Pass-Through from Policy Rate to Retail Interest Rates in Zambia

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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Contents

List of tables

List of figures

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Abstract

In April 2012, Zambia changed its monetary policy regime from a monetary aggregate regime to one of interest rate targeting. This study estimates the extent of pass-through from the policy rate to retail interest rates via the interbank rate from April 2012 to December 2019, covering the period of monetary policy regime change. A two-step estimation of the vector error correction model is employed. The empirical results reveal the existence of complete pass-through from the policy rate to interbank rates. However, an incomplete and asymmetric pass-through from the interbank rate to retail interest rates is found. The existence of imperfections in the retail market may partially explain a weak relationship between the interbank rate and retail rates, especially in the short run.

Key words: Pass-through, monetary policy rate, interest rates, vector error correction model
JEL classification: E42, E52, E58

1. Introduction

Effective monetary policy plays a vital role in achieving macroeconomic stability. A well-functioning financial market facilitates the effectiveness of monetary policy (Simpasa et al, 2014). Monetary policy entails actions by the central bank to influence either the money stock or interest rates in order to achieve the desired objective (Loayza and Schmidt-Hebbel, 2002). One of the most important aspects of monetary policy is the ability of the central bank to influence market interest rates, particularly at the shorter end of the yield curve, which in turn influences aggregate demand and, ultimately, inflation (Zgambo and Chileshe, 2014).

The transmission mechanism of monetary policy is the process through which decisions by the central bank affect the economy in general and the price level in particular (South African Reserve Bank, 2018). The different channels through which monetary policy can be transmitted include the interest rate, exchange rate, credit and expectations.

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). The magnitude and speed of adjustment of the lending and deposit rates determine the effectiveness of monetary policy. Aziakpono, Wilson and Manuel (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.

In Zambia, the financial and monetary policy environment has undergone some reforms since the country attained independence in 1964. Notably, the liberalization of the financial sector which commenced in the early 1990s resulted in the abolishment of credit, interest rate and exchange controls (Simatele, 2004). Further, the conduct of monetary policy has also evolved over the years in line with the changes in financial and money market conditions.

With a view to enhancing the accountability and transparency of the monetary policy process, in April 2012 the Bank of Zambia (BoZ) took the first step towards the modernization of the monetary policy framework when the operational procedure changed from monetary aggregates (quantities) targeting to interest rate (prices) targeting. The BoZ policy rate was introduced as a starting point, and this came with a shift in the monetary policy operational target from reserve money to the overnight interbank rate (Zgambo, 2017).

Two studies that attempted to assess monetary policy transmission during the current monetary policy framework are those by Chileshe and Akanbi (2016) and Zgambo (2017). However, these studies did not analyse the magnitude and speed of monetary policy transmission via the interest rate channel. For example, Zgambo (2017) concentrated on liquidity management best practices in an inflation-targeting framework by taking a country comparative approach to draw lessons for Zambia. Conversely, Chileshe and Akanbi (2016) focused on confirming the existence of an asymmetric response by retail and bond yield rates to changes in monetary policy-controlled interest rates. Further, although Chileshe and Akanbi (2016) cover a longer time span (1992–2016), the analysis combines both monetary targeting and inflation-targeting (transitional) regimes, which makes it difficult to assess the effectiveness of the interest-rate-based framework adopted in 2012.

This study seeks to build on Chileshe and Akanbi (2016) to assess the effectiveness of monetary policy under the current price-based monetary policy framework in Zambia. The objective of the study is to empirically establish the degree (magnitude) and speed of adjustment of commercial bank retail interest rates to changes in the monetary policy rate. The study also investigates the symmetrical/asymmetrical nature of the pass-through process during episodes of contractionary and expansionary monetary policy. The study, therefore, seeks to answer two key questions:

1. What is the degree (magnitude) and speed of adjustment of commercial bank retail interest rates to changes in the monetary policy rate?
2. What is the symmetric/asymmetric nature of the pass-through process during episodes of contractionary and expansionary monetary policy?

In order to answer these questions, a two-step estimation approach is employed: first from the BoZ policy rate to the interbank rate and, second, from the interbank rate to commercial bank retail interest rates. This is different from the single-step regression analysis approach by Chileshe and Akanbi (2016), where the pass-through from monetary policy to retail rates is directly estimated (the unifying or monetary approach). A unifying or monetary approach may not adequately account for what happens at every stage of monetary policy transmission. Conversely, a two-step regression approach has the potential of identifying specific areas of high flexibility or rigidities in the pass-through process that might need customized policy intervention to enhance the effectiveness of monetary policy (Sanusi, 2010). Further, previous studies on Zambia did not provide empirical explanations for the factors underlying established interest rate pass-through. For example, Chileshe and Akanbi (2017) find the pass-through to be asymmetric but did not shed light on the possible reasons for this result.

The findings of this study are significant for the practice of monetary policy formulation and implementation globally as it provides information to central bankers and financial regulators on the nature of interest rate pass-through by illustrating how long it takes for a particular policy action to have an impact on the real sector of the economy. In turn, this would facilitate timely monetary policy decision-making and

implementation as well as the selection of appropriate tools that can be employed at the appropriate time to meet the key central bank objective of price and financial system stability. The results of interest rate pass-through such as the speed and magnitude of adjustment are also essential in assessing the soundness of the financial system of a given country.

The rest of the paper is organized as follows: Section 2 presents a brief description of the monetary policy framework in Zambia and the structure of interest rates. Section 3 reviews the literature. Section 4 outlines the empirical model and methodology, as well as data descriptions and sources. Section 5 presents the empirical results and Section 6 concludes.

2. Monetary policy framework and structure of interest rates in Zambia

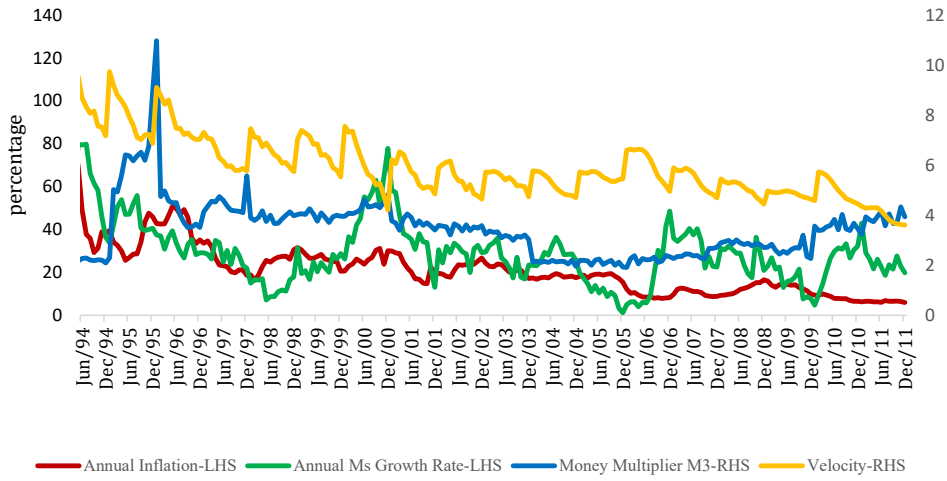
The primary objective of the BoZ is to achieve and maintain price and financial system stability. The rationale behind price stability is to protect the value of income and savings and, subsequently, encourage investment flows to boost the economy's productive capacity. This is necessary for employment and economic growth. To achieve the price stability objective, it is imperative to clearly define, within the adopted monetary policy framework, operational, intermediate, and ultimate targets as well as the policy instruments.

