MONETARY POLICY TRANSMISSION IN ZAMBIA: PASS-THROUGH FROM THE BANK OF ZAMBIA POLICY RATE TO COMMERCIAL BANKS MARKET INTEREST RATES

By

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

THE UNIVERSITY OF ZAMBIA
LUSAKA
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DECLARATION

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APPROVAL

This dissertation of **Cleopatra Ngoma** has been approved as a 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

This study investigates the monetary policy transmission in Zambia by examining the magnitude and speed of the pass-through from the Bank of Zambia policy rate to commercial bank interest rates using the Johansen cointegration approach. The study also investigates the symmetric/asymmetric behavior of the pass-through with respect to particular monetary policy stance undertaken. Using monthly time series data consisting of Bank of Zambia Policy Rate, interbank rate, commercial banks' lending and deposit rates, the empirical results reveal that there is incomplete but high pass-through from the Bank of Zambia policy rate to the short-term interbank rate. Subsequently, the pass-through from the interbank rate to commercial bank interest rates is incomplete, low and slow, implying that commercial banks adjust their interest rates in response to changes in policy rate by a small margin and with long lags. This suggests that commercial banks exhibit high rigidity in response to monetary policy changes via the interbank rate. The pass-through appears to be asymmetric with deposit rates exhibiting high downward flexibility during expansionary monetary policy episodes and lending rates exhibiting high upward flexibility during contractionary monetary policy periods. Therefore, study proposes the need for undertaking further studies that will help establish the weak link between the interbank money market and the commercial banks' retail market by investigating the causes or determinants of commercial banks interest rates rigidity.

Keywords: ***Policy Rate, Interbank Rate, Pass-through, symmetric/asymmetric, VECM***

DEDICATION

To Allan (late dad) and Maureen (mother).

ACKNOWLEDGEMENTS

First and foremost, I want to thank the almighty God in heaven for the gift of life and the abundant provision of resources throughout my study, Glory be unto him now and forever more.

I am grateful to Dr. Jonathan M. Chipili for his guidance, encouragement and mentorship during the period he supervised me as I worked on my dissertation.

I am thankful to all my colleagues at Bank of Zambia in the Department of Economics for the support during my study. Particularly I would like to thank Ms. Brenda Mwanza, Dr. Jacob Lungu, Mr Francis Mbao, Mr. Kafula Longa and Mr. Kamwi Mulele for their guidance and support throughout my studies. Let me also not forget to thank Mr. Masauso Ngulube for his assistance during the hectic moments of juggling between school and work.

I thank all my family members for they have been instrumental to my academic attainments thus far.

I also want to thank my all friends and course mates. Am particularly grateful to Mr. Chimuka Matongo, Mr. Kelvin Chileshe, Mr. Mufara Gatawa, Mr. Gerald Soko and Ms Sekai Mwanza for the academic assistance and encouragements.

Finally, I wish to express sincere gratitude to the hard working members of staff of the Department of Economics at the University of Zambia for making this work possible.

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey–Fuller
AR	Auto Regressive
BAZ	Bankers Association of Zambia
BOZ	Bank of Zambia
CSME	Caribbean Single Market and Economy
ECT	Error Correction Term
GDP	Gross Domestic Product
IMF	International Monetary Fund
IRF	Impulse Response Function
IRPT	Interest Rates Pass-through
MAT	Monetary Aggregate Targeting
MPC	Monetary Policy Committee
MTAR	Momentum Threshold Autoregressive
NPL	Non-Performing Loans
OECs	Organization for East Caribbean Countries
OMO	Open Market Operations
PP	Phillips–Perron
SEECs	South Eastern European Countries
SIC	Schwarz Information Criterion
SSA	Sub-Saharan Africa
TAR	Threshold Autoregressive
VAR	Vector Auto regression
VECM	Vector Error Correction Model

CHAPTER ONE

INTRODUCTION

1.1 Background

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, 2017). It entails the formulation and execution of policies by the central bank to achieve the desired objective or set of objectives (Loayza and Schmidt, 2002). Monetary policy changes directly or indirectly influence commercial bank interest rates as the central bank controls certain types of short-term interest rates. One of the most important aspects of monetary policy is the ability of central bank to influence market interest rates through influencing short-term money market rates. Ability to influence the market interest rates is crucial in influencing aggregate demand and consequently inflation (Zgambo and Chileshe, 2014).

The transmission mechanism of monetary policy is the process through which monetary policy decisions affect the economy in general and the price level in particular. The potential channels through which monetary policy can affect output are the interest rate, credit, asset price, and the exchange rate, (RSA, 2018).

A critical and most important issue in the monetary policy transmission mechanism is the pass-through defined as the degree and speed of adjustment with which a change in the monetary policy instrument is passed on to the economy (Aydin, 2007). For instance, if the interest rate pass-through (IRPT) from the central bank key policy rate to commercial bank interest rates is equal to one, it implies that the interest rate channel is effective and the interest rate pass-through is complete. On the other hand, if the interest rate pass-through is less than one, it implies that the interest rate channel is ineffective and the interest rate pass-through is incomplete or sluggish. A high interest rate pass-through would suggest a developed, competitive and efficient financial system while a low interest rate pass-through would imply the opposite (Aziakpono and Magdalene, 2010).

In this regard, a key aspect of the monetary policy transmission process is the speed at which changes in policy interest rate is reflected in commercial banks' deposit and lending interest rates. The effectiveness of the central bank's monetary policy depends largely on how commercial banks adjust their range of lending and deposit rates to changes in the central bank's policy interest rate. The magnitude and speed of these adjustments in lending and deposit rates determines whether these tools of monetary policy are effective or not. Wilson and Magdalene (2007) assert that if the response of the retail interest rates is too small to be noticed or delayed or sluggish, monetary policy may not achieve its desired goal irrespective of the size or magnitude of the change in the official rate.

Several explanations for the variations in the magnitude and speed of interest rate pass-through across countries and over time are provided in the literature. Some common explanations include the structure of the financial system, monetary policy regime whether market-oriented or controlled (Cottarelli and Kourelis, 1994), the transparency of monetary policy (Kaketsis and Sarantis, 2006; Kleimeier and Sander, 2006; Gambacorta, 2008; Liu et al., 2008), the degree of competition amongst financial intermediaries (Cottarelli and Kourelis, 1994), the stages of financial market development, concentration within the banking sector, degree of financial market openness (Cottarelli and Kourelis, 1994; Borio and Fritz, 1995; Mojon, 2000; Weth, 2002), asymmetric information (Stiglitz and Weiss, 1981), menu costs (Rotemberg and Saloner, 1987; Hannan and Berger, 1991; Hofman and Mizen, 2004), switching cost (Fried and Howitt, 1980; Ausubel, 1991; Cottarelli, Ferri and Generale,1995; Angeloni et al., 1995; Berlin and Mester, 1997), adverse selection (Lowe and Rohling, 1992), risk sharing (Fried and Howitt, 1980; Lowe and Rohling, 1992); consumer irrationality (Fried and Howitt, 1980; Lowe and Rohling, 1992), implicit contract between banks and their customers as a result of a long standing relationship (Berger and Udell, 1992; Allen and Gale, 2004), and economic policy and regulation of the economy (Wang and Lee, 2009).

In Zambia, the primary objective of the central bank (Bank of Zambia) is to achieve and maintain price and financial systems stability. In order to achieve this objective, the Monetary Policy Committee (MPC) 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 aimed at achieving the inflation objective. However, the MPC can meet at any other time during the year to deliberate on monetary policy issues and/or to consider the stance of monetary policy should changes in macro-economic conditions warrant such a review. The MPC decision to either loosen or tighten the monetary policy stance is made through changes to the Bank of Zambia policy rate which is used as a key interest rate to signal the central bank monetary policy stance. Introduced in April 2012 as a starting point towards inflation targeting, the policy rate is a key interest rate that signals the monetary policy stance. This done in line with expected inflation over the medium term with the interbank rate being the operating target, replacing reserve money, which was an operating target under MAT (Zgambo, 2017). Further, the policy rate provides a credible and stable anchor to financial market participants in setting their interest rates. More precisely, commercial banks use the policy rate as the base rate when setting the price or interest rates for their loans and advances (BoZ, 2015). Further, the policy rate guides the Bank of Zambia's open market operations and is expected to influence the overnight interbank rate (operating target). The interbank rate is the rate extended to other banks in the money market being the rate at which banks lend each other funds in order to replenish their liquidity shortfalls. The interbank rate is kept within the corridor of +/- 1 percentage points around the policy rate through the open market operations (OMO) by supplying or withdrawing liquidity from the banking system. The +/-1 corridor is the revised width of the interest rate corridor from +/- 2 percentage points, which had been applicable since the introduction of the policy rate in April 2012 until May 2017. Changes to the policy rate are guided by a comprehensive economic analysis and forecasts that inform short-term and medium-term risks to price stability.

1.2 Statement of the Problem

Under current monetary policy framework (transition to inflation targeting), the degree and speed of monetary policy rate pass-through to retail bank interest rates has never been adequately investigated in Zambia. Thus, since the introduction of the policy rate in 2012 there is limited literature available. The two key papers available on this subject as far as this study is concerned, are the ones by Chileshe and Olusegun (2016) as well as Zgambo (2017) who investigated the symmetric/asymmetric response of rates to monetary policy controlled rates and reviewed liquidity management in an inflation targeting regime, respectively. The Monti-Klein framework (1971) states that under perfect competition, banks are able to keep retail rates and wholesale rates in long-run equilibrium most times. This is because any change in wholesale rates tends to be reflected in retail rates within a relatively short period of time (Banerjee, Bystrov and Mizen, 2012).

Aziakpono and Magdalene (2010) argue that if monetary policy is to be effective, changes in the monetary policy rate should be transmitted to other interest rates quickly and the magnitude of the change should be large enough to influence investment and consumption. If the opposite happens then it becomes ineffective and interest rates are sticky (Fuentes and Ahumada 2003). This entails that monetary policy pass-through is an important macroeconomic phenomenon that calls for an in-depth investigation and understanding

1.3 Objectives

This study seeks to investigate how the interest rate channel of monetary policy transmission mechanism works in Zambia. It endeavors to empirically establish the degree and speed of adjustment of commercial banks retail rates to changes in the monetary policy rate.

Specifically, the study objectives are to establish:

i. The magnitude and speed of interest rates pass-through from the monetary policy rate to commercial banks' deposit and lending rates in Zambia; and
ii. Whether the interest rates pass-through is symmetrical or asymmetrical during the expansionary and contractionary monetary policy episodes.

1.4 Research Questions

i. What is the magnitude and speed of interest rates pass-through from the monetary policy rate to commercial banks' deposit and lending rates in Zambia; and
ii. Is the interest rates pass-through is symmetrical or asymmetrical during the expansionary and contractionary monetary policy episodes.

1.5 Rationale

Understanding the effects of monetary policy on the economy is central to the study of macroeconomics and practice of policy making. Estimation of the speed of adjustment in response to monetary policy changes provides information regarding how long it takes for monetary policy interventions to take effect in the real sector. All this is instrumental in the formulation of monetary policy strategies particularly the choice of monetary policy instruments and timing of monetary policy actions that promote growth and stability in the economy.

Further, while a number of studies in this area have been conducted in developed countries, very few have been carried out on African countries. The studies on Africa point to mixed results. Emerging from these studies is that the monetary transmission process differs in magnitude (size) and speed among different countries for different bank rates. For instance, Aziakpono and Magdalene (2014) found a high speed and magnitude of pass-through towards lending rates than other bank rates in South Africa. Accordingly, Bangura (2012) finds a high pass-through from monetary policy to lending rates and a low pass-through from monetary policy to deposit rates in Nigeria. However, in the same study, it was established the pass-through in Ghana was the opposite of what was prevailing in Nigeria as the pass-through to deposit rate was higher than the pass-through to lending rates. With respect to the asymmetric/symmetric adjustment, Aziakpono and Magdalene (2014) found deposit rates to be rigid upwards in South Africa while Matimilola (2014) and Jankee (2005) found deposit rates to be rigid downwards and lending rates rigid downwards in South Africa and Mauritius, respectively.

