Heterogeneous Monetary Policy Pass-through in Zambia

Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy-Economics
September 2025

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Abstract

This study examines the extent of monetary policy passthrough in Zambia to different credit segments, focusing on SMEs, large corporations, real estate (mortgage), and personal loans interest rates. It also investigates the role of foreign banks in shaping monetary policy transmission and assesses the influence of external financial conditions, including global risk-free investment decisions, global risk sentiments and monetary policy spillovers from foreign banks' countries of origin. To support the empirical analysis, the study compiles a previously unavailable Monthly Indicator of Economic Growth (MIEG), a high-frequency proxy for GDP that aligns well with official quarterly GDP estimates and is applied in the empirical analysis.

The study uses novel data collected from Zambian commercial banks to make three main contributions to research on monetary policy passthrough in Zambia. First, more recent data are used covering the period of interest rates targeting from 2012 to 2022. Second, the extent of passthrough is estimated for four different credit segments – small and medium enterprises (SMEs), large corporations, real estate (mortgages) and individual borrowers. Third, bank heterogeneity is addressed by investigating the role of foreign banks in monetary policy transmission, the extent to which they are affected by external financial conditions (including global risk and monetary policy spillovers from their home countries), and how foreign and domestic banks differ.

Employing a newly constructed dataset spanning April 2012 to July 2022, the study uses a combination of econometric techniques, including Johansen cointegration technique, Panel ARDL estimated by dynamic fixed effects model with Driscoll-Kraay standard errors and bank-by-bank time series ARDL. Results reveal significant heterogeneity of passthrough across borrower segments and bank ownership. Across borrower segments, the passthrough is higher in the SME lending rate, followed by the personal loan lending rate, and lower for the mortgage and corporate lending rates, suggesting less responsiveness of these credit market segments to monetary policy changes. In terms of bank ownership structures, the results show that domestic banks exhibit twice as high monetary policy passthrough to lending rates compared to foreign banks. This suggests a stronger responsiveness of domestic banks to monetary policy than their foreign counterparts. Additionally, the study results reveal a structural shift in Zambia's credit market after 2016, and this appears to have further weakened overall monetary policy transmission.

Overall, the findings provide critical insights into the challenges of monetary policy effectiveness in a highly globalised banking system and have important implications for policymakers in Zambia and other low-income economies with similar financial structures. To avoid policy misalignments, there is need for the Bank of Zambia to adopt a monetary policy formulation approach that actively engages with specific monetary policies of parent countries for influential foreign banks, beyond the global developments it actively follows. Finally, the paper calls for policymakers to develop policies aimed at encouraging the development and expansion of domestic banks to moderate the influence of foreign banks and enhance monetary policy effectiveness. These results also underscore the need for targeted policy interventions to enhance monetary policy effectiveness given lower passthrough is some borrower segments.

Acknowledgements

First and foremost, I would like to express my deepest gratitude to God Almighty for the gift of life, good health, and divine guidance throughout the course of my studies. It is through His grace that I have been able to embark on and complete this academic journey.

I am sincerely grateful to the senior management of my employer and sponsor, the Bank of Zambia, for their unwavering support, encouragement, and the opportunity to pursue this PhD programme. Their investment in my professional and personal development has been invaluable and I will use it to the best of my abilities to the service of Mother Zambia. In particular, I am thankful to the Governor, Dr. Denny Kalyalya, and his Deputies, Dr. Francis Chipimo and Mrs. Rheka Chifuwe-Mhango, for their support. I also thank the Director of Research Department, Dr. Jonathan Chipili, for his guidance, mentorship and encouragement. I am equally grateful to the HR Director, Mrs. Mumbi Mwila, the Assistant Director–Administration, Mrs. Mwaka Sikombe Shimabale, and the Training Managers, Mrs. Febby Mulambya and Mrs.Matakala Mabuku, for their diligent logistical support, that enabled my studies go smoothly. A special thank you to my colleague and friend, Mrs. Tendai Dandawa Couvaras, for her tireless support with data throughout this entire journey.

I would also like to extend my heartfelt appreciation to my supervisors, Professor Oliver Morrissey and Dr. Atsuyoshi Morozumi, for their patience, guidance, and constructive feedback throughout the research process. Their expertise and mentorship have been instrumental in shaping this thesis. I also thank my Internal Assessor Dr. Markus Eberhardt. I am equally grateful to the Postgraduate Research (PGR) Directors at University of Nottingham, School of Economics for their continuous support and oversight during my studies.

Lastly but not the least, I wish to thank my family and friends for their support, encouragement, and understanding throughout this demanding but rewarding period. Their love and belief in me have been a constant source of motivation. A big thank you, to my mother, Mrs. Maureen Maambo for her prayers have not been in vain. I also wish to honour the memory of my late second mother, Mrs. Beverly Chinjila Msoni, and my grandmother, Mrs. Mutinta Chibuno Maambo (both posthumously); their love, sacrifices, and teachings remain with me always. A heartfelt appreciation to my big sister, Mrs. Rudo Phiri- Mumba and her husband Mr. Charles Mumba (AKA my second parents) for always looking out for me. I thank all my siblings, my nieces and nephews, for always cheering me on. I also thank Dr. Austin Mwange for his encouragement and support. To my childhood friend, Ng'andu, your constant support meant the world to me. This PhD would have been much harder without your constant reminders of how far I have come in this academic journey, and this gave me that extra push when I needed it most. I also thank Mr. David Barker (post- posthumously) for his support and encouragement during this entire journey.

To all who have contributed in one way or another to the successful completion of this PhD, I remain truly grateful.

List of Abbreviations

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BEA	Bureau of Economic Analysis
BoZ	Bank of Zambia
CBOE	Chicago Board Options Exchange
COVID	Coronavirus Disease 2019
CPI	Consumer Price Index
CUTS	Consumer Unity & Trust Society
DK	Driscoll-Kraay
DSUR	Dynamic Seemingly Unrelated Regression
ECB	European Central Bank
ECM	Error Correction Model
ECT	Error Correction Term
EMDE	Emerging Markets and Developing Economies
ERB	Energy Regulation Board
EU	European Union
FE	Fixed Effects
FED	Federal Reserve (USA)
FSD	Financial Sector Deepening
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GRZ	Government of the Republic of Zambia
IEH	Informational Efficiency Hypothesis
IMF	International Monetary Fund
KNBS	Kenya National Bureau of Statistics
LAG	Lag Length

LME	London Metal Exchange
MAT	Monetary Aggregates Targeting
MEIG	Monthly Economic Indicator of Growth
NPLS	Non-Performing Loans
PAYE	Pay As You Earn
PMG	Pooled Mean Group
SAA	Sub-Saharan Africa
SME(s)	Small and Medium Enterprises
SUR	Seemingly Unrelated Regression
TMRF	Targeted Medium-Term Refinancing Facility
UIP	Uncovered Interest Parity
UK	United Kingdom
UMP	Unconventional Monetary Policy
USA	United States of America
USD	United States Dollar
VA	Value Added
VAR	Vector Autoregression
VAT	Value Added Tax
VECM	Vector Error Correction Model
VIX	Chicago Board Options Exchange's CBOE Volatility Index
XLPBM	Excel-based Linear Projection Benchmarking Method
ZamStats	Zambia Statistics Agency
ZICTA	Zambia Information and Communications Technology Authority
ZMW	Zambian Kwacha

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Chapter 1: Introduction

1.1 Introduction

Zambia's monetary policy framework underwent a significant shift in April 2012, transitioning from a monetary aggregate targeting (MAT) framework to interest rate targeting. Under the MAT framework, monetary policy focused on controlling money supply growth to achieve price stability, using open market operations as the main tool. Under the new framework, the Bank of Zambia (BoZ) introduced the Policy Rate and set this as the key instrument to signal the monetary policy stance, with the interbank rate serving as the operational target. This transition marked a fundamental change in the conduct and transmission of monetary policy to the real economy in Zambia (BoZ, 2012).

Previous empirical studies found that Zambia's monetary policy passthrough was incomplete and sluggish, limiting its effectiveness in influencing price and financial system stability. Given Zambia's highly open financial system and the importance of foreign banks (of the 17 banks in operation by 2022, only six were locally owned; BoZ, 2022), external monetary shocks and global risk factors may influence the transmission of domestic monetary policy. Foreign banks dominate Zambia's financial sector, holding over 70% of total banking assets, and their response to domestic monetary policy changes will be influenced by their global funding linkages, cross-border lending decisions, and exposure to parent country monetary conditions.

This study uses novel data collected from Zambian commercial banks to make three main contributions to research on monetary policy passthrough in Zambia. First, more recent data are used covering the period of inflation targeting from 2012 to 2022. Second, the extent of passthrough is estimated for four different credit segments – small and medium enterprises (SMEs), large corporations, real estate (mortgages) and individual borrowers. Third, bank heterogeneity is addressed by investigating the role of foreign banks in monetary policy transmission, the extent to which they are affected by external financial conditions (including global risk and monetary policy spillovers from their home countries), and how foreign and domestic banks differ. The specific objectives are to:

i. Examine the extent and speed of monetary policy passthrough to SME, corporate, personal, and mortgage lending rates (heterogeneity across loan types).

ii. Compare the transmission of monetary policy to SME and corporate lending rates between foreign and domestic banks, and within the foreign bank group between global and Pan African banks operating in Zambia, while accounting for global financial market conditions and risk-related factors.
iii. Evaluate if foreign banks operating in Zambia react to global and home country monetary policy shocks.

The key contribution is examining monetary policy passthrough heterogeneity in two key aspects. First, heterogeneity across different borrower segments, distinguishing between firms (corporate and SME) and individuals (personal and mortgage). Second, heterogeneity across banks, comparing domestic and foreign institutions. Unlike previous studies, which relied on aggregate data on (average) lending rates, this study employs granular bank-level data, allowing for deeper analysis of monetary policy passthrough. Weighted averages (by measures are bank size) are employed instead of simple averages to provide more accurate measures of interest rates in aggregate (national level) analysis. This provides policymakers with insights into the effectiveness of the interest rate channel of monetary policy transmission across different market segments, essential for designing targeted interventions and key for developing practical policies to enhance the efficacy of monetary policy transmission in Zambia.

Another contribution of this research, in addition to collection of data from commercial banks, is the construction of a previously unavailable Monthly Index of Economic Growth (an index many Central Banks construct as a proxy for monthly GDP) to facilitate the empirical analysis. The analysis of heterogeneous pass-through uses genuinely novel data, providing new insights.

1.2 Brief Overview of Monetary Policy in Zambia

Zambia's monetary policy has evolved over time reflecting broader economical, institutional, and global developments. Following Zambia's independence in 1964, the Bank of Zambia (BoZ) was established under the 1965 Act to administer monetary and supervisory functions. Initially, Zambia's economic model was characterised by interest rate ceilings, fixed exchange rates, and direct credit controls until the early 1990s when policies proved unsustainable due to deteriorating macroeconomic conditions.

Following the Liberalisation of the economy in 1991, the economic model transitioned to market-based monetary instruments such as the introduction of the Treasury bill market as the primary platform for conducting Open Market Operations (OMOs). In addition, the BoZ adopted the Monetary Aggregates Targeting (MAT) monetary policy framework, using reserve and broad money targets to control inflation. However, the increasingly unstable link between

inflation and money supply, undermined the effectiveness of this framework, prompting the BoZ to adopt an interest rate targeting monetary policy regime in April 2012. With this shift, the policy rate became the main tool to signal monetary policy stance to the economy and serves as a benchmark rate for loan pricing in Zambia, while the interbank rate became the operating target.

The inaugural policy rate was set at 9% and the BoZ has continued using the policy rate to promote price stability and economic growth in line with prevailing domestic and external macroeconomic conditions. Notably, between 2014 and 2015, the BoZ pursued aggressive monetary policy to combat inflationary pressures driven by exchange rate depreciation, rising fuel prices, and global commodity shocks, driving the policy rate to a peak of 15.5% in late 2015. However, as inflation stabilised and economic conditions modestly improved, the BoZ adopted a more accommodative monetary policy stance with the policy rate reaching a historic low of 8% in 2020 during Covid-19. As a response to the pandemic, the BoZ also introduced supportive initiatives such as the Targeted Medium Term Refinancing Facility (TMRF) to ease liquidity constraints and support lending to the private sector. Despite the recurrence of macroeconomic challenges in Zambia, the evolution of monetary policy regimes from direct controls, monetary aggregate targeting and now the modern interest rate targeting reflects the country's efforts to achieve price and financial sector stability and sustainable economic growth.

1.3 Thesis Structure and Linkages

This thesis is structured into five main chapters, each building upon the preceding one all aimed at providing a comprehensive understanding of monetary policy transmission in Zambia and these are discussed below:

Chapter 2: Institutional Background and Understanding the Data

This chapter documents the institutional setting and constructs a novel bank-level dataset to study monetary-policy transmission in Zambia. First, it traces the evolution of the monetary framework from direct controls to interest-rate targeting (policy-rate corridor introduced in 2012). It then summarises key macro episodes (2014–16 depreciation; COVID-19) and their interaction with policy implementation, including the use of foreign exchange (FX) operations and liquidity tools and also discusses the exchange-rate framework in Zambia. Next, it characterises Zambia's banking market in terms of ownership structure, and operations of the interbank market and motivates the use of the overnight interbank rate, the operating target as

a proxy for monetary policy stance. While using only averages for confidentiality, the chapter then details a field-based data collection from 16 commercial banks (2012–2022, cleaning protocols, variable definitions, and weighting schemes that convert bank-level loan volumes and rates into borrower-segment weighted average lending rates. Stylised facts compare foreign vs domestic banks trends on corporate, SME, personal and mortgages credit segments, as well as non-performing loans and liquidity dynamics. Together, these elements establish the measurement framework and empirical priors for the pass-through analysis that follows in chapters 4 and 5.

Chapter 3: Construction of the Monthly Indicator of Economic Growth (MIEG).

Given the absence of a high-frequency GDP measure in Zambia, this chapter describes the construction of the previously unavailable MIEG to provide a monthly measure of economic activity. This has been constructed using the Proportional Denton method based on the 2017 quarterly national accounts manual which is in line with the System of National Accounts 2008 (2008 SNA) framework. The constructed index is essential for econometric modelling in later chapters as a proxy for GDP, reducing omitted variable bias. The constructed MIEG aligns well with the official GDP numbers and is a key contribution for the Bank of Zambia, filling a gap and meeting standard practice among central banks internationally.

Chapter 4: Monetary Policy Passthrough and Bank Loan Portfolios: Aggregate Analysis

This chapter uses the original data to empirically examine the extent and speed of monetary policy transmission to SME, corporate, mortgage and personal loans lending rates, showing interest rates passthrough heterogeneity for types of lending rates (research objective i). The analysis assesses structural shifts in lending rates, particularly after 2016. Employing weighted average lending rates for the period April 2012 to July 2022 using Johansen cointegration and Error Correction Mechanism (ECM) methods, with ARDL for shorter samples, the study establishes incomplete and heterogeneous monetary policy passthrough, higher for SME and personal interest rates and lower for mortgage and corporate rates. The strength of monetary policy passthrough is found to be stronger in the period before 2016 than after, suggesting the occurrence of structural change in Zambia's credit market after 2016. This coincides with a period macroeconomic challenge such as rising inflation, persistent exchange rate depreciation, and external shocks like Covid-19. This structural shift might also be a contributing factor to the incomplete monetary policy pass-through in Zambia.

Chapter 5: Heterogeneous Monetary Policy Passthrough to firms in Zambia: Bank-level Analysis

This chapter extends the analysis by examining the heterogeneous response of foreign and domestic banks across firms' credit segments (SME and large corporate) to monetary policy in the presence of external financial and risk shocks (research objectives ii and iii). These external shocks are proxied by the US Treasury rate, VIX, and monetary policy rate measures from the respective countries of origin of each foreign bank operating in Zambia. Panel ARDL estimated via dynamic fixed effects model with Driscoll-Kraay (DK) standard errors and bank-by bank time series ARDL model from April 2012 to July 2022 are employed. The study investigates the heterogeneity of monetary policy passthrough across different categories of banks, distinguishing between domestic banks, Pan-African banks, and global banks. This classification makes it possible to capture how ownership structures that shape the transmission of Zambian monetary policy. The study establishes that monetary policy passthrough is heterogeneous and influenced by external factors. Domestic banks exhibit a stronger response to domestic monetary policy, with passthrough levels nearly twice as high as those observed in foreign banks. Among foreign institutions, Pan-African banks show higher passthrough in SME lending, reflecting their deeper integration with local credit markets, while global banks exhibit stronger passthrough in corporate lending, consistent with their focus on internationally connected firms. Foreign banks are more responsive to global shocks and monetary policy spillovers from their parent countries given their strong links with the global financial markets, cross boarder funding and parent country credit lines. For domestic banks, the passthrough was higher in SME rates than corporate rates, validating the findings of the aggregate analysis. While the interest rates channel of monetary policy transmission is present in Zambia, its strength might be diluted by the heavy presence of foreign banks.

Chapter 6 provides concluding comments.

Chapter 2: Institutional Background and Understanding the Data

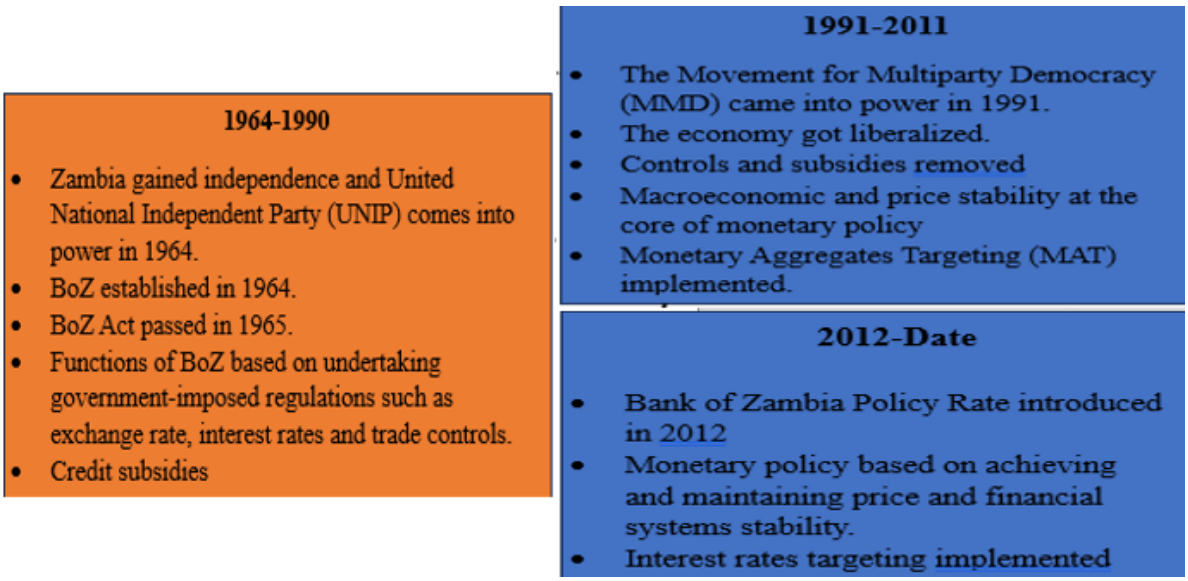
2.1 Introduction

This chapter lays the institutional and data foundations for the thesis' empirical analysis of interest-rate pass-through across borrower segments in Zambia. The chapter begins by outlining the monetary policy regime shift from monetary aggregates targeting to an interest-rate based framework in April 2012, under which the policy rate signals stance and the overnight interbank rate operates within a corridor in normal times. It then describes the size and structure of the banking sector, emphasising ownership segmentation and interbank market features that condition liquidity redistribution and pricing. The core contribution of the chapter is the collection of a novel monthly data spanning 2012 to 2022 from 16 banks, covering new-loan volumes and associated lending rates for SMEs, corporates, personal credit, and mortgages, augmented with bank-level capital and liquidity. To preserve anonymity of the bank level data, only average trends of these variables are presented, as the limited numbers of banks would make it easier to identify the bank-specific data which are confidential.

2.2 Evolution of Monetary policy in Zambia and Monetary Policy Framework

The evolution of monetary policy in Zambia dates to 1964 when the Bank of Zambia (BoZ) was established to take over from the Bank of Northen Rhodesia in the Bank of Zambia Act passed in 1965, replaced by the Bank of Zambia Act of 1985, Act of 1996 and finally the 2022 Act. The Act gives the BoZ the mandate to formulate and execute monetary and supervisory policies to foster price and financial stability. Price stability refers to low and stable prices, achieved by protecting the value of people's savings, reducing uncertainty, encouraging business planning, promoting investments, and ultimately enhancing economic growth (BoZ, 2014a; see Figure 2.1).

Figure 2.1:History of Monetary Policy in Zambia in Summary



Source: Adapted from Bank of Zambia website, 2023.

During the period 1964-1990, monetary policy was based on government administered measures as part of the centralized economic approach. A fixed exchange rate system, export and import controls as well as interest rates ceilings were implemented to support government projects and enterprises. Macroeconomic conditions deteriorated after almost two decades of implementing these state controls and it became unsustainable to continue providing direct and subsidized credit to preferred parastatals (IMF, 2004).

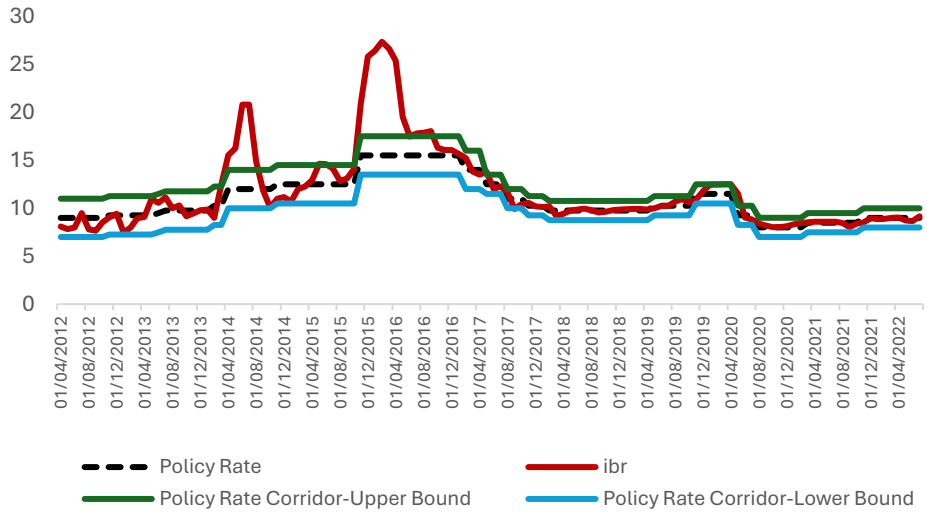
In 1991, Zambia took major political, economic, social, and institutional adjustments to alter the monetary landscape. Market-oriented reforms were implemented resulting in the liberalization of different sectors of the financial system. The Bank of Zambia adopted indirect market-based monetary policy instruments moving away from direct controls. The treasury bill market was introduced, and open market operations (OMOs) were used for liquidity management and interest rates control. Another noteworthy development was the suspension of the Exchange Control Act in 1994 and the deregulation of both the current and capital accounts (Simatele, 2004; BoZ, 2014b).

The Monetary Aggregates Targeting (MAT) policy framework was implemented where reserve money was the operating target and broad money an intermediate target intended to control inflation. The link between reserve money and broad money was based on the hypothesis that the two are related to each other through the money multiplier. If the money multiplier is predictable and stable, the Bank of Zambia could control general monetary conditions by holding reserve money at a level in line with the expected broad money expansion. The speed

of liquidity management efforts was guided by deviations from the reserve money target (BoZ, 2014b). However, a weakening relationship between inflation and money supply made it difficult to achieve low and stable inflation (Simpasa *et al.*, 2015). This was largely on account of unstable and unpredictable relationship between the operational target (reserve money) and the intermediate target (broad money). As such, hitting the target did not guarantee the realisation of low and stable inflation (the ultimate goal). This meant that MAT was no longer capable of providing a sufficient monetary policy stance signal, making it difficult to deal with inflationary pressures and central bank credibility (Zgambo & Chileshe, 2014).

In a bid to modernize its monetary policy framework, Zambia adopted an interest rate targeting regime in April 2012 (BoZ, 2012; Figure 2.1). The Bank of Zambia policy rate was introduced as a key interest rate to signal monetary policy stance, and the overnight interbank rate became an operational target. The BoZ implemented a mid-rate interest rate corridor where the policy rate is in the middle of the corridor, and the overnight interbank rate can fluctuate within a range of +/- 1[1] percentage points of the policy rate to manage liquidity supply. The Bank conducts either expansionary or contractionary open market operations (OMOs), depending on the circumstances, to hold the interbank rate within the corridor if the overnight interbank rate tends towards the lower or upper band of the corridor. However, the corridor was not always maintained. Figure 2.2 shows a substantial deviation between the Policy Rate and overnight interbank rate in 2014 and 2016, when the interbank rate was allowed to exceed the policy rate upper bound corridor.

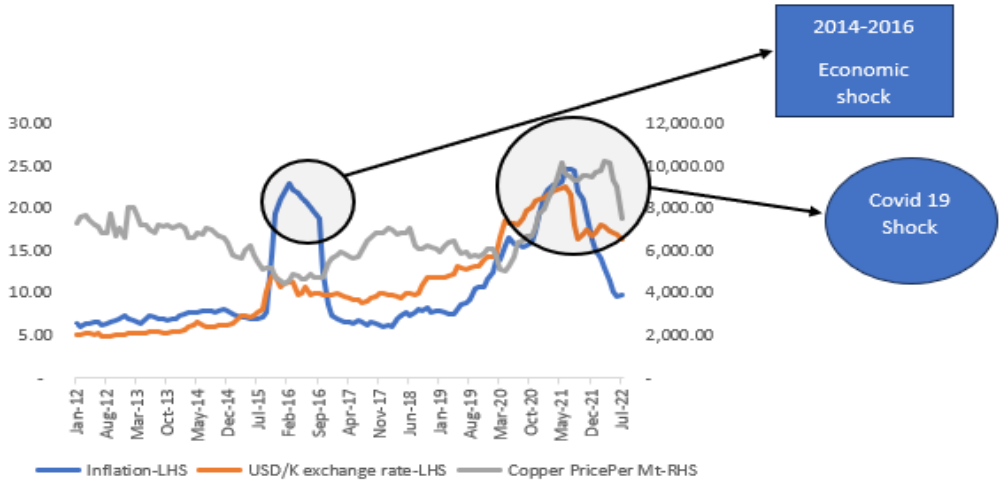
Figure 2.2:BoZ Policy Rate, Overnight Interbank Rate, and Interest Rate Corridor



[1] The Bank of Zambia formally reduced the policy rate corridor from -/+2 percentage points to -/+1 percentage point on 17 May 2017 to improve clarity of the policy stance and enhance effectiveness of monetary policy and enhance effectiveness of monetary policy

This deviation was deliberately allowed by the Bank of Zambia to contain the inflationary pressures following the exchange rate depreciation, increased electricity load shedding, and low copper production associated with reduced copper prices at the London Metal Exchange at the time (see Figure 2.3). Consequently, Zambia recorded high of about 23% inflation in February 2016, up from 7.4% recorded in the same month the previous year. Aggressive contractionary monetary policy was undertaken, and the policy rate rose from 9.75% in January 2014 and reached 15.5% in November 2016 (BoZ, 2014a; BoZ, 2017).

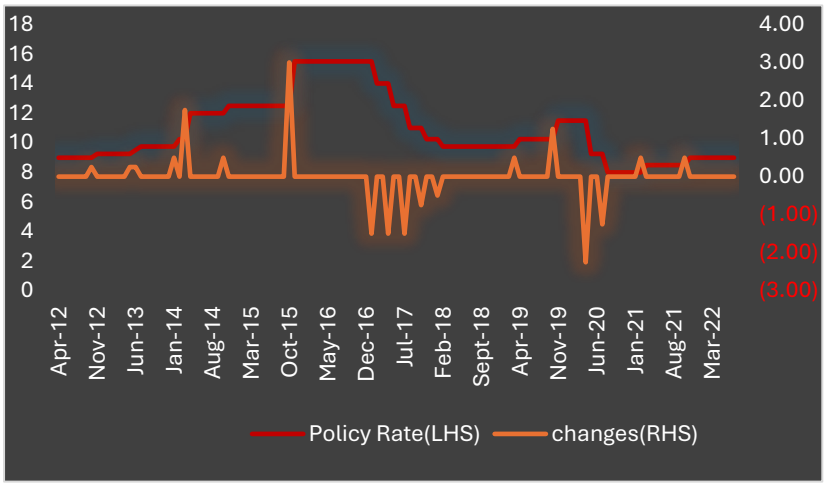
Figure 2.3: Copper prices, exchange rate, and inflation



2.3 General Overview of Monetary Policy Rate Developments in Zambia

Figure 2.4 provides an overview of the evolution of the BoZ Policy Rate for the period covered.

Figure 2.4: Evolution of Policy Rate in Zambia (April 2012-July 2022)

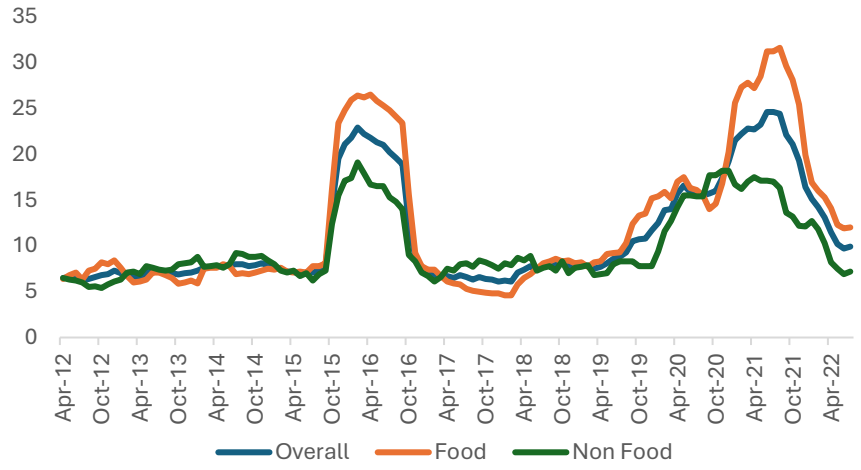


The Bank of Zambia's Monetary Policy Committee (MPC) meets quarterly to decide on the monetary policy stance, whether contractionary, expansionary, or unchanged, followed by the

announcement of the policy rate at a media briefing delivered by the Bank Governor. At the inception of the new monetary policy regime based on interest rate targeting in April 2012, the Bank of Zambia Policy Rate was set at 9%. It remained stable until October 2013 when it was revised upwards by 25 basis points to 9.25% and it gradually increased to 12% in February 2014 in response to rising inflation, mainly due to higher petroleum and maize prices following the partial removal of fuel and maize subsidies by the Government of the Republic of Zambia in May 2013 coupled with seasonal effects of lean periods in the agricultural sector. The passthrough effects of the local currency depreciation against major currencies and increase in banking sector liquidity, largely due to a 41.9% rise in public service wages in September 2013, posed inflationary risks (BoZ, 2013; BoZ, 2014). From a global perspective, threats from higher global food prices, negative global economic outlook and prolonged debt crisis in the euro zone contributed to increasing inflation (IMF, 2013).

