IMPACT OF MONETARY POLICY RATE ON MONEY SUPPLY IN ZAMBIA (2012-2020)

By

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DECLARATION

I, **Inambao Simangolwa**, declare that this dissertation:

(a) Represents my own work; and

(b) Has not previously been submitted for a degree at this or any other University;

Signed……..

Date……..

APPROVAL

This dissertation of **Inambao Simangolwa** has been approved as fulfilling the partial fulfilment of the requirements for the award of the Degree of Master of Arts in Economics by the University of Zambia.

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ABSTRACT

Money supply is one of the key variable any monetary policy framework aims at influencing. Central banks all over the world have several instruments at their disposal to control the supply of money in their economies and one such instrument is the monetary policy rate. This study provides an analysis of the impact of monetary policy rate on money supply in Zambia. Quarterly time series data for monetary policy rate, money supply-2, lending rate and exchange rate covering the period from second quarter 2012 to fourth quarter 2020 was used. The study focused on channels through which monetary policy rate directly and indirectly affects money supply. Vector Autoregression (VAR) and the Autoregressive Distributed Lag (ARDL) approach were used to analyse the indirect and direct impact of monetary policy rate on money supply respectively. Empirical results revealed that monetary policy rate has a significant positive impact on lending rate in the short run only. Its impact on lending rate is weak as after 8 quarters, only 21 percent of the variations in lending rate is attributed to monetary policy rate while 79 percent is explained by own shocks in lending rate. With regards to exchange rate, the results showed the absence of pass-through effect from monetary policy rate to exchange rate. In the short run, monetary policy rate has no impact on money supply while exchange rate has both positive (i.e. wealth effect) and negative (i.e. currency substitution effect) impacts, with positive impact outweighing the negative impact. In the long run, both monetary policy rate and exchange rate have significant effect on money supply with a positive elasticity attributed to exchange rate being greater than the negative elasticity attributed to monetary policy rate in absolute terms. These elasticities have far reaching implications on the effectiveness of monetary policy rate on money supply as its impact is overshadowed by the exchange rate wealth effect. In view of the aforementioned, to improve the effectiveness of monetary policy rate, policies that ensure competition in the banking sector and stability of exchange rate should be strengthened.

Keywords: Policy Rate, Exchange Rate Pass-through effect, Structural break, ECM, Impulse Response

DEDICATION

Dedicated to my lovely wife Nelly, wonderful children; Brighton, Namasiku and Tumelo.

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LIST OF ACRONYMS

ADF	Augmented Dickey–Fuller
AIC	Akaike Information Criterion
ARDL	Autoregression Distributed Lag
BOZ	Bank of Zambia
ECM	Error Correction Model
ECT	Error Correction Term
ExR	Exchange Rate
FSDP	Financial Sector Development Programme
GDP	Gross Domestic Product
GRZ	Government of the Republic of Zambia
IMF	International Monetary Fund
IRF	Impulse Response Function
LR	Lending Rate
M2	Broad Money-2
M3	Broad Money-3
MAT	Monetary Aggregate Targeting
MPC	Monetary Policy Committee
MPR	Monetary Policy Rate
PP	Phillips–Perron
SIC	Schwarz Information Criterion
SSA	Sub-Saharan Africa
UIP	Uncovered interest rate parity
USD	United States Dollar
VAR	Vector Autoregression
VECM	Vector Error Correction Model

CHAPTER 1

INTRODUCTION

1.1 Background

The performance of the economy is based on the effectiveness of various policies among which include monetary policy. Monetary policy refers to the measures or actions taken by the monetary authority of the country to alter the quantity, availability and cost of money or credit in the economy (BoZ, 2014). Monetary policy requires high level coordination at all times with other economic policy instruments (Akhtar, 2006). The effectiveness of monetary policy together with fiscal policy has emerged as the bedrock of success for other economic policies.

Money supply plays a vital role in the operation of an economy. Through money supply, the private sectors are able to access credits for both consumption and investment at a price referred to as interest rate (Asuquo et al., 2020). Changes in the size of money supply have a number of implications on other macroeconomic variables especially inflation (Badr et al., 2020). Monetary policy actions regardless of their form impact the money supply in an economy by having their most direct and immediate effect on the broader financial markets including stock market, government and corporate bond market, market for consumer credit, foreign exchange market among many others (Mishkin, 2000).

According to the Bank of Zambia StatisticsFortnightly volumes, definition of monetary aggregates is in three main groups namely; money supply-M1, broad money supply-M2, and broad money supply-M3. Money supply-M1 is a narrow definition of money comprising currency in circulation and demand deposits. Currency in circulation is the Currency with non-bank which is cash held by the public excluding vault cash in deposit taking institutions. Broad money supply-M2 is equal to M1 plus local currency time and savings deposits and foreign currency demand deposits while broad money supply-M3 is equal to M2 plus other foreign currency deposits (Boz, 2020). Since transactions are conducted in both local and foreign currency, the broad money supply of interest in the study is money supply-M2.

Central banks generally have three main objectives or functional roles; to maintain price stability, subject to the monetary regime in current operation, to maintain financial stability and foster financial development more broadly as well as to support the state's financing needs at times of crisis, but in normal times to constrain misuse of the state's financial powers (Goodhart, 2010). They implement monetary policy primarily by fixing short-term interest rates and controlling the amount of money and credit available in an economy.

The effectiveness of monetary policy depends on several factors. One of the factors is the level of financial intermediation. In economies with weak financial intermediation system, the implementation of money policy to influence availability of financial resources in the economy is impeded by the weak intermediation capacity. Further, economies with weak financial intermediation system are characterised by excessive high lending rates coupled with low saving rates which are usually negative in real terms due to persistent high inflation (Ng'andwe, 2020). This makes economic agents with surplus funds not to use banks and other deposit institutions and at the same time making it difficult for those in need of financial resources to access them. Therefore, as observed by Nicias (2016) "shallow financial system harm the transmission mechanism of monetary policy".

In 2012, Zambia adopted inflation targeting framework and monetary policy rate was introduced as the main monetary policy instrument. This was a shift in the monetary policy framework from targeting monetary aggregates (quantities) to interest rates (prices) (BoZ, 2012). The policy rate is an interest rate that the Central Bank sets in order to influence the evolution of the main monetary variables in the economy such as consumer prices, exchange rate or credit expansion among others. The policy rate determines the levels of other interest rates in the economy, as it is the price at which private agents-mostly private banks obtain money from the Central bank (Anon, 2021). In developed and competitive financial systems, market forces quickly align interbank rates to policy rates which in turn through market dynamics spill over to lending rates. However, in countries with underdeveloped and oligopolistic financial systems, the efficancy of the policy rate is weak. Ng'andwe (2020) observed that lending interest

rates have remained immune to policy rate changes making the overall effectiveness of the policy rate which is the major monetary policy variable questionable.

According to Fadum (2011), the main operating principle guiding the policy rate is to control the supply of settlement balance of banks and motivate the banking system to target zero balances at the Central bank through active interbanking trading transfer of balances. Banks then offer financial products to their clients at an interest rate that is normally based on the policy rate. Central banks use the policy rate to perform contractive or expansive monetary policy. A rise in policy rates is commonly used to curb inflation, currency depreciation, excessive credit growth or capital outflows. On the contrary, by reducing policy rate, a Central bank might be seeking to boost economic activity by fostering credit expansion or currency depreciation in order to gain competitiveness. It is the rate that controls the amount of money in circulation at any given time (Ishaku et al., 2021).

Adjustments to policy rate are done by the Monetary Policy Committee (MPC) which meets every quarter of the year to decide on the monetary policy stance by reviewing economic developments in the previous quarter and prospects for inflation eight quarters ahead. However, the Committee can meet at any other time whenever the macroeconomic fundamentals dictate. Changes to the policy rate signal the Central bank's monetary policy stance. Since its adoption, the Bank of Zambia has revised the policy rate on several occasions with a minimum value of 8 percent and maximum of 15.5 percent. The MPC has met 35 times out of which the policy rate was increased on 9 occassions, reduced on 7 occassions while unchanged on 19 occasions. In 2014, it was increased 3 times from 9.75 percent to 12.5 percent while in 2017 it was reduced on 4 times from the maximum of 15.5 percent to 10.25 percent (BoZ, 2017). The movements in money supply quarterly growth with regard to changes in monetary policy rate from 2012 to 2020 are shown in Table 1.1.

Table 1.0.1: Monetary policy rate and Money supply quarterly growth 2012 to 2020

Period	*MPR(%)change*	*Broad Money growth-M2 (%)*	*Broad Money growth-M3 (%)*
2012Q2 - 2012Q4	*9% - 9.25%*	*15.9%*	*13.3%*
2013Q1 - 2013Q4	*9.25% - 9.75%*	*14.3%*	*14.6%*
2014Q1- 2014Q4	*10.25% - 12.5%*	*3.9%*	*5.3%*
2015Q1 - 2015Q3	*0%*	*13.5%*	*15.9%*
2015Q4 - 2016Q4	*12.5% -15.5*	*-3.7%*	*-5.8%*
2017Q1 - 2017Q4	*14% - 10.25%*	*14.9%*	*14.6%*
2018Q1 - 2019Q1	*10.25% - 9.75%*	*15.7%*	*17.8%*
2019Q2- 2019Q3	*9.75% - 10.25%*	*2.2%*	*2.2%*
2019Q4 - 2020Q1	*10.25% - 11.50%*	*9.1%*	*9.2%*
2020Q2 - 2020Q3	*11.5% - 9.25%*	*22.3%*	*21.0%*
2020Q3 – 2020Q4	*9.25% - 8%*	*9.6%*	*8.9%*

Source: Author's own computations using Statistics Fortnightly Volumes data from BoZ

When it was introduced in 2012, the policy rate was pegged at 9 percent and by fourth quarter 2012, it reached 9.25 percent. In 2013, the policy rate was revised upward from 9.25 percent to 9.75 percent. Also from January, 2014 to October, 2014, it was raised from 10.25 percent to 12.5 percent. The movement in money supply during the aforementioned periods was not in line with apriori expectations as these changes led to an increase instead of a reduction in money supply. Ideally, money supply is expected to contract with tight monetary policy. According to Bank of Zambia Statistics Fortnightly Volumes from 2012 to 2021, during the periods 2014 April to October, 2015 January to October, 2015 November to December 2016, and from 2018 February to 2019 April, the policy rate was maintained at 12 percent, 12.5 percent, 15.5 percent and 9.75 percent respectively. During these periods, money supply increased by 13.5 percent and reduced only during the period from November 2015 to December 2016 by -3.7 percent. Money supply responded by increasing when the policy rate was reduced during 2017 and from second to fourth quarter 2020. From the information above, it can be seen that money supply was sticky downward to increase in policy rate but was responsive to reduction in policy rate. This could be attributed to the effect of exchange rate on money supply considering that money supply and exchange depreciation where moving in the same direction. With regards to periods in which the policy rate was unchanged, money supply depicted mixed trends.

Monetary policy rate also affects money supply via its effect on interest rate structure and exchange rate (BoZ, 2014). Since the policy rate is the reference rate through which other interest rates are determined, it has an impact on commercial retail interest rates such as lending rate. Increasing it increases lending rate which in turn constricts money supply via credit channel.

In an economy with no capital controls, changes in foreign interest rates and exchange rates also affect the amount of money held in the economy because alternative investment opportunities arise for domestic economic agents in foreign capital markets (Simatele, 2004). Changes in interest rates results in rate of return differentials on financial instruments. This causes foreign capital flows whose direction is determined by whether the differential is positive or negative. Therefore, increase in monetary policy rate should result in currency appreciation while a reduction results in depreciation.

Foreign capital flows affects exchange rate which in turn impact money supply through either wealth effect or currency substitution effect. The wealth effect of exchange rate increases money supply and exist when households prefer holding domestic currency to foreign currency when there is depreciation of the domestic currency. When economic agents expects a further depreciation of the domestic currency, they may hedge themselves from the loss of value of the domestic currency by holding more of the foreign currency hence reducing domestic money supply in the process. This is called the currency substitution effect of exchange rate (Bahmani, 2002). However, despite regular meetings by the MPC, changes that have been made to the policy rate have not produced expected impact on not only monetary aggregates but also on the exchange rate and lending interest rate. Table 1.2 shows the trends between monetary policy rate and the two channel variables namely exchange rate and lending interest rate over the years.

Table 1.0.2: Trend of Policy rate (MPR), Exchange rate (ExR) and Lending rate (LR) 2012 to 2020

Period	*MPR(%)change*	*EXR Change*	*LR Change*
2012Q2 - 2012Q4	*9% - 9.25%*	*K5.23 - K5.19*	*20.65% - 16.19%*
2013Q1 - 2013Q4	*9.25% - 9.75%*	*K5.33 - K5.46*	*16.19% -16.33%*
2014Q1- 2014Q4	*10.25% - 12.5%*	*K5.77 - K6.34*	*16.33% - 20.24%*
2015Q1 - 2015Q3	*0%*	*K6.85 - K8.66*	*20.44% - 20.75%*
2015Q4 - 2016Q4	*12.5% -15.5*	*K11.68 - K9.85*	*22.72% - 29.17%*
2017Q1 - 2017Q4	*14% - 10.25%*	*K9.77 - K9.93*	*28.98% - 25.17%*
2018Q1 - 2019Q1	*10.25% - 9.75%*	*K9.75 - K11.96*	*24.30% - 24.41%*
2019Q2- 2019Q3	*9.75% - 10.25%*	*K12.86 - K12.98*	*24.95% - 25.76%*
2019Q4 - 2020Q1	*10.25% - 11.50%*	*K13.86 - K15.21*	*27.38% - 28.44%*
2020Q2 - 2020Q3	*11.5% - 9.25%*	*K18.34 – K19.26*	*27.52% - 25.93%*
2020Q3 – 2020Q4	*9.25% - 8%*	*K19.26 - K20.87*	*25.93% - 25.09%*

Source: Author's own computations using Statistics Fortnightly Volumes data from BoZ

From Table 1.2, it can seen that at the first quarter in 2012 when monetary policy rate was adopted, it was set at 9 percent while exchange rate and lending rate, a proxy for other interest rates were at K5.23/USD and 20.65 percent respectively. However, in November of the same year, the policy rate was increased to 9.25 percent, exchange rate appreciated while lending rate reduced. In 2013 and 2014, it was increased from 9.25 percent to 9.75 percent and from 10.25 percent to 12.5 percent respectively during which exchange rate continued depreciating while lending rates increased as expected. In periods where the policy rate remained the same, exchange rate continued depreciating while lending rate continued increasing as well. Lastly, in 2017 and in 2020 when the policy rate was reduced, the Kwacha continued on the path of depreciation while lending rate reduced which is in accord with theoretical expectation. On quarterly basis, from 2012 when the policy rate was adopted to 2020, the Kwacha depreciated by 299 percent while lending rate increased by 21.5 percent. This disparity between the policy rate and the two macroeconomic variables exchange rate and lending rate signifies that its impact particularly on exchange rate is weak. Therefore, this research endevours to investigate the direct and indirect impact of monetary policy rate on money supply through the lending rate and exchange rate channel.

1.2 Statement of the Problem

The stability of macroeconomic variables which include money supply, interest rates, and exchange rate is important for efficient operation of the overall economy. These macroeconomic variables are important information variables which influence expectation formation for various key economic players such as investors. The variables are influenced both directly and indirectly by the monetary policy instruments used by the Central bank. However, in spite of Monetary Policy Committee meeting 35 times in which it has revised the monetary policy rate (BoZ, 2020), monetary aggregates, exchange rate and lending rate have continued increasing. Monetary aggregate-2 increased by 338 percent, exchange rate depreciated by 299 percent from K5.23 to K20.87 while lending rates increased by 21.5 percent from 20.65 percent to 25.09 percent.

Given the important role money supply plays in the economy, it is important that its management and transparency of policy around money supply is assured as the economic distortions associated with it have negative effects on welfare. Therefore, the continued volatility of money supply and exchange rate among others variables despite the fine tuning of the policy rate does not only affect expectation formation but also affects the credibility of the Central Bank's policy stance. Money supply is expected to respond to changes in policy rate so that both short term and long term goals of the Central Bank are realised as envisaged.