In Zambia, monetary policy has undergone changes since 1964 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, from 1964 to 1991, and the second is the liberalization era, from 1992 to the present (Bank of Zambia, 2014a).

Prior to April 2012, monetary policy was based on the monetary aggregate targeting (MAT) framework. Under this framework, reserve money was the operating target while broad money was the intermediate target, with inflation-targeting the ultimate objective. This monetary policy framework relied on the assumption that the velocity of money was constant, and that the relationship between reserve money and broad money through the multiplier process was stable. In turn, it was postulated that broad money had a stable and predictable relationship with inflation. In this regard, the BoZ could control overall monetary conditions in the economy by keeping reserve money at a level consistent with the desired broad money growth. Deviations from the reserve money target determined the pace and aggressiveness of the BoZ's liquidity management activities.

However, Simpasa et al (2014) provided evidence of a weakening link between money supply and inflation. This was on the basis of a volatile and declining velocity of money accompanied by a rising money multiplier, particularly from December 2003, contributing to the observed inverse relationship between broad money growth and inflation (Figure 1).

Figure 1: Money multiplier, money supply, velocity of money and inflation (1994–2011)



Source: Authors' computation using data from Bank of Zambia Statistics Fortnightly 2019.

Hitting the operating target did not guarantee the attainment of the ultimate goal of low and stable inflation. This implied that MAT could no longer provide an adequate signal about the stance of monetary policy, making it difficult to deal with inflationary pressures and to assess central bank accountability.

Compelled by the challenges of achieving quantitative monetary targets and with a view to modernizing monetary policy, the BoZ embarked on the transition towards a price-based 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. This signalled the central bank's commitment to a more transparent, credible and effective monetary policy (Bank of Zambia, 2012).

The monetary policy committee (MPC) meets every quarter to decide on the policy rate and may meet at any other time during the year should conditions warrant a change in the monetary policy stance. Changes to the policy rate are guided by a comprehensive set of economic indicators that inform about short- and medium-term risks to price stability. This ensures that monetary policy does not overlook important information relevant for assessing future inflation trends. Specifically, the economic indicators that guide the MPC in setting the policy rate include expected inflation, output gap, money supply, interest rates, exchange rate, foreign prices and commodity prices.

The policy rate is a key interest rate that signals the monetary policy stance. Further, it 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 (Bank of Zambia, 2012). The policy rate also guides open market operations in influencing the operating target – the overnight interbank rate. The interbank rate, the price at which banks lend to each other, is expected to influence retail interest rates set by commercial banks and in turn demand for credit, aggregate demand and, ultimately, inflation.

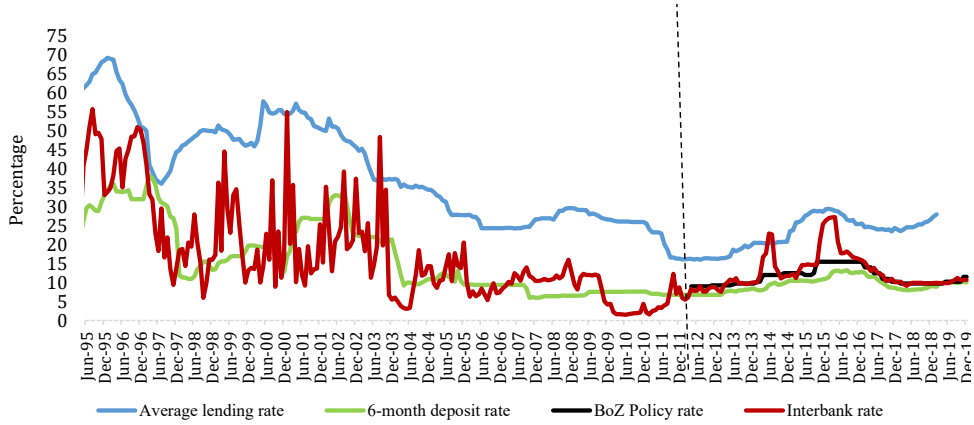
With the introduction of the Bank of Zambia Policy Rate in 2012, a mid-rate interest rate corridor system was adopted for the policy rate. The overnight interbank rate is expected to fluctuate within the corridor, but as close as possible to the policy rate. Currently, the BoZ aims to keep the overnight interbank rate within +/- 1 percentage point of the policy rate having revised it down in May 2017 from the initial +/- 2 percentage points.[1] Thus, when the overnight interbank rate tends towards the lower bound of the corridor, the BoZ undertakes contractionary open market operations to push it up, but still within the corridor. Similarly, when the interbank rate tends towards the upper bound of the corridor, expansionary open market operations are undertaken to stop it from breaching the upper bound of the corridor (Zgambo, 2017).

The evolution of the interbank rate has been episodic. It was very volatile during 1995–2006, but broadly stabilized from April 2012, when the interest rate-targeting framework was adopted (Figure 2). High volatility in the interbank rate can be expected under MAT, as the objective of this framework is money supply stability in order to achieve 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 MAT, the amount of liquidity to be withdrawn from or injected into the market to meet the reserve money target at interest rates determined by the market was significant.

The interbank rate became relatively stable after 2006 with distinct stability observed after 2012, partly attributable to the adoption of a price-based framework that requires the interbank rate to fluctuate within the lower and upper bound of the policy rate. After 2012, the interbank rate tracked the policy rate. This suggests the existence of a strong link between the policy rate and the interbank rate. Further, the data show that the interbank rate and the deposit rate moved more closely in tandem with each another than before. Conversely, lending rates persistently appear to deviate from the interbank rate. This preliminary observation suggests a weak link between the interbank rate and the lending rate. This is comparable to the experience of other African countries implementing an inflation-targeting framework such as South Africa (Aziakpono and Magdalene, 2010; Matemilola et al, 2015), Kenya (Berg et al, 2018), Uganda (Okkelo, 2014; Berg et al, 2018) and Ghana (Sakyi, Mensah and Obeng, 2016). This study empirically tests this relationship to establish the extent of the responsiveness of retail interest rates to policy rate changes via the interbank rate.

1 Views expressed in this paper do not represent the official position of the Bank of Zambia. The authors remain responsible for all errors and omissions.

Figure 2: Money market interest rates in Zambia (1995–2019)



Source: Authors' computation using data from Bank of Zambia Statistics Fortnightly 2019.

