the subject known to the researcher in the Zambian context is that of Peter Fairman (1986) who analysed the applicability of the monetary approach in the balance of payments using 1970 to 1983

data and found that the approach holds up well in Zambia and that the monetary processes despite the economic shocks in the said period were relatively stable.

This research is therefore significant as it tries to bridge the knowledge gap that exists in evaluating the MABP significance in the Zambian and SSA context. Most importantly, the study's relevance and uniqueness is reinforced by the following; i) unlike other studies in the Zambian and other African context, the study employs the SVAR model in the determination of the roles of monetary policy variables in the MABP which will make the findings empirically robust and theoretically consistent, ii) the study period closely corresponds to the period when Zambia was actively receiving BoP support from the IMF, and iii) the study offers a more recent examination of the MAPB in Zambia.

Given the BoP problems that Zambia has been experiencing, there is need to provide more recent evidence to the monetary policy officials on the significance and implications of the MABP in our economy. By examining the MABP, the research offers a basis for understanding the relationship between monetary policy and BoP problems in Zambia. The results will in this way provide renewed knowledge to policy makers on the required mix of monetary policy instruments when trying to spur growth in the economy while at the same time maintaining a healthy BoP (external balance), which is important in the solving of BoP problems that the country may face in future. The study also adds to the existing pool of knowledge for students of modern open macroeconomics and will provide a basis for future research in the area in the Zambian context.

1.6 Scope of the study

The study will aim at evaluating the implications of the Zambian monetary policy within the MABP over the period 1980 to 2011. The period has been chosen because it coincides with the period when Zambia was actively receiving BoP support from the IMF.

The rest of the research is outlined as follows; Chapter 2 reviews literature on the MABP and alternative BoP approaches and Chapter 3 gives an account of the evolution of macroeconomic policy in Zambia. Chapter 4 describes the methodology, followed by Chapter 5 which gives the empirical findings of the study and also discusses the results. Lastly but not the least, policy implications and conclusions are given in Chapter 6.

CHAPTER 2

EVOLUTION OF MACROECONOMIC POLICY IN ZAMBIA

2.0 Overview

Zambia's macroeconomic policy has been largely shaped by the evolving political system. Since independence, the country has seen three episodes, namely; the immediate post-independence market-based policy under the Multi-Party political system (1964-1973), the socialist policy under the One-Party State political system (1975-1990) and the capitalist policy under the Multi-Party political system (1991 to date).

Due to the existing One-Party system with a socialist ideology, the period prior to 1991 was featured by a controlled economy. Consumer prices, interest rates, exchange rates and credit allocation were administratively fixed by the State without any consideration for market forces of demand and supply. In addition, the State owned all the companies including mining firms which culminated into inefficiency in production and allocation of national resources. In 1991 after the insurgence of a Multi-Party state, the economy was liberalised and the macroeconomic policy was reformed to one characterised by capitalist practices. During this period, markets and institutions were restructured with Government influence being limited to policy direction. The economy reacted favourably to the reforms resulting in restoration of stability in macroeconomic variables including growth, tax revenues, money supply and inflation. Capital formation has increased substantially (as a percentage of GDP) since 1992, and non-traditional exports and services have been growing fast since the early 1990s and with copper production and export increasing significantly (IMF, 2000). In addition, the international reserves position has strengthened. The general business environment has also improved, with increased volumes of foreign direct and portfolio investments driving resurgent private sector led growth.

2.2 Exchange Rate Policy

The exchange rate policy in Zambia has highly involved three regimes, these being fixed, mixed and flexible. A fixed exchange rate regime existed from independence up to 1983, while a mixture of regimes was in existence in the period 1983 to 1991 and a flexible exchange rate has been in existence since the 1992 economic reforms. Table 2 below summarises the exchange rate regimes from 1964 to date.

From 1964 to 1967, the Zambian pound was a fully convertible currency and pegged to the British pound. In January 1968, the Zambia pound was replaced by the Zambian kwacha at an official exchange rate of K0.714 per US dollar or K1.70 per British pound sterling. However, in 1971, the kwacha was linked to the US dollar at an exchange rate of K0.643 per US dollar until 1973 when it was re-valued by 11.1 percent and was maintained until July 1976.

Table 2: Exchange Rate Regimes in Zambia, 1964 to 2011

No.	Period	Type of Exchange Rate Policy
1(a)	1964-1971	Foreign exchange rate fixed to British Pound
1(b)	1971-1976	Foreign exchange rate fixed to the US Dollar
2	1976-1983	Kwacha pegged to the SDR with periodic devaluations
3	1983-1985	Crawling peg to a basket of major trading partners' currencies
4	1985-1987	Foreign exchange auctions
5	1987-1989	Fixed to the US dollar with occasional devaluations
6	1990-1991	Dual exchange rate regime
7	1991-2011	Freely Floating exchange rate system

Source: Bank of Zambia

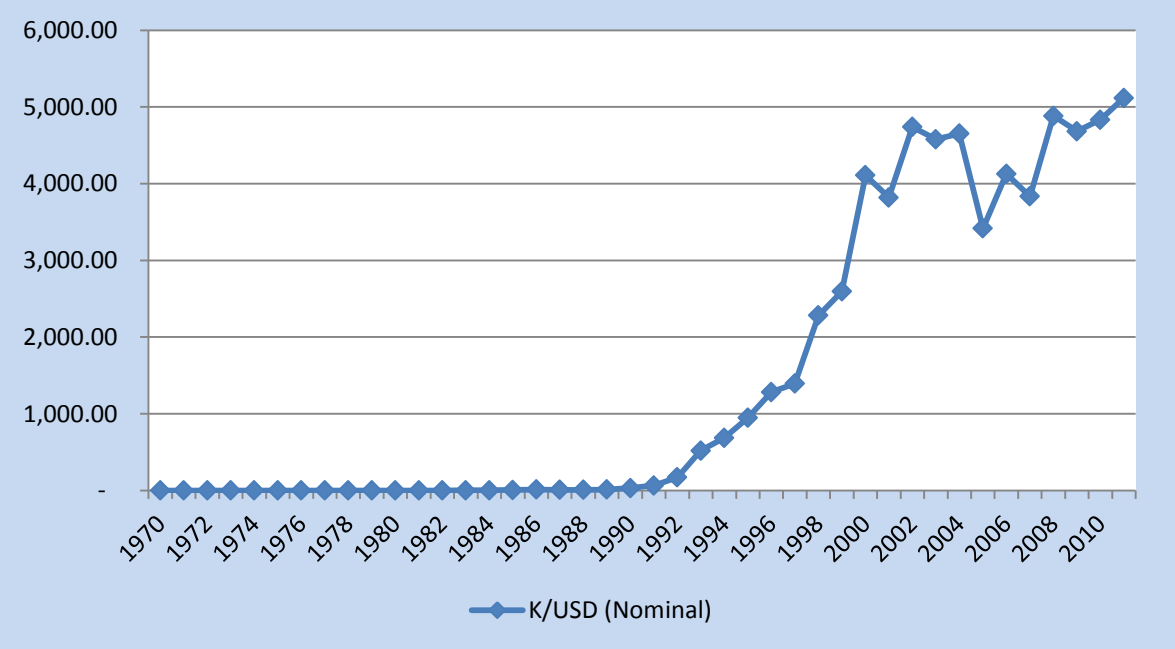
Then the kwacha was linked to the special drawing rights (SDR) at the rate of SDR1.0848 after further 20 percent devaluation. The kwacha was de-linked from SDR in July 1983 and it was pegged to a basket of five major international currencies, a mechanism under which the kwacha was devalued by 1.0 percent every month (Ibid, 2000).

Due to further deterioration of the external position mainly as a result of fall in Copper prices on the international market, an auction (floating) exchange rate system was introduced between 1985 and 1987 with a view to improving the allocation of foreign

exchange and eliminating the parallel underground exchange rate market that was emerging at the time. Amidst significant depreciations and soaring inflation, the auction system was abandoned in mid-1987 and replaced by a fixed exchange rate system with careful devaluations administered by the Foreign Exchange Management Committee (FEMAC). This system was in operation until 1990.

In 1990, a dual exchange rate system managed by FEMAC was adopted with a retail window for importers, an Open General Licence (OGL) system, and an official window with a lower rate. The OGL retail and official exchange rate were unified in 1991 with the commencement of economic liberalisation. Foreign exchange bureaus were licenced to operate in mid-1992 and allowed to determine their exchange rate freely. The supply of foreign exchange to the export retention and bureau markets was increased significantly by raising the non-traditional export retention entitlement to 100 percent and by permitting others to sell foreign exchange to the bureaus (IMF, 1993). Figure 4 below depicts the exchange rate movements from 1970 to 2011.

Figure 4: Exchange Rate Developments in Zambia, 1970 to 2011 (Nominal)



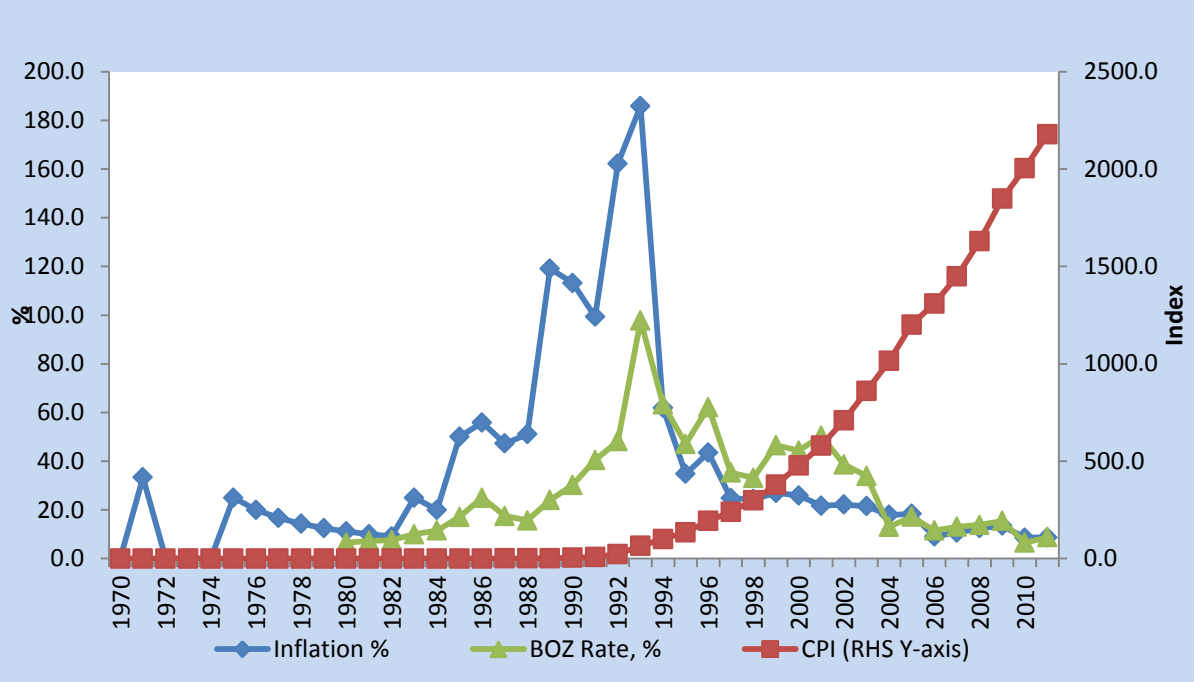
Data Source: Bank of Zambia

After liberalisation, Zambia Consolidated Copper Mines (ZCCM) earnings were now exchanged at the market rate as a way of integrating the foreign exchange market. The official exchange rate was devalued by 30 percent and the rate of crawl accelerated to 8 percent per month. Further modifications of the OGL system were made in 1993 with most exchange controls transferred to commercial banks and a dealing system was established. To pave way for the full convertibility of the kwacha, the Exchanged Control Act of 1965 was suspended in January 1994 resulting in the liberalisation of both the current and capital accounts. To date the exchange rate system remains liberalised and floating but under the sparing control by the Central Bank (Bank of Zambia, 2014).

2.3 Monetary Policy

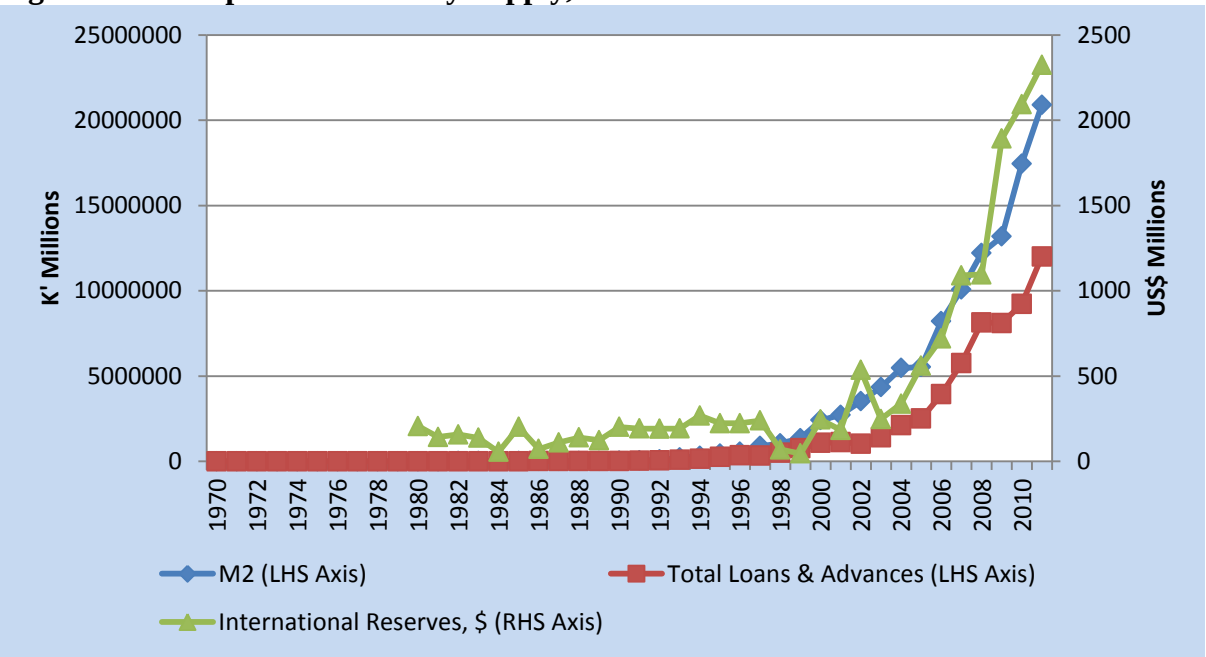
In the period 1964 t0 1991, Zambia's monetary policy was characterised by the implementation of direct instruments for controlling monetary aggregates which saw administratively fixing of interest rates, credit allocation control, and the use of core liquid assets and statutory reserves requirements. In addition, the consumer prices were fixed (Ibid, 2014). This resulted in deterioration of the economy evidenced by the period's high inflation, negative real interest rates, predominantly negative real GDP growth, an unsustainable balance of payments position, increasing foreign debt and shortage of essential commodities. In 1991, after heeding to the advice of the IMF and World Bank, the economy was liberalised which brought in macroeconomic reforms oriented towards the development of the private sector and the use of market-based instruments to maintain price and financial systems' stability (See Figure 5 and Figure 6).

Figure 5: Movements in Monetary Variables, 1970 to 2011



Data Source: Bank of Zambia and CSO

Figure 6: Developments in Money Supply, 1970 to 2011



Data Source: Bank of Zambia and CSO

The liberalisation of the economy was initially accompanied by a sharp rise in inflation due to the lack of a nominal anchor for monetary policy. Inflation, driven by a sharp increase in broad money and domestic credit (predominantly to the government), accelerated rapidly reaching a record high of 240 percent in July 1993. As the country was implementing the policy prescriptions under the IMF and World Bank's SAPs, inflation rapidly declined to below 50 percent by mid-1994. Key policy adjustments undertaken included (i) tightening of monetary policy that reduced broad money growth from more than 200 percent in 1990 to around 70 percent in 1992 and sharply increased nominal interest rates; and (ii) the introduction of a new fiscal policy rule designed to commit the government to a balanced domestic budget, the "cash budget" that helped reduce the deficit from around 10 percent in 1989 and 1990 to below 3 percent in 1992 (IMF, 2000).