Studies which have been undertaken thus far in Zambia focused on policy rate interest rate transmission mechanism (Ngoma, 2018) as well as on its impact on inflation (Habaazoka and Nanchengwa, 2016). Further, other studies conducted by Chisha (2017) and Mumba e tal. (2021) used the lending rate as the proxy for monetary policy rate to model the interaction between monetary policy and credit. No study on money supply which not only focuses on the Inflation Targeting monetary policy framework period but also use the actual monetary policy rate instead of a proxy variable such as discount rate had been conducted so far.

1.3 Objectives

1.3.1 General objective

Undertake an investigation of the impact of Monetary policy rate on money supply in Zambia.

1.3.2 Specific objectives:

i. To determine the impact of monetary policy rate on lending rate;
ii. To determine the impact of Monetary policy rate on exchange rate ; and
iii. To establish the impact of monetary policy rate and exchange rate on money supply.

1.4 Research Hypotheses

i. $H_0$1: Monetary policy rate has no impact on the lending rate;
ii. $H_0$2: Monetary policy rate has no impact on the nominal Kwacha-US dollar exchange rate; and
iii. $H_0$3: Monetary policy rate and Exchange rate have no impact on money supply.

1.5 Justification and significance of the study

This study is important in understanding the effects of changes in monetary policy orientation on money supply. The control of money supply has been central to monetary authorities. Considering the sensitivity of money supply as an economic variable and its influence to determines the pace of economic activities, its expansion or contraction dictates the growth in investment and output of any economy.

The importance of monetary policy resides in its capacity to influence money supply. Main goals of Bank of Zambia is to maintain price stability, promote financial system stability and foster sustainable economic development. The management of money supply is crucial to the attainment of the aforementioned goals as it is one of the most important transmission mechanism of monetary policy.

In Zambia, few studies have been conducted on monetary policy rate and on its impact on broad money supply. So far, studies which have been conducted on monetary policy have focused on the interest rate transmission mechanism (Ngoma, 2018) as well as on

its impact on inflation (Habaazoka and Nanchengwa, 2016). Therefore, despite the findings, empirical studies on the efficacy of monetary policy rate in Zambia are scanty. This study endeavours to establish the nexus between monetary policy rate-qmoney supply in Zambia by addressing the question; does monetary policy rate impact money supply in Zambia?

The study will contribute to the empirical literature on the effectiveness of monetary policy rate as well as provide analysis of monetary developments which will further provide an insight in the monetary policy rate and money supply interaction. In the case for Zambia, there has been no study on the determinants of money supply in Inflation targeting monetary policy framework and on the pass-through from the policy rate to the exchange rate.

1.6 Scope of the Study

From 1990 to 2012, Monetary Aggregate Targeting (MAT) was adopted as monetary policy framework. According to Zgambo and Chileshe (2014), the MAT framework was based on a strong and stable relationship between monetary aggregates and inflation which was the primary monetary policy target. However, the control of broad money became a challenge as the link between reserve money (operational target) and broad money (intermediate target) became unpredictable due to the instability of the money multiplier. The study therefore considers the period 2012-2020 covering the period when the Central bank of Zambia shifted to Inflation targeting monetary policy framework using the policy rate as a major monetary policy instrument.

CHAPTER 2
MONETARY POLICY AND MONEY SUPPLY IN ZAMBIA

2.1 Money supply in Zambia

According to the Bank of Zambia Act No. 43 of 1996, the primary objective of the Bank is to formulate and implement monetary and supervisory policies that achieve and maintain price stability and promote financial system stability in the Republic of Zambia. Zambia has had changes in its monetary policy orientation while maintaining its overall goal of achieving price stability and fostering sustainable economic development. Monetary policy impacts money supply which in turn affects economic activities.

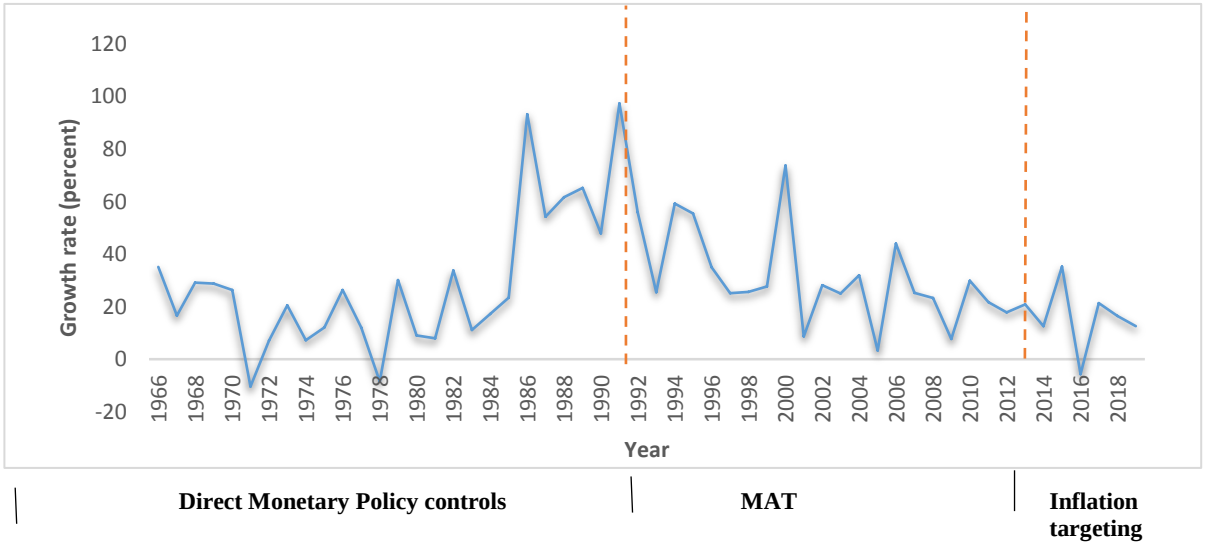
Money supply in Zambia have had different paths depending on the monetary policy regime in use. From 1964 to 1991, monetary policy had multiple objectives without clearly defined targets and largely employed direct instruments for monetary control. It included direct interest rate and credit allocation controls, high core liquid assets and statutory reserve requirements. The national budget was predominantly financed through borrowing from the Central bank (Kalyalya, 2016). Direct controls resulted in financial repression which in turn promoted inefficiency and wastage of resources allocation. Direct monetary controls proved ineffective as most macroeconomic fundamentals deteriorated with annual broad monetary growth rate and real interest rate reaching 41.5 percent and -15.5 percent respectively during the 1981-1990 period (BoZ, 2014b). During the period, real annual growth in GDP was 1.1 percent while average annaul inflation rate was 76.9 percent. Due to the associated inefficiencies, the monetary framework was changed from direct controls to indirect control in form of Monetary Aggregate Targeting (MAT).

From 1991 to 2012, MAT was adopted as monetary policy framework. This involved the use of reserve money which are legal cash minimums that banks must have on hand in order to meet central bank requirements. Reserve money was the main operating target and monetary aggregate (broad money) was the intermediate target. During this period annual broad monetary growth rate reduced from 41.5 percent to 21.7 percent and

inflation improved from average double digits of the 90s to single digit of about 6.4 percent by 2011 (Zgambo and Chileshe, 2014). Real GDP grew by 6.8 percent while real interest rate reduced to 5.6 percent. Though growth in monetary aggregates was not as high as under direct controls due to economic policy reforms of liberalisation, the link between reserve money (operational target) and broad money (intermediate target) became unpredictable due to the instability of the money multiplier. Therefore achieving the target of reserve money did not signal the attainment of the required growth rate in money supply goal, instead money supply volatility continued. This implied that MAT could no longer provide an adequate signal about the stance of monetary policy. This prompted the shift from monetary aggregate targeting to Inflation targeting in 2012.

From April 2012, Inflation targeting framework was adopted and monetary policy rate was introduced as the main monetary policy instrument. A shift to inflation targeting with monetary policy rate as the policy instrument drastically reduced growth rate of broad money. In the first year of its implementation, annual broad monetary growth rate reduced from 21.7 percent in 2011 to 17.9 percent and inflation maintained a single digit of 6.6 percent. However, volatility of money supply has continued even under the monetary policy rate regime. Figure 3.1 below provides trends of annual broad money growth rate from 1966 to 2019.

Figure 3.1: Broad money growth (annual percent) in Zambia (1966-2019)



Source: Author's own computations using data from World Bank data bank

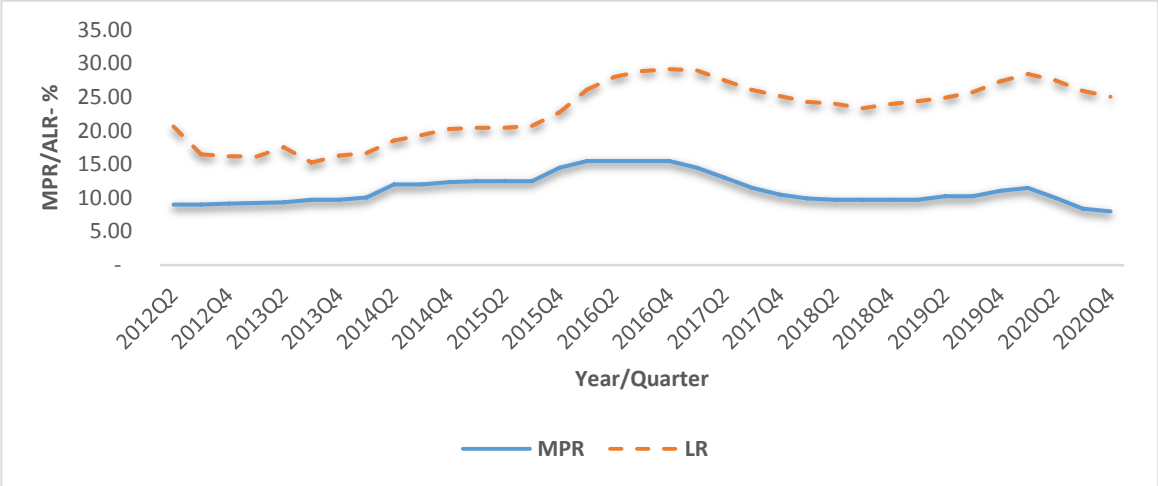
As shown in Figure 3.1 above, during the period of direct monetary policy controls, broad money growth increased from 35 percent in 1965 to 97 percent in 1991. Since almost all sectors of the economy were largely controlled including the foreign exchange market, there were no in-built mechanisms in the system to adjust to both the internal and external pressures. From 1991 to 2012, MAT was adopted and the focus was to move to more indirect means of monetary control and therefore freeing controls on both credit and interest rates. Indirect instruments that came into use included Open market operations such as auctions of government treasury bills and bond. Foreign exchange market was also liberalized. Growth in broad money reduced from 97 percent in 1991 to 17.9 percent in 2012 (BoZ, 2012). From April 2012, Inflation targeting framework was adopted and policy rate was introduced as the main monetary policy instrument. Growth in broad money increased from 23 percent in 2012 to 47.2 percent by 2020.

2.2 Monetary Policy rate to money supply channels

2.2.1 Monetary policy rate and Interest Rate (lending rate)

Traditionally, interest rate and credit channels are the dominant monetary policy transmission channels of policy rate. The interest rate channel operates through changes in the policy rate which directly affects overnight interbank rate (operating target) which in turn affects lending and saving rate given that the policy rate is the reference for banks' pricing of their credit products (BoZ, 2014). Changes in the lending rates triggers the credit channel which operates through the supply of bank loans. An expansionary monetary policy increases excess reserves in the banking system through reduction in interest rate. This makes loans available to bank dependent economic agents to increase. Increased supply of loans makes it possible for bank dependent economic agents to increase investment as well as consumption spending which result in increased economic activity (Dabla and Floerkemeier, 2006). Therefore, adjustments in the policy rate affects the quantity of loans supplied by commercial banks to firms and households which in turn influences monetary supply. Figure 3.2 depicts the movement of the monetary policy rate and lending rate from 2012 to 2020.

Figure 3.2: Quarterly Trend of policy rate and Lending Rate (2012 to 2020)



Source: Author's own computations using data from BoZ

From Figure 3.2, it can be seen that, lending rate (LR) decreased in the fourth quarter of 2012.The fall in the lending rate was mainly attributed to the introduction of the policy rate, reduction of corporate tax for banks and statutory reserve ratio (BoZ, 2012). Although the change was not proportional, lending rate increased in periods when policy rate was raised and decreased when it was reduced. However, it can be seen that, even in periods where policy rate remained the same such as from first quarter to third quarter in 2015, from first quarter 2018 to first quarter 2019 and from second quarter 2019 to third quarter 2019, lending rate continued increasing. Generally lending rate tend to co-trend with policy rate indicating some impact of policy rate on lending rate. However, although there is co- movement between policy rate and lending rate, the variance between the two appears to be high. This can be attributed to the structure, conduct and performance of the banking sector in Zambia.

The credit channel is more effective in economies where there are many small firms with little capacity to raise capital on stock markets. Further, an under-developed capital markets as is the case in most developing economies makes the bank lending channel stronger. However, this channel seems to be weak in Zambia due to the oligopolistic nature of the banking sector and the distorted interest rate regime among other reasons. Zambia has had persistent high lending interest rates which stand at around 40%, and have in the past been as high as 100% coupled with very low savings rates which are

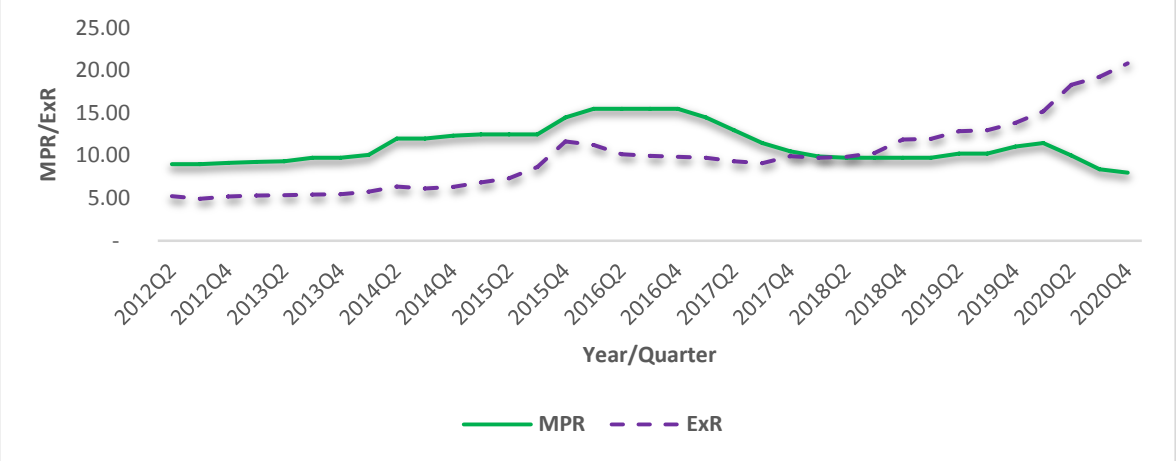
usually negative in real terms as they are rarely inflation indexed. This makes credit via banks inaccessible to majority of those in need and at the same time makes people with surplus funds to shy away from banks and other deposit institutions (Ng'andwe, 2020). The overall result is an ineffective financial intermediation system which contributes to weak lending channel in Zambia.

2.2.2 Monetary policy rate (MPR) and Exchange Rate (ExR)

The exchange rate channel is one of the primary transmission channels of monetary policy in open economies, especially those with flexible exchange rate regimes. Monetary policy can influence the exchange rate through interest rates, direct intervention in foreign exchange markets or through inflationary expectations (Dabla and Holger, 2006). The transmission mechanism of monetary policy rate on exchange rate is known as the pass-through from the policy rate to the exchange rate. According to the conventional view, when a Central bank changes its policy rate, returns on domestic investments relative to foreign investments also change. Such interest rate differential drives capital flows and thus the relative exchange rate (Disyatat and Vongsinsirikul, 2002).