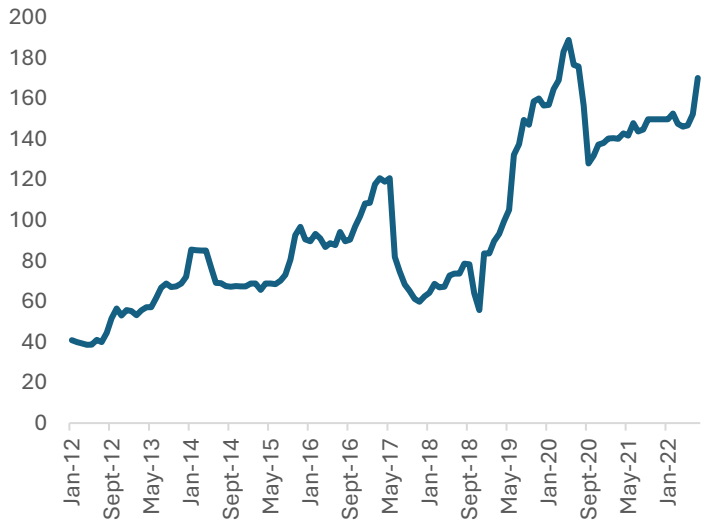
From 2014, the policy rate remained stable until November 2015 when it reached 15.5% following an aggressive contractionary monetary policy stance by BoZ to counter persistent inflationary pressures arising from domestic and global factors (Figures 2.5).

Figure 2.5: Annual Overall, Food and Non-Food Inflation



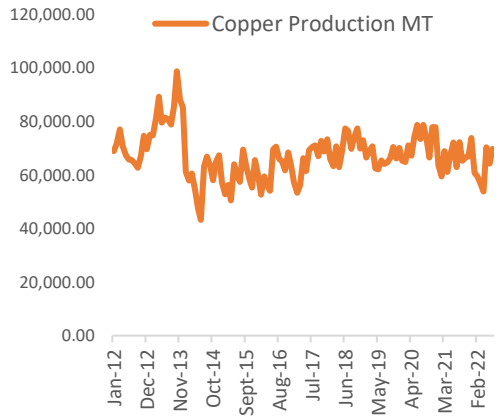
Local currency depreciation played a significant role in inflation by raising the prices of imported commodities, especially fuel given that Zambia is a net importer. Simultaneously, due to the effects of prolonged dry spells experienced in 2014/2015 rainy season, maize prices rose (Figure 2.6).

Figure 2.6: Maize Prices (K'/50Kg)



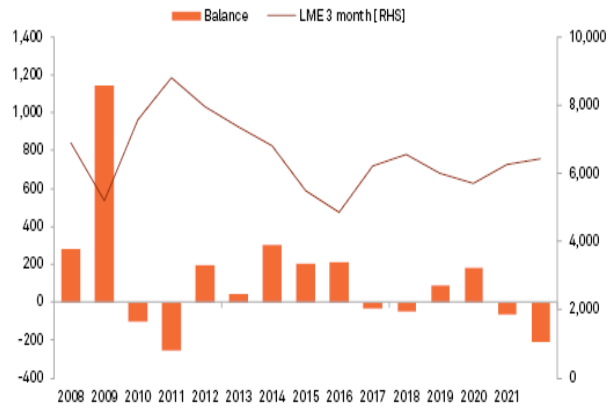
Dry spells in 2012/13 caused a significant decline in hydroelectricity generation which caused severe electricity rationing, with a negative impact on the production processes of all sectors, especially mining leading to low copper production (Figure 2.7).

Figure 2.7: Copper Production



Source: Ministry of Mines Zambia

Figure 2.8: Copper Prices

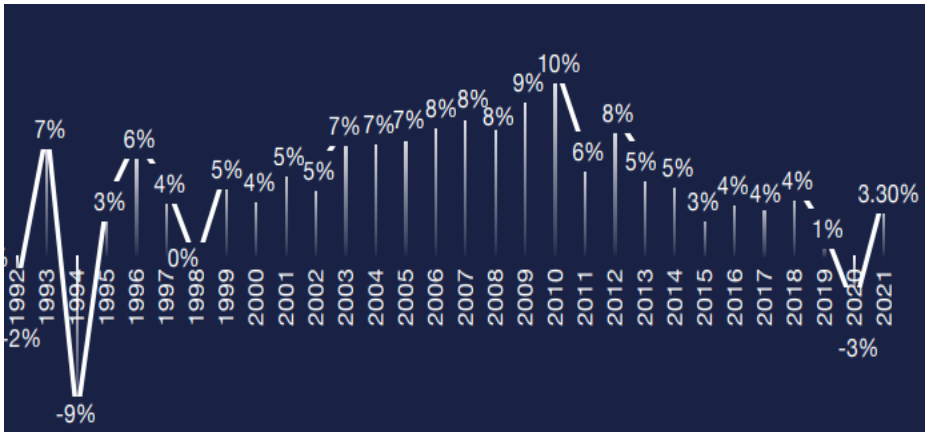


Source: S&P Global Market Intelligence
https://www.capitaliq.spglobal.com/articles/404469752.png

Copper prices on the London Metal Exchange (LME) fell at the same time when production went down largely due to China's economic slowdown (Figure 2.8). Closely related, the trade balance went from a surplus to a deficit as goods exports fell faster than imports, and international reserves dwindled largely on account of increased foreign debt repayments. Concurrently, interest rates on government securities rose significantly on account of increased government financing needs and tight liquidity conditions at the time (CUTS International,

2014; BoZ, 2015; Fitch Ratings, 2015). Other key foreign drivers of rising inflation in Zambia were inflation spill overs from the interest rates hikes by the US Federal Reserve Bank at the end of 2015, the Greek debt crisis, concerns about Zambia's credit rating downgrade by Fitch as well as amplified geopolitical tensions in Ukraine, North Africa, and Middle East. The inflation rebound in advanced economies such as the UK and the USA following the expected improvement in economic growth had an impact on Zambia's exchange rate and ultimately inflation dynamics (Caceres et al., 2016; Ortiz & Rodrigo, 2015; Duvhammar, 2018; IMF, 2015). Consequently, Zambia's GDP fell and recorded a 3% growth rate in 2015 down from the 5% recorded in 2014 (see Figure 2.9)

Figure 2.9: Zambia GDP Growth Rates:1991-2021



Source: Trading Economics

The Policy Rate remained stable until February 2017 when it fell to 14% and gradually declined until it reached 9.75% in February 2018 following a significant reduction in annual inflation to 7.5% in December 2016 from 18.9% in September 2016. The fall in inflation was largely attributed to the relative macroeconomic stability, renewed investor confidence, anticipated favourable agricultural output following improvements in the rainfall pattern, improved electricity supply and restored local currency exchange rate stability. In addition, the downward adjustment of the policy rate necessitated by the desire to boost sluggish economic growth observed between 2015 and 2016 by making access to credit cheaper. During the period of economic downturn, risk in the credit market grew characterised by high retail lending rates, associated with high non-performing loans (Central Statistics Office, 2017; BoZ, 2017).

From February 2018, the Policy Rate remained unchanged the until May 2019 and October 2019 when it was revised upwards to 10.25% and 11.5%, respectively. This reaction was triggered by observed and expected inflationary pressures, particularly the resurgence of

exchange rate depreciation and higher domestic food prices following erratic rainfall during the 2018/2019 farming season (BoZ, 2019).

However, in May 2020, an accommodating monetary policy stance was undertaken by BoZ and the Policy Rate was revised downwards to 9.25%. This was in a bid to mitigate economic growth risks emanating from sustained challenges of the Covid-19 pandemic, external debt vulnerabilities, weaker external demand and lower copper prices, underperformance of the rain-dependent agriculture sector due to drought, tight liquidity conditions.

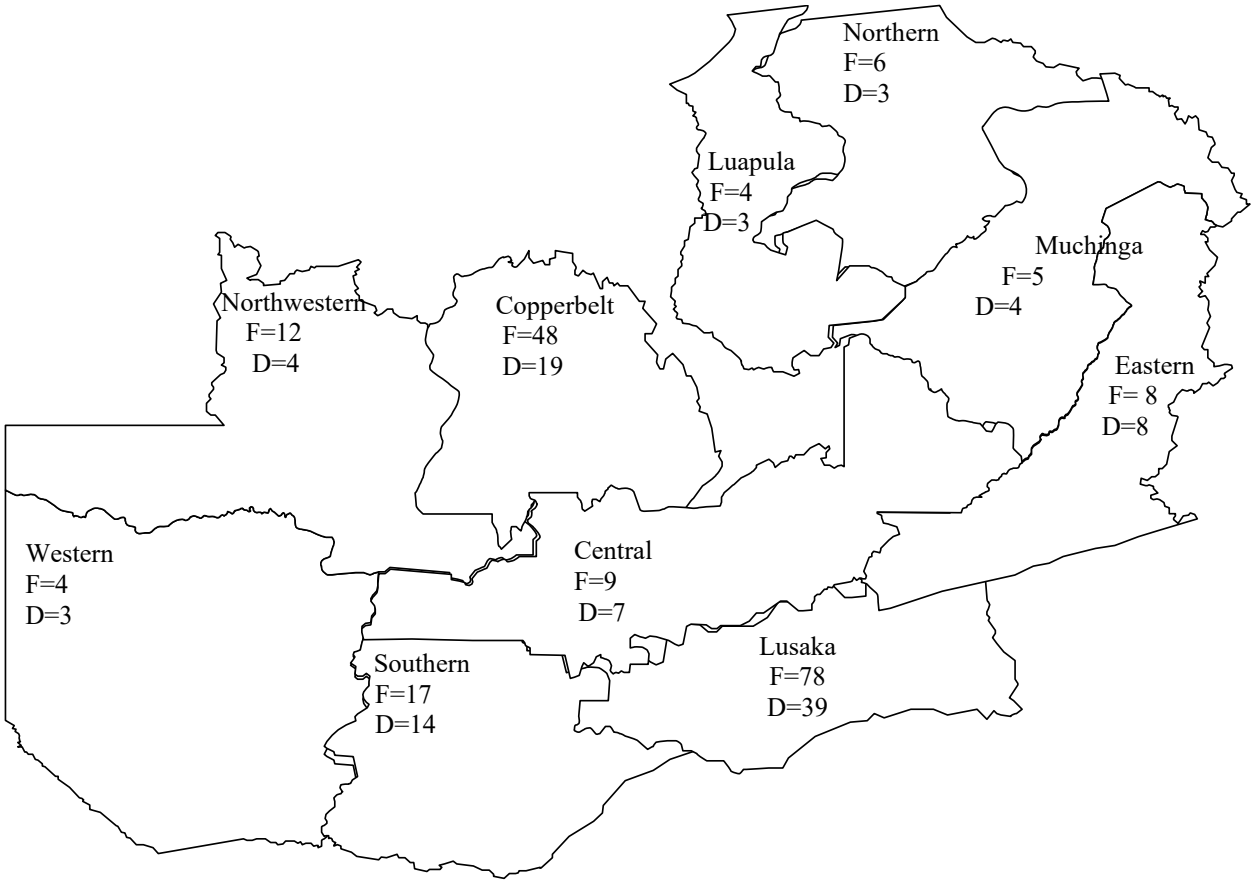
The COVID-19 outbreak worsened the situation of an already economically fragile country causing an unprecedented profound recession in output, the worst during the past 20 years. Just like other central banks, monetary policy in Zambia was aimed at stabilising economic growth by mitigating the adverse impact of COVID-19 whilst safeguarding financial systems stability and being mindful of inflation. Throughout 2020 to 2022, the Bank of Zambia took a deliberate decision to maintain the policy rate at lower levels, reaching an all-time low of 8% in August 2020. To compliment conventional monetary policy during this challenging time, the bank of Zambia introduced the Targeted Medium-Term Refinancing Facility (TMTRF), a market liquidity support programme and it had a direct impact on retail lending rates. The Policy Rate was then marginally revised upwards in February 2021 to 8.5% and 9% in November 2021. This was an attempt to steer inflation back to single digits and respond to projected inflationary pressures mainly from planned fuel price and electricity tariffs increases as part of the fiscal reforms by the newly formed Government in August 2021 (BoZ, 2020; IMF, 2020; BoZ, 2022).

Having looked at the movements in the policy rate, the next section looks at trends in credit supply and interest rates in Zambia's credit markets by different borrower segments.

2.4 Stylised Facts About Zambia's Banking Sector

Zambia's financial sector is relatively small consisting of banks and non-bank financial institutions. The banking sector plays a leading role in the financial system in terms of asset size. This structure reflects a segmented banking system, where, as of December 2022, the banking sector consisted of seventeen licensed commercial banks, twelve foreign owned and five domestically owned. Foreign banks dominated the banking sector in terms of branch network, loan size, total deposits, and asset size with over 70% of total assets (see Figures 2.10,2.11 and 2.12).

Figure 2.10: Bank Branch Network



Total	**295**
F	191
D	104

F=Foreign banks
D=Domestic

Figure 2.11: Total Credit Supply for New Loans (Foreign & domestic banks) (K' billions)

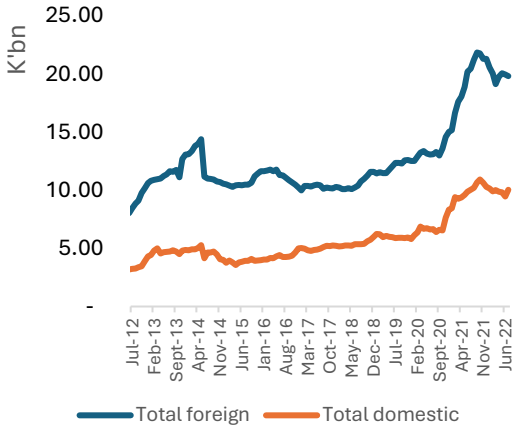
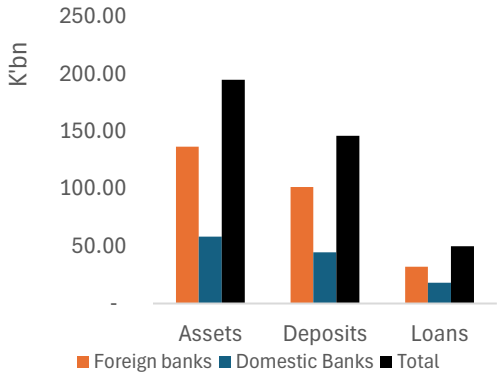
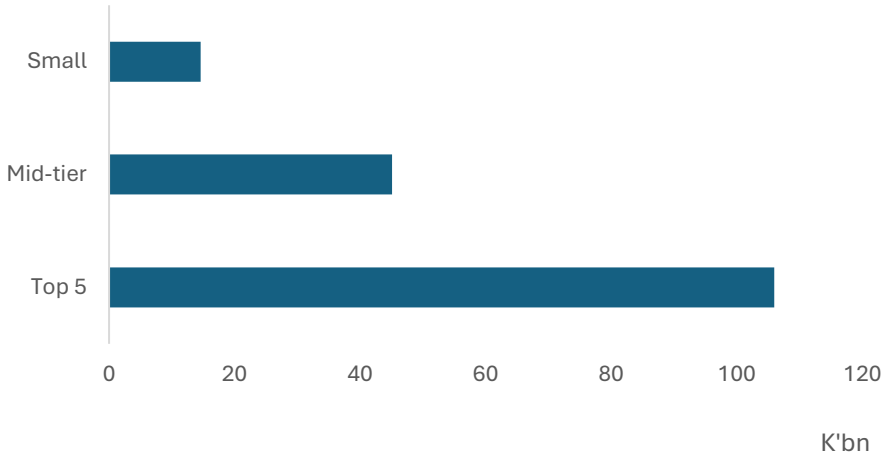


Figure 2.12: Outstanding Total Assets, Deposits and Loans as of December 2022 (K 'billions)



In addition, segmentation in the banking sector is observed through bank size, with most banking assets (about 64%) concentrated in the top five banks, leaving mid-tier and smaller institutions with a much smaller share of the market (see Figure 2.13).

Figure 2.13: Concentration of Bank Assets in Big 5 banks



2.5 Exchange Rate Framework in Zambia

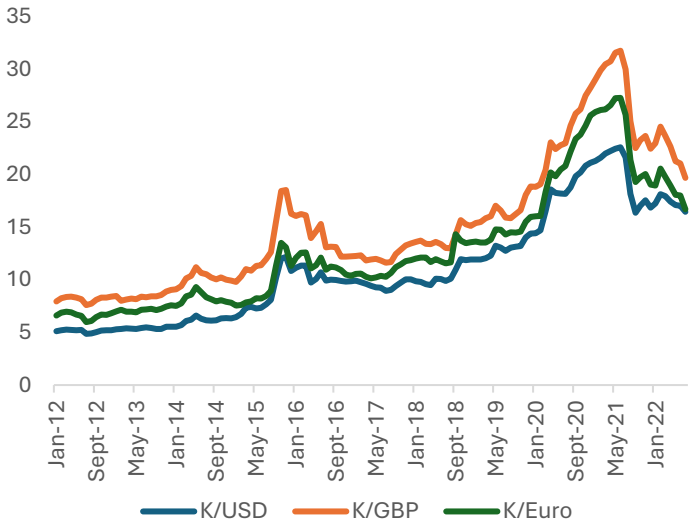
Since the liberalisation of external accounts and foreign exchange markets in the mid-1990s, Zambia has operated under a flexible (managed float) exchange rate regime in which the kwacha is determined largely by market forces. The Bank of Zambia (BoZ) intervenes occasionally to smooth episodes of excessive volatility and preserve orderly market conditions. Such interventions are typically conducted through foreign exchange auctions and over-the-counter operations with commercial banks, with sterilisation achieved via open-market operations and reserve-money management to ensure that short-term liquidity conditions

remain consistent with the policy-rate corridor. In normal times, this coordination keeps the overnight interbank rate the operating target of monetary policy close to the policy signal. During stress episodes, however, the BoZ may allow temporary deviations while using FX operations to lean against disorderly market dynamics.

The exchange rate plays a central role in Zambia's price-based monetary policy framework. A depreciation of the kwacha directly raises tradables inflation through higher import prices and fuels inflation expectations, thereby necessitating a tighter policy stance to stabilise inflation around the target (Rodger et al., 2017; Chipili, 2022). At the same time, exchange rate depreciation increases foreign-exchange funding costs and risk premia in the banking sector, particularly for institutions with foreign liabilities or importer-heavy loan portfolios. This widens the spread between retail lending rates and the policy rate, dampening the pass-through of monetary policy to end borrowers even when the interbank market reacts promptly. These channels were especially evident during the 2015–2016 tightening episode, when interbank rates were deliberately maintained above the policy corridor to contain second-round inflationary effects from a sharp kwacha depreciation.

Evidence from Bai–Perron multiple breakpoint tests applied to monthly USD/ZMW exchange rate (2012–2022) confirms the presence of major structural breaks in 2015–2016 and again in 2020. These breaks coincide with Zambia's largest episodes of exchange rate instability: the 2015–2016-kwacha collapse, driven by the global commodity price downturn and domestic fiscal imbalances; and the 2020 depreciation, reflecting the combined shocks of COVID-19, capital outflows, and sovereign debt distress. Together, the regime's flexibility and these breakpoints underscore the kwacha's sensitivity to both external shocks and domestic vulnerabilities (see Figure 2.14).

Figure 2.14: Zambian Kwacha Exchange Rate Movements



2.6 Size of Zambia's Interbank Market

Having only emerged in the 1990s, interbank markets in many low-income countries (LICs), including Zambia are still in the early stages of development (Calice & Zhou, 2018). Zambia's interbank market is relatively underdeveloped though the interbank transactions have increased to about 30% of GDP in the past decade (Raga & Tyson, 2021). This reflects some progress, although the market still falls short of the depth observed in more developed financial markets. Overnight transactions conducted largely on an uncollateralised, over the counter (OTC) basis dominate Zambia's intrabank trading, making it highly dependent on counterparty trust and relationship-based credit lines. Chipili et al. (2019) highlight several structural issues associated with the interbank market that might limit its effectiveness in reallocating liquidity across the banking system. However, despite these structural constraints, daily trading data show that all banks participate in both interbank lending and borrowing at least once every month, indicating that while the market is incomplete, it is not disjointed and serves as a critical backstop for liquidity redistribution.

In terms of market structure, the interbank market is highly segmented, largely driven by bank size and ownership. For instance, large foreign-owned banks, with large deposit bases, dominate interbank lending and tend to charge and pay lowest rates when trading to peers of similar ownership and size. However, they tend to charge relatively higher rates when lending to riskier and smaller banks mainly driven by parent-bank exposure limits and internal policies. On the other hand, small and medium-sized banks, which are often locally owned or pan-African in nature, participate more on the borrowing side and similarly trade more actively within their own categories than across groups. Small banks tend to charge relatively lower

rates when trading with peers than with larger banks while they charge high interest rates when they are lending to medium-sized banks (Chipili et al., 2019; Bwire et al., 2019).

With regards to pricing behaviour, for nearly 80% of the time since 2012, the overnight interbank rate has traded above the Bank of Zambia policy rate (IMF, 2017). This persistent above the policy rate lending rates reflect a combination of asymmetric information, heightened risk aversion and precautionary liquidity hoarding among participating banks. This forces banks with liquidity short positions, especially small banks, to rely on central bank funding facilities despite having ample liquidity in the system (Chipili et al., 2019). The absence of formal and comprehensive interbank market regulations further fuels this uncertainty and discourages wider participation, limiting the full potential of the interbank market.

While Zambia's interbank market is quite concentrated and thin, it is functional, and this makes the interbank rate an appropriate proxy for the monetary policy stance in Zambia in line with other previous studies. Unlike the policy rate, which is reviewed quarterly and may be held constant for extended periods, the interbank rate fluctuates almost daily, reflecting real-time market responses to liquidity conditions and central bank interventions. Moreover, under the current price-based monetary policy framework in Zambia, the interbank rate is explicitly the operating target for the Bank of Zambia and is expected to trade within +/- 1 percentage point of the policy rate corridor under normal conditions, except for episodes such as in 2014 and 2015 when it was deliberately allowed to trend above the upper bound to counter foreign exchange pressures and associated inflationary pressures. Therefore, the 5-day interbank rate which smooths out daily volatility was used in this study as it provides a timely, market-based, and policy-relevant indicator of the Bank of Zambia's monetary policy stance.

The calculation of the weighted average interbank rate used in the regressions is based on the individual banks' loan volumes and interbank borrowing rates with a maturity of 5 days. Importantly, during the period under consideration, every bank borrowed at least once per month on the interbank market, and this provides a comprehensive coverage of all banks' presence on interbank activity. For each month, individual banks' borrowing rates were weighted and averaged to derive an industry-wide interbank rate (proxy for policy rate).. Mathematically, this is expressed as:

$$IBR_{\mathrm{t}} = \frac{\sum_{i=1}^{n} r_{\mathrm{i,t}} \times Vi,t}{\sum_{i=1}^{n} V_{\mathrm{i,t}}} \qquad 2.1$$

Where:

IBR_t is the weighted average interbank rate at month t; r_{it} is the interbank borrowing rate of bank i in month t (for 5-day maturity loans); V_{it} is interbank loan volume for bank *i* in month *t* and *n* is the total number of borrowing banks. The weighted interbank rate is preferred as it provides a more realistic market-level measure of the cost of interbank borrowing.

2.7 Data Collection Process

Given the absence of bank level data in Zambia, a field-based data collection exercise was undertaken in 2022, with letters of introduction from my supervisors and the Bank of Zambia which emphasized the importance of the data for the study and provided assurances regarding data privacy (Appendices 2.1 to 2.3). I travelled to Zambia at the end of June and discussed with my sponsor, the Bank of Zambia, how to facilitate the collection of granular data from commercial banks. Before visiting individual banks, I visited the Trans Africa Union Zambia Office that manages the Credit Reference Bureau with a view that it would be easier to collect the required credit data from one place. This proved futile as the Credit Reference Bureau could only provide information on loan applications and approvals, not on the interest rates essential for the analysis.

I went back to Bank of Zambia and approached the Economics Department, the custodian of all the BoZ data, explaining that I could not collect all the data from Trans Africa Union and that the aggregate data available in-house is not the format required for the study. The Economics Department supported my request and provided a memo for the Bank Supervision Department, that supervises commercial banks, requesting for its intervention and support. There was discussion to decide the best approach that would avoid any form of conflict of interest as a regulator. After almost a month, a data request letter was cleared by Senior Management to be sent to commercial banks by the Bank Supervision Department. These approvals were completed after a month (see letters in Appendices 2.2 to 2.3).[2]

After the letter was approved, it was sent to 16 banks requesting them to provide monthly credit data for the period 2012 to 2022 for the four lending categories consisting of: loan applications, approvals, interest rates, provincial and gender distribution of the data. They were asked to complete the exercise within three weeks but only two banks managed to do so – for most the information was not readily available in the required format as it had to be extracted from manual systems for the period before 2018 (this took time and resulted in some errors). I sent reminders to banks via phone calls and physical visits and by the beginning of October 12 banks

[2] I am grateful for the support from my supervisors and my sponsors during the data collection process.

had sent their submissions. I then travelled back to Nottingham in the second week of October, but continued communications with the other four banks through email and international phone calls.

I then undertook careful data cleaning. Given the level of detail going back over ten years and the fact that much was retrieved manually, errors were discovered. A common problem was missing monetary values for loan applications and approvals in the month although the numbers of applications and approvals were recorded (and sometimes the reverse). In some cases, some variables were omitted completely although the other information submitted suggested the data on those variables were available, and in some cases could be derived from the other information. For instance, some bank officers thought the total monetary value of loans disbursed could be derived from the gender numbers, yet these numbers only covered personal loans (exclude loans to firms). Frequent follow-up contacts with banks via email or phone call was required to resolve issues.

By mid-2023 the dataset for 16 banks was completed, including the liquidity and asset values for each bank. Generally, the data on average monthly interest rates for the four loan categories was reliable; there were some large changes in some months for specific banks, but this is plausible where they are lending to relatively few clients and the composition of borrowers, size and conditions of loans can very between one month and the next. These large changes are addressed in the empirical analysis. The data on the number of loan approvals was generally reliable but was less useful as the numbers of loan approvals were not disaggregated by type of lending but provided as a block figure. The information on sector, province and gender (for personal loans) proved less useful in the analysis. Table 2.1 gives a summary of the variables that were collected straight from the 16 commercial banks operating in Zambia and how they were used in the study.

Table 2.1: Definitions and Relevance of Collected Variables

Category	Definition	Used or Not Used in Study
Loan Applications (Number)	Total number of new loan applications per bank, disaggregated by province, borrower sector of activity, and gender.	Not used as it is not disaggregated by borrower type. Moreover, Provincial-level and gender specific loan volume were of limited analytical value without corresponding lending rates that are determined

		centrally at bank headquarters and remain uniform across provinces and are not gender sensitive.
Loan Approvals (numbers)	Total number of new loans granted per bank, disaggregated by province, and gender.	Same as above
Loan Volumes (aggregate)	Aggregate Volume (monetary value) of new loans granted per bank, disaggregated by province and gender.	Same as above
Bank Capital	Capital levels for each commercial bank.	Used as a control for balance sheet effects
Bank Liquidity	Liquidity levels for each commercial bank.	Used as a control for lending capacity
Consumer Loans Volumes and Interest rates	Volume and interest rates of newly issued personal loans per bank per bank.	Used in loan-type heterogeneity analysis
Mortgages Loan volumes and interest rates	Volume and interest rates of newly issued mortgage (real estate) loans per bank.	Used in loan-type heterogeneity analysis
Commercial Loans (Corporate and SME)	Volume and interest rates of newly issued SME and corporate loans per bank.	Used – focus on corporate/SME pass-through

Accordingly, the final dataset used for analysis primarily focuses on new loan volumes and their corresponding interest rates by borrower type, alongside bank-level capital and liquidity indicators. This novel dataset provides the necessary granularity to assess heterogeneous monetary policy transmission through the interest rate channel.

2.8 Credit Supply by Bank Type and Loan Type

As already highlighted, foreign banks were the major lenders across all types of credit products throughout the sample period, although the volume of lending was similar to domestic banks for SME credit (see Figures 2.15, 2.16, 2.17 & 2.18). This similarity for SME lending might be an indication of a comparable risk profile placed on the SME borrowers throughout the banking sector.

Figure 2.15: Foreign and Domestic Banks by Credit Product Type: SME (K' Billion)

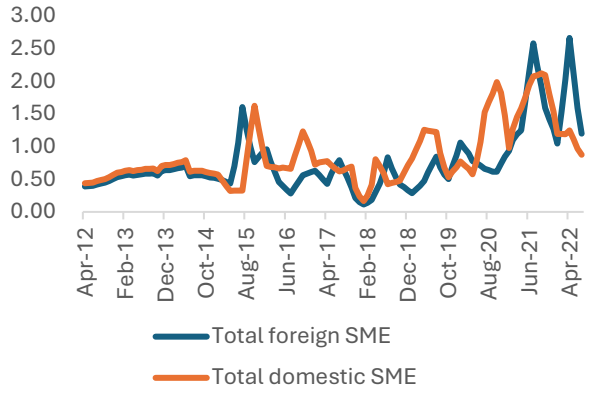


Figure 2.16: Foreign and Domestic Banks by Credit Product Type: Corporate (K' Billion)

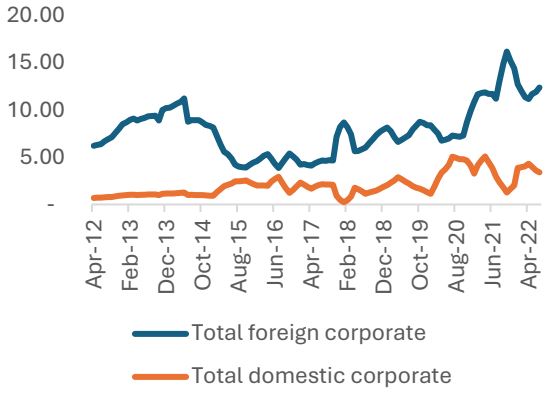


Figure 2.17 Foreign and Domestic Banks by Credit Product Type: Personal (K' Billion)

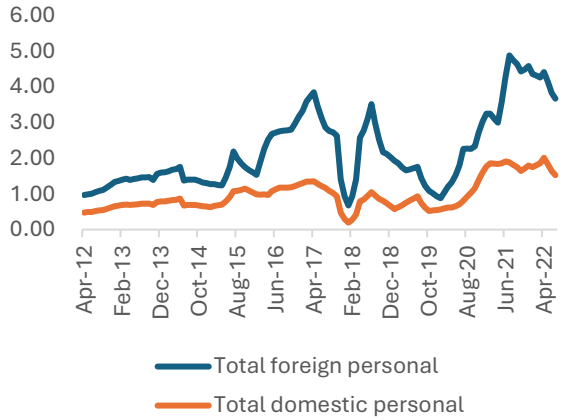
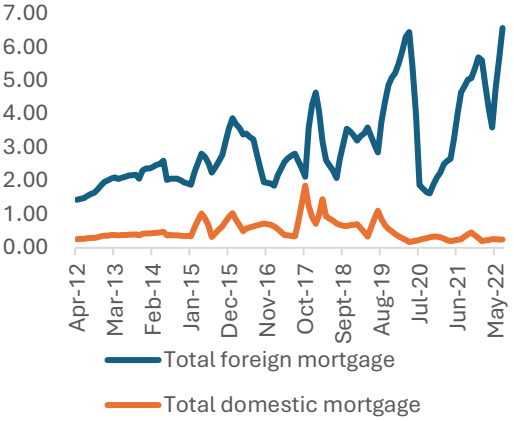


Figure 2.18: Foreign and Domestic Banks by Credit Product Type: Mortgage (K' Billion)



2.9 Sectoral Credit Supply

Total credit supply in Zambia by both foreign and domestic banks was concentrated in a few key sectors, notably agriculture, manufacturing, wholesale and retail trade. Domestic banks were relatively more concentrated in lending to agriculture, at least until 2018 and Personal and community services after 2017(see Figures 2.19 & 2.20).