In Zambia, most empirical evidence has mostly focused on general monetary policy transmission process (Chileshe et al., 2014; Mbewe, 2013), determinants of interest rates pass through (Banda, 2010), and the bank lending channel of monetary policy pass-through (Simpasa, 2014) without putting emphasis on the speed and magnitude of adjustment. Most of these studies have not paid attention to the symmetrical/asymmetrical adjustment processes of the interest rates pass through thereby assuming that the pass-through from the monetary policy rate to bank retail rates is the same under different monetary policy episodes (expansionary and contractionary). This could be inaccurate and is capable of producing spurious results especially that most empirical literature does not support symmetrical interest rates pass-through (Greenwood-Nimmo et al., 2010; Roelands, 2012; Jamilov and Egert, 2014; Mbowe, 2015) elsewhere and in Zambia Chileshe and Oluseguni (2016).

This study therefore attempts to provide new evidence on the speed and magnitude of adjustment of interest rates pass through; and it explores the symmetrical/asymmetrical nature of commercial banks' retail rates adjustment processes in response to monetary policy changes in Zambia for the period April 2012 to May 2018 using monthly data.

However, it is important to note that a study by Chileshe and Olusegun (2016) provides similar evidence on adjustment dynamics but the key differences with this study is their dataset, the sample and the methodology. Thus, while their study consists of 16 quarterly variables for the period 1992-2016 (combination monetary aggregates and inflation targeting lite frameworks), this study only concentrates on four monthly variables for the period 2012-2018 (period of transition to inflation targeting) making the analysis much simpler and focused. Also, in their study monetary policy was proxied by interbank and t-bill rate which could not be an accurate representation of the central bank actions, while in this study the policy rate which is the actual monetary policy tool has been used and this is capable of giving a clear indicator concerning the nature of interest rates pass-through in Zambia.

1.6 Scope of the Study

This study considers the period 2012-2018 covering the period when the central bank of Zambia embarked on the transition towards inflation targeting.

1.7 Organization of the Study

Following the introduction chapter, the study is divided into six chapters. Chapter two looks at the monetary policy and structure of interest rates in Zambia. The third chapter reviews the literature. Chapter four outlines the methodology and estimation techniques. Chapter five presents and discusses the results. Chapter six provides the conclusion and policy recommendations.

CHAPTER TWO

MONETARY POLICY AND STRUCTURE OF INTEREST RATES IN ZAMBIA

2.1 Evolution of Monetary Policy in Zambia

The Bank of Zambia (BoZ) was established at independence in 1964 by an Act of Parliament which was subsequently replaced by the Bank of Zambia Act of 1985 and later the 1996 Act. This Act mandates the bank to formulate and implement monetary and supervisory policies that ensure price and financial stability. Price stability entails low and stable inflation which is expected to contribute to the improvement of living standards for all Zambians. The rationale behind price stability is its ability to protect the value of incomes and savings, and subsequently encourage investment in the nation's productive capacity. This is necessary for employment and economic growth as well export competitiveness. In order to achieve the price stability objective, the monetary policy framework is used which defines the intermediate targets that are monitored and used to achieve the policy objectives. Intermediate targets are those variables that have a direct bearing on the policy objectives and are influenced by the central bank. Generally, the intermediate targets can be specified as any or a combination of monetary aggregates, interest rates, and the exchange rate (BoZ, 2014 a).

In Zambia, the conduct of monetary policy has undergone change overtime to suit the prevailing economic environment. Although the stages in the evolution of monetary policy in Zambia can be divided into several timeframes, there are two distinct eras. The first is the pre-liberalization period, which spans from 1964 to 1991 and the second is the liberalization era, which spans from 1992 to the present time (BoZ, 2014b). During the pre-liberalization period, the financial sector and monetary policy in this environment were geared toward the provision of subsidized credit to state owned enterprises. Monetary policy relied on administrative measures of credit and capital controls, involving credit ceilings, interest rate controls in order to channel resources to the preferred state enterprises. Further, trade was heavily regulated and the exchange rate was fixed. After nearly two decades of controls, macroeconomic performance deteriorated sharply and major problems emerged in the financial sector such that by the early 1990s it was clear that the policy of direct lending and the provision of subsidized credit to preferred sectors had become unsustainable (IMF, 2004).

In 1991, an overall economic reform was fully embarked on and one of the key issues to be addressed was financial reforms. The key economic reforms and measures included the decontrol of interest rates in 1992, introduction of a competitive primary market for treasury bills in 1993, introduction of a competitive primary market for Government bonds in 1995, and introduction of daily open market operations in 1995. Further, another remarkable development in the external sector was the liberalization of both the current and capital accounts following the suspension of the Exchange Control Act in 1994. The purpose of these financial sector reforms and measures was to regulate monetary aggregates in particular, reserve money and broad money growth in the banking system through the use of market- based mechanism (BoZ, 2014b and Simatale, 2004).

Monetary policy was based on the monetary aggregate targeting (MAT) framework until April 2012. Under the MAT framework, reserve money was the operating target while broad money was the intermediate target, aimed at controlling inflation, the ultimate target. The link between the operational target and the intermediate target was based on the theoretical paradigm that, reserve money is related to broad money through the money multiplier. In this view, if the money multiplier is stable and predictable, the central bank could control the overall monetary conditions in the economy by keeping reserve money at a level that is consistent with desired broad money growth. The fundamental strategy of this framework was to constrain monetary expansion to within the defined path consistent with inflation and real GDP growth objectives. Deviations from the reserve money target determined the pace and aggressiveness of the central bank's liquidity management activities (BoZ, 2014b).

Simpasa et al. (2015) provides new evidence of a weakening relationship between money supply (target variable) and inflation (goal variable). This was on the basis that money multiplier became unstable and this resulted into an unpredictable link between reserve money (operational target) and broad money (intermediate target). Therefore hitting the target did not guarantee the attainment of the goal (low and stable inflation). This implied that MAT could no longer provide an adequate signal about the stance of monetary policy. In this case, it became difficult to deal with inflationary pressures and to assess central bank accountability. The key notable episodes of money multiplier instability include the period before 2000 and the period after 2008 up to the period of transition towards inflation targeting in 2012 (Chileshe and Zgambo, 2014). Figure 1 provides more information.

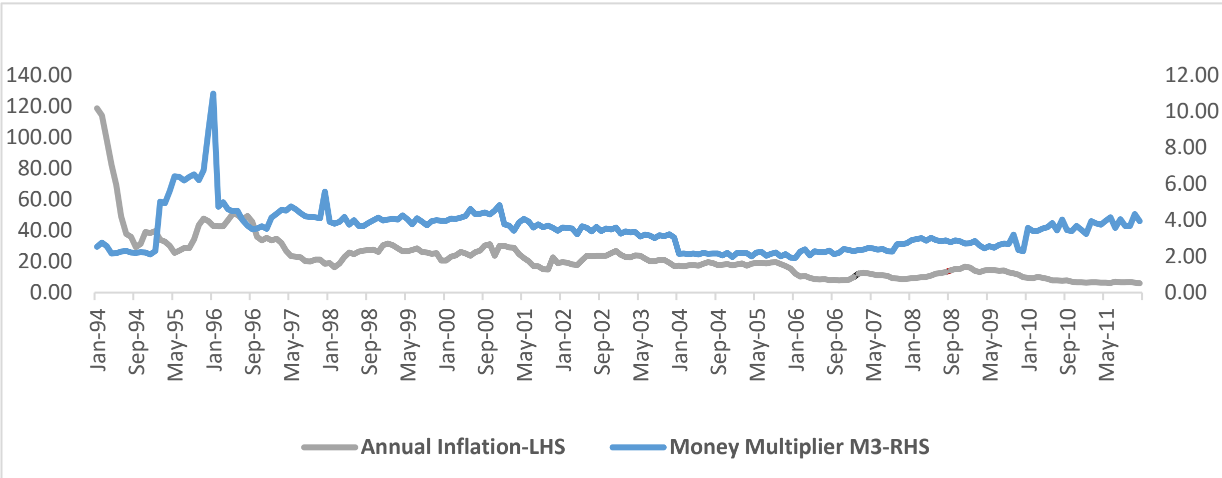

Figure 1: Money Multiplier vs. Inflation (1994-2011)

Compelled by challenges of achieving quantitative monetary targets and with a view of modernizing monetary policy, the Bank of Zambia embarked on the transition towards inflation targeting framework in April 2012. The starting point was the introduction of the Bank of Zambia policy rate with the ultimate objective of adopting a fully-fledged inflation targeting monetary policy framework in the near future. The migration towards inflation targeting signaled the central bank's commitment to a more transparent, credible and effective monetary policy (BoZ, 2012).

The success of monetary policy based on interest rate targeting is determined by the strength of the relationship between the operating targeting (interbank rate) and the key monetary policy interest rate (BoZ Policy Rate). This is because, the interbank market is the more liquid and deeper of all money markets and therefore best suited to provide signals for monetary policy (ibid).

2.2 Structure of Interest Rates in Zambia

Concerning the interest rates structure, the starting point is the mid-1960s when the commercial banks' deposit and lending rates were controlled by the BoZ which maintained a policy of low interest rates in order to minimize borrowing costs. Until 1984, commercial bank lending interest rates were held between 7 per cent and 13 per cent. In addition, a preferential rate was stipulated for agricultural lending from 1978. Nominal rates were generally held below the rate of inflation, which averaged 10 per cent during the 1970s and 20 per cent during 1980-84. There was an increase in both inflation and nominal interest rates from the mid-1980s onwards (Simatale, 2004).

The implementation of a stabilization programme led to a small rise in administered interest rates in 1984 and the decontrol of interest rates and introduction of a Treasury bill auction in September 1985. Lending rates rose sharply thereafter to around 30 per cent in 1986. However, this was accompanied by an acceleration of inflation and hence real interest rates remained negative. Interest rate controls were re-imposed in May 1987 following the breakdown of an IMF supported adjustment programme, and held below 20 per cent for the remainder of the decade. The government adopted a new IMF supported adjustment programme in 1989 under which interest rates were again raised, although they remained far below prevailing inflation rates which had by this time reached levels in excess of 100 per cent per annum. During the 1990s interest rates were again raised and then liberalized (Brownbridge, 1996).

Interest rates continued rising until around 2005 when they dropped and the average lending rates were about 38%. Around 2010, the interest rates increased again and only became low in 2012 after the introduction of the Policy Rate and lending caps. However, in 2015 the lending rates rose again following the tightening of the monetary policy in response to currency depreciation and inflationary pressures experienced in the economy. Beginning May 2017, the lending rates started falling down following the expansionary monetary policy stance being undertaken in order to stimulate economic growth (BoZ 2017).

Figure 2 shows a trend analysis of the money markets wholesale rate (interbank rate), commercial banks 'retail interest rates (lending, deposit and savings) as well as the key monetary policy rate (BoZ Policy Rate) for the period 1995 to 2018.