Changes in exchange rate may have positive or negative effect on the Money supply. A depreciation of a local currency increases the domestic value of foreign assets and people may sell the foreign assets/currency for a capital gain. This may results in local money demand increasing. This relationship is known as a wealth effect (Arango and Nadiri, 1981). On the other hand, a depreciation of a local currency may develop the expectations of further depreciation. In this case, people may hold or buy more of the foreign currency in their portfolio for speculative purposes. Consequently, demand for local currency may decrease and this relationship is known as currency substitution effect or an expectation hypothesis (Bahmani and Pourheydarian, 1990). An increase/decrease in the policy rate should therefore result in an appreciation/depreciation in the exchange rate (BoZ). This in turn affects money supply through the wealth and currency substitution effect. Figure 3.3 depicts the movement of the monetary policy rate and exchange rate from 2012 to 2020.

Figure 3.3: Quarterly Trend of MPR) and ExR (2012 to 2020)



Source: Author's own computations using data from BoZ

From second quarter 2014 to third quarter 2015, the kwacha depreciated. This was attributed to the higher than programmed fiscal deficit and falling copper prices attributed to slower than expected growth in China among other factors. These resulted in reduced inflows of foreign exchange (BoZ, 2015). From the period fourth quarter 2015 to second quarter 2016, exchange appreciated when policy rate was increased from 12.5 percent to 15.5 percent. However, other measures such as restriction of commercial banks' access to the Overnight Lending Facility (OLF) window to once per week from unlimited access and strengthening of the interbank market's code of conduct were also undertaken by BoZ. The myriad of interventions taken at the same time poses a challenge in isolating the impact of policy rate on exchange rate. While from 2012 to third quarter 2017 the exchange rate steadily increased and was below the policy rate, it depreciated from fourth quarter 2017 onward. In nominal terms, the Kwacha weakened against its major trading partner currencies in 2018, on the back of negative market sentiments emanating from the downgrade by credit rating agencies such as Moody as well as Standards and Poor (S & P) agencies ((BoZ, 2018).

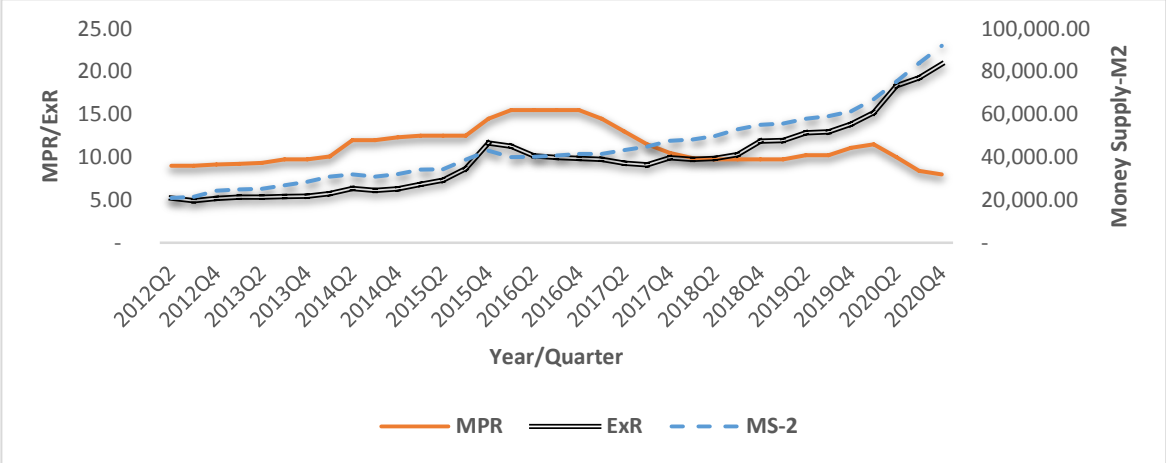
The strength of the exchange rate channel is affected by several factors such as; the exchange rate regime, sensitivity of the interest rates, the size and openness of the economy, degree of capital mobility and the degree of expenditure switching between domestic and imported goods (Boivin et al., 2010; Mishra et al., 2010; Tahir, 2012).

However, despite adjustments in the policy rate, the Kwacha continued to depreciate against the US dollar.

2.2.3 Monetary policy rate (MPR), Money supply (MS-2) and Exchange rate (ExR)

Adjustments in the policy rate are also transmitted directly through changes in monetary aggregates (broad money) and ultimately affect inflation (BoZ, 2016). This money channel should not be considered as an isolated, independent pathway but rather as just another component in the complex working of the monetary policy transmission mechanism of the policy rate (Bernanke, 1995). As alluded to, policy rate do not only react to but also affects money supply which in turn influence other macroeconomic variables. Therefore, effects of the policy rate are not just via its impact on interest rate and exchange rate for market transaction but also the result of its direct impact on money supply. Figure 3.4 depicts the combined movement of the monetary policy rate, money supply and exchange rate from 2012 to 2020.

Figure 3.4: Quarterly trend MPR, MS-2 and ExR (2012 to 2020)



Source: Author's own computations using data from BoZ

From Figure 3.4 above, it is clear that broad money supply has been on an upward trend since 2012. From 2012 to second quarter 2013, policy rate, money supply and exchange rate had almost the same growth pattern with exchange rate having the lowest change. From first to second quarter in 2014, policy rate was revised upward. During this period, money supply increased faster than exchange rate. From first to third quarter in 2015 and from fourth quarter 2015 to fourth quarter 2016, policy rate was maintained at 12.5

percent and 15.5 percent respectively. During the period both money supply and currency continued increasing (depreciating) faster. From 2017 up to 2020, policy rate reduced from 14 percent to 8 percent during which money supply and exchange rate drastically increased indicating a wealth effect of exchange rate. According to the channels of policy rate, money supply is directly influenced by policy rate and indirectly by exchange rate. However, despite changes to policy rate, both money supply and exchange rate continued with the same upward pattern indicating a deviation from the expected impact of the policy rate on money supply and exchange rate.

2.2.4 Expectations Channel

This works through the expectations that economic agents form about key macroeconomic variables. Since economic agents are forward looking and rational, the expectation channel is in effect fundamental to the working of all channels of monetary policy transmission. This channel is mainly operational in developed economies with well-functioning and deep financial markets (Davoodi and Pinter, 2013). For instance, if economic agents anticipate future changes in the policy rate, this can affect medium and long-term interest rates immediately. Therefore, changes in the monetary policy stance can influence expectations about the future course of real economic activities. Since expectations on macroeconomic variables such as inflation, interest rate, income and exchange rate affects economic agents' demand for money, changes in policy rate have an impact on money supply.

CHAPTER 3
LITERATURE REVIEW

3.1 Theoretical literature

The subject of whether monetary policy rate affects money supply is best analysed through the channels of monetary policy rate on variables which influence money demand. The theories which explains the monetary policy rate-Money supply nexus include:

3.1.1 Price- cost margin (Lerner Index) Model

The Lerner index is a measure of a firm's market power and was formalized by Lerner (1934). Market power is the ability of a firm to manipulate either the supply or demand of the product or service it sells to increase economic profit (Syverson, 2019). In other words, market power occurs if a firm does not face a perfectly elastic demand curve and can set its price above marginal cost without losing revenue. Price cost margin pricing in economics refers to the practice of setting the price of a product to equal the extra cost of producing an extra unit of output. The difference between the price and the marginal cost is the mark up and is measured by the Lerner Index. The pricing cost margin model stipulates that in a perfect competitive market, the marginal price must equal to marginal cost and the derivative of prices with respect to marginal costs equals one. Therefore, the Lerner Index is equal to zero as any changes in marginal cost should offset a unit elastic change in marginal prices. This is only achievable when the information in the banking system is symmetric and the market is perfectly competitive.

When the assumptions of perfect competition and complete information are relaxed as is the case in the financial sector, the Lerner Index typically becomes less than one implying some monopoly/Monopolistic power. When competition is far from perfect, in a seller's (Commercial Bank) equilibrium position, marginal cost will equal marginal revenue but the price will stand higher than the marginal cost or marginal revenue (Ahuja, 2008). This approach is interested in the effect that monetary policy rate has on lending rates, and it concentrates solely on the question of how closely lending rates follow policy rates (Kwapil and Scharler, 2006).

3.1.2 Uncovered interest rate parity (UIP)

Capital move freely between the world's main financial centers in response to changes in rates of return as reflected by interest rates. This nexus between monetary policy and exchange rate under the uncovered interest parity (UIP) condition were popularised by the open macroeconomic models developed independently by Fleming (1962), Mundell (1963), and Dornbusch (1976). The UIP links changes in the interest rates to exchange rates. Based on arbitrage considerations, uncovered interest rate parity states that the interest rate differential between two countries has to equal the expected change in the exchange rate. It assumes that exchange rates instantaneously adjust to changes in relative interest rates between two currencies so as to eliminate arbitrage opportunities. The change in interest rates differences among international financial markets, in turn, tends to reflect changes in expected future economic fundamentals that are related to exchange rate determination. If uncovered interest parity holds, the difference in interest rates equals the forward premium rate (Yutaka, 2015). The forward premium on a currency measures the amount by which investors expect that currency to appreciate. Therefore, according to UIP, a higher domestic interest rate indicates an expected appreciation of the domestic currency while a lower domestic rate than the reference interest rate indicates an expected depreciation of the domestic currency. Hence, this approach is interested in analysing the effect that monetary policy rate has on capital flows, and it concentrates solely on the question of how closely exchange rate follow policy rate.

3.1.3 Keynes liquidity preference theory of interest rate

Liquidity preference is one of the Endogenous theory on money supply that contend that the Central bank is unable to control the money supply process. Liquidity preference is the desire to hold cash. It contends that the existence of money in an economy is driven by the requirements of the real economy that is, market forces combined with Central bank establishes money supply (Pollin, 1991). It believes that Central bank is unable to solely determine money supply as changes in money supply is under the control of various economic agents outside its control (Fontana and Venturino, 2003).

Liquidity preference is attributed to Keynes (1936) who postulated that there are three motives for holding real money balances: transaction motives; precautionary motives; and speculative motives. According to liquidity preference, considerations from non-public bank and banking sector can influence both the demand for money and banks portfolio positions and these may have a feedback effect on bank lending and money supply (Palley, 1991). From liquidity preference point of view, it is the relative interest rates that reconcile the decision to borrow with the decisions to hold increased deposits. Under Classical economics, the transactions and precautionary motives of money demand argue that the demand for real money balances depends on money income (Zgambo and Chileshe, 2014). Under the speculative motive, Keynes argued that interest rates cause uncertainty about the future and this may influence the demand for money and hence money supply. From liquidity preference theory, money demand hence money supply is affected by interest rate and income. Hence, this model is interested in analysing the effect that monetary policy rate has on money supply and it concentrates solely on the question of how closely money supply through money demand respond to policy rate changes. The rate of interest in Keynes word is the premium which has to be offered to induce people to hold the wealth in some form other than hoarded money. However, other variables such as inflation and exchange rate also affect the demand for money. Therefore additional variables should be included in the model in empirical analysis.

In Zambia, changes in policy rate are followed by adjustments in commercial retail interest rates. However, interest rates particularly lending rates are more responsive to an increase in policy rate than to a reduction. This is mainly attributed to the market structure of the banking sector. According to Ng'andwe (2020), the oligopolistic tendencies among the banks in Zambia have kept the lending interest rates prohibitively high, and interest rates on government securities very high at around 32% in 2020. The commercial banking sector in Zambia comprised 18 licensed commercial banks. 9 of these banks were subsidiaries of foreign banks, 5 were locally owned private banks and 4 were partially owned by the Government of the Republic of Zambia (BoZ, 2020). In the blueprint of the FSDP, Simpasa (2013) concluded that dominance of foreign owned banks may be a possible source of collusive behaviour. In 2020, Subsidiaries of foreign

banks continued to dominate the sector as they accounted for 73.8 percent assets, 68 percent loans and 74.6 percent deposits in the Zambian banking sector. Ng'ona (2018) also observed that out of the 18 banks in the banking sector, 5 were big banks with an average market share of 15 percent each as measured by their balance sheets.

Further, a study by Simpasa (2013) revealed that parameter on other income sources was positively significant suggesting that including a measure of non-interest revenue in the regression of determinants of competition in Zambian banking sector helped address the importance of non-intermediated sources of income for banks. This may contribute to monetary policy stance having a weak impact on the market power of banks which is reflected in high variance between Monetary policy rate and lending rate. This trend is in line with Ngoma's (2018) observation that signal of the policy rate in Zambia where financial systems are underdeveloped was confined to the interbank rate which quickly moved close to the policy rate but had no impact on the lending rate in the long run.

The foreign exchange market is influenced by several factors both internal and external. Factors such as performance of the Mining sector, public debt and intervention in foreign exchange market among others all affect exchange rate. The complication to assessing whether UIP holds is that, a myriad of interventions are taken at the same time posing a challenge to isolate the impact of interest rate differential occasioned by policy rate on exchange rate. Generally in Zambia, changes in the policy rate are hardly transmitted to the foreign exchange market.

3.2 Empirical literatures

Broad money supply is one of the most important macroeconomic variables that affect other economic variables and can result in distortion of economic activities of any country if not well controlled. Money supply is influenced by not only monetary policy but by other economic variables such as exchange rate. As a result, there exists a large number of empirical studies on not only determinants of money supply but also effectiveness of monetary policy. Since economic theory postulate that supply should equal demand, it follows that money supply should equal quantity of money demanded. Therefore, literature on money demand will also be considered. Review are some of the studies focusing not only on Zambia but also the rest of the world.

Ishaku et al. (2021) empirically examined the impact of monetary policy rate on selected macroeconomic variables; real GDP, inflation and exchange rate in Nigeria using quarterly data from 2008 first quarter to 2019 fourth quarter. An Autoregresion Distributed Lag model (ARDL) and Toda-Yamamoto Granger Causality were used. The cointegration result revealed a long run relationship between monetary policy rate and real GDP, inflation and exchange rate with impact being more in the long run than in the short run. Granger causality indicated no significant impact of policy rate on the macroeconomic variables both individually and collectively. While the study considered the impact of policy rate on several macroeconomic variables, the current study focuses on the impact of policy rate on money supply both directly and indirectly through its channnel variables namely; lending rate and exchange rate.

Badr et al. (2020) examined the empirical evidence of the existence of a long-run and short-run relationship between money supply and it is determinants in Sudan. Gross Domestic Product growth, exchange rate, domestic investment, inflation rate, exports, cost of finance, foreign direct investment and government spending were used as exogenous variables (determinants). ARDL approach associated error correction method (ECM) was used on annual time series data covering the period from 1980 to 2016. The results revealed that real GDP and real government spending had positive and statistically significant effects on real money supply in the long run and short run, while real exports had negative and statistically significant effects on real money supply just in the long run. On the other hand, exchange rate, cost of finance, real domestic investment, inflation, and foreign direct investment had statistically insignificant effects on real money supply both in the long run and short run. This study did not look at the effectiveness of monetary policy instrument with regard to money supply but focused on the link between selected macroeconomic variables and money supply.

Akarara (2018) conducted an investigation of the effectiveness of monetary policy rate as monetary policy instrument in the control of inflation in Nigeria. Monthly data from January 2009 to December 2016 for inflation, broad money supply growth rate, exchange rate, and treasury bill rate were also included in the study. An error correction model was used and the study concluded that monetary policy rate was effective in the

long run, exchange rate and money supply were very effective in the short run while treasury bill rate was effective both in the short run and long run. The study was more of an assessment of the effectiveness of monetary policy rate and other several monetary variables on inflation which is the ultimate target. The current study considers the impact of policy rate on the intermediate target which is money supply.

Yugang (2017) examined the impact of selected macroeconomic variables on money supply by analysing the relationship between money supply-M2 and real GDP, inflation and interest rate in China. Annual time series data from 2000 to 2016 was used in a Vector Autoregression (VAR) model. Yugang found that GDP and inflation had a significant positive impact on money supply while interest rate had a negative significant impact. In China, the over arching function of monetary policy is to maintain the currency's value so as to accelerate economic growth.