Figure 2.19: Sectoral Credit Allocation-Foreign Banks (K' Billion)

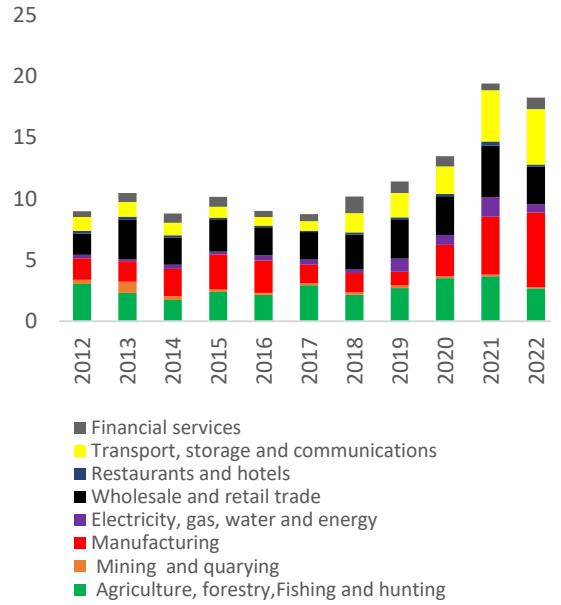
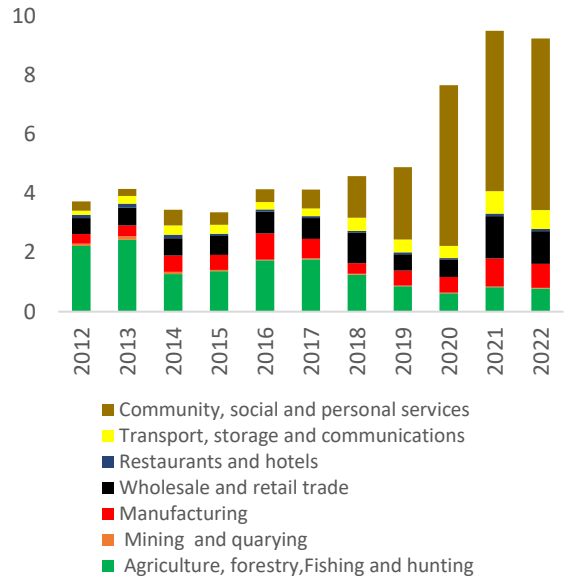


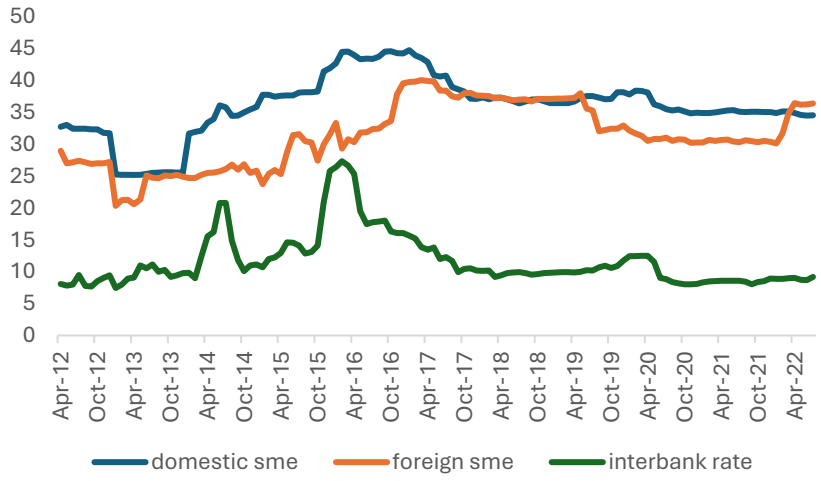
Figure 2.20: Sectoral Credit Allocation-Domestic Banks (K' Billion)



2.10 Interest Rates Movements

In this section, trends in interest rates movements are analysed across all borrower segments throughout the sample period. Figure 2.21 shows movements in SME lending rates for both domestic and foreign banks.

Figure 2.21: Foreign and Domestic Average SME Lending Rates



Both domestic and foreign banks seem to follow movements in the interbank rate but with minor misalignments. For instance, following the reduction of the policy rate in 2017, the average SME rate by foreign banks remained elevated while domestic SME rate showed a slight positive response (see Figure 2.21). Further when the monetary policy was raised in November

2019 as a response to the resurgence of exchange rate depreciation and higher domestic food prices, foreign SME rates remained low until February 2022, but domestic banks SME rate was raised almost immediately. In terms of pricing behaviour to SMEs, collectively, domestic banks tend to have slightly higher lending rates than foreign banks. The slightly lower average SME rate by foreign banks could be because of their greater liquidity. It may be that domestic and foreign banks lend to different types of SMEs (foreign banks may favour the SME targeted credit guarantee schemes, implemented with international partners, and offer lower rates for these loans).

Looking at the average corporate lending rate, domestic banks seem to follow movements in the interbank rate more closely than foreign banks, which charge lower corporate rates (see Figure 2.22). The lower rates could be because the main clientele of foreign banks are corporate borrowers with established long-term lending arrangements (corporate clients are also a major source of liquidity through deposits).

Figure 2.22: Foreign and Domestic Average Corporate Lending Rates

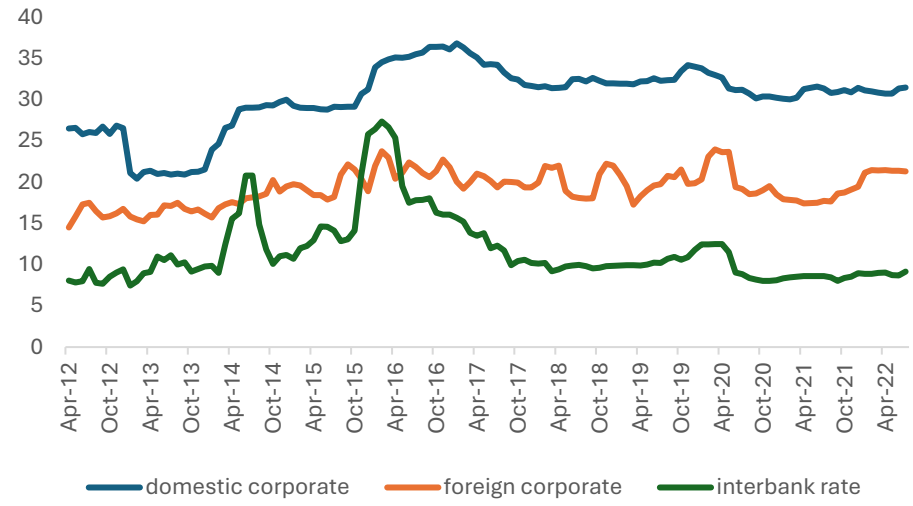
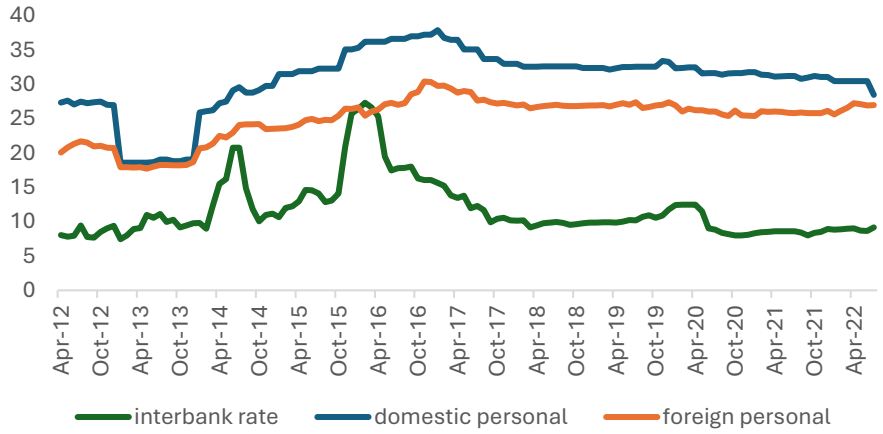
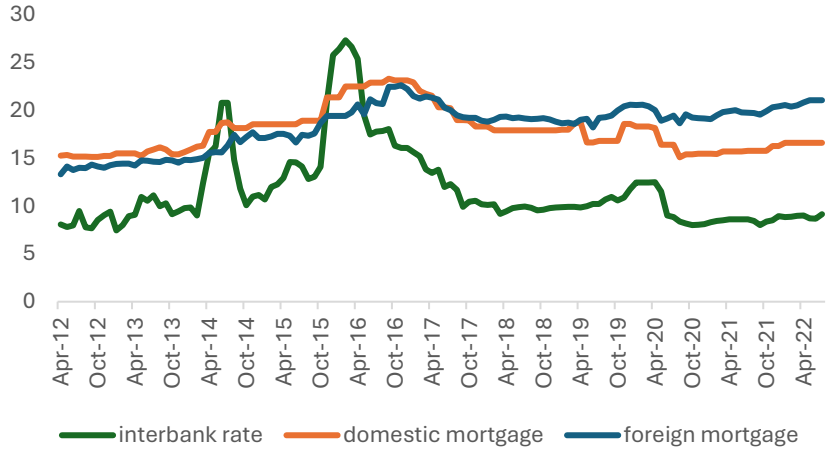


Figure 2.23: Foreign and Domestic Personal Average Lending Rate



As for the individual lending rates, both foreign and domestic banks seem to follow interbank changes, except for domestic banks in 2013 (Figure 2.23). The average personal lending rate set by domestic banks is higher, perhaps because personal loans form a large part of domestic banks loan portfolios compared to foreign banks. These personal loans are usually associated with higher risk given that most are only salary backed with limited collateral. This, associated with the high cost of funds faced by most domestic banks given their low assets and deposits, could compel domestic banks to set personal loan interest rates higher.

Figure 2.24: Foreign and Domestic Mortgage Average Lending Rates



Throughout most of the sample period, the average mortgage lending rates of both domestic and foreign banks showed similar responsiveness to changes in the interbank rate (Figure 2.24). However, a slight misalignment in the lending rate is noted after 2020 whereby the average mortgage rate by foreign banks appeared to be higher than the average mortgage rate charged by domestic banks. This might be attributed to the revaluation of the mortgage collateral

denominated in local currency by foreign banks following the continuous depreciation of the Zambian Kwacha against major convertible currencies.

It is important to note that within the Zambian banking sector, only a small proportion of loans are offered at fixed interest rates, primarily in the form of mortgage products. For the period under study (2012–2022), fixed-rate loans accounted for approximately 6% of the total loan portfolio captured in the dataset. These fixed rates are usually set for the entire loan cycle with tenures ranging between 5 and 15 years. The interest 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. In terms of monetary policy pass-through, it is expected that monetary policy changes are transmitted quickly through variable interest rates, with limited immediate effect on fixed interest rates. But with only 6% of the portfolio on fixed terms, the overall lending rate should largely mirror the prevailing monetary policy stance, with only a small dampening from the fixed-rate share, and this will be investigated further in the loan-specific analysis.

2.11 Weighting the Lending Rates

The bank level loan volumes data is used to weight the average interest rates presented above (and used in earlier studies) which could be misleading if there are some outlier banks charging different rates on a type of credit product. To address this, the lending rates across the different categories of loan products are aggregated into weighted average interest rates following the method of Brealey *et al*. (2010):

$$\text{Weight}_{\text{j}} = \frac{Blv_j}{\sum_{\text{j=1}}^{\text{n}} \text{Tlv}} \qquad 2.2$$

$$WALR = \sum_{i=1}^{n} \text{Weight}_j * lr_j \qquad 2.3$$

Where:

Weight_{j} is the weight of bank *j* in the total loan portfolio holdings in each loan product category and $WALR$ is the weighted lending rate of each loan category. Blv_j denotes loan volume for bank *j* for each loan product category, $\sum_{\text{j}}^{\text{n}} \text{Tlv}$ is the total banking sector loan portfolio for each loan category, lr_j is the interest rate for bank *j* for each loan product category and *n* is the total number of banks in each loan category.

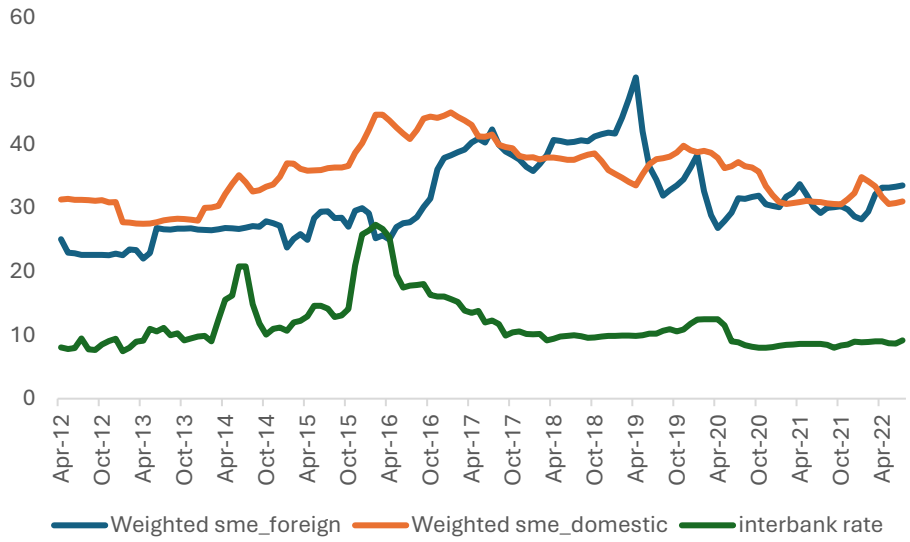
The weighting of the interest rates is done in two steps with the first weighting being carried out at the individual bank level. Thus, for each bank, lending rates were weighted by

corresponding loan volumes in every borrower category to have bank-level weighted interest rates in a given month. Therefore, what was collected at each bank was the bank-level weighted interest rate. Subsequently, the weighting process was repeated at the aggregate banking sector level, where these bank-level weighted rates were used to calculate the industry-wide weighted average lending rates for all borrower segments across all banks, using bank loan volumes as weights. This two-step process of weighting ensures that both intra-bank and inter-bank loan pricing variations are adequately captured to get a more representative and realistic measure of lending rates at the market level.

It is important to note that the interest rates used in the analysis are the rates for newly issued loans in each given month. This is to ensure that the rates used accurately reflect the prevailing monetary policy stance and other key macroeconomic conditions than reflecting historical information.

Weighted lending rates are employed in the aggregate analysis in chapter 4 as they ensure that banks with larger weights have a greater influence on the overall average in comparison to those with smaller weights, capturing the influence of larger banks on the aggregate measure.

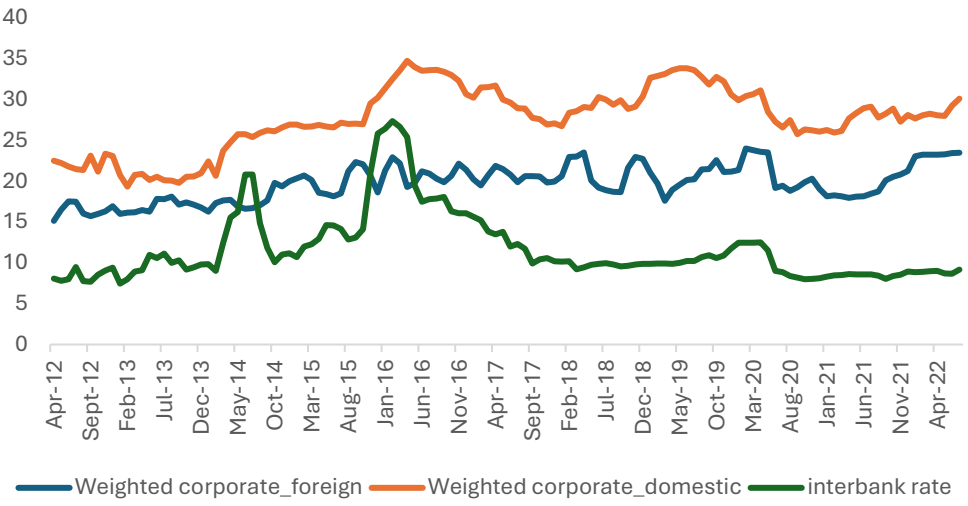
Figure 2.25: Foreign and Domestic Weighted Average SME Lending Rates



The pattern of movement for weighted SME lending rates appears broadly similar to unweighted rates except that foreign banks follow the interbank rate less closely than domestic banks (Figure 2.25). A widening gap emerges after 2016, with the SME rate of foreign banks rising significantly (and above that of domestic banks between April 2018 and July 2019) less responsive to interbank fluctuations and more volatile. The rate for domestic banks is relatively stable even after 2016. This suggests that foreign banks' SME lending is concentrated in banks

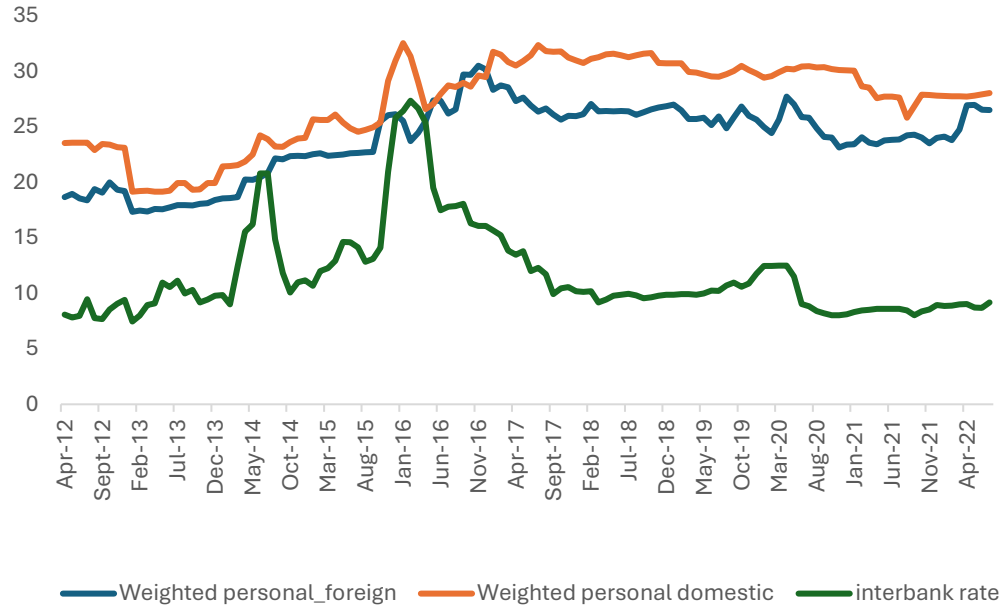
with lower use of interbank funds and less sensitive to interbank changes. Domestic banks appear to have greater use of and sensitivity to interbank funds for SME lending.

Figure 2.26: Foreign and Domestic Weighted Average Corporate Lending Rates



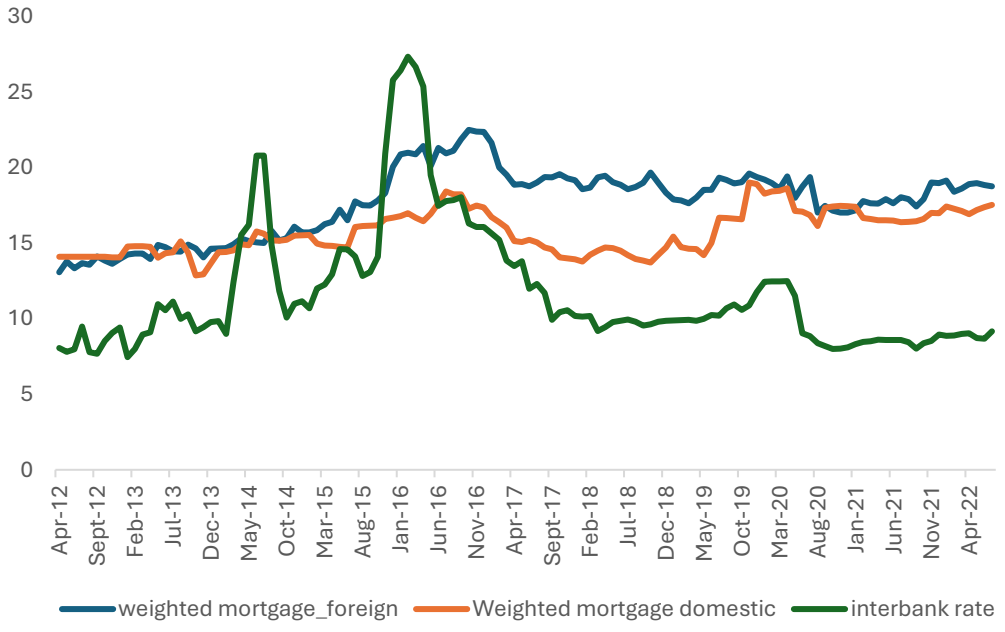
The sensitivity of weighted corporate lending rate to interbank changes seems higher in domestic banks than foreign banks and domestic banks have higher rates (see Figure 2.26). The widening margin between the weighted average corporate rate for foreign and domestic banks after 2016 is less pronounced than observed in the SME rate. This suggests relative pricing stability across all banks in corporate lending whereby banks might be operating under similar borrower profiles and market conditions. The higher domestic weighted corporate lending rate is consistent with domestic banks facing higher funding costs, lower liquidity or lending to higher risk corporate borrowers.

Figure 2.27: Foreign and Domestic Weighted Average Personal Lending Rate



Weighted interest rates for personal loans exhibit a similar trend to unweighted rates (see Figure 2.27) where weighted average personal rates for domestic banks are slightly higher than for foreign banks. The margin between interbank rate and weighted personal lending rate is significantly wider after July 2016, as observed in the SME lending rate suggesting a potential structural change.

Figure 2.28: Foreign and Domestic Weighted Average Mortgage Lending Rates



The weighted mortgage lending rates seem to closely track movements in the interbank rate with foreign banks offering higher lending rates than domestic banks for most of the period (see Figure 2.28). The increase in mortgage rates, particularly after 2015, can be largely attributed to the continuous depreciation of the domestic currency, which is the currency in which most mortgage collateral is denominated but the source of funding by these foreign banks might be abroad. Also, the spread between the interbank rate and interest rates after 2016 remained wider even after weighting the lending rates, strengthening the possibility of a structural change after that period.

Table 2.2: Annual Differences Between Interest Rates and Interbank Rates: Weighted vs Unweighted-Domestic Banks

	Average Mortgage	Weighted Mortgage	Average Personal	Weighted Personal	Average Corporate	Weighted Corporate	Average SME	Weighted SME
2013	6.90	5.90	16.23	13.67	16.28	13.26	21.75	21.66
2014	5.29	3.48	10.72	9.58	11.89	10.50	17.08	18.20
2015	4.70	1.54	16.21	10.58	15.48	12.58	22.26	20.96
2016	2.72	0.47	14.30	7.79	11.54	9.77	20.93	19.62
2017	6.24	0.72	20.43	13.01	19.44	15.95	27.45	26.92
2018	8.07	3.67	22.78	20.58	21.71	17.46	27.62	28.36
2019	8.25	4.62	22.68	21.15	22.29	20.93	26.88	26.74
2020	6.31	6.02	21.39	18.56	21.74	20.67	26.47	26.84
2021	7.04	8.34	22.91	21.07	21.92	18.00	26.60	25.26
2022	7.48	8.14	22.26	18.86	22.43	19.56	26.44	23.22

Table 2.3: Annual Differences Between Interest Rates and Interbank Rates: Weighted vs Unweighted-Foreign Banks

	Average Mortgage	Weighted Mortgage	Average Personal	Weighted Personal	Average Corporate	Weighted Corporate	Average SME	Weighted SME
2013	5.71	5.43	11.66	10.15	7.65	7.92	16.93	14.52
2014	4.16	4.02	8.59	7.63	6.09	6.59	14.00	15.67
2015	3.23	1.91	9.97	8.17	5.09	4.92	12.02	12.68
2016	1.05	0.75	5.92	4.51	0.96	0.81	10.78	8.31
2017	5.02	4.61	12.31	11.92	4.65	4.26	19.58	17.12
2018	8.69	8.30	16.66	15.61	9.55	10.33	27.09	28.03
2019	9.17	8.73	17.10	16.56	9.55	10.18	27.25	32.70
2020	8.57	7.80	15.58	14.46	9.72	10.42	21.79	22.77
2021	10.64	9.00	17.18	15.72	10.28	10.65	21.95	22.37
2022	11.50	9.67	17.42	15.60	10.65	12.07	22.76	21.59

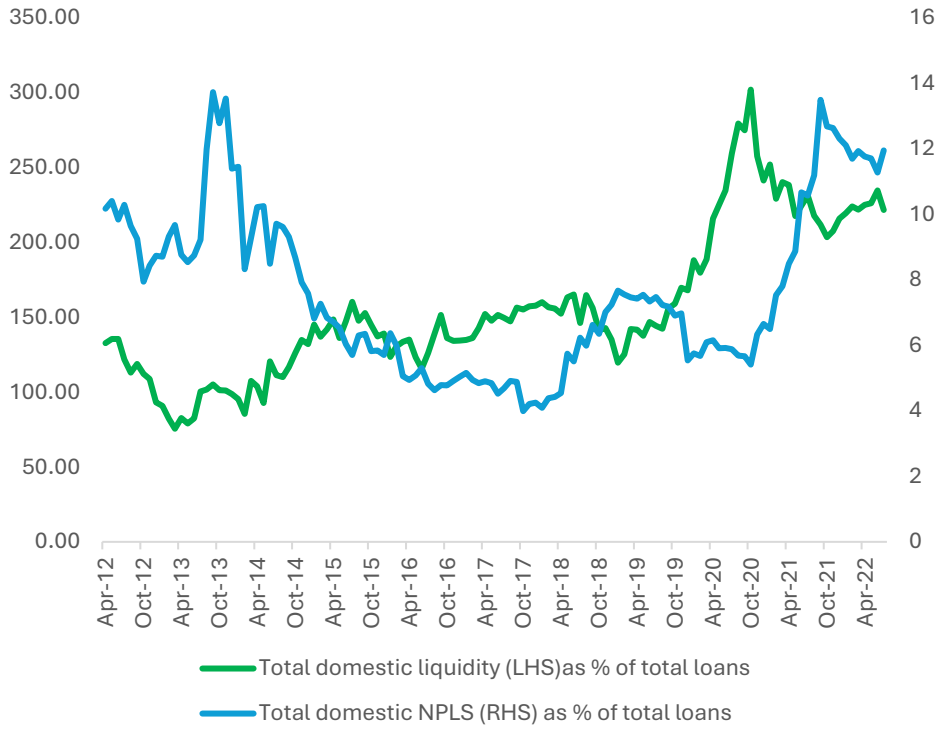
Tables 2.2 and 2.3 show annual differences between interest rates and the interbank rate by bank by type of borrowers, distinguishing between unweighted (simple average) and weighted interest rates to get insights on the effect of weighting the rates. The observed differences

between unweighted and weighted interest rates are non-trivial, an indication that weighting interest rates is important. For instance, for domestic banks, the spread between the unweighted interest rate and the interbank rate is consistently wider than the spread that exists when rates are weighted, especially for personal and mortgage segments in 2016 and 2017. This indicates that larger loans may have been extended at lower rates, causing the weighted lending rate to reduce. For foreign banks, the divergence between unweighted and weighted interest rates become more pronounces after 2018, especially for corporate and SME segments where it seems a larger share of loans were offered at higher lending rates, and the opposite may hold for personal and mortgage rates.

2.12 Non-Performing Loans and Liquidity

This section looks at trends in non-performing loans (NPLS) and liquidity levels.

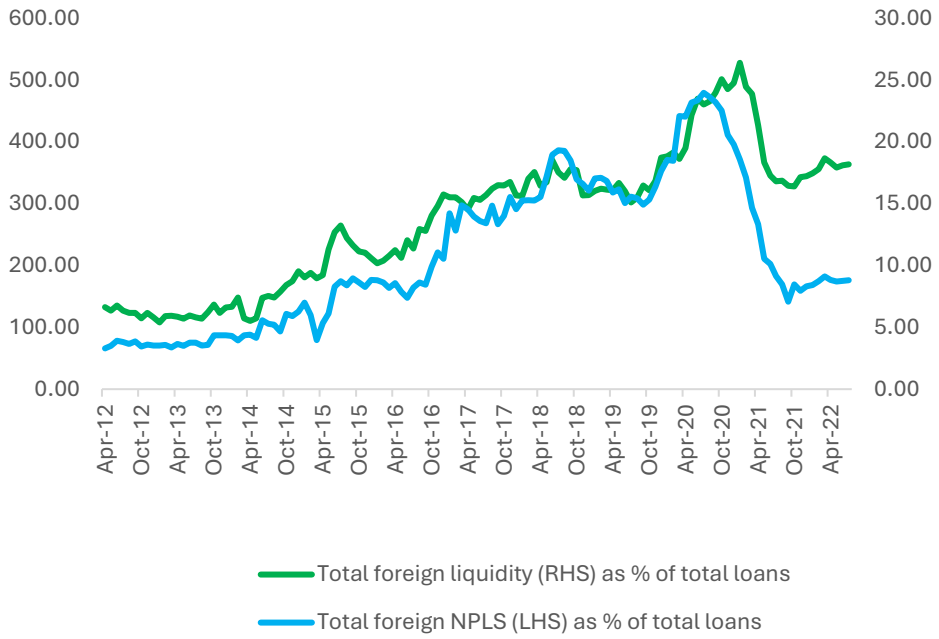
Figure 2.29: NPLs and Liquidity-Domestic Banks (K 'Million)



For domestic banks, the levels of NPLS were very high during two episodes, between 2015 and 2018 and again between 2020 and 2021, the 2015/2016 domestic macroeconomic crisis and the Covid-19 Pandemic (see Figure 2.29). Liquidity-to-loan ratios for domestic banks were generally low over much of the sample, and the first surge in NPLs coincided with especially tight liquidity conditions. This might explain why domestic banks consistently had relatively higher interest rates than foreign banks across different loan segments. The rise in liquidity

levels for domestic banks after July 2020 was driven by uptake of funds from the TMTRF, which was earmarked for onward lending to businesses. As banks received these funds, borrowers also benefited from improved credit availability and slightly lower rates. Subsequently, NPLs began to decline after May 2021 supported by both affordable financing and the resumption of normal business activity following the partial relaxation of Covid-19 restrictions.

