Monetary Policy Pass-through to Firms and Households in Zambia

Cleopatra Ngoma

cngoma@boz.zm

Bank of Zambia

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ABSTRACT

This paper examines monetary policy pass-through from the interbank rate to SME, corporate, personal, and mortgage lending rates in Zambia using monthly data from April 2012 to July 2022. Employing cointegration techniques and nonlinear time-series models, the study estimates both long-run and short-run transmission and assess asymmetry in adjustment following monetary tightening and easing. Results show incomplete and heterogeneous pass-through across borrower segments, with stronger transmission in SME and personal lending rates and weaker adjustment in corporate and mortgage lending rates. Evidence of significant asymmetry is found, with banks adjusting more rapidly to monetary tightening than easing. Pass-through is further found to weaken during the 2015–2016 macroeconomic crises and the COVID-19 period, indicating increased financial frictions. The findings highlight structural rigidities in Zambia's credit market and suggest targeted policy measures to improve monetary transmission.

Keywords: Monetary Policy, Pass-through, NARDL, Lending Rates, Zambia

I. INTRODUCTION

Monetary policy, central bank actions that influence interest rates and money supply to achieve low and stable inflation as well as financial systems stability plays a key role in any given economy Mishkin (1996). Understanding the process of monetary policy transmission, the mechanisms through which central bank policy actions are communicated to the real economy, enables the central bank to guide the economy and is one of the cornerstones of modern monetary policymaking. A central element of transmission is how commercial banks alter lending and interest rates in response to policy changes.The transmission channels, as well as their strength and speed, define the efficacy of monetary policy. However, the mechanism is complex and can take many different forms depending on circumstances such as macroeconomic factors, financial market structure and growth, and the regulatory framework.Among the various channels of monetary policy transmission, the interest rate channel is the most scrutinised, especially with the increasing adoption of inflation targeting as a monetary policy framework, in it plays a central role Gigineishvili (2011).

The neoclassical and Keynesian economic theories provide a theoretical foundation for explaining monetary pass-through to retail interest rates through the interest rate channel. These theories offer complementary insights into how changes in central bank policy rates affect the cost of borrowing for retail consumers and consequently, the overall economy. While the Keynesian framework emphasises the role of market frictions and imperfections in credit markets that may affect the speed and magnitude of monetary policy transmission, the neoclassical view highlights the role of efficient markets and rational decision-making. Closely aligned with neoclassical principles is the marginal cost pricing model, which is commonly used in interest rate pass-through studies and suggests a direct link between interest rate movements and underlying costs. However, in the absence of perfect competition and complete information, interest rate pass-through departs from this ideal (Bernanke and Blinder, 1992; Mishkin, 1996; Taylor, 1995).

In April 2012, Zambia's monetary policy framework underwent a significant change, transitioning to interest rate targeting (IRT) from monetary aggregates targeting (MAT) that existed since the early 1990s by introducing the Policy Rate as a key interest rate to signal monetary policy stance (Bank of Zambia, 2012).Over the subsequent period, Zambia also experienced major macroeconomic and financial disruptions, most notably the 2015–2016 exchange rate crisis and energy shock, followed later by the COVID-19 pandemic. This regime shift, together with persistent disturbances in the macro-financial environment, provides a unique opportunity to re-examine how monetary policy is transmitted to retail interest rates under the current framework. Previous studies for Zambia have typically assessed monetary policy pass-through using the simple average lending rate (Chileshe and Akanbi, 2016; Ngoma and Chanda, 2022). However, this aggregate rate implicitly treats all retail lending rates as identical, masking

possible heterogeneity across loan products. As a result, it provides only limited insight into how monetary policy affects different segments of the real economy (Gertler and Gilchrist, 1994; de Haanet al., 2009; Abuka et al., 2019).

This study creates a unique borrower-segmented dataset with SME, corporate, personal, and mortgage lending rates gathered directly from Zambian commercial banks in order to get beyond the drawbacks of aggregate lending-rate analysis. This paper acknowledges that commercial banks may react differently to monetary tightening and easing due to credit risk considerations, relationship banking, liquidity constraints, and asymmetric information, in contrast to earlier research that assumes a linear and symmetric relationship between policy and retail lending rates. As a result, the study expands on the traditional pass-through literature by investigating the potential for asymmetric lending rate adjustment in addition to the degree and speed of monetary policy transmission across borrower categories. The study specifically looks into whether responses to rises and falls in the interbank rate differ between households and businesses. Under Zambia's interest-rate-targeting paradigm, this offers a more policy-relevant understanding of monetary transmission.

1.1 Monetary Policy Framework

Since its establishment in 1964, the Bank of Zambia has undergone successive legislative reforms with the most recently being the 2022 Act which has strengthened its mandate to formulate and implement monetary and supervisory policies focused on price and financial stability. Price stability, characterised by low and stable inflation, protects savings, reduces uncertainty, and supports investment and business planning, while financial stability promotes a resilient and well-functioning financial system capable of withstanding shocks and supporting sustainable economic growth.

Until April 2012, the Bank of Zambia operated a Monetary Aggregates Targeting framework, where reserve money as the operational target and broad money as the intermediate target to control inflation. The framework relied on a stable money multiplier to link reserve money to broad money, but growing instability in this relationship weakened the transmission from money supply to inflation. Consequently, achieving monetary targets no longer ensured low and stable inflation, undermining policy signalling and central bank credibility (Simpasa et al., 2015; Zgambo and Chileshe, 2014). As a response, in April 2012, Zambia transitioned to an interest rate targeting framework, introducing the Bank of Zambia Policy Rate as the key interest rate to signal monetary policy stance while the overnight interbank became operating target. Under this framework, policy implementation is conducted through a mid-rate interest rate corridor of -/+100 basis points around the policy rate, supported by open market operations to manage liquidity. However, as shown in Figure 1, the corridor has not always been binding, as evidenced by a substantial deviation between the Policy Rate and the overnight interbank rate in 2014 and 2016, when the interbank rate was deliberately allowed to exceed the upper bound of the policy rate corridor to contain inflationary pressures associated with exchange rate depreciation and electricity load-shedding (Ngoma and Chanda, 2022).