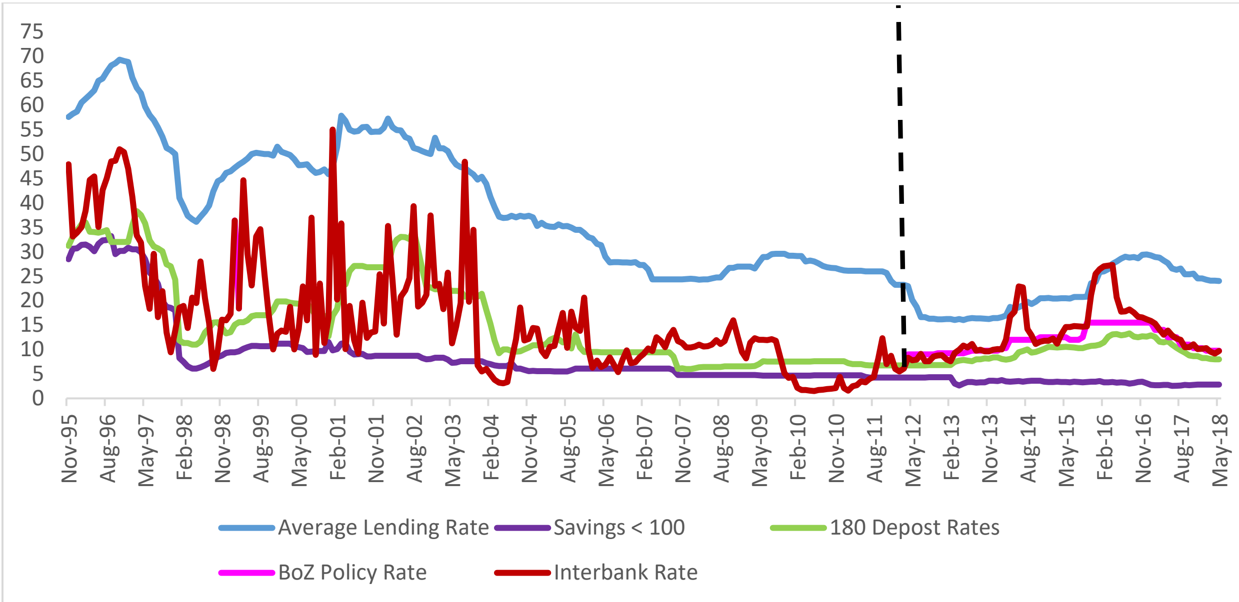

Figure 2: Linkage between Money Market and Commercial Banks' Retail Rates in Zambia (1995-2017)

The period is chosen as it covers the period when the interbank market and policy rate were introduced in 1995 and 2012, respectively. It has been revealed that the interest rates spreads have been high historically. Further, the interbank rate has been very volatile compared to the commercial banks retail rates during the period 1995 to 2006 despite being positively correlated. High volatility in the interbank rate is expected under MAT since the objective of this framework is money supply stability for the achievement of price stability. This was achieved by focusing on the deviations of money growth from a pre-announced target rather than pursuing interest rate stability. Thus, under a MAT, the quantities of liquidity to be withdrawn or injected in the market for purposes of meeting liquidity requirement targets at interest rates determined by the market was of great significance. This was based on the market's prevailing liquidity situtions that varied from time thereby resulting into interest rates volatility (Zgambo, 2017; Chileshe and Oluseguni, 2017).

The interbank rate became relatively stable after 2006 with distinct stability observed after 2012 and this could be attributed to the introduction of the Bank of Zambia Policy Rate in 2012. Following the introduction of the BoZ Policy Rate, the Bank also adopted a mid-rate interest rate corridor system with the Policy Rate in the middle of the corridor. Under this system, the overnight interbank rate is required to fluctuate within the corridor of +/- 100 (revised from +/-200) basis points of the Policy Rate to regulate liquidity supply. If the overnight interbank rate inclines towards the lower or upper band of the corridor, the Bank undertakes either expansionary or contractionary open market operations (OMOs) depending on the situation in order to contain the interbank rate within the corridor.

Figure 3 reveals some significant deviation between the interbank rate and Policy Rate in 2014 and 2016 reflected in the interbank rate rising above the upper bound corridor of the Policy Rate.

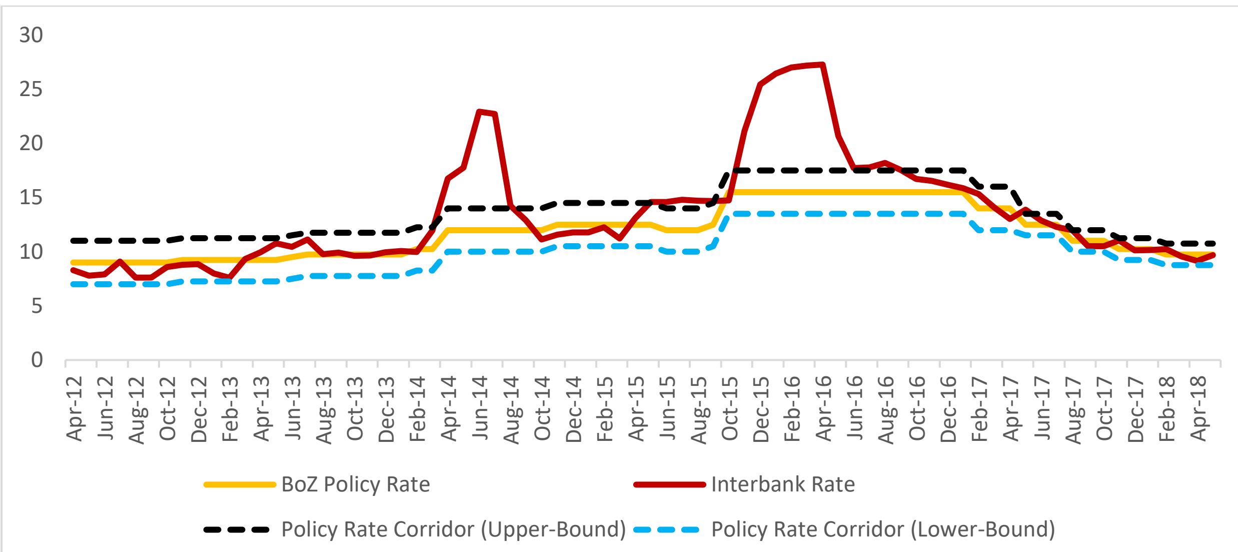

Figure 3: BoZ Policy Rate, Policy Rate Corridor and Interbank Rate (April 2012 to May 2018)

This was a response to the contractionary monetary policy undertaken by rising the BoZ policy rate in a bid to address inflationary pressures and exchange rate volatility experienced. Notable episodes of contractionary monetary policy include the adjustment of the policy rate from 9.75% to 10.25% in January 2014, then from 10.25% to 12.5% in April 2014; and from 12.5% to 15.5% in November 2015. It is important to note that the Bank could not carry out monetary operations to steer the interbank rate back into the Policy Rate corridor as expected. This was to enable the central bank assess the impact of the contractionary measures that had been carried out. Trying to steer the interbank back to the corridor by carrying out an expansionary OMO (liquidity injection) would have not helped at the time, instead it might have resulted into further inflationary pressures (BoZ, 2014; BoZ, 2016).

CHAPTER THREE

LITERATURE REVIEW

This chapter presents both the theoretical and empirical review of the literature relevant to this study.

3.1 Theoretical Review

The major theories that explain the interest rates pass-through include:

3.1.1 Marginal Cost Pricing Model (Monetary Policy Approach)

The marginal cost-pricing model stipulates that the marginal price must equal to marginal cost and the derivative of prices with respect to marginal costs equals one. This is only achievable when the information in the banking system is symmetric and the market is perfectly competitive. Therefore, any changes in marginal cost should offset a unit elastic change in marginal prices. This one to one ratio indicates that under such market mechanism the pass through is complete (Bondt, 2002). However, when the assumptions of perfect competition and complete information are relaxed, this derivative typically becomes less than one. In summary, this model focuses on the transmission of monetary policy impulses into the financial sector. Hence, this approach is interested in the effect that monetary policy has on banking rates, and it concentrates solely on the question of how closely banking rates follow policy rates (Kwapil and Scharler, 2006).

3.1.2 Monti-Klein Model

The Monti-Klein model assumes that the monopolistic and competitive behavior of banks determines the interest rates pass-through from the monetary authority key interest rate(s) to commercial banks' lending rates. The Monti-Klein model asserts that bank competition influences the degree that interest rate pass-through deviates from one. In this framework, there are no adjustment costs, as such any change in administration costs or the degree of competition is expected to be reflected within the shortest period in retail rates enabling banks to keep retail rates and market rates in long run equilibrium most times. On the other hand, the model identifies restriction to entry into the banking sector by regulatory agencies as one of the preconditions for monopoly power, which promotes bank concentration (Niggle, 1987). In highly concentrated banking markets, oligopolistic behaviour of banks may cause interest rates to be sticky and adjust asymmetrically to an increase or decrease in the official monetary policy rate (Aziakpono and Magadalene, 2013). Thus, retail bank interest rates in less competitive or oligopolistic segments of the retail bank market adjust partially and only with a delay, while bank interest rates set in a fully competitive environment respond quickly and completely (Laudadio, 1987).

3.1.3 Consumer Behavior Hypothesis

The consumer behavior hypothesis stipulates that the degree of consumer sophistication about the financial markets as well as the search and switching costs associated with alternative sources of financing have a bearing on interest rate pass-through. Thus, a high proportion of unsophisticated consumers relative to sophisticated consumers along with the search and switching costs enable banks have greater market power to adjust interest rates to their advantage. Like the collusive behavior hypothesis, the consumer behavior hypothesis suggests that lending rates are rigid downward and flexible upwards (Matemilola et al., 2015).

3.1.4 Switching Costs Hypothesis

According to this hypothesis, switching costs such as information acquisition, search and administrative costs are potentially important in markets where significant transaction costs exist. Switching costs may arise when bank customers consider switching or transfer their savings deposits from one bank to another. These costs are expected to be high in markets with long-term relationships and repeated transactions (Sharpe, 1997). However, even in the presence of small switching costs, the theory predicts that the smaller the proportion of customers that are “new” to the market, the less competitive prices will be. Klemperer (1987) shows that generally the existence of switching costs results in market segmentation and reduces the demand elasticity. Even with non-co-operative behavior, switching costs result in a retail bank interest rate adjustment of less than one to a change in the market interest rate (Lowe and Rohling, 1992).

3.1.5 Information Asymmetry Hypothesis

According to Stiglitz and Weiss (1981), another explanation for interest rate rigidity is based on asymmetric information. Information asymmetry creates an adverse selection problem in the loan markets where high interest rates attract riskier borrowers or bring about moral hazard. When banks perceive the risk of default is high, they tend to maintain a large spread between lending and deposit rates. If this mitigation measure is very large, the market lending rate becomes relatively insensitive to some changes in the official rate more especially when the changes are small (Aziakpono and Magdalene, 2013).

3.1.6 Collusive Behavior of Banks Theory

The collusive behavior hypothesis relate to the degree of competition among banks and the level of concentration of the retail market. The hypothesis states that banks are unlikely to decrease lending rates because they do not want to disrupt their collusive arrangement. The collusive behavior hypothesis suggests that lending rates will be rigid downward with a decrease in the central bank official rate while deposit rates will move rigidly upward when the official rate is increased (De Bondt, 2005; and Aziakpono and Magdalene, 2013).

3.1.7 Adverse Customer Reaction Theory

The customer reaction hypothesis relates to the reaction of borrowers to central bank official rate (policy rate) changes. The hypothesis states that commercial banks that operate in a highly competitive environment may not increase the lending rate because they fear negative reactions from customers. The adverse customer reaction hypothesis suggests that commercial banks' deposit rates will move rigidly downward when the official rate is decreased, while the lending rates will move rigidly upward in the case of an increase in the official rate so as to retain customers (Aziakpono and Magdalene, 2013).

Besides the above outlined theories, another factor that could influence interest rates pass-through is the bank ownership structure (state-owned or private sector owned). A banking system which is dominated by state owned banks results in banking concentration or some form of monopoly. This coupled with simple inefficiency or political pressures may cause rigidity in the interest rates adjustment as noted above under the marginal cost pricing and Monti-Klein models (Cottarelli and Kourelis, 1994).

The level of financial system development has an impact on the degree of interest rate adjustment. A well-developed financial system provides a wide range of financial instruments and intermediaries for savers and investors and therefore provides alternative sources of financing. Some alternative sources of financing include active and broad markets for Treasury bills, long-term bonds (both government and private), and an active stock market. In such a developed financial system, interest rates are more flexible in response to central bank induced money markets changes because no single financial intermediary enjoys absolute market power (Aziakpono and Magdalene, 2013).

The preceding discussion has presented some theoretical groundwork that shows the several factors that could affect the interest rates pass-through process. However, it is important to note that these factors could vary from country to country and could also vary within a country as the financial environment changes. In the next section, the study explores the some of the empirical studies on this subject matter.

3.2 Empirical Review

It has been established that interest rates pass-through differs across countries, financial institutions and financial products (Cottarelli and Kourelis 1994; Borio and Fritz 1995; Hofmann and Mizen 2004; Mbotwe, 2015; Chileshe and Olusegun, 2017). In this regard, this study will first highlight the literature on the speed and nature (symmetrical/asymmetrical) of monetary policy pass-through from developed economies then emerging/developing economies and finally look at the Zambian case.

In developed countries with deep and well-functioning financial markets such as the United States of America and United Kingdom, empirical literature indicates that there is no consensus among scholars on the nature and adjustment dynamics of the pass-through. Thus, while some studies such as Altunbas, Fazylov, & Molyneux (2002), Bernanke & Gertler (1995), Cook (2008), Kashyap and

Stein (2000) report that the pass-through is complete and fast, others such as Bondt (2002), Hofmann & Mizen (2004), Liu et al. (2008), Mojon (2000) and Ozdemir (2009) contradict such findings and conclude that the pass-through is incomplete citing heterogeneity across countries in financial markets and retail bank products to be the reason. For instance, while the banking system plays a more significant role in lending in Europe, its role is limited in the United States of America.