Niaz et al. (2016) examined the long-run and short-run effect of exchange rate on money demand in Pakistan using times series data from 1972 to 2014. The Autoregressive distributed lag bounds approach was employed for examining the short-run and long-run effects of exchange rate on money demand. The study revealed that exchange rate had a positive significant effect both in the long run and short-run on money demand. The study concluded the existence of the "wealth effect" of exchange rate where households prefer holding domestic currency to foreign currency when there is depreciation of the domestic currency.

Akosah (2015) examined the effectiveness of the monetary transmission mechanism in Ghana using monthly data from January 2002 to December 2014. Inflation, monetary policy rate, treasury bill rate, interbank rate and lending rate were used as variables. vector error correction and Vector Autoregression techniques were used in the study. In the short term, exchange rate shocks had significant effect on inflation than that attributed to interest rate. The study concluded that changes in monetary policy rate mainly moved lending rate and exchange rate signifying that the monetary policy transmission to inflation was mainly through both interest rate and exchange rate channel. The study looked at the two paths of monetary transmission, interest rate and

exchange rate with regard to inflation. It did not extend it to money supply or include the direct impact of the policy rate on money supply which has an effect on inflation as well.

Sabri (2013) conducted a study to determine the endogeneity of money supply using a panel analysis of 177 countries. Annual date from 1970 to 2011 was used with money supply variable represented by money and quasi money (M2) as percentage of GDP, bank lending and Inflation as variables. To correct for unobserved country heterogeneity, omitted variable bias, measurement error and potential endogeneity that frequently affect growth estimation, Generalised Methods of Moments (GMM) was used in the study. For additional robustness check, as far as the results were concerned, the model was estimated using cross sectional (Pooled Ordinary Least Square- Pooled OLS) and panel fixed effect methods. The results reveals that real GDP per capita and bank lending were significant determinants of money supply supporting the endogeneity of money supply.

Tsenkwo et al. (2013) conducted a research to establish the impact of changes in monetary policy rate in Nigeria on bank saving rate and bank lending rate. Annual data from 1986 to 2010 was used in the study. Granger causality among other econometric techniques was used. The study revealed existence of unidirectional causality between monetary policy rate and banking lending rate, banking lending rate and bank saving rate as well as a bidirectional causality between monetary policy rate and bank saving rate. While the research focused on the impact of monetary policy rate on lending and saving rate pass-through effect, the current study focuses on the independent impact of monetary policy rate on broad money supply. Further, while yearly data was used, the research will use quarterly data, the time series frequency for policy rate.

Nyalihama (2011) conducted a study on the determinants of money supply in Rwanda using monthly time series data from1995 to 2001 with money supply, net domestic credit to banks, net foreign assets, and domestic credit to government as variables. Cointegration analysis and granger causality tests technique were employed. The study revealed evidence of all variables having a significant positive effect on money supply with the banking sector being the key player in the money supply process. Both the cointegration and granger causality confirmed the Post Keynesian endogenous money

theory in the short run with mixed results in the long run (both Endogeneity and Exogeneity).

Ahmad and Ahmed (2006) studied Pakistan monthly data from 1980 to 2003. They found that Pakistan money supply for the period of 1980 to 2003 was endogenously determined in the short run. In the long run, they found that it was the monetary base that determined the total bank advances which is different from other studies of money supply endogeneity. In principle, they concluded that the Central Bank of Pakistan had some considerable influence on the money supply in the long run which was in line with the Monetarist view.

Bahmani et al. (2002) estimated the money demand function for Hong Kong with quarterly time series data that covered the period of 1985 first quarter to 1999 fourth quarter. The independent variables included real income, domestic and foreign interest rate and exchange rate. By employing the ARDL model, the results revealed exchange rate had a negative significant effect on money demand confirming the hypothesis of "currency substitution effect" of exchange rate.

Vera (2001) provided evidence that the supply of credit money is endogenous. Using the time series data from Spain (1987-1998), a Granger Causality test was done between monetary base, bank lending and various money multipliers. Granger causality was found to run from bank lending to the monetary base and to the money supply and not from monetary base to the money supply and to loans as the mainstream view maintains (Monetarist).

Panagopoulos and Spiliotis (1998) conducted an empirical study of the commercial banks' lending behaviour in Greece. The study revealed that credit money was mainly determined by the banking system in response to the demand for loans. This evidence verified the post Keynesian approach of the credit-money supply process being an endogenous one.

The above studies by Sabri (2013), Panagopoulos and Spiliotis (1998), Vera (2001), Ahmad and Ahmed (2006) and Nyalihama (2011) focused only on investigating the

determinants of money supply and their dynamics over period. Less attention was given to the effectiveness of monetary policy instruments in the studies.

In Zambia several studies have been conducted on the effectiveness of monetary policy and on determinants of money supply.

Mwenda (1993) looked at the impact on the effectiveness of monetary policy of switching to indirect monetary policy instruments from direct instruments, with a special focus on growth and variability in broad money and in inflation. He estimated Auto Regressive models to evaluate whether there was a change in the growth of money supply and inflation since the switch to indirect instruments. The study found that the shift to indirect instruments for policy had indeed reduced the variability in broad money and inflation. However, he found that the growth in money supply remained unchanged.

Mumba and Ziramba (2021) conducted an analysis of the money demand function for Zambia using the Gregory Hansen Cointegration Approach. Annual data for the period covering 1978 to 2018 was used. The study also employed Hendry's General, a specific technique to estimate the error correction model by obtaining a parsimonious model. Real money supply, exchange rate, interest rate and inflation were used as variables with a dummy to represent structural break. The results obtained by the study revealed that inflation and interest rate were the robust determinants of real money demand both in the short and long run.

Ngoma (2018) conducted a study on the transmission mechanism of monetary policy in Zambia with focus on the pass-through from policy rate to commercial banks market interest rates using Johansen Cointegration approach. Monthly time series data from 2012 to 2018 for commercial banks interest rates, policy rate, 180 days deposit rate and overnight interbank were used. The study revealed incomplete but high pass-through from policy rate to overnight interbank with incomplete, low and slow pass-through from overnight interbank rate to commercial banks interest rates. Therefore, according to Ngoma, the signal of the policy rate is confined to the interbank rate which quickly moves close to the policy rate, but has no impact at all on the lending rates of commercial banks.

Ngoma (2018) focused on interest rate transmission mechanism of monetary policy rate, the current study focuses on the independent transmission mechanism where adjustments in the policy rate are transmitted directly through changes in monetary aggregates (broad money). Further, while Ngoma's study used the three stage VECM to analyse the pass through from policy rate to overnight interbank and in turn to commercial banks interest rates, the current study will apply VAR to assess the impact of policy rate on lending rate. This will capture the response of lending rate to changes in policy rate.

Chisha (2017) documented the private sector's response to changes in the monetary policy using monthly data from January 2001 to December 2015. Private sector credit, lending rate, and decomposed annual GDP were used as variables in a Vector Error Correction model (VECM). The study revealed that, positive changes in lending rate had negative impact on the private sector credit in the long run. In the short run, private sector credit was influenced by own dynamics with a lag of three months and a lag of six months in GDP. The study concluded that through interest rate transmission mechanism, rise in policy rate would lead to fall in credit in the long run and vice versa. Since policy rate series was only available for the period starting April 2012 when the new monetary policy framework that signal price was implemented, Chisha used lending rate as proxy for policy rate.

Study by Chisha (2017), covered both periods of monetary aggregate targeting (MAT) from January 2001 to March 2012 and inflation targeting from April 2012 to December 2015, and Mumba and Ziramba (2021) covered all the three monetary policy frameworks, and both studies used the lending rate as the proxy for monetary policy rate to model the interaction between monetary policy and credit. The current study will not only focus on the Inflation Targeting monetary policy framework period but will also use the actual monetary policy rate instead of a proxy.

Chileshe and Kafula (2016) investigated the effects of fiscal policy on the conduct and transmission mechanism of monetary policy in Zambia. Their main objective was to assess the direct and indirect effects of fiscal policy shocks on monetary policy conduct and effectiveness in Zambia. Their results showed that fiscal policy stance has an effect

on the channels of monetary policy transmission in Zambia; and thus concluded that fiscal policy shocks have significant implications for the effectiveness of monetary policy in Zambia. The study focused on the interaction between Monetary Policy and fiscal policy and how it affects monetary policy transmission mechanisms.

Habaazoka and Nanchengwa (2016) conducted a study on the effectiveness of monetary policy rate on inflation for the period 2012 to 2014. A two-stage regression model was used in which the exchange rate of the Zambian kwacha against the United States dollar was used as a control variable. The results indicated that both policy rate and exchange rate were significant in explaining changes in inflation when considered in univariate separate models. However, though the policy rate was significant in explaining inflation when considered in a univariate model, the study established that the policy rate had little or no impact on the rate of inflation when exchange rate was introduced in the model as the variations in the rate of inflation due to those in the policy rate were already explained by variations in exchange rates, implying the impotence of the monetary policy rate in controlling inflation. The study focused on assessing the effectiveness of the policy rate in controlling inflation and not on its direct or indirect impact on money supply.

Zgambo and Chileshe (2014) conducted a study on the effectiveness of monetary policy in Zambia using time series data of; 91-days Treasury bill rate, real GDP, Exchange rate and Inflation rate. Money demand function and the monetary transmission mechanism were investigated using ARDL and VAR respectively. Real income, 91 -days Treasury bill rate, Exchange rate were found to have a significant effect on money demand in the long run with inflation influencing it in the short run, a requisite for monetary aggregate policy framework. On the other hand, monetary aggregate (broad money) and exchange rate channel were found to be important for the transmission of monetary policy. The study concluded that monetary aggregate would still continue to be an integral part in the Bank of Zambia's conduct of monetary policy as it moved towards adopting inflation targeting via policy rate as a monetary policy tool. The study focused on the determinants of money demand in the context of monetary aggregate targeting.

Zulu (2001) did a study to evaluate the role and determinants of money supply in Zambia using the money multiplier approach over a period of 28 years (1970-1998). Elements of both the money multiplier and monetary base were used, each having an econometric model. Various variables which included net foreign assets, real exchange rate, total credit to government, government expenditure (public finance component), government fiscal deficits, total tax revenue, balance of payments (current account trade balance), real income (GDP) and credit to the rest of the economy were analysed using multiple regression models. The study concluded that fiscal operations as reflected in significant bank of Zambia claims on government and Net Foreign Assets were found to have a significant influence on money supply growth patterns in the economy. The study also revealed that cash and excess reserve to money ratios were significantly influenced by real income (GDP). The study covered the period when direct controls were used in monetary policy and focused on investigating the determinants of money supply and the constituents of the money multiplier. Less attention was given to the effectiveness of monetary policy tools in the studies. Moreover, the study was on the period which covered both direct monetary controls and monetary aggregate targetings.

From the literature, it is clear that money supply is influenced by several monetary policy instruments and other macroeconomic variables. Exchange rate remains the dominant variable driving movements in money supply in most countries. However, although the literature is huge on determinants of money supply, only a few studies have been done on the effectiveness of monetary policy instruments under the inflation targeting framework in general and on the impact of monetary policy rate on money supply in particular. A few of the studies which have been conducted thus far on monetary policy rate explored its transmission mechanism on interest rates and its effects on inflation level. In addition, in most studies, commercial retail interes rate was used in the analysis of money supply processes. So far no literature is known on studies conducted under the inflation targeting framework to determine the impact of the policy rate on money supply in Zambia and elsewhere. This is despite the significant role policy rate plays in the management of macroeconomic variables in the economy. This study endevours to explore the monetary policy rate-money supply nexus in Zambia.

CHAPTER 4
METHODOLOGY

4.1 Theoretical Framework

The relationship between monetary policy rate and money supply is investigated through the Liquidity preference framework. Firstly, the interest rate channel of monetary policy rate was explained through the price-cost margin model proposed by Professor Lerner (1934). Ruthernberg and Ricky (1996) as well as Cuciniello and Signoretti (2015) applied the price-cost margins to test the structure-performance theorem empirically for European banks. Ngoma (2018) also used it in assessing the pass-through from the policy rate to interbank rate and utimately to commercial retail interest rate. The price-cost margin model model does not only assume perfect competition with complete information and equality of prices with marginal costs but also takes into account imperfect competition which is what exists in the banking sector. Likewise, the Lerner index of prices with respect to marginal cost equals zero but becomes less than one if the perfect competition and information is suspended. The application of this is to capture the price setting (i.e. lending rate) behavior of banks in response to policy rate. The price-cost margin model equation;

$$\frac{P-MC}{P} = \frac{1}{\varepsilon_P} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. \quad (1)$$

Where P is the price, MC is the marginal cost and ε_P is the price elasticity of demand. Although banks have other costs, policy rate is used as proxy for marginal cost because changes in policy rate are expected to be transmitted to lending rate. In relation to this study, price (P) will be replaced with the lending rate (LR) for financial institutions, marginal cost (MC) with the monetary policy rate (MPR);

$$\frac{LR-MPR}{LR} = \frac{1}{\varepsilon_{lr}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$LR = MPR + \frac{MPR}{\varepsilon_{lr}-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where $\frac{1}{\varepsilon_{lr}-1}$ represents the mark up. Since banks have other overhead costs, the constant is larger than MPR as it factors in other fixed costs. Therefore, determination of the lending rate in response to changes in MPR is presented by;

$$LR = \alpha + \beta MPR \text{ .... (4)}$$

Where α is a constant and β is the markup and MPR is the monetary policy rate which is an approximate marginal cost. Parameter β will be significant if MPR affects LR and it represents the degree of market power. Market power is the ability of a firm to change prices for its products without losing its customers. It refers to the ability of a firm to influence the price at which it sells a product or service to increase economic profit. In the current context, market power is strong if the LR changes disproportionally to the change in MPR.

The impact of MPR on exchange rate will be explained by the UIP model. According to James (2015) and Jaratin et al. (2012), application of the UIP results in the following equation;

$$E\ (\Delta s_{t+i})_t = i_d - i_f \text{ .... (5)}$$

where $E\ (\Delta s_{t+i})_t$ is the expected change from time t to t+1 in the spot exchange rate, conditional on information at time t, and expressed as the home currency price of a unit of the foreign-currency, i_d is the one-period home interest rate and i_f is the one-period foreign interest rate. Since $E\ (\Delta s_{t+i})_t$ can be expressed as $\frac{ExR^e - ExR^s}{ExR^s}$, equation (5) becomes;

$$r^z - r^f = \frac{ExR^e - ExR^s}{ExR^s} \text{ .... (6)}$$

where r^z denotes domestic interest rate, r^f denotes foreign interest rate, ExR^e denotes expected exchange rate, and ExR^s denotes the current nominal exchange rate. UIP model states that, the difference in the nominal interest rates between two nations equal to the relative changes in the exchange rate over the same period of time. The term on

the left-side of the equation (5) is the risk premium, which indicates risk-averse participants 'request for additional profits as they holds risky assets. Differences in interest rate between two nations should result in a situation where exchange rate between the two nations adjusts through either depreciation or appreciation such that return in terms of each nation's currency regardless of the nation it is invested in is equal. Therefore, the equilibrium;

$$ExR^s\,(1 + r^z) = ExR^e\,(1 + r^f) \quad \text{..... (7)}$$

Solving for ExR^e;

$$ExR^e = \frac{ExR^s}{1+r^f}(1 + r^z) \quad \text{..... (8)}$$

Substituting r^z with equation (4)

$$ExR^e = \frac{ExR^s}{1+r^f}(1 + \alpha + \beta MPR) \quad \text{..... (9)}$$

$$ExR^e = \frac{ExR^s}{1+r^f}(1 + \alpha) + \frac{ExR^s}{1+r^f}(\beta MPR) \quad \text{..... (10)}$$

Equation 9 reduces to;

$$ExR^e = \alpha + \gamma MPR \quad \text{... (11)}$$

Where α is $\frac{ExR^s}{1+r^f}(1 + \alpha)$ and γ is $\frac{ExR^s}{1+r^f}(\beta)$

Parameter γ should be negatively significant if *MPR* affects *ExR* and it represents the pass-through from the policy rate to the exchange rate. Uncovered interest rate parity (UIRP) predicts that high yield currencies should be expected to depreciate. It also predicts that, ceteris paribus, a real interest rate increase should appreciate the currency (Yutaka, 2015).