Figure 2.30: NPLs and Liquidity -Foreign Banks (K 'Million)



With regards to foreign banks, they do not appear to have been heavily affected by the 2015/2016 domestic crisis, as their NPLs as a share of total loans did not rise sharply, while liquidity relative to loans remained elevated though somewhat volatile (Figure 2.30). However, NPL ratios continued to increase gradually thereafter and rose steeply in 2020, reflecting the adverse impact of COVID-19 on businesses. Elevated liquidity-to-loan levels may partly explain the relatively moderate response of foreign banks in adjusting their lending rates to movements in the interbank rate. The decline in NPL ratios after 2020 can be attributed to similar drivers as in the domestic segment, including improved liquidity from TMRF funding and the partial easing of COVID-19 restrictions. This suggests that the entire banking sector faced common challenges during the pandemic, with both domestic and foreign banks benefiting from the same policy support and recovery dynamics.

2.13: Descriptive Statistics by Bank Type

The descriptive statistics disaggregated by bank type are presented in table 2.4

Table 2.4. Descriptive Statistics

	FOREIGN BANKS					DOMESTIC BANKS				
	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
SME Rate	1,116	31.30	12.43	14.11	77.74	620	36.07	5.77	23.10	49.00
Corporate Rate	1,116	19.26	4.10	10.20	34.51	620	30.26	5.87	16.01	43.41
Assets (ZMW Billions)	1,364	5.27	5.30	0.26	30.900	620	3.816	5.30	0.10	30.400
Liquidity (ZMW Billions)	1,364	3.098	3.292	0.159	16.745	620	1.970	2.856	0.037	16.745
Capital (ZMW Millions)	1,364	724.765	565.93	4.47	3,725.35	620	392.40	404.27	0.802	2,242.3
	PAN AFRICAN BANKS					**GLOBAL & OTHER FOREIGN BANKS**				
	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
SME Rate	744	31.77	14.79	14.11	77.74	372	30.369	5.024	18.971	45.919
Corporate Rate	496	19.70	4.32	11.72	34.51	620	18.903	3.889	10.202	28.325
Assets (ZMW Billions)	744	5.57	6.23	0.03	31.00	620	4.91	3.92	0.16	16.00
Liquidity (ZMW Billions)	744	2.94	3.58	0.02	21.34	620	3.28	2.90	0.07	13.08
Capital (ZMW Millions)	744	631.97	650.80	4.48	3,700.00	620	665.780	451.119	14.295	2600

Descriptive statistics show that foreign banks charge lower interest rates than domestic banks on average. SME lending averages 31.30 percent for foreign banks, compared with 36.07 percent for domestic banks. In addition, corporate lending averages 19.26 percent for foreign banks, compared with 30.26 percent for domestic banks. In terms of size, foreign banks are larger on average, holding about ZMW 5.27 billion in assets, compared with ZMW 3.82 billion at domestic banks. They also hold more liquidity, about ZMW 3.10 billion compared with ZMW 1.97 billion, and more capital, about ZMW 724.77 million compared with ZMW 392.40 million.

Within the foreign group, Pan-African subsidiaries charge slightly higher average rates than global and other foreign banks. SME lending averages 31.77 percent for Pan-African banks, compared with 30.37 percent for global and other foreign banks. Corporate lending averages 19.70 percent for Pan-African banks, compared with 18.90 percent for global and other foreign banks. Pan-African banks are larger on assets, averaging ZMW 5.57 billion compared with ZMW 4.91 billion, whereas global and other foreign banks hold more liquidity on average at ZMW 3.28 billion compared with ZMW 2.94 billion, and more capital at ZMW 665.78 million compared with ZMW 631.97 million.

2.14 Conclusions

This chapter provides a detailed institutional background and analysis of Zambia's credit market, focusing on the evolution of monetary policy and policy rate trends, the composition of the banking sector, the size and structure of the interbank market, and key macroeconomic

developments including inflation, economic growth, and exchange-rate dynamics. It presents the commercial bank data collected and uses this to depict liquidity and NPLs, and interest rate movements distinguishing foreign and domestic bank averages across SME, corporate, real estate and individual lending segments. The trend analysis highlights that domestic and foreign banks exhibit varying and differing responses to interbank rate changes, empirically tested in chapters 4 and 5 of the thesis. The bank level credit segmented loan volumes data permits constructing the weighted interest rates to be employed in subsequent analysis of monetary policy passthrough. Weighted lending rates are shaped by the concentration of lending activity in a given lending segment by specific banks. This mitigates the impact of outliers by ensuring that banks with substantial lending activity have a fair influence on overall interest rate changes, resulting in a more realistic outcome of the aggregate analysis.

The data also reveals the possibility of a structural shift in Zambia's credit market after 2016 characterised by a widening gap between the interbank rate and lending interest to SMEs, individuals and corporates. This is empirically tested in chapter 4. The trend also show that liquidity levels have been generally low for domestic banks for most of the sample period before rising substantially after 2020 due to the access of Covid-19 support funds on the TMTRF. The trends also show that NPLS rise in periods of economic crisis such as the 2015/2016 domestic shock for domestic banks and the Covid-19 pandemic for both foreign and domestic banks.

With these insights, the chapter sets the stage for the empirical analysis in Chapters 4 and 5 to investigate the heterogeneous responses of interest rates by credit segmentation and bank types, to support policymaking. Chapter 3 describes the Monthly Indicator of Economic Growth (MIEG) to proxy monthly GDP also employed in the empirical analysis.

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Chapter 2 Appendices

Appendix 2.1 Letter from my supervisors at University of Nottingham

Our reference:

Your reference

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The Chief Executive Officer,
TransUnion Zambia,
P.O BOX 31199 Lusaka, Zambia.

August 12, 2022

RE: Data Request: Ms Cleopatra Ngoma

Ms Cleopatra Ngoma is a PhD student in the School of Economics, on secondment from the Bank of Zambia. She is undertaking research on monetary policy and monetary transmission in Zambia.

One component of the research aims to use bank level data (following a study for Uganda) to allow for heterogeneous effects of monetary policy transmission. For this analysis, she needs to collect monthly data on lending by the main banks in Zambia. This anonymous data should include:

Loan Applications, Approvals, Volumes, and Interest Rates (Credit Monitoring Report-2012 to 2021)

1. Total number of loan applications per bank at provincial level, borrower sector of activity and gender
2. Total number of loans granted per bank at provincial level, borrower sector of activity and gender
3. Volume or Amount of loans granted per bank at provincial level, borrower sector of activity and gender
4. Interest rates for the newly given loans per bank at provincial level, borrower sector of activity and gender
5. Bank capital for each bank
6. Bank Liquidity for each bank

Sectoral Distribution of Loans and Interest Rates (2000-2021)

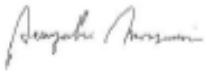
7. Volume and interest rates of Consumer Loans (Personal Loans) per bank
8. Volume and interest rates of Mortgages (Real Estate) per bank
9. Volume and interest of Commercial Loans (Aggregate Sectoral loans) per bank
10. Volume and interest of Loans to Government per bank

Leverhulme Centre for Research on Globalisation and Economic Policy
School of Economics, University of Nottingham

This letter is to verify that the data is requested for research purpose only, will be fully anonymous and securely stored at all times, and Ms Ngoma is working under our supervision. We would be happy to make the results of the analysis available if requested.

Yours sincerely,

Dr Oliver Morrissey
Professor in Development Economics and Director of CREDIT



Dr Atsuyoshi Morozumi
Associate Professor of Economics

Appendix 2.2 Bank of Zambia Memo from Director-Economics to Director-Bank Supervision

Bank *of* Zambia

ECONOMICS DEPARTMENT

MEMORANDUM

TO	:	Director- Bank Supervision
FROM	:	Director
DATE	:	August 22, 2022
SUBJECT	:	**DATA REQUEST: Ms. CLEOPATRA NGOMA**

Ms Cleopatra Ngoma, currently a PhD student at the University of Nottingham, is in the country to collect data for her research on monetary policy transmission in Zambia. She requires monthly bank level lending data to enable her assess heterogeneous effects of monetary policy transmission. The required data include, loan applications, loan approvals, interest rates for different loan products, location, sector, and gender of borrowers for the period 2012 to date.

However, the available quarterly data in the Bank is not sufficiently long to enable her to undertake the research. She has established, through Bank Supervision colleagues and some commercial banks, that commercial banks have up-to-date raw credit data. Considering the frequency, sample period and other commitments, it might take time for banks to prepare the data into the desired format. In view of this, I wish to request, through your office, if commercial banks could submit raw credit data to the Bank in two weeks time for the period 2012 to date. We will manipulate the data into the desired format and share with you at a later stage.

Thanking you in anticipation.

Jonathan M. Chipili

Appendix 2.3 Bank of Zambia Circular to all commercial banks from Director-Bank Supervision

BANK *Of* ZAMBIA

29 August 2022

To All Heads of Commercial Banks

Dear Sir/Madam

REQUEST FOR CREDIT DATA FROM JANUARY 2012 TO JULY 2022

Reference is made to the above matter.

Kindly note that one of our members of staff is currently pursuing a Doctorate Degree at the University of Nottingham and is undertaking research on monetary policy transmission in Zambia. The data required for this research include monthly credit trends on loan application and approval, loan disbursements by geography (i.e., by province), loan disbursements by gender and sector, and interest rates charged on various loan products. Please submit the data for the period January 2012 to July 2022, using the attached template.

This data should be submitted by close of business day on Friday, 9th September 2022 and should be emailed to the following email addresses: cngoma@boz.zm; tdandawa@boz.zm; and a copy sent to the Desk Officer on or before the stated date.

The data will be treated with utmost confidentiality and will be reported in aggregate. This research will add to the body of knowledge not only for the Bank but for the Country at large. Should you require any further clarification, please do not hesitate to contact the office of the Director - Bank Supervision.

Yours faithfully
FOR AND ON BEHALF OF THE BANK OF ZAMBIA

Gladys Chongo Mposha (Ms)
DIRECTOR – BANK SUPERVISION

Chapter 3: Compilation of a Monthly Indicator of Economic Growth (MIEG)

3.1 Introduction

A Monthly Indicator of Economic Growth (MIEG) is an index intended to capture trends in economic activity on a more regular basis (monthly) than quarterly or annual GDP. It offers a detailed perspective of changing economic conditions useful for analysing macro-economic developments, forecasting, empirical research, and policy formulation (Stanger, 2020). It was necessary to construct the MIEG to undertake econometric estimation including a monthly proxy for GDP (avoiding omitted variable bias). The outbreak of COVID-19 made it even more relevant due to high levels of uncertainty increasing the need for timely and sector specific insights on economic activity. Authorities in several countries have developed an MIEG (the name of the index varies) to support policy making and implementation in a changing economic environment. However, Zambia does not compile a MIEG despite information on most economic indicators being available monthly. This hinders the country's ability to monitor and undertake responsive research to respond effectively to economic changes in a timely manner.

The Bank of Zambia (BoZ) has been collecting several monthly real sector indicators to support monetary policy analysis by capturing economic activity developments. However, these indicators are fragmented and not combined in an index so are inappropriate for inclusion in econometric modelling. To overcome this challenge, a Monthly Indicator of Economic Growth (MIEG) for Zambia is constructed using real sector data collected by the Bank of Zambia with the specific objectives to:

- Construct the MIEG for Zambia using the available data based on concepts in the quarterly national accounts.
- Validate the reliability and accuracy of the constructed MIEG by comparing trends over time with existing official quarterly GDP data.

In addition to providing a core variable for my analysis, the MIEG provides a contribution to support the Bank Zambia in monitoring economic performance and informing monetary policy, including setting the Policy Rate. The MIEG facilitates timely economic monitoring,

supporting key decision-making and effective policymaking. To the best of my knowledge, this is the first attempt to construct a MIEG in Zambia.

3.2 Overview of GDP compilation in Zambia

National accounts in Zambia were until recently compiled using an outdated benchmark (the 1994 economic census) and a methodology from 1968. This provided an increasingly incomplete picture of the economy, especially considering periods of economic growth and structural change in the 2000s. To bring the national accounts up to international standards, in 2014, with the support from the IMF, Zambia rebased its national accounts statistics from 1994 to 2010, based on the 2008 System of National accounts (SNA). This included expanded coverage to include previously omitted activities. Official GDP numbers were released on an annual basis prior to 2016, when the first official quarterly GDP was published. However, quarterly GDP is still not timely, it is released with a 90-day lag after the end of the quarter, delaying the assessment of economy by policy makers. A Monthly Indicator of Economic Growth can be useful in providing a report on economic conditions in a timely manner (a lag of not more than 60 days); the aim of the MIEG is to provide early estimates within 30 to 45 days (IMF, 2017).

3.3 Literature Review on MIEG

There are several arguments that advocate for the use of high-frequency economic indicators. Construction of a Monthly Index of Economic Growth is motivated by the Informational Efficiency Hypothesis (IEH) proposed by Fama (1970), an economic theory that financial markets quickly and accurately incorporate all available information into asset prices. According to this hypothesis, financial markets are efficient, meaning that it is difficult to consistently achieve above average returns by trading on publicly available information. High-frequency economic indicators, such as weekly or monthly data, provide more frequent updates on economic conditions, enabling market participants to make more informed decisions and react quickly to changing circumstances. By applying this theory to the construction of a MIEG, the relevance of real-time information distribution and the quick adjustment of asset values to new economic events is acknowledged. This emphasizes the need of using high-frequency economic indicators, such as monthly data, which offer more regular updates on economic circumstances than standard quarterly or annual GDP releases.

There have been several studies on methods for calculating monthly economic growth or monthly composite indicators of economic activity in both developed and developing countries.

Mariano & Murasawa (2003) conducted a study on forecasting quarterly GDP with monthly economic indicators in the USA. To bridge the gap between the availability of high-frequency monthly data and the need for quarterly GDP forecasts, the authors created a monthly composite index of economic activity using a two-step approach. In the first step, a set of monthly indicators was chosen based on their economic significance and availability in a timely manner. These indicators included variables such as industrial production, retail sales, and employment figures. In the second step, the author utilized regression analysis to estimate the relationship between the selected monthly indicators and quarterly GDP. The accuracy of the composite indicator was evaluated by comparing the forecasts generated to the actual quarterly GDP figures, finding that the composite indicator provided more accurate forecasts of quarterly GDP compared to individual monthly indicators.

Woloszko (2020) developed machine learning based techniques to develop a weekly economic activity tracker over a large number of member countries for the Organisation for Economic Co-operation and Development (OECD) and G20. A quarterly model of GDP growth was initially computed using Google trends and search intensities at a quarterly frequency to nowcast weekly GDP growth. Thereafter, the weekly Google Trends series is applied to the relationship between Google Trends and activity to produce a weekly tracker, using the same elasticities calculated from the quarterly model. A model is used to fit the link between Google trends variables and GDP growth neural network machine learning algorithm. The technique captures non-linearities that, albeit difficult to estimate using more traditional econometric approaches, are likely to be crucial in severe circumstances. The Tracker is thus particularly well suited to assess economic activity when it is changing very rapidly especially when responding to an impact of a major shock. The study concluded that high frequency indicators can indeed provide valuable information for short-term GDP forecasting, but it's crucial to select the most pertinent and trustworthy ones for precise forecasting.

Stanger (2020) studied the construction of the Composite Economic Activity Indicator (CEAI), a monthly indicator of economic growth for low-Income countries. The paper covers the data and statistical requirements involved in creating such an index based on the System of National Accounts (SNA). The SNA approach ensures consistency with the GDP estimates from the Zambia Statistics Agency (ZamStats).

Marini (2014) developed XLPBM, an excel based add-in to assist compilers of national accounts statistics. The XLPBM is implemented using standard Microsoft tools available to all users and only requires that users have licensed versions of Microsoft Office. The XLPBM

employs the Proportional Denton method to benchmark the monthly index to the quarterly GDP. The Denton method calculate the selected monthly economic indicators in terms of Value Added (VA) while preserving the observed patterns and relationships of the official quarterly GDP. The tool also extrapolates the monthly estimates when quarterly GDP by activity is not available and is a useful resource for compiling economic indices at a higher frequency.

Moses et al. (2016) construct a composite index of leading indicators for the unemployment rate in Nigeria, using the OECD system described in Gyomai and Guidetti (2012). The prediction procedure entails examining numerous series that cover a range of economic activity elements that are known to have a strong correlation with unemployment. A single composite indicator is created based on Granger Causality and cross-correlation estimations of selected series within a given time frame. The findings show how well the composite index can forecast changes in the unemployment rate.

Hegazi et al. (2023) investigated the drivers of business cycles in Egypt by analysing the coincident and leading indicators, noting that cyclical patterns of variables could be used to gauge or forecast overall economic activity. Two quarterly composite indices are created, the Composite Index of Coincident Economic Indicators (CEI) and the Composite Index of Leading Economic Indicators (LEI), which perform well at forecasting Egypt's overall economic activity.

Anguyo (2011) created a Composite Indicator of Economic Activity (CIEA) for Uganda and showed how helpful it is in explaining short-term economic volatility. In small, open dynamic economies, the CIEA is regarded as a flexible and helpful instrument for assessing and forecasting economic activity. The CIEA was generated using monthly data from January 2005 to April 2011 on significant factors like exports, imports, credit, VAT, PAYE, excise duty, cement output, and sales of items.

3.4 Case Studies

Several developed countries compile and publish monthly GDP data to provide more timely insights into their economic performance. Outside Africa, notable examples include:

United States: The Bureau of Economic Analysis (BEA) in the United States releases the monthly GDP data, known as the "Monthly GDP Estimate." It provides an early estimate of economic growth and is used to monitor the state of the economy on a more frequent basis (Beureau of Economic Analysis, 2023).

United Kingdom: The Office for National Statistics (ONS) in the United Kingdom publishes the monthly GDP estimate as part of its national accounts. It provides an indication of the current economic activity and serves as an important tool for policymakers and analysts (Office for National Statistics, 2023).

Canada: Statistics Canada releases the monthly GDP data, providing a snapshot of the country's economic performance. It includes detailed breakdowns of GDP by production and expenditure components such as household consumption, investment, and exports (Statistics Cananda, 2023).

Germany: The Federal Statistical Office of Germany (Destatis) publishes monthly GDP data, known as the "Flash Estimate," which provides an early indication of economic growth. It is used to monitor the economic situation and guide policy decisions (Federal Statistical Office of Germany, 2023).

In Africa, the countries that compile monthly GDP or composite indicators of economic activity include:

South Africa: Statistics South Africa (Stats SA) compiles and releases monthly GDP estimates known as the ‘composite leading indicator (CLI)’ It provides insights into the economic performance of the country monthly (OECD, 2023).

Nigeria: Central Bank of Nigeria publishes a monthly GDP report called ‘Composite, Industry, Services and Agriculture Purchasing Managers' Index’ that provides information on the country's economic output and growth. It includes quarterly and annual GDP estimates as well (Central Bank of Nigeria, 2023).

Kenya: The Kenya National Bureau of Statistics (KNBS) compiles and publishes the Monthly Leading Economic Indicators report which highlights changes in consumer price indices (CPI), inflation, interest rates, and exchange rates. In addition, the report presents changes in indicators of international trade, agriculture, energy, manufacturing, building and construction, tourism, and transport. It offers insights into the performance of key sectors and economic activities in the country (KNBS, 2019).

Ghana: Bank of Ghana compiles composite index of economic activity. The index uses a selected real sector data such as tourist arrivals, mineral production, imports and exports (Bank of Ghana, 2023).

There are some African countries moving towards the construction of MIEG based on national accounts concepts despite Central Banks compiling composite indicators of economic activities. These include Ghana, Namibia, Uganda, Togo and Zimbabwe.

3.5 Methodology

The MIEG for Zambia was constructed using the 2017 Quarterly National Accounts Manual, which follows the System of National Accounts (2008 SNA). The MIEG therefore is an extension of quarterly GDP compilation on a monthly basis. The production and expenditure approaches are the two common methods of measuring economic activity in Zambia on an annual basis. However, currently, only quarterly GDP by production is available in volumes and nominal terms. Due to availability of high frequency indicators, the production approach in volumes was used as the main framework. In this approach, it is easy to weight economic activity indicators using quarterly GDP benchmarks (Sheik & Epaulard, 2017; Stanger, 2020).

The following key steps in constructing the MIEG were undertaken:

i. Collection of monthly indicators from different sources related to the economic activity in the GDP by production (see Table 3.1). The main source is the Bank of Zambia real sector and trade data databases, supplemented with other sources such as ZamStats and Ministry of Finance.

ii. Assessment of the selected indicators.

iii. Constructing the MIEG based on the proportional Denton method.

iv. Validate the constructed MIEG by comparing with official quarterly GDP.

3.5.1 Collection and Selection of the Real Sector Indicators: Data Sources

The Bank of Zambia real sector database is the main data source and contains the following production and sales indicators on: Cement, sugar, clear beer, opaque beer, soft drink, steel, metal, shoes, leather, round poles and sawn timber particle boards and plywood, spinning cotton fibre, mineral water, coal, kraft and tissue, rubber sheets and horse pipes, polypipes, PVC pipes, chicken drinkers, gemstones, quicklime, hydrated lime, milk, sugar, copper, electricity, electricity consumption. It also includes sales data from selected major supermarkets. There is also data on international passengers' arrivals and departures, domestic passengers' arrivals and departures, aircraft movement, tourist arrivals by national parks as well as total diesel consumption in the country.

Despite the data base having a variety of real sector indicators certain indicators appropriate for the MIEG compilation were missing or incomplete. To address this data gap, alternative sources such as ZamStats, Ministry of Finance, Zambia Information and Communications Technology Authority (ZICTA) and Energy Regulation Board (ERB) were consulted. Not all additional data could be compiled (there was no institutional support for this data collection exercise) and the missing data have been included in recommended data that the BoZ should incorporate in the real sector survey.

The scope of this MIEG was determined by the availability of the indicators that represent GDP for specific sectors, selected in line with the 2017 Quarterly National Accounts Manual. In some cases, an activity may have more than one indicator. In this case, an activity weighted index was created by using the latest available official quarterly value added (VA) weights applied by the ZamStats in line with Yamada (2016). For instance, manufacturing, construction, accommodation and food, transport had more than one indicator; weights were obtained from the detailed official value added (GDP) table for Zambia to combine indicators into one index to represent the higher-level industry. As an illustration, the construction index was created by combining indicators such as cement production, steel output, and timber production, with each indicator weighted accordingly. Table 3.1 summarises the selected real sector indicators in line with the official GDP sectors.

Table 3.1: Selected Indicators by Industry

GDP Sector	Monthly Indicator Used
Agriculture, forestry, and fishing	No monthly indicator available[3]
Mining and quarrying	Copper production (MT)
Manufacturing	Cement (MT) production, mealie meal production (Kgs), milk production (ℓ) and beer production (ℓ). A weighted index was constructed.
Electricity generation and supply	Electricity generation (MGH)
Water supply; sewage& waste	Data not collected by BoZ
Construction	Cement Production (MT), wood production (MT) and steel production (MT). A weighted index was constructed.
Wholesale and retail trade	Turnover sales (ZMW) from selected three big supermarkets.
Transportation and storage	Copper production (MT) and total fuel consumption (ℓ). A weighted index was constructed
Accommodation and food service activities	Number of tourist arrivals and beer production (ℓ)
Information and communication	Monthly data not collected by BoZ
Financial and insurance activities	Stock of loans and deposits (ZMW)
Real estate activities	Population growth
Professional, scientific, and technical activities	Copper production
Administrative and support service activities	Copper production
Public administration and defense	All public service workers' emoluments include defense.
Education	Number of students at three main public universities
Human health and social work activities	Monthly data not collected by BoZ
Arts, entertainment, and recreation	Tourist arrivals
Other service activities	Population growth
Net taxes on products	Total net taxes

Notes: Copper production appears in several sectors: In Transport and Storage, copper production drives both inbound freight (fuel, equipment) and outbound export logistics. Mining operations are also major consumers of Scientific and Technical Services (geology, engineering, ICT, and environmental consultancy). Mines are key subcontractors of Administrative and Support Services (security, catering, accommodation, maintenance, and cleaning services).

3.5.2 Assessment and Conversion of the Selected Indicators

Given that it is the same economy that both the MIEG and quarterly GDP measure, the performance of the activity indicators was assessed by comparing quarterly GDP growth rates with the corresponding growth rate of the selected indicator through correlation tests. Many indicators have shown strong positive correlations with sector specific GDP growth rates due to the same indicators being used in both quarterly GDP and MIEG (see Table 3.2). As the MIEG is in volumes, all indicators that were in nominal terms (monetary value) were converted to volumes using the consumer price index (CPI) as a price deflator. The CPI was re-referenced

[3] Despite omitting agriculture, a large section of the economy, output is partly captured in some manufacturing and retail

to the annual average of 2012 for the starting point for the study. For example, the sales turnover and the stocks of loans and deposits were changed into volumes using total CPI.

Table 3.2: Correlation Test and the Share of GDP

	Correlation (%)	Share of GDP (%)
Agriculture, forestry and fishing	NA[4]	7.2
Mining and quarrying	96.8	9.1
Manufacturing	9.6	8.4
Electricity generation and supply	77.6	1.9
Water supply; sewerage & waste	NA	0.3
Construction	21.4	9.6
Wholesale and retail trade	14.1	18.0
Transportation and storage	8.2	5.1
Accommodation and food service activities	72.9	1.8
Information and communication	NA	7.6
Financial and insurance activities	45.5	4.8
Real estate activities	76.1	3.6
Professional, scientific, and technical activities	59.6	2.1
Administrative and support service activities	81.6	0.9
Public administration and defense	33.3	4.5
Education	30.2	7.7
Human health and social work activities	NA	1.8
Arts, entertainment, and recreation	32.1	0.3
Other service activities	77.8	0.7
Net taxes on products	9.8	4.8

3.5.3. Calculation of the MIEG

Having converted all indicators into volumes to have the same measure, the value-added weights needed for the construction of MIEG were computed. As the relationships between aggregate values and specific indices are influenced by the weighting structure and the periods at which the weights are applied, in accordance with IMF (2017) guidelines the general Laspeyres formula was employed as follows:

$$LQ_t = \sum_{i=1}^{n} \left(\frac{q_i^t}{q_i^0} \right) * W_i^0 \qquad 3.1$$

Where: *LQ* is the aggregate volume index, *i* identifies the different component of the index (*n* is the total number of components), *t* is the current period (months), 0 is the initial observation (addressed as the base or reference period which 2012), *w* represents the weights (proportions) used to aggregate the quantity (or volume). These weights were derived using the national

[4] Not available

accounts weighting procedure, consistent with Zambia's system of national accounts. They are based on the share of the value added (VA) of each economic activity in total quarterly official GDP, in which they indicate the relative importance of each VA component in aggregate output. This approach ensures that sectoral contributions accurately reflect their role in economic activity, maintaining coherence with official GDP compilation practices.

The monthly value added (VA) of each economic activity in volumes are then calculated through benchmarking, in which monthly VA estimates are aligned with the quarterly VA official numbers using the XLPBM based on the Proportional Denton method.

3.5.3.1. Benchmarking based on the Proportional Denton Method

The benchmarked series largely preserve the quarterly or monthly growth rates in the indicator subject to the constraints given by the benchmarks (annual or quarterly). The minimization formula for the Extended Linear Projection Benchmarking Method (XLPBM) is given by:

$$\min_{X_t} \left[\sum_{t=2}^{q} \frac{X_t}{I_t} - \frac{X_{t-1}}{I_{t-1}} \right]^2 \qquad 3.2$$

Subject to

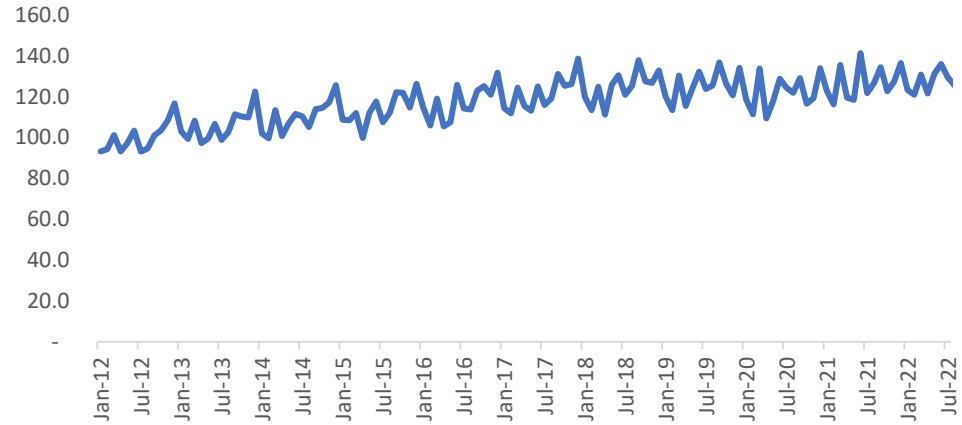
$$\sum_{t=4n-3}^{4n} X_t = A_n \qquad \text{for } n = 1, \ldots, y \qquad 3.3$$

Where: q is the last quarter for which quarterly source data are available, denoting either the fourth quarter of the last available year (q=4y) in case of a distribution problem or any subsequent quarter (q>4y) for a problem with extrapolation. X_t represents the value of the variable of interest at time t; I_t represents the benchmark index value at time t; and A_n is the benchmark value for a particular period n.

3.6 Results

Once the benchmarking is successfully conducted, then the monthly indicator VA across all sectors is summed to calculate a total monthly GDP, the MIEG our case (see Figure 3.1). The same procedure is applied when extrapolating, the only difference is that during extrapolation due to the non-availability of current official VA numbers, the previous official VA data are used as a reference point.

Figure 3.1: MIEG (Reference Annual 2012 = 100)



3.6.1 Validation of the MIEG

To check the consistency and validity of the constructed MIEG, the MIEG was converted to quarterly and compared with the official quarterly GDP. The results from the MIEG seem to move in the same direction with the official quarterly GDP series and is also highly seasonal as the official GDP (see Figure 3.2). In addition, annual growth rates were computed for each activity by comparing the quarter of the current year with the same quarter the previous year. The growth rates for the MIEG were close to those computed from the official quarterly GDP (see Table 3.3). However, there were a few notable misalignments in the MIEG and official growth rates, mainly as a result of the incomplete data used in the computation of the MIEG while the computation of official GDP uses a complete data set. For instance, data on activities such as information and communication, water supply, government expenditure data were missing while data on wholesale and retail trade data were incomplete.