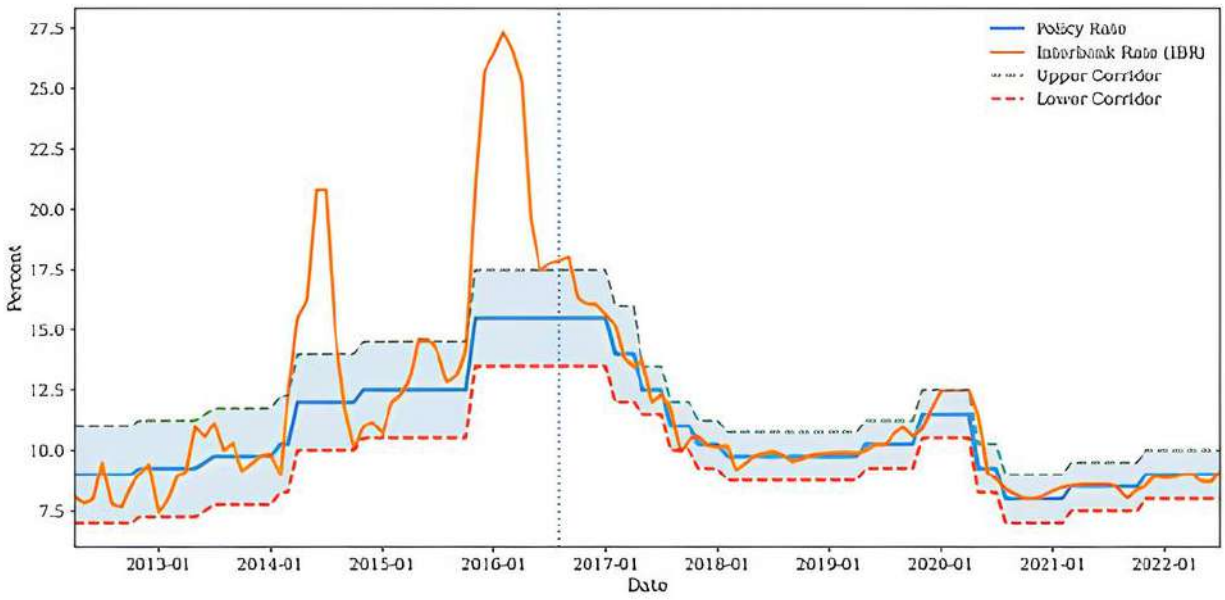

Figure 1
BoZ Policy Rate, Overnight Interbank Rate, and Interest Rate Corridor

II. LITERATURE REVIEW

2. 1 Theoretical Review

Traditional theories of interest rate pass-through developed for advanced economies with deep and well-functioning financial markets are not easily applicable to Sub-Saharan African (SSA) economies, where financial systems are often characterised by shallow markets, limited competition, information asymmetries, and structural and institutional constraints. To address these differences, the literature has adapted existing theoretical frameworks to better reflect the realities of developing economies. Two approaches dominate the theoretical analysis of monetary policy pass-through to SME and corpo- rate lending rates: the marginal cost pricing framework and the information asymmetry framework.

The marginal cost pricing theory, developed by Rousseas (1985), predicts a direct and complete transmission of changes in policy rates to retail lending rates under conditions of perfect competition, as banks price loans based on their marginal cost of funds. However, such conditions rarely hold in practice. Information asymmetry theory, advanced by Akerlof (1970), Spence (1973), andStiglitz (1975) , highlights how imperfect information between borrowers and lenders gives rise to adverse selection and moral hazard, which can weaken, delay, or distort the pass-through of monetary policy. These frictions may lead banks to adjust lending rates sluggishly or asymmetrically in response to policy changes, particularly in SSA economies where information constraints are more pronounced (Mishra and Montiel, 2012; Peiris and Cl´ement, 2010).

2.2 Empirical Review

A large body of literature examines monetary policy transmission and interest rate pass-through, initially focusing on advanced economies and more recently extending to emerging and developing countries. Early studies typically relied on aggregate or averaged interest rates to assess banks' responsiveness to policy changes. However, a growing strand of the literature largely for developed economies employs disaggregated loan categories and bank-level data to capture heterogeneity in pass-through across products and borrowers (Gertler and Gilchrist, 1994; De Bondt, 2002; Sorensen and Werner, 2006; de Haan et al., 2009; Ahmad and Aziz, 2013; Maravalle and Pandiella, 2022; Greenwood-Nimmo et al., 2022). These studies consistently show that monetary policy pass-through varies by loan type, institutional setting, and sample period, highlighting the limitations of aggregate measures.

Methodologically, studies using Error Correction Models (ECM), Vector Autoregressions (VAR), and Autoregressive Distributed Lag (ARDL) frameworks generally find that pass-through is stronger and more complete in the long run than in the short run. For example, De Bondt (2002) and Ahmad and Aziz (2013) document incomplete and sluggish short-run adjustment but near-complete long-run pass-through in the Euro Area and the UK, respectively. Similarly, Gregor and Melecky (2018), using ARDL for the Czech Re- public, find full long-run pass-through to SME, corporate, mortgage, and personal lending rates, alongside weak short-run transmission. Cross-country panel approaches, such as Sorensen and Werner (2006),further demonstrate substantial heterogeneity across countries and retail products, with corporate and mortgage rates often responding differently to policy shocks.

Evidence from emerging and developing economies points to weaker and more heterogeneous pass-through, often reflecting structural constraints. Studies for Mexico, India, Pakistan, and Nigeria find incomplete, asymmetric, and loan-specific transmission, with stronger responses in short-term or unsecured lending relative to long-term or real estate loans (Das, 2015; Maravalle and Pandiella, 2022; Choudhary et al., 2012; Oyadeyi, 2022). In Sub-Saharan Africa, the literature remains limited and predominantly relies on aggregate, unweighted interest rates. Existing studies suggest that information asymmetries, excess liquidity, weak competition, and institutional frictions dampen the effectiveness of interest-rate transmission(Sacerdoti, 2005; Gigineishvili, 2011; Mishra and Montiel, 2012).

2.3 Monetary Policy Pass-through in Zambia

For Zambia, early studies focused on broad monetary transmission mechanisms using aggregate macroeconomic indicators, largely before the adoption of interest rate targeting in 2012 (Munancinga, 2004; Mutoti, 2006). Subsequent work confirms the existence of a bank lending channel and highlights the role of bank size and competition, but continues to rely on aggregate lending rates and mixed policy regimes (Simpasa et al., 2015; Chileshe, 2016; Chileshe and Akanbi, 2016). More recently, Ngoma and Chanda (2022) provide the first explicit analysis of monetary policy pass-through under the interest rate-targeting framework, documenting complete pass-through to the interbank rate but incomplete and asymmetric transmission to aggregate retail rates. Building on this work, the present study contributes by employing newly constructed, borrower-specific lending rates for SMEs, corporates, personal loans, and mortgages. By using disaggregated and weighted interest rates under the current policy regime, the study provides a more granular and policy-relevant assessment of monetary policy transmission in Zambia, aligning the domestic evidence with international best practice and addressing a key gap in the existing literature.

2.4 Asymmetric Monetary Policy Pass-through

Recent empirical literature increasingly recognises that monetary policy pass-through may be nonlinear and asymmetric, particularly in developing economies characterised by imperfect competition, shallow financial markets, and elevated credit risk (Yahaya & Bello, 2026). Under asymmetric pass-through, commercial banks may respond more rapidly to monetary policy tightening than easing, or vice versa, implying that retail lending rates do not adjust uniformly to positive and negative policy shocks.

Several theoretical explanations support asymmetric adjustment behaviour. First, banks may increase lending rates rapidly during periods of monetary tightening to preserve profit margins and compensate for heightened default risk, while adjusting downward more slowly during easing cycles due to menu costs, market power, or balance-sheet considerations (Hannan & Berger, 1991; Scholnick, 1999). Second, relationship banking may weaken downward adjustment for large corporate borrowers, as banks smooth lending conditions for preferred clients (Berlin & Mester, 1999). Third, information asymmetries are generally more pronounced for SMEs and unsecured household lending, increasing sensitivity to changes in monetary conditions (Stiglitz & Weiss, 1981).

Empirical evidence also supports asymmetric pass-through dynamics. Greenwood-Nimmo et al. (2022) document nonlinear interest-rate transmission during the COVID-19 period, while Maravalle and Pandiella (2022) find significant asymmetries in retail lending-rate adjustment across borrower categories. Similarly, Choudhary et al. (2012) show that pass-through differs across lending products due to variations in loan maturity, collateralisation, and borrower risk profiles.