CHAPTER 4

LITERATURE REVIEW

3.0 Overview

According to Fleermuys (2005), the balance of payments account records a country's international economic performance, with the two most significant accounts being the current account and capital account. Whereas the current account records all transactions of goods and services and unrequited transfers in a country, the capital account records all exchanges and money capital for various kinds of real or financial assets. The latter account is important as it relates domestic transactions to international transactions. There are three key approaches to the balance of payments namely the elasticities approach, the absorption approach and the monetary approach which is the main concern of this research. Differences among these approaches have occasionally been the focus of sharp controversy, most notably in the case of elasticity and absorption, and recently in the case of the monetary approach as contrasted with the others.

3.1 The elasticity approach

The elasticity approach focuses on the current account of the balance of payments and is concerned with the condition under which exchange rate changes can compensate for price distortions in international trade, which are assumed to be the major cause of the value of imports exceeding exports. The Marshallian partial equilibrium analysis is applied to markets for exports and imports. Capital movements are assumed away and the domestic price level varies with respect to the world price level. Whether an improvement in the balance of payments occurs as a result of devaluation depends crucially on the foreign elasticity of demand for exports and home elasticity of demand for imports denoted *ex* and *em*, respectively. If the elasticity condition, that is, $ex + em > 1$ held, devaluation would improve the balance of payments (assuming of course that the foreign exchange market was stable). This is called the Marshall-Lerner condition. If the sum is equal to unity, a change in the exchange rate will leave the balance of trade

unchanged. If the sum is smaller than unity, depreciation will make the balance unfavourable and an appreciation will make it more favourable (Harbeler, 1949).

There are considerable doubts about the efficacy of devaluation in developing countries. It is argued that the elasticities of exports and imports are sufficiently low, therefore devaluation cannot be expected to lead to an improvement of the balance of payments (see, for instance, Miles, 1979; Kincaid, 1984; and Saidi, 1987). A similar source of pessimism surrounds the lags in the response of the current account to relative price changes. The argument is that trade volumes respond sluggishly to price changes because of the inertia of importers switching domestic expenditure away from imports, and the existence of contracts. Thus, in the short run, it is unlikely that domestic export earnings following devaluation will increase by enough to offset the initial increase in the value of expenditure on imports. This is the "J Curve effect" on the current account, where, following devaluation, the balance of trade appears worse before it improves. Moreover, the elasticity approach ignores any direct effects devaluation may have on the domestic price level and domestic nominal wages.

3.2 The absorption approach

We have seen that in the elasticity approach to the analysis of devaluation, the effect of exchange rate adjustments on BoP depends principally on the elasticities of imports for home and foreign goods. This means that the relative price changes due to devaluation will be a pointer to the substitution effects that will happen. In this analysis income is assumed fixed. Thus, the income multiplier effects of devaluation are ignored. Alexander (1952) criticizes the elasticity approach as a partial equilibrium analysis. Instead, he proposes the absorption approach as an alternative. The central tenet of the absorption approach is that a favourable configuration of price elasticities may not be sufficient to produce a positive balance of payments effect resulting from devaluation, if devaluation does not succeed in reducing domestic absorption. The starting point of the absorption approach is the national income identity:

$$Y=C + I + G + X- M \ldots\ldots\ldots(1)$$

where Y = national income;

C = private consumption of goods and services purchased at home and from abroad;

I = total investment, by firms as well as by government;

G = government expenditure on goods and services

X = exports of goods and services; and

M = imports of goods and services.

It should be noted that recently this national income identity has been used to explain the current account as the difference between optimal savings and investment decisions (Rosensweig, 1994). Combining $C + 1 + G$ expenditure terms into a single term, A, representing domestic absorption (i.e., total domestic expenditure) and $X - M$ terms into B, net exports/trade balance, we get:

$$Y = A + B \ldots\ldots\ldots (2)$$

Equation 2 states that national income equals absorption plus the trade balance, or alternatively

$$B = Y-A \ldots\ldots(2')$$

Equation 2' can be expressed in changes as shown below:

$$dB = dY - dA \ldots\ldots(2'')$$

But changes in absorption depend on real income and other factors related to devaluation. Taking these into account, changes in absorption dA can be expressed as:

$$dA = cdY – dD\ldots\ldots (3)$$

where c = the propensity to absorb; and

d = the direct effect of devaluation on absorption.

Substituting Equation 3 into Equation 2 the result is:

$$dB = (l- c)\, dY + dD \ldots\ldots \quad (4)$$

Machlup (1943) postulates that the principal effect of devaluation on income is associated with the increased exports of the devaluing country and the induced stimulation of domestic demand through the multiplier effect, provided the economy is operating below full capacity. Alexander (1952) postulates two effects of the income effect, namely the idle resources effect and the terms of trade effect. The idle resources effect will result in an improvement in the balance of payments as long as the marginal propensity to absorb, *c*, is less than unity. If *c* is equal to or greater than unity, the foreign balance will not be improved as a result of improved output. Under such circumstances, the devaluation will be effective in stimulating recovery, but not improving the foreign balance except possibly through direct effects (Alexander, 1952). On the other hand, the effect of income on the change in terms of trade is assumed to worsen the balance of payments. Thus, when the devaluing country is at full employment, or c is equal to or greater than unity, devaluation will improve the balance of payments through the direct effect on absorption, that is, the expenditure reducing effect of devaluation. This expenditure reducing effect occurs through three channels, namely, the real cash balance (the most important effect), income redistribution and money illusion effects. The real balance effect occurs when money holders accumulate cash due to the increase in the general price level as a result of devaluation. This will result in a fall in real expenditure. This increase in demand for cash holdings will also result in a rise in interest rates, further reducing absorption through a reduction in investment. Thus, the real balance effect has a direct and indirect effect. The redistribution of income effect occurs when wages lag behind prices, such that prices increase at the expense of profit. If income is shifted from individuals with high propensity to those with low propensity, absorption will decline, and the balance of payments will improve.

3.3 The monetary approach

The monetary approach to the balance of payments is said to have been developed in the 1950s and 1960s by the IMF Research Department under Jacques J. P. Polak, and Harry

G. Jonson, Robert A. Mundell and their students at University of Chicago[1]. Empirical work on the fundamental basis of the MABP has been conducted by scholars such as Dornbusch (1971), Frenkel (1971), Johnson (1972), Laffer (1969), and Mundell (1968, 1971). Mundell (ibid.) emphasised that monetary factors, not real factors, exert the most influence on the balance of payments through their effects on the currency and capital accounts of a country. This approach contends that disequilibrium in a country's balance of payments shows an equivalent discrepancy between that economy's money demand and supply (Alawode, 1997).

In the monetary approach to the balance of payments, money market disequilibrium is seen as a crucial factor that provokes balance of payments disequilibrium. The stock imbalance between the demand for and supply of money causes external disequilibrium or balance of payments disequilibrium. If people demand more money than is being supplied by the central bank, then the excess demand for money would be satisfied by inflows of money from abroad. On the other hand, if the central bank is supplying more money than is demanded, the excess supply of money is eliminated by outflows of money to other countries. In this approach, balance of payments imbalances will restore equality between the demand for and supply of money in the absence of official intervention. In other words, external disequilibrium is transitory and will self-equilibrate in the long-run. The approach therefore looks beyond merchandise trade and incorporates the important role of financial assets (Melvin, 1992).

The MABP, which regards the balance of payments as a "*monetary phenomenon*", expresses the relationship between a country's balance of payments and its money supply (Chacholiades, 1990). Furthermore, it argues that there is disequilibrium in the money market if there are surpluses and deficits in the balance of payments. Deficits are caused by money supply exceeding money demand, while surpluses are caused by money demand exceeding money supply (Howard & Mamingi, 2002). The MABP, therefore, largely emphasizes the monetary implications of balance of payments disequilibria. In

[1] http://wps.aw.com/wps/media/objects/11358/11631194/Appendix_18.pdf

terms of prices, the MABP regards the general price level as the determinant of the real value of nominal assets, money and international debt. Relative prices seem to play a secondary role as they are considered to have only a transitory effect on the balance of payments (Umer, *et al.*, 2010).

The MABP specifies a money supply identity, money demand identity, and an equilibrium condition. The model consists of the following equations:

$$Ms = (R+D) \cdots \cdots \cdots (1)$$
$$Md = F(Y, P, I) \cdots \cdots \cdots (2)$$
$$Ms = Md \cdots \cdots \cdots (3)$$

Where; Ms = Money supply

R = International Reserves

D = Domestic credit

Md = Money demand

Y = Level of real domestic income

P = Price level

I = Rate of interest

The monetary theory holds that there is a positive relationship between money demand and income ($\partial Md / \partial Y > 0$), and between money demand and the price level ($\partial Md / \partial P > 0$). However, there is a negative relationship between money demand and the interest rate ($\partial Md / \partial I < 0$). If interest rates are increased, people will demand less money as the opportunity cost of holding cash balances is increased, thus creating incentives for investing in interest-bearing securities.

Then the reserve flow equation is written as :

$$\Delta R = \Delta [F(Y, P, I)] - \Delta D \cdots \cdots \cdots (4)$$

Equation (4) is the basic equation of the MABP, stating that the balance of payments is the result of divergence between the growth of money demand and the growth of domestic credit, whilst the monetary consequences of the balance of payments bring the money market into equilibrium. With money demand being stable, an increase in domestic credit will cause an equal and opposite change in international reserves. The coefficient of ΔD is, therefore, known as an *offset coefficient*: it shows the extent to which changes in domestic credit are offset by changes in international reserves. The MABP envisages a value of minus unity for this coefficient in the reserve flow equation (Dhliwayo, 1996). The MABP claims that balance of payments deficits result in decreases in the money supply as a consequence of a loss in international reserves. This loss in reserves will only be temporary, however, provided that monetary authorities do not completely sterilise them. Many small economies experience persistent deficits in their balance of payments because authorities use "*credit policies and expenditure policies to maintain levels of output and employment*" (Howard & Mamingi, 2002).

The MABP regards money demand as a demand for a stock; therefore, the inflows or outflows of money are regarded as the disequilibrium between desired and actual stocks, which can be adjusted through an excess of income over expenditure or vice versa. The differences between income and expenditure will be corrected when the flow of money brings the desired and actual money stock back into equilibrium (Fleermuys 2005).

Monetary authorities only have an influence on the *flow* supply of money. They do not have control over the *stock* of money supply. Therefore, it is assumed that, in the case of countries with fixed exchange rates, money supply is endogenous. Monetary policy only has an influence on the balance of payments through its control over credit creation. In the modern, demand-determined world, where money supply is credit-driven and loans make deposits, this argument has gained ground, especially as the banking systems of countries develop (Fleermuys 2005). It is important for researchers to understand the underlying propositions of the MABP. Kemp (1975) outlines the key characteristics of the MABP as: the MABP maintains that the transactions recorded in the balance of payments are essentially a reflection of monetary phenomena; only those BoP

transactions which have an influence on domestic and foreign monetary bases and thus on domestic and foreign money supplies are considered in the MABP; the model assumes efficient world market for goods, services, and securities; it is a theory of an automatic adjustment; and it provides a framework within which one is able to assess the differential impact of monetary disturbances which occur in a world in which there is at least one Reserve Currency Country (RCC) as opposed to those occurring in a world with no RCCs.

In terms of which of the three approaches to the BoP is better, MABP is often presented as superior to the other two because of its unique feature that the money market is stable and if there is any disequilibrium in the money market, an automatic adjustment process is initiated, which restores equilibrium in the long-run. According to the MABP, any dis-equilibrium in the money market is expected to be adjusted through changes in the international reserve flows or in the exchange rate or both, depending on the existing exchange rate regime (Chaudhary and Shabbir, 2004).

3.4 Empirical Evidence of MABP

A number of studies have been undertaken to test the MABP using data from both the developed market economies and LDCs. Kreinin and Officer (1978) surveyed 37 studies that tested the MABP in general and found that the number of studies they considered yielded negative results and the number of studies that supported the MABP were approximately equal, suggesting that the empirical evidence then was inconclusive. In the same survey, 14 studies tested the reserve-flow model. Three (3) studies produced negative, seven (7) mixed and four (4) positive results. Out of these 14 studies, five (5) used data from LDCs and one study reported negative (Cheng and Sargen, 1975), three mixed (Connolly and Taylor, 1975 and 1979; and Aghevli and Khan, 1977) and one reported positive (Cox and Wilford, 1978) results. Further examination of these five studies reveals that the Cheng and Sargen study, which produced negative results, and the Cox and Wilford study, which produced positive results, used annual time series data while those with mixed results used cross-section data. All of them applied ordinary least

squares (OLS) regression technique, except Aghevli and Khan (1977) who, in one of their two specifications, used correlation analysis. Rivera-Batiz and Rivera-Batiz (1985) have also concluded that even though a large number of empirical studies exists on the monetary approach, covering a wide range of countries and time periods, the weight of this evidence does not overwhelmingly support or reject the monetary approach. In support of the proponents, Duasa (2007) employed the bound testing approach to cointegration and error correction models developed within the Autoregressive Distributed Lag (ARDL) framework and found a significant long-run relationship between monetary variables and the Malaysian trade balance. Gulzar (2008) who econometrically tested the significance of the MABP in Pakistan using data for the period 1990 to 2008, established that the MABP did not hold in Pakistan. He however, found that the exchange rate and inflation had positive significant impacts on the BoP in Pakistan.

As to the predictions of the MABP, some unanimity has been reported on the existence of a demand for money function as hypothesised by the approach. Johnson (1977), for example, points out, following Mundell (1968), that: 'The most robust specific proposition is that, contrary to Keynesian predictions, the fastest-growing countries will have the strongest (surplus) balance-of-payments positions because their demand for money will tend to grow faster than the supply of domestic credit.' This observation is supported by the studies reviewed by Kreinin and Officer (1978) who find that the evidence on the effect of exogenous movements in income and the price level supports the monetary approach. They, however, observe that the approach is less favourably supported on the other predictions. Others, however, conclude that the signs of the estimated coefficients confirm the postulated ones, that is, inflation and income growth turn out to be positively associated with the balance of payments while domestic credit creation, multiplier growth and interest rate increases are negatively related to the balance of payments. Further, while the signs turn out as predicted, the magnitudes of the coefficients are different from those predicted by the approach as specified in Equation (5) (Rivera-Batiz and Rivera- Batiz, 1985).

In the African context, Silumbu D.E (1995) examined the roles of the exchange rate and monetary policy in the MABP in Malawi through the reserve flow mechanism and found that devaluation of the Malawian Kwacha led to loss of international reserves. He also observed that domestic credit had a positive coefficient as expected from the MABP model implying effective use of credit policy by the monetary officials. In Zimbabwe's investigation of the MABP, it was revealed that money played a significant role in determining the balance of payments during the period 1980 to 1991. It was also found that there was a one-to-one negative relationship and strong link between domestic credit and the flow of international reserves (Dhliwayo, 1996). Danjuma, F (2013) and Boateng and Ayentimi (2013) econometrically analysed the applicability of MABP to Nigeria and Ghana, respectively. The general conclusion in both papers was that the balance of payments in both economies was a monetary phenomenon in line with similar studies in other countries. In Zambia, Mutale (1983) in his MABP related study which focused on money supply as influenced by domestic credit and international reserves using OLS on Zambian data for the period 1970 to 1980, observed that international reserves did not have a significant effect on the growth of money supply but domestic credit. He further revealed that monetary policy was essentially determined by developments in the BoP with a payment surplus leading to higher Government revenue collections and the converse to a deficit.

Although the monetary approach has been commended for explaining the balance of payments well, it has prompted criticism from other scholars as an approach that ignores other parts of international trade in determining the balance of payments. The MABP has been blamed for disregarding the fiscal and real factors that influence changes in the balance of payments, whilst concentrating only on monetary factors (Umer, et al., 2010). Contrary to these views, it can be stated that the monetary approach does not ignore these factors. Valinezhad (1992) contends that "the MABP only asserts that the effect on the balance of payments of a higher rate of economic growth should be analysed with the tools of monetary theory". Further, Bilquees (1989) who followed up the Aghevli and Khan (1977) study of cross-section data on 39 LDCs including Pakistan, by applying the same model to a single country Pakistan, found that the MABP failed to explain international reserve movements in countries like Pakistan and India as monetary policy

as well as foreign exchange and capital markets were restrictive and highly controlled in these economies. Bilquees (Ibid) went on to argue that in the majority of LDCs, financial and commodity markets were very different from those in developed economies because of features such as strict exchange controls which rendered currencies of these countries almost inconvertible, in addition to which the capital markets are extremely limited and governed by factors including political stability and approval of the developmental and financial programmes of these countries by the IMF.