Figure 3.2: Official Quarterly GDP vs MIEG

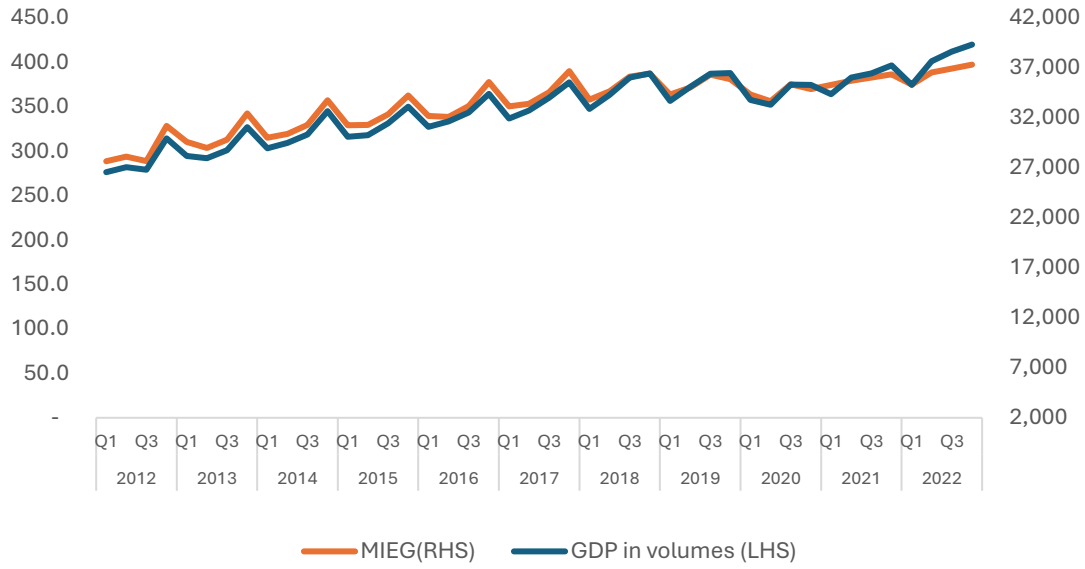


Table 3.3: Official Quarterly GDP vs MIEG

		GDP in volumes	MIEG	GDP Growth Rates (%)	MIEG Growth Rates(%)
2012	Q1	26,573	288.8		
	Q2	27,056	293.9		
	Q3	26,828	288.8		
	Q4	29,963	328.6		
2013	Q1	28,206	310.7	6.1	7.6
	Q2	27,953	303.6	3.3	3.3
	Q3	28,758	313.1	7.2	8.4
	Q4	31,075	342.5	3.7	4.2
2014	Q1	28,947	315.1	2.6	1.4
	Q2	29,516	319.3	5.6	5.2
	Q3	30,326	329.5	5.5	5.3
	Q4	32,668	357.4	5.1	4.3
2015	Q1	30,115	329.2	4.0	4.5
	Q2	30,274	329.8	2.6	3.3
	Q3	31,475	341.7	3.8	3.7
	Q4	33,140	362.7	1.4	1.5
2016	Q1	31,099	339.5	3.3	3.1
	Q2	31,652	338.7	4.6	2.7
	Q3	32,553	351.0	3.4	2.7
	Q4	34,419	377.9	3.9	4.2
2017	Q1	31,948	350.6	2.7	3.3
	Q2	32,751	353.6	3.5	4.4
	Q3	34,020	366.2	4.5	4.3
	Q4	35,552	390.2	3.3	3.2
2018	Q1	32,899	358.2	3.0	2.2

		GDP in volumes	MIEG	GDP Growth Rates (%)	MIEG Growth Rates(%)
	Q2	34,303	367.5	4.7	3.9
	Q3	36,042	384.1	5.9	4.9
	Q4	36,444	387.1	2.5	-0.8
2019	Q1	33,692	364.0	2.4	1.6
	Q2	35,107	371.7	2.3	1.2
	Q3	36,429	386.2	1.1	0.5
	Q4	36,473	381.2	0.1	-1.5
2020	Q1	33,792	363.7	0.3	-0.1
	Q2	33,307	356.1	-5.1	-4.2
	Q3	35,338	375.5	-3.0	-2.8
	Q4	35,318	369.8	-3.2	-3.0
2021	Q1	34,360	374.5	1.7	3.0
	Q2	36,043	379.4	8.2	6.5
	Q3	36,442	382.9	3.1	2.0
	Q4	37,245	386.5	5.5	4.5
2022	Q1	35,301	375.1	2.7	0.2
	Q2	37,663	388.8	4.5	2.5
	Q3	38,626	393.2	6.0	2.7
	Q4	39,338	397.5	5.6	2.8

3.7 Robustness Checks through PCA-Based Factor Model

To assess the robustness of the Denton based Monthly Indicator of Economic Growth (MIEG), an alternative nowcasting framework based on Principal Component Analysis (PCA) was constructed. This follows the seminal work of Stock & Watson (2002) who demonstrated that a small number of common factors, extracted from a large dataset of economic indicators, can explain much of the variation in macroeconomic aggregates such as inflation and GDP. In the case of this study, the PCA extracts latent common factors from a large set of monthly indicators of economic activity and uses them to generate and nowcast contemporaneous monthly GDP. This approach is attractive as it can be easily extended into full GDP forecasting frameworks such as Unrestricted Mixed Data Sampling (U-MIDAS) and Factor augmented VAR (FAVAR), thereby linking short-term monitoring to forward-looking analysis.

While PCA itself is an established method, its application to construct a MIEG for Zambia is novel. To our knowledge, this is the first systematic application of PCA-based factor bridge models to Zambia's real-sector dataset. The contribution of this section is therefore methodological in context: demonstrating that factor-based nowcasting, already standard in advanced economies, can be feasibly implemented in a developing economy with limited but growing high-frequency indicators.

Building on Stock & Watson (2002)'s PCA approach, Giannone et al. (2008), formalized a dynamic factor model technique nowcasting GDP in the US. Their research shown that main components may efficiently condense the co-movements of hundreds of financial and macroeconomic variables, allowing for precise real-time GDP tracking. This paradigm was then expanded to European economies by Bańbura et al (2013), who contended that factor models are particularly useful in contexts with a wealth of data but a publishing lag, where policymakers need timely signals about the state of the economy.

Since then, central banks in developed countries have incorporated PCA-based frameworks or factor modelling techniques to their nowcasting toolkits. For instance, the ECB uses bridge and dynamic factor models that condense information from a wide range of monthly indicators, while several Federal Reserve Bank such as the New York Fed run high-dimensional factor models to produce their nowcast updates (Almuzara et al., 2023). The Bank of England applies PCA-type factor structures to extract signals from surveys and market data for GDP and inflation, and the Bank of Canada has employed similar methods to account for regional heterogeneity and commodity exposure. Other central banks, such as Norges Bank and the Reserve Bank of New Zealand, have also explored PCA/factor models to improve the timeliness of GDP assessments, often embedding them into Bayesian or mixed-frequency frameworks (Bank of England, 2017; Chernis & Sekkel, 2017; Martinsen et al., 2011; Bayarmagnai, 2025).

3.7.1 Estimation Approach

To generate the PCA-based MIEG, a factor bridge model is estimated following the diffusion index approach of Stock & Watson (2002) and Giannone et al. (2008). The objective is to translate a large dataset of monthly economic indicators into a timely single measure of economic activity (the MIEG). The procedure is implemented as follows:

The first step involves the Standardisation and compression of a high dimensional dataset into a few principal components that summarises the co-movements of the entire dataset. The standardisation is necessary to deal with scale heterogeneity and volatility of economic indicators despite all being in volumes. Then the PCA analysis is applied to the standardized data matrix Z_t giving a small set of latent factors (F_t) that capture dominant common variations across the indicators and gives a summary of the information.

$$F_t = Z_t W_, \qquad 3.4$$

Where, W is matrix of eigenvectors of the covariance matrix of Z_t. The second step conducts temporal aggregation of the indicators to quarterly frequency to temporally align them with official GDP which is only observed on a quarterly basis.

$$\bar{F}_q = \frac{1}{M_q} \sum_{m \varepsilon q} F_m \,, \qquad 3.5$$

Where, $M_q$is the number of months in quarter q and $\bar{F}_q$ is the vector of quarterly factors. Thereafter, bridge regression of GDP nowcasting is undertaken where GDP series, yq, is regressed on aggregated factors to obtain the bridge equation:

$$y_q = \alpha + \beta^T \bar{F}_q + \epsilon_q, \qquad 3.6$$

Here, α is an intercept while β is a vector of factor loadings while ϵ_q is an error term. By creating an in-sample fitted series and, importantly, permitting nowcasts for quarters with only partial monthly data available, this regression bridges the high-frequency monthly indicators to the low-frequency GDP objective.

Next, the continuous high frequency MIEG is constructed by inverting the estimated quarterly bridge regression back to the monthly factors.

$$\hat{y}_m = \alpha + \beta^T \bar{F}_m \qquad 3.7$$

3.7.2 Out-of-Sample Forecast Evaluation

To evaluate the performance of the PCA-based MIEG, a pseudo real-time forecasting exercise was implemented across the entire sample (2012–2022). Following Giannone et al. (2008), the procedure recursively re-estimates the PCA factors and bridge regression each quarter using only data available up to that point and then generates nowcasts of GDP for the subsequent quarter. Forecasts are produced using partial-quarter vintages (one-month, two-month, and three-month averages of the factors) and then compared against official GDP once released.

Although this monthly GDP series is not directly observed, it is very similar to other interpolation-based methods, including Denton's proportional benchmarking (Denton, 1971).In addition, this approach allows to observe real time monthly sequential vintages of quarterly GDP nowcast that are generated in line with the movements of the real time macroeconomic indicators data and are given as follows:

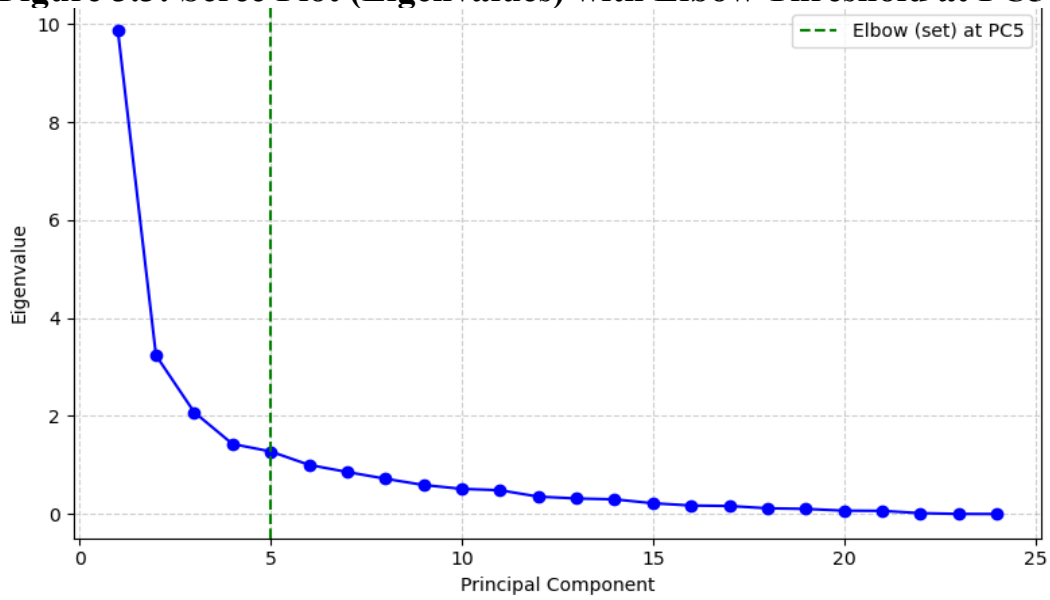
Equation: $\hat{y}_{q|m} = \alpha + \beta^T \bar{F}_{q,m}$ and m=1,2,3 3.8

Where, $\bar{F}_{q,m}$ refers to the partial-quarter mean of the factors up to month m. This procedure illustrates how decision-makers would instantly update their GDP nowcast if fresh monthly data became available. Here, the factors available for that one month of the quarter are utilised after one month; the first two months' average is used after two months; and the full-quarter average is used after three months until the official GDP numbers are available.

3.7.3 Selection of Factors

The selection of the number of principal components to retain was guided by the scree plot criterion (Cattell, 1966). Figure 3.3 presents the eigenvalues associated with successive principal components. The curve exhibits a sharp decline for the first four components, followed by a marked flattening after the fifth, which represents the "elbow" point. This inflection indicates that additional components beyond the fifth contribute only marginally to explaining the variance among the indicators and are likely to capture noise rather than systematic co-movements.

Figure 3.3: Scree Plot (Eigenvalues) with Elbow Threshold at PC5



Therefore, based on this elbow criterion, five principal components were retained for constructing the PCA-based Monthly Indicator of Economic Growth (MIEG). These five factors jointly explain approximately 75% of the total variance in the underlying indicators, which provides a parsimonious yet comprehensive representation of aggregate economic activity. This choice is consistent with the approach of Stock and Watson (2002) and Giannone

et al. (2008), who advocate selecting a small number of common factors sufficient to capture the dominant co-movements in macroeconomic data while avoiding overfitting.

3. 7.2 Results

Figure 3.4: Denton_ MIEG vs PCA_MIEG (Reference Annual 2012 = 100)

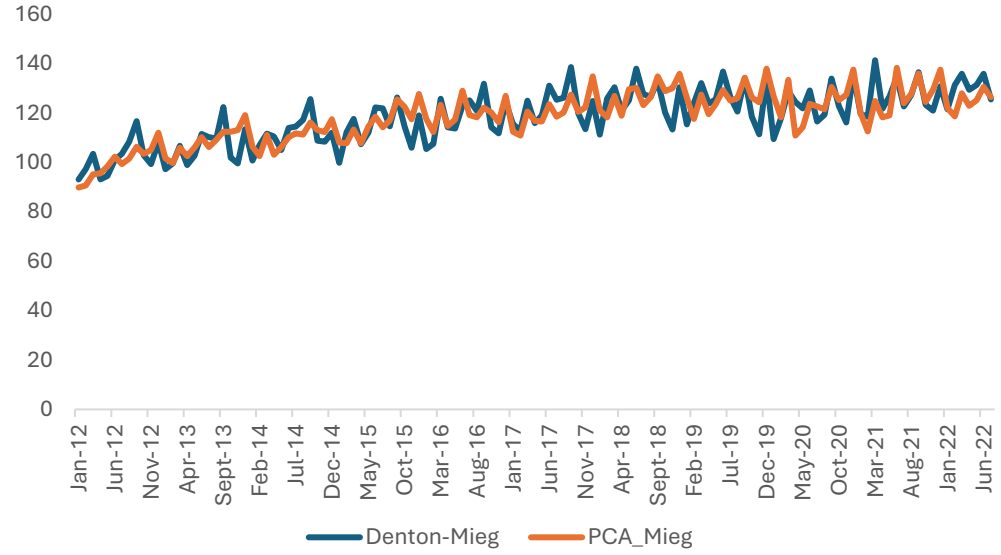
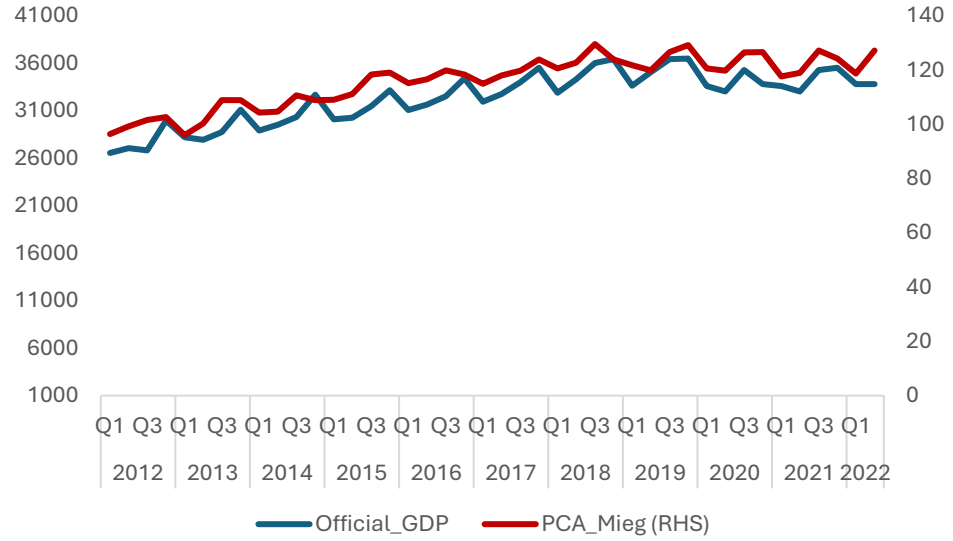


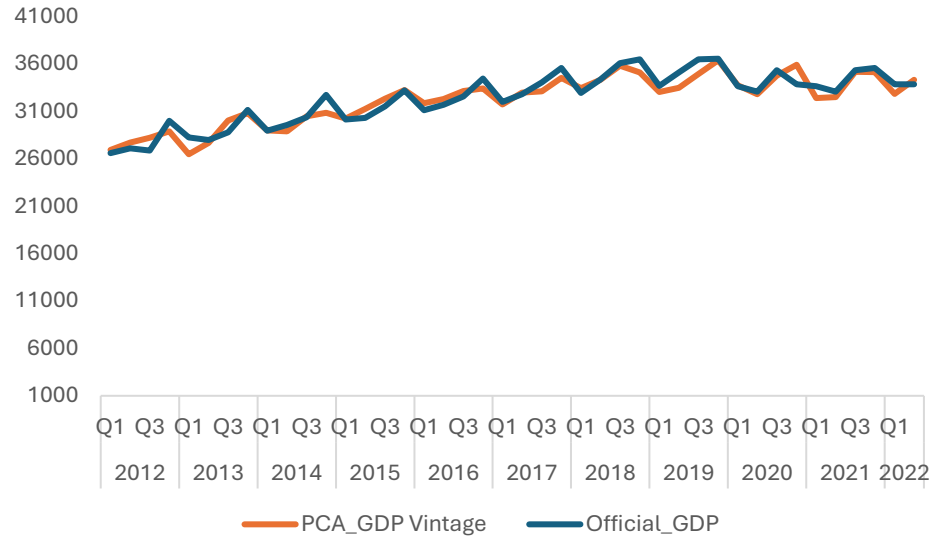
Figure 3.4 compares the Denton-based and PCA-based Monthly Indicators of Economic Growth (MIEG). Both indices exhibit a strong co-movement and capture the same medium-term growth dynamics over 2012–2022. The Denton-MIEG displays sharper short-term fluctuations, reflecting its direct benchmarking to quarterly GDP and closer alignment with high-frequency variations in the underlying indicators. In contrast, the PCA-MIEG is relatively smoother, as it relies on factors extracted from a large set of indicators through bridge regressions, which compress idiosyncratic noise. The close alignment of the two series, despite methodological differences, validates the PCA-based approach as a robust complementary measure to the Denton benchmark, providing a coherent and timely monthly signal of economic activity.

Figure 3.5: PCA_MIEG vs Official GDP



The PCA-based MIEG tracks Zambia's official GDP series quite closely as it produces dynamics that are highly consistent with both the official GDP benchmarks (see Figure 3.5). This confirms its robustness as an independent approach for now casting GDP based on a data-driven factor model that captures co-movements in the indicators and can be extended to real-time monitoring and forecasting.

Figure 3.6: Quarterly GDP: PCA_GDP Vintage vs Official GDP



Likewise, the PCA based GDP vintages follow the official GDP quite closely, effectively capturing the cyclical patterns (see Figure 3.6). This demonstrates the value of the PCA based vintage framework for real-time GDP monitoring. As new monthly information accumulates

within each quarter, the model refines its estimates and provides policymakers with an early signal of GDP development, even before official quarterly releases are available.

3.7 Out of Sample PCA MIEG

Following Stock & Watson (2002) and Giannone et al. (2008), the PCA-based MIEG was evaluated in a pseudo real-time out of sample exercise. The training sample covers 2012–2016, while forecasts are generated for 2017–2022. This setup mimics the information set available to policymakers at the time and allows us to compute genuine forecast errors. PCA-based nowcasts were compared against official GDP.

Figure 3.7: Out of Sample MIEG vs Official GDP

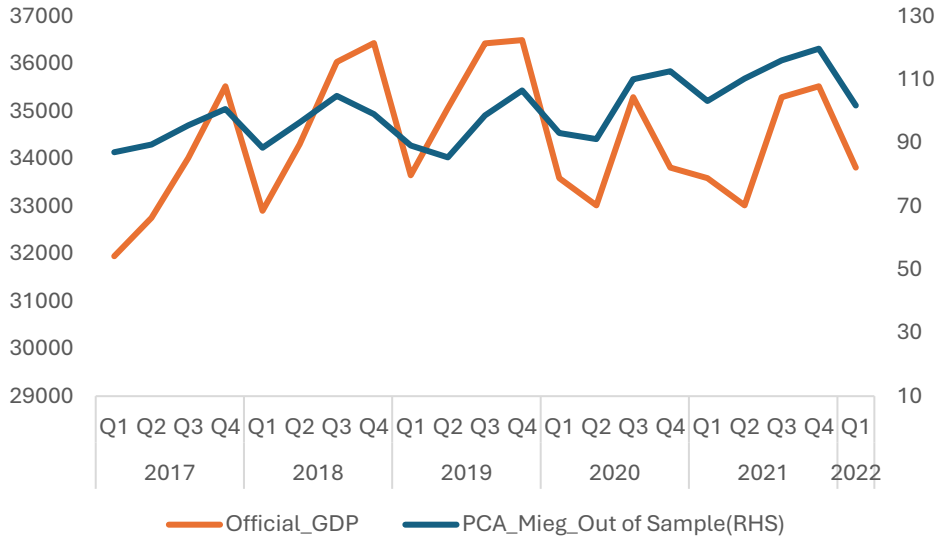


Figure 3.7 compares Zambia's official GDP series with the PCA-based Monthly Indicator of Economic Growth (MIEG) generated in a fully out-of-sample setting over the period 2017Q1–2022Q1. The PCA MIEG tracks the broad cyclical profile of official GDP quite closely, capturing major turning points such as the 2017–2018 slowdown, the 2019 expansion, and the contraction associated with the COVID-19 shock in 2020.

Notably, while the PCA MIEG tends to smooth out some of the quarter-to-quarter volatility present in the official GDP data, it provides timely signals that are consistent with observed business cycle fluctuations. This result is in line with international evidence (Stock & Watson, 2002; Giannone et al., 2008; Bańbura et al., 2013) showing that factor-based models can extract reliable common components from high-dimensional indicator sets.

The out-of-sample performance further validates the robustness of the PCA approach: the forecast errors remain moderate, and the co-movement with official GDP suggests that the extracted factors are informative about real activity even when official GDP is not used in estimation. Thus, the PCA MIEG offers a viable real-time monitoring tool for Zambia's economy, complementing the Denton-based benchmark series.

3.9 Conclusions

The Bank of Zambia collects a range of real sector indicators that are valuable for monitoring economic activity and informing monetary policy. However, in their raw form these data are fragmented and difficult to integrate into econometric analysis. To address this gap, this study constructed a Monthly Indicator of Economic Growth (MIEG) for Zambia covering the period 2012–2022, using real sector indicators compiled by the Bank.

The compilation followed the Quarterly National Accounts Manual (2017) framework, consistent with the 2008 SNA. The MIEG was generated in volumes using the Proportional Denton method, implemented via the XLPBM Excel add-in, which benchmarks monthly indicators to quarterly GDP by economic activity. The method also extrapolated values where official quarterly data were unavailable. To validate the index, the MIEG was converted into quarterly frequency and compared with official GDP. The two series exhibited the expected co-movement, with minor discrepancies largely attributable to incomplete underlying data.

The analysis further highlighted gaps in the Bank of Zambia's real sector database. Some important indicators that could improve real sector assessment and strengthen the MIEG compilation remain absent. Expanding the scope of the survey to incorporate these indicators would enhance the quality and reliability of the index.

A complementary approach, based on PCA factor bridge models, produced an alternative MIEG that closely aligned with the Denton-based series. The strong co-movement across major turning points, and the only model' differences in short-term volatility, reinforce the robustness of both approaches. In line with international best practice for countries initiating MIEG compilation, this study adopts the IMF's Denton-based approach as the main series. The Denton-based MIEG is straightforward to compile and is sector-specific, thereby providing insights into which sectors are driving growth at any given time.

Overall, this exercise provides a consistent and reliable monthly proxy for GDP in Zambia. Beyond its immediate empirical use in this study, the MIEG establishes a foundation for developing more advanced machine learning models for GDP nowcasting and forecasting. The

procedures outlined here demonstrate both their practical feasibility and their relevance for strengthening macroeconomic monitoring in Zambia.

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Chapter 4: Monetary Policy Passthrough and Bank Loan Portfolios: Aggregate Level

4.1 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 the 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 guidance.

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 transmission, the interest rate channel is the most scrutinized. With the increasing popularity of inflation targeting as a monetary policy framework, of which the interest rate channel is a fundamental foundation, transmission gained more attention (Gigineishvili, 2011).

The neoclassical and Keynesian economic theories offer a theoretical foundation that is useful in explaining monetary passthrough to retail interest rates via the interest rates channel. These theories offer complementary insights into how shifts in central bank policy rates affect the cost of borrowing for retail consumers and, consequently, the overall economy. While the Keynesian framework emphasizes the impact of market frictions and imperfections in the credit market which might affect the speed and magnitude of monetary policy transmission, the neoclassical view emphasizes the role of efficient markets and rational decision-making. Closely aligned to the neoclassical principles is the Marginal Cost Pricing Model which is a standard theoretical framework for interest rates passthrough studies. This suggests a direct link between interest rate fluctuations and underlying costs, consistent with the neoclassical concept of optimal resource allocation. However, on the absence of optimal competition and complete information, the interest rate passthrough departs from this ideal. A synthesis of both the neoclassical and Keynesian frameworks makes it possible to have a comprehensive analysis of

interest rates passthrough (Bernanke & Blinder, 1992; Mishkin, 1996; Taylor, 1995). This provides an empirical framework for understanding how changes in marginal costs (such as monetary policy rates) influence commercial bank pricing behaviour in the context of interest rate passthrough.

The Bank of Zambia (BoZ) was established in 1964 to oversee monetary policy in Zambia. The interest rates channel is of great importance to Zambia as it provides feedback on how, by how much, and for how long monetary policy impulses affect the business cycle, credit cycle and inflation (Gregor and Melecky, 2018). In April 2012, Zambia's monetary policy framework underwent a significant change, to interest rate targeting (IRT) from monetary aggregates targeting (MAT) that existed since the early 1990s when the economy was liberalized (BoZ, 2014b). Under the monetary aggregates targeting framework, the focus of the BoZ was to control money supply growth to attain price stability. Open market operations, chiefly through treasury bills issuance, were the key instruments used to manage liquidity levels in the banking system and reserve money was an operational target (Muhanga *et al*., 2014). However, the focus of the new monetary policy framework introduced in 2012 is on interest rate targeting, where the interbank rate is an operating target. With the adoption of interest rate targeting, the Policy Rate became the key interest rate that signals the monetary policy stance. Under this framework, the central bank accomplishes its policy objectives and influences economic activity through the adjustment of the Policy Rate. Changes in the Policy Rate are transmitted to the real economy via the interbank rate, which in turn influences retail interest rates. The Policy Rate is also a benchmark rate which financial institutions use in pricing their loans (BoZ, 2012; Ngoma & Chanda, 2022).

This significant shift in the monetary policy framework provides an opportunity to investigate monetary policy passthrough to retail interest rates in Zambia under the current monetary policy regime. Therefore, this study assesses how monetary policy changes impact interest rates on small and medium enterprises (SMEs), corporates (large firms), mortgages (real estate) and personal loans in Zambia.

The main objective is to assess monetary policy passthrough into SME, corporate, personal and mortgage retail interest rates under the current interest targeting monetary policy framework in Zambia. Specifically, the study intends to:

1. Asses the magnitude and speed of monetary policy passthrough to the four different lending interest rates.
2. Explore differences across different types of loans.

This paper adds to the literature on the commercial banks' response to monetary policy impulses during the current monetary policy framework in Zambia by using a novel dataset collected from commercial banks in 2022. It innovates by distinguishing lending rates by the four credit segments (SME, corporate, personal and mortgage) to estimate responses of different bank retail loan rates to a change in the interbank rate. Previous studies of monetary policy transmission in Zambia were based on simple average aggregate lending rates (Chileshe & Akambi, 2016; Ngoma and Chanda, 2022) which treats all retail interest rates equally and does not provide inclusive information (Gertler & Gilchrist, 1993; Haan *et al.,* 2009; Abuka, *et al.,* 2019). However, the reaction of commercial bank rates to interbank changes can differ among different credit segments, due to variations in risk profiles and market dynamics. Assessing the response of each lending interest rate makes provides a better understanding of monetary policy transmission and the influence on key business segments of the economy.

In addition to addressing the four types separately, for each a weighted average retail rate is used to enhance accuracy. By assigning weights using loan volumes of each lending bank, the influence of banks with significant lending activity is appropriately captured, providing a clearer reflection of monetary policy passthrough across the banking sector. In addition, earlier studies concentrated on the period before 2012 (Chileshe & Akambi, 2016; Mutoti, 2006; Simatele, 2004) whereas this study covers the new monetary policy framework since 2012. This is key for effective monetary policy formulation and implementation necessary for macroeconomic stability in Zambia. To the best of my knowledge, this is the first attempt to employ disaggregated and weighted interest rates in assessing monetary policy passthrough in Zambia

The key findings are that incomplete monetary policy passthrough is established and varies in different credit segments. SME lending and personal lending rates appear to be more responsive than corporate and mortage lending rates. There is evidence that the Covid-19 pandemic slightltly weakned monetary policy passthrough (estimated passthrough is higher in the period prior to 2020). Passthrough is higher during the period April 2012 to August 2016 for all interest rates, becoming weaker after August 2016, suggesting increasing structural rigidities in Zambia' credit market.

4.3 Literature Review

This section reviews the theoretical and empirical perspectives on monetary policy passthrough to SME and corporate interest rates.

4.3.1 Theoretical Literature

The direct application of traditional theories related to interest rates passthrough developed in industrialized economies with well-functioning financial markets to developing Sub-Saharan African (SSA) economies has been a challenge. Theories have been modified to address the distinct financial characteristics in SSA countries, such as shallow and underdeveloped financial markets, information asymmetry, structural and institutional constraints. Theoretical models of interest rates passthrough that have been widely cited in empirical studies include the marginal cost and Information Asymmetry theories.

The Marginal Cost Theory

Developed by Rousseas (1985), the marginal cost hypothesis gives insights in understanding monetary policy transmission to retail interest rates under perfectly competitive markets. Commercial banks set their retail interest rates based on monetary policy changes and various costs, including operational costs, borrowing costs from depositors, capital markets, interbank market, capital markets and other sources of finance. According to this theory, changes in the monetary policy key interest rate have a direct impact on banks' marginal cost of funds which is later reflected in their pricing of retail interest rates passed on to their customers. When the central bank reduces (increases) the policy rate, commercial banks' cost of funds also reduces (increase), and this would reduce (increase) the retail interest rate. The marginal cost theory suggests a one-to-one and complete monetary policy passthrough to retail interest rates under perfect conditions. However, in the real world there are other key factors that play a role in commercial bank decisions, notably imperfect information.