Despite this growing literature, evidence on asymmetric monetary policy transmission in Sub-Saharan Africa remains limited, particularly using borrower-segmented lending rates. Existing studies for Zambia largely rely on aggregate lending rates and linear specifications, potentially masking important nonlinearities across credit markets. This study contributes to the literature by examining asymmetric pass-through across SME, corporate, personal, and mortgage lending rates under Zambia's interest-rate-targeting regime.

III. METHODOLOGY

In the ideal world of complete information with perfect competition, prices (interest rates) are based on marginal costs, with a one-to-one correspondence between the change in prices and marginal costs. This implies a strong positive relationship between the wholesale monetary policy rates and market retail rates charged by commercial banks. However, where the assumption of complete information and perfect competition is violated, the rate of change of prices with respect to marginal costs is less than one due to the influence of other factors. For instance, commercial banks include an additional premium on retail rates to account for risk and maturity conversions linked to their operations. In the context of this study, the marginal cost pricing model in line with Rousseas (1985), modified by De Bondt (2002) and Gigineishvili (2011) is formalized as follows:

$$cr = \beta_0 + \beta_1 mc \qquad (1)$$

Where cr_t refers to denotes the commercial bank retail lending rate at time t, mc_t is the marginal cost proxied by an analogous market interest rate, β_0 is a constant markup, and β_1 measures the degree of interest rate pass-through and ε_t is the error term.

When $\beta = 1$, pass-through is complete, indicating fully competitive markets with complete information. When $\beta_1 < 1$, interest rate pass-through is incomplete, implying that banks possess some degree of market power. Conversely, when $\beta 1 > 1$, banks react to changes in the cost of funds(mc) on a more than one-to-one basis, suggesting overreaction to market interest rate movements, potentially reflecting heightened risk considerations or incentives to amplify the impact of cost changes (Coricelli et al., 2006). The baseline model is defined as follows:

$$MR_t = \Psi_0 + \Psi_1 OR_t + \Psi_2 CSD_t + \varepsilon_t, \qquad (2)$$

It is important to note that theoretical literature on interest rate pass-through typically stresses the complex nature of real-world financial systems, recognizing the necessity to include extra factors or variables in addition to the basic marginal cost pricing model. These expansions enable a more comprehensive understanding of the dynamics affecting commercial bank interest rate setting, incorporating the effect of factors such as GDP, inflation, and liquidity. For instance, incorporating GDP is one way of recognizing the influence of macroeconomic conditions on banks' pricing decisions. Variations in GDP growth can impact banks' perceptions of risk and default possibilities (Carlstrom and Fuerst, 2001; Holmstrom and Tirole, 1998).Banks may be more inclined to decrease interest rates during episodes

of economic boom to boost lending and investment, but during periods of economic collapse, they may be more likely to raise rates to limit credit risk.

Incorporating liquidity as a measure of bank size captures its influence on the behaviour of financial institutions during the interest rates adjustment process, such as how bank size affects interest rates during times of economic stress. According to Kashyap and Stein (2000), larger banks seem to have higher liquidity buffers, enabling them to modify interest rates more flexibly in reaction to shifts in market conditions while the opposite is true for small banks. This extension of the marginal cost pricing framework enhances the model's relevance in capturing the complex nature of the interest rates pass-through to the real world. Incorporating the Consumer Price Index (CPI) addresses effects of inflation (Galı and Gertler, 1999; Smets and Wouters, 2007).

3.1 Empirical Model

The study employs the Johansen cointegration approach to examine monetary policy transmission to SME, corporate, personal, and mortgage lending rates (Mbowe, 2015; Das, 2015). This method requires all variables to be integrated of order one, I (1), consistent with the Engle and Granger (1987) and Johansen and Juselius (1994) frameworks. Unlike the two-step Engle–Granger procedure, which may propagate estimation errors across stages, the Johansen method estimates cointegrating relationships in a single system, allowing direct identification of the number and structure of long-run equilibria without imposing prior restrictions. Moreover, the Johansen framework facilitates straightforward construction of an error correction model (ECM), enabling simultaneous analysis of short-run dynamics and long-run equilibrium adjustment while preserving long-term information (Johansen, 1991).

3.1.1 The Error Correction Model

In this study, the ECM offers a coherent framework for quantifying the speed and magnitude of dynamic monetary policy pass-through to SME, corporate, mortgage, and personal lending rates. The long-run and short-run empirical models for the interest rate pass-through are specified as follows (Mbowe, 2015; Das, 2015):

Long run:

$$cbr_t = \theta_0 + \theta_1\, ibr_t + X_t + \mu_t \tag{3}$$

Short Run:

$$\Delta cbr_t = \alpha_0\, ecm_{t-1} + \sum_{k=1}^{K} \alpha_1\, \Delta cbr_{t-k} + \sum_{k=1}^{K} \alpha_2\, \Delta ibr_{t-k} + \sum_{k=1}^{K} \alpha_3\, \Delta X_{t-k} + \Delta D_{ibr,t-k} + \mu_t \tag{4}$$

Where cbr_t denotes commercial bank retail lending rates (SME, corporate, personal, and mortgage), X_t is a vector of control variables including GDP, liquidity, and CPI, Dibr is a dummy variable capturing episodes in which the interbank rate deviated from the policy rate corridor during periods of exchange rate depreciation, and μ_t is the error term. The term ecm_{t-1} represents the error correction component, while α_0 denotes the speed-of-adjustment coefficient, measuring the rate at which deviations from long-run equilibrium are corrected.

Short-run dynamics are visualised to gain insights into the immediate effects of shocks and the speed of adjustment towards equilibrium. By plotting these dynamics, it is possible to observe the impact of transitory shocks and the persistence of deviations from equilibrium (Taylor, 2000; Perotti, 2005; De Bondt, 2005; Gemmell et al., 2011).

Although the theoretical framework identifies the policy rate as the primary determinant of retail lending rates, the empirical analysis uses the interbank rate as a proxy for monetary policy, consistent with the Bank of Zambia's price-based operating framework in which the interbank rate serves as the operational target (Bank of Zambia, 2018). The interbank rate provides a more timely and market-based indicator of banks' marginal funding costs and liquidity conditions than the policy rate, which is revised less frequently (quarterly) and may remain constant for extended periods.

3.2 Robustness Checks

To validate the core results, robustness checks are conducted in two stages. First, the core models (3) and (4) are re-estimated using the data from 2012:04 to 2020:04 prior to the declaration of COVID-19 as a national disaster in Zambia. Comparing this to estimates for the full period to 2022:07 allows the study to assess whether the COVID-19 pandemic had an influence on monetary policy pass-through.

A visual inspection of the data reveals a widening spread between commercial lending rates and the interbank rate after August 2016, suggesting a potential structural change in the Zambian economy that may have altered the functioning of the credit market (see Figure 2).