Figure 3 reveals some significant deviation of the interbank rate from the policy rate in 2014, 2015 and 2016. During these periods, the economy experienced significant inflationary pressures largely driven by the sharp depreciation of the domestic currency (kwacha) and supply shocks. For example, inflation rose almost threefold between 2014 and 2015, to 21.1% from 7.9%

To contain inflationary pressure, the BoZ increased the policy rate to 15.5% from 12.5%, raised the statutory reserve ratio to 18% from 14%, increased the borrowing cost on the Overnight Lending Facility (OLF)[2] to 12.5% from 9.5% and restricted access to central bank liquidity to once a week rather than daily. The Bank of Zambia also abolished the roll-over of intra-day loans into an overnight loan.[3] As a result, the overnight interbank interest rate came under substantial strain. Despite the interbank rate rising and breaching the set policy rate corridor, the central bank intentionally did not conduct any open market operations. This was deliberately done to keep liquidity conditions tight to dampen demand for foreign exchange. It was judged that expansionary open market operations would have injected liquidity into the market that could have caused a further depreciation of the kwacha, adding to inflationary pressures (Bank of Zambia, 2014; Bank of Zambia, 2016).[4] Exchange rate developments play a pivotal role in inflation dynamics in Zambia. The Zambian economy is highly

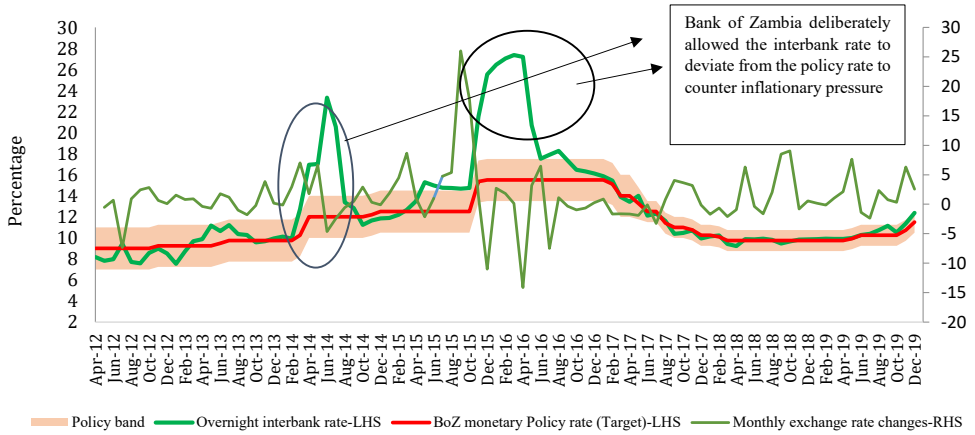
2 The rationale behind narrowing the policy rate corridor from +/- 2 to +/- 1 percentage point was to improve clarity of the monetary policy stance and effectiveness of monetary policy by moderating volatility in the interbank rate.

3 This is a lending facility the BoZ uses to provide short-term liquidity assistance to commercial banks to help them meet their short-term obligations when they are unable to access funds on the interbank market. The OLF rate is determined by the central bank as the policy rate plus a margin.

4 This was to further tighten liquidity conditions in the market and to curb the rapid depreciation of the kwacha.

dependent on imports of goods and services from abroad and there is a significant exchange rate pass-through to consumer prices. Thus, the floating exchange rate regime in Zambia allows for interventions in the foreign exchange market to partly control for pass-through to inflation. Ebeke and Azangue (2015) argue that selected central banks may resort to foreign exchange (FX) intervention as a useful tool in controlling inflation and reaching their inflation objective. However, a forward-looking central bank will not necessarily react too quickly to movements in the exchange rate as long as the inflation forecast remains within the tolerated range.

Figure 3: Policy rate, interbank rate and exchange rate (2012–2019)



Source: Authors' computation using data from Bank of Zambia of Statistics Fortnightly 2019.

Following the adoption of the interest rate-targeting framework, commercial banks are required to link lending rates to the policy rate by adding a margin. This is intended to bring transparency to the credit market in determining the borrowing costs faced by customers. The margin is set by commercial banks on the basis of the risk premium assessment (Bank of Zambia, 2012).

Empirical evidence suggests that the banking sector in Zambia is highly concentrated with liquidity held by few large banks that largely extend liquidity to a few sectors that are deemed less risky (Simpasa and Pla, 2016). This implies that credit risk plays a crucial role in the determination of commercial banks' lending decisions and interest rates. By and large, to maintain profitability margins, commercial banks tend to consider bank competition, statutory reserve ratios and yield rates on government securities when setting deposit rates.

3. Literature review

Theoretical review

The interest rate pass-through and the subsequent symmetric/asymmetric adjustment process is broadly explained by the marginal cost pricing model in which perfect and complete market conditions are assumed. The model stipulates that when information in the banking system is symmetric and the market is perfectly competitive, the marginal price must equal the marginal cost. Relating this to the interest rate pass-through process, the theory implies a positive relationship between the interbank rate (money market) and retail interest rates. The pricing of retail products includes a premium for maturity and risk transformation. Underlying marginal cost pricing are the Monti-Klein model of imperfect competition (Monti, 1972; Klein, 1971), the collusive behaviour hypothesis, consumer behaviour hypothesis, customer reaction hypothesis, switching costs, menu costs and the information asymmetry hypothesis. The Monti-Klein model assumes that the monopolistic behaviour of banks determines the interest rate pass-through from the monetary authority key interest rate to commercial banks' lending rates. The model identifies restriction to entry into the banking sector by regulatory agencies as one of the preconditions for monopoly power that promotes bank concentration (De Bondt, 2002). In highly concentrated banking markets, the 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 Magdalene, 2013). Thus, retail bank interest rates in less competitive or oligopolistic segments of the retail bank market adjust partially and with a delay, while bank interest rates set in a fully competitive environment respond quickly and completely (Laudadio, 1987).

Closely related to the Monti-Klein model is the collusive behaviour of banks hypothesis. It relates to the degree of competition among banks and the level of concentration of the retail market. According to this hypothesis, banks are unlikely to reduce lending rates because they do not want to disrupt their collusive arrangement. Thus lending rates will move rigidly 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; Aziakpono and Magdalene, 2013).

The consumer behaviour hypothesis stipulates that the degree of sophisticated consumers in 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. A high proportion of unsophisticated consumers relative to sophisticated consumers along with the search and switching costs enable banks to have greater market power to adjust interest rates to their advantage. Like the collusive behaviour hypothesis, the consumer behaviour hypothesis suggests that lending rates are rigid downwards and flexible upwards (Matemilola et al, 2015).

The customer reaction hypothesis relates to the response of borrowers to changes in the central bank official rate (policy rate). It states that commercial banks operating in a highly competitive environment may not increase the lending rate for fear of negative reaction from customers. Commercial banks' deposit rates will move rigidly downward when the official rate is reduced while lending rates will move rigidly upward when the official rate rises so as to retain customers (Aziakpono and Magdalene, 2013).