Information Asymmetry Theory

Proposed by Akerlof (1970), Spence (1973) and Stiglitz (1975), the information asymmetry theory highlights the role of imperfect information between borrowers and lenders. In the framework of monetary policy, this theory suggests information disparity between borrowers and lenders can influence the transmission of monetary policy to retail interest rates. Two core factors are adverse selection and moral hazard. Adverse selection arises because banks want to lend to the most reliable borrowers, but asymmetric information implies, they don't know which are the more risky potential borrowers (who may be more likely to seek credit, especially if interest rates are high). Lenders can require collateral and incur costs to acquire information on potential borrowers, but in an environment of relatively small banks and many small borrowers' information asymmetries persist.

Moral hazard arises when lenders have limited ability to ensure that borrowers use funds productively or are unable to prevent borrowers undertaking risky activities that reduce their ability to repay. This encourages lenders to increase lending rates even when it is not appropriate to do so as a way of accounting for potential risks (such as compensated for expecting some borrowers to default). This in turn limits the ability of the central bank to effectively signal its monetary policy stance via interest rates, quite likely in SSA where information asymmetries are greater (Mishra & Montiel, 2012; Peiris & Clément, 2010).

4.3.2 Empirical Literature

Monetary policy transmission and passthrough has been investigated in numerous studies, especially in developed countries and more recently in emerging and developing economies. Beyond examining the general responsiveness of commercial banks to changes in monetary policy rate using aggregate and averaged data, some studies (mostly for developed economies) have used disaggregated loan portfolio and bank level data (Gertler, 1993; Bondt, 2002; Sorensen & Werner, 2006; Ahmad & Aziz, 2013; Maravalle & Pandiella, 2022; Greenwood-Nimmo *et al,* 2022). Table 4.1 summarises selected studies showing that passthrough varies according to the interest rate, methodology, country or geographical location and sample period.

Table 4.1: Literature Summary

Author(s) & Year	Objectives	Methodology	Key Findings
Bondt (2002)	Monetary policy passthrough process to deposit, consumer, and house purchase retail interest rates in the Euro Area for the period 1996 to 2001	Error correction model (ECM) Sample Split to account for the impact of the introduction of the euro on the passthrough process	Short-run retail interest rates stickiness with the highest passthrough for lending rates within a month found to be 50%. Complete long run passthrough at 100%. Increased bank competition and decrease in information asymmetry and switching costs were highlighted to be key drivers of the strong passthrough in the long run. Split sample results suggest a quicker passthrough since the introduction of the euro.
Sørensen & Werner (2006)	Interest Rates Passthrough from wholesale rate to mortgage, consumer, enterprises, and deposit retail rates in the euro area covering ten countries for the period 1999 to 2004.	Cross-country heterogeneity of the pass-through process is tested. Panel error-correction dynamic seemingly unrelated regression	High degree of heterogeneity, weak and incomplete long run passthrough and the speed of adjustment across ten-euro countries was established. Considering the product specific retail rates, corporate retail interest rates were found

		(DSUR) approach employed. Newly constructed harmonized interest rates dataset.	to be the most responsive followed by mortgage rates and lastly deposit rates. Lack of fragmentation and integration in the banking retail sector could be a key determinant of the weak passthrough in the euro area.
Ahmad & Aziz (2013)	Interest rate pass-through in the UK from the LIBOR to time deposit rate, instant deposit rate, secured lending rate and mortgage rate in the UK during the financial crisis for the period 1999 to 2006	Error correction model (ECM)	Interest rates passthrough in the UK is complete in the long-run but incomplete in the short-run.
Haan *et al.* (2009)	Monetary policy passthrough to real estate, consumer and commercial and industrial (C&I) loans in Canada for the period 1972 to 2007.	VAR model	Evidence of heterogeneous monetary policy passthrough across the different types of interest rates. Higher interest passthrough to consumer loans was observed during a monetary and non-monetary downturn while a higher passthrough on corporate and SME loans was only observed during a non monetary downturn.
Gertler & Gilchrist (1994)	Impact of monetary policy shocks on borrowing costs and investment decisions of small and large manufacturing enterprises in the USA for the period 1958 to 1994.	Seemingly Unrelated Regressions (SUR)	Small enterprises contract far more than large firms when monetary policy is tight, and that they account for a disproportionately disproportionate share of the subsequent manufacturing decrease. Passthrough is higher in small firms than large firms
Sacerdoti (2005)	Reviews access to credit by SMEs, profit margins, bank interest rates spreads and their determinants in developing countries	Employs a literature review approach	Finds that the margins between lending and deposit interest rates are high mainly due to high operation costs. Credit extension to the informal sector is mainly constrained by underdeveloped information, legal and financial systems in most SAA countries.
Gigineishvili (2011)	Investigates the impact of macroeconomic and financial variables on interest rates passthrough in 80 low-income, emerging, and developed economies covering the	Auto regressive distribute lag (ARDL) model	Passthrough is found to be weak in low-income countries, countries with fixed exchange rate systems and island states. Inflation, GDP per capita, overhead costs, historical

	period December 2005 to 2010.		interest rates and bank competition were found to be positive determinants of the passthrough while excess liquidity and market volatility were found to be negative.
Mishra & Montiel (2012)	Asses the effectiveness of monetary policy in low-income economies	A survey of literature approach based on studies that derived impulse response functions (IRFs) from estimated vector autoregressions (VARs)	The relevance of the bank lending channel of monetary policy in many sub-Saharan African countries is limited by the small size of and flaws of the financial sector
Gregor & Melecký (2018)	Monetary policy passthrough SME, corporate, mortgage, personal and the role of macro-financial factors in Czech Republic, an OECD high income country for the period 2004 to 2017.	Auto regressive lag distributive (ARDL) based co-integration approach.	Finds a complete passthrough to SME, corporate, mortgage and personal loans in the long-run but a weak and slow passthrough in short-run. Leverage, bank competition, non-performing loans, foreign exchange interventions, and fiscal policy proxy (spread between government securities and monetary policy rate) had a significant influence on the passthrough process of monetary policy.
Maravalle & Pandiella (2022)	Monetary policy passthrough into real estate, credit card, and automotive retail interest rates for the period 2011 to October 2020.	Auto regressive distributed lag model (ARDL).	Finds strong and quick passthrough to short-term interest rates as it only takes a quarter to achieve complete passthrough. However, credit markets heterogeneity was established as the real estate market was found to be weaker than the automotive market. Bank profitability, competition, and capital to banks assets ratio were found to have a significant influence on the passthrough in the long run.
Das (2015)	Effectiveness of monetary policy transmission to average lending and deposit rates in India during a time of monetary policy regime changes for the period 2001 to 2011.	A two-step vector error correction model (VECM)	Incomplete and asymmetrical but significant passthrough. Lending rates reacted more quickly to contractionary monetary policy than expansionary, and the opposite was true for deposit rates.
Oyadeyi (2022)	Interest rates passthrough to wholesale and retail average lending and deposit rates using for the	Error correction model (ECM) and Mean Adjustment Lags (MAL)	Strong short-run and long-run passthrough in the wholesale market.

	period 2006 to December 2020.		Incomplete in the retail markets Weak and incomplete passthrough was established in the retail market. Heterogeneous passthrough between retail rates as deposit rates were more responsive to changes in interbank rate in comparison to retail lending rates.
Simpasa *et al.* (2015)	The effectiveness of bank lending channel of monetary policy transmission in Zambia and the effects of bank size for the period 1998 to 2011	Panel-data GMM estimation procedure	Evidence of bank lending channel in Zambia which is mainly operating through large banks
Chileshe (2016)	Builds on Simpasa et al. (2015) and examines the bank-lending channel of monetary policy for Zambia and the effect of the market structure (bank competition) covering the period 2005 to 2016.	Dynamic panel data approach	Confirms the existence of bank lending channel in Zambia Monetarypolicy transmission is adversely affected by lack of competition in the financial sector.
Ngoma & Chanda (2022)	Interest rate passthrough to the wholesale interbank rates, retail lending and deposit rates in Zambia for the period 2012 to 2020.	A two-step vector error correction model (VECM).	Complete and swift passthrough to interbank rate Incomplete passthrough from interbank rate to retail lending and deposit rates Asymmetric adjustment between lending and deposit rates as lending rates are more responsive to monetary tightening while deposit rates are more responsive to monetary loosening.

These studies highlight key variations in passthrough by looking at different aspects such as duration, type of interest rates, sample size as well as study location.

Several studies employing error correction models (ECM), vector autoregressive (VAR), and autoregressive distributed lag (ARDL) approaches similar to this study confirm this find that the magnitude of interest rates passthrough appears to be stronger in the longrun than the shortrun.. For instance, Bondt (2002) investigates the monetary policy passthrough to several retail interest rates in the Euro area for 1996-2001 using monthly data. Employing an Error

Correction Model (ECM) supplemented by vector autoregressive (VAR) impulse responses, the study establishes short-run retail interest rates stickness with the highest passthrough for lending rates within a month found to be 50%. However, a complete passthrough was found in the long run for bank lending rates. The study also finds that the introduction of the Euro currency had a positive impact on the speed of the passthrough process. Increased bank competition and the associated decrease in information asymmetry and switching costs were highlighted to be key drivers of the strong passthrough in the long run.

Similarly, Ahmad & Aziz (2013) investigate interest rate pass-through in UK using ECM and find that while long-run pass-through is complete, short-run adjustments are incomplete and asymmetric across lending rates. Further, Gregor & Melecký (2018), using an ARDL in the Czech Republic, find complete monetary policy pass-through in the long-run to retail lending rates, but weak and slow short-run transmission.

Heterogeneity in pass-through across loan types is also well-documented. Haan *et al.* (2009) show that monetary tightening in Canada results into a sharp decline in consumer loans rates while it has limited effects on SME and corporate interest rates during non-monetary downturns. Sørensen & Werner (2006), using a dynamic seemingly unrelated regression (DSUR) approach, find incomplete and sluggish pass-through to retail interest rates in the Eurozone, with corporate rates being the least responsive.

For developing countries, Maravalle & Pandiella (2022) apply ARDL to Mexico and find rapid pass-through to short-term rates but weaker transmission in real estate loans. Choudhary et al. (2012) analyze Pakistan's SME and corporate lending rates, showing that SMEs experience greater interest rate pass-through than large firms, with small banks being more aggressive in transmitting policy shocks.

Studies on interest rate pass-through in Sub-Saharan Africa (SSA) are limited and often rely on unsegmented and unweighted interest rates. Aziakpono & Wilson (2013) use ECM on South African data (1980–2007) and find that aggregate lending rates adjust faster than bond yields. Also with aggregate unweighted interest rates and ECM, Oyadeyi (2022) uses monthly data for Nigeria from January 2006 to December 2020 and finds strong short-run and long-run passthrough in the wholesale market but weak and incomplete passthrough in the retail markert.

Early studies on Zambia's monetary transmission mechanisms primarily focused on general macro-economic dynamics rather than the specific transmission to retail interest rates. These studies largely relied on aggregate indicators and are mainly for the period before the Bank of

Zambia's adoption of the interest rates targeting framework in 2012. For example, Mutoti (2006) examines the influence of money supply and exchange rates on inflation and output using a cointegrated structural VAR model for the post-liberalisation period (1992–2003). The study results suggest that money supply has limited and short-term influence on inflation and output, while inflation is largely explained by aggregate supply, exchange rate and output.

In a related study, Munacinga (2004) investigates how financial sector reforms altered monetary transmission mechanisms, using a VAR model spanning 1970–2001. By comparing pre- and post-liberalisation periods, using aggregate interest rates, the study reveals that the bank lending channel became more effective following financial liberalisation. Despite being foundational, the study relied on monetary aggregates and did not examine sector-specific dynamics within credit markets.

Later studies shifted their focus to evaluating monetary policy passthrough via the interest rates channel. For instance, Chileshe (2016) examines the bank-lending channel of monetary policy for Zambia and the effect of the market structure (bank competition) covering the period 2005 to 2016. The study results confirm the existence of bank lending channel in Zambia and also highlights that monetary policy transmission is adversely affected by lack of competition in the financial sector. A further contribution by Chileshe & Akambi (2016) assess the asymmetric response of retail and bond interest rates to monetary policy shocks and establishes that deposit rates react more to expansionary monetary policy, while lending and bond rates respond more to tightening. Despite these studies touching on monetary policy via the interest rates channel, they combine data for the monetary targeting and interest rates targeting regimes, making it difficult to isolate and evaluate the performance of the current monetary policy framework. In addition, they rely on aggregate lending rates, and this does not give full information on sector specific reaction of the credit market to monetary policy changes.

More recent studies have specifically focused on the current monetary policy regime. For instance, Zgambo (2017) examined liquidity management best practices in an interest rate targeting monetary policy regime through case studies, drawing lesson for Zambia but does not directly address monetary policy passthrough to retail interest rates. Ngoma and Chanda (2022) build on the earlier studies and provide one of the earliest studies to explicitly study monetary policy passthrough in Zambia under the current interest rates targeting regime using a two-step Vector Error Correction (VECM) for the period 2012–2020. Their study finds a complete and quick pass-through from the policy rate to the interbank rate in the first step of the pass-through. However, it finds that retail lending and deposit rates do not fully reflect the changes in

the interbank rate in the second step of the pass-through. Asymmetric adjustment dynamics are also documented in the study: deposit rates react more to monetary loosening, whilst lending rates respond more to monetary tightening. However, this study is also constrained by its reliance on aggregate retail rates, which leaves out information on potential variations of monetary policy passthrough across borrower segments in the credit market key in policy making.

Against this backdrop, the present study extends the findings of Ngoma & Chanda (2022) by employing disaggregated borrower-specific lending rates, providing a more granular view of monetary policy transmission in Zambia. This study examines how different types of lending rates: SME, personal, corporate and mortgage react to changes in the monetary policy. International evidence such as Haan *et al.* (2009) in Canada, Gregor & Melecký (2018) in Czech Republic and Maravalle & Pandiella (2022) in Mexico support the use of disaggregated interest rates as already highlighted above. Employing disaggregated data to assess monetary policy passthrough during the Interest Rates Targeting framework, provides comprehensive, sector specific information on interest rates passthrough and feedback on the efficacy of the current monetary policy regime key for targeted policy interventions.

4.4 Methodology

4.4.1 Deriving the Model

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 Bondt (2002) and Gigineishvili (2011) is formalized as follows:

$$cr = \beta_0 + \beta_1 mc \qquad 4.1$$

where cr refers to the price set by commercial banks (bank interest rate), mc is the marginal cost price estimated by an analogous market interest rate, β_0 is a constant markup, and $\beta_1$is a

measure of interest rate passthrough. When β_1 is equal to 1, there is complete passthrough, indicating that markets are complete with full information and are perfectly competitive. On the other hand, when β_1 is less than 1, the interest rates passthrough is incomplete implying that banks have some degree of market power. When β_1 is more than 1, it indicates that banks are reacting to changes in the cost of funds (*mc*) on a more than one-to-one basis, overreacting to the changes in market interest rates, potentially due to risk or some motivation to exaggerate the impact of cost changes (Coricelli *et al.*, 2006).

The baseline model is defined as follows:

$$MR_t = \Psi_0 + \Psi_1 OR_t + \Psi_2 CSD_t + \varepsilon_t \quad 4.2$$

MR_t denotes the endogenously determined retail interest rates, OR_t, represents the BoZ official interest (Policy) rate, CSD_t is credit supply and demand controls and ε_t is the stochastic error term.

It is important to note that theoretical literature on interest rate passthrough 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 & Fuerst, 2001; Holmström & Tirole, 1998). Banks could 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 inclined 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 & 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 passthrough to the real world. Incorporating the Consumer Price Index (CPI) addresses effects of inflation (Gali & Gertler, 1999; Smets & Wouters, 2007).

4.4.2 Empirical Model

In line with literatue, the study applies the Johansen cointegration method to assess the transmission of monetary policy to SME, corporate, personal and mortgage bank retail rates (Mbotwe, 2015; Das, 2015). This requires that all the variables in the model are of the same order of integration, namely I (1), as in the Engle & Granger (1987) and Johansen & Juselius (1994) cointegration procedures. While the Johansen cointegration method estimates the matrix rank and its eigenvalues in a single stage, the Engle and Granger approach uses a two-stage estimator where possible errors introduced in the first stage could be transferred into the second stage. Moreover,the Johansen method estimates the cointegrating relationships directly from the data, in contrast to other approaches that call for the pre-specification of the cointegrating vectors. Because of its adaptability, it is especially helpful when the underlying economic concept does not offer precise instructions on the number or structure of cointegrating relations. In addition, the Johansen method makes use of a straightforward linear transformation to easily build an error correction model (ECM). The easy integration of short-run modifications and long-run equilibrium prevents the loss of long-term information (Johansen, 1991).

4.4.2.1 Error Correction Model

An Error Correction Model (ECM) is a dynamic model that offers an in-depth understanding of the relationship by capturing and revealing both short-run and long-term equilibrium effects. The ECM model reveals insights into the effectiveness and efficiency of interest rate transmission mechanisms by examining how responsive retail rates are to changes in the overall interest rate environment. This provides policymakers and market players with useful tools for making informed decisions. The long-run and short-run empirical models for the the interest rates passthrough are specified as follows (Mbotwe, 2015; Das, 2015):

Long run:

$$cbr_t = \theta_0 + \theta_1 ibr_t + X_t + \mu_t \quad 4.3$$

Short run:

$$\Delta cbr_t = \alpha_0 ecm_{t-1} + \sum_{K=1}^{K} \alpha_1 \Delta\, cbr_{t-K} + \sum_{K=1}^{K} \alpha_2 \Delta\, ibr_{t-K} + \sum_{K=1}^{K} \alpha_3 \Delta X_{t-K} + \Delta D_{ibr_{t-K}} + \mu_t \quad 4.4$$

where cbr_t is a measure of commercial bank retail rates (SME, corporate, personal and mortgage); X_t is vector of control variables (GDP, liquidity and CPI); D_{ibr} is a dummy variable to account for the episodes when the interbank rate deviated from the policy rate corridor during the period of exchange rate depreciation and μ_t is the error term. The ecm is the error correction term and α_0 is the speed of adjustment coefficient which determines how quickly equilibrium is restored. It is important to note that, although exchange rate depreciation and manufcturing share are included in the analysis in Chapter 5, they are not included as controls here. This is mainly because both effects are likely to differ between foreign and domestically owned banks, making them more appropriate to address in Chapter 5 where ownership heterogeneity is explicitly analysed. Nonetheless, this could be incorporated in future research, to asses the relevance of the exchange rate expectations alongside the interest rate channel under current monetary policy framework.

To gain insights into the immediate effects of shocks and the speed of adjustment towards equilibrium, short-run dynamics are visualised. By ploting these dynamics, it is easy 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).

While the theoretical framework (Equation 4.2) sets out the policy rate as the main determinant of retail lending rates, the empirical analysis employs the interbank rate as the key marginal cost proxy. This choice reflects the Bank of Zambia's current price-based operating framework, in which the interbank rate serves as the operational target for monetary policy and is expected to fluctuate within +/- 1 percentage point of the policy rate, except in exceptional episodes when it was deliberately allowed to trade above the corridor to counter inflationary pressures (Bank of Zambia, 2018). Since the interbank rate fluctuates almost daily, it provides a more timely, market-based measure of banks'responses to liquidity conditions and central bank interventions than the policy rate, which is revised less frequently (quarterly) and may remain constant for extended periods.

The calculation of the weighted average interbank rate used in the regressions is based on the individual banks' loan volumes and interbank borrowing rates with a maturity of 5 days. Importantly, during the period under consideration, every bank borrowed at least once per month on the interbank market, and this provides a comprehensive coverage of all banks' presence on interbank activity. For each month, individual banks' borrowing rates were weighted and averaged to derive an industry-wide interbank rate (proxy for policy rate). The

calculated interbank rate serves as a policy-driven benchmark that equally applies to all banks. This is expressed as:

$$IBR_{\mathrm{t}} = \frac{\sum_{i=1}^{n} r_{\mathrm{i,t}} \times Vi,t}{\sum_{i=1}^{n} V_{\mathrm{i,t}}} \quad 4.5$$

Where:

IBR_{t} is the weighted average interbank rate at month t; r_{it} is the interbank borrowing rate of bank i in month t (for 5-day maturity loans); V_{it} is interbank loan volume for bank *i* in month *t* and *n* is the total number of borrowing banks. The weighted interbank rate is preferred as it provides a more realistic market-level measure of the cost of interbank borrowing.

4.4.3 Robustness Checks

To validate the core results, robustness checks are conducted in two stages. First, the core models (4.3) and (4.4) 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. This allows the study to assess whether the COVID-19 pandemic had an influence on monetary policy passthrough. Second, a visual inspection of the data shows a widening margin between commercial lending rates and the interbank rate after August 2016, suggesting a structural change in the Zambian economy around this time that may alter functioning of the credit market (see Figure 4.1).

To formally test for such changes, sequential Zivot-Andrews unit root test was conducted (Zivot & Andrews, 1992), which identified a structural breakpoint in August 2016 with a test statistic (–6.261) significant at the 1% level, reflecting a substantial structural change. This aligns with known policy actions in late 2016, such as the tightening of the Overnight Lending Facility by 600 basis points in 2014, raising the statutory reserve ratio to 18% from 14% in April 2015, the tightening of exchange rate regulations in October 2015, and aggressively raising the policy rate to 15.5% from 12.5% in November 2015 (Chipili et al., 2019). It can be argued that these changes in reserve requirements and liquidity management reshaped the behaviour of interbank rates relative to the policy rate. 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 as long as the models remains dynamically stable (Pesaran & Shin, 1999). The estimated ARDL model is specified as:

The generalised long-run ARDL (p,q) model is:

$$cbr_t = C_0 + \sum_{i=1}^{p} \Psi_{0i}\, cbr_{t-i} + \sum_{i=0}^{q} \Psi_{1i}\, Ibr_{t-i} + \sum_{i=0}^{q} \Psi_{2i}\, X_{t-i} + \varepsilon_t \quad 4.6$$

Where: C_0 is model intercept; Ψ_{0i} is the coefficient on the lagged dependent variable cbr_{it} which is commercial banks retail rates (Personal, Mortgage, Corporate and SME) at time t; ibr is the interbank rate (proxy for monetary policy stance); X is a vector of controls which include GDP, CPI, and liquidity; Ψ_{1i} and Ψ_{2i} represent the coefficients of the lagged explanatory variables on commercial banks SME and corporate rates at a given lag structure; ε_t is the idiosyncratic error term .It is convenient to re-parameterise the generalised ARDL model into an error correcting (EC) form for better interpretability. In line with Kripfganz & Schneider (2023), the reparameterised short-run ARDL error correction form is specified as:

The short-run ARDL error correction form is specified as:

$$\Delta cbr_t = C_0 - \lambda ECT_{t-i} + \sum_{i=1}^{p-1} \delta_{1i}\, \Delta\, cbr_{t-i} + \sum_{i=0}^{q-1} \delta_{2i}\, \Delta\, ibr_{t-i} + \sum_{i=0}^{q-1} \delta_{3i}\, \Delta X_{t-i} + \delta_4 Dibr_t + \varepsilon_t \quad 4.7$$

Where: *ECT* is the error correction term representing the deviation from long-run equilibrium in the previous period; λ is the speed of adjustment coefficient, reflecting the speed at which at which deviations from the long-run equilibrium are corrected to restore equilibrium after a shock; $Dibr$ is a dummy equal to 1 for the months when the interbank rate diverged from the interbank corridor, more pronounced during the 2015/2016 economic shock (see chapter 2); δ_{1i}, δ_{2i}, δ_{3i} short-run dynamic coefficients while $\delta_4$is the dummy coefficient.

The coefficients in (4.7) can be mapped in a straightforward algebraic way to the coefficients in (4.6):

$$\lambda = 1 - \sum_{i=1}^{p} \Psi_{0i}\ ;\ \phi_1 = \frac{\sum_{i=0}^{q} \Psi_{1i}}{\lambda} \text{ and } \phi_2 = \frac{\sum_{i=0}^{q} \Psi_{2i}}{\lambda} \quad 4.8$$

The error correction term becomes:

$$ECT_{i,t-1} = (cbr_{t-1} - \phi_1 ibr_{t-1} - \phi_2 X_{t-1}). \quad 4.9$$

It is more computationally convenient to fit the following ARDL model in Stata that produces both long-run and short-run results in one step:

$$\Delta cbr_t = C_0 + \pi_0 cbr_{t-1} + \pi_1 ibr_{t-1} + \pi_2 X_{t-1} + \sum_{i=1}^{p-1} \delta_{1i} \Delta cbr_{t-i} + \sum_{i=0}^{q-1} \delta_{2i} \Delta ibr_{t-i} + \sum_{i=0}^{q-1} \delta_{3i} \Delta X_{t-i} + \delta_4 Dibr_t + \varepsilon_t \quad 4.10$$

From the above model, it is easy to recover the speed of-adjustment coefficient $\lambda = -\pi_0$ and the long-run coefficients $\phi_1 = \frac{\pi_1}{\lambda}$ and $\phi_2 = \frac{\pi_2}{\lambda}$

To establish long-run relationship, the empirical application of the ARDL technique requires undertaking the bounds test for cointegration.

4.4.4 Lag-Length Selection Criteria and Diagnostic Tests

Several pre and post estimation diagnostic tests were carried out to check the adequacy of the models estimated. These include the unit root, cointegration, serial correlation and stability elaborated further in section 4.5. A combination of these diagnostic tests and the Akaike information criterion (AIC) are used for appropriate lag-length selection criteria. This is because, while information criteria are useful in suggesting lag structures that balance model fit and parsimony, they do not guarantee the absence of misspecification (Juselius, 2006; Lütkepohl, 2005). Therefore, having models that satify both econometric adequacy and information criteria is useful. In instances where conflict between lags bsed on information criteria and those supported by residual diagnostics was establised, residual diagnostics were priotised to mitigate risks of econometric misspecification specifically for the models on simple and weighted average rates.

4.4.5 Data and Sources

The study employs a monthly novel dataset collected by the author (details in Chapter 2). Since the Bank of Zambia only compiles aggregate retail interest rates, disaggregated SME, corporate personal and mortgage retail rates data were collected from 16 commercial banks. In addition, given that Zambia does not compile monthly GDP, the Monthly Indicator of Economic Growth (MEIG), a proxy of monthly GDP was constructed using the real sector data collected by the BoZ and Zambia Statistical Agency (details in Chapter 2). The interbank rate was used to proxy monetary policy in line with the empirical best practice as it is directly affected by the policy rate changes and hence it reflects monetary policy stance. CPI, GDP(MEIG) and liquidity ratio (calculated as total liquid assets to total assets) were included as control variables to account for other factors that could impact retail interest rates besides monetary policy. The sample

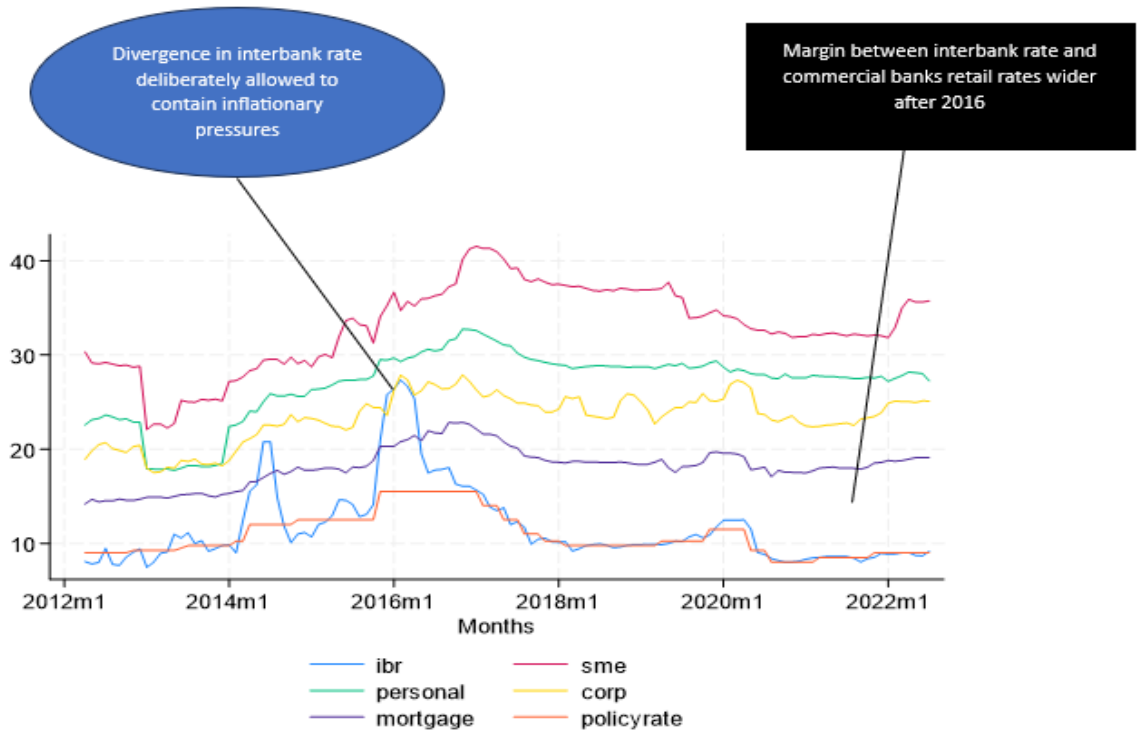
period for the study is April 2012 to July 2022 covering the period of the new monetary policy regime. Table 4.2 defines the variables used in econometric regression and their sources and Figure 4.1 plots key variables.

Table 4.2: Variable Definitions and Data Sources

Variable	Definition	Source
Interbank rate	Interest rate that banks lend each other on the interbank market with 5 days maturity.	Bank of Zambia
Average lending rate	Unweighted mean of interest rates across SME, corporate, personal and mortgage loan types, giving each rate equal importance regardless of loan size.	Compiled by author
Weighted Average lending rate	Average interest rate adjusted for the size of each loan, giving more weight to loans or banks with larger shares in total lending.	Compiled by author
Weighted corporate lending rate	Weighted interest rates that commercial banks charge to corporate clients.	Commercial banks survey
Weighted SME lending rate	Weighted interest rates that commercial banks charge to SMEs.	Commercial banks survey
Weighted personal lending rates	Weighted interest rates banks charge to individuals on personal loans	Compiled by author
Weighted mortgage lending rate	Lending interest rate charged on real estate loans (mortgages).	Commercial banks survey
Liquidity ratio	Ratio of total liquidity assets to total bank assets.	Commercial banks survey
GDP	Monthly Indicator of Economic Growth (MEIG) calculated using real sector data from BoZ and Zamstats. 2012 is used as a base year.	Compiled by author
CPI	The consumer price index measures the average change in prices over time and reflects inflation.	Zamstats

Notes: Lending rates are weighted using loan volumes for each respective borrower segment (SME, corporate, mortgage, and individuals).