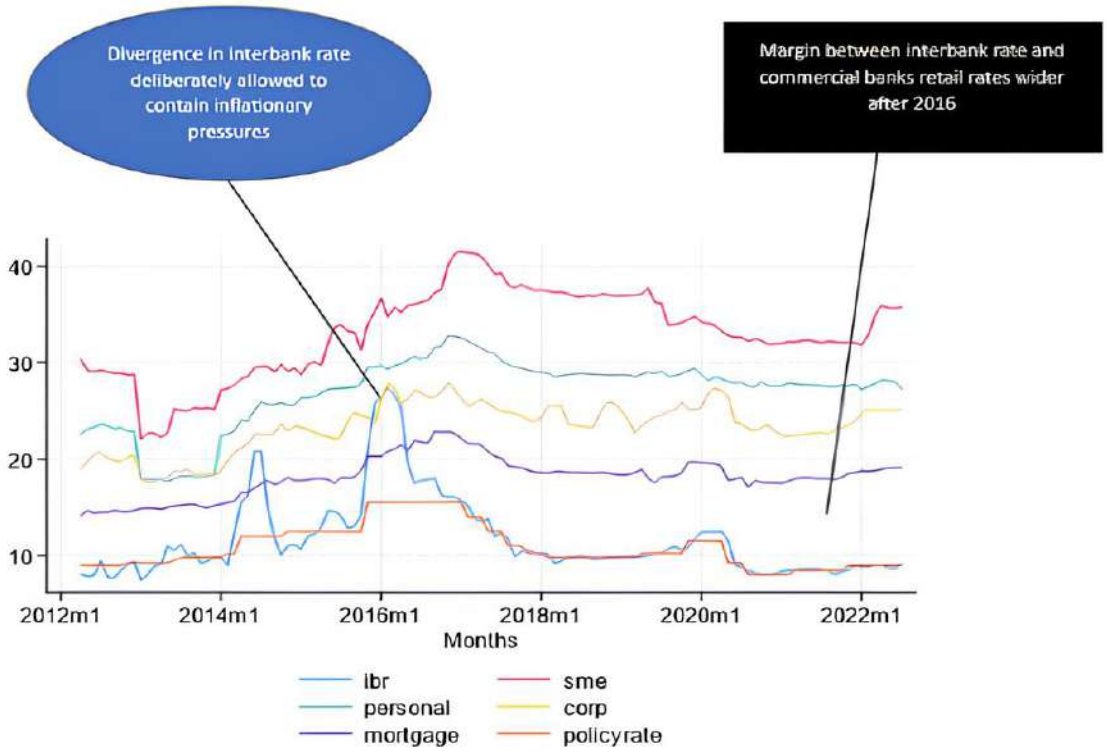

Figure 2
Interbank Rate, SME, Corporate and Mortgage Retail Rates

To formally assess this possibility, the sequential Zivot–Andrews unit root test was applied (Zivot and Andrews, 1992), identifying a statistically significant structural breakpoint in August 2016, with a test statistic of −6.261 significant at the 1% level. This breakpoint coincides with a sequence of major policy interventions, including the tightening of the Overnight Lending Facility by 600 basis points in 2014, an increase in the statutory reserve ratio from 14% to 18% in April 2015, the tightening of exchange rate regulations in October 2015, and a sharp increase in the policy rate from 12.5% to 15.5% in November 2015 (Chipili et al., 2019). Collectively, these measures reflect a markedly contractionary monetary policy stance and substantial liquidity tightening, which likely reshaped interbank market dynamics and altered the transmission of policy impulses to retail lending rates.

Given this, the full sample is divided into two distinct periods: April 2012 to July 2016 and August 2016 to July 2022. Since the sub-sample analysis reduces the number of observations, an ARDL estimation technique is employed as it is well suited for small samples and provides reliable short-run and long-run estimates, provided the model remains dynamically stable (Pesaran et al., 1999).

The estimated ARDL model is specified as:

Long-run ARDL (p, q):

$$cbr_t = C_0 + \sum_{i=1}^{p} \Psi_{0i}\, cbr_{t-i} + \sum_{i=0}^{q} \Psi_{1i}\, ibr_{t-i} + \sum_{i=0}^{q} \Psi_{2i}\, X_{t-i} + \varepsilon_t. \qquad (5)$$

Where C denotes the model intercept; *cbrt*represents commercial bank retail lending rates (personal, mortgage, corporate, and SME); *ibrt* denotes the interbank rate, which proxies the monetary policy stance; X_t is a vector of control variables including GDP, CPI, and liquidity; and ε_t is the idiosyncratic error term.

It is convenient to reparameterise the generalised ARDL model into an error correction (EC) form to enhance interpretability. Following Kripfganz and Schneider (2023), the reparameterised short-run ARDL error correction specification is given by:

$$\Delta cbr_t = C_0 - \lambda ECT_{t-1} + \sum_{i=1}^{p-1} \delta_{1i}\, \Delta cbr_{t-i} + \sum_{i=0}^{q-1} \delta_{2i}\, \Delta ibr_{t-i} + \sum_{i=0}^{q-1} \delta_{3i}\, \Delta X_{t-i} + \delta_4 D_{ibr,t} + \varepsilon_t. \quad (6)$$

Where ECT_{t-1}denotes the error correction term capturing deviations from long-run equilibrium in the previous period, and λ is the speed-of-adjustment coefficient, measuring the rate at which such deviations are corrected following a shock. The dummy variable $Dibr_t$ takes the value one in months when the interbank rate diverged from the policy rate corridor, most notably during the 2015–2016 economic shock, and zero otherwise. The parameters δ_1,δ_2, and δ_3 represent short-run dynamic coefficients, while δ_4 captures the effect of the policy-regime dummy.

The coefficients in the short-run error correction model can be mapped algebraically to those in the long-run ARDL specification as:

$$\lambda = 1 - \sum_{i=1}^{p} \Psi_{0i}, \quad (7)$$

$$\phi_1 = \frac{\sum_{i=0}^{q} \Psi_{1i}}{\lambda}, \quad \phi_2 = \frac{\sum_{i=0}^{q} \Psi_{2i}}{\lambda}. \quad (8)$$

The corresponding error correction term is defined as:

$$ECT_{t-1} = (cbr_{t-1} - \phi_1\, ibr_{t-1} - \phi_2\, X_{t-1})\,. \quad (9)$$

For empirical implementation, the following ARDL specification is estimated in Stata, which yields both long-run and short-run coefficients simultaneously:

$$\Delta cbr_t = C_0 + \pi_0\, cbr_{t-1} + \pi_1\, ibr_{t-1} + \pi_2\, X_{t-1} + \sum_{i=1}^{p-1} \delta_{1i}\, \Delta cbr_{t-i} + \sum_{i=0}^{q-1} \delta_{2i}\, \Delta ibr_{t-i} + \sum_{i=0}^{q-1} \delta_{3i}\, \Delta X_{t-i} + \delta_4 D_{ibr,t} + \varepsilon_t. \quad (10)$$

From the above model, the speed-of-adjustment coefficient and long-run elasticities are recovered as:

$$\lambda = -\pi_0, \quad (11)$$

$$\phi_1 = \frac{\pi_1}{\lambda}, \quad \phi_2 = \frac{\pi_2}{\lambda}. \quad (12)$$

Lag lengths **were** selected using the Akaike Information Criterion alongside residual diagnostics, including tests for stationarity, cointegration, serial correlation, and stability. Where the AIC and diagnostic tests implied different lag structures, diagnostic adequacy was prioritised to reduce the risk of misspecification (Juselius, 2006; Lütkepohl, 2005).

3.3 Nonlinear ARDL (NARDL) Model

To capture potential asymmetries in monetary policy transmission, the study extends the baseline ARDL framework using the nonlinear autoregressive distributed lag (NARDL) model of Shin et al. (2014). This approach allows positive and negative changes in the interbank rate to have differential effects on retail lending rates.