According to the switching costs hypothesis, customers are unlikely to change financial products and/or institutions in search of better funding or investment terms when there are high switching costs (Heffernan and Kalotychou, 2010). Customers need to spend time and effort to establish which bank is offering the best deal and may find it very inconvenient and/or too costly to switch banks. The rigidity in interest rates may thus be attributed to the banks' exploitation of consumers' inertia in switching financial products and/or institutions. If banks can selectively price their products to exploit customers' inertia, then interest rates are expected to be rigidly upwards for customer deposits and downwards for loans. In other words, banks may adjust their deposit rate upwards more slowly and adjust their loan rate downwards more slowly. This will lead to asymmetry in the adjustment speed in interest rates (Liu et al, 2008).

In the case of menu costs, banks are reluctant to adjust interest rates if changes in the benchmark interest rates are very small and/or temporary (Dutta et al, 1999). As there are adjustment costs involved in changing retail interest rates, banks may respond slowly to temporary changes in monetary policy rate, but quickly to more permanent changes in policy rates.

According to Stiglitz and Weiss (1981), a plausible explanation for interest rate rigidity is asymmetric information. Information asymmetry creates an adverse selection problem in the credit market where high interest rates attract riskier borrowers or causes moral hazard. When banks perceive the risk of default to be high, they tend to maintain a large spread between lending and deposit rates (Aziakpono and Magdalene, 2013).

Apart from the theories discussed above, another factor that could influence interest rate pass-through is the bank ownership structure, i.e., 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 interest rate adjustments as noted under the Monti-Klein model (Cottarelli and Kourelis, 1994). Further, 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 are 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 market changes because no single financial intermediary enjoys absolute market power (Aziakpono and Magdalene, 2013).

The discussion so far has presented the theoretical groundwork that shows several factors that could affect the interest rate pass-through process. However, it is important to note that these factors could vary from country to country and within a country as the financial environment changes. The next sub-section considers some empirical studies on the subject.

Empirical review

Empirical literature suggests that interest rate pass-through differs across countries, financial institutions and financial products (Cottarelli and Kourelis, 1994; Borio and Fritz , 1995; Hofmann and Mizen, 2004; Mbowe, 2015; Chileshe and Akanbi, 2017). This study highlights the literature on the speed and nature (symmetric/asymmetric) of monetary policy pass-through for developed economies, emerging markets and developing economies.

Empirical evidence on interest rate pass-through is mixed in developed economies with well-functioning and developed financial markets such as the USA and UK. Thus, there is no consensus among scholars on the nature and adjustment dynamics of the interest rate pass-through. While some studies such as Altunbas, Fazylov and Molyneux (2002), Bernanke and Gertler (1995), Cook (2008) and Kashyap and Stein (2000) report complete and quick pass-through, others such as De Bondt (2002), Hofmann and Mizen (2004), Liu et al (2008) and Mojon (2000) conclude that the pass-through is incomplete and asymmetric due to the presence of banks' collusive behaviour, adverse customer reaction as well as heterogeneity in competition across countries in financial markets and retail bank products. For example, while the banking system plays a more significant role in lending in Europe, its role appears to be limited in the USA (Karagiannis et al, 2010).

Diverse empirical results for emerging markets and developing economies outside Africa also exist. While Haughton and Iglesias (2011) find evidence for complete and symmetric pass-through in Organization of Eastern Caribbean States (OECS) by employing asymmetric threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) models, Wang and Lee (2009) find contrasting results for other countries in the Caribbean single market using the same empirical models. The variation in results was attributed to the existence of information asymmetry within the financial markets of the OECS contrary to Caribbean single market countries. Further, Jamilov and Égert (2014) applied an autoregressive distributed lag (ARDL) approach and found mixed results on the symmetric/asymmetric nature of the pass-through for five Caucasian economies (Armenia, Azerbaijan, Georgia, Kazakhstan and Russia). Specifically, the study found evidence of symmetrical adjustment for Armenia,

Azerbaijan, and Russia on the one hand and asymmetric adjustment for Georgia and Kazakhstan on the other hand, which can be largely explained by market structure differences in these economies.

Further, Mishra and Montiel (2012) investigated the effectiveness of monetary transmission in developing countries by employing a vector autoregressive (VAR) model. The results suggest that monetary transmission appears to be weak and incomplete in developing countries. The authors suggest that this is due to the underdevelopment of the financial markets in developing economies. Das (2015) provides evidence on the credit channel of monetary policy transmission in India by using a two-step estimation of the vector error correction model. The results indicate the existence of incomplete, slow and asymmetric pass-through from changes in the policy rate to bank interest rates. However, some improvements were noted after the introduction of the new base rate system in 2010.

Evidence of the existence of a sluggish and incomplete interest rate pass-through in African economies, Zambia included, exists. Aziakpono, Wilson and Manuel (2007) employed an asymmetric error correction model proposed by Scholnick (1996) to examine how market interest rates in South Africa adjust to changes in the South African Reserve Bank official rate under different monetary policy regimes. The findings indicate that the pass-through is incomplete and asymmetric as the speed of adjustments was higher during contractionary than expansionary periods. The study attributes the asymmetric behaviour of retail interest rate adjustments to the negative customer reaction and collusive pricing behaviour of banks. Mbowe (2015) also assessed 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 lend support to incomplete monetary policy rate pass-through to commercial bank short-term interest rates, both in the short and long run, due to the underdevelopment of the financial sector in Tanzania. By splitting the sample into two periods, the results do not support the view that the policy rate pass-through in Tanzania had improved over time. However, the study did not take into account symmetric/asymmetric interest rate adjustment dynamics.

In Zambia, empirical studies have mostly focussed on the general monetary policy transmission process (Simatele, 2004; Mutoti, 2006; Chileshe et al, 2014; Zgambo and Chileshe, 2014), the bank lending channel of monetary policy pass-through (Simpasa, Nandwa and Nabassaga, 2014) and the determinants of interest rate spreads (Banda, 2010). The magnitude and speed of adjustment have not been comprehensively explored, yet it is critical for the assessment of the effectiveness of monetary policy. However, Chileshe and Akanbi (2016) analysed the symmetric/asymmetric nature of interest rate pass-through in Zambia by employing a non-linear ARDL approach. The study's results provide support for the existence of low and asymmetric adjustment of retail and bond yield rates to changes in policy-controlled interest rates (interbank and three-month Treasury bill rate). Zgambo and Chileshe (2014) estimated the interest rate pass-through from the interbank rate to commercial bank lending interest rates for the period 1995–2014 (covering both monetary and interest rate-targeting

regimes). 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 for most of the sample period.

With respect to possible determinants of interest rate pass-through, asset quality and default risk tend to have a bearing on the degree of monetary policy pass-through. According to Reint and Florian (2010), banks with weak balance sheets may react to an expansionary monetary policy stance by shoring up liquidity rather than extending credit at lower interest rates. A change in the policy rate may thus have a limited impact on market rates. In essence, potential new loans are crowded out by the presence of bad loans on the balance sheet. This is reinforced by Saborowski and Weber (2013) who assessed the determinants of interest rate pass-through in developed and emerging-market economies. Their study found that countries with low non-performing loans (NPLs) had a long-term pass-through of about 11 per cent higher than countries with high NPLs.