CHAPTER 4

METHODOLOGY

4.1 Theoretical Framework

The theoretical framework that was adopted in this thesis is the analysis of MABP model based on the basic Reserve Flow Equation (RFE) as used by Silumbu (1995) in his paper "Roles of exchange rate and monetary policy in the MABP in Malawi" and by Bilquees (1989) in his study "MABP: The Evidence on Reserve Flow from Pakistan". This model is outlined in detail below. The key advantage of using the RFE is that it enables the single-equation analysis of the MABP as opposed to using a macro-model. Thus, the RFE is appropriate for this research as it is argued that for a small[2] country such as Zambia, the results from a single-equation analysis of the MABP and those from a macro-model analysis are the same (Miller, 1986).

However, the econometric specification of the model that is employed is the Structural Vector Auto-Regression (SVAR) model of the RFE in the MABP. The SVAR has been chosen because of the method's enrichment in the econometric analysis of fluctuations in economic variables as result of policy changes. Two key strengths highlighted in all studies that utilize SVAR models are that i) SVAR allows for the time varying variance of monetary policy shocks via stochastic volatility specification and ii) it allows a dynamic interaction between the level of endogenous variables in the VAR and line varying volatility (Mumtaz and Zanetti, 2013). After the SVAR, an impulse-response analysis of the model will be conducted.

Since the early 1980s, VAR models have become a standard tool for empirical analysis by macroeconomists. They are easy to use, they are often more successful in predictions than complex simultaneous models (Bahovec and Erjavec, 2009) and they are a priori non-restrictive, that is, they do not require "incredible identification restrictions" (the

[2] A small country is one which has no significant influence of the world prices, interest rate or incomes and as such is a price taker on international markets (Miller, 1986).

often used phrase of Sims (Enders, 2003)). Models of structural vector auto-regressions (SVAR) use the restrictions imposed by economic theory to identify the system, that is, from a reduced form of shocks to obtain an economic interpretative function of the impulse response.

Mumtaz and Zanetti (2013) employed a structural vector auto-regression (SVAR) model to analyse the impact of the volatility of monetary policy. In their analysis they established that the nominal interest rate, output growth, and inflation fall in reaction to an increase in the volatility of monetary policy. Ravnik and Zilic (2010) in their paper on the effects of fiscal policy in Croatia used the multivariate Blanchard-Perotti SVAR methodology to analyze disaggregated short-term effects of fiscal policy on economic activity, inflation and short-term interest rates where they found that the effects of government expenditure shocks and the shock of government revenues are relatively the highest on interest rates and the lowest on inflation.

4.2 The Reserve Flow model

The research employs the SVAR model of the basic reserve flow equation (RFE) variant of the MABP. The basic MABP model assumes that there is a stable long-run demand for money (M_d) which positively depends on the domestic price level (P_d) and real income (Y), negatively depends on the interest rate(r) as the opportunity cost of holding cash balances or as an inducement to wealth accumulation and is negatively related to the domestic inflation rate[3] (π). As argued by Chaudhary and Shabbir (2004), the specific features of underdeveloped economies, like Zambia, in terms of an impact of different monetary variables are different from the case of developed countries. In less developed economies, interest rate is included in money demand function as an opportunity cost variable which remains one of the most controversial issues because in such economies, interest rate is not determined by market forces due to the existence of dual money

[3] It should be noted that although the interest rate embodies inflation, some scholars argue that in the case of LDCs, where interest rates are generally fixed, the inflation rate is a better measure of opportunity cost of holding cash balances (Haudhary and Habbir , 2004 and Bilqees, 1989). On this basis, the researcher will in some cases interpret the two variables interchangeably.

market (organized and unorganized) and frequent interference of government. In LDCs where the range of alternative assets is limited, substitution may take place between goods and money. Therefore, it is more appropriate to represent the opportunity cost by both the interest rate and the rate of inflation which is the implicit return on goods. This is why the adopted money demand function includes both the price level and inflation. Hence, the following demand for money is used:

$$\boldsymbol{M_d = P_d^{(+)} Y^{(+)} r^{(-)} \pi^{(-)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where the superscript in () indicates the sign of the direction of the influence of the variable on money supply.

Getting the natural logarithm of both sides of the equation we obtain:

$$\boldsymbol{\ln(M_d)_t = \ln(P_d)_t + \ln(Y)_t + \ln(r)_t + \ln(\pi)_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Noting that mathematically, say we have times series variable, Z, then the growth rate over time is given as

$$\boldsymbol{\dot{Z}_t = ln(Z_t) - \ln(Z_{t-1})}$$

Where a (.) above the variable is the growth operator.

Generating the growth rates of each variable over time in (2) in growth rates, we get;

$$\begin{aligned}\boldsymbol{\ln(M_d)_t - \ln(M_d)_{t-1}} &\\ &= \boldsymbol{[\ln(P_d)_t - \ln(P_d)_{t-1}] + [\ln(Y)_t - \ln(Y)_{t-1}] + [\ln(r)_t} \\ &\boldsymbol{- \ln(r)_{t-1}] + [\ln(\pi)_t - \ln(\pi)_{t-1}]} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)\end{aligned}$$

Denoting equation (3) in growth terms ;

$$\boldsymbol{\dot{M_{d_t}} = \dot{P_{d_t}} + \dot{Y}_t + \dot{r}_t + \dot{\pi}_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

On the supply side of the money market, the supply of money (M_s) is a multiple of the high powered money (monetary base, H) and the money multiplier (m). In turn, the high powered money has two components: the domestic, which comprises domestic credit (DC), and the external, which comprises international reserves (R). Thus:

$$\boldsymbol{M_s = mH = m(R + DC)} \ldots\ldots\ldots\ldots (5)$$

Getting the natural logarithm of both sides of the equation, we get;

$$\boldsymbol{\ln(M_s)_t = \ln(m)_t + \ln(H)_t = \ln(m)_t + \ln(R + DC)_t} \ldots\ldots\ldots\ldots (6)$$

Using the growth rate principle outlined above to express (6) in growth terms we obtain;

$$\boldsymbol{\dot{M}_{s_t} = \dot{m}_t + \dot{H}_t = \dot{m} + \left(\frac{R}{H}\dot{R}_t + \frac{DC}{H}\dot{DC}_t\right)} \ldots\ldots\ldots\ldots (7)$$

Monetary equilibrium requires that supply of money equals demand for money, that is, equating (4) to (7):

$$\boldsymbol{\dot{M}_{s_t} = \dot{m}_t + \left(\frac{R}{H}\dot{R}_t + \frac{DC}{H}\dot{DC}_t\right) = \dot{P}_{d_t} + \dot{Y}_t + \dot{r}_t + \dot{\pi}_t = \dot{M}_{d_t}} \ldots\ldots\ldots (8)$$

Expressing the balance of payments as a reserve-flow equation (that is, making term with growth in international reserves as subject) under the assumptions of the MABP, relation (8) becomes:

$$\boldsymbol{\frac{R}{H}\dot{R}_t = \dot{P}_{d_t} + \dot{Y}_t + \dot{r}_t + \dot{\pi}_t + \dot{m}_t + \frac{DC}{H}\dot{DC}_t} \ldots\ldots\ldots (9)$$

Under the assumptions of the MABP theory, the increase in the rate of growth of prices ($\dot{P}_d$) and real income ($\dot{Y}$) will lead to an improvement in the balance of payments (increase in stock of international reserves), while the increases in the growth rates of inflation ($\dot{\pi}$), the interest rate ($\dot{r}$), the money multiplier ($\dot{m}$) and domestic credit ($\dot{DC}$) will lead to loss of international reserves, holding all other factors constant (Bilquees, 1989).

Adding a constant, coefficients and the disturbance term to equation (9), the MABP is empirical tested by the equation:

$$\frac{\boldsymbol{R}}{\boldsymbol{H}}\dot{\boldsymbol{R}}_{\boldsymbol{t}} = \boldsymbol{b_0} + \boldsymbol{b_1}\dot{\boldsymbol{P}}_{\boldsymbol{d_t}} + \boldsymbol{b_2}\dot{\boldsymbol{Y}}_{\boldsymbol{t}} + \boldsymbol{b_3}\,\dot{\boldsymbol{r}}_{\boldsymbol{t}} + \boldsymbol{b_4}\dot{\boldsymbol{\pi}}_{\boldsymbol{t}} + \boldsymbol{b_5}\dot{\boldsymbol{m}}_{\boldsymbol{t}} + \boldsymbol{b_6}\frac{\boldsymbol{DC}}{\boldsymbol{H}}\dot{\boldsymbol{DC}}_{\boldsymbol{t}} + \boldsymbol{u_t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where, u_t, is a disturbance term.

According to the MABP, it is expected that:

i) $\boldsymbol{b_0 = 0}$;

ii) $\boldsymbol{b_1 = 1}$;

iii) $\boldsymbol{b_2 > 0}$;

iv) $\boldsymbol{b_3, b_4, < 0}$; *and*

v) $\boldsymbol{b_5 = b_6 = -1}$.

The joint MABP conditions (hypotheses) in i), ii) and iii) are joint tested using the F-Statistic which is expresses as the ratio of a Wald statistic to the respective degrees of freedom (Greene, 2012) defined as:

$$\boldsymbol{F} = \frac{(\boldsymbol{Rb - q})^{\boldsymbol{T}}[\boldsymbol{s^2 R(X^T X)^{-1} R^T}]^{-1}(\boldsymbol{Rb - q})}{\boldsymbol{v}} \tilde{} \boldsymbol{F(v,\ n - k)}$$

Where;

X is a k*k variable matrix

s^2 is k*k covariance matrix

R is a v*k vector of restrictions

b is a k*1 vector of parameters

q is the resultant v*1 vector from Rb

v is the number of restrictions

n is the number of observations

The rest of the hypotheses are tested through the standard sign and significant tests.

4.2.1 The price level and the exchange rate in the model

To show the role of exchange rate variations in influencing the demand for money and ultimately the BoP, the domestic price level (P_d) can be defined as a weighted average of traded goods prices (P_t) and non-traded goods prices (P_n). In turn, P_t is an average of exports and imports prices in foreign currency (P_t*) converted by the nominal exchange rate (NER) measured in local currency units (Silumbu, 1995). That is:

$$\boldsymbol{P_d = P_n{}^a\, NER^b\, P_t{}^{*c}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where;

$$\boldsymbol{P_t = NER^b\, P_t{}^{*c}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11a)$$

However, what is also important from the BoP angle is the relative price of tradable products which can be represented by the real exchange rate as:

$$\boldsymbol{RER = \frac{P_t}{P_n} = NER.\frac{P_t{}^*}{P_n}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

In growth terms (11) and (12) become, respectively:

$$\boldsymbol{\dot{P}_d = \dot{P}_n + \dot{NER} + \dot{P}_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

$$\boldsymbol{\dot{RER} = \dot{P}_t - \dot{P}_n = \dot{NER} + \dot{P}_t - \dot{P}_n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (13a)$$

Equations (11) and (12), though seemingly introducing an ambiguity, are valid given the evolution and extensions of the MABP. Extreme monetarism (Whitman, 1975), which assumed 'the law of one price', denied the role of non-traded goods price so that a =0 in (11) and said there is no role for relative prices to influence balance of payments. Current

monetarist thinking has incorporated the role of non-traded goods price in two respects. From the money demand side, a rise in any component of the domestic price level $\dot{P}_n, \dot{P}_t$ (due to devaluation and/or exogenous rise in (P_t*) raises the nominal demand for money, other things being equal, relative to the domestic monetary base, and therefore leading to an improvement in the BoP. This is the real balance effect.

The MABP model adopted in this study does not allow for distinguishing between exports and imports or terms of trade movements as a separate relative price. However, to gauge the empirical role of prices of tradable products and non-tradable product in influencing BoP within the RFE of the MABP, the inflation components of (13) and (13a) are substituted for the domestic price in (10). It should be recognized that a positive coefficient for P_n, as in (13), implies money demand effect while its negative coefficient, as in (13a), means relative price effect on BoP.

4.3 The Structural Vector Autoregressive (SVAR) model

The general representation of a VAR(p) is

$$A_0 y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t \quad \ldots\ldots\ldots\ldots 14$$

Where;

y_t is a vector of k endogenous variables in the model.

A_i is a k*k matrix of contemporaneous effects.

$i = 1,2, \ldots, p$; and

e_t is the error term satisfying;

i) $E(e_t) = 0$
ii) $E(e_t e_t') = \Omega$
iii) $E(e_t e_{t-k}') = 0$

From this VAR, the following Structural VAR may be obtained (Lutkepohl, 2005);

$$B_0 y_t = c_0 + B_1 y_{t-1} + B_2 y_{t-2} + \cdots + B_p y_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots 15$$

Where;

B_i is a k*k matrix of contemporaneous effects

ε_t is a 1*k vector of shocks at time t, satisfying;

i) $(\varepsilon_t) = 0$
ii) $E(\varepsilon_t \varepsilon_t') = \Sigma$
iii) $E(\varepsilon_t \varepsilon_{t-k}') = 0$

We can get the reduced form of the SVAR by pre-multiplying equation (15) by B_0^{-1};

$$\boldsymbol{A_0 y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t} \ldots\ldots\ldots\ldots 16$$

Or

$$\boldsymbol{A_0 y_t = c + (A_1 L_1 + A_2 L_2 + \cdots + A_p L_p) y_t + e_t} \ldots\ldots\ldots\ldots\ldots 17$$

Where;

$y_t = (\frac{R}{H}\dot{R}_t, \dot{P_{d}}_t, \dot{Y}_t, \dot{r}_t, \dot{\pi}_t, \dot{m}_t \; and \frac{DC}{H}\dot{DC}_t)'$;

L is the lag operator;

$B_0^{-1}c_0 = c$, $B_0^{-1}B_i = A$ for all $i = 1,2, \ldots, p$; and

$B_0^{-1}\varepsilon_t = e_t$ and is a vector of structural shocks that underlies the impulse reaction functions.

Further, the research conducted times series unit root tests and other auxiliary statistical tests as per econometric requirements. In addition, impulse response functions for the variables at hand were generated.

4.4 Data Sources and Analysis

The study used secondary time series data for the period 1980 to 2011 obtained from the Bank of Zambia (BoZ) and Central Statistical Office (CSO). The data obtained from the Bank of Zambia included international reserves, nominal and real exchange rates, market interest rates, Bank of Zambia interest rates, money supply, money demand, commercial banks loans and advances, statutory reserves, currency in circulation, balance

of payments (BoP) and metal production. The data sourced from CSO included inflation, real and nominal gross domestic product (GDP), consumer price index (CPI) and the index of industrial production (IIP). The World Bank and IMF web based data sources, and ZRA database were also consulted on a number of occasions. The data variables were chosen in accordance to the requirements of the MABP model and other related work done. Data analysis and management was conducted by use of statistical software namely STATA and Excel.

4.5 The Model Variables

i) Domestic Credit

Under the assumptions of the MABP, increase in net domestic assets of the central bank or domestic credit will lead to reduction in the stock of international reserves, holding all other factors constant. Domestic credit is collated through the monetary survey conducted by the Bank of Zambia on a monthly basis. The study could not access the full dataset on domestic credit for period under consideration due to data unavailability and unreliability. Therefore, the level of commercial bank loans and advances in kwacha loans was used as a proxy for domestic credit.

ii) Gross Domestic Product (GDP)

The theory postulates that increases in the rate of growth of real income (Y_t) will lead to an improvement in the balance of payments, ceteris paribus. For the estimations based on monthly data, the study used the total production of Copper and Cobalt in Zambia as a proxy for real GDP for the period under consideration. This is because real GDP and mineral production (Copper and Cobalt) were seen to be moving together in the same direction in the period under review and thus it was concluded that metal production would be a good proxy for GDP. It is worth noting that Zambia's GDP was largely driven by mining activities during the period 1980 to 2005 (CSO, 2010). For the

estimations based on annual data, the actual real GDP series as recorded by CSO were used.

iii) Interest rates

The MABP postulates that growth in the interest rate has a negative impact on international reserves, holding all other factors constant. In Zambia, the Central Bank Rate (BoZ rate) has traditionally formed the basis upon which commercial banks set their interest rates. Commercial banks are the conduits of monetary policy. The desire of the study was to use the Weighted Average Lending Base Rate (WALBR) for the commercial banks as a proxy for the market interest rate. The monthly WLBR was however not available for the period prior to 1994. Therefore, in the estimations based on annual data, the study proxied the market interest rate using the BoZ rate.

iv) The Money Multiplier

Under the MABP, it is assumed that the increase in the rate of the money multiplier will lead to less international reserves, holding all other factors constant. The money multiplier is expressed as the ratio of reserve money in the domestic currency to money supply (IMF, 2014). The researcher was able to access reliable and complete (both monthly and annual) data on money supply in Zambia, at the M2 level. According to Mishkin (2004), M2 can be defined as the total summation of currency in circulation, traveller's checks, demand deposits, other checkable deposits, small-denomination time deposits and repurchase agreements, savings deposits and money market deposit accounts, and money market mutual fund shares (non-institutional) in the economy. Therefore, the study assumed money supply at M2 level. In this regard, the multiplier was computed by dividing the M2 into Kwacha reserves held by commercial banks at BoZ.

v) Price level and inflation

Data on both Consumer Price Index (CPI or price level) and inflation was available on both monthly and annual basis for the entire study period. The MABP assumes that

increase in the growth of the price level (inflation) will lead to increase in the growth of international reserves, holding all other factors constant, while increase in the rate of growth of inflation (depreciation) leads to deterioration in the stock of international reserves, ceteris paribus.