The interbank rate is decomposed into partial sum processes as follows:

$$IBR_t^+ = \sum_{j=1}^{t} \Delta IBR_j^+, \quad IBR_t^- = \sum_{j=1}^{t} \Delta IBR_j^- \tag{13}$$

Where $\Delta IBR_j^+ = \max(\Delta IBR_j, 0)$, and $\Delta IBR_j^- = \min(\Delta IBRj, 0)$.
The nonlinear long-run relationship is specified as:

$$cbr_t = \alpha_0 + \alpha_1 IBR_t^+ + \alpha_2 IBR_t^- + \alpha_3 X_t + \varepsilon_t \tag{14}$$

This specification differs from the baseline ARDL only in the decomposition of the policy variable, while retaining identical lag structures and control variables.

Asymmetry is tested using the null hypothesis:

$$H_0: \alpha_1 = \alpha_2 \tag{15}$$

Rejection of the null hypothesis indicates asymmetric monetary policy pass-through, implying that lending rates respond differently to monetary tightening and easing.

3.4 Data

The analysis uses a novel monthly dataset collected from 16 commercial banks, covering disaggregated retail lending rates for SMEs, corporates, personal loans, and mortgages. The interbank rate is used as the monetary policy indicator, while CPI, a constructed Monthly Indicator of Economic Growth (MEIG), and a liquidity ratio are included as controls. The sample spans April 2012 to July 2022, covering the period of the new monetary policy regime. Table 1 defines the variables.

Table 1
Variable Definitions and Data Sources

Variable	Definition	Source
Interbank rate	Interest rate at which banks lend to each other on the interbank market (5-day maturity)	Bank of Zambia
Simple average lending rate	Unweighted mean of SME, corporate, personal, and mortgage lending rates	Compiled by author
Weighted average lending rate	Loan-volume weighted average of lending rates across all segments	Compiled by author
Corporate lending rate	Interest rates charged to corporate clients	Commercial banks survey
SME lending rate	Interest rates charged to SMEs	Commercial banks survey
Personal lending rate	Interest rates charged to individuals	Commercial banks survey
Mortgage lending rate	Interest rates on real estate loans	Commercial banks survey
Liquidity ratio	Total liquid assets / total bank assets	Compiled by author
GDP (MEIG)	Monthly Indicator of Economic Growth (base year 2012)	Compiled by author
CPI	Consumer Price Index measuring inflation	ZAMSTATS

Table 2
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Simple average rate	124	26.516	3.557	10.836	26.154
Weighted average rate	124	23.263	2.669	17.98	30.061
Interbank rate	124	11.713	4.26	7.455	20.373
SME rate	124	32.299	4.945	32.501	86.409
Corporate rate	124	21.979	2.579	27.735	23.621
Personal rate	124	24.627	3.361	27.339	16.719
Mortgage rate	124	16.883	1.801	41.937	17.699
Liquidity ratio	124	64.467	10.183	26.154	47.48
GDP	123	115.554	90.749	23.621	140.186
CPI	124	206.955	69.598	16.719	121.63

IV. EMPIRICAL FINDINGS & DISCUSSION

4.1 Pre-estimation Tests

Prior to model estimation, unit root tests were conducted. The Augmented Dickey–Fuller (ADF) test with constant and trend was applied. Results indicate that all variables are integrated of order one, I (1) (Table 3).

Table 3
ADF Unit Root Test

	(1)Levels			(2) First Difference			(3) Order of Integration
Variable	t-Stat	CV	p-Value	t-Stat	CV	p-Value	=
Average lending	-1.146	-2.885	0.695	-5.893	-3.447	0.000	I(1)
Interbank rate	-2.167	-3.447	0.508	-7.297	-3.447	0.000	I(1)
SME lending rate	-2.598	-3.447	0.28	-15.111	-3.447	0.000	I(1)
Corporate lending rate	-2.406	-4.032	0.305	-16.228	-3.447	0.000	I(1)
Mortgage lending rate	-2.865	-3.447	0.174	-11.216	-3.447	0.000	I(1)
CPI	-2.65	-3.447	0.257	-4.991	-3.447	0.000	I(1)
Liquidity	-2.162	-2.162	0.997	-13.598	-2.456	0.000	I(1)
GDP	-2.543	-2.579	0.106	-18.165	-3.889	0.000	I(1)

Notes: All interest rates are weighted; constant and linear trends are included; CV is the 5% critical value of the Dickey–Fuller test, and the p-value is for the t-statistic.

4.2 Johansen Cointegration Analysis

Having determined that all the variables are of the same order of integration, the Johansen cointegration test was used to assess the existence of a long-run relationship among the variables. The trace statistics are greater than the corresponding critical values at the 5 percent significance level; hence, we reject the null hypothesis (H0) of no long-run relationship and conclude that there exists at least one long-run equilibrium relationship among the variables of interest. This finding holds across all four models estimated in the study (Table 4).

Table 4
Johansen Cointegration Test Results

	Full Sample			Pre-COVID		
Variable	CE-Trace statistics	Critical Value	Maximum Rank	CE-Trace statistics	Critical Value	Maximum Rank
Weighted Average Lending Rate	88.548	69.188	1	51.526	47.856	1
SME Lending Rate	86.055	69.189	1	87.742	69.827	1
Personal Lending Rate	114.66	77.818	1	110.459	69.822	1
Corporate Lending Rate	87.2	69.819	1	71.901	68.829	1
Mortgage Lending Rate	91.909	69.818	1	55.925	47.856	1

Notes: Cointegration tests for the full sample and pre-Covid 19 sub-sample (April 2012 to February 2020); cointegration critical value at 0.05% in [ ].

4.3 Long-run and Short-run Results

Since a long-run relationship is established, a Vector Error Correction Model (VECM) is employed. The long-run and short-run estimates are presented in Table 5 and Figure 3 shows short-run visualisations. The VEC stability, serial correlation and heteroskedasticity tests are undertaken as post estimation diagnostic tests.

Since the overnight interbank rate is a market (or quasi-market) price set within the BoZ operating corridor and co-moves with liquidity and other key macroeconomic developments, it is treated as endogenous in this aggregate analysis which is accommodated within the Johansen VECM framework employed (though not explicitly tested). The reported pass-through coefficients therefore should be interpreted as long-run relations within a jointly determined, cointegrated system, not as effects of a purely exogenous interbank-rate shock.

In the long run, the interbank rate has a positive impact on the commercial bank lending rates to firms (SME and corporate) and individuals (personal and mortgage). The coefficients suggest that a percentage point increase in the interbank rate is associated with a 0.55 increase in the average lending rate, 0.34 for weighted average, 0.49 increases for SME rate, 0.41 for personal, 0.27 for mortgage and 0.23 for corporate lending rates, ceteris paribus.