The degree and magnitude of interest rate pass-through could also be affected by bank competition as banks' adjustment of interest rates could be on the basis of what other banks are doing. 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 per cent of total banking assets and more than 67 per cent of total banking sector deposits. This is consistent with empirical findings by Greenwood-Nimmo et al (2010) that retail rates might be rigid downwards due to the market structure in the banking system, especially if the market is oligopolistic. In a monopolistic banking industry, banks are reluctant to make adjustments to their retail rates.

In summary, most empirical studies undertaken on this subject used a unified estimation approach to assess monetary policy transmission influence on retail rates. This is different from the step-wise estimation approach employed in this study which shows specific areas that require attention in the transmission system.

4. Methodology

Model specification

The relationship between interbank money market and commercial bank retail interest rates is explained by the marginal cost pricing model proposed by Rousseas (1985) and modified by De Bondt (2002). According to De Bondt (2002), the price-setting behaviour of banks can be represented as:

$$br = \gamma_0 + \gamma_1 mr \quad (1)$$

where br is the price set by banks (bank interest rate); mr is the marginal cost price approximated by a comparable market interest rate; γ_0 is a constant markup; and γ_1 is a measure of interest rate pass-through.

The pass-through or unitary interest rate elasticity of demand for deposits and loans is complete if γ_1 is equal to 1 (Coricelli et al, 2006). This implies that markets are perfect (full information and perfectly competitive) and banks are risk-neutral. The pass-through is incomplete if γ_1 is less than 1. In this case, banks have some degree of market power. Over pass-through, or overshooting, exists when γ_1 exceeds 1. This implies that banks respond to monetary policy changes on a one-to-one basis and take on more risk.

This study uses a two-step approach in determining the extent of monetary policy pass-through to market interest rates as follows:

Step 1: Pass-through from the Policy Rate to the Interbank Rate

In step 1, the pass-through from the policy rate to the interbank rate (operating target) is specified as:

Long run:

$$ibr_t = \beta_0 + \beta_1 pr_t + \varepsilon_t \quad (2)$$

Short run:

$$\Delta ibr_t = \delta_0 ecm_{t-1} + \sum_{K=1}^{K} \delta_1 \Delta ibr_{t-K} + \sum_{K=1}^{K} \delta_2 \Delta pr_{t-K} + \varepsilon_t \quad (3)$$

where ibr_t is the interbank rate; pr_t is the Bank of Zambia Policy Rate (policy rate); β_1 is the coefficient measuring the pass-through from the policy rate to the interbank rate; $ecm_{t-1} = ibr_{t-1} - \hat{\beta}_0 - \hat{\beta}_1 pr_{t-1}$ is the error correction term; Δ is the difference operator; ; and ε_t is the error term.

Equation 2 measures the long-run relationship while Equation 3 is the short-run relationship for the two variables under consideration in step 1.

Complete pass-through exists if β_1 is equal to 1. There is overshooting if β_1 exceeds 1. The pass-through is incomplete or interest rate are sticky when β_1 is less than 1 (Aziakpono and Wilson, 2010; De De Bondt, 2005).

The average long-run pass-through elasticity of the interbank rate with respect to the policy rate is computed as:

$$\text{Long-run pass-through elasticity} = \beta_1 \frac{Mean(Policy\ Rate)}{Mean(Interbank\ Rate)} \quad (4)$$

Step 2: Pass-through from the interbank rate to commercial bank retail rates

In step 2, the extent of the pass-through from the interbank rate to bank retail rates (lending and deposit rates) is specified as:

Long run:

$$cbr_t = \theta_0 + \theta_1 ibr_t + \mu_t cbr_t = \theta_0 + \theta_1 ibr_t + \mu_t \quad (5)$$

Short run:

$$\Delta cbr_t = \alpha_0 ecm_{t-1} + \sum_{K=1}^{K} \alpha_1 \Delta cbr_{t-K} + \sum_{K=1}^{K} \alpha_2 \Delta ibr_{t-K} + \mu_t \quad (6)$$

where cbr_t is a measure of commercial bank retail rates, in this study represented by the 6-month deposit and average lending rates; ibr_t ibr_t is the interbank rate; θ_1 is the coefficient measuring the degree of pass-through from the interbank rate to retail rates; $ecm_{t-1} = cbr_{t-1} - \theta_0 - \theta_1 ibr_{t-1}$ is the error correction term; Δ is the difference operator; and μ_t is the error term.

The long-run pass-through elasticity is computed as:

$$\text{Long-run pass-through elasticity} = \theta_1 \frac{Mean(Interbank\ Rate)}{Mean(Commercial\ banks' retail Rate)} \quad (7)$$

The half-life, defined as the time taken for a unit shock to disperse by half, is used in this study to assess the number of months that are required to achieve about 50 per

cent of the pass-through (Louangrath, 2014; Das, 2015). In the context of this paper, the half-life informs the degree of rigidity in retail interest, computed as follows:

$$Half\ life = \frac{\log 2 * time}{log\left[\frac{IQ}{FQ}\right]} \tag{8}$$

where IQ is the initial quantity before estimation at 100% and FQ is the final quantity that remains after accounting for the speed of adjustment in the initial quantity.

Further, to determine the nature of adjustment of the pass-through process when the policy rate is increased and decreased, the study follows Aziakpono and Magdalene (2010) by splitting the residuals from Equation 6 into positive and negative series as follows:

$$ecm_{t-1}^{+} = ecm_{t-1} \quad \text{if} \quad ecm_{t-1} > \mu$$

$$ecm_{t-1} = 0 \quad \text{if} \quad ecm_{t-1} < \mu \tag{9}$$

$$ecm_{t-1}^{-} = 0 \quad \text{if} \quad ecm_{t-1} < \mu$$

$$ecm_{t-1} = 0 \quad \text{if} \quad ecm_{t-1} > \mu \tag{10}$$

where μ is the mean of the residual from the cointegration equation. The asymmetric specifications in Equations 9 and 10 are introduced as separate dummy variables in the error correction model to obtain an asymmetric short-run dynamic equation specified as:

$$\Delta cbr_t = \alpha_0 + \alpha_1 ecm_{t-1}^{+} + \alpha_2 ecm_{t-1}^{-} \sum_{K=1}^{K} \alpha_3 \Delta\, cbr_{t-K} + \sum_{K=1}^{K} \alpha_4 \Delta\, ibr_{t-K} + \mu_t \tag{11}$$

where α_1 and α_2 are coefficients of the error correction term representing policy rate increases (contractionary monetary policy) and declines (expansionary monetary policy), respectively. To confirm the results obtained here, the Wald test is carried out to establish the equality between the coefficients of the two error correction terms (positive and negative). Asymmetry is confirmed if the null hypothesis of α_3=α_4= 0 is rejected at a 10% level of significance.

Estimation and testing

Similar to Mbowe (2015) and Das (2015), this study used a cointegration approach to estimate Equations 2 and 5 over the period April 2012 to December 2019 with an appropriate lag determined based on information criteria. The short-run equations were estimated using the ordinary least squares method.