CHAPTER 5

EMPIRICAL RESULTS

5.0 Overview

In testing the MABP model in Zambia, this research used OLS regression of the reserve flow equation by running two regressions; one based on monthly data and the other on annual data and it is worth noting that proxies were used for certain independent variables in both regressions. In order to avoid ambiguity in the rejection criteria among the three conventional significance levels, 1 percent, 5 percent and 10 percent, all the tests were concluded on none stringent basis. According to this research, none stringent rules for conclusion in a statistical test entail widening the acceptance region for favourable hypotheses to 99 percent and reducing the acceptance region for unfavourable hypotheses to 90 percent. This means that when the null hypothesis in a particular test was favourable with regard to the research hypothesis, it was rejected, if and only if, it was significant at 1 percent level. Similarly, when the null hypothesis in a particular test was unfavourable with regard to the research hypothesis, it was rejected, if and only if, it was significant at 10 percent level.

5.1 Unit Root Tests

This section gives the results of the unit root tests that were conducted on all the data variables. Two types of tests, the Augmented Dickey-Fuller and Phillips-Perron unit root tests were conducted on both the monthly and annual data series.

a) Monthly Data

Table 3 depicts the results of the Augmented Dickey-Fuller and Phillips-Perron tests for unit roots for the monthly data for the period 1995 to 2011 (Davidson and MacKinnon, 1993). In level form, only the Multiplier and Inflation were stationary (See Appendix 1). With respect to the logged variables, all except CPI, WLBRATE and Inflation were significant at at least one of the levels of significance. At the logging stage, International

Reserves and Domestic Credit were weighted as required by equation (9), by R/H and DC/H, respectively. The first difference of the log of all the variables were all stationary at the conventional levels of significance. However, it is worth noting that in the last stage, Inflation and WLBRATE were not logged but only differenced (1) because they were already growth rates.

Table 3: Unit Root Test Results, Monthly Data

Variable	Test	Z(t)[P-Value]
Δw_ln (Inter_Reserves)	ADF	-19.649[0.000]***
	Phillips-Perron	-21.128[0.000]***
Δw_ln(D_Credit)	ADF	-19.502[0.000]***
	Phillips-Perron	-20.931[0.000]***
Δln(CPI)	ADF	-12.786[0.000]***
	Phillips-Perron	-12.781[0.000]***
Δln(Met Production)	ADF	-23.158[0.000]***
	Phillips-Perron	-23.489[0.000]***
Δ(Wlbrate)	ADF	-15.246[0.000]***
	Phillips-Perron	-15.819[0.000]***
Δln(Multipler)	ADF	-22.059[0.000]***
	Phillips-Perron	-26.972[0.000]***
Δ(Inflation)	ADF	-14.223[0.000]***
	Phillips-Perron	-14.497[0.000]***

Note: ADF is Augmented Dickey-Fuller Test and Δ is the first difference operator. The null hypotheses for all the tests are that there is a unit root (i.e. the variable is non-stationary); (***) implies significance at 1 percent, 5 percent and 10 percent, (**) significance at 5 percent and 10 percent and (*) significance at 10 percent only.

b) Annual Data

Table 4 below shows the unit root test results for the annual dataset that ran from 1980 to 2011.

Table 4: Unit Root Test Results, Annual Data

Variable	Test	Z(t)[P-Value]
Δw_ln (Inter_Reserves)	ADF	-8.023[0.0000]***
	Phillips-Perron	-8.615[0.0000]***
Δw_ln(D_Credit)	ADF	-7.966[0.0000]***
	Phillips-Perron	-8.619[0.0000]***

Δ(CPI)	ADF	11.115[0.000]***
	Phillips-Perron	7.092[0.000]***
Δln(GDP)	ADF	-5.397[0.0000]***
	Phillips-Perron	-5.438[0.0000]***
Δ(BoZrate)	ADF	-6.545[0.0000]***
	Phillips-Perron	-6.572[0.0000]***
Δln(Multiplier)	ADF	-6.949[0.000]***
	Phillips-Perron	-7.708[0.000]***
Δ(Inflation)	ADF	-5.211[0.0000]***
	Phillips-Perron	-5.231[0.0000]***

Note: ADF is Augmented Dickey-Fuller Test and Δ is the first difference operator. The null hypotheses for all the tests are that there is a unit root (i.e. the variable is non-stationary); (***) implies significance at 1 percent, 5 percent and 10 percent, (**) significance at 5 percent and 10 percent and (*) significance at 10 percent only.

In level form, all variables with exception of Inflation and BoZ rate were stationary at the three (3) levels of significance. The log of the values of the weighted Domestic Credit and the Multiplier were stationary at all levels of significance under both tests, whereas real GDP was found to be stationary under the Phillips-Perron test. The first differences of log of all variables except for CPI were stationary at the three (3) levels of significance (See Appendix 1). Therefore, in regression based on annual data, CPI was taken in its level form while the logged values of the rest of the variable were used.

5.2 OLS Regression Results

The MABP model was estimated by running equation 10 (the RFE) using both monthly and annual data with the purpose of adequately evaluating whether the MABP theory was holding in Zambia. In the monthly regression, metal production $(met\ production)_t$ was used as proxy for real GDP due to the non-measurement of GDP on either a quarterly or monthly basis during the period under consideration. In the annual regression, the Bank of Zambia rate $(bozrate)_t$ was used as a proxy for interest rates due to the unavailability of the long series for the study period.

a) Monthly

The results of the regression based on monthly data with the dependent variable being the growth rate in weighted international reserves, $\boldsymbol{\Delta w\_ln(ireserves)_t}$, are presented in the table below. It is worth noting that for the rest of the paper, international reserves and BoP are taken to mean one and the same thing, so the two terms are used interchangeably.

Table 5: Regression Estimates, Monthly Data

Dependent Variable: :Δw_ln(ireserves)$_t$		
	Independent Variable	**Coefficient (Standard Error)**
1.	$\Delta\ln(\text{cpi})_t$	1.323241*** (.1056806)
2.	$\Delta\ln(\text{met production})_t$	0.0493561 (0.0312613)
3.	$\Delta(\text{wlbrate})_t$	0.0022921 (0.002262)
4.	$\Delta(\text{inflation})_t$	0.0020388 (.0018203)
5.	$\Delta\ln(\text{multiplier})_t$	0.0662149** (0. 0276548)
6.	Δw_ln(dcredit)$_t$	-1.032645*** (0. 0031031)
7.	constant	0.0024493 (0. 0064445)
Adjusted R-Squared=0.9983		

Note: Figure in brackets is standard error, *** implies significance at 1 percent, 5 percent and 10 percent, ** significance at 5 percent and 10 percent and * significance at 10 percent only.

The estimation results reveal that the coefficient for CPI is highly significant at all conventional levels of significance. The CPI coefficient of approximately 1.32 implies that for a 1 percent increase in the rate of growth of the CPI (inflation), the rate of change in the International Reserves increases by 1.32 percent. We can therefore conclude that the rate of change in the domestic price level in Zambia has a significant positive impact on the rate of change of International Reserves.

Metal Production which was a proxy for GDP in the regression was found to be insignificant at all conventional levels. Nonetheless, the sign of the coefficient of 0.049 on metal production was positive thus in accordance with the expectations of the MABP. Similarly, the third variable in the regression, WLBRATE (weighted average lending base rate) was also found to be insignificant at all levels of significance but of the correct sign as postulated by the MABP.

The rate of growth of Inflation (depreciation rate of local currency) was also found to be insignificant at all levels of significance in the monthly data regression. In addition, the sign of the coefficient for Inflation was also not consistent with expectation of the MABP.

The coefficient on the Multiplier was significant at 5 percent level of significance. The coefficient of approximately 0.066 meant that for every 1 percent increase in the rate of growth of the money multiplier, there is a 0.066 percent increase in the rate of growth of International Reserves .Put differently, for every 100 percent increase in the rate of growth of the multiplier, there is a 6.6 percent increase in the rate of growth of International Reserves. This therefore implies that growth in the Multiplier has a positive influence in the rate of growth of International Reserves in Zambia.

More importantly, the coefficient on Domestic Credit (total loans and advances in the economy) was found to be highly significant as evidenced by its P-Value of 0.000***.The coefficient of -1.033 on Domestic Credit implies that for every 1 percent increase in the rate of growth of the Domestic Credit, there is a 1.033 percent reduction in the rate of growth of International Reserves. It is worth noting that the negative sign of the coefficient is in agreement with the expectation of the MABP. The finding implies that changes in Domestic Credit (commercial banks loans and advances) have a negative impact on the changes in Zambia's International Reserves.

The constant was found to be insignificant at all conventional levels of significance. This implies that if all other factors were fixed (zero), the increase in the growth of International Reserves would be zero.

The adjusted R-Squared of approximately 99.8 percent means that the independent variables in the model together or that the model, accounts for about 99.8 percent of the variations that take place in International Reserves.

b) Annual

The results of the regression based on monthly with the dependent variable being the growth rate in weighted international reserves, $\boldsymbol{\Delta w\_ln(ireserves)_t}$, are presented in the table below.

Table 6: Regression Estimates, Annual Data

Dependent Variable: :Δw_ln(ireserves)$_t$		
	Independent Variable	**Coefficient**
1.	$\Delta(\text{cpi})_t$	0.5455456*** (0.1824094)
2.	$\Delta\ln(\text{cgdp})_t$	-0.3361475 (1.208522)
3.	$\Delta(\text{bozrate})_t$	0.0019394 (0.0045635)
4.	$\Delta(\text{inflation})_t$	-0.0003117 (0. 0019005)
5.	$\Delta\ln(\text{multiplier})_t$	0.0196897 (0. 0862556)
6.	$\Delta\text{w\_ln(dcredit)}_t$	-1.026496*** (0 .0106947)
7.	constant	0.1704661** (.0807734)
Adjusted R-Squared =99.70%		

The CPI was revealed to be significant at all conventional levels of significance. The coefficient of approximately 0.546 on CPI implies that for every 1 percent increase in the growth rate of CPI there is a 0.546 percent increase in the growth rate of International Reserves. This finding is in tandem with the finding in the estimation that used monthly data.

The real GDP, BoZ rate, Inflation and the Multiplier were all found to be insignificant in the estimation using annual data. This implies that each of these variables did not have

significant impact on International Reserves, if we used annual data. This could be as a result of over compressing information in annual data for time series (Greene, 2012)

Domestic Credit was also found to be significant at all levels of significance. The -1.026 coefficient on domestic credit meant that for every 1 percent increase in the rate of growth of domestic credit, there is a warranted 1.026 percent decline in the rate of growth of International Reserves, ceteris paribus (using annual data).

Unlike in the regression using monthly data, the constant term was found to significant at 5 percent and 10 percent level using annual data. The 0.17 coefficient on the constant term implies that when all other variables are fixed (zero) the growth rate of International Reserves will be increasing by 0.17 percent on an annual basis. The adjusted R-Squared of 99.7 percent means that the model explained about 99.7 percent of the variations that took place in International Reserves.

5.3 Hypothesis Testing for the MABP

In testing the validity of the MABP in Zambia, the study jointly tested the restrictions (hypotheses) imposed by the MABP. The hypotheses postulated by the MABP are:

i) $contant_t = 0$;

ii) $CPI_t = 1$;

iii) $GDP\ (Met\ Production)_t > 0$;

iv) $Wlbrate\ (BoZrate)_t, Inflation_t, < 0;\ and$

v) $Multiplier_t = D\_Credit_t = -1$.

Restrictions (i), (ii) and (v) were jointly tested using the F-test, whereas hypotheses (iii) and (iv) are tantamount to sign and significance tests of coefficients conducted using the computed T-Statistic or the P-Value of the estimated coefficients. If these restrictions jointly hold, then it can be concluded that the MABP holds in Zambia and vice-versa.

a) Test on Monthly Data Regression

For the estimation based on monthly data, the joint null hypothesis, H_0 , tested using the F-test is:

$$H_0: Constant\ = 0;\ CPI = 1;\ Multiplier = D\_credit = -1$$

The computed F-Statistic: F (4,196)=404.69 with P-Value=0.0000***

Conclusion:

Since the computed F-Statistic is significant at all conventional levels as seen from its P-Value, we reject H_0 and conclude that the MABP doesn't hold in Zambia.

In addition, we conduct the sign and significance tests for restrictions (iii) and (iv) above:

$$H_0: Met\ Production\ = 0$$

T-statistic=1.58, P-Value=0.116

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $Met\ Production = 0$ unlike the hypothesis postulated by the MABP.

$$H_0: Wlbrate\ = 0$$

T-statistic=1.01, P-Value=0.312

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $Wlbrate = 0$ unlike the hypothesis postulated by the MABP.

$$H_0: Inflation\ = 0$$

T-statistic=-0.16, P-Value=0.264

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $Inflation = 0$ unlike the hypothesis postulated by the MABP.

On the basis of the test results revealed above, it can be concluded that the MABP does not hold when tested using Zambian monthly data.

b) Test on Annual Data Regression

For the estimation based on annual data, the joint null hypothesis, H_0 , tested using the F-test is:

$$H_0: Constant = 0;\ CPI = 1;\ Multiplier = D\_credit = -1$$

The computed F-Statistic: F (4,24)=49,000,000 with P-Value=0.0000***

Conclusion:

Since the computed F-Statistic is significant at all levels as seen from its P-Value, we reject H_0 and conclude that the MABP does not hold in Zambia.

Similarly, we conduct the sign and significance tests for restrictions (iii) and (iv):

$$H_0: CGDP = 0$$

T-statistic=-0.28, P-Value=0.783

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $CGDP = 0$ unlike the hypothesis postulated by the MABP.

$$H_0: BoZrate = 0$$

T-statistic=0.42, P-Value=0.675

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $BoZrate = 0$ unlike the hypothesis postulated by the MABP.

$$H_0: Inflation = 0$$

T-statistic=1.12, P-Value=0.871

The P-Value is not significant at all conventional levels, hence we do not reject H_0 and conclude that statistically $Inflation = 0$ unlike the hypothesis postulated by the MABP.

Based on the preceding test results, the overall conclusion is therefor that the MABP does not hold in Zambia, when tested using annual data.

5.4 SVAR and Impulse Response Functions

The SVAR analysis was conducted using monthly data from 1995 to 2011, in order to allow for a large sample size. Equation 17 was estimated using an SVAR whose underlying VAR was based on 3 lags as determined by both the Akaike and FPE information criterion (Lutketpohl,2005) (see Appendix 4a) and treated the inflation rate variable as exogenous (recall, interest rates and inflation rate can be taken interchangeably in LDCs, (Bilqees, 1989)). Impulse reaction functions were generated based on the structural shocks, e_t, given in equation 16 or 17.