The results imply that commercial banks adjust retail lending rates to reflect changes in the interbank rate with incomplete passthrough (almost half for SME and personal, around a quarter for corporates and mortgages). This outcome aligns with the broader evidence that monetary policy passes through is almost always incomplete in Sub Saharan African countries, including Zambia, as documented by Ngoma & Chanda (2022), Chileshe (2016) and Mishra et al. (2012). While complete passthrough is not expected, this degree of incompleteness reported here limits the full potency of the monetary policy transmission mechanism, thereby constraining the ability of the Bank of Zambia to influence aggregate demand, credit conditions and ultimately inflation. It is important to note that the incomplete pass-through observed here does not, by itself, suggest deliberate smoothing of monetary policy impulses by banks, rather, it signals frictions in credit pricing. This suggests that factors other than the interbank rate influence commercial banks' retail-rate adjustment behaviour such as funding structures, risk, mark-ups and market power an indication that lending rates can vary independently of policy-rate adjustments. The study controls for other factors that influence bank interest rates, and the level of economic activity (GDP) is the only consistently significant control, showing the importance of demand-side factors in the pass-through process, consistent with monetary policy transmission theory (Nikoloz, 2011). Other reasons for incomplete pass-through in low-income countries include underdeveloped and shallow financial markets and inadequate bank competition (Mishra et al., 2012; Sacerdoti, 2005). In particular, Zambia's banking sector is highly concentrated: the four largest private banks hold over 74% of total assets and more than 67% of deposits (Simpasa, 2011; Mutoti & Musonda, 2011)

The study does not only documents the degree of monetary policy passthrough but also assess whether the degree of passthrough is systematically different across borrower segments (SME, personal, corporate, and mortgage). This helps to identify the segments of the credit market that are more responsive monetary policy changes and those that are not. In addition, the results show heterogeneous responses across loan types. SME and personal lending rates appear to be more responsive to interbank rates than corporate and mortgage lending rates, a similar finding to Choudhary et al. (2012) for Parkistan, Gregor & Meleck´y (2018) in Czech Republic. This could be explained by risk considerations, relationship banking, tenure and whether arrangements are fixed or variable. Large corporations may have stronger relationships and bargaining power with their banks compared to SMEs (Angori et al., 2020; Stein, 2002) as relationship banking is associated with more personal and closer long-term interactions between banks and their clients. Banks benefit from such arrangements in earnings from special service charges and deposit holdings that can be invested and may be more reluctant to pass on monetary policy tightening to these large corporates (Beck et al., 2014). In addition, SMEs have less negotiation power, shorter-loan maturities and limited financing alternatives due to higher credit risks, making the rates sensitive to monetary policy. Similarly, personal loans are also risky, mostly unsecured (salary backed in some instances) and short-term in nature, and hence their lending rates are frequently adjusted in response to monetary policy impulses to protect profit margins. The positive effect of liquidity on SME rates suggests a crowding out effect on SME borrowers, who are often classified as high risk and face higher competition for available funds

On the contrary, mortgage lending rates may not be very responsive to monetary policy shocks, because real estate loans are long-term and issued on fixed interest terms backed by high quality surety (Degryse & Cayseele, 2000; Mier-y-Teran, 2012). However, these only account for a small proportion of loans within the Zambian banking sector. For the period under study (2012–2022), mortgages only accounted for approximately 6% of the total loan portfolio captured in the dataset. Thus, about 94% of lending in the sample is variable-rate. These fixed rates are usually set for the entire loan cycle with maturities ranging between 5 and 15 years. The fixed rates used in this study are the rates applied to new loans at the time they were issued. All other loan types personal, SME and corporate loans are predominantly priced at variable lending rates, which are typically benchmarked against prevailing Bank of Zambia policy rate as the base lending rate applied by all banks.

Following Clogg et al. (1995) and Paternoster et al. (1998), using the two standard error rule as a guide, the differences in passthrough coefficients across loan categories reported in Table 5 were formally assessed for statistical significance. The results show no statistically significant difference between SME and personal lending rates (Z = 0.806) and between mortgage and corporate rates (Z = 0.585). In contrast, the differences between SME and mortgage (Z = 2.345), SME and corporate (Z = 2.691), personal and mortgage (Z = 2.128), and personal and corporate (Z = 2.553) were statistically significant at the 5% level. This validates the finding that strongest passthrough effects are concentrated in the personal and SME credit markets, whereas corporate and mortgage lending remain relatively insulated from interbank rate changes.

The short-run dynamics highlight a relatively weak speed of adjustment to equilibrium and are in line with the findings of Ahmad and Aziz (2013) for the UK. The error correction terms (ECT) for the short-run VECM specification suggest that the previous month's deviation from the long-run equilibrium is corrected in the current period at the speed of 28.7%,15.5%,14.7%, 17.6% ,30% and 10.3% for the average rate, weighted average rate, SME rate, personal rate, mortgage rate, and corporate rate, respectively. The short-run simulations that show how an initial shock in the interbank rate gradually dissipates, suggest that it might take 5 months for the average lending rate, 8.5 months for the weighted average rate, 10 months for SME rate, 9 Months for personal rate, 5 months for the mortgage and 12 months for corporate rate to achieve at least 50% of the passthrough (Figure 3). The relatively slow adjustment of corporate lending rates may suggest credit market rigidities such as delays in risk assessments or long-term contracts. The observed short-run differences on the reactions of different types of lending rates have key monetary policy implications as they highlight the distinct behaviour of each credit market segment.