Figure 4.1: Interbank Rate, Average, SME, Corporate and Mortgage Retail Rates



4.4.5.1 Aggregate Descriptive Statistics

Descriptive statistics in Table 4.3 show the mean, standard deviation, minimum and maximum values of the variables for the aggregate sample.

Table 4.3: Aggregate Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Simple average rate	124	26.516	3.557	17.980	32.501
Weighted average rate	124	23.263	2.669	17.603	27.735
Interbank rate	124	11.713	4.260	7.455	27.339
SME rate	124	32.299	4.945	23.621	41.937
Corporate rate	124	21.979	2.579	16.719	26.154
Personal rate	124	24.627	3.361	17.699	30.061
Mortgage rate	124	16.883	1.801	13.518	20.373
Liquidity	124	64.467	10.183	47.48	86.409
GDP	123	115.554	10.836	90.749	140.186
CPI	124	206.955	69.598	121.63	363.91

4.5 Presentation and Discussion of Findings

4.5.1 Pre-estimation Tests

4.5. 1.1 Unit Root Tests

As non-stationary series can produce spurious results a first step is to ensure that variables are stationary to avoid erroneous results (Dougherty, 2011) A stationary time series has mean, variance, and autocorrelation that are constant throughout time (time independent) or is integrated of order zero, I(0). If a series is non-stationary, compute the differences between consecutive observations (differencing *d* times), so it becomes integrated of order *d*, I(*d*), where *d* is the number of differentiating operations needed for the series to become stationary (Perron, 1990). Typically, I(1) series are stationary after differencing once. The Augmented Dickey-Fuller (ADF) unit root test with constant and trend is used based on its flexibility and capacity to account for serial correlation. A trend term in the ADF unit root test is useful for capturing possible structural breaks, integrating long-term economic dynamics, improving test power, and aligning with the theoretical and empirical model. The ADF unit root results indicate that all the variables are integrated of the same order I (1) (Table 4.4).

Table 4.4: ADF Unit Root Test

	(1) LEVELS			(2) FIRST DIFFERENCE			(3) ORDER I(d)
Variable	t-Stat	CV	p-Value	t-Stat	CV	p-Value	
Average lending rate	-1.146	-2.885	0.695	-5.893	-3.447	0.000	I(1)
Weighted average lending rate	-1.450	-3.447	0.916	-10.450	-3.447	0.000	I(1)
Interbank rate	-2.167	-3.447	0.508	-7.297	-3.447	0.000	I(1)
Weighted SME lending rate	-2.598	-3.447	0.280	-15.111	-3.447	0.000	I(1)
Weighted Corporate lending rate	-2.406	-4.032	0.305	-16.228	-3.447	0.000	I(1)
Weighted Mortgage lending rate	-2.865	-3.447	0.174	-11.216	-3.447	0.000	I(1)
CPI	-2.650	-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: 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.

4.5.2 Johansen Cointegration Analysis

Having determined that all the variables are of the same order of integration, the Johansen cointegration test assesses the existence of a long-run relationship among the variables. If there is no long-run association there is no credible basis for inference based on standard distributions. The Johansen cointegration approach is employed primarily due to its ability to explore multiple cointegrating relationships at the same time, providing a comprehensive understanding of data interdependencies, particularly when dealing with different interest rate series, as well as their long-term relationships (Johansen & Juselius, 1994). The trace statistic indicates the existence of a long-run relationship among the variables for all the four models of interest (Table 4.5). The trace statistics are greater than the corresponding critical value at 5% and we reject the null hypothesis (H_0) of no long-run relationship and conclude that there is at least one long-run relationship among the variables of interest.

Table 4.5: Johansen Cointegration Test

	Full-Sample			**Pre-Covid 19**		
	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	114.660	77.818	1	110.459	69.822	1
Corporate lending rate	87.200	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 [ ]

4.5.3 Long-run and Short-run Analysis

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 4.6 and Figure 4.2

shows short-run visualisations. The VEC stability, serial correlation and heteroskedasticity tests are undertaken as post estimation diagnostic tests.

Table 4.6: Long-run and Short-run Estimates-Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)
	Average Lending	Weighted Average Lending	Weighted SME	Weighted Personal	Weighted Mortgage	Weighted Corporate
LONG-RUN						
Interbank Rate	0.545***	0.346 ***	0.486***	0.413***	0.270***	0.226***
	(0.049)	(0.048)	(0.078)	(0.046)	(0.049)	(0.057)
GDP	0.389***	0.295***	0.348***	0.375***	0.236***	0.346***
	(0.029)	(0.030)	(0.096)	(0.002)	(0.031)	(0.031)
CPI	0.054	0.039	0.017**	0.024***	0.004	0.022
	(0.032)	(0.031)	(0.002)	(0.003)	(0.037)	(0.043)
Liquidity	0.056**	-0.017	0.118**	-0.039	-0.058**	-0.017
	(0.021)	(0.022)	(0.079)	(0.020)	(0.024)	(0.029)
SHORT-RUN						
ECT	-0.287***	-0.155***	-0.147***	-0.176***	-0.303***	-0.103**
	(0.057)	(0.053)	(0.005)	(0.058)	(0.076)	(0.036)
Half Life-Months	5.5	8.5	10	9	5	12
Dummy Interbank Rate	-0.004	0.006	0.035*	-0.018	0.020	0.007
	(0.235)	(0.011)	(0.030)	(0.019)	(0.024)	(0.022j)
LM Test	22.647	32.022	23.975	32.793	18.909	33.343
	[0.598]	[0.157]	[0.521]	[0.136]	[0.801]	[0.123]
Heteroskedasticity	955.247	1240.560	1092.611	1004.308	65.216	217.278
	[0.537]	[0.646]	[0.639]	[0.156]	[0.588]	[0.350]
VEC Stability	Stable	Stable	Stable	Stable	Stable	Stable
No.Obs	115	114	115	116	118	120

Notes: Column (1) is about simple average lending rate, Column (2) is about weighted average lending rate, Colum (3) is about SME interest rate, Colum (4) is about Personal interest rate while Colum (5) contains mortgage interest rate and Column (6) is about corporate rate. Significant short-run error correction term (ECT) confirms cointegration; the model passes LM serial correlation, Heteroskedasticity and VEC stability (see appendix 4.3a for eigenvalue stability condition *vecstable* graph Dummy Interbank Rate is a dummy variable for years with 'excess' interbank rate. CPI and GDP are lagged to capture their delayed influence on the current lending activity. AIC length Selection Criteria used with a lag structure of 4(Average), 4(Weighted average),3(SME), 4(Personal), 3(Mortgage) and 2(Corporate). The half -life is derived from the cumulative short-run analysis in Figure 4.2. Standard errors in ( ), diagnostic test p-values in [ ], *** p<0.01, ** p<0.05, * p<0.1.

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 increase 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 pass-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), consistent with the trend analysis undertaken in Chapter 2 (see Figure 2.13).

The aim of this study is not only to document the degree of monetary policy passthrough but goes beyond 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.

The results further 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 & Melecký (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.

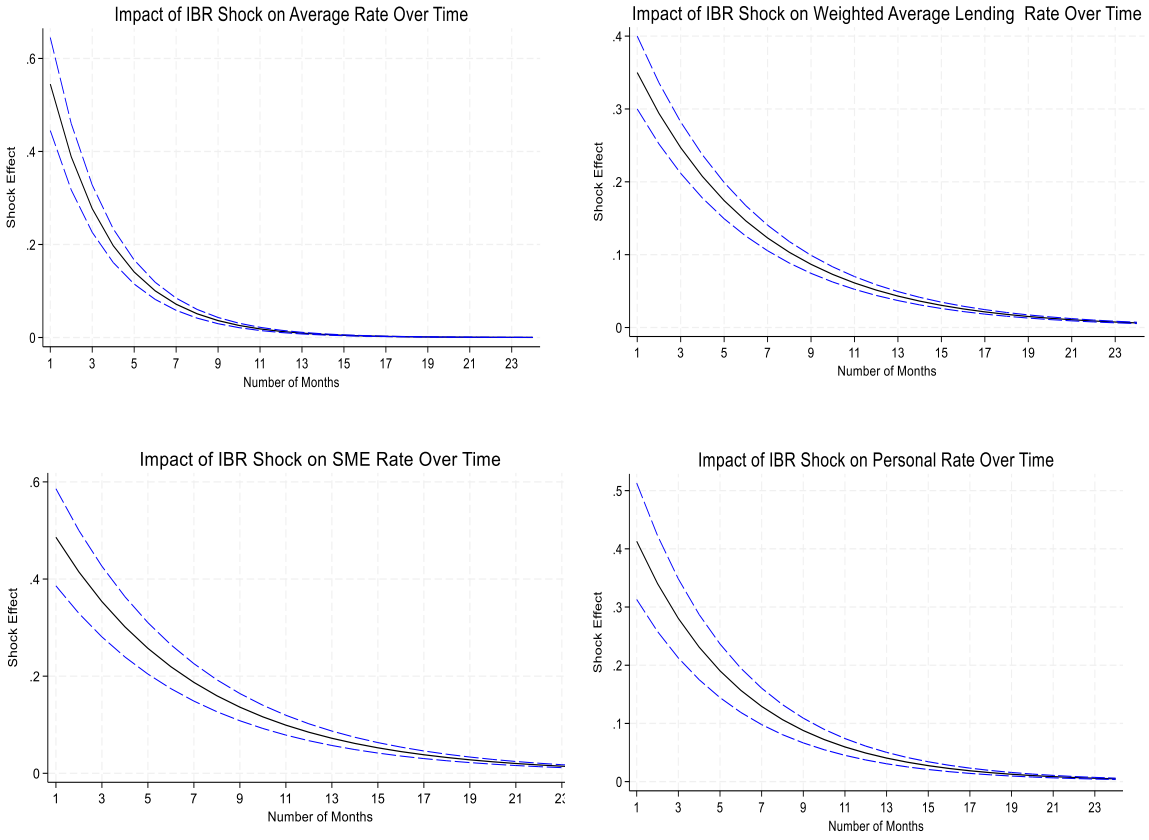
On the contrary, mortgage lending rates may not be very responsive to monetary policy shocks, because real estate loans are long-term and issued on fixed interest terms backed by high quality surety (Degryse & Cayseele, 2000; Mier-y-Teran, 2012). However, these only account for a small proportion of 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.

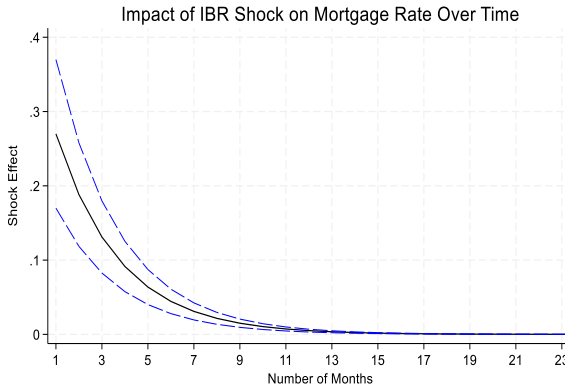
Following the approach of Clogg et al. (1995) and Paternoster et al. (1998), using the two-standard-error rule as a guide, the differences in passthrough coefficients across loan categories reported in Table 4.6 were formally assessed for statistical significance. The results show no statistically significant 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.

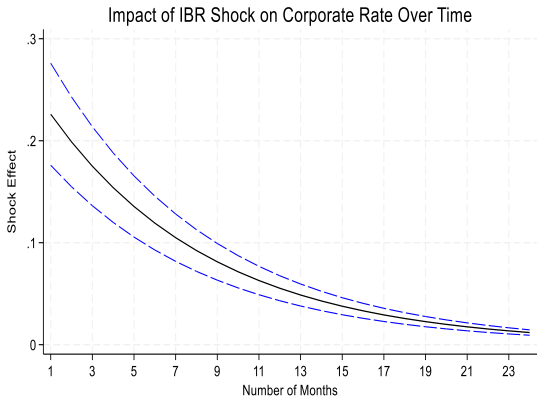
The short-run dynamics highlight a relatively weak speed of adjustment to equilibrium and are in line with the findings of Ahmad & Aziz (2013) for the UK. The error correction terms for

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 4.2). 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 4.2: Cumulative Short-run Dynamics of Interbank Rate Shocks on Lending Rates







4.5.4 Robustness Analysis

This section presents robustness checks on the extent of the passthrough before the COVID-19 pandemic and compares how the passthrough has been from April 2012 to February 2016 and from March 2016 to July 2022.

4.5.4.1 Pre-Covid Sample: April 2012 to February 2020

To account for the economic instability caused by the Covid-19 pandemic, in line with Greenwood-Nimmo *et al.* (2022), the study estimates a sub-sample covering the period before the onset of the pandemic. This allows for a comparison of monetary policy pass-through under normal economic conditions, unaffected by Covid-19, with the main analysis, which includes the period of the pandemic, offering insight into how the COVID-19 crisis affected monetary transmission in Zambia. Table 4.7 provides the results for the pre-Covid analysis.

Table 4.7: Long-run and short-run estimates: Pre-Covid sample

	(1)	(2)	(3)	(4)	(5)	(6)
	Average Lending Rate	Weighted Average Lending Rate	Weighted SME	Weighted Personal	Weighted Mortgage	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	32.990	25.446	16.610	12.791
SHORT-RUN						
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*	-0.020
	(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
	[0.462]	[0.480]	[0.778]	[0.698]	[0.733]	[0.523]
Heteroskedasticity	1106.766	120.989	970.549	954.674	613.310	358.397
	[0.522]	[0.403]	[0.399]	[57.854]	[0.892]	[0.513]
VEC Stability	Stable	stable	Stable	Stable	Stable	Stable
No.Obs	87	87	87	87	87	91

Notes: 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 main 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 long-run 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.

4.5.4.2 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 rates. The summary of results is presented in Table 4.8 while complete results are reported in appendices 4.1 and 4.2

Table 4.8: Long-run and Short-run Estimates: Structural Change Assessment

	(1) LONG-RUN	(2)	(3) SHORT-RUN	(4)	(5)
	Interbank Rate Coefficient		ECT & Half-Life (Months)		
	Pre- July 2016	Post- July 2016	Pre-July 2016	Post-July 2016	Chow Test
Average Weighted Lending Rate	0.664***	0.459***	-0.277***	-0.307***	3.00*
	(0.228)	(0.100)	(0.095)	(0.090)	{0.087}
			[5.5]	[5]	
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)	(0.220)	(0.066)	{0.085}
			[4]	[5]	
Weighted Personal	0.473***	0.332***	-0.443***	-0.374***	2.96*
	(0.140)	(0.085)	(0.123)	(0.082)	{0.088}
			[3.5]	[4.5]	
Weighted Mortgage	0.334*	0.280***	-0.499*	-0.822*	3.72*
	(0.170)	(0.056)	(0.278)	(0.130)	{0.056}
			[3]	[1.5]	
Weighted Corporate	0.246**	0.220*	-0.440***	-0.506***	0.10
	(0.115)	(0.130)	(0.143)	(0.112)	{0.754}
			[3.5]	[3]	

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 in{ }. The Chow test results confirm the existence of a structural break between the pe-2016 and post-2016 sub-samples for all interest rates, except the corporate lending rate. SME, personal and mortgage interests. 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 4.7, while the estimates for the second period are similar to the full sample estimates in Table 4.6. 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.

The structural change coincided with macroeconomic challenges following the 2015/2016 domestic economic shock, with aggressive hydroelectricity rationing due to a terrible drought, rising debt, exchange rate depreciation and volatility. During this period, the Zambian Kwacha depreciated by about 65%, weakening from K10.01/US$ at end of July 2016 to K16.5/US$ by the end July 2022. The declining value of the Zambian Kwacha relative to major currencies also influenced import prices and inflation, affecting the reaction of the financial sector to

monetary policy impulses, and altering interest rate pass-through (BoZ, 2017). 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 crisis[5] and episodes cholera outbreak[6] in the main cities at the onset of most of the rainy seasons. These apparent structural issues might explain why the extent of monetary policy passthrough seems to have declined after 2016.

4.5.5 Post-Estimation Tests

4.5.5.1 VEC Stability Test

The VEC stability tests are undertaken based on eigen-value graphs to provide a simple and intuitive visual way of identifying structural shifts over time. Stable dynamics are achieved if all eigenvalue roots lie within unit circle (Lutkepohl, 1991). The eigenvalue graphs demonstrate that none of the remaining eigenvalues are visible around the unit circle, implying the models are specified correctly and parameters or coefficients do not change over time, indicating consistency and stability (see appendix 4.3).

4.5.5.2 Serial Correlation Test

The Breusch-Godfrey serial correlation test detects correlation in the residuals by evaluating higher-order autocorrelations to analyse probable serial correlation patterns. The null hypothesis for the test statistic states that no serial correlation of any rank up to *p* exists; if the p-value for the test statistic is less than the 5% level of significance we can reject the null hypothesis and infer that autocorrelation prevails among the residuals. If the p-value is greater than 5% level of significance, we fail to reject the null hypothesis and conclude serial correlation does not exist (Breusch & Godfrey, 1981). The results for all the models indicate the absence of serial correlation, and the assumptions of the models concerning the independence of the residuals are satisfied.

4.5.5.3 Heteroskedasticity Test

The models are tested for heteroskedasticity, specifically time-varying volatility in the error terms, using the ARCH-LM test proposed by Engle (1982). This test examines whether the

[5] Zambia defaulted on the Eurobond interest payment in October 2020(FITCH, 2020).

[6] So far Zambia has had 3 episodes of cholera outbreaks from 2016 to July 2022 (Ministry of Health, 2018; Reliefweb, 2022)

squared residuals are serially correlated, which would indicate autoregressive conditional heteroskedasticity. The null hypothesis of the ARCH-LM test is that there are no ARCH effects, meaning the residuals have constant variance over time. The null is rejected, and heteroskedasticity is present, if the test statistic's p-value is less than the 5% significance level. The results for all models show that heteroskedasticity is absent, confirming that the error terms display constant variance. This indicates that the models are well-specified and that the standard errors are reliable for statistical inference.

4.6 Conclusions and Policy Recommendations

The aim is to assess the magnitude and speed of monetary policy passthrough to SME, corporate, personal and mortgage retail rates in Zambia, using the interbank rate to proxy the BoZ Policy Rate. The Johansen cointegration techniques was employed to determine the existence of a long-run relationship, a vector error correction model (VECM) assessed the long-run and short-run passthrough dynamics, and an ARDL model was employed for the sub-sample for robustness checks. The sample is monthly from April 2012 to July 2022, when the monetary policy framework in Zambia shifted from monetary targeting to interest rates targeting. The study finds incomplete long run passthrough for all lending rates in all sample periods. Passthrough varies for types of retail rates, higher for SME and personal rates and lower for corporate and mortgage rates. This reflects differences in loan tenures, risk perceptions, relationship banking and interest rate setting strategies (such as variable or fixed) for different borrower segments. There is a need for policy makers to understand the unique underlying credit dynamics within each borrower segment to identify specific factors influencing reactions to monetary policy changes. This will facilitate better targeted policy interventions to strengthen monetary policy transmission. The analysis of different periods reveals a decline in the passthrough rates after August 2016 (following a macroeconomic crisis), compared to 2012-2016, or following the Covid-19 pandemic (2020-2022 compared to 2012-2020). This is plausible considering the macroeconomic challenges Zambia encountered related to high inflation, exchange rate depreciation, elevated sovereign debt, drought, frequent cholera outbreaks and spillovers from geo-political tensions. Structural barriers to passthrough (Cecchetti *et al.,* 2000) hinder the ability of commercial banks to react to monetary policy signals. There is need for policymakers to investigate the underlying causes of these structural rigidities in the credit market and devise strategies of addressing them to enhance monetary policy effectiveness in Zambia.

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Chapter 4 Appendices

Appendix 4.1: Pre-July 2016 Sub-Sample

Table 4.9: Long-Run and Short-Run Estimates: Structural Change Assessment-Pre 2016

	(1)	(2)	(3)	(4)	(5)	(6)
	Average Weighted Lending Rate	Weighted Average Lending Rate	Weighted SME	Weighted Personal	Weighted Mortgage	Weighted Corporate
LONG-RUN						
Interbank Rate	0.664***	0.452**	0.655***	0.473***	0.334*	0.246**
	(0.228)	(0.177)	(0.192)	(0.140)	(0.170)	(0.115)
GDP	-0.030	0.446***	0.091	0.465***	0.077	0.106**
	(0.074)	(0.127)	(0.087)	(0.111)	(0.060)	(0.045)
CPI	-0.043	0.273	-0.549	0.296	-0.357	-0.040
	(0.206)	(0.101)	(0.184)	(0.124)	(0.239)	(0.127)
Liquidity	0.235	-0.046	0.101	0.060	0.048	-0.172**
	(0.215)	(0.074)	(0.080)	(0.064)	(0.062)	(0.064)
Constant	1.128	-9.556	3.730	-15.194	2.432	1.305
SHORT-RUN						
ECT	-0.277***	-0.358***	-0.418*	-0.443***	-0.499*	-0.440***
	(0.095)	(0.118)	(0.220)	(0.123)	(0.278)	(0.143)
Half-Life-Months	5.5	4.5	4	3.5	3	3.5
Dummy Interbank Rate	0.022	0.005	0.004	-0.053**	-0.058	0.002
	(0.040)	(0.018)	(0.042)	(0.025)	(0.037)	(0.036)
LM Test	0.059	0.144	2.470	0.060	0.236	0.808
	{0.808}	{0.502}	(0.116)	(0.806)	(0.626)	(0.368)
Heteroskedasticity	43.00	38.87	0.040	0.290	0.690	0.010
	{0.428}	{0.704}	(0.843)	0.589	(0.407)	(0.907)
Bounds Test	3.561	3.006	9.585	3.877	4.097	4.129
	[2.576]	[2.646]	[5.337]	[3.135]	[3.993]	[3.933]
No.Obs	44	44	47	44	47	49

Notes: The table structure is as in tables 4.6 and 4.7. The analysis here is by ARDL model. The Bounds Test confirms the existence of long-run relationships. The serial correlation and heteroskedasticity tests confirm the adequacy of the replicated ARDL models across different types of lending rates. AIC Lag length selection criteria used with an ARDL lag structure of between 1 to 4 lags across. The half -life is derived from the cumulative short-run visualizations in appendix 4.2b and 4.2c. The Chow test results confirm the existence of a structural break between the pe-2016 and post-2016 sub-samples in SME and personal interests. Standard errors in (), Bounds test critical-values in [ ], Chow test p-values in {} *** p<0.01, ** p<0.05,* p<0.1.

Appendix 4.2: Post-July 2016 Sub-Sample

Table 4.10: Long-Run and Short-Run Estimates: Structural Change Assessment-Post 2016

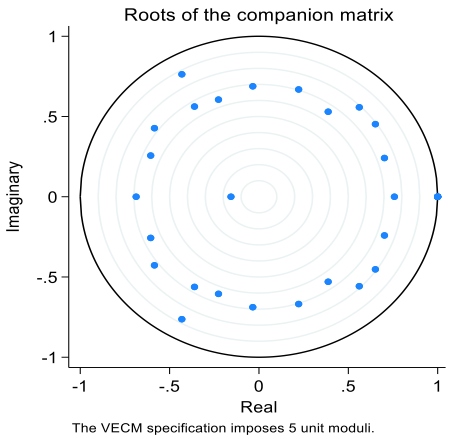
	(1)	(2)	(3)	(4)	(5)	(6)
	Average Lending Rate	Weighted Average Lending Rate	Weighted SME	Weighted Personal	Weighted Mortgage	Weighted Corporate
LONG-RUN						
Interbank Rate	0.459***	0.322*	0.480*	0.332***	0.280***	0.220*
	(0.100)	(0.088)	(0.242)	(0.085)	(0.056)	(0.130)
GDP	0.114**	0.031	0.053	0.074*	-0.016	0.172**
	(0.053)	(0.024)	(0.045)	(0.045)	(0.011)	(0.085)
CPI	-0.050	-0.045	0.284***	0.095***	-0.020	-0.053
	(0.034)	(0.036)	(0.088)	(0.031)	(0.020)	(0.044)
Liquidity	-0.043***	0.014	-0.134**	-0.037**	-0.013	-0.015
	(0.016)	(0.023)	(0.052)	(0.018)	(0.012)	(0.024)
Constant	2.264	3.616	3.915	5.005	16.451	2.026
SHORT-RUN						
ECT	-0.307***	-0.220***	-0.261***	-0.374***	-0.822***	-0.506***
	(0.090)	(0.075)	(0.066)	(0.082)	(0.130)	(0.112)
Half-Life-Months	5	7.5	5	4.5	1.5	3
Dummy Interbank Rate	0.007	0.019	0.089**	-0.025	0.005	-0.103**
	(0.016)	(0.014)	(0.039)	(0.020)	(0.036)	(0.045)
LM Test	1.110	0.302	0.217	0.384	1.271	0.427
	(0.292)	(0.582)	(0.641)	(0.535)	(0.259)	(0.513)
Heteroskedasticity	65.000	62.000	01.690	1.730	0.200	1.170
	(0.442)	(0.440)	(0.194)	(0.188)	(0.656)	(0.279)
Bounds Test	6.165	3.791	3.698	6.047	3.230	5.320
	[4.327]	[2.518]	[2.443]	[3.245]	[2.589]	[1.818]
No.Obs	65	70	67	68	68	67

Note: Table 4.2.1 follows the structure of Table 4.1.1; The ARDL models post-July 2016 pass the serial correlation and heteroskedasticity tests

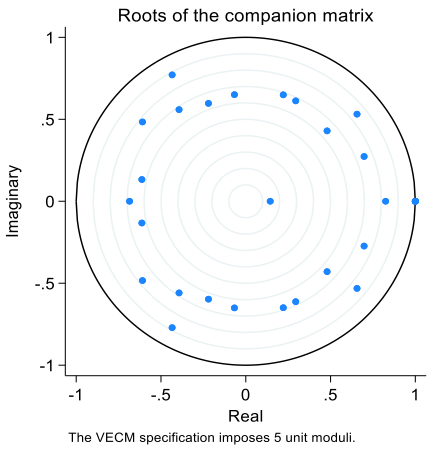
Appendix 4.3: VEC Stability Tests-Inverse Roots of AR Characteristic Polynomial

Figure 4.3: VEC stability Tests-Full Sample

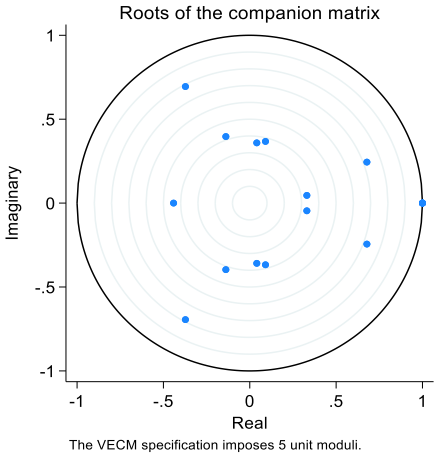
Average Lending Rate



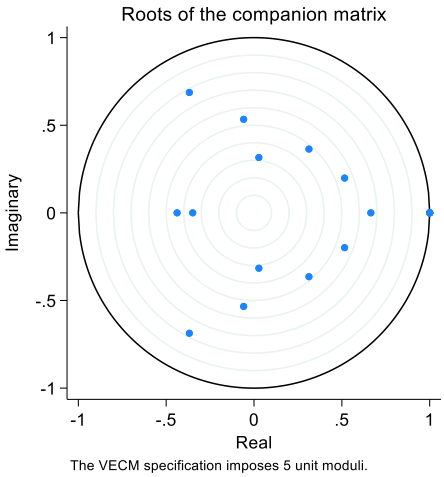
Weighted Average Lending Rate



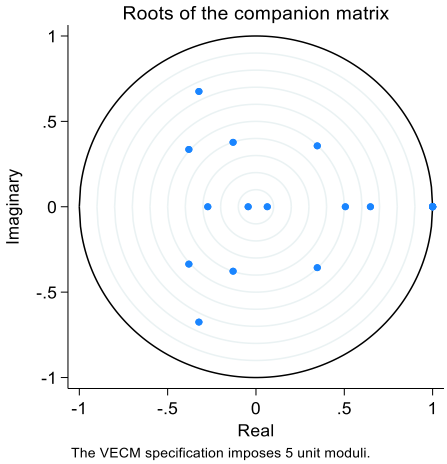
Weighted SME Lending Rate



Weighted Personal Lending Rate



Weighted Mortgage Lenidng Rate



Weighted Corporate Lending Rate

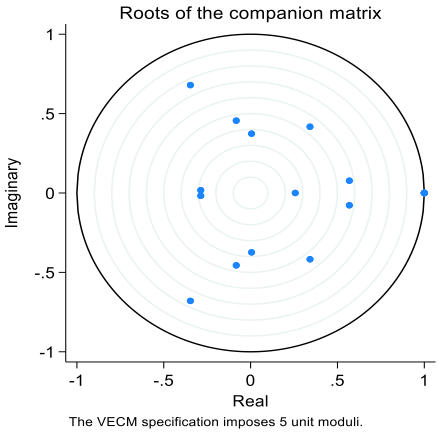
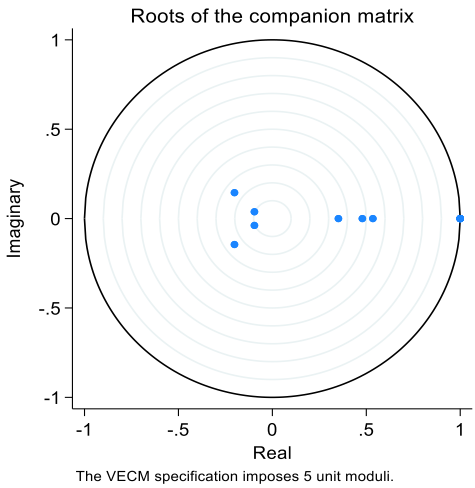
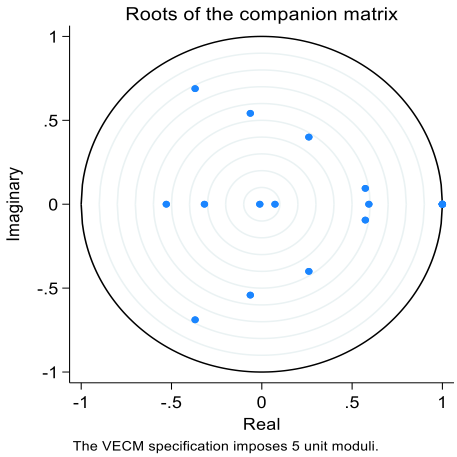