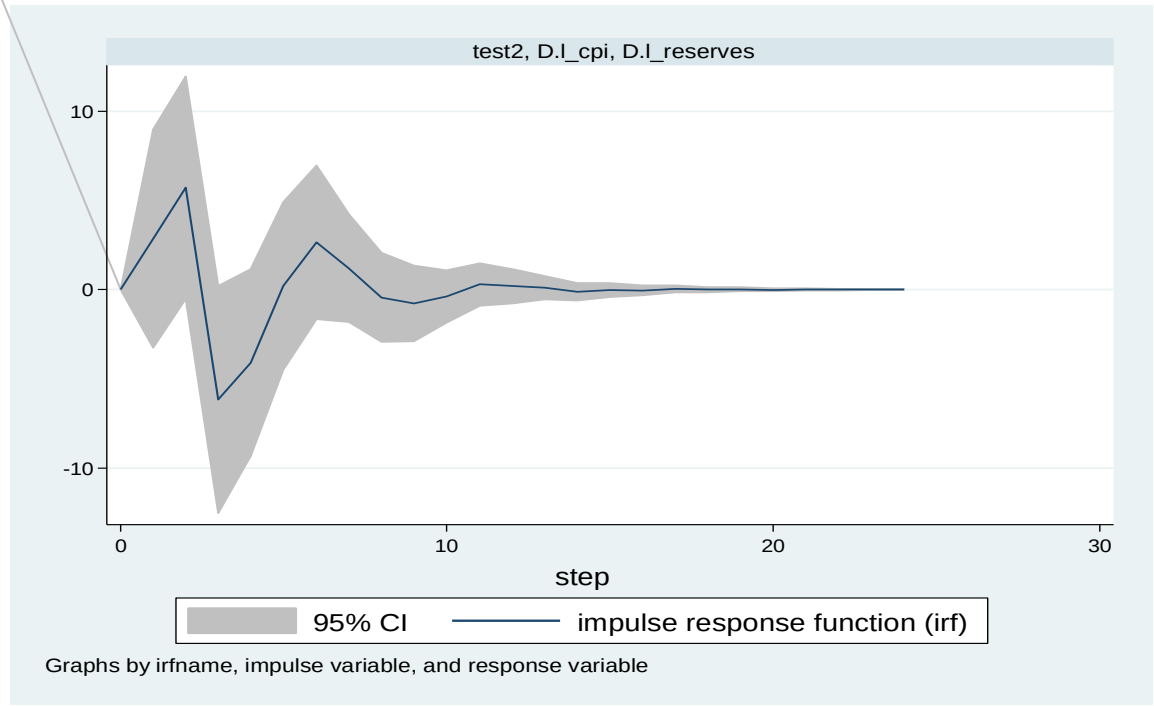
a) CPI

When the CPI is shocked by 1 percent, the impact on international reserves is positive in the first 2 months, then becomes negative in the 5th month and eventually dies off after the 10th month. The initial positive response in International Reserves as a result of a 1 percent increase in the CPI, is a reflection of the impact arising from domestic currency depreciation which makes the country's exports more attractive relative to others in the global market. This results in an increase (also increase in value) of exports and consequently, build-up of international reserves.

The negative development in International Reserves after the 5th month or so, is as a result of setting in of the price effect where domestic prices increase relative to the available stock of money, therefore inducing money supply to increase which partially happens through running down International Reserves.

This implies that price policies may assist in inducing favourable responses from International Reserves.

Figure 7: Response of International Reserves to a one percent shock in CPI



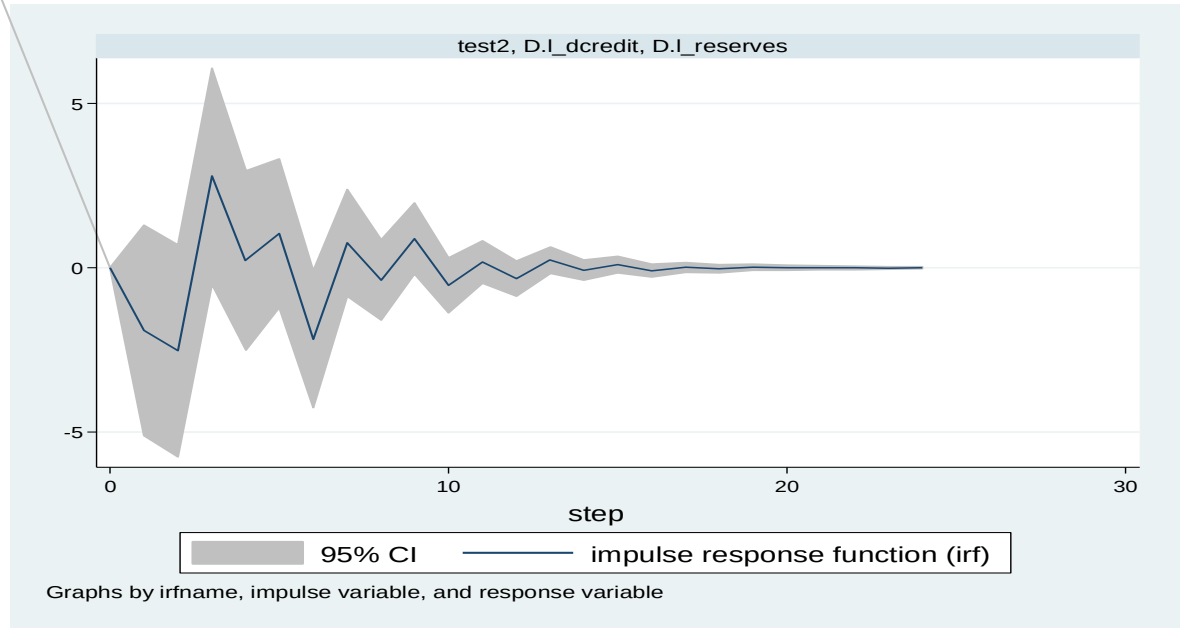
b) Domestic Credit

With regards to Domestic Credit, when the variable is given a 1 percent shock, International Reserves negatively responds in the first 2 months, then positively in the 3rd month and then negative after about the 5th month or so before dying off. The initial negative response in International Reserves is largely influenced by the Government borrowing from the banking system which drives up consumption, increasing the demand for imports and therefore resulting in a trade deficit. This results in a decline in international reserves or deterioration of the balance of payments.

After about three months, increased credit to the economy induces an increase in private investment and therefore production, which then promotes exports or reduces imports and positively affects the BoP by the third month.

This implies that credit policy can assist in inducing the position of the BoP and the two are inversely related.

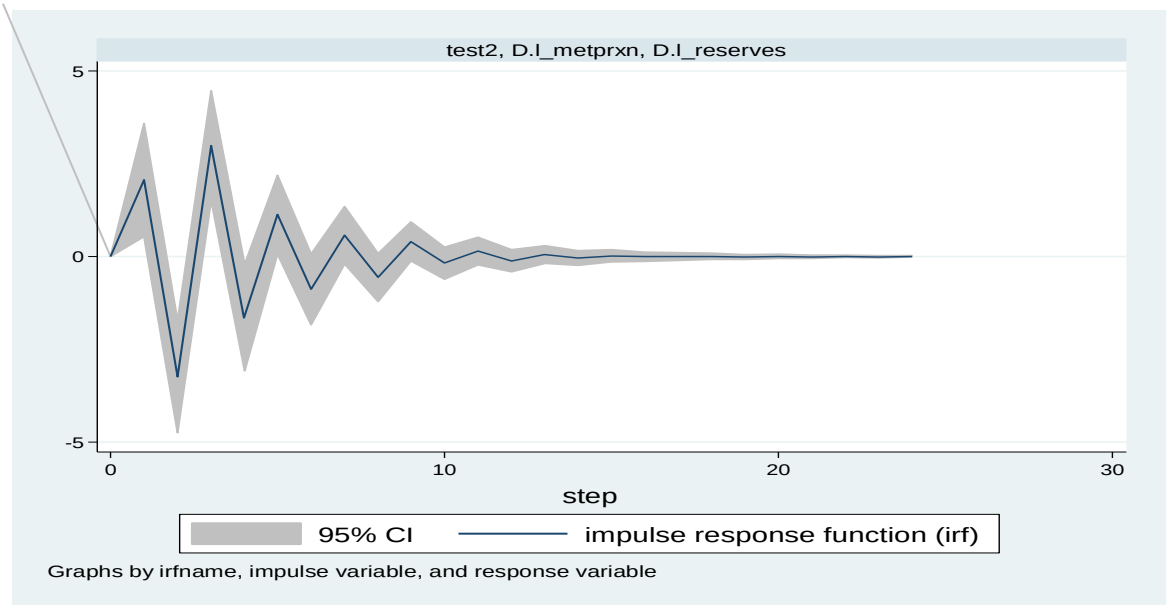
Figure 8: Response of International Reserves to a one percent shock in Domestic Credit



c) Metal Production (Real GDP)

Metal production was also found to have a significant impact on international reserves as given in Figure 7 with a relatively thin 95 percent confidence bound around the impulse line. When metal production is shocked by 1 percent, there is a positive response in international reserves observed in the first two months or so, which becomes positive by the 3rd month. The impact is negative until the 4th month when the response becomes positive again, thereafter; the effect is positive half of the time until the 10th or so when it fades off. This result indicates that income has a significant impact on the BoP in Zambia. This is because as income or economic activity increases, production and exports increase which results in increased earnings of foreign exchange, consequently leading to build-up of international reserves.

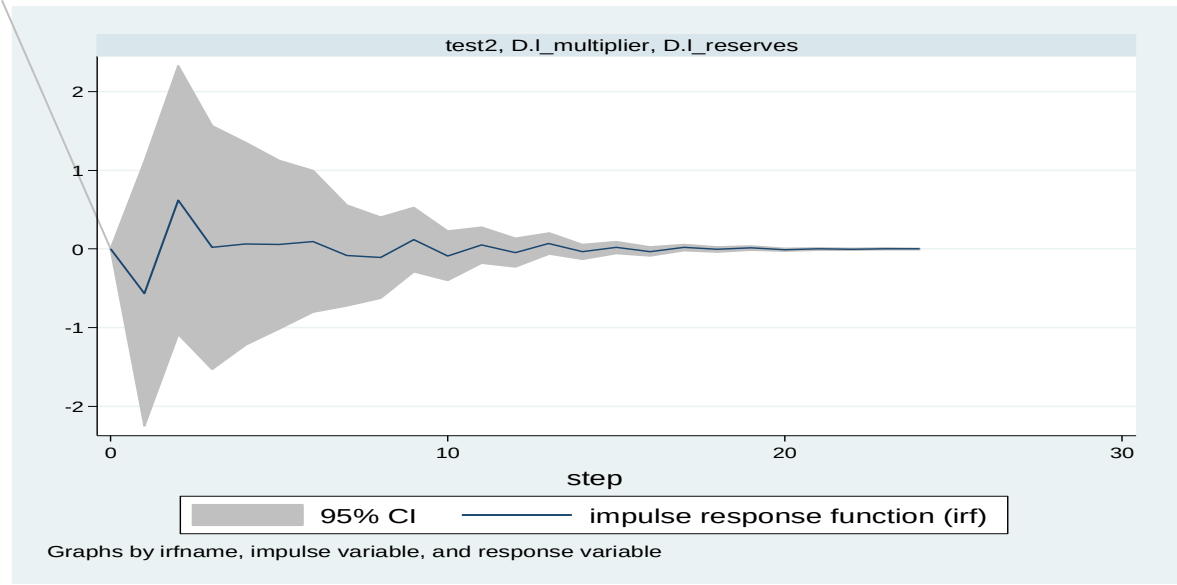
Figure 9: Response of International Reserves to a one percent shock in Metal Production (Real GDP)



d) The Money Multiplier

Similar to metal production (income), the money multiplier is found to have little impact on International Reserves (BoP), with observes wide regions of the 95 percent confidence bound around te impulse line (See Figure 7). The multiplier is observed to have an insignificant impact on the BoP in the first 10 months or so which fades off afterwards.

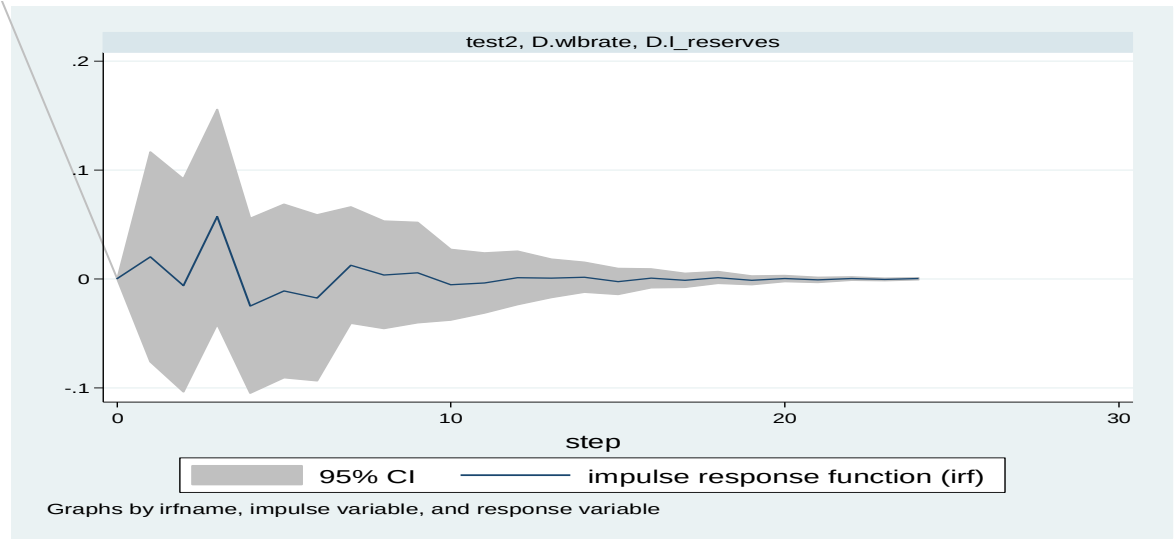
Figure 10: Response of International Reserves to a one percent shock in Mulriplier



e) Interest Rates

The interest rate (wlbrate) is found to have no impact at all on international reserves (BoP) as evidenced by the impulse line which is close to zero from time of the shock. The response of international reserves to a 1 percent shock in the Wlbrate is very insignificant.

Figure 11: Response of International Reserves to a one percent shock in Wlbrate (Interest Rates).



5.6 Discussion

The research has first of all tested the applicability of the MABP in Zambia using the OLS regression of the Reserve Flow Equation (RFE) for both monthly and annual data during the 1980 to 2011 period when Zambia was actively pursuing the IMF support programs for BoP problems. In both regressions, it is established that the conditions provided by the MABP theory do not jointly hold in Zambia. The joint F-test of the null hypothesis that constant =0, CPI =1, and multiplier=Domestic Credit = -1, do not hold at all conventional levels of significance. In addition, the hypothesis that GDP >0, inflation and interest rates<0 do not hold in monthly data as all the coefficients on these variables are not significant at all conventional levels and the results are the same in annual data. These results indicate that the MABP does not hold in Zambia.

Nevertheless, in the monthly regression it is revealed that CPI and Domestic Credit are highly significant in influencing the BoP in Zambia. In particular, a 1 percent increase in the growth of the CPI was found to induce a 1.32 percent increase in the rate of growth of International Reserves, while a 1 percent rise in the growth of Domestic Credit was estimated to lead to a 1.03 percent reduction in the growth of International Reserves. This is similar to findings by Duasa (2007) who established that there was long-run relationship between the Malaysian trade balance and monetary variables particularly, prices and domestic credit. Further, in the regression using monthly data, the Money Multiplier was found to be significant at a 5 percent level of significance, although the negative sign of the coefficient contradicted *a priori* expectation. The rest of the variables were insignificant.

Results from the regression using annual data were largely in line with those in the one based on monthly data. Again, the CPI and Domestic Credit were observed to be highly significant repressors. A 1 percent rise in the rate of growth of the CPI was found to result in a 0.55 rise in the growth of International Reserves, where as a 1 percent increase in the growth of Domestic Credit was revealed to induce a 1.03 percent reduction in the rate of growth of International Reserves. The constant was also significant at a 5 percent level of significance and the rest of the variables were insignificant. The regression

findings suggest that key influencing monetary variables for Zambia's BoP are the CPI and Domestic Credit. This implies that as far as monetary policy is concerned policies around these two variables are more effective in influencing positive performance of Zambia' BoP.

Reinforcing the regression findings are the long run and short run estimations conducted using the SVARs which indicated that three variables particularly, CPI, Domestic Credit and Income have significant influence on International Reserves in Zambia. This is in line with findings by Silumbu (1995) and Dhiliwayo (1996) who employed approaches similar to the one used by this study and established that Domestic Credit and Inflation hold significant effect on the balance of payments for Malawi and Zimbabwe respectively.

The largest significant impact on International Reserves (or BoP) in Zambia is exerted by CPI whose 1 percent shock has a positive impact in the first two months or so. The response thereafter becomes negative from about 5 months and dies off after the 10^{th} month or so. The positive influence that 1 percent shock in CPI imposes on the BoP, is as a result of the Kwacha depreciation relative to other currencies (exchange rate effect) that is experienced as the price level increases. This depreciation makes local products more attractive and more valuable on the international market which results in increased earnings of foreign exchange from exports. By the 5^{th} month or so, the response of international reserves becomes negative due to the price effect that sets in after inflation as when domestic prices increase, residents resort to imported commodities which increases the volumes of imports and exerts pressure on international reserves. The reaction fades off after the 10^{th} step indicating that there is no long-run relationship between CPI and international reserves.