When variables are integrated of the same order, widely used cointegration procedures include those by Engle and Granger (1987) and Johansen and Juselius (1994). In this study, the Johansen cointegration method is used. 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 procedure generates an estimator in a single stage based on estimates of the matrix rank when the eigenvalues are obtained. Conversely, the Johansen method test results are invariant to the choice of the variable selected for normalization thereby avoiding conflicting conclusions. It is also easy to derive an error correction model under this approach through a simple linear transformation which integrates short-run adjustments with long-run equilibrium without losing long-run information.

Data description and sources

Monthly data for the period April 2012 to December 2019 were used, which is summarized in Table 1. During this period, the monetary policy regime changed to interest rate targeting from the previous monetary aggregate approach.

Table 1: Summary of data

	Variable description	Unit of measurement	Source
pr_t	Policy rate	Percentage	Bank of Zambia Statistics Fortnightly
ibr_t	Interbank rate	Percentage	Bank of Zambia Statistics Fortnightly
lr_t	Lending rate	Percentage	Bank of Zambia
dr_t	Deposit rate	Percentage	Bank of Zambia Statistics Fortnightly

The policy rate is a key tool used to signal the monetary policy stance. It also provides a credible and stable anchor to financial market participants in setting their own interest rates. The overnight interbank rate is the operating target in the monetary policy framework which the BoZ seeks to influence in the monetary policy transmission scheme. It is the rate at which banks access credit in the interbank money market on an overnight basis, and represents the initial cost of funds. The interbank money market, therefore, serves as a conduit through which monetary policy decisions or impulses are transferred into the retail banking sector. The lending rate is the average cost of funds when commercial banks extend credit to

households and firms. In the case of Zambia, lending rates are determined on the basis of the prevailing monetary policy rate set by the BoZ plus a margin to reflect the riskiness of a borrower. Lending rates are used in this study as they transfer the monetary policy decisions into the real sector since it signifies the benchmark cost of credit. The deposit rate reflects the amount of funds paid out in interest by a bank or financial institution on cash deposits. It also transfers monetary policy decisions into the real sector.

5. Empirical findings and discussion

Tables 2 and 3 highlight the descriptive statistics and a summary of a pairwise correlation matrix.

Table 2: Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.
pr_t	11.48	10.25	15.50	9.00	2.23
ibr_t	12.84	11.16	27.37	7.54	4.69
lr_t	22.47	23.82	29.46	16.02	4.38
dr_t	9.50	9.51	13.26	6.76	1.83

Table 3: Summary of pairwise correlations

	pr_t	ibr_t	lr_t	dr_t
pr_t	1			
ibr_t	0.8336	1		
lr_t	0.5781	0.3708	1	
dr_t	0.8995	0.6992	0.7449	1

To ensure that spurious relationships typically associated with time series data are avoided, stationarity tests were performed on the data using the Augmented Dickey-Fuller (ADF) unit root test. The ADF unit root results in Table 4 show that all the variables are integrated of order one.

Table 4: Augmented Dickey-Fuller unit root results

	t-ADF level	Lags	t-ADF first difference	lags	Deterministic terms	Order of integration	Variable description
pr_t	-1.24	0	-8.86***	0	C&T	I(1)	Policy rate
ibr_t	-2.51	1	-7.18***	0	C&T	I(1)	Interbank rate
lr_t	-1.18	0	-8.57***	0	C&T	I(1)	Lending rate
dr_t	-1.44	1	-6.72***	0	C&T	I(1)	Deposit rate

***, ** and * imply 1%, 5% and 10% levels of significance; C and T are constant and linear trends included in the ADF test, respectively.

Based on the Akaike Information Criterion (AIC), four lags were considered appropriate for the model to estimate the pass-through from the policy rate to the interbank rate (Table 5). In the case of the models estimating the pass-through from the interbank rate to the lending and deposit rates, two and three lags were used, respectively (Table 5).

Table 5: VAR lag order selection criteria

Endogenous variables: $ibr_t\ pr_t ibr_t\ pr_t$

Exogenous variables: $Dummy\_ibr_t Dummy\_ibr_t$

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-322.3040	NA	7.403877	7.677741	7.792689	7.723976
1	-193.2154	246.0277	0.390185	4.734479	4.964376	4.826950
2	-176.8197	30.47671	0.291572	4.442816	4.787661*	4.581522*
3	-173.7100	5.634017	0.297937	4.463765	4.923558	4.648706
4	-167.4594	11.03042*	0.282874*	4.410810*	4.985551	4.641987
5	-166.0672	2.391308	0.301258	4.472170	5.161860	4.749582

Endogenous variables: $lr_t lr_t\ \ ibr_t ibr_t$

Exogenous variables: $Dummy\_lr_t Dummy\_lr_t$

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-458.9371	NA	184.3620	10.89264	11.00759	10.93887
1	-244.8882	407.9521	1.316129	5.950310	6.180206*	6.042781*
2	-239.7142	9.617544*	1.280695*	5.922686*	6.267531	6.061393
3	-236.7051	5.451692	1.311755	5.946003	6.405796	6.130945

Endogenous variables: $dr_t dr_t\ ibr_t ibr_t$

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-186.7062	NA	0.304668	4.487204	4.602152	4.533439
2	-179.4492	13.83096	0.282226*	4.410569	4.640465	4.503040
3	-176.1284	6.172744	0.286868	4.426550*	4.771395*	4.565257*
4	-172.6997	6.211889	0.290939	4.439994	4.899787	4.624936

Impulse dummies $Dummy\_ibr_t Dummy\_ibr_t$ and $Dummy\_lr_t Dummy\_lr_t$ were respectively included in the interbank and lending rate equations to account for the effect of

deliberate policy decision to allow the interbank rate to deviate substantially from the policy rate corridor. This was important in the model specification to achieve cointegration and broadly obtain plausible results.

The Johansen cointegration approach was conducted on Equations 2 and 5 after establishing that the variables under consideration are integrated of the same order 1. The results reveal the existence of a cointegrating relationship among the variables of interest (Table 6).

Table 6: Johansen cointegration approach

Cointegration analysis of the interbank rate and policy rate				
Hypothesized No. CE(s)		None *	At most 1	
λ_{trace} test		84.72		4.48
Eigenvalue		0.5982		0.0497
95 per cent critical value		20.26		9.16
$\lambda_{maximum\ eigenvalue}$ test	24.51		3.84	
Eigenvalue		0.2384		0.0329
95 per cent critical value		15.49		3.84
Cointegration analysis of the lending rate and interbank rate				
Hypothesized No. CE(s)		None *	At most 1	
λ_{trace} test		30.31		5.73
Eigenvalue		0.2389		0.0617
95 per cent critical value		20.26		9.16
$\lambda_{maximum\ eigenvalue}$ test	17.16		1.68	
Eigenvalue		0.1719		0.0183
95 per cent critical value		17.15		3.81
Cointegration analysis of the deposit rate and interbank rate				
Hypothesized No. CE(s)		None *	At most 1	
λ_{trace} test		18.16		2.68
Eigenvalue		0.1846		0.0292
95 per cent critical value		14.26		3.84
$\lambda_{maximum\ eigenvalue}$ test	20.00		1.90	
Eigenvalue		0.2455		0.0264
95 per cent critical value		14.26		3.85

*denotes rejection of the null hypothesis at the 0.05 level.