With regards to symmetrical/asymmetrical adjustment process, a study conducted by Karagiannis and Vlamis (2010) in selected South Eastern European economies (SEE) namely, Greece, Bulgaria and Slovenia found mixed results by employing the disaggregated general to specific methodology. The results for Greece provides support for symmetrical adjustment of retail rates in response to changes in the central bank rate as banks tend to pass to depositors and borrowers equally decreases and increases of the original central bank and money and interbank money market rate changes. In contrast, the results for Slovenia and Bulgaria showed that the adjustment process for the loan and deposit rates was asymmetrical in response to changes in the money market rate. The study cites the presence of banks' collusive behavior, adverse customer reaction as well as heterogeneity in competition across countries in financial markets and retail bank products among the banking systems in these selected SEE economies to be the reason for such mixed results.

In emerging/developing economies outside Africa, results on the interest rates pass-through and symmetrical/asymmetrical adjustment dynamics are also mixed. Thus, while some empirical evidence suggests that the pass-through is complete and symmetric, other studies provide support for incomplete and asymmetrical pass-through. For instance, Haughton and Iglesias (2011) analyzed asymmetric interest rate pass through and the monetary transmission mechanism in the countries of the Caribbean Single Market and Economy (CSME) using the asymmetric threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) cointegration models. Their empirical findings indicate that complete pass through exists in the retail lending rate for Trinidad and Tobago and for St. Lucia and therefore, by extension in all the countries of the Organization of Eastern Caribbean States (OECS) but not the other countries of the CSME. It was highlighted that such variation in interest rates pass-through could be as a result of differences in information and competition structures of these economies. With regard to the adjustment dynamics, the study found an asymmetric integrating relationship in the lending and deposit rate with the lending rate displaying downward adjustment rigidity and the deposit rate displaying upward adjustment rigidity (Wang and Lee, 2009).

Furthermore, Jamilov and Egert (2014) found mixed results on the symmetrical/asymmetrical nature of the pass-through of five Caucasian economies (Armenia, Azerbaijan, Georgia, Kazakhstan, and Russia). By applying an ARDL model, the study found evidence of symmetrical adjustment for Armenia, Azerbaijan, and Russia on one hand and asymmetrical adjustment for Georgia and Kazakhstan on the other hand due to differences in the market structure differences in these economies.

Mishra and Montiel (2012) investigated the effectiveness of monetary transmission in developing countries. They conclude that, despite methodological issues present in the literature, monetary transmission appears to be weak in developing countries. Subsequently, Mishra et al. (2014) undertook a study on monetary policy and bank lending rates in low-income countries. Using heterogeneous panel estimates, they found large variation in the response of bank lending rates to monetary policy shocks across countries, with weaker transmission in developing countries.

Das (2015) provides new evidence on the credit channel of monetary policy transmission in India by using a two-step estimation of vector error correction model. The results indicate the existence of incomplete and slow pass through of policy rate changes to bank interest rates in India. The study also provides evidence of the existence of asymmetry adjustment of bank retail rates with respect to changes in monetary policy with lending rates being more responsive during tightening than loosening episodes of monetary policy while deposit rates being more responsive during the loosening periods. The study also reveals that there had been an improvement in the speed of adjustment of monetary policy following the introduction of new the new base rate system in 2010.

In Africa, Acheampong (2005) investigated the interest rate channel of monetary policy transmission by analyzing both the impact and the long run adjustments of the lending rate to changes in the money market rates in Ghana by employing an error correction model. The study found that interest rates in Ghana respond sluggishly to changes in the money market rates and the adjustment is asymmetrical. However the study does not give further information on the direction of specific bank interest rates in the asymmetrical adjustment process.

Aziakpono, Magdalene and Manuel (2007) employed an asymmetric error correction model proposed by Scholnick (1996) to examine how market interest rates adjust to changes in the South African Reserve Bank (SARB) official rate under different monetary policy regimes in South Africa. Their findings indicate that the pass through is incomplete and that there were higher speeds of adjustment during contractionary eras than it is during expansionary eras.

Closely related to this, Aziakpono and Magdalene (2010) measured the speed of adjustment in different policy regimes in South Africa by using four types of cointegration tests, symmetrical/asymmetrical error correction model and rolling window techniques on data from 1980 to 2007. Their results suggest that the speed of adjustment varies across retail interest rates, with lending rates having the highest and government bond yield having the lowest speeds of adjustment. They also found asymmetry in retail interest rates adjustment and suggested that such asymmetries could be as a result of the negative customer reaction and collusive pricing behavior of banks.

Mbowe (2015) undertook a study to assess the degree and speed of adjustment of commercial banks' interest rates to monetary policy rate changes in Tanzania by employing an error correction model. The empirical findings of his study also lend support to incomplete monetary policy rate pass-through to commercial banks' short-term interest rates both in the short and long term. By splitting the sample into two periods, obtained results do not support the view that policy rate pass-through in the country had improved over time. However, this study did not take into account of the asymmetric/ asymmetrical interest rates adjustment dynamics.

Further, Kelilume (2014) examined the effect of monetary policy rate on interest rates in Nigeria over the sampling periods 2007-2012 being the period when Central Bank of Nigeria adopted monetary policy rate (MPR) as the benchmark interest rate, a shift from the use of minimum rediscount rates (MRR). The study found sticky pass-through from monetary policy rate to the commercial banks 'retail rates in both the short and long run. Such stickiness in the pass-through could as a result of the presence of high menu and transaction cost and imperfect financial market condition. However, the study found a positive relationship between monetary policy rate and interbank rates as the speed of adjustment tends to be fast and higher in the first stage of the pass-through (monetary policy rate to interbank rate).

Although the success of monetary policy is to larger extent significantly influenced by the responsiveness of commercial banks retail interest rates to changes in monetary policy (Aziakpono and Magdalene, 2013), there is little work done on this subject matter in Zambia. However, there are number of studies that have attempted to study the general monetary policy transmission mechanism in Zambia such as Chileshe et al. (2014); Zgambo and Chileshe (2014), Mutoti (2006), and Simatele (2004). Nonetheless, the focus of these studies is on the impact of monetary policy on money supply, inflation and other macroeconomic variables without explicitly investigation the response of commercial banks' retail rates to changes in monetary policy. This on the basis that the first stage in the monetary policy transmission involves the effect of monetary policy actions on the prices of financial market variables such as short-term interest rates, commercial banks' lending rates, deposit rates, stock prices and exchange rates (Chileshe, 2016).

Chileshe and Olusegun (2016) analyzed the nature of pass-through in Zambia by focusing on the asymmetric response of retail and bond yield rates to monetary policy controlled rates. The study utilized a non-linear ARDL model to investigate the relationship between policy-controlled rates and retail rates as well as bond yield rates. The study results lend support to the existence of low and asymmetric adjustment of retail and bond yield rates to changes in policy-controlled interest rates (interbank and 3-month T-bill rate). Precisely, the study reveals that there exists a negative asymmetry in the response of deposit rates to changes in the interbank and 3-month rates while there is a positive asymmetry with regard to lending and bond yield rates.

Furthermore, Zgambo and Chileshe (2014) undertook an empirical analysis of the effectiveness of monetary policy in Zambia and estimated the interest rates pass-through from interbank rate to commercial banks' lending interest rates for the period 1995 to 2014. By employing an error correction model, the study found that the interest rate pass-through was slow and low in both the short and long run though it recorded some improvements after 2001.

This study is therefore an attempt to provide new evidence on monetary policy transmission by specifically looking at the magnitude and the speed of monetary policy pass-through as well the symmetric/asymmetric nature of adjustment. This is the point of departure from the previous studies that just concentrated on the general monetary policy transmission process without being specific.

CHAPTER 4

METHODOLOGY

4.1 Theoretical Framework

The relationship between money market and retail rates is explained through the marginal cost pricing model proposed by Bondt (2002). The model assumes perfect competition with complete information and equality of prices with marginal costs. Likewise, the derivative of prices with respect to marginal cost equals one but becomes less than one if the perfect competition and information prices are suspended (Tai, Sek, & Har, 2012; Rousseas, 1985). The application of this idea to the price setting behavior of banks results in the following marginal cost pricing model equation (Rousseas, 1985 and Bondt, 2002).

$$br = \gamma_0 + \gamma_1 mr ------------------------------- (\mathbf{1})$$

Where *br* is the price set by banks, that is the bank interest rate, γ_0 is a constant markup and *mr* is the marginal cost price approximated by a comparable market interest rate. Parameter $\gamma_1$will be less than one if banks have some degree of market power.

4.2 Empirical Model for the Study

Borrowing from the works of Mbotwe (2015) and Das (2015), the study employed the Johansen cointergartion approach. The Johansen cointegartion approach was used on the basis that all the variables were integrated of the same order I (1). It's important to note that when variables are integrated of the same order, the common methods to use are the Engle and Granger (1987) and Johansen and Jeselius (1994) cointegration procedures. However, unlike the Engle and Granger approach which involves an estimator obtained in two stages where possible errors introduced in the first stage are transferred to the second stage, the Johansen cointegration method is based on estimates of the matrix rank and its eigenvalues are obtained in a single stage. Further, unlike the Engle-Granger approach to cointegration that is sensitive to normalization adopted and can result in conflicting conclusions depending on the variable chosen as the dependent variable. The Johansen test results by contrast are invariant to the choice of the variable selected for normalization and this avoids conflicting of conclusions. It is also easy to derive an error correction model (ECM) under this approach through a simple linear transformation which integrates short run adjustments with long run equilibrium without losing long-run information (Toppinen, 1998).

4.2.1 Speed and Magnitude of Interest Rates Pass-through

The first stage in the monetary policy transmission involves the effect of monetary policy actions on the prices of financial market variables such as short-term interest rates and consequently commercial banks' interest rates (deposit and lending), stock prices and exchange rates. The effect of monetary policy actions on financial market prices can be quantified through the interest rate pass-through. According to Granger representation theorem, if two or more variables have a long term equilibrium association, then the relationship between them can be expressed in the form of an ECM (Engle and Granger, 1987). Therefore, having found that there was cointegration (long-run relationship) between the variables, a vector error correction model (VECM) was estimated in order to investigate the long-run and short-run dynamics. The key advantage of an error correction model is its capability to reveal more information on the long and short-run behavior of the economic variables (Lungu et al., 2012; Ogunsakin et al., 2014). The baseline model showing the relationship between the interest rates is specified as:

$$MR_t = \alpha_0 + \alpha_1 BR_t + \varepsilon_t -------------------------(2)$$

BR_t, represents the official interest rate, exogenously determined by the Bank of Zambia, MR_t denotes the endogenously determined market interest rates (average lending rates and deposit lending rates) and ε_t is the stochastic error term

Figure 4: Set up of Stepwise Estimation of a Vector Error-Correction Model

Source: Das, 2015.