A 1 percent shock in Domestic Credit has a significant negative impact on International Reserves in the first 2 months which becomes positive after 5 months or so, then is negative after 7 months and fades off after the 11^{th} month. The negative initial impulse in International Reserves is an indication of increased consumption as credit increases, which leads to the rise in imports thereby negatively affecting the trade balance. Increased consumption in the initial stage reflects the significant participation of

Government in the borrowing market which crowds out private borrowing and consequently adversely affects private investment. Part of the credit would have initially gone to the private sector which eventually increases investment and production which favourably affects the BoP, consequently resulting in the positive impact on the BoP in the 5^{th} month.

The impulse reaction function results from the conducted SVAR reveals that Income level or GDP does have a significant impact on International Reserves. This result is not surprising, because as income levels increase, there is both increased local production increased consumption which induce rises in exports and imports, which positively and negatively respectively impact the BoP. The initial effect of a 1 percent shock on income has a positive effect on the BoP largely through the trade balance as local production and therefore exports increases. By the second month or so, the income shock also leads to increased consumption which results in a rise imports, thereby negatively affecting the BoP. The effects of the shock keep alternating in this manner until about the 10^{th} month or so when it fades off.

The Interest Rate was also found to have no significant impact on the BoP in Zambia. This is attributed to the fact that a rise in interest rate may have a double impact on the BoP largely through the trade balance. High interest rates discourage borrowing and therefore negatively affect output and exports while at the same time, high interest rates will discourage consumption and possibly imports, therefore resulting in a neutral impact on the external position.

Further, the impulse reaction function results indicate that the Money Multiplier does not have significant impact on international reserves through the MABP channel. Changes in the Money Multiplier induce changes in the money supply with the transmission of the impacts continuing to other variables including interest rates, prices and output. However, changes in the money multiplier have a double impact on the BoP transmitted through the trade account just like in the case of interest rates. The resultant effect of a shock in the Money Multiplier is neutral effect on the BoP.

CHAPETR 6

POLICY IMPLICATIONS AND CONCLUSION

The study successfully tested the MABP in Zambia for the period that the country was actively receiving technical support on the BoP from the IMF and established that the model does not hold implying that Zambia's BoP is not purely a monetary phenomenon. This is similar to findings by studies from other LDCs including Malawi (Silumbu 1995), Nigeria (Bobai, 2013) and Zimbabwe (Dhiliwayo, 1996). In addition, Gulzar (2008) had similar findings using Pakistan data.

Notwithstanding, it was established that the domestic price level and Domestic Credit have highly significant effects on the BoP in Zambia. In this regard, the study suggests that policy makers can work towards stabilising inflation as a way of maintaining a balanced BoP. Changes in inflation exert both an exchange rate and price effect on the domestic economy which impose turbulences in the overall BoP. However, stabilising the price level is often a challenge as the variable is vulnerable to many other economic phenomena both in the domestic and external environment that may lie outside the control of monetary authorities.

Further, Domestic Credit whose impact on the BoP is negative reflecting a large proportion of credit going to consumption, offers the best opportunity for monetary authorities to influence the BoP as they have reasonably high control over the variable. The study results indicate that if properly managed, domestic credit can be utilised to turnaround the negative impact it may exert on the BoP to a positive one. Economic prudence requires that most of the credit goes towards production especially that related to non-traditional exports (NTEs) rather than consumption. Therefore, monetary authorities in Zambia can take advantage of this by designing deliberate policy that directs more credit towards the private sector, particularly industry involved in the production of NTEs, which will result in a positive impact on the BoP. In addition, the Government can also reduce its borrowing from the banking system to avoid crowding out of the private sector, which will go a long way towards maintaining a healthy BoP.

Furthermore, following the finding that Income (GDP) also has a significant impact on the BoP, the study recommends that policy makers should encourage growth policy biased towards export oriented sectors, especially NTEs. The increased production (activity) that may arise from increased incomes may lead to increased exports thus posing a positive impact on the BoP. This could be used together with the interest rate which can be a tool for inducing output and exports by promoting policy that offers lower interest rates to producers of NTEs. In this regard, the Bank of Zambia may further lower the policy rate in order to induce lower market interest rates and also promote lending to the private sector involved in NTEs, in efforts to spur output and therefore increase the country's share on the international market and positively affect the BoP.

REFERENCES

Adamu, P. A. & Itsede, C. O. (2009). "Balance of adjustments: the West Africa Monetary zone experience". *Journal of Monetary and Economic Integration*.Vol.10 No. 2.

Aghevli, B. B. & Khan, M. S. (1977). The Monetary Approach to Balance of Payments Determination: An empirical text. In International Monetary Fund (Eds.). *The monetary approach to the balance of payments*. Washington, DC:

Alexander, S.S. 1952. "Effects of devaluation on a trade balance". *IMF Staff Papers.* 2(2):263-78.

Bank of Zambia, Annual Report 2010.

Bank of Zambia, Annual Report 2011.

Bank of Zambia, Annual Report 2012.

Bank of Zambia, Fortnightly Statistical Bulletin, (1995 to 2011)

Bank of Zambia, Jubilee Celebrations Booklet 2014.

Barbone, L. and F. Rivera-Batiz. 1987. "Foreign capital and contractionary impact of currency devaluation, with application to Jamaica". *Journal of Development Economics.* 26:1-15.

Bevan, D., P. Collier and P. Horsnell, 1990, Controlled Open Economies: A Neoclassical Approach to Structuralism, Clarendon Press, Oxford.

Bilquees, F. (1989). "Monetary Approach to Balance of Paymens: The Evidence on Reserve Flow from Pakistan." The Pakistan Developmemt Review 28:3 (Autumn 1989) 195-206.

Blackwell, Carl P., 1978, 'Reflections on the Monetary Approach to the Balance of Payments', IMF Survey, February 20, pp. 52-55 and March 6, pp. 7 1-73.

Blades, D.W., 1972, 'Devaluation and the Direction of Malawi 's Import Trade', East African Economic Review, Vol. 4, No. 1, June, pp. 63-70.

Bobai, F. D. (2013). "An Empirical Analysis of the Balance of Payments as a Monetary Phenomenon: Nigeria's Experience." Journal of Emerging Issues in Economics, Finance and Banking, Vol. 1, No. 2.

Boateng, C. and Ayentimi, D. T. (2013). "An Empirical Analysis of Balance of Payment in Ghana using the Monetary Approach." European Journal of Business and Management, Vol. 5, No. 8.

Breusch, T. S. (1978). "Testing for autocorrelation in dynamic linear models". Australian Economic Papers 17: 334–355.

Caves, R.E., J.A. Frankel, and R.W. Jones, 1990, World Trade and Payments, Scott, Foresman/Little Brown Higher Education, Gensview.

Central Statistics Office, Monthly Statistical Bulletins (1995 to 2012).

Central Statistics Office, (2010). "Living Conditions Monitoring Survey." CSO Zambia.

Chacholiades, M. (1990). *International Economics*. New York: McGraw-Hill Publishers.

Chaudhary, M.A. and Shabbir, G. (2004). "The Impact of Domestic Credit, Deficit and Changing Exchange Rate Regimes on Foreign Reserves in Pakistan". Pakistan Economic and Social Review. 42 (1&2): 1-20.

Cheng, Hang-Sheng and Nicholas P. Sargen, 1975, 'Central-Bank Policy Towards Inflation', Federal Reserve Bank of San Francisco Business Review, Spring, pp. 3 1-40.

Connolly, Michael and Dean Taylor, 1976, 'Testing the Monetary Approach to Devaluation in Developing Countries', Journal of Political Economy, Vol. 84, pp. 849-859.

Cooper, R., 1971, 'Currency Devaluation in Developing Countries' ,Essays in International Finance, University Press, Princeton.

Coppin, A. (1994). "The Determinants of International Reserves in Barbados: A test of the Monetarist Approach".*Journal of Social and Economic Studies*, Vol. 43, No. 2, pp.75–89.

Davidson, R., and MacKinnon J. G. (1993). "Estimation and Inference in Econometrics". New York: Oxford University Press.

Dhliwayo, R. (1996). "The Balance of Payments as a Monetary Phenomenon: An Econometric Study of Zimbabwe's Experience". *African Economic Research Consortium*, Research Paper 46.

Dhliwayo, R. and T. Moyo. 1990. *"The Monetary Approach to Balance Of Payments: a case study of Zimbabwe"*. Final Report. African Economic Research Consortium. Nairobi.

Duasa, J. (2007). "Determinants of the Malaysian Trade Balance: An ARDL Bound Testing Aproach". Journal of Economic Co-operation 28 (3): 21-40.

Durbin, J. and G. S. Watson, (1950). Testing for serial correlation in least squares regression". I. Biometrika 37: 409–428.. 1951. Testing for serial correlation in least squares regression. II. Biometrika 38: 159–177.

Durbin, J. (1970). "Testing for serial correlation in least-squares regressions when some of the regressors are lagged dependent variables". Econometrica 38: 410–421.

Dornbush, R. 1973. "Currency depreciation, hoarding and relative prices," *Journal of Political Economy.* 81(4):893-915.

Enders, W., 2003. *Applied Econometric Time Series*. New York: John Wiley & Sons, Inc.

Fleermuys, F. N. (2005). "The Balance of Payments as a Monetary Phenomenon: An Econometric Study of Namibia". DEA Research Discussion Paper No.72.

Gould,W.W. (1996). "Wald test of nonlinear hypotheses after model estimation". Stata Technical Balletin 29:2-4. College Station. TX: Stata Press.

Gulzar, A. (2008)."Pakistan's Balance of Payments as a Monetary Phenomenon: (Econometric Evidence)". Journal of Managerial Sciences, 5(2):167-178.

Greene,W.H. (2012): "Econometric Analysis." Seventh Edition, Upper Suddle Rirre,NJ: Prentice Hall.

Howard, M. & Mamingi, N. (2002). "The Monetary Approach to the Balance of Payments: An Application to Barbados". *The Singapore Economic Review*, 47(2):213–228.

International Monetary Fund, (1977). *The monetary approach to balance of payments.* International Monetary Fund. Washington DC.

International Monetary Fund (1992). "*IMF Conditionality 1980-1991*". Arlington, VA: Alexis de Tocqueville Institution.

International Monetary Fund (1997):"Zambia - Selected Issues Statistical Appendix".Washington D.C.:International Monetary Fund.

International Monetary Fund, 2000: The IMF Approach to Economic Stabilization, NBER Macroeconomics Annual 1999, Volume 14, MIT Press.

Inoue, T. and Hamori, S. (2009). "What Explains Real and Nominal Exchange Rate Fluctuations? Evidence from SVAR Analysis for India." IDE Discussion Paper No. 216.

Kannan, R. 1989. "Monetary approach to balance of payments- a case study of India, 1968-1985". *Economic and Political Weekly.* 15(4):627-636.

Kreinin, M.E. and Officer, L.H. 1978. "The monetary approach to balance of payments: a survey". *Study in International Finance. No. 43.* Princeton University. Princeton.

Kremers, J.J.M. N.R. Eriscsson. and J.J. Dolado. 1992. "The power of cointegration tests". *Oxford Bulletin of Economics and Statistics.* 54:325-48.

Lutkepohl, H. (2005). "New Introduction to Multiple Time Series Analysis". New York: Springer.

Machlup, F. 1955. "Relative prices and aggregate spending in the analysis of devaluation". *The American Economic Review.* 45(3):255-78.

Magee, S.P. 1976. "The empirical evidence of the monetary approach to the balance of payments and exchange rates". *The American Economic Review.* 66:163-70.

Miles, A.M. 1979. "The effects of devaluation on the trade balance and the balance of payments". *Journal of Political Economy.* 87(3):600-19.

Miller, C. N. (1986). "A General Approach to the Balance of Payments and Exchange Rates". Journal of Economic Integration. 1(1):85-122.

Mishkin, F. (2004): "The Economics of Money, Banking and Financial Markets." Seventh Edition. Pearson.

Mundell, R.A. 1968. *"International Economics"*. Macmillan. London.
Ranis, G. ed. 1971. *"Government and Economic Development".* Yale University. New Haven.

Mutale, O. H. (1983): "Money Supply, Inflation and the Balance of Payments, Zambia (1970-1980)." Master of Arts in Economics Dissertation, University of Zamabia.

Obioma, E. C. (1998). "Balance of Payments and Exchange Rate Management in Nigeria: Empirical Evidence from the Monetary Approach". *NCEMA Policy Analysis Series*. 4 (2).

Ogiogio, G. O. (1996). "Exchange Rate Policy, Trade Policy Reform and the Balance of Payments".

Phillips, P. C. B. (1988). "The ET Interview: Professor James Durbin". Econometric Theory 4: 125–157.

Ravnik, R. and Zilic, I. (2010). “The use of SVAR Analysis in Determining the effects of Fiscal Shocks in Croatia.”

Rivera-Batiz, F. and Rivera-Batiz, L. (1985). “International Finance and Open Economy Macroeconomics”. MacMillan Publishing Company, New York.

Rosensweig, J.A. and E.W. Tallman. 1993. "Fiscal policy and trade adjustment: are the deficits really twins?" *Economic Inquiry.* 31 (4):580-94.

Silumbu, E. B. D. (1995). “The role of Exchange Rate and Monetary Policy in the Monetary Approach to the Balance of Payments: Evidence from Malawi.” Economic Research Consortium, research paper 37.

Szeftel, M. (2000) “Eat With Us”: Managing Corruption and Patronage Under Zambia's Three Republics, 1964-99. *Journal of Contemporary African Studies,* **18** (2)**,** 207-224.

Taylor, Mark P., 1987, 'Testing the Exogeneity Specification underlying the Monetary Approach to the Balance of Payments: Some UK Evidence', Applied Economics, Vol. 19, No. 5, May, pp. 557-661.

The World Bank (2004) *Zambia Country Economic Memorandum (In Two Volumes)*

Umer, M., Muhammad, S. D., Abro, A. A., Sheikh, Q. A. & Ghazali, A. (2010). “Balance of Payments as a Monetary Phenomenon: Econometric Evidence from Pakistan”, *International Research Journal of Finance and Economics*, ISS 38.

Valinezhad, M. (1992). “A Comment on Lascaux’s Critique of the Monetary Approach to the Balance of Payments”. Journal of Economic Issues, 26(1):262–270.

Whitman, Maria N., 1975, 'Global Monetarism and the Monetary Approach to the Balance of Payments', Brookings Papers on Economic Activity, No. 3, pp. 491-536.

APPENDICES

Appendix 1: Unit Root Test Results

Table 7: Unit Root Test Results, Monthly Data

Variable	Test	Level: Z(t)[P-Value]	Logged Value: Z(t)[P-Value]	First Difference of Logged Value: Z(t)[P-Value]
Inter_Reserves	ADF	0.255[0.9752]	Weighted-4.240[0.0006]***	Weighted-19.649[0.000]***
	Phillips-Perron	0.913[0.9933]	Weighted-3.782[0.0031]***	Weighted-21.128[0.000]***
D_Credit	ADF	0.565[0.9867]	Weighted-4.795[0.0001]***	Weighted-19.502[0.000]***
	Phillips-Perron	0.870[0.9927]	Weighted-4.442-[0.003]***	Weighted-20.931[0.000]***
CPI	ADF	0.555[0.9865]	1.903[0.3305]	-12.786[0.000]***
	Phillips-Perron	0.623[0.9882]	-1.954[0.3069]	-12.781[0.000]***
Met Production	ADF	-2.000 [0.2864]	-3.158[0.0225]**	-23.158[0.000]***
	Phillips-Perron	0.768 [0.8285]	-2.107[0.2416]	-23.489[0.000]***
Wlbrate	ADF	1.590[0.4884]	-1.205[0.6714]	not logged-15.246[0.000]***
	Phillips-Perron	-1.245[0.6541]	-0.898[0.7888]	not logged-15.819[0.000]***
Multipler	ADF	-4.444[0.0002]***	-5.444[0.000]***	-22.059[0.000]***
	Phillips-Perron	-4.438[0.0003]***	-5.774[0.000]***	-26.972[0.000]***
Inflation	ADF	-2.837[0.0535]*	-2.386[0.1457]	not logged-14.223[0.000]***
	Phillips-Perron	-2.587[0.0957]*	-2.045[0.2674]	not logged-14.497[0.000]***

Recall: ADF is Augmented Dickey-Fuller Test. The null hypotheses for all the tests are that there is a unit root (i.e. the variable is non-stationary); (***) implies significance at 1 percent, 5 percent and 10 percent, (**) significance at 5 percent and 10 percent and (*) significance at 10 percent only.