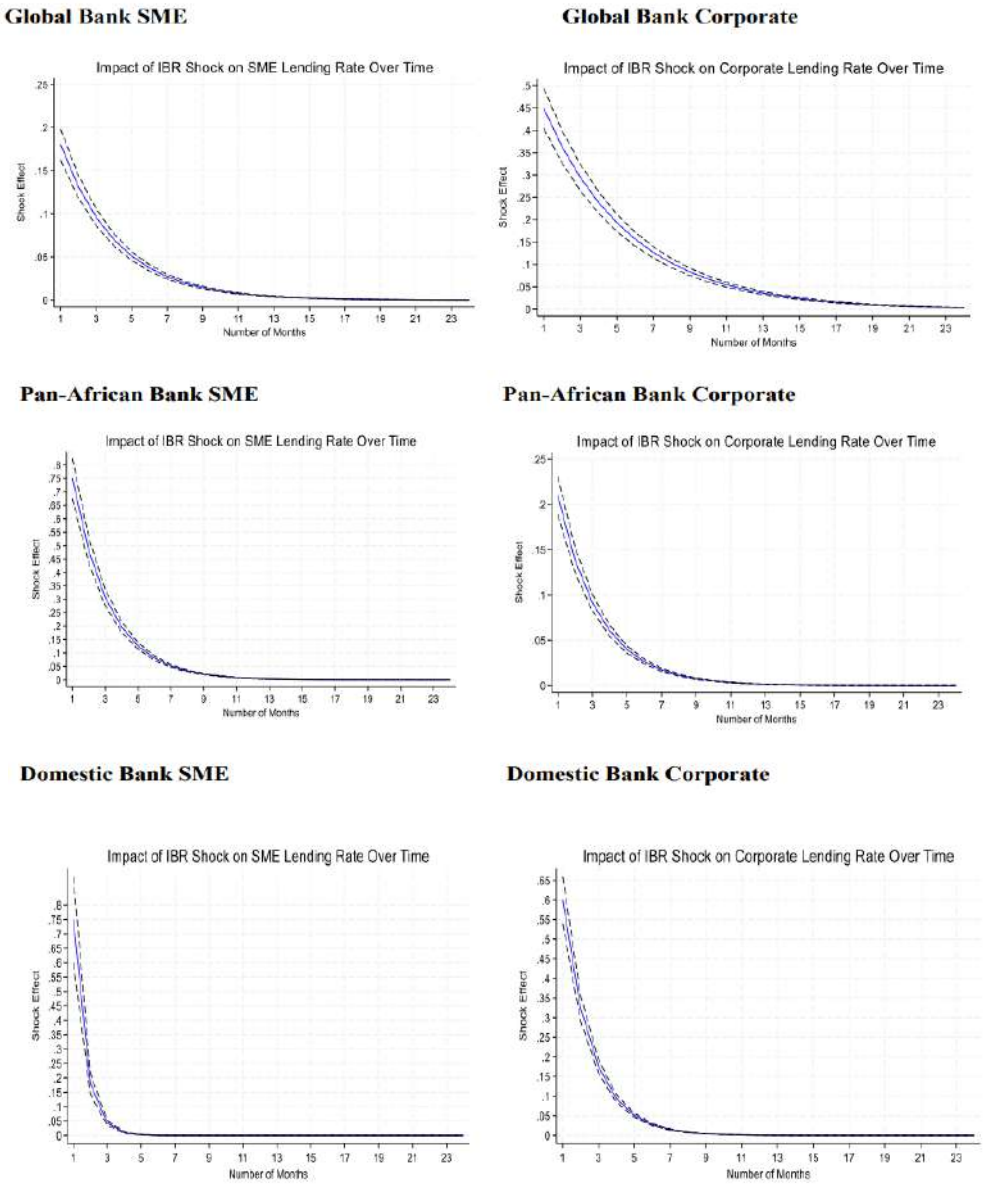

Figure 3

Cumulative Short-run Dynamics of Interbank Rate Shocks on Lending Rates

4.4 Robustness Checks

This section presents robustness checks on the extent of the passthrough before the COVID-19 pandemic and also undertakes a sub-sample analysis for structural change.

4.4.1 Pre-Covid Sample: April 2012 to February 2020

To account for the economic instability caused by the COVID-19 pandemic, the study follows Greenwood-Nimmo et al. (2022) by estimating a pre-pandemic sub-sample.This allows monetary policy pass-through before COVID-19 to be compared with the fullsample results, showing whether the pandemic affected monetary transmission in Zambia. Table 6 reports the pre-COVID estimates.

Table 6

Long-run and Short-run Estimates – Pre-COVID Sample

Variables	(1) Average Lending Rate	(2) Weighted Average Lending Rate	(3) Weighted SME	(4) Weighted Personal	(5) Weighted Mortgage	(6) Weighted Corporate
LONG-RUN						
Interbank Rate	0.600***	0.432***	0.561**	0.451***	0.313***	0.299***
	-0.068	-0.106	-0.185	-0.081	-0.096	-0.103
GDP	0.398***	0.357***	0.509***	0.346***	0.218***	0.273***
	-0.022	-0.035	-0.062	-0.027	-0.033	-0.036
CPI	0.020*	0.058	0.436	0.058	0.042	0.059
	-0.012	-0.081	-0.176	-0.065	-0.095	-0.099
Liquidity	0.056**	-0.008	0.095**	0.059***	-0.050*	0.001*
	-0.015	-0.028	-0.044	-0.017	-0.027	-0.031
Constant	30.916	22.351	32.99	25.446	16.61	12.791
SHORT-RUN						
Error Correction Term (ECT)	-0.442***	-0.139**	-0.116*	-0.231*	-0.348*	-0.208*
	-0.093	-0.058	-0.075	-0.108	-0.089	-0.063
Half-Life (Months)	3.5	10.5	11	7	5	6.5
Dummy Interbank Rate	0.031	0.007	0.001	-0.027	0.015*	-0.02
	-0.026	-0.053	-0.003	-0.023	-0.029	-0.025
LM Test	25.008	24.671	19.373	20.892	20.243	21.568
Heteroskedasticity Test	1106.766	120.989	970.549	954.674	613.31	358.397
VEC Stability	Stable	Stable	Stable	Stable	Stable	Stable
No. Observations	87	87	87	87	87	91

Notes: Significant short-run error correction term (ECT) confirms cointegration; the model passes LM serial correlation, heteroskedasticity and VEC stability (see Appendix 4.3b for eigenvalue stability condition vecstable graph). AIC length selection criteria used with a lag structure of 4 (Average), 4 (Weighted average), 3 (SME), 4 (Personal), 2 (Mortgage) and 2 (Corporate). The half-life is derived from the cumulative short-run visualizations in Figure 4.2. Standard errors in ( ), diagnostic test p-values in [ ], *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The long-run results for the period before Covid-19 show higher pass-through for all rates compared with the full sample analysis. Passthrough increases by 0.15 points for average lending rate, 0.09 points for weighted average lending rate, 0.15 points for SME rate, 0.04 points for personal rate, 0.04 points for mortgage rate, and 0.07 points for corporate rate. However, the broad pattern of passthrough observed in the full sample analysis is evident in pre-Covid sample as higher passthrough is found for SME rate, followed by personal, mortgage and lastly corporate rates. The pre-covid sample average lending results of 0.60 results are quite comparable to the results by Ngoma & Chanda (2022), who, using aggregate data for the same sample period (2012–2020) found a longrun passthrough of 0.68 and a passthrough elasticity of 0.40. However, the weighted average long-run passthrough is lower at 0.432, suggesting that banks with higher loan volumes in the total banking sector loan portfolio were less responsive to monetary policy changes. Unlike Ngoma & Chanda (2020), this study identifies considerable heterogeneity, an innovation that supports more targeted policy interventions by analysing four distinct lending rates.

The lower long-run passthrough observed in the full sample might be explained by high economic uncertainty and a rise in credit risk as a result of the pandemic. Commercial lending rates remained elevated during the pandemic to mitigate potential defaults despite the Bank of Zambia aggressively cutting the Policy Rate by 3.5 percentage points

between February 2020 and February 2021. Further, the implementation of unconventional monetary policy by BoZ through the Targeted Medium-Term Refinancing Facility (TMRF) reduced the reliance of banks on the interbank market as banks had easy access to alternative funding. This might have moderated the impact of the traditional interest rates channel of monetary policy transmission being implemented by BoZ. In addition, the efficacy of monetary policy passthrough might have been dampened as a result of households and businesses facing income losses resulting in reduced credit demand while banks might have prioritised liquidity buffers over increased lending during this period. In addition, short-run deviations are corrected more quickly for the pre-covid period, suggesting that disequilibrium is not persistent, and the long-run relationship is more stable during this period. For instance, the speed of adjustment suggests a half-life of about 3.5 months for the average lending rate, 5 months for the mortgage rate, 6.5 months for corporate rate and 7 months for the personal rate.

4.4.2 Sub-Sample for Structural Change

To undertake the structural change sub-sample analysis, the sample was split into two periods: April 2012 to July 2016 and August 2016 to July 2022. Due to the reduced sample sizes in these sub periods, the analysis is undertaken using the ARDL estimator. A Chow test for a structural break between these two samples is undertaken for each type of lending rate. The summary of results is presented in Table 7.