In order to investigate the impact of monetary policy rate on money supply under inflation targeting monetary policy framework in Zambia, Liquidity preference view of

endogenous theory will be used. The functional model is given by M=L(r) which fixes the quantity of money which the public will hold when the rate of interest is given; so that if r is the rate of interest, M is the quantity of money and L is the function of liquidity preference. Keynes argued that the demand for money to satisfy the transaction and precautionary motives change in response to changes in income, while the demand due to the speculative motive is sensitive to changes in interest rate. If $M_{d1} = L_1(Y)$ is the amount of cash held to satisfy the transaction and precautionary motives and $M_{d2} = L_2(i)$ the amount held to satisfy the speculative motive (Ahuja, 2008), then the total demand for money (M_{dT}) is as shown in the equation:

$M_{dT} = L_1(Y) + L_2(i)$ …… *(12)*

Therefore,

$M_{dT}=f(i,Y)$ i=interest rate, *Y*=income…… *(13)*

This equation states that the level of money balances depends not only on interest rate but also on income (Mankiw, 2009). Substituting i with equation (4) in equation (8);

$M_{dT}=f(\alpha + \beta mpr, Y)$, $M_{dT}=f(mpr, Y)$…… *(14)*

In an open economy, changes in foreign interest rates and exchange rates also affect the amount of money held because of relative changes in value of domestic and foreign currency as well as alternative investment opportunities which arise for domestic economic agents in foreign capital markets. To capture these motives, we assume that money demand is a function of not only income (y) and interest rate (i) but also a function of the exchange rate (Exr);

$M_{dT}=f(\alpha + \beta mpr, Exr, Y)$…… *(15)*

According to the Quantity Theory of Money, in equilibrium the quantity of money demanded (M_{dT}) is equal to the quantity of money supplied(M_s), therefore;

$M_s = f(mpr, Exr, Y)$…… *(16)*

4.2 Model specification

From the theoretical framework and empirical literature surveyed, a common money supply/demand function in which money supply is a function of several exogenous variables such as interest rate, inflation, exchange rate, government expenditure, Gross National Product etc. has emerged as one of the most adopted model in monetary analysis. Therefore, to investigate the impact of monetary policy rate on broad money supply in Zambia, the model specification by Badr et al. (2020), Niaz and Mohd (2016) and Zgambo and Chileshe (2014) will be adopted with slight adjustment in terms of the variables included. The models estimated were as follows;

$$LnLR_t = \sigma_t + \beta_1 LnMPR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{(17)}$$

$$LnExR_t = \delta_t + \beta_2 LnMPR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{(18)}$$

$$LnMs_t = \alpha_t + \beta_3 LnMPR_t + \beta_4 LnEXR_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{(19)}$$

Where $\sigma_t, \delta_t \; and \; \alpha_t$ = Intercepts

LR_t = lending rate

EXR_t = the nominal exchange rate of United States dollar against Zambian Kwacha.

Ms_t = Money supply-M2

MPR_t = Monetary Policy Rate

ε_t = Error term

Equation (17) is for the pass-through from the policy rate to lending rate, equation (18) is for the pass-through from the policy rate to the exchange rate and equation (19) is for the impact of MPR and ExR on money supply.

4.2.1 A priori Expectation

This refers to the expected sign and direction an economic relationship among the variables of the model based on theoretical criteria. The expectations for equations 17-19

are that, the coefficients in the models are; β_1 positive as increase in MPR increases the cost of borrowing, β_2 negative as increase in MPR results in appreciation of the Kwacha, β_3 negative as increase in MPR increases the cost of borrowing and the opportunity cost of holding money which should result in reduced money supply, β_4 positive or negative depending on whether the exchange rate has a wealth effect or currency substitution effect respectively.

If however the estimates of the parameters turn up with signs not conforming to the a priori expectation, further inquiry should be instituted into the abnormality before the estimates are rejected as being insignificant or unsatisfactory.

Equations (17) was estimated using Vector Autoregression (VAR) as presented below;

$$LnLR_t = \beta_0 + \sum_{i=1}^{p} \beta_1 LnLR_{t-i} + \sum_{i=1}^{q} \beta_2 LnMPR_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (20)$$

$$LnMPR_t = \beta_0 + \sum_{i=1}^{p} \beta_1 LnMPR_{t-i} + \sum_{i=1}^{q} \beta_2 LnLR_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (21)$$

For equation (20) only impulse responses and Variance decomposition (i.e. Cholesky decompositions) were analysed as coefficients cannot be interpreted in an unrestricted/basic VAR.

Since the focus is on invistigating the impact of MPR on money supply both in the short run and long run, an Autoregresive Distributed Lag model (ARDL) approach to cointegration was estimated using the following Unrestricted Error Correction Model (UECM) equations presented below;

$$\Delta lnM2_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta lnMs_{t-i} + \sum_{i=1}^{q} \beta_2 ln\Delta MPR_{t-i} + \sum_{i=1}^{r} \beta_3 ln\Delta EXR_{t-i} + \sum_{i=1}^{q} \alpha_1 lnM2_{t-i} + \sum_{i=1}^{q} \alpha_2 lnMPR_{t-i} + \sum_{i=1}^{q} \alpha_3 lnEXR_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (22)$$

$$\Delta lnExR_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta lnExR_{t-i} + \sum_{i=1}^{q} \beta_2 ln\Delta MPR_{t-i} + \sum_{i=1}^{r} \beta_3 ln\Delta M2_{t-i} + \sum_{i=1}^{q} \alpha_1 lnM2_{t-i} + \sum_{i=1}^{q} \alpha_2 lnMPR_{t-i} + \sum_{i=1}^{q} \alpha_3 lnEXR_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (23)$$

Model (22) was used to estimate the pass-through effect from the monetary policy rate to the exchange rate. The short run impact in the above two models will be captured by the differenced part while the long run aspect will be captured by the lagged component of the equation.

The short run dynamics in equation (*22*) and *(23)* are captured by the differenced part of the equation,

$$\Delta lnM2_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta lnMs_{t-i} + \sum_{i=1}^{q} \beta_2 \, ln\Delta MPR_{t-i} + \sum_{i=1}^{r} \beta_3 \, ln\Delta EXR_{t-i} + \gamma ECT_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (24)$$

$$\Delta lnExR_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta lnExR_{t-i} + \sum_{i=1}^{q} \beta_2 \, ln\Delta MPR_{t-i} + \sum_{i=1}^{r} \beta_3 \, ln\Delta M2_{t-i} + \gamma ECT_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (25)$$

Where ECT_{t-1} is the equilibrium error correction term of one-period lag which is the residual from the long run component of the ARDL equation and measures period t-i deviations from the long run stationary relationship. The γ is the adjustment parameter which captures the magnitude of the adjustment towards the long run equilibrium. It signifies the time to correct the disequilibrium. The coefficient of ECT therefore shows how quickly or slowly the relationship returns to its equilibrium path and it should have a statistically negative significant coefficient (Pahlavani etal., 2009).

ARDL has a number of advantages over conventional Johansen cointegration techniques. To start with, the ARDL is a more statistically significant approach for determining cointegrating relationships in small samples (Ghatak and Siddiki, 2001) while the Johansen co-integration techniques still require large data samples for the purposes of validity. A further advantage of the ARDL is that while other cointegration techniques requires that all of the variables be integrated of the same order, the ARDL can be applied when the dependent variable is I(1) and when the regressors are I (1) and/or I (0), i.e. whether the variables are all unit root or all stationary or when mixed results are obtained. However, the procedure is not valid if any of the variables under consideration is I(2).

Structural change is of considerable importance in the analysis of macroeconomic time series. To take into account the spike in exchange rate and monetary policy rate in 2015, conventional techniques that allows for the incorporation of only single structural breaks time series was undertaken by introducing a dummy variable, Dt. As opposed to separating the analysis into two, the pre and post structural break periods, introduction of dummy variables are a common way of solving structural breaks as it does not involve splitting the data and also has the benefit of not losing any degrees of freedom through a loss of observations. Determining the correct timing of these structural breaks is clearly of paramount importance in any macroeconomic time series analysis. Leybourne and Newbold (2003) argue that if structural breaks are not dealt with appropriately, empirical results obtained from the use of, say, cointegration techniques could be spurious and misleading.

4.2.2 Structural break analysis

In this study, the break was assumed to have occurred in the fourth quarter of 2015. Therefore, the stability of the coefficients in model *22* were tested by estimating a fully interacted ARDL regression models as shown below:

$$\Delta lnExR_t = \alpha + \sum_{i=1}^{p} \beta_1 \Delta lnExR_{t-i} + \sum_{i=1}^{q} \beta_2 \, ln\Delta MPR_{t-i} + \sum_{i=1}^{r} \beta_3 \, ln\Delta M2_{t-i} + \sum_{i=1}^{q} \alpha_1 \, lnM2_{t-i} + \sum_{i=1}^{q} \alpha_2 \, lnMPR_{t-i} + \sum_{i=1}^{q} \alpha_3 \, lnEXR_{t-i} + \gamma_1 Dt_t + \sum_{i=1}^{q} \gamma_2 \, DtlnMPR_{t-i} + \sum_{i=1}^{q} \gamma_3 \, Dt \, lnM2_{t-i} + \sum_{i=1}^{q} \delta_1 \, ln\Delta DtMPR_{t-i} + \sum_{i=1}^{r} \delta_2 \, ln\Delta DtM2_{t-i} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (26)$$

Where Dt_t= 1 if t ≥2015q4, and = 0 otherwise.

With the null hypothesis of $\gamma_1 = \gamma_2 = \gamma_3 = 0$, implying coefficients are constant over the full sample hence no structural break. If at least one of $\gamma_1, \gamma_2, or\ \gamma_3$ are nonzero, the regression function changes at date 2015q4.

4.3 ESTIMATION TECHNIQUES

Before actual estimation of the model was conducted, tests for time series properties of the variables were performed. These included testing for unit root (i.e. stationarity tests) and cointegration technique.

4.3.1 Unit root test

When a time series regression is used to study the relationship among time series, it is important to test for stationarity of the original sequence first (Yugang, 2017). This is because, even though the series is non-stationary, the result of the regression may find a noTable relationship among the series implying spurious results which cannot be used for inference and hence decision making. Therefore, to ascertain if variables are nonstationary or not, unit root tests was conducted on all variables. To check for consistency, two stationarity tests namely; Augmented Dicky -Fuller (ADF) and Phillip Perron (PP) were used for this purpose.The ADF and PP tests are based on the null hypothesis (Ho) that the variable has a unit root or is not stationary against the alternative (H1) that the variable has no unit root or is stationary.

4.3.2 Cointegration Analysis

Data observed over a considerable period of time tend to trend up or down in a non-stationary manner. However, when the data is analysed as a pair or group of variables, the resulting linear combination may tend to drift together or co-trend in a stationary manner, implying a long run relationship.

$$e_t = y_t - \beta_0 - \beta_1 x_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (27)$$

Given that the errors are a linear combination of the variables as shown above, it will be expected that when both x_t and y_t are nonstationary, the error will have a unit root and therefore also exhibit nonstationary behaviour. It is this nonstationarity of error that results in spurious regression results. However, it is possible that unit roots in both variables can cancel each other resulting in error being stationary. If variables are nonstationary but a linear combination of them is stationary, then the variables are said to have a long run equilibrium relationship or cointegrated. In this case the error will not get too large and the variables will not diverge from one another or will trend together (Ergun, 2013). If the variables are cointegrated, the error correction model (ECM) is used to capture the long run equilibrium with its associated adjustment parameter. Therefore, the data was checked for cointegration after testing for unit root. Estimation by Ngoma (2018) using Johansen test of cointegration on monthly time series data

established no long run relationship between policy rate and lending rate. Despite the sample size being relatively small, to ascertain the results with quarterly time series data, the relationship between lending rate with the policy rate was also subjected to Johansen test of cointegration. However, ARDL bound test for cointegration approach was used for the other relationships namely; exchange rate and monetary policy rate as well as monetary policy rate and money supply.

4.4 DIAGNOSTIC TESTS

Diagnostic tests tell us about the robustness of estimated coefficients. Residual diagnostics is the most crucial part of diagnostic tests in economic modeling since the regression models try to minimize errors (Min and Guna, 2018). The error terms must be white noise (independently and identically distributed, i.i.d.). Lagrange multiplier (LM) test and heteroskedasticity test are the major test methods for residual diagnostics. The stability diagnostics examine whether the parameters of the estimated model are sTable across various sub-samples of the data. Therefore, to determine whether the model is accepTable, the following diagnostic tests were performed:

4.4.1 Test for serial autocorrelation

In order to test for serial correlation of the residual, the Langrage Multiplier (LM) test was used to test the null hypothesis that the errors are serially independent against the alternative hypothesis that they are either moving average [MA(m)] or autoregressive [AR(m)], where m is 1,2,3,…, is the lag length (Zgambo and Chileshe, 2014). This test is important as serial independence is a requirement for the selection of the number of lags when undertaking a cointegration estimation. Breusch-Godfrey LM test for autocorrelation method was be used for the test.

4.4.2 Test for heteroscedasticity

The data was tested for heteroscedasticity to ascertain the presence of homoscedasticity. The null hypothesis that the errors are homoscedastic (i.e. Constant variance) against the alternative hypothesis that they are heteroscedastic. Breusch-Pagan test for heteroscedasticity method was used for the test.

4.4.3 Stability of the model

The cumulative sum test (CUSUM) was used to test the stability of the model. Both the cumulative sum square (CUSUMSQ) which detects the sudden changes from constancy of the regression coefficients and the cumulative sum which identifies systemic changes in the regression coefficients were conducted.

4.4.4 Test for Normality

Normality is one of the assumptions for many statistical tests and the Jarque-Bera test for normality was performed to check for normality in the sample data. This assists in ascertaining if the sample had the skewness and kurtosis matching a normal distribution.

4.5 DATA

Quarterly time series data from the Bank of Zambia covering a period of April 2012 to December 2020 was used for the study. Monetary policy rate, average lending rate, monetary supply-M2 was used for monetary aggregate and nominal exchange rate of United States dollar against Zambian Kwacha. It was envisaged that, the sample size of 35 was enough to capture the effect of monetary policy rate on money supply process and therefore be able to make meaningful assessments of its effectiveness. The Statistics fortnightly volumes, Bank of Zambia Annual reports amongs were a resource for the data.

CHAPTER 5
PRESENTATION, INTERPRETATION AND DISCUSSION OF RESULTS

The main purpose of the study is to assess the direct and indirect impact of monetary policy rate through its direct and indirect effects on money supply in Zambia. This chapter presents and discusses the findings in the study. Empirical analysis was carried out using Stata/MP14 statistical software.

5.1 Unit Root

In modeling time series data, it is a requirement that the data is subjected to stationarity test before it is analysed. The results for the unit root tests as confirmed both by the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) are presented in Table 5.1. Phillips-Perron was added for robustness check.

Table 5.1: Unit root tests

	ADF		PP		
Variable	**Level**	**1st Δ**	**Level**	**1st Δ**	**Order of Integration**
LnM2	-0.865	-4.489**	-1.326	-4.448**	I (1)
LnLR	-1.727	-5.608**	-2.165	-5.580**	I (1)
LnEXR	-1.466	-4.387**	-1.864	-4.347**	I (1)
LnMPR	-0.659	-3.098**	-1.072	-3.098 **	I (1)
Dt	-1.203	-5.874**	-1.193	-5.879**	I (1)
DtLnM2	-1.140	-5.810**	-1.121	-5.815**	I (1)
DtLnMPR	-1.374	-5.477**	-1.401	-5.473**	I (1)
DtLnExR	-0.946	-5.874**	-0.888	-5.897**	I (1)

*Note: The asterisks ** imply significance at 5% levels, Δ=difference operator*

The results indicated that the natural logarithms of all variables were integrated of order one. This was to ensure that the inferences derived from the relationships estimated are not spurious. Spurious regression arises when it is erroneously demonstrated that there is a relationship among variables when in actual fact such a relationship is just coincidental and does not exist.