Table 8: Unit Root Test Results, Annual Data

Variable	Test	Level: Z(t)[P-Value]	Logged Value: Z(t)[P-Value]	First Difference of Logged Value; Z(t)[P-Value]
Inter_Reserves	ADF	4.1489[0.000]***	Weighted (2.502)[0.1151]	Weighted (8.023)[0.0000]***
	Phillips-Perron	5.873[0.000]***	Weighted (2.390)[0.1446]	Weighted (8.615)[0.0000]***
D_Credit	ADF	5.818[0.000]***	Weighted(4.473[0.0002]***	Weighted (7.966)[0.0000]***
	Phillips-Perron	7.451[0.000]***	Weighted (4.4441)[0.0003]***	Weighted (8.619)[0.0000]***
CPI	ADF	11.115[0.000]***	(2.087)[0.2497)	(1.665)[0.4490]
	Phillips-Perron	7.092[0.000]***	(1.444)[0.5609]	(1.695)[0.4336]
GDP	ADF	3.849[0.000]***	2.180[0.9989]	(5.397)[0.0000]***
	Phillips-Perron	5.184[0.000]***	3.134[1.000]***	(5.438)[0.0000]***
BoZrate	ADF	(1.986)[0.292]	(1.646)[0.4589]	not logged (6.545)[0.0000]***

	Phillips-Perron	(1.982)[0.2944]	(1.673)[0.4453]	not logged (6.572)[0.0000]***
Multiplier	ADF	(4.699)[0.0001]***	(4.031)[0.0013]***	(6.949)[0.000]***
	Phillips-Perron	(4.735)[0.0001]***	(3.971)[0.0016]***	(7.708)[0.000]***
Inflation	ADF	91.878)[0.3425]	(1.240)[0.6563]	not logged (5.211)[0.0000]***
	Phillips-Perron	(1.890[0.3367]	(1.315)[0.6222]	not logged (5.231)[0.0000]***

Recall: ADF is Augmented Dickey-Fuller Test. The null hypotheses for all the tests are that there is a unit root (i.e. the variable is non-stationary); (***) implies significance at 1 percent, 5 percent and 10 percent, (**) significance at 5 percent and 10 percent and (*) significance at 10 percent only.

Appendix 2: OLS Regression Estimation Results

Table 9: Regression Estimates, Monthly Data (1995-2011)

Dependent Variable: :Δw_ln(ireserves)$_t$				
	Independent Variable	**Coefficient**	**T-Statistic**	**P-Value**
1.	$\Delta\ln(\text{cpi})_t$	1.323241***	12.52	0.000***
2.	$\Delta\ln(\text{met production})_t$	0.0493561	1.58	0.116
3.	$\Delta(\text{wlbrate})_t$	0.0022921	1.01	0.312
4.	$\Delta(\text{inflation})_t$	0.0020388	1.12	0.264
5.	$\Delta\ln(\text{multiplier})_t$	0.0662149**	2.39	0.018**
6.	Δw_ln(dcredit)$_t$	-1.032645***	-332.78	0.000***
7.	constant	0.0024493	0.38	0.704
Adjusted R-Squared=0.9983				

Table 10: Regression Estimates, Annual Data (1980-2011)

Dependent Variable: :Δw_ln(ireserves)$_t$				
	Independent Variable	**Coefficient**	**T-Statistic**	**P-Value**
1.	$\Delta(\text{cpi})_t$	0.5455456	2.99	0.006***
2.	$\Delta\ln(\text{cgdp})_t$	-0.3361475	-0.28	0.783
3.	$\Delta(\text{bozrate})_t$	0.0019394	0.42	0.675
4.	$\Delta(\text{inflation})_t$	-0.0003117	-0.16	0.871
5.	$\Delta\ln(\text{multiplier})_t$	0.0196897	0.23	0.821
6.	Δw_ln(dcredit)$_t$	-1.026496	-95.98	0.000***
7.	constant	0.1704661	2.11	0.045**
Adjusted R-Squared =99.70%				

Appendix 3: OLS Post Regression Diagnostic Tests

Table 11: Summary of post regression diagnostic tests results

Test	Monthly Data	Annual Data	H_0:there is	Conclusion
Breush-Pagan/ Cook-Weisberg (P-Value)	0.3034	0.227	Heteroscedesticity	There is Homostedasticity in all models
Vif	1.06	1.82	There is Multicollinearity	There is no Multicollinearity in both models
Durbin-Watson (d-statistic)	2.2354≈2	2.2784≈2	No Serial Correlation	There is no serial correlation in both models
Dickey-Fuller Predicted Residuals (P-Value)	0.0000***	0.0000***	Unit root in predicted redsiduals	There is no Unit root in the predicted residuals

Following the above positive result of the post estimation diagnostics, it was concluded that the estimations based on both monthly and annual data were statistically valid to be used for inference.

Appendix 4: VAR Outputs

a) Lag-order selection

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-291.925				8.5e-07	3.05452	3.13489	3.25311*
1	-221.58	140.69	36	0.000	6.1e-07	2.70935	3.03085*	3.50371
2	-177.213	88.733	36	0.000	5.6e-07	2.62526	3.18789	4.0154
3	-113.082	128.26	36	0.000	4.2e-07*	2.34253*	3.14628	4.32845
4	-82.4013	61.362*	36	0.005	4.5e-07	2.39599	3.44087	4.97768

Endogenous: D.l_reserves D.l_cpi D.l_metprxn D.wlbrate D.l_multiplier D.l_dcredit
Exogenous: D.inflationrates _cons

b) VAR Estimation results (Monthly data, 1995m1-2011m12, 200 observations)

Log likelihood = -114.4129		AIC	= 2.344129
FPE = 4.22e-07		HQIC	= 3.144996
Det(Sigma_ml) = 1.26e-07		SBIC	= 4.323119

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_l_reserves	20	1.89089	0.3240	95.84046	0.0000
D_l_cpi	20	.053354	0.2541	68.13024	0.0000
D_l_metprxn	20	.166645	0.3875	126.5569	0.0000
D_wlbrate	20	2.54625	0.2852	79.81403	0.0000
D_l_multiplier	20	.157383	0.2239	57.70328	0.0000
D_l_dcredit	20	1.82691	0.3217	94.86881	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_l_reserves						
l_reserves						
LD.	-2.051307	1.576623	-1.30	0.193	-5.141431	1.038816
L2D.	-2.866769	1.574897	-1.82	0.069	-5.953511	.2199732
L3D.	.5193066	1.516351	0.34	0.732	-2.452686	3.491299
l_cpi						
LD.	2.857402	3.12407	0.91	0.360	-3.265663	8.980466
L2D.	7.356301	3.138505	2.34	0.019	1.204944	13.50766
L3D.	-6.669609	3.017639	-2.21	0.027	-12.58407	-.755145
l_metprxn						
LD.	2.065719	.7799305	2.65	0.008	.5370836	3.594355
L2D.	-1.657663	.8637375	-1.92	0.055	-3.350558	.0352311
L3D.	1.568702	.8140241	1.93	0.054	-.026756	3.16416
wlbrate						
LD.	.0204667	.0492032	0.42	0.677	-.0759697	.1169032
L2D.	-.0152871	.0490548	-0.31	0.755	-.1114327	.0808585
L3D.	.0695654	.0469954	1.48	0.139	-.0225438	.1616747
l_multiplier						
LD.	-.5672996	.8587876	-0.66	0.509	-2.250492	1.115893
L2D.	.2856457	.8869993	0.32	0.747	-1.452841	2.024132
L3D.	.444327	.5968402	0.74	0.457	-.7254584	1.614112
l_dcredit						
LD.	-1.90467	1.632399	-1.17	0.243	-5.104114	1.294773
L2D.	-2.875912	1.626075	-1.77	0.077	-6.062961	.3111369
L3D.	.81777	1.566245	0.52	0.602	-2.252014	3.887554
inflationr~s						
D1.	.0356314	.0381233	0.93	0.350	-.0390889	.1103517
_cons	.0671805	.136708	0.49	0.623	-.2007621	.3351232
D_l_cpi						
l_reserves						
LD.	-.0279073	.0444866	-0.63	0.530	-.1150995	.0592849
L2D.	.0203919	.044438	0.46	0.646	-.0667049	.1074887
L3D.	.003877	.042786	0.09	0.928	-.079982	.0877359
l_cpi						
LD.	.1877771	.08815	2.13	0.033	.0150062	.360548
L2D.	.0441609	.0885573	0.50	0.618	-.1294083	.2177301
L3D.	-.3199712	.0851469	-3.76	0.000	-.4868561	-.1530862
l_metprxn						
LD.	-.026895	.0220068	-1.22	0.222	-.0700276	.0162376
L2D.	-.0511782	.0243716	-2.10	0.036	-.0989456	-.0034108
L3D.	.0045129	.0229688	0.20	0.844	-.0405052	.049531
wlbrate						
LD.	-.0012463	.0013883	-0.90	0.369	-.0039674	.0014748
L2D.	.0004245	.0013841	0.31	0.759	-.0022883	.0031374
L3D.	-.0007727	.001326	-0.58	0.560	-.0033717	.0018263
l_multiplier						
LD.	-.006615	.0242319	-0.27	0.785	-.0541087	.0408787
L2D.	-.0169672	.0250279	-0.68	0.498	-.0660211	.0320866
L3D.	-.0625196	.0168407	-3.71	0.000	-.0955267	-.0295124
l_dcredit						
LD.	-.0266904	.0460604	-0.58	0.562	-.1169672	.0635864
L2D.	.0197665	.045882	0.43	0.667	-.0701605	.1096936
L3D.	.0038178	.0441938	0.09	0.931	-.0828005	.0904361
inflationr~s						
D1.	.0003562	.0010757	0.33	0.741	-.0017522	.0024645
_cons	.0154255	.0038574	4.00	0.000	.0078651	.0229859

D_l_metprxn						
l_reserves						
LD.	-.2048193	.138948	-1.47	0.140	-.4771524	.0675138
L2D.	-.1546752	.138796	-1.11	0.265	-.4267104	.1173599
L3D.	-.1607069	.1336362	-1.20	0.229	-.4226291	.1012153
l_cpi						
LD.	-.2342326	.2753248	-0.85	0.395	-.7738594	.3053941
L2D.	.9349453	.276597	3.38	0.001	.3928252	1.477065
L3D.	-.139432	.2659451	-0.52	0.600	-.6606747	.3818108
l_metprxn						
LD.	-.6060569	.0687354	-8.82	0.000	-.7407758	-.471338
L2D.	-.4346332	.0761213	-5.71	0.000	-.5838283	-.2854382
L3D.	-.1169413	.0717401	-1.63	0.103	-.2575493	.0236666
wlbrate						
LD.	.0041812	.0043363	0.96	0.335	-.0043177	.0126802
L2D.	.0009527	.0043232	0.22	0.826	-.0075207	.009426
L3D.	.0054771	.0041417	1.32	0.186	-.0026405	.0135947
l_multiplier						
LD.	.0964882	.0756851	1.27	0.202	-.0518518	.2448283
L2D.	.1939983	.0781714	2.48	0.013	.0407852	.3472114
L3D.	.0813592	.0525996	1.55	0.122	-.0217342	.1844525
l_dcredit						
LD.	-.2219084	.1438636	-1.54	0.123	-.5038759	.0600591
L2D.	-.1700435	.1433063	-1.19	0.235	-.4509187	.1108316
L3D.	-.1758387	.1380334	-1.27	0.203	-.4463793	.0947019
inflationr~s						
D1.	-.004409	.0033598	-1.31	0.189	-.0109942	.0021761
_cons	.0176906	.0120481	1.47	0.142	-.0059233	.0413044
D_wlbrate						
l_reserves						
LD.	.1689776	2.123061	0.08	0.937	-3.992145	4.3301
L2D.	-1.1892	2.120738	-0.56	0.575	-5.34577	2.967369
L3D.	-.4647721	2.041899	-0.23	0.820	-4.466821	3.537277
l_cpi						
LD.	-.7108411	4.206835	-0.17	0.866	-8.956086	7.534404
L2D.	3.98887	4.226273	0.94	0.345	-4.294473	12.27221
L3D.	-.8102523	4.063516	-0.20	0.842	-8.774598	7.154094
l_metprxn						
LD.	-.2660687	1.050245	-0.25	0.800	-2.324511	1.792374
L2D.	.8870497	1.163098	0.76	0.446	-1.392581	3.166681
L3D.	2.386851	1.096155	2.18	0.029	.2384268	4.535275
wlbrate						
LD.	.0549414	.0662564	0.83	0.407	-.0749188	.1848016
L2D.	.0057737	.0660566	0.09	0.930	-.1236948	.1352422
L3D.	-.3734308	.0632834	-5.90	0.000	-.497464	-.2493976
l_multiplier						
LD.	1.844799	1.156433	1.60	0.111	-.4217685	4.111366
L2D.	1.028583	1.194423	0.86	0.389	-1.312443	3.369608
L3D.	-.8143334	.8036979	-1.01	0.311	-2.389552	.7608854
l_dcredit						
LD.	-.0844699	2.198169	-0.04	0.969	-4.392802	4.223862
L2D.	-1.165832	2.189653	-0.53	0.594	-5.457474	3.12581
L3D.	-.5339194	2.109087	-0.25	0.800	-4.667653	3.599815
inflationr~s						
D1.	.1127392	.0513364	2.20	0.028	.0121216	.2133567
_cons	-.1471069	.1840893	-0.80	0.424	-.5079153	.2137015
D_l_multip~r						
l_reserves						
LD.	.2119681	.1312258	1.62	0.106	-.0452299	.469166
L2D.	.2792988	.1310823	2.13	0.033	.0223823	.5362153
L3D.	.1405835	.1262093	1.11	0.265	-.1067821	.3879491
l_cpi						
LD.	-.3409429	.2600234	-1.31	0.190	-.8505794	.1686935
L2D.	-.6313906	.2612248	-2.42	0.016	-1.143382	-.1193994
L3D.	-.1710454	.2511649	-0.68	0.496	-.6633196	.3212287
l_metprxn						
LD.	-.0494068	.0649154	-0.76	0.447	-.1766386	.077825
L2D.	-.0589707	.0718908	-0.82	0.412	-.1998742	.0819327
L3D.	-.1041487	.0677531	-1.54	0.124	-.2369422	.0286449
wlbrate						
LD.	-.0079435	.0040953	-1.94	0.052	-.0159702	.0000831
L2D.	-.0144338	.0040829	-3.54	0.000	-.0224363	-.0064314
L3D.	.0078834	.0039115	2.02	0.044	.0002169	.0155498
l_multiplier						
LD.	-.3743373	.0714788	-5.24	0.000	-.5144333	-.2342414
L2D.	-.3109444	.0738269	-4.21	0.000	-.4556425	-.1662462
L3D.	-.1168552	.0496764	-2.35	0.019	-.214219	-.0194913
l_dcredit						
LD.	.2261604	.1358683	1.66	0.096	-.0401365	.4924573
L2D.	.2927601	.1353419	2.16	0.031	.0274948	.5580254
L3D.	.1449861	.1303621	1.11	0.266	-.1105189	.4004912
inflationr~s						
D1.	.0000285	.0031731	0.01	0.993	-.0061907	.0062476
_cons	-.0052991	.0113785	-0.47	0.641	-.0276005	.0170024

D_l_dcredit						
l_reserves						
LD.	1.663613	1.523273	1.09	0.275	-1.321947	4.649174
L2D.	2.616835	1.521606	1.72	0.085	-.3654583	5.599129
L3D.	-.7247859	1.46504	-0.49	0.621	-3.596212	2.146641
l_cpi						
LD.	-2.093446	3.018358	-0.69	0.488	-8.009319	3.822427
L2D.	-6.923163	3.032305	-2.28	0.022	-12.86637	-.9799553
L3D.	6.361704	2.915529	2.18	0.029	.6473728	12.07604
l_metprxn						
LD.	-2.081201	.7535393	-2.76	0.006	-3.558111	-.6042909
L2D.	1.554868	.8345105	1.86	0.062	-.0807421	3.190479
L3D.	-1.544729	.7864792	-1.96	0.050	-3.0862	-.0032581
wlbrate						
LD.	-.0213589	.0475383	-0.45	0.653	-.1145322	.0718143
L2D.	.0173354	.0473949	0.37	0.715	-.0755568	.1102276
L3D.	-.0650626	.0454052	-1.43	0.152	-.1540551	.0239299
l_multiplier						
LD.	.6607755	.8297281	0.80	0.426	-.9654617	2.287013
L2D.	-.2537142	.8569852	-0.30	0.767	-1.933374	1.425946
L3D.	-.5380936	.5766444	-0.93	0.351	-1.668296	.5921088
l_dcredit						
LD.	1.517639	1.577162	0.96	0.336	-1.573542	4.60882
L2D.	2.614226	1.571052	1.66	0.096	-.4649797	5.693432
L3D.	-1.021194	1.513247	-0.67	0.500	-3.987103	1.944715
inflationr~s						
D1.	-.0321747	.0368333	-0.87	0.382	-.1043667	.0400172
_cons	-.0384369	.1320821	-0.29	0.771	-.2973129	.2204392