Table 7

Long-run and Short-run Estimates: Structural Change Assessment

	LONG-RUN		**SHORT-RUN**		
	Interbank Rate Coefficient		**ECT & Half-Life (Months)**		
	Pre–July 2016	**Post–July 2016**	**Pre–July 2016**	**Post–July 2016**	**Chow Test**
Simple Average Lending Rate	0.664***	0.459***	-0.277***	-0.307***	3.00*
	-0.228	-0.1	-0.095	-0.09	{0.087}
			[5.5]	[5.0]	
Weighted Average Lending Rate	0.452**	0.322**	-0.358***	-0.220***	2.97*
	-0.177	-0.088	-0.118	-0.075	{0.087}
			[4.5]	[7.5]	
Weighted SME	0.655***	0.480*	-0.418*	-0.261***	3.03*
	-0.192	-0.242	-0.22	-0.066	{0.085}
			[4.0]	[5.0]	
Weighted Personal	0.473***	0.332***	-0.443***	-0.374***	2.96*
	-0.14	-0.085	-0.123	-0.082	{0.088}
			[3.5]	[4.5]	
Weighted Mortgage	0.334*	0.280***	-0.499*	-0.822*	3.72*
	-0.17	-0.056	-0.278	-0.13	{0.056}
			[3.0]	[1.5]	
Weighted Corporate	0.246**	0.220*	-0.440***	-0.506***	0.1
	-0.115	-0.13	-0.143	-0.112	{0.754}
			[3.5]	[3.0]	

Notes: The half-life in months is reported in [ ] and is derived from the cumulative short-run visualizations in Appendix 4.4b and 4.4c. Chow test p-values are reported in { }. Standard errors in ( ), *** p < 0.01, ** p < 0.05, * p < 0.1.

There is support for a structural change as passthrough is relatively higher in the earlier period and lower after August 2016. In broad terms, the passthrough estimates for the first period are comparable to those for the pre-Covid sample in Table 6, while the estimates for the second period are similar to the full sample estimates in Table 5. The pattern is similar for all periods as the relative passthrough magnitudes are consistent for all the rates. The short-run dynamics show a higher speed of adjustment for weighted average, SME and personal lending rates before August 2016 while there is little difference for average and corporate rates comparing the two periods. The Chow test confirms a structural break in all lending rates except the corporate rate. This suggests that the pricing dynamics of the corporate loans remained stable across the two periods, consistent with it being associated with more security for lending.

This reflects a broader shift in Zambia's macroeconomic and financial environment following the 2015/2016 domestic economic shock. This period was characterised by severe hydroelectricity rationing due to drought, rising debt vulnerabilities, and sustained exchange rate depreciation and volatility. These developments likely altered risk perceptions and funding conditions in the banking sector, weakening the transmission of monetary policy to retail lending rates. Since that time, Zambia's macro-economic fundamentals have never reverted to the pre 2015/2016 shock levels, with recent shocks being the pandemic and global geopolitical tensions (Ukraine and Russia war). Zambia faces persistent exchange rate depreciation, rising inflation, widening fiscal deficits, a sovereign debt crisis1 , and episodes of cholera outbreak in the main cities at the onset of most rainy seasons2 . These apparent structural issues might explain why the extent of monetary policy pass-through seems to have declined after 2016.

4.4.3 Post-Estimation Diagnostic Tests

Post-estimation diagnostic tests were conducted to assess the adequacy of the VECM specifications. The eigenvalue stability condition confirms that the models are stable Figure 4 and Figure 5), while the Breusch–Godfrey test indicates that serial correlation is absent. In addition, the ARCH-LM test shows no evidence of heteroskedasticity. Overall, the results confirm that the estimated models satisfy the key post-estimation diagnostic requirements.

6.5 Nonlinear ARDL (NARDL) Results

To assess whether monetary policy pass-through in Zambia is symmetric, the study estimates a nonlinear ARDL (NARDL) model decomposing interbank rate movements into positive and negative changes. This allows the analysis to distinguish between monetary tightening and monetary easing effects on retail lending rates.

Table 8

Nonlinear ARDL (NARDL) Asymmetric Pass-through Results

Variable	SME Rate	Personal Rate	Corporate Rate	Mortgage Rate
LONG-RUN EFFECTS				
Interbank Rate (+)	0.521*** (0.071)	0.446*** (0.062)	0.233** (0.091)	0.182* (0.104)
Interbank Rate (−)	0.271** (0.108)	0.198** (0.087)	0.210* (0.112)	0.165 (0.121)
GDP	0.041** (0.019)	0.038** (0.017)	0.026* (0.015)	0.021 (0.018)
CPI	0.059*** (0.021)	0.046** (0.020)	0.033* (0.018)	0.029 (0.022)
Liquidity	0.017* (0.009)	0.014* (0.008)	0.012 (0.010)	0.011 (0.012)
SHORT-RUN EFFECTS				
Variable	SME Rate	Personal Rate	Corporate Rate	Mortgage Rate
Error Correction Term (ECT)	-0.312***	-0.285***	-0.201***	-0.176**
Half-life (months)	4.6	5.1	7.8	9.3
Δ Interbank (+)	0.389*** (0.065)	0.332*** (0.058)	0.180** (0.072)	0.142* (0.081)
Δ Interbank (−)	0.162** (0.074)	0.141** (0.061)	0.155* (0.083)	0.118 (0.089)

The nonlinear ARDL (NARDL) results indicate that monetary policy pass-through in Zambia is both heterogeneous and asymmetric across borrower segments. Positive changes in the interbank rate (monetary tightening) transmit more strongly to SME and personal lending rates than negative changes (monetary easing), with statistically significant Wald tests confirming asymmetry in these segments, while corporate and mortgage lending rates exhibit no significant asymmetry. This suggests that banks adjust lending rates upward more rapidly during tightening cycles but reduce them more cautiously during easing periods, consistent with pricing frictions, market power, and information asymmetries in credit markets. The results further show faster short-run adjustment in SME and personal lending relative to corporate and mortgage segments, reinforcing the presence of segmented credit market rigidities. Overall, the findings extend the linear pass-through literature by demonstrating nonlinear monetary transmission in Zambia, where contractionary policy is transmitted more effectively than expansionary policy, thereby amplifying the impact of tightening while limiting the effectiveness of monetary easing (Hannan & Berger, 1991; Stiglitz & Weiss, 1981; Shin et al., 2014; Greenwood-Nimmo et al., 2022).

V. CONCLUSION

The study assessed the magnitude, speed, and asymmetry of monetary policy pass-through to SME, corporate, personal, and mortgage lending rates in Zambia using the interbank rate as a proxy for the Bank of Zambia (BoZ) policy rate over the period April 2012 to July 2022. The findings indicate the existence of a stable long-run relationship between policy rates and retail lending rates, confirming the presence of a functional interest rate channel in Zambia. However, the pass-through is incomplete and varies significantly across credit segments. SME and personal lending rates exhibit relatively stronger responsiveness, while corporate and mortgage lending rates show weaker transmission. The results further reveal clear evidence of asymmetric adjustment, with banks responding more strongly to monetary tightening than easing. In addition, monetary policy transmission weakened following major macroeconomic shocks, particularly the 2015–2016 crisis and the COVID-19 period, suggesting increased structural rigidities and financial market frictions over time. The findings demonstrate that monetary policy transmission in Zambia is nonlinear, heterogeneous across borrower segments, and sensitive to macroeconomic and financial conditions. These dynamics imply that the effectiveness of the interest rate channel depends not only on policy design but also on structural features of the banking and credit market.

VI. RECOMMENDATIONS

Policymakers ought to enhance financial market development and competition to strengthen interest rate pass-through, particularly in corporate and mortgage lending markets. Improving credit risk assessment frameworks, increasing transparency, and reducing market frictions can contribute to more efficient monetary transmission.Targeted policy interventions for segments with weak responsiveness, such as mortgages, are necessary. Furthermore, strengthening macroprudential oversight and promoting financial inclusion can improve the resilience and responsiveness of the credit market, thereby enhancing the overall effectiveness of monetary policy in Zambia.

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