5.2 Lag Length Selection Criteria

The variable selection order criterion was used to determine the optimal lag length to be applied in the models. Appendix A show optimal lags for each variable based on the Akaike information criterion (AIC). According to the principal of parsimony in selecting lag lengths, if two or more models are used to explain the same phenomena but have different lag lengths or number of variables, the model with lowest number of lags or variables should be selected. This assists in preventing the loss of information when higher lags or more variables are included and therefore preserve the degrees of freedom (Zgambo and Chileshe, 2014).

5.3 Cointegration

Having found that the variables are integrated of order (1), cointegration test was conducted to determine the existence of the long run relationship among the variables. To ascertain the results on monetary policy rate to lending rate pass-through with quarterly time series data , the relationship between lending rate with the policy rate in model *(20)* was subjected to Johansen test of cointegration. However, ARDL bound test for cointegration was used in other two models, *(22)* and *(24)*. ARDL was adopted over other estimation methods because ARDL can be applied when the under-lying variables are integrated of order one, order zero or mixed integrated. The other reason is that the ARDL test is relatively more efficient in the case of small and finite sample data sizes (Harris and Sollis, 2003). The fully interacted model with dummy variable represented by equation (*22)* to capture structural break if any in exchange rate during the period under study was used. The presence of cointegration among variables allows for the estimation of the model with non-stationary level variables without concerns of spurious estimates (Gujarati, 2004). Table 5.2 shows the Johansen test of cointegration between lending rate and monetary policy rate while Table 5.3 shows the bound test for cointegration for Money supply, Monetary policy rate and Exchange Rate.

Table 5.2: Johansen test of cointegration, Ln LR, LnMPR

Maximum rank	**parms**	**LL**	**Eigenvalue**	**Trace Statistic**	**5% Critical Value**
0	6	106.7528	-	11.31114*	15.41
1	9	112.0473	0.27449	0.7221	3.76
Maximum rank	**parms**	**LL**	**Eigenvalue**	**Max-Eigen Statistic**	**5% Critical Value**
0	6	106.7528	-	10.5890	14.07
1	9	112.0473	0.27449	0.7221	3.76

Table 5.3: Bound test for cointegration: Money Supply, policy rate and exchange rate

Model	**Lags**	**F-statistic**	**Signif.**	**I(0)**	**I(1)**	**model Status**
1. LnM2(LnMPR, LnExR)	(1,2,2)	4.218***	10%	3.17	4.14	Cointegration
			5%	3.79	4.85	
			2.5%	4.41	5.52	
			1%	5.15	6.36	
Model	**Lags**	**F-statistic**	**Signif.**	**I(0)**	**I(1)**	**model Status**
2.LnExR(LnM2,LnMPR,Dt,DtLnM2, DtLnMPR)	(1,1,0,0,0,2)	4.699**	10%	2.26	3.35	Cointegration
			5%	2.62	3.79	
			2.5%	2.96	4.18	
			1%	3.41	4.68	

*Note: The asterisks **, *** imply significance at 5% and 10% respectively*

In Table 5.2, the results for both cointegration equations showed that trace statistic and max statistic are less than critical values hence, no cointegration between lending rate and monetary policy rate at 5% significance level. These findings are consistent with a study in Zambia by Ngoma (2018) who used monthly time series data and found a co-integrating relationship between the interbank rate and lending rate. She further found no cointergartion relationship between the policy rate and average lending rates when a direct long-run estimation was carried out from the policy rate to the lending rates suggesting the absence of the long-run relationship between the policy rate and the lending rate. This means that, changes in monetary policy rate are not transmitted to lending rate in the long run. The overall impact of the policy rate on lending rate is therefore restricted only to the short run period.

The bound test for cointegration results in Table 5.3 are based on both the F-statistic and t-statistic with respect to both the lower and upper bounds indicated by I (0) and I (1) respectively. When the F-statistic is less than the lower bound, then there is no long run relationship while a value greater than the upper bound indicates the presence of the long run relationship. The value between the bounds leads to inconclusive decision. Model 1 is marginally significant at 10 percent while model 2 is significant at 5 percent. Therefore, there is long run relationship among variables in the two models. Hence, both the short run and long run relationship were estimated in the models using the Error Correction Model (ECM).

5.4 Pass-through from monetary policy rate to lending rate

Based on the Akaike information criterion (AIC), it was revealed that two lags was optimal for the monetary policy rate to lending rate pass-through model. Since there was no cointegration between Ln LR and LnMPR, the pass-through from monetary policy rate to lending rate was analysed using Vector autoregression (VAR). Table 5.4 shows the results and full output in Appendix B.

Table 5.4: Monetary policy rate to lending rate

		Coef.	**Std. Err.**	**z**	**P>z**
A Ln LR	LnMPR				
	L.1	0.456025**	0.1423889	3.2	0.001
	L.2	-0.412503**	0.1497339	-2.75	0.006
	_cons	0.020072	0.1436929	0.14	0.889
B LnMPR	Ln LR				
	L.1	0.086367	0.175006	0.49	0.622
	L.2	-0.232377	0.1807684	-1.29	0.199
	_cons	0.537233	0.1795671	2.99	0.003
Diagnostic Tests					
Normality		Jacque Bera [18.57] Prob. (0.00095)			
Serial Correlation		LM [2.5897] Prob. (0.62865)			
Stability condition polynomial<1		Inverse roots of AR characteristic			

*Note: The asterisks ** imply significance at 5% level*

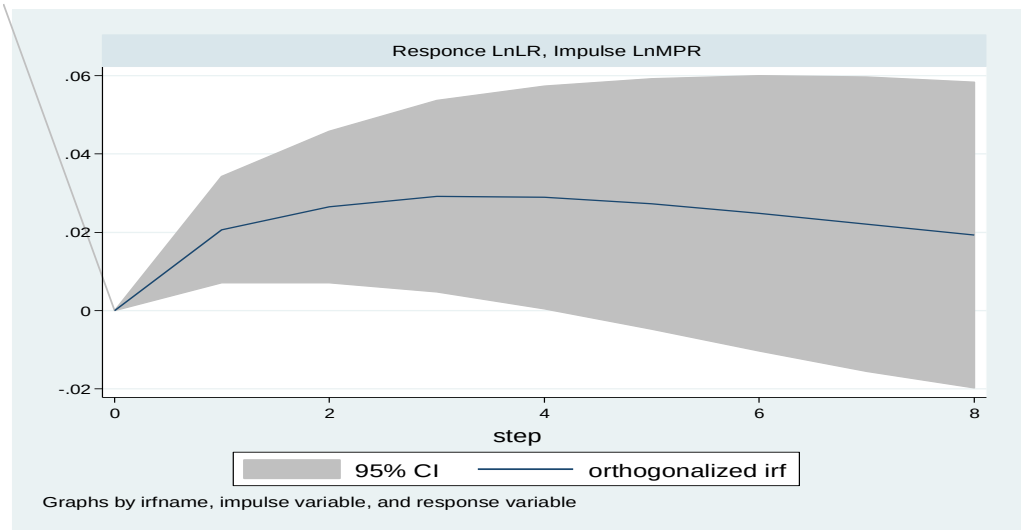
Diagnostic tests are also presented in summary in Table 5.4 and the associated details in appendix A2 reveal that the model is structurally sTable and reliable. The errors in the

model are not normally distributed as shown by the normality test. However, as per the Central limit theorem if the number of observations is greater than 30, the issue of normality can be ignored (Ayunku, 2018). The Central limit theorem states that the sample mean of moderately large samples is ususally well-approximated by a normal distribution even if the data are not normally distributed. This holds regardless of whether the source population is normal or skewed, provided the sample size is sufficiently large more than 30.

5.4.1 Impulse Response Function

To capture the path of lending rate due to changes in monetary policy rate, the impulse response function (IRF) was conducted. The IRF traced out the effect over time on lending rate of a structural one standard deviation change to the monetary policy rate. Eight quarter period was chosen as it is the horizon on which BoZ makes future projections on macroeconomic fundamentals. Figure.5.1 below shows the responses of lending rate to a one standard deviation change to monetary policy rate.

Figure 5.1: Impulse Response Function for LR and MPR



From Figure 5.1, a change in the monetary policy rate leads to statistically significant effects on lending rate up to four quarters. The maximum positive effect is within the first quarter. However, the effect reduces but remains cumulatively positive over the four quarters ahead. Other paired impulse responses are shown in appendix C.

5.4.2 Variance decomposition

Variance decomposition break down the forecast variance of lending rate into components that can be attributed to each of the various changes in the system which in this case is the monetary policy rate. This allows for the examination of the relative importance of various changes to fluctuations in lending rate. According to the results, monetary policy rate explains only about 21 percent in lending rate variations. The variance decompositions for lending rate and monetary policy rate is shown in Table 5.5.

Table 5.5: Variance decompositions for LR

Period (Quarterly)	Lending rate (LR)	Monetary policy rate (MPR)
1	100	0
2	0.916031	0.083969
3	0.87534	0.12466
4	0.846782	0.153218
5	0.826957	0.173043
6	0.812279	0.187721
7	0.801068	0.198932
8	0.792328	0.207672

The variance decomposition showed that the influence of monetary policy rate on lending rate though positive is minimal as changes to monetary policy rate explain only about 8 percent of the variations in lending rate after 2 quarters while 92 percent is explained by own shocks in lending rate over the same period. After 8 quarters which is the time horizon on which BoZ makes macroeconomic projections on, 21 percent of the variations in lending rate is explained by monetary policy rate while 79 percent is explained by own shocks in lending rate over the same period. This shows that monetary policy rate pass-through to lending rate is weak both in the short run and in the long run. Hence, monetary policy rate weakly predicts variations in lending rates, as a larger part of variations is explained by other factors and own dynamics in lending rate.

Bank of England (1999), Tahir (2012), Horvath et al. (2006) and Dabla-Norris et al. (2012) observed that although changes in the central bank's policy rate are expected to be immediately transmitted to short-term money market rates, several factors which include; the structure and competiveness of banking sector and the speed with which the

policy rate is transmitted to commercial lending rates influence the effectiveness of the interest rate channel. In Zambia, Ngoma's (2018) study revealed that they exist a high but incomplete pass-through from the policy rate to the short-term interbank rate of 86 percent but an incomplete and low pass-through of 32 percent for the lending rates with a 9 percent speed of adjustment to re-establish equilibrium after a shock.

The absence of the long run relationship and incomplete pass-through between monetary policy rate and lending rate may be attributed to the market structure of the bankng sector in Zambia. According to Ng'andwe (2020), the typical underdeveloped economy is under-banked where the modest number of banks have opportunity to collude, and the market is often characterised by lack of competitive practices. In the blueprint of the Financial Sector Development Programme (FSDP), it was concluded that dominance of foreign owned banks was the possible source of collusive behaviour in the banking sector (GRZ, 2004). Further, according to Simpasa (2013), the Zambian banking system continued exhibiting a high level of concentration with few large banks dominating the financial landscape. In 2020, Subsidiaries of foreign banks continued to dominate the sector as they accounted for 73.8 percent assets, 68 percent loans and 74.6 percent deposits before tax by ownership type in the Zambian banking sector (BoZ, 2020). These among other reasons may be contributing factors to monetary policy stance not having a significant impact on the market power of banks which is reflected in not only a high variance between Monetary policy rate and lending rate but also in the absence of the long run relationship and an incomplete pass-through between the two.

Given that lending rate affects the supply of credit by banks, monetary policy rate is expected to have an impact on money supply through its effect on lending rates. On the other hand, lending rate was found not to have any impact on monetary policy rate. Therefore, the causality is unidirectional and runs from monetary policy rate to lending rate. This is in line with theoretical expectation where the policy rate is the reference point on which all other interest rates in the market are based and this was confirmed by the granger causality test results in Table 5.6. Studies by Tai et al. (2012), Wang and Thi (2010), Wang and Lee (2009) as well as Payne and Waters (2008) revealed that the bank lending rate adjust faster when there is an increase than when there is a decrease in the

policy rate. Ngoma (2018) also found that lending rate responded largely to contractionary monetary policy, that is increase in monetary policy rate than to expansionary monetary policy. In other words, bank lending rate is rigid downward when policy rate is reduced. This partly explains why lending rates are sticky downward to changes in monetary policy rate. Generally, the pass-through from monetary policy rate to lending rate increases with time but at a very slow pace.

5.4.3 Granger Causality Test Results

The results of the pairwise granger causality tests are presented in Table 5.6 below. In the first row of the Table, we fail to accept at 5 percent significance the null hypothesis that suggests that monetary policy rate does not granger cause lending rate. But the second hypothesis that lending rate does not granger cause monetary policy rate cannot be rejected.

Table 5.6: Granger causality Wald tests LR and MPR

Equation	Excluded	chi2	df	Prob > chi2
Ln LR	LnMPR	10.624**	2	0.005
Ln LR	ALL	10.624 **	2	0.005
LnMPR	Ln LR	5.7331	2	0.057
LnMPR	ALL	5.7331	2	0.057

*Note: The asterisks ** imply significance at 5% levels*

5.5 Pass-through from monetary policy rate to Exchange rate

The bound test for cointegration confirmed the presence of the long run relationship between exchange rate with monetary policy rate and money supply. Therefore the relationship among the three variables is not explosive but converges to its equilibrium path in the long run. Model.2 in Table 5.3 was used to analyse the pass-through from monetary policy rate to exchange rate. Table 5.7 shows both the short run and long run results. See Appendix D for details.

Table5.7: Error Correction Model, Dependent Variable: DLnExR

Short run Error Correction Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT(L1)	-0.452605**	0.1309695	-3.46	0.002
D1(LnM2)	0.5225743***	0.2615663	2.00	0.058
LD(LnM2)	-.0467634	0.0841754	-0.56	0.583
D1(DtLnMPR)	0.0719355**	0.168375	4.27	0.000
LD(DtLnMPR)	0.043491**	0.176252	2.27	0.021
C	-4.270374**	1.861436	-2.29	0.031

Long Run Form Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnM2	1.032175**	0.4637107	2.23	0.036
LnMPR	0.254194	0.5094692	0.50	0.623
D1	-4.40224	3.761178	-1.17	0.254
DtLnM2	0.3708438	0.4463227	0.83	0.415
DtLnMPR	0.1722857	.05517883	0.31	0.758

R^2 =0.8456, Adj R^2=0.7852

*Source: Authors Computation. Note: The asterisks **, *** imply significance at 5% and 10% levels respectively.*

The results showed that monetary policy rate has no significant impact on exchange rate both in the short run and in the long run. This could also be attributed to the underdeveloped financial and capital market in Zambia. The results are in line with Zgambo and Chileshe (2014) who also found similar results in their empirical analysis of the effectiveness of monetary policy in Zambia. They found that, when the interest rate was used as a policy variable, impulse response function suggested statistically insignificant effect on exchange rate. Ng'andwe (2020) also noted that, for underdeveloped economies, the transmission channel from interest rate/policy rate to exchange rate may not be very active because the interest rate is not a major determinant of investments and capital movements.

Money supply has a positive insignificant effect in the short run but has a positive significant effect in the long run. A 1 percent increase in money supply increases the exchange rate by 1.03 percent in the long run. This result is expected because increase in money supply in the money market other things being equal reduces interest rates. Reduction in interest rates results in capital outflow which contributes to the depreciation of the exchange rate. In addition, increase in money supply is associated with a corresponding increase in money demand which results in increase in imports

which also contribute to domestic currency depreciation. The results are in line with Su (2012) who investigated the impact of the relationship among the degree of openness, government expenditure, relative productive activity, real money supply and Renminibi exchange rate in China. The study found that real money supply had a depreciating effect on real exchange rate and were significant for the long-run equilibrium of Renminbi exchange rate. The results are also in line with those obtained by Mumuni and Owusu (2004) findings in their work on the determinants of the Cedi/Dollar Rate of exchange in Ghana, using the monetary approach. They found out that the immediate past history of exchange positively affects exchange rate and a higher levels of monetary growth were associated with higher levels of depreciation.

The coefficient on the lagged error-correction term is significant at 5 percent level of significance with the expected negative sign. Its value is estimated to be -0.45 which implies that the speed of adjustment to equilibrium after a shock is relatively high. This means that when there is a disturbance from the previous quarter in the long-run equilibrium between exchange rate, monst suply and policy rate, it adjusts back at a rate of about 45 percent within the current quarter. Therefore, it takes about 2 quarters for the adjustment to be complete. The coefficient of determination R^2 =0.8456 indicates the adquancy of the estimated model and shows that about 85 percent of the systematic variation in exchange rate rate is jointly explained and is well accounted for by the independent variables.