A. First Step: Pass-through to Interbank Rate from Policy Rate

$$(LR)INT_t = \beta_0 + \beta_1 PR_t + \varepsilon_t ----------------------------(3)$$

$$(SR)\ \Delta INT_t = \delta_0 ECT_{t-1} + \sum_{K=1}^{K} \delta_1\ \Delta\, INT_{t-K} + \Delta\, \delta_2 PR_{t-K} + \varepsilon_t ------------(4)$$

where

- INT is the weighted average interbank rate and PR the Bank of Zambia policy rate.
- β_1 is the coefficient of PR. If β_1 is equal to one, then there exist complete pass-through ,when it is more than one then there is overpass though or overshooting and when it takes the value of less than one then pass-through is incomplete or there is interest rate stickiness (Aziakpono and Wilson, 2010; De Bondt, 2005).
- The error correction term $ECT_t = INT_{t-1} - \hat{\beta}_O - \hat{\beta}_1 PR_{t-1}$, is the residual from the long run equation which measures period $_{t-1}$ deviations from the long run stationary relationship.
- The coefficient of δ_0 is the share of the deviation from the LR equilibrium that decays each month representing the speed of adjustment**.**

B. Step 2: Pass-through to Bank Commercial Banks' Retail Rates from Interbank Rate

In the second step, the study is looking at pass-through from interbank to bank retail rates (lending and deposit rates) and the model is specified as follows:

$$(LR)CRR_t = \theta_0 + \theta_1 INT_t + \varepsilon_t ----------------------------(5)$$

$$(SR)\ \Delta CRR_t = \alpha_0 ECT_{t-1} + \sum_{K=1}^{K} \alpha_1\ \Delta\, CRR_{t-K} + \Delta\, \alpha_2 INT_{t-K} + \varepsilon_t ------------(6)$$

where

- CRR is the commercial banks' retail rates (180 deposit and average lending rates).
- θ_1 is the coefficient of INT and its size determines the degree of the pass-through as highlighted under step one.
- The error correction term $ECT_t = CRR_{t-1} - \hat{\theta}_O - \hat{\theta}_1 INT_{t-1}$

- The coefficient of α_0 represents the speed of adjustment

The number of months that are required to achieve 50% of the pass through are obtained by calculating the half-life. In line with Das (2015), the half-life is computed in absolute terms as:

$$Half\ Life = \frac{\log 2 * time}{log\left[\frac{IQ}{FQ}\right]} ------------------------------ (7)$$

where

- $IQ = Initial\ Quantity\ (100)$
- $FQ = Quantity\ that\ remains\ after\ adjustment$

The half-life computed in equation (7) informs the degree of rigidity in retail interest rates. The higher the half-life, the higher the interest rates rigidity (slow adjustment). Conversely, a low half-life indicates low rigidity of retail interest rates (fast adjustment).

4.2.2 Symmetric/Asymmetric Adjustment

Furthermore, empirical literature reveals that the response of commercial banks retail rates with respect to monetary policy changes differs according to the kind of monetary policy stance being carried out by the central bank either expansionary or contractionary policy. This entails of an asymmetrical adjustment response of retail rates. Therefore in order to carry out an analysis of the nature of adjustment of the pass-through process when the policy rate is increasing or decreasing, the study follows Aziakpono and Magdalene (2010) and split the residuals from the cointegrating equation of the policy rate and interbank rate into two series, $EC^{+}$and EC^{-}, where

$$ECT^{+} = EC \quad if \quad EC > \mu ---------------------------(8)$$

$$EC = 0 \quad if = EC < \mu ------------------------------(9)$$

and

$$ECT^{-} = EC \quad if \quad EC < \mu --------------------------- (10)$$

$$EC = 0 \quad if = EC > \mu ------------------------------ (11)$$

where μ is the mean of the residual from the cointergration equation (EC). The asymmetric specifications in equations 7 and 9 are introduced as separate variables (in the form of dummy variables) in the error correction model to obtain an asymmetric short-run dynamic equation specified as follows:

$$\Delta CRR_t = \theta + \alpha CRR_{t-1} + \sum_{K=1}^{K} \varphi_j \, \Delta CRR_{t-K} + \sum_{i=0}^{K} (\gamma_i^{+} \, \Delta EC_{t-i}^{+} + \gamma_i^{-} \Delta EC_{t-i}^{-}) + \varepsilon_t ----(12)$$

Where γ_i^{+} and γ_i^{-} are coefficients of the the error correction term representing policy rate increases and declines respectively. The coefficents are expected to bear the corerect signs being the positive and negative signs for positive and negative error correction residuals respectively.

To establish if the adjsutsment of the commercial banks interest rates (lending and deposit) is symetric or asymetric in relation the to the monetary policy stance being undertaken (contractionary or expansionary), the Wald test is carried out. This is achieved by testing the equality between the coefficients of the positive and negative residuals in the asymmetric error correction model

4. 3 Diagnostic Tests

The following diagnostic tests were carried out to check the model adequacy:

4.3.1 Unit Root Test

Usually time series analysis is associated with problems of non-stationarity, implying that statistical properties such as mean, variance, autocorrelation are not constant over time (time dependent). One problem associated with the use of non-stationary series is that it may lead to meaningless or spurious results (Dougherty, 2006). In order to avoid getting spurious results, it is imperative to ensure econometric models consist of stationary variables. A stationary time series is one whose statistical properties such as mean, variance and autocorrelation are all constant over time (time independent) or it is integrated of order zero I (0). One way of making some time series stationary is to compute the differences between consecutive observations. This is known as differencing where time series are integrated of order d, I (d) where d is the number of differencing required to make it stationary. For robustness checks, the study undertakes the Augmented Dickey-Fuller (ADF) and the Phillips-Peron (Pperron) unit root tests (Pelgrin, 2012; Malile, 2013).

4.3.2 Cointegration Test

To verify if the variables have a long meaningful relationship, the study undertakes a cointegration test. If variables have no long-run relationship, there is usually no valid base for inference based on standard distributions. The study adopts the Johansen's cointegration approach which takes the vector auto regression (VAR) of order p as its starting point. This is given by:

$$Yt = \mu + A1\, yt - 1 + \cdots + Ap\, yt - p + \varepsilon t \quad -----------------(13)$$

Where $\mathbf{y_t}$ is an *n*x1 vector of variables that are integrated of order one – commonly denoted as I(1), and $\boldsymbol{\varepsilon_t}$ is an *n*x1 vector of innovations. This VAR can be re-written as,

$$\Delta Yt = \mu + \Pi yt - 1 + \sum_{i-1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \quad ---------------------(14)$$

Where;

$$\Pi = \sum_{i-1}^{p} Ai - I \text{ and } \Gamma i = - \sum_{j=i+1}^{p} Aj \quad ------------------------(16)$$

If the coefficient matrix Π has reduced rank $r < n$, then there exist n x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. r is the number of co-integrating relationships, the elements of α are known as the adjustment parameters in the long run model and each column of β is a co-integrating vector. Johansen proposes two different likelihood ratio tests: the trace test and maximum eigenvalue test, shown in equations (14) and (15) respectively.

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \quad ---------------------------(17)$$

$$J_{max} = -T \ln\left(1 - \hat{\lambda} r +\right) -----------------------------(18)$$

Here T is the sample size and λ_i is the i: th largest canonical correlation. The trace test tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of r +1 co-integrating vectors.

4.3.3 Test for the Non-Serial Correlation

When undertaking a cointegration estimation, it is important to test for the existence of serial correlation as it is a requirement for the selection of the number of lags. In order to test for serial correlation of the residual, the LM test is 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).

4.3.4 Test for Heteroscedasticity

One of the important assumptions of linear regression is that, there should be no heteroscedasticity of residuals. In order to test for heteroscedasticity, a Breusch Pagan Test introduced by Trevor Breusch and Adrian Pagan in 1979 is used. This test assumes that the error terms are normally distributed by testing whether the variance of the errors from a regression is dependent on the values of the independent variables (Prabhakaran, 2017).

4.3.5 Test for Normality

Normality is one of the assumptions for many statistical tests and the Jarque–Bera test of goodness-of-fit is carried out to ascertain if the sample data had the skewness and kurtosis matching a normal distribution.

4. 4 Data

The study uses time series monthly data for the period April 2012 to May 2018 being the period of transition towards inflation targeting by BoZ. The data was collected from the Bank of Zambia website consisting of the Bank of Zambia Policy Rate, overnight interbank rate, commercial banks' average lending and 180 days' deposit rates.

4.5 Limitations of the Study

This study only focused on the magnitude and speed of monetary policy pass-through without empirically investigating the determinants of the pass-through. There is therefore need to undertake an empirical investigation of the determinants of monetary pass-through for comprehensive policy analysis.

The sample period though enough is relatively short. There is therefore need to undertake the same study in future using same methodology but under a long sample period for robustness and validation of the study results. This is on the basis that the weak and slow pass-through of the policy rate established in this study could be partly prompted by the relative short period under which the policy rate has been implemented. The Bank of Zambia policy rate was recently introduced as such its impact might not yet be fully realized. It is hoped that the relationship between the policy rate and commercial banks' market rates will evolve and improve with time.

The study results are based on a single method. Therefore, further investigations could be conducted on this topic in future but perhaps using a different methodology such as the application of a VAR model. Under a VAR model, the impulse response function (IRF) and variance decomposition analysis are carried out in order to assess the extent of the pass-through. The IRF traces out the effect over time on rates of a structural one standard deviation shock to the policy rate. The variance decompositions break down the forecast variance of retail bank rates into components that can be attributed to each of the various shocks in the system. This allows the examination of the relative importance of various shocks for fluctuations in retail prices

CHAPTER 5

PRESENTATION, INTERPRETATION AND DISCUSSION OF FINDINGS

5.1 Descriptive Statistics

The table 1 shows the descriptive statistics for the data used in the study.

	PR	INT	AVL	DPR
Mean	11.84122	13.49556	21.80421	9.552547
Median	12.00000	11.97540	20.51627	9.459562
Maximum	15.50000	27.27968	29.46239	13.26196
Minimum	9.000000	7.575227	16.02350	6.755000
Std. Dev.	2.355616	5.089293	4.649804	2.018951
Skewness	0.421358	1.243516	0.241243	0.278947
Kurtosis	1.795037	3.911009	1.625250	1.922431
Probability	0.035677	0.000020	0.037910	0.103317
Sum	876.2500	998.6714	1613.512	706.8885
Sum Sq. Dev.	405.0718	1890.766	1578.310	297.5600
Observations	74	74	74	74

Table 1: Descriptive Statistics

5.2 Unit Root Tests

The ADF and Phillips-Peron unit root results show that the variables are all integrated of order one, implying that they become stationary after the first difference. Table 2 gives a summary of the results.

Variable	**ADF level**	**ADF 1st Difference**	**PP level**	**PP 1st Difference**	**Order of Integration**
Policy Rate(PR)	-1.250702	-3.370301***	-1.200909	-7.765536***	I(1)
Interbank Rate (IR)	-2.265370	-4.4243237***	-2.038224	-6.102779***	I(1)
Lending Rate(AVL)	-1.408933	-4.603710***	-0.817696	-7.237068***	I(1)
Deposit Rate(DR)	-0.581554	-5.272777***	-0.730911	-8.907303***	I(1)
*** indicates significance at 1 percent					

Table 2: Unit Root Results

5.3 Lag Length Selection Criteria

The lag length selection criterion was used to determine the optimal number of lags to be applied in the autoregressive (AR) model. It was revealed that two lags were appropriate for the model estimating the magnitude and speed of adjustment based on the Schwarz criterion (SIC). Further, one lag was appropriate for the model estimating the symmetric or asymmetric adjustment response based on the SIC.

Notable to mention is that according to the principal of parsimony in selecting lag lengths, if two or more models explain the same phenomena but have different lag lengths, choose the model with lower lags to avoid losing information when higher lags are included and to preserve the degrees of freedom (Zgambo and Chileshe, 2014). It is for this reason that two lags and one lag have been selected for the model on the speed and magnitude of adjustment as well as the model on symmetric/ asymmetric adjustment process, respectively (Appendix A1-A5).

5.4 Johansen Co-Integration Approach

After determining that none of the variables were integrated of order two but integrated of order one, the study undertook a Johansen co-integration test. Under this approach, the decision rule is that reject the null hypothesis of no cointegration if the value of the trace and max-eigen statistics are greater than 5% critical value, otherwise fail to reject the null hypothesis and conclude that there is no cointegration. The results reveal the existence of a co-integrating relationship between the policy rate and the interbank rate, and between the interbank rate and the bank rates (lending and deposit rates). Table 3 presents the Johansen co-integration test results.

Policy Rate and Interbank

Date: 09/05/18 Time: 18:46
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Trend assumption: Linear deterministic trend
Series: INT PR
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.261866	23.87487	15.49471	0.0022
At most 1	0.032110	2.317191	3.841466	0.1279

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.261866	21.55768	14.26460	0.0030
At most 1	0.032110	2.317191	3.841466	0.1279

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Interbank and Lending Rates

Date: 09/05/18 Time: 19:41
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Trend assumption: Linear deterministic trend
Series: AVL INT
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.237807	22.27423	15.49471	0.0041
At most 1	0.041289	2.993787	3.841466	0.0836

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.237807	19.28045	14.26460	0.0074
At most 1	0.041289	2.993787	3.841466	0.0836

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Interbank and Deposit Rate

Date: 09/07/18 Time: 18:51
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Trend assumption: Linear deterministic trend
Series: DPR INT
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.245584	21.91322	15.49471	0.0047
At most 1	0.026469	1.904639	3.841466	0.1676

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.245584	20.00858	14.26460	0.0055
At most 1	0.026469	1.904639	3.841466	0.1676

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3: Johansen Co-integration Test Results

According to Geda and Tafere (2011), if there is evidence of co-integration in the data, it is appropriate to estimate an error correction model. Thus, the existing long run relationships were analysed using the equilibrium correction model and regression results are presented below starting with the long-run relationship and thereafter look at the short-run analysis (Aziakpono and Magda, 2010).