Appendix 5: VAR Post Estimation Diagnostics

a) Granger Causality

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
D_l_reserves	D.l_cpi	10.921	3	0.012
D_l_reserves	D.l_metprxn	30.558	3	0.000
D_l_reserves	D.wlbrate	2.4179	3	0.490
D_l_reserves	D.l_multiplier	1.2848	3	0.733
D_l_reserves	D.l_dcredit	4.8889	3	0.180
D_l_reserves	ALL	41.636	15	0.000
D_l_cpi	D.l_reserves	.82019	3	0.845
D_l_cpi	D.l_metprxn	6.6178	3	0.085
D_l_cpi	D.wlbrate	1.1767	3	0.759
D_l_cpi	D.l_multiplier	13.837	3	0.003
D_l_cpi	D.l_dcredit	.70384	3	0.872
D_l_cpi	ALL	28.071	15	0.021
D_l_metprxn	D.l_reserves	3.426	3	0.330
D_l_metprxn	D.l_cpi	12.634	3	0.005
D_l_metprxn	D.wlbrate	2.5187	3	0.472
D_l_metprxn	D.l_multiplier	7.3604	3	0.061
D_l_metprxn	D.l_dcredit	3.8126	3	0.282
D_l_metprxn	ALL	29.606	15	0.013
D_wlbrate	D.l_reserves	.38073	3	0.944
D_wlbrate	D.l_cpi	.96542	3	0.810
D_wlbrate	D.l_metprxn	5.7486	3	0.125
D_wlbrate	D.l_multiplier	4.4361	3	0.218
D_wlbrate	D.l_dcredit	.30919	3	0.958
D_wlbrate	ALL	18.031	15	0.261
D_l_multiplier	D.l_reserves	5.9151	3	0.116
D_l_multiplier	D.l_cpi	7.7165	3	0.052
D_l_multiplier	D.l_metprxn	2.4497	3	0.484
D_l_multiplier	D.wlbrate	21.631	3	0.000
D_l_multiplier	D.l_dcredit	6.1589	3	0.104
D_l_multiplier	ALL	30.704	15	0.010
D_l_dcredit	D.l_reserves	4.5241	3	0.210
D_l_dcredit	D.l_cpi	10.178	3	0.017
D_l_dcredit	D.l_metprxn	31.199	3	0.000
D_l_dcredit	D.wlbrate	2.3451	3	0.504
D_l_dcredit	D.l_multiplier	1.8497	3	0.604
D_l_dcredit	ALL	41.73	15	0.000

b) Autocorrelation in residuals

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	44.6964	36	0.15161
2	38.1562	36	0.37165

H0: no autocorrelation at lag order

c) Test for Normally Distributed Residuals

Jarque-Bera test

Equation	chi2	df	Prob > chi2
D_l_reserves	125.687	2	0.00000
D_l_cpi	53.127	2	0.00000
D_l_metprxn	1041.330	2	0.00000
D_wlbrate	809.904	2	0.00000
D_l_multiplier	135.720	2	0.00000
D_l_dcredit	5.350	2	0.06892
ALL	2171.119	12	0.00000

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
D_l_reserves	.50903	8.637	1	0.00329
D_l_cpi	-.22194	1.642	1	0.20005
D_l_metprxn	-1.4533	70.407	1	0.00000
D_wlbrate	-.57494	11.018	1	0.00090
D_l_multiplier	.48195	7.743	1	0.00539
D_l_dcredit	-.0635	0.134	1	0.71391
ALL		99.582	6	0.00000

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
D_l_reserves	6.7478	117.050	1	0.00000
D_l_cpi	5.4856	51.485	1	0.00000
D_l_metprxn	13.794	970.923	1	0.00000
D_wlbrate	12.791	798.886	1	0.00000
D_l_multiplier	6.9188	127.978	1	0.00000
D_l_dcredit	3.7911	5.215	1	0.02239
ALL		2071.537	6	0.00000

d) Stability of Condition of Estimates

Eigenvalue stability condition

Eigenvalue	Modulus
-.7627449 + .09282677*i*	.768373
-.7627449 - .09282677*i*	.768373
.314921 + .6360795*i*	.709769
.314921 - .6360795*i*	.709769
.3438828 + .6114582*i*	.701524
.3438828 - .6114582*i*	.701524
.04730609 + .6277224*i*	.629502
.04730609 - .6277224*i*	.629502
.3685901 + .4948176*i*	.617011
.3685901 - .4948176*i*	.617011
.1955638 + .566566*i*	.599368
.1955638 - .566566*i*	.599368
-.2130745 + .5584171*i*	.597688
-.2130745 - .5584171*i*	.597688
-.5723139 + .1320154*i*	.587343
-.5723139 - .1320154*i*	.587343
-.5803376	.580338
-.1352674	.135267

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

e) Wald Lag-exclusion Test

Equation: D_l_reserves

lag	chi2	df	Prob > chi2
1	18.6525	6	0.005
2	11.18677	6	0.083
3	35.56172	6	0.000

Equation: D_l_cpi

lag	chi2	df	Prob > chi2
1	8.927224	6	0.178
2	6.784327	6	0.341
3	44.52892	6	0.000

Equation: D_l_metprxn

lag	chi2	df	Prob > chi2
1	95.33621	6	0.000
2	49.66639	6	0.000
3	11.88706	6	0.065

Equation: D_wlbrate

lag	chi2	df	Prob > chi2
1	9.105285	6	0.168
2	2.303995	6	0.890
3	48.13653	6	0.000

Equation: D_l_multiplier

lag	chi2	df	Prob > chi2
1	28.66078	6	0.000
2	26.73276	6	0.000
3	13.72337	6	0.033

Equation: D_l_dcredit

lag	chi2	df	Prob > chi2
1	18.47246	6	0.005
2	10.89057	6	0.092
3	35.27788	6	0.000

Equation: All

lag	chi2	df	Prob > chi2
1	203.7161	36	0.000
2	114.7978	36	0.000
3	178.459	36	0.000

Appendix 6: SVAR Outputs

a) Short-run SVAR estimation results (Number of observations =200, sample: 1995m1 to 2011m12)

Exactly identified model   Log likelihood = -114.4129

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
/a_1_1	1	.	.	.	.	.
/a_2_1	-.0021678	.0019893	-1.09	0.276	-.0060668	.0017311
/a_3_1	-.0040565	.0062351	-0.65	0.515	-.016277	.008164
/a_4_1	.2274158	.0940298	2.42	0.016	.0431208	.4117108
/a_5_1	.0124388	.0057207	2.17	0.030	.0012264	.0236512
/a_6_1	.9647756	.0029893	322.74	0.000	.9589167	.9706346
/a_1_2	(omitted)					
/a_2_2	1	.	.	.	.	.
/a_3_2	-.1523326	.2209731	-0.69	0.491	-.5854319	.2807667
/a_4_2	2.529226	3.332883	0.76	0.448	-4.003105	9.061557
/a_5_2	.5817771	.2001567	2.91	0.004	.1894771	.9740771
/a_6_2	-1.28341	.1055362	-12.16	0.000	-1.490257	-1.076563
/a_1_3	(omitted)					
/a_2_3	(omitted)					
/a_3_3	1	.	.	.	.	.
/a_4_3	-.2510897	1.065247	-0.24	0.814	-2.338936	1.836756
/a_5_3	-.0556671	.0638905	-0.87	0.384	-.1808903	.069556
/a_6_3	-.0215574	.0330603	-0.65	0.514	-.0863543	.0432395
/a_1_4	(omitted)					
/a_2_4	(omitted)					
/a_3_4	(omitted)					
/a_4_4	1	.	.	.	.	.
/a_5_4	.0119269	.0042404	2.81	0.005	.0036158	.020238
/a_6_4	-.0056577	.002233	-2.53	0.011	-.0100342	-.0012812
/a_1_5	(omitted)					
/a_2_5	(omitted)					
/a_3_5	(omitted)					
/a_4_5	(omitted)					
/a_5_5	1	.	.	.	.	.
/a_6_5	-.1322105	.0365201	-3.62	0.000	-.2037886	-.0606324
/a_1_6	(omitted)					
/a_2_6	(omitted)					
/a_3_6	(omitted)					
/a_4_6	(omitted)					
/a_5_6	(omitted)					
/a_6_6	1	.	.	.	.	.
/b_1_1	1.793858	.0896929	20.00	0.000	1.618063	1.969653
/b_2_1	(omitted)					
/b_3_1	(omitted)					
/b_4_1	(omitted)					
/b_5_1	(omitted)					
/b_6_1	(omitted)					
/b_1_2	(omitted)					
/b_2_2	.0504666	.0025233	20.00	0.000	.045521	.0554123
/b_3_2	(omitted)					
/b_4_2	(omitted)					
/b_5_2	(omitted)					
/b_6_2	(omitted)					
/b_1_3	(omitted)					
/b_2_3	(omitted)					
/b_3_3	.1577098	.0078855	20.00	0.000	.1422545	.173165
/b_4_3	(omitted)					
/b_5_3	(omitted)					
/b_6_3	(omitted)					
/b_1_4	(omitted)					
/b_2_4	(omitted)					
/b_3_4	(omitted)					
/b_4_4	2.375877	.1187939	20.00	0.000	2.143045	2.608709
/b_5_4	(omitted)					
/b_6_4	(omitted)					
/b_1_5	(omitted)					
/b_2_5	(omitted)					
/b_3_5	(omitted)					
/b_4_5	(omitted)					
/b_5_5	.1424786	.0071239	20.00	0.000	.128516	.1564413
/b_6_5	(omitted)					
/b_1_6	(omitted)					
/b_2_6	(omitted)					
/b_3_6	(omitted)					
/b_4_6	(omitted)					
/b_5_6	(omitted)					
/b_6_6	.0735863	.0036793	20.00	0.000	.0663749	.0807976

b) Long-run SVAR estimation results (Number of observations =200, sample: 1995m1 to 2011m12)

```
Overidentified model                                  Log likelihood  = -2085.759
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
/c_1_1	1	.	.	.	.	.
/c_2_1	.0009876	.0707107	0.01	0.989	-.1376028	.139578
/c_3_1	.0202201	.0723501	0.28	0.780	-.1215835	.1620238
/c_4_1	.0290098	.3785959	0.08	0.939	-.7130246	.7710441
/c_5_1	-.0198192	.085434	-0.23	0.817	-.1872667	.1476283
/c_6_1	-.9715529	.1082279	-8.98	0.000	-1.183676	-.7594302
/c_1_2	(omitted)					
/c_2_2	1	.	.	.	.	.
/c_3_2	-.2165835	.0707107	-3.06	0.002	-.3551739	-.0779931
/c_4_2	-4.001635	.2515342	-15.91	0.000	-4.494633	-3.508637
/c_5_2	-.6774061	.070743	-9.58	0.000	-.8160598	-.5387524
/c_6_2	1.119817	.0737789	15.18	0.000	.9752126	1.264421
/c_1_3	(omitted)					
/c_2_3	(omitted)					
/c_3_3	1	.	.	.	.	.
/c_4_3	3.413779	.0707107	48.28	0.000	3.275189	3.552369
/c_5_3	.0271123	.070717	0.38	0.701	-.1114905	.165715
/c_6_3	-.0347778	.0737379	-0.47	0.637	-.1793014	.1097458
/c_1_4	(omitted)					
/c_2_4	(omitted)					
/c_3_4	(omitted)					
/c_4_4	1	.	.	.	.	.
/c_5_4	-.0133597	.0707107	-0.19	0.850	-.1519501	.1252307
/c_6_4	.0047021	.0737371	0.06	0.949	-.13982	.1492243
/c_1_5	(omitted)					
/c_2_5	(omitted)					
/c_3_5	(omitted)					
/c_4_5	(omitted)					
/c_5_5	1	.	.	.	.	.
/c_6_5	.2956908	.0707107	4.18	0.000	.1571004	.4342812
/c_1_6	(omitted)					
/c_2_6	(omitted)					
/c_3_6	(omitted)					
/c_4_6	(omitted)					
/c_5_6	(omitted)					
/c_6_6	1	.	.	.	.	.

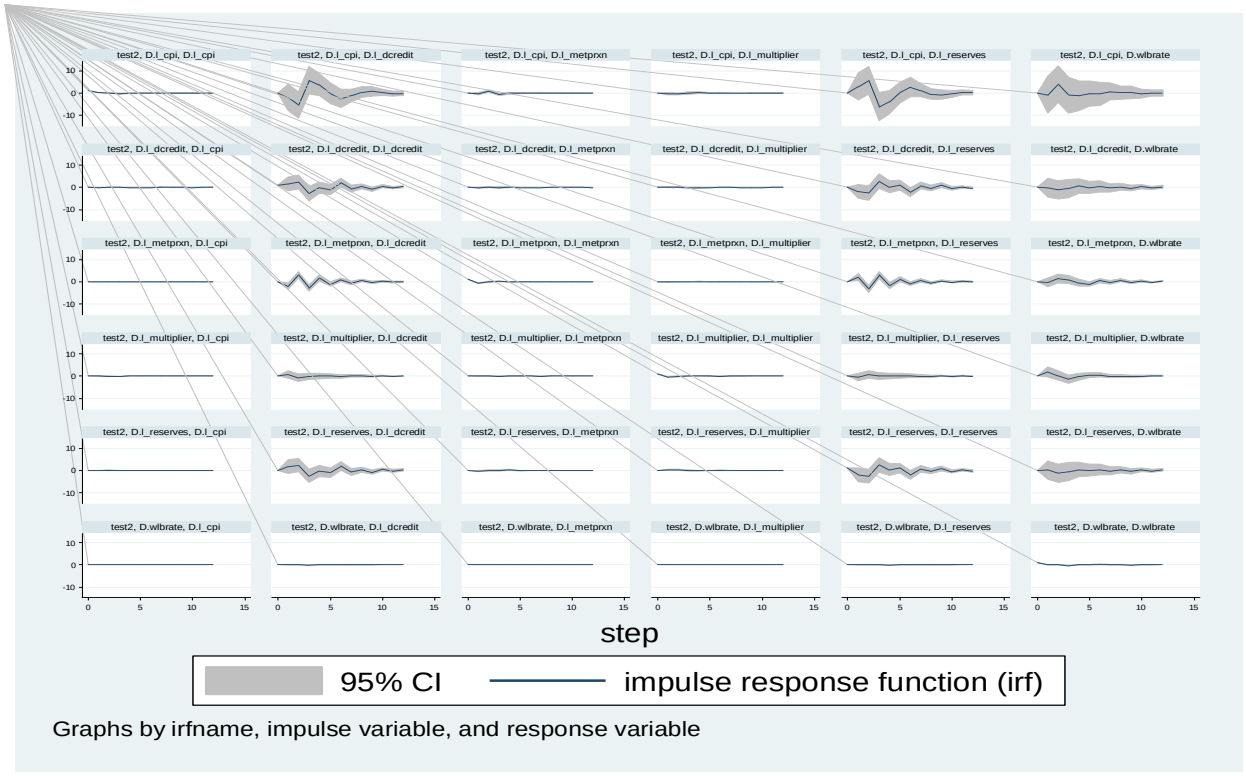
```
LR test of identifying restrictions:  chi2(  6)=     3943  Prob > chi2 = 0.000
```

c) Cholesky Decomposition Matrix

```
choll2[6,6]
                      D.            D.            D.            D.            D.
               l_reserves         l_cpi     l_metprxn       wlbrate  l_multiplier
D.l_reserves    1.7938579             0             0             0             0
     D.l_cpi    .00388879    .05046662             0             0             0
 D.l_metprxn    .00786911    .00768771    .15770978             0             0
   D.wlbrate   -.41581143   -.12571121     .0395993     2.3758771             0
D.l_multip~r   -.01917851   -.02743303    .00830695    -.02833687     .14247863
 D.l_dcredit    -1.730398    .06059691    .00472212     .00969559     .01883717

                      D.
               l_dcredit
D.l_reserves             0
     D.l_cpi             0
 D.l_metprxn             0
   D.wlbrate             0
D.l_multip~r             0
 D.l_dcredit    .07358627
```

d) SVAR Impulse Response Functions Graphs



Graphs by irfname, impulse variable, and response variable