According to Engle and Granger (1987), if there is evidence of cointegration in the data, it is appropriate to estimate an error correction model. In this regard, a vector error correction model (VECM) was estimated, and the results are summarized in Table 7a.

The models passed all the diagnostic tests except for normality in the two-retail interest rate equations. Nonetheless, the results are suited for policy use as the Johansen cointegration method is robust to non-normal errors (Diouf, 2007).

Table 7a: Cointegration, half-life and weak exogeneity test results

Long-run cointegrating results					
	Policy rate to interbank rate		Interbank rate to lending rate		Interbank rate to deposit rate
ibr_{t-1}	1.00	lr_{t-1}	1.00	dr_{t-1}	1.00
pr_{t-1}	1.32(16.4)***	ibr_{t-1}	0.68(4.9)**	ibr_{t-1}	0.46(7.24)**
c	2.95(3.3)**	c	-14.06(-7.5)**	c	0.03(0.9)
ibr_t mean value	12.8	$lr_t lr_t$ mean value	21.6	$dr_t dr_t$ mean value	9.50
pr_t mean value	11.5	$ibr_t ibr_t$ mean value	12.8	$ibr_t ibr_t$ mean value	12.8
Long-run pass-through elasticity from policy to interbank rate	1.10	Long-run pass-through elasticity from interbank to lending rate	0.40	Long-run pass-through elasticity from interbank to deposit rate	0.62
Vector error correction model					
	Δibr_t		Δlr_t		Δdr_t
ecm_{t-1}	-0.62(-9.0)**	ecm_{t-1}	-0.10(-4.6)**	ecm_{t-1}	-0.09(-3.3)**
Δibr_{t-1}	0.10(1.3)	Δlr_{t-1}	0.02(0.2)	Δdr_{t-1}	0.19(1.7)*
Δibr_{t-2}	0.10(1.3)	Δibr_{t-1}	0.03(0.8)	Δdr_{t-2}	0.09(0.7)
Δibr_{t-3}	0.08(1.1)	D_lr	0.56(3.43)**	Δibr_{t-1}	0.02(0.9)
Δpr_{t-1}	1.23(5.3)**			Δibr_{t-2}	-0.00(-0.5)
Δpr_{t-2}	0.56(2.2)**				
Δpr_{t-3}	-0.16(-0.6)				
D_ibr	5.42(7.7)**				
Adjusted R^2	0.70		0.58		0.66
LM test	0.6236[0.6464]		0.876476[0.4794]		1.46.280[0.2167]
ARCH 1	0.7652[0.5775]		0.708979[0.1049]		41.47995[0.2440]
J-B Normality	4.1589[0.1250]		25.01308[0.0000]		13.83981[0.0010]
RESET Test	0.91918[0.3405]		0.53232[0.5906]		2.00923[0.1604]

t-values in parentheses; probability values in brackets, *, ** and *** denote significance at 10%, 5% and 1% levels

Table 7b: Half-life and weak exogeneity test

	Policy rate to interbank rate	Interbank rate to lending rate	Interbank rate to deposit rate
Months	1.0	7.0	7.3
IQ	100	100	100
FQ	36	90	91
Weak exogeneity test			
	Ho: interbank rate (^{ibr_t}) is weakly exogenous $\chi^2(4) = 59.7[0.00]$	Ho: lending rate (^{lr_t}) is weakly exogenous $\chi^2 = 15.5[0.00]$	Ho: deposit rate (^{lr_t}) is weakly exogenous $\chi^2 = 9.64[0.00]$
	Ho: policy rate (^{pr_t}) is weakly exogenous $\chi^2(4) = 2.69[0.10]$	Ho: interbank rate (^{ibr_t}) is weakly exogenous $\chi^2 = 2.51[0.11]$	Ho: interbank rate (^{ibr_t}) is weakly exogenous $\chi^2 = 2.38[0.12]$

Probability values in parentheses.

In the long run, the interbank rate responds to monetary policy changes on a one-to-one basis. The policy rate coefficient of 1.32 in the interbank rate equation translates into a long-run pass-through elasticity of 1.10% from the policy rate to the interbank rate. This demonstrates the effectiveness of monetary policy transmission in the first step. This result is similar to Kleimeier and Sander (2006) for the Eurozone, Das (2015) for India and Chileshe and Akambi (2016) for Zambia. The complete pass-through can be attributed to the active use of open market operations by the BoZ to limit the fluctuations of the interbank rate within the set corridor and keep it as close as possible to the policy rate.

The policy rate also has a short-run decaying effect on the interbank rate. The cumulative positive impact is about 1.8 percentage points for lags one and two. The interbank rate exhibits persistence given the statistically significant lagged coefficients. In addition, the adjustment to equilibrium following a shock is relatively fast, at 62% per month. Based on the weak exogeneity test result, the interbank rate is endogenous while the policy rate is weakly exogenous implying that when there is a shock in the relationship between the policy rate and the interbank rate, it is the interbank rate that adjusts to re-establish equilibrium. Further, it takes one month for 50% of the pass-through from a change in the policy rate to the interbank rate, a result similar to that of Mbowe (2015). Lastly, the decision to deliberately allow the interbank rate to exceed the upper bound of the policy rate corridor in order to contain aggregate demand resulted in a substantially higher increase in the interbank rate by slightly over 5 percentage points.

Unlike the thorough response of the interbank rate to the policy rate adjustment, the long-run pass-through from the interbank rate to deposit and lending rates is incomplete. This implies that deposit and lending rates are sticky. The stickiness in the deposit and lending rate results is consistent with those of Liu et al (2008), Das (2015), Aziakpono and Wilson (2013), Mbowe (2015) and Zgambo and Chileshe (2014). The coefficients of 0.68 and 0.46 in the lending and deposit rate equations translate

into long-run pass-through elasticities of 0.40 and 0.62, respectively. This suggests that, during the sample period, commercial banks considered other factors to be more significant in setting lending and deposit rates than changes in the interbank rate. This lends support to the collusive behaviour hypothesis and the market structure, which suggests that bank competition plays a cardinal role in the transmission process. Thus, banks that operate in less competitive markets tend to be less sensitive to customer reaction and are more likely to adjust interest rates to their advantage when they exercise market power (Laudadio, 1987; Scholnick, 1996; Lim, 2001; De Bondt, 2005). In the case of Zambia, this is consistent with the empirical findings by Simpasa (2013), Mutoti (2006) and Musonda (2008) who found that the banking industry is highly concentrated and monopolistic in nature. It was revealed that the largest four private banks accounted for over 74% of total banking assets and about 67% of total banking sector deposits.