Exchange rate is affected by several internal which include policy changes and external factors which include oil shocks among others. The dummy slope for the monetary policy rate in the short run is significant implying possibility of a structural break. Structural break was detected in exchange rate in 2015. The structural break in exchange rate was attributed to several factors which included economic crises and changes in institutional arrangements and policy changes among others. In 2015, the global economy faced many challenges which resulted in reduced growth. According to BoZ (2015), global economic growth declined to 3.1 perccent in 2015 from 3.4 percent in 2014. Low commodity prices, weakening trade, declining capital flows and volatility in the financial markets contributed to the slowdown in economic growth. Growth in

Zambia's real GDP slowed down to 3.2 percent in 2015 from 5 percent in 2014. Growth was mainly constrained by the electricity supply deficit, weak international copper prices, and high production costs associated with the increase in fuel prices. The sluggish global growth, particularly in Zambia's major trading partners, continued to adversely impact Zambia's external sector performance. The aforementioned partly explains the structural break in exchange rate.

5.5.1 Diagnostic tests

Table 5.8: Diagnostic test results for model 2

Test	Statistics	x^2	p-value
Chow Test (Dt=0,DtLnM2=0,DtLnMPR=0) F(3, 23)	5.42		0.0057
Breusch-Godfrey LM Test autocorrelation	1.166	Prob. Chi-Square(2)	0.5584
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.12	Prob. Chi-Square(1)	0.7278
Durbin-Watson d-statistics (10,33)			1.994457
Jarque-Bera normality test	1.898	Prob. Chi-Square(2)	0.3872

Source: Authors Computation

The diagnostic results as summarised in Table 5.8 show that there is homoscedasticity, normality and no serial correlation. The F-statistic of Chow test is statistically significant at 5 percent level. This confirms the presence of the structural break in 2015. Both the cumulative sum and the cumulative sum square are sTable implying structural stability of the model as shown in Figure 5.2 and Figure 5.3 respectively. CUSUM measures systematic change in the parameter over time and a quick change in the parameter is measured by CUSUMSQ. Part of the CUSUMSQ which represent abrupt change in coefficients lies outside the bounds but reverts back to within the bounds. This is attributed to the structural break which took place. The model is generally considered sTable as the CUSUMSQ is within the bounds at 5 % significance level.

Figure 5.2: Cumulative Sum, Pass-through from policy rate to Exchange rate

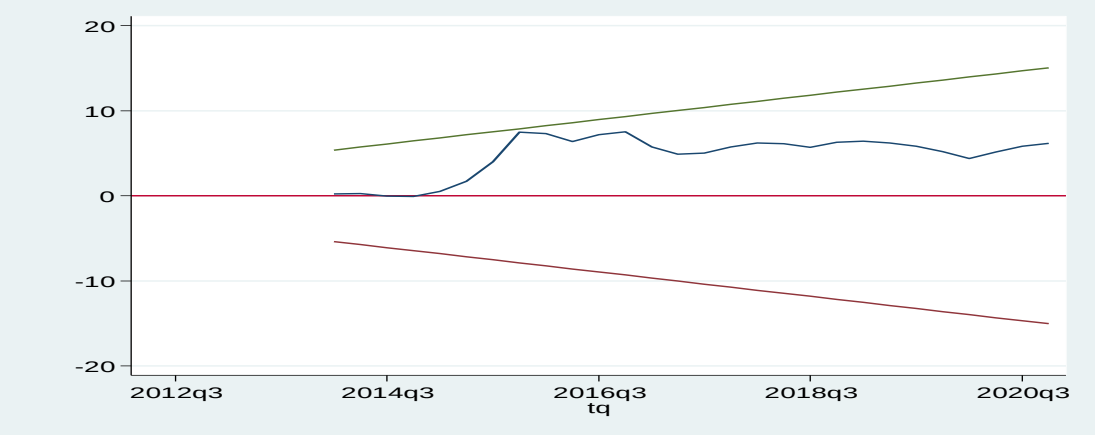
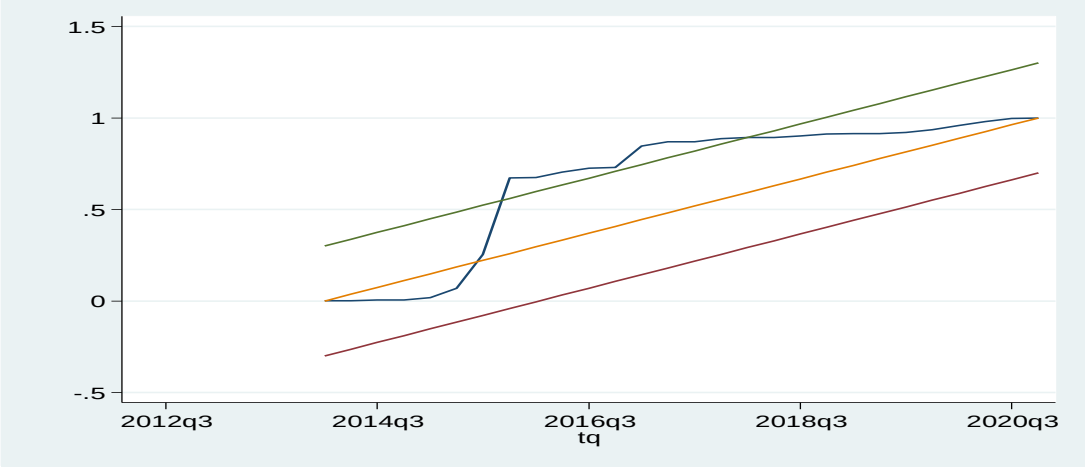


Figure 5.3: Cumulative Sum Square, Pass-through, policy rate to Exchange rate



The value of the sequence outside the range of 5 % significance rejects the null hypothesis and indicates structural change in the model over time.

5.6 Impact of Monetary policy rate and Exchange Rate on Money Supply

The impact of the monetary policy rate on money supply was investigated using the ARDL. Using model 1 in Table 5.3, both the short run and long run dynamics where estimated using the ECM. The results are depicted in Table 5.9. Details in Appendix E.

Table 5.9: Error Correction Model, Dependent Variable: DLnM2

(a) Short run Error Correction Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT(L1)	-0.1831494**	0.65583	-2.79	0.010
D1(LNMPR)	-0.1206708	0.0790176	-1.53	0.139
LD(LNMPR)	-0.0467634	0.0841754	-0.56	0.583
D1(LnExR)	0.3374275**	0.072828	4.63	0.000
LD(LnExR)	-0.1827229**	0.0652501	-2.80	0.010
C	1.859022**	0.608354	3.06	0.005

(b) **Long Run Form Estimation**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnMPR	-0.5228549**	0.1796806	-2.91	0.007
LnExR	0.8643481**	0.0752531	11.49	0.000

R^2 =0.7696, Adj R^2=0.7051

Source: Authors Computation

*Note: The asterisks ** imply significance at 5% levels*

The results indicated that, in the short run, monetary policy rate has a negative impact on money supply as expected though not statistically significant. The study results may be linked to Ngoma's (2018) findings which suggested the effectiveness of monetary policy rate in regulating liquidity supply in the system through the interbank market via the existence of a relatively strong pass-through in the first stage of the transmission process (policy rate to interbank rate) which was estimated to be at 86 percent but low pass-through from interbank rate to lending rate of 33 percent. This affects the interest rate channel of monetary policy rate hence making it ineffective in impacting money supply in the short run. Though the pass-through from monetary policy rate to lending rate is relatively significant in the short run, its impact on money supply is insignificant.

The insignificant impact of monetary policy rate on money supply in the short run is largely attributed to the oligopolistic market structure of the bankng sector in Zambia. The commercial banking sector in Zambia comprised 18 licensed commercial banks out of which nine are subsidiaries of foreign banks, five are locally owned private banks and four are partially owned by the Government of the Republic of Zambia (BoZ, 2020). In 2011, the banks' market structure as indicated by the three firm concentration ratio (CR3) in three main components of the banks' balance sheet showed that three banks

accounted for 64.6 percent assets, 66.6 percent deposits and 65.3 percent loans. Further, a study by Simpasa (2010) on Competition and Market Structure in the Zambian Banking Sector revealed that parameter on other income sources was positively significant suggesting that including a measure of non-interest revenue in assessing determinants of competition in Zambian banking sector helped address the importance of non-intermediated sources of income for banks. From microeconomic perspective, the market structure which to a larger extent determines the conduct, that is the behavior of banks has a bearing on the effectiviness of monetary policy in as far as money supply control is concerned. Therefore, in addition to the incomplete pass-through effect on lending which affect the interest rate channel on money supply, the market structure of the banking sector contributes to monetary policy rate having no significant impact on money supply in the short run.

In the short run, only exchange rate is statistically significant at 5 percent and exhibits two different effects on money supply. The first difference of exchange rate has a positive significant coefficient of 0.337 indicating wealth effect while the first lag has a negative significant coefficient of -0.183 indicating currency substitution effect. The wealth effect exists when households prefer holding domestic currency to foreign currency when there is depreciation of the domestic currency. generally, most economic players evaluate their asset portfolio in terms of their domestic currency. Exchange rate depreciation leads to an increase in the value in domestic currency terms of their foreign assets held and hence wealth enhancing. To maintain a fixed share of their wealth invested in domestic assets, they will transfer part of their foreign assets to domestic assets, including domestic currency. Hence, exchange rate depreciation would increase the demand for domestic currency which in turn leads to increasing money supply in domestic currency terms.

The results are consistent with Bova (2009) who tested the sensitivity of Zambian food and non-food inflation to changes in the money supply and in the exchange rate. The results indicated that in the short-run, broad money was positively sensitive to changes in the exchange rate. Zgambo and Chileshe (2014) found similar results in their empirical analysis of the effectiveness of monetary policy in Zambia. The first lag of

exchange rate has a currency substitution effect hence has a negative impact on money supply. In the short run, the wealth effect of exchange rate has a higher elasticity of about 0.34 percent compared to 0.18 percent for currency substitution effect. This implies that, in general, exchange rate has a positive impact on money supply in the short run. Therefore, Changes in exchange rate drives changes in money supply in the short run in Zambia.

In the long run, the results indicates that monetary policy rate and exchange rate significantly influence money supply. According to the results in Table 5.9 (b), the negative coefficient of monetary policy rate supports theoretical expectation that an increase in policy rate increases lending rates resulting in overall reduction of money supply through the credit channel in the long run. The findings imply that though monetary policy rate pass-through to lending rate exhibits some increasing effect in the short run, it may take a considerable time before the effect of a change in monetary policy rate can have an impact on money supply. The coefficient of determination R^2 =0.7696 indicates the adquancy of the estimated model and shows that about 77 percent of the systematic variation in money supply rate is jointly explained by monetary policy rate and exchange rate.

As opposed to the short run where exchange rate has both wealth effect and currency substitution effect, in the long run, the exchange rate has only a wealth effect implying that depreciation of the kwacha increases the nominal kwacha value of a dollar resulting in economic agents holding more domestic currency hence resulting in an increase in money supply. This is anticipated because in an import dependent economy, depreciation of the domestic currency is associated with inflation (Cost push). This make economic agents hold more domestic currency to meet purchases in times of currency depreciation hence increasing money supply in the long run. The results are similar to those obtained by Niaz e tal. (2016).

Exchange rate has an elasticity of 0.86 percent while monetary policy rate has an elasticity of about negative 0.52 percent. This means that, a 1 percent depreciation of kwacha against the dollar increases money supply by 0.86 percent in the long run while

a 1 percent increase in monetary policy rate ceteris paribus, results in 0.52 percent reduction in money supply in the long run. This effect of exchange rate on money supply has implications on the effectiveness of monetary policy rate in Zambia considering that dynamics in foreign markets are influenced mainly by external factors. The high elasticity of exchange may partly explain why when kwacha continues weakening, money supply continue increasing despite tightening monetary policy through raising monetary policy rates.

As theoretically expected, the coefficient on the lagged error-correction term is significant with the expected negative sign, which further validates the long-run equilibrium relationship between money supply and its associated determinants. Its value is estimated to be -0.18 which implies that the speed of adjustment to equilibrium after a shock in the previous quarter is low but significant. It indicates that when there is a shock or disturbance from the previous quarter in the long-run equilibrium between money supply, policy rate and exchange rate, it adjusts back at a rate of about 18 percent within the current quarter. This implies that, it takes about 5 quarters 41 days for the adjustment to the equilibrium state to be complete. This result corroborates the "marginal cointegration" relationship among the variables in the model. The two determinants of money supply, that is, monetary policy rate and exchange rate can therefore be considered as the long-run forcing variables for the explanation of money supply in Zambia.

Since exchange rate has significant effect on money supply both in the short and long run and money supply has the same effect on exchange rate in the long run, they exist a bidirectional granger causality between exchange rate and money supply.

5.6.2 Diagnostic tests

The model is found to be free of serial correlation in the errors and the variance of the errors term are homoscedastic as shown in Table 5.10. Residuals are also normally distributed. This ensures that the estimation results are not only unbiased but are also efficient.

Table 5.10: Diagnostic Tests

Test	Statistics	x^2	p-value
Breusch-Godfrey LM Test autocorrelation	0.107	Prob. Chi-Square(2)	0.7432
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.49	Prob. Chi-Square(8)	0.2229
Durbin-Watson d-statistics (10,31)			1.727714
Jarque-Bera normality test	0.308	Prob. Chi-Square(2)	0.9847

Source: Authors Computation

Further, the model is dynamically sTable as shown by both the CUSUM and CUSUM of squares tests thereby supporting statistical conclusions. Figure 5.4 and Figure 5.5 plot the results for CUSUM and CUSUMSQ respectively.

Figure 5.4: Cumulative Sum, policy rate and Exchange Rate on Money Supply

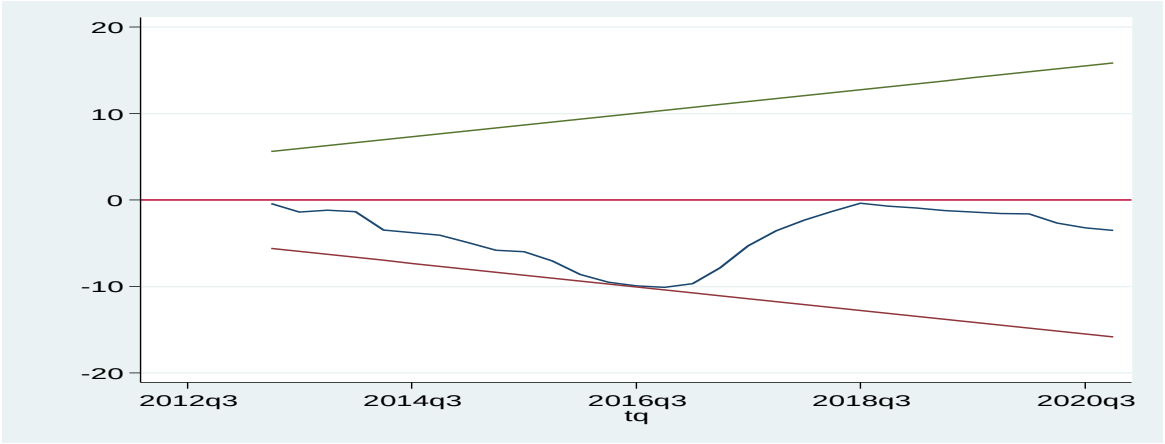
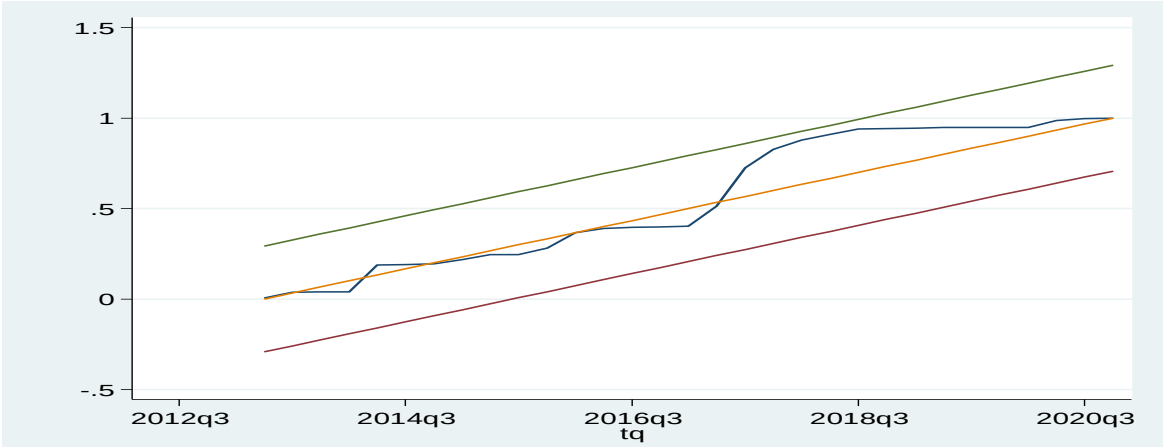


Figure 5.5: Cumulative Sum Square, policy rate and Exchange Rate on Money Supply



CHAPTER 6
CONCLUDING OBSERVATIONS AND RECOMMENDATIONS

6.1 General Conclusion

The aim of the study was to establish the impact of monetary policy rate on money supply in Zambia. The study examined the channels through which monetary policy rate affects money supply indirectly through lending rate and exchange rate as well as its direct impact on money supply. The relationship between monetary policy rate and lending rate was assessed using VAR while that between money supply, monetary policy rate and exchange rate was examined using ARDL model. The results showed the presence of pass-through effect from monetary policy rate to lending rate in the short run. However, monetary policy rate explains a small portion of variations in lending rate, a larger part of variations is explained by other factors and own dynamics in lending rate. This implies that, the influence of monetary policy rate on lending rate in the short run is minimal and increases at a slow pace after several lags. On the other hand, the impact of monetary policy rate on exchange rate was found to be insignificant. This means that, in Zambia, changes in monetary policy rate have no impact on exchange rate making its impact on money supply via exchange rate pass through impotent. The implication is that monetary policy rate cannot be relied on in addressing dynamics in the foreign exchange market in Zambia.