5.4 Long-Run Pass-through Analysis

Table 4 provides the Johansen normalization results and appendix B1 provides actual outputs.

	Policy Rate to Interbank Rate	**Interbank Rate to Lending Rate**	**Interbank Rate to Deposit Rate**
LONG-RUN	-0.861823 [-8.08767]	-0.326683 [-2.17299]	-0.479701 [-7.92549]
t-values in brackets			

Table 4: Long- Run Results

Under the Johansen cointegration approach, the Johansen normalization result is used to interpret the long-run relationships among the cointegrating variables. It is important to mention that when interpreting the Johansen normalization coefficients, the signs are reversed in the long-run (Adeleye, 2018). Following this principle, it can be said that in the long-run, the policy rate has a positive impact on the interbank rate. That is, the coefficient value of 0.861823 entails that a one percentage increase in the policy rate leads to a 0.86 percentage increase in the interbank rate. Further, there is a statistically significant positive relationship between interbank rate and market interest rates. That is, a one percentage increase in the interbank rate results into an increase of 0.33 percentages and 0.47 percentages of lending and deposit rates, respectively in the long-run.

This implies that whenever the interbank rate changes, only 33 percent of the change is passed on to the lending rate and 47 percent passed on to the deposit rates, an indication that the deposit rates might exhibit a higher magnitude of the pass-through than the lending rates. This would be as a result of maturity mismatches between the two banks interest rates under consideration. For instance, the tenure for the deposit rate in analysis is 180 days (6 months) while the lending rate is the average for all loans advances that include long-term loans with the average tenure for long-term loans being three years.

Another possible explanation would be that under the current operational framework, commercial banks are not at liberty to set their base rate since the policy rate is their base rate as compared to the previous regime (MAT) when they were at liberty to set their own base rate. Adjusting their lending rate each time the policy rate change would negatively affect their profit margins. Instead, commercial banks find it easier to make their adjustments through the deposit rates in their pursuit of maintaining high interest spreads for profit maximization. The adjustment of deposit rates especially during the expansionary episodes implies cost reduction on their part. To validate this result, a direct long-run estimation was carried out from the policy rate to the lending and deposit rates. The estimation results show that there was no cointergartion relationship established between the policy rate and average lending rates, while a long-run relationship was established between the policy rate and deposit rate. This result suggests that the long-run relationship between the policy and the lending rate does not exist, hence the policy rate might not have an impact on the lending rates. Having established a long-run relationship between the policy rate and the deposit rates a VECM is estimated. Appendix D1-D3 shows the actual output results.

In line with the consumer behavior hypothesis (Matemilola, 2015), another additional possible explanation why 33% and 47% of the monetary policy changes are passed to the lending and deposit rates, respectively would be that lending rates face relatively stronger market resistance than deposit rates. That is, while the commercial banks may try to adjust the lending and deposit rates to protect their profit margins, the borrowers may have relatively more market power than the depositors to resist upward pressure on interest rates. Even if the commercial banks were to behave with monopoly power, they would not completely determine both the volume and price of credit. They are more likely to determine the quantum of credit but the borrowers may have some say on the market interest rate.

Further, these results suggest that the pass-through from the policy rate to interbank rate is quite high (close to one) while the pass-through from the interbank rate to market interest rates is relatively low. This suggests that in the long-run, interest rates pass-through to the market interest rates might be far lower than the pass-through to short-term money market interbank rate.

These findings are consistent with previous studies in emerging and developing economies that found greater monetary policy pass-through to interest rates with shorter maturities. For instance, Liu et.al (2005) in New Zealand, Das (2015) in India, Aziakpono and Magdalene (2014) in South

Africa, Mbowe (2015) in Tanzania, Zgambo and Chileshe (2014) in Zambia found incomplete but high interest rates pass-through from the monetary policy rates to money interbank rate. On the best case scenario, Cottarelli and Kourelis (1994), Borio and Fritz (1996), Kleimeier and Sander (2000), Donnay and Degryse (2001), Tobia et.al (2012), Chileshe and Olusegun (2017) and Yildrim (2012) found a complete long-term pass-through in the first stage of the monetary policy transmission. Such findings imply that monetary policy pass-through exhibits some decreasing effect since the transmission works through the different stages of the transmission mechanism before it eventually reaches the ultimate goal of the policy. This is an indication that it may take a considerable long time before the effect of a monetary policy action, such as change of official policy rate can be felt.

5.5 Short-Run Pass-through Analysis

Table 5 shows the short-run results that include an error correction term extracted from the long-run equations.

Policy Rate to Interbank Rate

Vector Error Correction Estimates
Date: 09/09/18 Time: 12:11
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
INT(-1)	1.000000
PR(-1)	-0.861823
	(0.10656)
	[-8.08767]
C	5.635095

Error Correction:	D(INT)	D(PR)
CointEq1	-0.310904	0.033789
	(0.07138)	(0.02640)
	[-4.35587]	[1.27999]
D(INT(-1))	0.274067	0.008321
	(0.10339)	(0.03824)
	[2.65078]	[0.21760]
D(INT(-2))	0.109957	-0.019553
	(0.10735)	(0.03970)
	[1.02428]	[-0.49248]
D(PR(-1))	0.926572	0.089510
	(0.33567)	(0.12415)
	[2.76033]	[0.72100]
D(PR(-2))	1.323456	0.005217
	(0.35233)	(0.13031)
	[3.75633]	[0.04004]
C	-0.008341	0.009745
	(0.17834)	(0.06596)
	[-0.04677]	[0.14775]
R-squared	0.467285	0.035759
Adj. R-squared	0.426307	-0.038413
Sum sq. resids	146.6607	20.06063
S.E. equation	1.502104	0.555540
F-statistic	11.40331	0.482107
Log likelihood	-126.4978	-55.87544
Akaike AIC	3.732333	1.742970
Schwarz SC	3.923545	1.934183
Mean dependent	0.022860	0.010563
S.D. dependent	1.983173	0.545168

Determinant resid covariance (dof adj.)	0.677640
Determinant resid covariance	0.567949
Log likelihood	-181.4061
Akaike information criterion	5.504396
Schwarz criterion	5.950558

Interbank Rate to Lending Rate

Vector Error Correction Estimates
Date: 10/15/18 Time: 16:17
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
AVL(-1)	1.000000
INT(-1)	-0.326683
	(0.15033)
	[-2.17299]
C	5.300758

Error Correction:	D(AVL)	D(INT)
CointEq1	-0.092628	0.102257
	(0.02632)	(0.03796)
	[-3.51529]	[2.69396]
D(AVL(-1))	-0.073445	0.532350
	(0.11841)	(0.39480)
	[-0.62026]	[1.34841]
D(AVL(-2))	0.283856	0.431704
	(0.10584)	(0.35289)
	[2.68190]	[1.22333]
D(INT(-1))	0.006000	0.380329
	(0.03642)	(0.12144)
	[0.16472]	[3.13181]
D(INT(-2))	-0.008521	0.031637
	(0.03847)	(0.12828)
	[-0.22148]	[0.24663]
C	0.072288	-0.021815
	(0.06624)	(0.22086)
	[1.09126]	[-0.09877]
R-squared	0.312086	0.190972
Adj. R-squared	0.259169	0.128739
Sum sq. resids	20.03594	222.7321
S.E. equation	0.555198	1.851121
F-statistic	5.897701	3.068657
Log likelihood	-55.83174	-141.3314
Akaike AIC	1.741739	4.150181
Schwarz SC	1.932951	4.341394
Mean dependent	0.072802	0.022860
S.D. dependent	0.645043	1.983173

Determinant resid covariance (dof adj.)	0.902602
Determinant resid covariance	0.756496
Log likelihood	-191.5827
Akaike information criterion	5.791062
Schwarz criterion	6.237224

Interbank Rate to Deposit Rate

Vector Error Correction Estimates
Date: 09/09/18 Time: 00:22
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
DPR(-1)	1.000000
INT(-1)	-0.479701
	(0.06053)
	[-7.92549]
C	-3.079673

Error Correction:	D(DPR)	D(INT)
CointEq1	-0.114094	0.159369
	(0.02839)	(0.16985)
	[-4.01816]	[0.93828]
D(DPR(-1))	0.225606	1.002128
	(0.11701)	(0.69994)
	[1.92809]	[1.43173]
D(DPR(-2))	-0.144301	-2.237285
	(0.11495)	(0.68759)
	[-1.25539]	[-3.25379]
D(INT(-1))	0.009297	0.330511
	(0.02022)	(0.12096)
	[0.45981]	[2.73250]
D(INT(-2))	-0.031990	0.033933
	(0.02128)	(0.12730)
	[-1.50324]	[0.26656]
C	0.016443	0.039062
	(0.03515)	(0.21025)
	[0.46783]	[0.18579]
R-squared	0.354610	0.263081
Adj. R-squared	0.304965	0.206395
Sum sq. resids	5.669695	202.8799
S.E. equation	0.295341	1.766700
F-statistic	7.142857	4.641012
Log likelihood	-11.01681	-138.0173
Akaike AIC	0.479347	4.056825
Schwarz SC	0.670559	4.248038
Mean dependent	0.017394	0.022860
S.D. dependent	0.354258	1.983173

Determinant resid covariance (dof adj.)	0.248017
Determinant resid covariance	0.207870
Log likelihood	-145.7243
Akaike information criterion	4.499276
Schwarz criterion	4.945438

t-values in brackets.

Table 5: VECM Short-Run Results

Looking at the adjustment parameters, the study finds an error correction term (ECT) between the policy rate and the interbank rate to be -0.31 which is statistically significant and correctly signed. This indicates that, when there is a deviation from equilibrium between the interbank rate and policy rate, the interbank rate adjusts by 31% per time period (1 month) towards the policy rate to reestablish equilibrium. At this rate, it would take about 2 months to achieve 50% of the pass-through from an increase in the policy rate.

Further, the ECT between the interbank rate and lending rate is -0.09 and is statistically significant. This indicates that the speed of adjustment towards the long-run equilibrium given that a shock occurs is 9.2% and at this rate it would about 7.2 months to achieve 50% of the pass-through. Das (2016) found similar results in India where the speed of adjustment between the key monetary policy rate and lending rate was 4.2 % per two weeks period resulting into 8.1 months to achieve 50% of the pass-through.

Finally, the ECT between the interbank rate and the deposit rate is -0.11 and this indicates that the deposit rate adjusts by 11% per month towards the interbank rate after a deviation from equilibrium, resulting in about 5.8 months to achieve 50% of the pass-through from a change in the interbank rate. In general, it can be stated that the speed of error correction is slow ranging from 31% to 9.2% implying that disturbances in the model are long-lived. Table 6 gives a summary of the half-life summary highlighted above.

	Policy Rate to Interbank	**Interbank Rate to Lending Rate**	**Interbank Rate to Deposit Rate**
Initial Quantity	100	100	100
Final Quantity	69	90.8	88.59
HALF-LIFE IN MONTHS	**2**	**7.2**	**5.8**

Table 6: Half Life Summary

The half-life results show that in order to achieve 50% of the pass-through from the policy rate to interbank rate about 2 months are required, while about 7.2 and 5.8 months are needed to achieve 50% of the pass-through from the interbank rate to the lending and deposit rates, respectively. Similar to the long-run findings, the short-run half-life results suggest the existence of high rigidity or slow adjustment of the pass-through from interbank rate to market rates9lending and deposit) as compared to the movement from policy rate to the interbank rate.

5.6 Symmetric/Asymmetric Adjustment

So far, the estimates carried out do not allow us to distinguish the nature of pass-through during instances of monetary tightening and loosening. Therefore, in order to establish the nature of the pass-through process during the rise and fall of the policy rate, the residuals from the cointegrating equation of the policy rate and interbank rate are decomposed and split into two new series $EC^{+}$and EC^{-}representing contractionary and expansionary monetary policy, respectively. The decision rule is that if the coefficients for the $EC^{+}$and EC^{-}-are significant and bear the correct signs that is a negative for EC^{-}- and positive for EC^{+} then proceed to test the Wald statistic test by setting the Null Hypothesis (Ho) that EC^{+}= EC^{-}. Table 7 gives a summary of the results.