Further, it was established that lending rates are stickier than deposit rates as about 40 per cent of the changes in the interbank rate induced by the policy rate are passed on to the former, compared with slightly over 60 per cent for the latter. The sensitivity differences between the deposit and lending rates to interbank changes could be the result of maturity profile disparities of commercial banks' assets (loans) and liabilities (deposits), which expose commercial banks to interest rate risk. This makes commercial banks reluctant to adjust interest rates each time the policy rate changes. For example, reducing the lending rate for outstanding loans and advances where capital was borrowed at a higher rate would result in a loss by commercial banks that are still paying their liabilities at a higher interest rate (Weth, 2002).

The long-run evidence suggests that monetary policy pass-through exhibits some decreasing effect as the strength of the policy rate signal is lost along the way during the transmission process. The declining effect of monetary transmission through the different stages of the transmission process decreases the efficacy of monetary policy in achieving the ultimate goal.

In the short run, changes in the interbank rate have a weak positive influence on both deposit and lending rates as all the lagged coefficients are statistically insignificant. The deposit rate tends to be driven by its own past changes (lag one), whereas the significant deviation of the interbank rate from the corridor played a key role in raising lending rates over the sample period by almost 60 basis points (0.6 percentage points). Further, the weak exogeneity test results reveal that both deposit and lending rates are weakly endogenous to the interbank rate in that they are the ones that adjust when the shock occurs instead of the interbank rate to re-establish equilibrium, and it takes almost the same time (seven months) for 50% of the pass-through from a change in the interbank rate to deposit and lending rates. This is similar to the finding of Das (2015) that the speed of adjustment and half-life between the key monetary policy rate and lending rate in India is 4.2% and 8.1 months, respectively. The low and sluggish size and speed of short-run adjustments in the lending rate may imply that in the short run monetary policy could have a limited impact on the interest rate channel, which is in line with the findings by Petrevski and Bogoev (2012).

Overall, the result suggests that in the short run the speed of adjustment of the deposit and lending rate to changes in the interbank rate is slow and of similar magnitude. However, this differs from the findings by Das (2015) who found that the deposit rate adjusts to deviations from the interbank rate more quickly than the lending rate. This variation could be explained by heterogeneity in the financial market structures for the two markets under discussion. Evidence on the incomplete pass-through in the second stage of the transmission process is an indication that it may take a considerable amount of time before the effect of a monetary policy action such as changes to the official policy rate can be felt.

To establish the nature of the pass-through process during the rise and fall of the policy rate, residuals from the cointegrating equation of the retail interest rates and interbank rate are split into two new series: ecm^{-}_{t-1} and ecm^{+}_{t-1}, respectively, representing expansionary and contractionary monetary policy. An asymmetric test was conducted using the Wald test and the results are summarized in Table 8.

Table 8: Asymmetric short-run VECM

	Interbank rate to lending rate		Interbank rate to deposit rate
c	0.07(0.45)	c	0.02(0.36)
ecm^{-}_{t-1}	-0.08(-2.02)*	ecm^{-}_{t-1}	-0.10(-2.4)**
ecm^{+}_{t-1}	0.12(2.03)**	ecm^{+}_{t-1}	0.07(0.12)
Δlr_{t-1}	-0.02(-0.17)	Δdr_{t-1}	0.18(1.70)*
		Δibr_{t-1}	0.02(0.76)
$Dummy\_lr$	0.545(3.21)***	Δibr_{t-2}	-0.01(-0.50)
	F(2,82)=9.1133[0.0003]		F(2,80)=5.4157[0.0062]
LM test	1.0913 [0.3715]		0.6350 [0.5327]
ARCH	0.5371 [0.8225]		1.7235 [0.4775]
J-B Normality	19.6158 [0.0000]		4.7213 [0.0044]
RESET Test	0.466532 [0.4964]		0.044099 [0.8342]

t-values in parentheses; probability values in brackets; *, ** and *** denote significance at 10%, 5% and 1% levels.

Broadly, the Wald test results reveal the existence of asymmetry in terms of the pass-through from the interbank rate to lending and deposit rates. The lending rate speed of adjustment coefficients of 0.08 for an expansionary and 0.12 for a contractionary monetary policy stance are both statistically significant. This result suggests that lending rates adjust more quickly to an increase in the interbank rate than to a decrease. The downward stickiness of the lending rates could possibly explain why the lending rates remained elevated over the sample period (Figure 2). With regard to the deposit rate, only the error correction term associated with expansionary monetary policy is statistically significant. The implication of this result is that deposit rates do not respond in the expected direction of the monetary policy

stance and could possibly explain why they have remained subdued over the sample period. This result is similar to those of Das (2015), Mbowe (2015), and Aziakpono and Wilson (2014). A possible explanation for this asymmetric behaviour would be that profit maximization is critical as far as commercial bank interest rate adjustments are concerned. Thus, commercial banks may delay adjusting lending rates and deposit rates during episodes of expansionary and contractionary monetary policy, respectively, in order to protect their profit margins.

6. Conclusion and policy implications

The aim of this study was to examine monetary policy transmission in Zambia by investigating the pass-through from the Bank of Zambia Policy Rate to commercial bank retail rates via the interbank market using a two-step estimation approach. Specifically, the study explored the magnitude and speed of the pass-through from the policy rate to lending and deposit rates, and also the symmetric/asymmetric behaviour of the pass-through with respect to the changes to the monetary policy stance (expansionary or contractionary). The findings of the study are instrumental in the formulation and implementation 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. A Johansen cointegration approach was carried out to establish the long-run relationship using monthly data from April 2012 to December 2019. The study results suggest the existence of significant and complete pass-through in the first step, and it takes about one month to achieve 50% of the pass-through. This suggests that the BoZ has succeeded in regulating liquidity supply in the system through the interbank market, thereby confirming the strength of the interest rate channel of monetary policy transmission. However, an incomplete pass-through of monetary policy changes to commercial bank interest rates via the interbank market was established in step two; it takes more than seven months to achieve at least 50% of the pass-through to both lending and deposit rates. This suggests that despite its presence, the interest channel of monetary policy may not be very strong in transmitting monetary policy changes to the real economy. In addition, an asymmetric adjustment of retail rates to monetary policy changes was established as deposit rates appear to respond faster to expansionary monetary policy while lending rates appear to be more sensitive to contractionary monetary policy. An incomplete and asymmetrical pass-through could be attributed to the underdeveloped and less competitive nature of financial markets in Zambia.

From a policy perspective, the findings indicate that monetary policy exhibits some decreasing effects as the pass-through becomes weaker during the second stage (interbank rate to commercial bank retail rates). The declining effect of monetary transmission during the second stage of the transmission process implies 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 lengthy time lags inherent in the transmission process require the BoZ to be forward-looking in its policy decisions through comprehensive economic forecasts. This will enable the central bank to carry

out pre-emptive rather than responsive monetary policy interventions so as to achieve the desired outcome within an ideal time. In addition, the asymmetric response of commercial banks' retail rates insinuates the existence of structural rigidities in the retail markets (loans and deposit) that may hinder the ability of the central bank to achieve the intended purpose when it signals to the market. Therefore, the Bank of Zambia must explore and identify these possible distortions and devise strategies of dealing with them to improve the impact of monetary policy.

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