Further, the results showed that changes in monetary policy rate and exchange rate have significant impact on money supply. Monetary policy rate affects money supply only in the long run only while exchange rate influences money supply both in the short run and long run. This suggests that, Monetary policy rate maintains its strength in signaling monetary policy stance in the long run. However, in the long run, exchange rate has a higher positive elasticity of 0.86 percent compared to the negative elasticity for monetary policy rate of 0.52 percent. This reduces the effectiveness of monetary policy rate on money supply as its impact is disproportionally cancelled out by exchange rate wealth effect.

From the aforementioned, the study revealed the important role that exchange rate plays in monetary policy implementation in general and money supply determination in

particular in Zambia. Both in the short and long run, the wealth effect of exchange rate was dominant and stronger than that attributed to not only currency substitution effect but also to monetary policy rate. Therefore, dynamics in the foreign exchange market will continue exerting influence on the impact monetary policy rate has on money supply. All in all, it is hoped that the relationship between the monetary policy rate and monetary aggregates will continue improving with time.

6.2 Recommendations

To enhance the effectiveness of monetary policy, the study recommends for more competition in the banking markets to be promoted as it is expected that higher degree of competition would result in higher bank efficiency in terms of intermediation. Further, mechanisms aimed at eliminating the dominance of few banks in the banking sector should be instituted. This would improve the pass-through effect from monetary policy rate to lending rate.

Focus should be on interventions in the foreign exchange market just like to monetary policy rate as they both influence monetary aggregates path in Zambia. Exchange rate policy and implementation should take into account the particular effects on not only trade balance but also on money supply. In particular, industrial, monetary and fiscal policies should be tailored in a manner that promotes a sTable exchange rate and favorable trade balance position. Activities that are likely to exert pressure on exchange rate and hence render monetary policy rate ineffective such as excessive external borrowing by government should be curbed. Further, strategies aimed at increasing foreign reserves such as economic diversification through import substitution among others should be strengthened to effectively reduce pressure on exchange rate. To effectively control money supply in the long run, the implementation of monetary policy should continue taking into account developments in the foreign exchange market.

Since monetary policy rate is theoretically expected to affect exchange rate through exchange rate channel, studies should be conducted on the impact of monetary policy rate on exchange rate in Zambia. Further studies on exchange rate structural break should be conducted with unit root tests such as the Zivot-Andrews and Perron-Vogelsang that allow for one structural break, as well as the Clemente-Montanes-Reyes

(1998) unit root test which allows for more than one structural breaks in the mean of the series.

6.3 Limitations of the Study

This study only focused on the impact of monetary policy rate on money supply. The sample period though enough was relatively short and as such may underestimate those effects of monetary policy rate that occur with a significant time lag. There is therefore need to undertake the same study in future under a long sample period for robustness and validation of the results using similar methodology.

It is also appreciated that there are many other factors influencing monetary aggregates. Besides the variable used in the model, other variables considered key in monetary economics such as statutory reserve requirements, international reserves/Net foreign Assets, financial innovations, fiscal variable such a ratio of expenditure to revenue as well as other monetary policy instruments in use could be included in a broader analysis to check the effect more precisely. However such a broader analysis would result in an over identified model hence lacking in detail than a more parsimonious focused studies. The study used the ARDL bound test approach to check for cointegration and thus conclusion drawn may differ from other studies using different approaches.

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APPENDICES

APPEDIX A: Lag selection for variables and model

Varsoc LnM2

Selection-order criteria

Sample: 5 - 35 Number of obs = 31

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-8.93795				.11117	.641158	.656237	.687416
1	54.8751	127.63*	1	0.000	.001932*	-3.4113*	-3.38114*	-3.31878*
2	55.533	1.3158	1	0.251	.001976	-3.38923	-3.34399	-3.25046
3	56.3495	1.633	1	0.201	.002002	-3.37739	-3.31707	-3.19236
4	57.2708	1.8425	1	0.175	.002015	-3.37231	-3.29692	-3.14102

Endogenous: LnM2

Exogenous: _cons

Varsoc Ln LR

Selection-order criteria

Sample: 5 - 35 Number of obs = 31

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	8.91935				.035127	-.510926	-.495847	-.464668
1	47.4153	76.992*	1	0.000	.003127	-2.93002	-2.89986	-2.8375*
2	48.609	2.3873	1	0.122	.003089	-2.94251	-2.89728	-2.80374
3	49.9261	2.6342	1	0.105	.003029*	-2.96297*	-2.90266*	-2.77794
4	50.8288	1.8056	1	0.179	.003053	-2.9567	-2.8813	-2.72541

Endogenous: Ln LR

Exogenous: _cons

Varsoc LnMPR

Selection-order criteria

Sample: 5 - 35 Number of obs = 31

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	8.74635				.035521	-.499764	-.484686	-.453507
1	37.3301	57.168	1	0.000	.005994	-2.27936	-2.2492	-2.18685
2	43.3581	12.056*	1	0.001	.004335*	-2.60375*	-2.55851*	-2.46497*
3	43.3836	.05102	1	0.821	.00462	-2.54088	-2.48056	-2.35585
4	43.8189	.87066	1	0.351	.004798	-2.50445	-2.42905	-2.27316

Endogenous: LnMPR

Exogenous: _cons

Varsoc LnExR

Selection-order criteria

Sample: 5 - 35 Number of obs = 31

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-12.9425				.143943	.899515	.914593	.945772
1	34.9974	95.88*	1	0.000	.006967	-2.12886	-2.09871*	-2.03635*
2	36.1205	2.2463	1	0.134	.006915*	-2.13681*	-2.09157	-1.99804
3	36.3824	.52361	1	0.469	.007258	-2.08918	-2.02887	-1.90415
4	36.3826	.00055	1	0.981	.007753	-2.02469	-1.94929	-1.7934

APPENDIX B: VAR output for pass-through from Policy rate to lending rate

var Ln LR LnMPR, lags(1/2)

Vector autoregression

Sample: 2012q4 - 2020q4		Number of obs =	33
Log likelihood = 112.4084		AIC =	-6.206569
FPE = 6.94e-06		HQIC =	-6.053984
Det(Sigma_ml) = 3.77e-06		SBIC =	-5.753082

Equation	Parms	RMSE	R-sq	chi2	P>chi2
Ln LR	5	0.046532	0.9522	657.9793	0.0000
LnMPR	5	0.058149	0.9149	354.9528	0.0000

		Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Ln LR							
	Ln LR						
	L.1	0.934511	0.1400431	6.67	0.000	.6600312	1.20899
	L.2	0.029648	0.1446543	0.2	0.838	-.2538694	0.313165
	LnMPR						
	L.1	0.456025	0.1423889	3.2	0.001	.1769478	0.7351019
	L.2	-0.412503	0.1497339	-2.75	0.006	-.7059763	-.1190302
	_cons	0.020072	0.1436929	0.14	0.889	-.2615612	0.3017048
LnMPR							
	Ln LR						
	L.1	0.086367	0.175006	0.49	0.622	-.2566383	0.4293724
	L.2	-0.232377	0.1807684	-1.29	0.199	-.5866765	0.1219227
	LnMPR						
	L.1	1.251139	0.1779374	7.03	0.000	.9023885	1.59989
	L.2	-0.287217	0.1871162	-1.53	0.125	-.653958	0.0795239
	_cons	0.537233	0.1795671	2.99	0.003	.1852884	0.8891783

VAR model stability LR, MPR, Eigenvalue stability condition

Eigenvalue	Modulus
.8902709 + .06666084i	0.892763
.8902709 - .06666084i	0.892763
0.617258	0.617258
-0.21215	0.21215

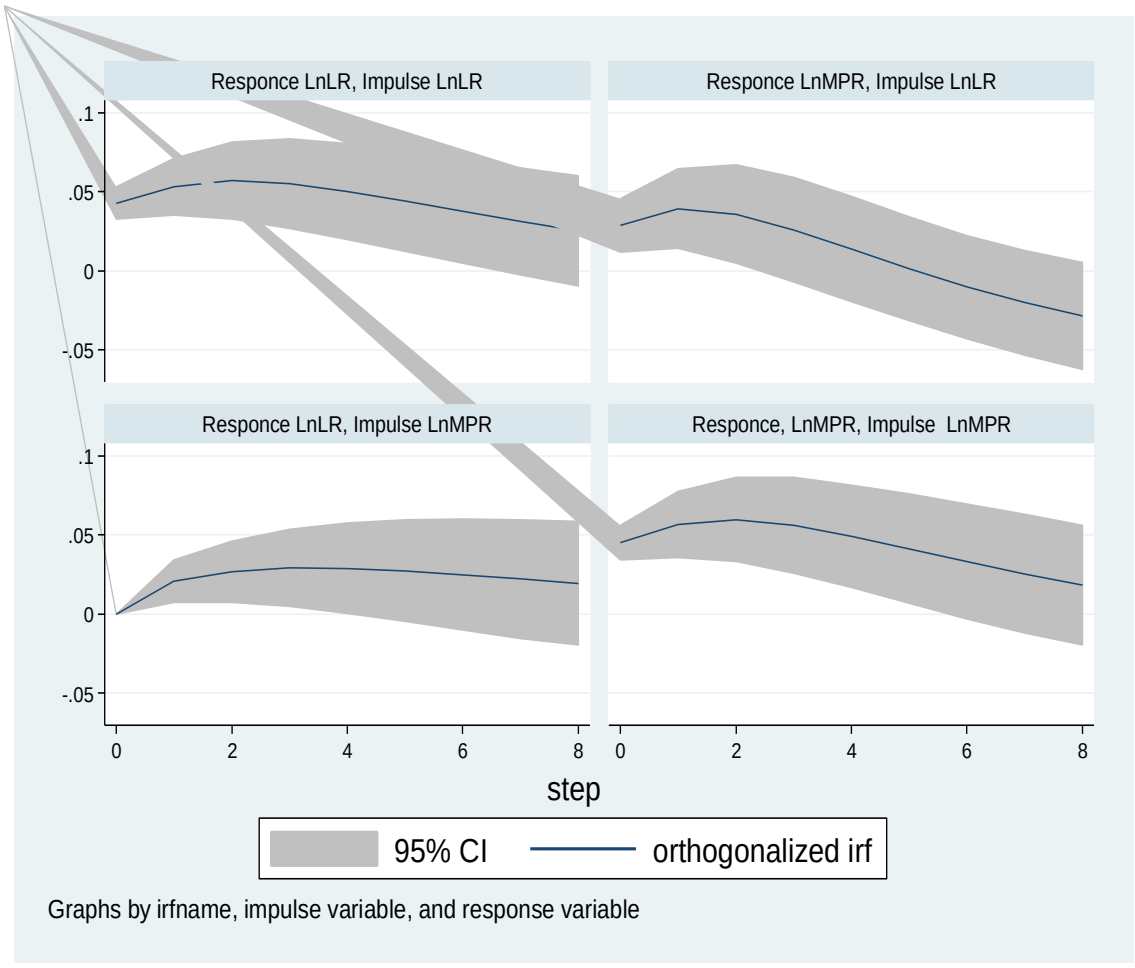
All the eigenvalues lie inside the unit circle. VAR satisfies stability condition.

VAR model, Lagrange-Multiplier test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	7.0779	4	0.13183
2	2.5897	4	0.62865

H_0: no serial correlation at lag order

APPENDIX C: Impulse Response Functions for LnLR and LnMPR



APPENDIX D: pass-through from Policy rate to Exchange rate

ardl LnExR LnM2 LnMPR D1LnM2 D1LnPMR D1
D1LnM2 D1LnMPR, lags(1 1 0 0 0 2) ec btest
ARDL(1 1 0 0 0 2) regression
Sample: 2012q4 - 2020q4

Number of obs = 33
R-squared = 0.8456
Adj R-squared = 0.7852
Log likelihood = 69.027216 Root MSE = 0.0358

D.LnExR		Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
ADJ	LnExR L1.	-.452605	.1309695	-3.46	0.002	-.723536	-.181674
LR	LnM2	1.032175	.4637107	2.23	0.036	.0729168	1.991434
	LnMPR	.254194	.5094692	0.50	0.623	-.7997232	1.308111
	Dt	-4.40224	3.761178	-1.17	0.254	-12.18283	3.378349
	DtLnM2	.3708438	.4463227	0.83	0.415	-.5524451	1.294133
	DtLnMPR	.1722857	.5517883	0.31	0.758	-.9691752	1.313747
SR	LnM2						
	Dt	.5225743	.2615663	2.00	0.058	-.0185168	1.063665
	DtLnMPR						
	D1	.0719355	.0168375	4.27	0.000	.0371045	.1067665
	LD	.043491	.0176252	2.47	0.021	.0070305	.0799515
	_cons	-4.270374	1.861436	-2.29	0.031	-8.121048	-.4196993

APPEDIX E: Error Correction Model for M2, MPR and ExR

ardl LnMS2 LnMPR LnExR, lags(1 2 2) ec btest
ARDL(1,2,2) regression
Sample: 2012q4 - 2020q4

Number of obs = 33
R-squared = 0.7696
Adj R-squared = 0.7051
Log likelihood = 80.971979 Root MSE = 0.0239

D.LnMS2		Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
ADJ	LnMS2 L1.	-.1831494	.065583	-2.79	0.010	-.3182202	-.0480786
LR	LnMPR	-.5228549	.1796806	-2.91	0.007	-.892914	-.1527959
	LnExR	.8643481	.0752531	11.49	0.000	.7093614	1.019335
	_cons	.2486633	.1775241	1.4	0.161	-.0992776	.5966043
SR	LnMPR						
	D1	-.1206708	.0790176	-1.53	0.139	-.2834106	.0420691
	LD	-.0467634	.0841754	-0.56	0.583	-.2201259	.1265991
	LnExR						
	D1	.3374275	.072828	4.63	0.000	.1874354	.4874195
	DL	-.1827229	.0652501	-2.91	0.010	-.317108	-.0483377
	_cons	1.859022	.608354	2.06	0.040	.6060932	3.11195