Deposit Rate= f($EC^{+}$and EC^{-})

Dependent Variable: D(DPR)
Method: Least Squares
Date: 11/16/18 Time: 16:52
Sample (adjusted): 2012M06 2018M05
Included observations: 70 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DPR(-1))	0.426733	0.116661	3.657879	0.0005
D(EC+(-1))	0.101922	0.015901	6.409792	0.0501
D(EC-(-1))	-0.193587	0.087210	-2.225137	0.0328

R-squared	0.466359	Mean dependent var	0.015219
Adjusted R-squared	0.342196	S.D. dependent var	0.355547
S.E. of regression	0.324531	Akaike info criterion	0.642575
Sum squared resid	6.951156	Schwarz criterion	0.771061
Log likelihood	-18.49014	Hannan-Quinn criter.	0.693611
F-statistic	5.606361	Durbin-Watson stat	2.916566
Prob(F-statistic)	0.001739		

Lending Rate=f($EC^{+}$and EC^{-})

Dependent Variable: D(AVL)
Method: Least Squares
Date: 11/16/18 Time: 16:25
Sample (adjusted): 2012M06 2018M05
Included observations: 70 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AVL(-1))	0.525822	0.104458	5.033809	0.0000
D(EC+(-1))	0.742070	0.151621	4.894237	0.0000
D(EC-(-1))	-0.135692	0.048420	-2.802395	0.0013

R-squared	0.336333	Mean dependent var	0.069185
Adjusted R-squared	0.306166	S.D. dependent var	0.665470
S.E. of regression	0.554314	Akaike info criterion	1.713274
Sum squared resid	20.27942	Schwarz criterion	1.841760
Log likelihood	-55.96460	Hannan-Quinn criter.	1.764310
F-statistic	11.14916	Durbin-Watson stat	2.197664
Prob(F-statistic)	0.000005		

Table 7: Symmetric/Asymmetric Adjustment Pass-through

The results show that coefficients for the positive and negative residuals ($EC^{+}$and EC^{-}) representing contractionary and expansionary monetary policy are significant and bear the correct signs (positive for tightening and negative for easing). With regards to the response of deposit rates, the coefficients of 0.101922 and -0.19587 imply that deposit rates respond relatively faster to expansionary monetary policy than to contractionary monetary policy. On the other hand, the lending rates coefficients of 0.742921 and -0.135692 suggest that lending rates respond largely to contractionary monetary policy than to expansionary monetary policy.

Having found significant results, the Wald test is then carried out by expressing the null hypothesis as C(2)=C(3), where C(2) represents contractionary monetary policy and C(3) represents expansionary monetary policy. Table 8 shows the Wald test results.

Wald Test-Deposit Rate				**Wald Test-Lending Rates**			
Wald Test: Equation: Untitled				Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability	Test Statistic	Value	df	Probability
t-statistic	1.982207	66	0.0031	t-statistic	4.89429	66	0.0000
F-statistic	2.829822	(1, 66)	0.0097	F-statistic	23.95356	(1, 66)	0.0000
Chi-square	2.829822	1	0.0004	Chi-square	23.95356	1	0.0000
Null Hypothesis: C(2)=C(3)				Null Hypothesis: C(2)=C(3)			

Table 8 : Wald Test Results

Given the p-value of 0.0031 and t-statistic of 1.982207 for the deposit rates, as well as the p-value of 0.000 and t-value of 4.89429 for the lending rates, the study rejects the null hypothesis at 1 percent level of significance and concludes that the pass-through is not symmetric but asymmetric. These results suggest that the lending rate is rigid in downward adjustment than upward adjustment while the deposit rate is rigid in upward adjustment.

However, this result differs from the findings by Matemilola (2014) who established that South African commercial banks exhibit some upward rigidity for lending rates and downward rigidity for deposit rates. Thus, commercial banks in South Africa tends to adjust their lending rate downwards whenever the monetary policy rate goes up while the deposit rates are adjusted upwards whenever there is a decline in the monetary policy rate in order to attract customers. These findings are attributed to the structure of the South African banking industry which is quite deep and developed, thereby resulting into high levels of competition within the sector. This supports the customer reaction hypothesis that states that commercial banks that operate in a highly competitive environment fear negative reactions from borrowers or customers. As a result, they are normally reluctant to adjust the lending rates upwards or reduce deposit rates even during tight and relaxed liquidity conditions, respectively (De Bondt, 2005).

This finding therefore lends support to collusive behaviour of commercial banks in the credit market (Aziakpono and Magda, 2010). This implies that commercial banks are less sensitive to customer reaction in the credit market as suggested by Scholnick (1996), Lim (2001) and De Bondt (2005). This is an unfavourable result given that the banking sector in Zambia is not very developed thereby suggesting that commercial banks' competition is weak.

According to Simpasa (2013), Mutoti (2011) and Musonda (2008), the Zambian banking industry is highly concentrated and monopolistic in nature with the largest four private banks accounting for over 74% of total banking assets and in excess of 67% in terms of total banking sector deposits. This is consistent with empirical findings of Greenwood-Nimmo (2010) who found that retail rates might be rigid downwards due to market structure in the banking system especially if the market is oligopolistic. In a monopolistic high concentrated banking industry, banks are reluctant to make adjustments to their retail rates. This is backed by the extended Mont-Klein theory that suggests that the speed of adjustment of interest rates in response to monetary policy changes depends on the degree of competition in the credit market and on the monetary policy regime (Hannan and Berger, 1991). This hypothesis appears to be supported by the empirical evidence (Neumark and Sharp, 1992; Cottarelli and Kourelis, 1994; and Mojon, 2000). Further, the bank concentration hypothesis states that banks are more likely to decrease deposit rates and increase lending rates when they are able to exercise their market power and adjust interest rates to their advantage.

The asymmetry of interest rates pass-through could also be explained by switching costs and information asymmetry. Switching costs may be as a result of bank customers switching from one bank to another. Switching cost such as costs of acquiring information search and administrative costs are potentially common in markets where information asymmetry problem exists (Sharpe, 1997; IMF, 2012). According to Stilgliz and Weiss (1981), commercial banks face both adverse selection and moral hazard problems when they are required to raise lending rates following an increase in the monetary policy rate. The presence of information asymmetry prompted by the existence of agency costs make banks more reluctant to adjust their market rates significantly over a short period. Thus, in the presence of information asymmetry, commercial banks may exhibit pass-through rigidity regardless of the monetary policy stance undertaken (expansionary or contractionary). As a result, unless commercial banks margins are under pressure, banks are reluctant to adjust their interest rates accordingly. For instance, when there is an upward pressure on lending rates banks are more likely to ration the amount of credit extended to borrowers than increase the interest rates which would make loan payments more difficult for borrowers. This would consequently lead to more problem loans and defaults (Bondt, 2005).

Closely related to the above, incomplete and asymmetrical interest rates pass-through could be as a result of maturity profile disparities of commercial banks' assets (loans) and liabilities (deposits). This exposes commercial banks to interest rate risk since they have to deal with demand for loans and supply of deposits that reach them asymmetrically in time. If a deposit arrives at a different time with a new loan demand, a bank will have to temporarily invest the funds in the money market at the short-term market interest rate. In doing so, a bank faces reinvestment risk at the end of the decision period should the market interest rate fall. Similarly, if the demand for a new loan is met by the bank without a contemporaneous inflow of deposits, the bank would have to resort to short-term borrowing in the money market to fund the loan, thereby facing refinancing risk if the short-term interest rate goes up. This entails that banks will not respond faster to monetary policy changes before they meet up their loan obligations which might have been acquired at a higher interest rate than what the central bank is signaling. The resistance is more pronounced during the contractionary episodes of monetary policy compared to the expansionary episodes. Reducing the lending rate for outstanding loans and advances whose capital was borrowed at a higher rate would result into loss making by commercial banks that are still paying their liabilities at a higher interest, hence the reluctance and asymmetry in the adjustment process (Weth, 2002).

In Zambia, this could be linked to the monetary policy tightening episode of 2015- 2016 which mopped up liquidity from the market. As a result, commercial banks carried high cost fixed deposits from different sources such as pension houses and insurance companies whose maturity was long-term in nature (BAZ, 2017). This resulted into maturity mismatches that have a negative impact on the transmission of monetary policy.

Asset quality and default risk have a bearing on the degree of monetary policy pass-through. According to Reint et.al (2007), banks with weak balance sheets may react to an expansive monetary policy stance by shoring up liquidity rather than extending credit at lower rates. A change in the policy rate may thus have only a limited impact on market rates. In essence, potential new loans are crowded out by the presence of bad loans on balance sheets. Saborowski and Weber (2013) in their assessment of the determinants of interest rate pass-through in the developed and emerging economies measured asset quality as the banking sector‘s non-performing loan (NPL) share in total. They found that countries with low NPLs had a long-term pass-through of about 11 percent higher than that of countries with high NPLs. In Zambia, the NPL are rising beyond the acceptable threshold of 10 percent with recent data showing that the NPL ratio has steadily increased to 13.0% in March 2018 from 8.4% in December 2012 (BoZ, 2018).

5.8 Diagnostic Tests

To establish the stability of the vector error correction models, the study estimated the white heteroscedasticity test for three models and it was found that the models had constant variance. Furthermore, by undertaking the LM serial correlation test, it was established that the models do not suffer from serial correlation. The results for Jaque-Bera residual normality tests indicate that the residuals are normally distributed. Appendix C1-C3 show the results

CHAPTER 6

CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Summary

The aim of this study was to provide evidence on the monetary policy transmission in Zambia by investigating the pass-through from the Bank of Zambia policy rate to the commercial banks market retail rates via the interbank market. Thus, the study examined the magnitude and speed of the Bank of Zambia Policy Rate pass-through to commercial banks' market retail rates (lending and deposit) and the symmetric/asymmetric behavior of the pass-through in line with the kind of monetary policy stance (expansionary or contractionary) undertaken. A Johansen cointegration approach was carried out to establish the long-run relationship among the variables. Having established cointegration among the variables, the study estimated a two-step VECM from the policy rate to the interbank rate and from the interbank rate to commercial bank's lending and deposit rates. The half-life analysis was then undertaken to establish the number of months that are required to achieve 50 percent of the pass-through. Finally, to establish the nature of the pass-through process (symmetry/asymmetry adjustment) during the rise and fall of the policy rate, two new series $EC^{+}$and EC^{-}representing contractionary and expansionary monetary policy, respectively were created from the residuals of the policy rate and interbank rate cointegration equation.

The study results suggested the existence of a high but incomplete pass-through from the Bank of Zambia policy rate to the short-term interbank rate at 86 percent. Consequently, the pass-through from the interbank rate to commercial bank interest rates was found to be incomplete and low being 32 percent and 47 percent for the lending and deposit rates, respectively. It was established that the speed of adjustment was 31 percent for the interbank rate, 9 percent for lending rates and 11 percent for deposit rates to re-establish equilibrium after a shock. At this rate, it would take about 2, 7.2 and 5.8 months to achieve 50 percent of the pass-through from the policy rate to the interbank rate and from the interbank to the lending and deposit rates respectively. Further, the study found evidence of asymmetric adjustment to monetary policy with deposit rates exhibiting an upward rigidity in response to monetary policy tightening but flexible downwards in response to monetary policy loosening. The opposite holds for lending rates as they are positively responsive to contractionary monetary policy than to expansionary monetary policy.

These results indicate that there might be significant but slow, incomplete and un-equal pass-through of monetary policy changes to commercial bank interest rates in Zambia via the interbank market. The pass-through appears to be relatively strong in the first stage of the transmission process (policy rate to interbank rate). From this result, it appears the central bank of Zambia has succeeded in regulating liquidity supply in the system through the interbank market, hence it should continue with the same practice.

In general, these findings suggest that monetary policy transmission may exhibit some decreasing effects as the pass-through becomes weaker during the second stage (interbank rate to commercial banks rates), an indication that the strength of the policy rate signal may be lost along the way during the transmission process. Accordingly, the asymmetric behavior of commercial banks in response to monetary policy changes may hinder the ability of the central bank to achieve the intended purpose when it signals to the market. There might be some structural rigidities present in the retail markets (loans and deposit) that might distort the transmission process thereby rendering monetary policy less effective and efficient. The central bank should therefore explore and identify these possible distortions and devise strategies of dealing with them to improve the impact of monetary policy. Other studies have attributed the weak and asymmetric pass-through to the limited development of the financial sector and relatively weak competition (Cottarelli and Kourelis, 1994; and Mojon; 2000). In the Zambian case, this appears to be supported by the empirical findings of Simpasa (2013) and Mutoti (2011).

6.2 Conclusion and Policy Recommendations

Based on these possible reasons identified, some policy recommendations would be to promote financial sector development and encourage measures that would result into increased competition in the financial sector.

Further, the declining effect of monetary transmission through the different stages of the transmission process suggests that it may take a very long time before the effect of a monetary policy action can be felt by economic agents in the real sector. The time lags inherent in the transmission process might make it difficult to conduct monetary policy. In particular, these long time lags require that the central bank of Zambia must be forward-looking in its policy decisions by anticipating what might happen in future through comprehensive economic forecasts. Forecasts with small margin of errors could enable the central bank to carry out pre-emptive rather than responsive monetary policy interventions, thereby achieving the desired impact of their actions within the intended or ideal period of time.

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APPENDICES

APPENDIX A: LAG LENGTH SELECTION CRITERIA

A1. Policy Rate to Interbank Rate

VAR Lag Order Selection Criteria
Endogenous variables: INT
Exogenous variables: C PR
Date: 07/13/18 Time: 21:18
Sample: 2012M04 2018M05
Included observations: 68

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-172.2768	NA	9.854499	5.125788	5.191068	5.151654
1	-139.8255	62.03927	3.907625	4.200750	4.298669	4.239548
2	-131.8024	15.10222	3.178623	3.994189	4.124748*	4.045921
3	-131.0273	1.436304	3.200130	4.000802	4.164002	4.065467
4	-128.2101	5.137276*	3.034170*	3.947355*	4.143194	4.024952*
5	-127.7549	0.816592	3.084023	3.963380	4.191859	4.053910
6	-126.4921	2.228467	3.061387	3.955651	4.216769	4.059114

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

A2. Interbank to Average Lending Rate

VAR Lag Order Selection Criteria
Endogenous variables: AVL
Exogenous variables: C INT
Date: 07/13/18 Time: 21:24
Sample: 2012M04 2018M05
Included observations: 68

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-192.1512	NA	17.68063	5.710330	5.775610	5.736196
1	-46.36976	278.6998	0.250132	1.452052	1.549971	1.490851
2	-42.94100	6.454148*	0.232905*	1.380618*	1.511177*	1.432349*
3	-42.93641	0.008505	0.239856	1.409894	1.573093	1.474559
4	-42.87664	0.108981	0.246629	1.437548	1.633387	1.515146
5	-42.75790	0.213041	0.253174	1.463468	1.691946	1.553998
6	-42.66158	0.169984	0.260088	1.490046	1.751165	1.593510

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

A.3 Interbank to 180 Days Deposit Rate

VAR Lag Order Selection Criteria
Endogenous variables: INT
Exogenous variables: C DPR
Date: 07/13/18 Time: 21:27
Sample: 2012M04 2018M05
Included observations: 68

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-205.8589	NA	26.46010	6.113498	6.178778	6.139364
1	-141.7211	122.6164	4.131678	4.256503	4.354423	4.295302
2	-136.9928	8.900287*	3.702866*	4.146848*	4.277407*	4.198580*
3	-136.9872	0.010362	3.813259	4.176095	4.339295	4.240760
4	-136.8556	0.240094	3.912661	4.201635	4.397474	4.279232
5	-136.3661	0.878151	3.972936	4.216651	4.445129	4.307181
6	-136.3651	0.001760	4.092887	4.246033	4.507152	4.349496

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

A.4 Lending Rates vs Contractionary (EC+) and Expansionary (EC-) Monetary Policy

VAR Lag Order Selection Criteria
Endogenous variables: AVL ECT+ ECT-
Exogenous variables: C
Date: 05/10/19 Time: 17:26
Sample: 2012M04 2018M05
Included observations: 67

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1295.070	NA	1.35e+13	38.74835	38.84707	38.78741
1	-1078.979	35.32168*	4.81e+10*	33.10385*	34.09103*	33.49448*
2	-1099.738	37.95625	6.81e+10	33.45487	34.14590	33.72831
3	-1120.931	327.4856	9.77e+10	33.81882	34.21369	33.97507

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

A.5 Deposit Rates vs Contractionary (EC+) and Expansionary (EC-) Monetary Policy

VAR Lag Order Selection Criteria
Endogenous variables: DPR ECT+ ECT-
Exogenous variables: C
Date: 05/10/19 Time: 17:42
Sample: 2012M04 2018M05
Included observations: 67

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1238.296	NA	2.48e+12	37.05362	37.15234	37.09269
1	-1115.907	230.1655	8.41e+10	33.66886*	34.06373*	33.82511*
2	-1098.765	30.70085*	6.61e+10*	33.42584	34.11686	33.69928
3	-1096.799	3.346696	8.19e+10	33.63578	34.62295	34.02641

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX B: REGRESSION RESULTS

B1: Long-Run Johansen Normalization Output

Policy Rate to Interbank Rate	Interbank Rate to Lending Rate	Interbank Rate to Deposit Rate
1 Cointegrating Equation(s): Log likelihood -181.4061	1 Cointegrating Equation(s): Log likelihood -191.5827	1 Cointegrating Equation(s): Log likelihood -145.7243
Normalized cointegrating coefficients (standard error in parentheses)	Normalized cointegrating coefficients (standard error in parentheses)	Normalized cointegrating coefficients (standard error in parentheses)
INT PR	AVL INT	DPR INT
1.000000 -0.861823	1.000000 -0.326683	1.000000 -0.479701
(0.10656)	(0.150338)	(0.06053)
Adjustment coefficients (standard error in parentheses)	Adjustment coefficients (standard error in parentheses)	Adjustment coefficients (standard error in parentheses)
D(INT) -0.310904	D(AVL) -0.092628	D(DPR) -0.114094
(0.07138)	(3.51529)	(0.02839)
D(PR) 0.033789	D(INT) 0.102257	D(INT) 0.159369
(0.02640)	(0.03796)	(0.16985)

APPENDIX C: DIAGNOSTIC TESTS

C1: Policy Rate to Interbank

Serial Correlation Test

VEC Residual Serial Correlation LM T...
Null Hypothesis: no serial correlation a...
Date: 09/18/18 Time: 13:34
Sample: 2012M04 2018M05
Included observations: 71

Lags	LM-Stat	Prob
1	5.917391	0.9779
2	3.435429	0.4878

Probs from chi-square with 4 df.

Normality Test

Component	Jarque-Bera	df	Prob.
1	0.091852	2	0.1230
2	0.167563	2	0.2185
Joint	0.259415	4	0.2301

Heteroskedasticity Test

oVEC Residual Heteroskedasticity Tests: No Cross Terms (only l squares)

Date: 10/15/18 Time: 15:56

Sample: 2012M04 2018M05

Included observations: 68

Joint test:

Chi-sq	df	Prob.
71.60361	66	0.2973

C2: Interbank Rate to Lending Rates

Serial Correlation Test

VEC Residual Serial Correlation LM T...
Null Hypothesis: no serial correlation a...
Date: 09/18/18 Time: 12:32
Sample: 2012M04 2018M05
Included observations: 71

Lags	LM-Stat	Prob
1	3.510765	0.1190
2	2.722407	0.1438

Probs from chi-square with 4 df.

Normality Test

Component	Jarque-Bera	df	Prob.
1	0.017896	2	0.8936
2	0.161440	2	0.6878
Joint	0.179336	4	0.5423

Heteroskedasticity Test

VEC Residual Heteroskedasticity Tests: Includes Cross Terms

Date: 10/15/18 Time: 15:45

Sample: 2012M04 2018M05

Included observations: 69

Joint test:

Chi-sq	df	Prob.
166.2152	162	0.3939

C3: Interbank Rate to Deposit Rate	
Serial Correlation Test	VEC Residual Serial Correlation LM T... Null Hypothesis: no serial correlation a... Date: 09/18/18 Time: 11:57 Sample: 2012M04 2018M05 Included observations: 71 Lags / LM-Stat / Prob 1 / 4.824533 / 0.3058 2 / 2.408898 / 0.6610 Probs from chi-square with 4 df.
Normality Test	Component / Jarque-Bera / df / Prob. 1 / 0.754114 / 2 / 0.6859 2 / 0.797071 / 2 / 0.5737 Joint / 1.551185 / 4 / 0.3046
Heteroskedasticity Test	VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares) Date: 10/15/18 Time: 15:49 Sample: 2012M04 2018M05 Included observations: 69 Joint test: Chi-sq / df / Prob. 66.98825 / 54 / 0.1103

Serial Correlation Test:

Lags	LM-Stat	Prob
1	4.824533	0.3058
2	2.408898	0.6610

Normality Test:

Component	Jarque-Bera	df	Prob.
1	0.754114	2	0.6859
2	0.797071	2	0.5737
Joint	1.551185	4	0.3046

Heteroskedasticity Test (Joint test):

Chi-sq	df	Prob.
66.98825	54	0.1103

APPENDIX D: ROBUSTNESS TESTS

POLICY RATE TO BANK RATES TEST FOR ROBUSTNESS CHECKS

D1: Policy Rate to Lending Rates

Date: 10/15/18 Time: 17:23
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Trend assumption: Linear deterministic trend
Series: AVL PR
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.105051	12.81834	15.49471	0.1216
At most 1 *	0.067188	4.938132	3.841466	0.0263

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.105051	7.880204	14.26460	0.3910
At most 1 *	0.067188	4.938132	3.841466	0.0263

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

D2: Policy Rate to Deposit Rates

Date: 10/15/18 Time: 17:47

Sample (adjusted): 2012M07 2018M05

Included observations: 71 after adjustments

Trend assumption: Linear deterministic trend

Series: DPR PR

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.238220	21.26709	15.49471	0.0060
At most 1	0.027066	1.948191	3.841466	0.1628

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.238220	19.31890	14.26460	0.0073
At most 1	0.027066	1.948191	3.841466	0.1628

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

D3: VECM Results-Policy Rate To Deposit Rate

Vector Error Correction Estimates
Date: 11/08/18 Time: 20:58
Sample (adjusted): 2012M07 2018M05
Included observations: 71 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
DPR(-1)	1.000000
PR(-1)	-0.837759 (0.04478) [-18.7072]
C	0.358456

Error Correction:	D(DPR)	D(PR)
CointEq1	-0.304754 (0.06968) [-4.37352]	0.055525 (0.14349) [0.38697]
D(DPR(-1))	0.293848 (0.10645) [2.76044]	0.034586 (0.21920) [0.15778]
D(DPR(-2))	-0.002946 (0.09985) [-0.02951]	0.171625 (0.20562) [0.83467]
D(PR(-1))	-0.023682 (0.07910) [-0.29938]	0.101680 (0.16289) [0.62423]
D(PR(-2))	-0.024642 (0.07489) [-0.32905]	0.042384 (0.15421) [0.27484]
C	0.012765 (0.03228) [0.39547]	0.005276 (0.06647) [0.07937]
R-squared	0.455104	0.024367
Adj. R-squared	0.413189	-0.050681
Sum sq. resids	4.786864	20.29762
S.E. equation	0.271374	0.558812
F-statistic	10.85776	0.324689
Log likelihood	-5.008077	-56.29238
Akaike AIC	0.310087	1.754715
Schwarz SC	0.501299	1.945927
Mean dependent	0.017394	0.010563
S.D. dependent	0.354258	0.545168

Determinant resid covariance (dof adj.)	0.022418
Determinant resid covariance	0.018789
Log likelihood	-60.39501
Akaike information criterion	2.095634
Schwarz criterion	2.541796
Number of coefficients	14

- The coefficient value of 0.837759 entails that a one percentage increase in the policy rate leads to a 0.84 percentage increase in the deposit rate in the long-run.
- An error correction term of -0.30 entails that when a shock occurs in the system, the deposit rates adjusts by 30% per month towards the policy rate to reestablish equilibrium. At this rate it would take about 2.1 months to achieve 50% of the pass-through.