Figure 4.4: VEC stability Tests-Pre-Covid-19

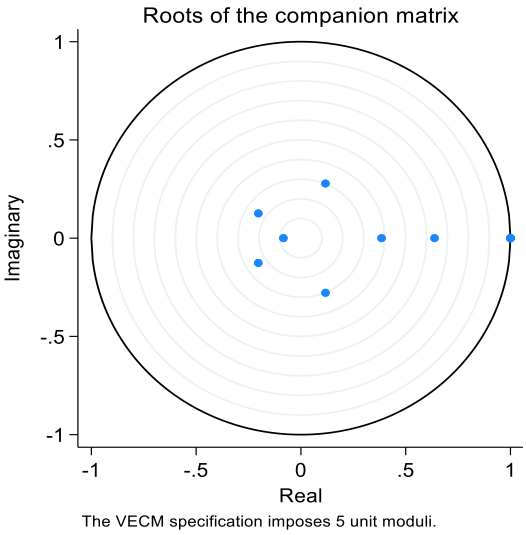
Average Lending Rate



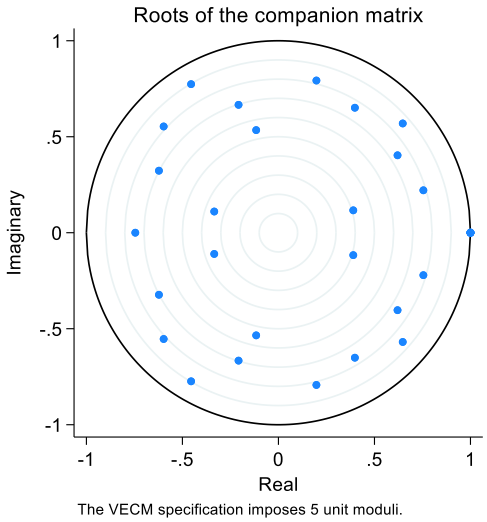
Weighted Average Lending Rate



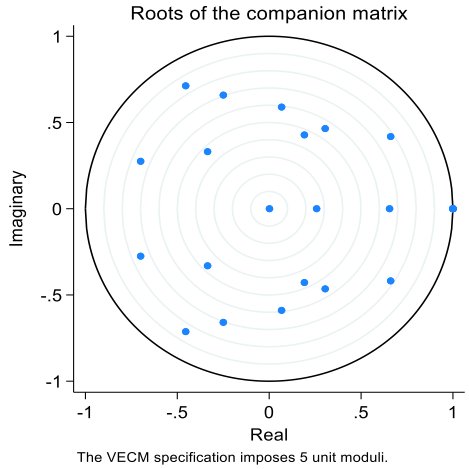
Weighted SME Lending Rate



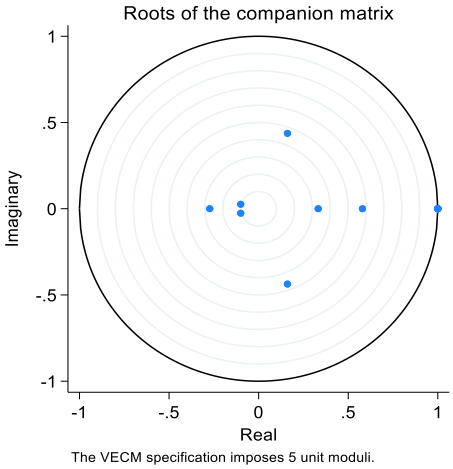
Weighted Personal Lending Rate



Weighted Mortgage Lenidng Rate



Weighted Corporate Lending Rate



Appendix 4.4: Cumulative Short-run dynamics of interbank Rate Shocks on Lending Rates

Figure 4.5: Cumulative Short-run dynamics of Interbank Rate Shocks on Lending Rates-Precovid-19: April 2012 to February 2020

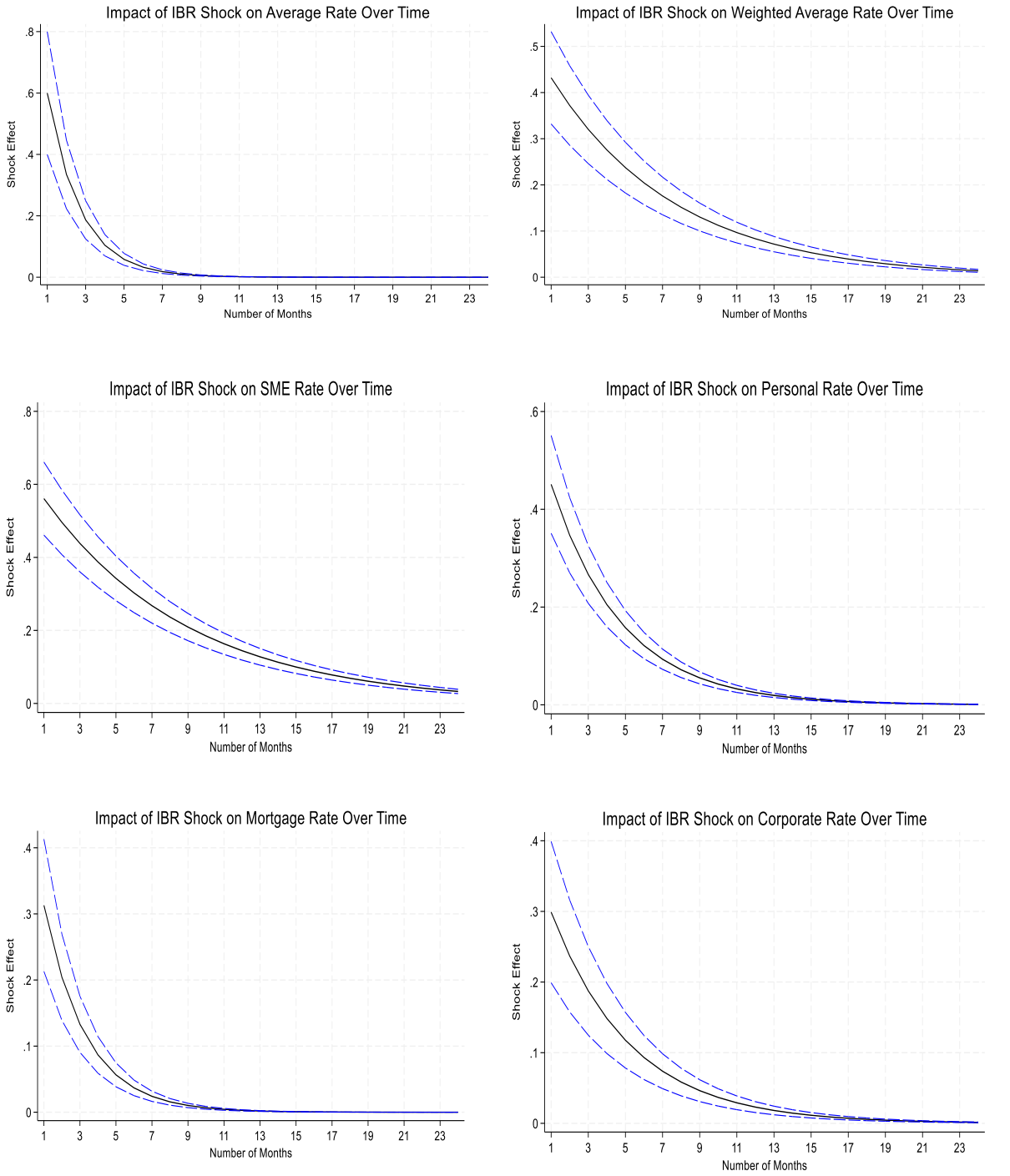


Figure 4.6: Cumulative Short-run dynamics of Interbank Rate Shocks on Lending Rates-Structural Change Analysis (April 2012 to July 2016)

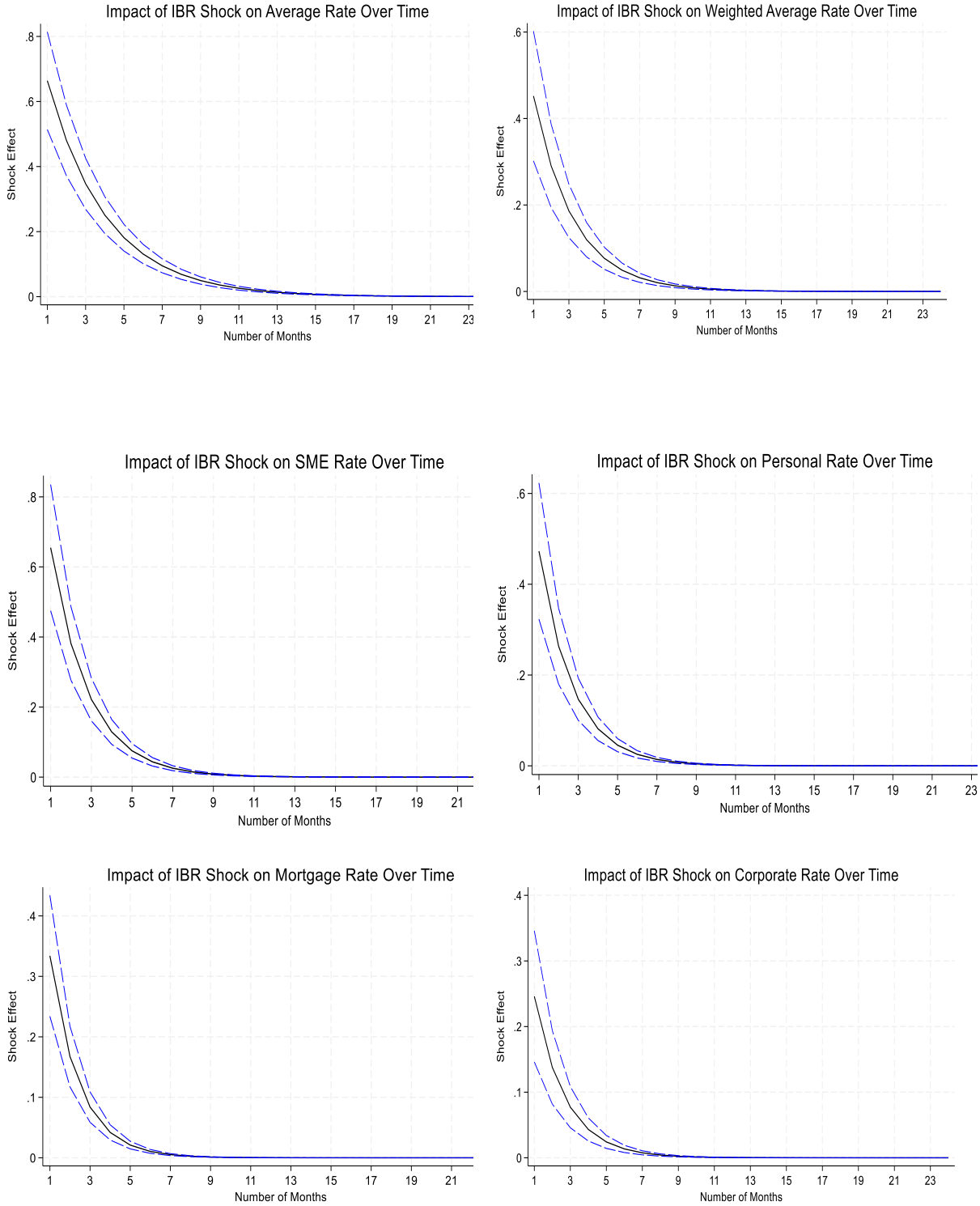
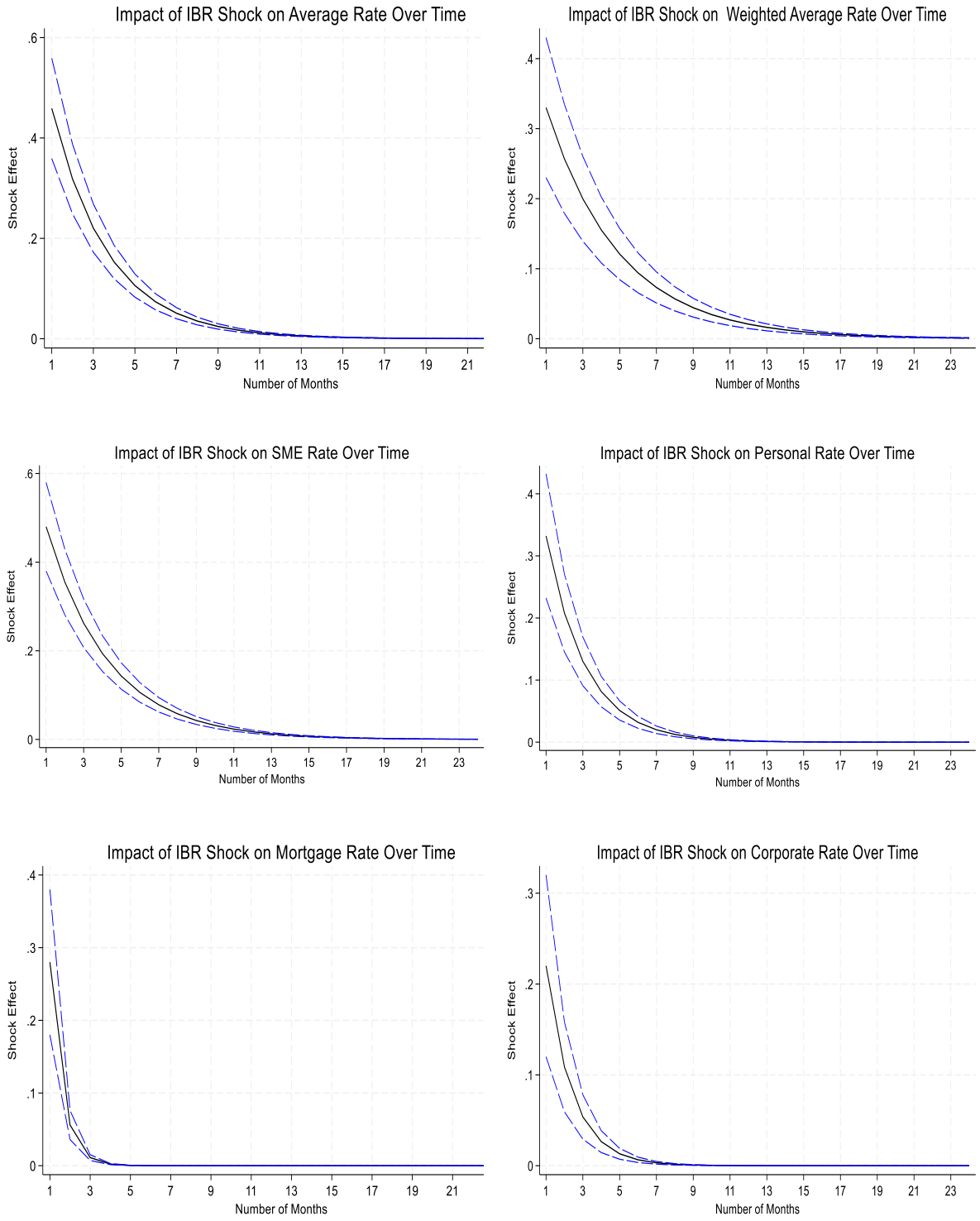


Figure 4.7: Cumulative Short-run dynamics of Interbank Rate Shocks on Lending Rates-Structural Change Analysis (August 2016 to July 2022)



Chapter 5: Heterogeneous Monetary Policy Passthrough to Firms: Bank-level Analysis

5.1 Introduction

Financial globalization and liberalisation have significantly changed the operations of the banking and finance sector and brought about a substantial rise in cross border banking capital flows. While this has many benefits such as enhanced capital allocation and efficiency, it presents challenges for regulating the financial sector and for how government policy is transmitted. Financial globalisation is associated with an increased presence of foreign and global banks in host countries. This has an effect on the transmission of domestic monetary policy because these banks may not respond in the same way as domestic banks to global shocks, external and domestic monetary policy conditions. With the increasing integration of the financial markets, central banks like the US Federal Reserve may significantly impact the monetary policies of other economies. This may occur through various transmission channels such as credit flows, capital flows, exchange rate regimes and other key macroeconomic factors (Rey, 2015). The concept of international monetary policy spillover effects has been topical since at least the early interwar period (Taylor & Obstfeld, 1998). The pioneering work of Mundell (1963) and Fleming (1962) laid a formal foundation for modelling monetary policy in an open economy, key in understanding how such spillovers could impact domestic economic conditions (Taylor & Obstfeld, 1998; Andersen et al.,2007; Kawai, 2015). The issue received greater attention during the global financial crisis (GFC) when interest rate differentials between global regions grew, and several central banks experimented with novel and unorthodox forms of monetary assistance.

Foreign banks have increased their presence in many emerging and developing countries such as Zambia (Feyen et al., 2020), sparking interest among policymakers, particularly concerning their influence on credit dynamics and financial stability. As such, understanding the role of foreign banks in host countries becomes increasingly important in assessing their impact on monetary policy transmission (Wu et al., 2011).

Empirical literature on Zambia using aggregate data suggests that Zambia's monetary policy transmission is both incomplete and sluggish (Chileshe & Akambi, 2015; Ngoma & Chanda,

2022) and as shown in Chapter 4 of this thesis. Given the highly integrated nature of the global economy, this incomplete monetary policy passthrough could be aggravated by external monetary policy spillovers as well as the investment and lending decisions of foreign banks. This is plausible given the structure and openness of Zambia's financial system which is dominated by foreign banks that hold over 70% of the total assets of the banking sector. As of December 2022, Zambia's total banking sector assets were approximately K195 Billion (US$ 10.7 Billion)[7],of which foreign banks held the majority of about K137 Billion (US$ 7.5 Billion) while domestic banks only accounted for about K58 Billion (US$ 3.2 Billion). Out of the 17 banks in operation at the time, only six were locally owned and this highlights the dominant role of foreign banks in Zambia's financial sector (BoZ, 2022).

Given the foregoing, there is need to assess the impact of cross border banking and external monetary shocks on Zambia's domestic monetary policy passthrough by focusing on the interest rate channel of transmission. The aim of this study is to assess the extent of monetary policy passthrough to firms, small and medium sized (SMEs) and corporates (large firms), in Zambia in the presence of external monetary shocks and global risk sentiments using bank level data. In the Zambian context, SMEs are firms with 11 to 100 employees and annual revenue of between ZMW 1 Million and ZMW 50 Million [between $55.3 Thousand and $2.8 Million][8](GRZ, 2023 ;Bank of Zambia, 2022; National Assembly of Zambia, 2017). Large firms are those whose annual revenue is ZMW 50 Million and above, concentrated in certain industries or economic sectors such as copper mining that are classified as large taxpayers by the Zambia Revenue Authority [ZRA] (National Assembly of Zambia, 2017; GRZ, 2015). The study focuses on interest rates passthrough to SMEs and corporate entities due to their key on employment creation and poverty reduction in Zambia. According to the World Bank (2019), SMEs contribute about 40% of GDP and more than 50% of employment in developing countries such as Zambia.[9]

Based on the ownership structure of banks in Zambia, and in line with Ananchotikul & Seneviratne (2015), we conjecture that banks operating in Zambia are far from homogeneous in many key aspects relevant for monetary policy transmission. The study therefore adopts a heterogeneous approach, recognising that the response of banks to monetary policy depends not only on domestic factors but also on their ownership structures and international linkages.

[7] Using the exchange rate of K18.07 per US$ at end December 2022((Bank of Zambia, 2023)
[8] Using the exchange rate of K18.07 per US$ at end December 2022((Bank of Zambia, 2023)
[9] [9] Reliable Zambian specific statistics not available

The study distinguishes between domestic banks and foreign banks, and among foreign banks it distinguishes between Pan-African banks and global banks. Specifically, the objectives are to:

- Undertake a comparative analysis on the extent of Zambian monetary passthrough between foreign and domestic banks, and within foreign banks, between global and Pan-African banks.
- Understand the extent to which domestic and foreign banks in Zambia respond to shocks in global interest rates (10-year US treasury rate) and global risk sentiments (CBOE VIX).
- Understand the extent to which foreign banks react to their parent country monetary policy shocks (spillover effect of country-of-origin monetary policy) by making a comparison between global and Pan-African banks.

While substantial empirical evidence on the impact of foreign bank presence and global economic shocks on domestic monetary policy exist in developed and emerging economies, (Ammer, *et al.,* 2016; Pierre-Richard & Pereira da, 2022; CIEPR, 2012; Ng, 2000; Hofmann & Takáts, 2015; Koepke, 2018; Denderski & Paczos, 2021; Wu et al., 2011; Ahmed, 2013; Forbes & Warnock, 2012; Fratzscher, 2011; Lee, 2019), research in many sub-Saharan Africa (SSA) countries such as Zambia remains scant. Some studies include SSA countries as part of a broader cross-country sample, but they lack country-specific analysis (Ghosh, *et al*., 2012; Demirgüç-Kunt et.al., 2020; Feyen et.al., 2020;). This is despite most of these SSA countries being linked to international financial markets through the presence of foreign banks operating in their economies. A few notable studies around this subject matter in Africa are Ekeocha & Udeaja (2020) in Nigeria and Katusiime (2021) in Kenya and Uganda. In Zambia, previous studies by Chileshe et al.(2018), Pamu (2002), Simpasa & Nandelenga (2022) and Funyina et.al (2024) have explored different aspects of the effects of global economic shocks in Zambia but not directly related to this study. These earlier studies on Zambia mainly concentrated on the spillover effects of the Fed Rate on macroeconomic conditions and monetary policy in general using an aggregate lending rate. They did not use bank-level data to explore differences across banks or assess the spillover effects of other external financial shocks, particularly those linked to international banking capital flows and their impact on domestic monetary policy passthrough to firms, which is the focus of this study.

This study employs a novel granular bank-level dataset that splits the lending rate by end-user categories, specifically the SME and corporate interest rates, rather than relying on aggregate data. The study also includes VIX as a key global shock which has not been considered in SSA studies despite the role of global risk appetite being key in domestic monetary policy transmission in the face of cross border banking (Ahmed & Zlate, 2013; Forbes & Warnock, 2010; Fratzscher, 2011; Ghosh et al., 2012; Agrippino & Rey, 2020; Koepke, 2018; Clark et al., 2016; Kearns et.al., 2018; Hofmann & Takáts, 2015). Another key innovation is the assessment of the impact of monetary policy spillovers from parent countries of foreign banks operating in Zambia, which could significantly affect domestic monetary policy passthrough. This aspect has mostly been ignored as most analyses only consider spillovers from global interest rate shocks. To the best of our knowledge, this paper is the first on Zambia to explicitly document the relationship between foreign bank ownership and monetary policy passthrough using disaggregated bank-level data. For purposes of clarity, the parent or home country is the country of origin for foreign banks operating in Zambia while domestic country is the host country (Zambia).

This study makes significant contributions to literature on the interest rate channel of monetary policy in Zambia. This is key for effective monetary policy formulation and implementation under the interest rate monetary targeting regime adopted by the country since April 2012. It provides a framework for understanding how the ownership structure of the banking sector, external financial and monetary conditions could impact domestic monetary policy transmission. Understanding monetary policy transmission through a heterogeneous lens provides valuable insights into bank-specific factors that could potentially impact monetary policy efficacy since banks are the conduits through which monetary policy is transmitted (Kashyap & Stein, 2000; Bundesbank, 2018). Using Zambian data, the research results could be generalised to other SSA countries with similar banking and financial systems given the prominence of cross border banking in the region.

The results reveal significant heterogeneity in how commercial banks in Zambia respond to domestic monetary policy changes, with domestically owned banks showing a higher passthrough to both SME and corporate rates while foreign banks show lower sensitivity. The heavy presence of these foreign banks could be one of the reasons why monetary policy transmissions in Zambia (and other developing countries with similar financial market conditions) is weak. This is partly explained by the ability of foreign banks to access funding support from their parent banks through internal group banking capital markets (Houston &

James, 1998; Wu, et al.; 2011; Ananchotikul & Seneviratne, 2015). Bank interest rates to firms in Zambia are not only influenced by domestic monetary policy shocks but also by global factors such as the VIX, the 10-year US treasury rate and monetary policy impulses from countries of origin of foreign banks. While the interest rate channel of monetary policy transmission is present in Zambia, its strength is moderated by the dominance of foreign banks and the associated monetary policy spillovers from their parent countries and global factors. Such external factors, which stem from global monetary policy shocks and other economic developments in countries of origin for foreign banks, might impede the host country's monetary policy activities of achieving price and financial system stability (Gelos & Sahay, 2023; Cesa-Bianchi et.al., 2021). This highlights the challenges that monetary policy decision makers are faced with in ensuring that monetary policy aligns well with domestic macroeconomic needs in a highly integrated global financial system.

Following the introduction, section 2 reviews the literature, section 3 presents the methodology, section 4 discusses the study results and section 5 concludes.

5.2 Literature Review

5.2.1 Theoretical Review

Keynesian models such as the Mundell-Fleming theory (Mundell, 1963; Fleming, 1962) provide a framework for analysing the interconnections between monetary policy, exchange rates, and economic activity in an open economy. The central premise is the trilemma, which asserts that governments cannot maintain stable exchange rates, unfettered capital mobility, and autonomous monetary policy all at the same time. Instead, they must select two out of three policy objectives. The Mundell-Fleming model shows how changes in fiscal and monetary policies affect local interest rates, exchange rates, and output levels, as well as how these changes spread to other nations via trade and capital flows. For example, an expansionary monetary policy, such as lower interest rates, can cause currency depreciation, making exports cheaper but potentially sparking inflation. In contrast, a contractionary monetary policy, such as hiking interest rates, might attract foreign capital inflows, strengthen the currency, and perhaps reduce exports.

However, the Trilemma is insufficient since it assumes that domestic monetary and financial factors influencing a country's macroeconomic position can be readily summarised by a single variable, the short-term interest rate (Rey 2013). If this were the case, the increased freedom obtained from exchange-rate flexibility would be sufficient to offset any effects of foreign

financial conditions on the home macroeconomy. However, in a world of globalised finance with various sorts of capital flows and financial market imperfections, developed countries' monetary policies can have a variety of effects on the monetary conditions and financial stability of other nations. Financial imbalances may develop, affecting domestic output in the long term. Alternatively, the presence of foreign debt may result in substantial balance-sheet effects that affect the impact of monetary relaxation. Allowing the exchange rate to float may not be sufficient to protect the home economy from global forces and maintain monetary policy independence, especially for big countries.

The traditional Keynesian view on the transmission of monetary tightening to the real economy is based on the bank lending channel. Stein (1998) provides a theoretical framework to understand how changes in monetary policy affect bank lending behaviour and, as a result, economic activity. According to the bank lending channel hypothesis, monetary policy measures, such as policy rate adjustments, influence credit supply by affecting bank balance sheets and lending criteria. Specifically, when the central bank tightens monetary policy by raising interest rates, banks' funding costs rise, resulting in higher lending rates and tighter credit conditions. In contrast, when the central bank eases monetary policy by decreasing interest rates, banks' funding costs fall, resulting in lower lending rates and more flexible credit conditions. Schematically, the bank lending channel is characterised as in line with Loayza & Schmidt-Hebbel (2002):

$$M\downarrow \rightarrow i\uparrow \rightarrow \mathrm{I}\downarrow \rightarrow Y\downarrow \qquad 5.1$$

In (1), contractionary monetary policy ($M\downarrow$) raises real interest rates ($i\uparrow$), which increases capital costs and reduces investment spending (I↓), leading to a decrease in aggregate demand and production ($Y\downarrow$). Central banks can undertake expansionary monetary policy ($M\uparrow$) by lowering policy rates. This alters the amount of liquidity in the economy and increases investment ($I\uparrow$) and consumption of durable goods by lowering long-term real interest rates ($i\downarrow$). The change in aggregate demand leads to an increase in aggregate production ($Y\uparrow$) and prices.

The foregoing describes a typical transmission mechanism for domestic monetary policy shocks. Based on this, what has now gained momentum in empirical research is if the same situation holds when looking at international monetary policy spillovers to other countries. For example, can monetary policy contractions or expansions in developed countries (United States, United Kingdon, Europe, and China) cause corresponding recessions or booms in emerging markets and developing countries? Can monetary policy changes in home countries

of foreign banks operating in other economies be passed on to host countries? These concerns are becoming prominent in the literature (Tumala et al., 2021).

Literature identifies two main channels of international monetary policy spillovers: the exchange rate channel and the interest rate channel. The exchange rate channel stipulates that a fall in a foreign country's interest rate (say, the United States) might lead to monetary expansion and, as a result, an improvement in trade balance through real exchange rate depreciation compared to the currency of a local economy (for example, Zambia). This channel assumes that the domestic monetary policy authority will not take any action in the short run, therefore the macroeconomy responds to the international monetary policy shock through the exchange rate channel. On the other hand, the interest rate channel of international monetary policy spillover assumes that an increase in a foreign country's interest rate can cause a rise in domestic interest rates via the monetary policy rate, which is then raised by the domestic monetary policy authority to prevent capital flight (Kim, 2001). The interest rate channel is more significant in this study looking at the impact of external monetary policies on Zambia's monetary policy passthrough.

5.2.2 Empirical Review

Table 5.1 presents a summary of key papers with empirical analysis, some of which are later discussed in detail.

Table 5.1: Literature Summary

Study	Objectives	Data & Sample Period	Methodology	Key Findings
Buch et al. (2018)	examine the international transmission of US monetary policy via bank lending across advanced economies.	Bank-level data from the US, euro area, UK, and Japan (2000–2015).	Panel regression with fixed effects.	US tightening reduces lending by internationally active banks, especially those dependent on wholesale funding. Lacks disaggregated loan category analysis.
Koepke (2018)	Analyse drivers of capital flows to EMs using the push-pull framework.	Empirical studies from multiple periods	Literature survey, push-pull analysis	Push and pull factors vary over time; global risk aversion (VIX) is crucial in shaping capital flows to EMs.
Degasperi et al. (2021)	Examine global propagation of U.S. monetary policy shocks using high-frequency identification.	macroeconomic and financial country level data spanning 1990:1-2018:	VAR approach	U.S. monetary policy shocks have significant global spillovers through financial channels.

Denderski & Paczos (2021)	Investigate bank ownership's impact on monetary policy transmission in Central and Eastern Europe.	Bank-level panel for the period 2005–2016).	Fixed effects regression.	Foreign banks rely more on cross-border funding and respond less to host monetary tightening. Sectoral credit detail missing.
Cetorelli & Goldberg (2012)	Investigate the role of global banks in transmitting monetary policy shocks across borders via internal capital markets.	US-based bank holding company data with cross-border linkages for the period 1995 to 2009.	VAR with global banking data.	Global banks reallocate liquidity internally, dampening domestic monetary policy effects and facilitating asymmetric international spillovers depending on bank structure. .
Wu et al. (2011)	Examine foreign bank penetration's impact on monetary policy transmission in emerging economies.	1996-2003, 1273 banks in Asia, Latin America, and CEE	Dynamic panel model, Pooled OLS, system GMM, panel VAR	Foreign banks are less responsive to domestic monetary shocks compared to domestic banks.
Anachotikul & Seneviratne (2015)	Assess monetary policy effectiveness in emerging Asia via the bank lending channel.	2003-2013, bank-level data in Asian countries	VAR model	Bank heterogeneity influences response to domestic monetary policy; ownership and global conditions matter.
Demirgüç-Kunt et al. (2020)	Investigate banking sector globalization's impact on monetary policy transmission in Asia.	2000-2014, data from 271 Asian banks	Country-level panel data analysis	Global banks with significant foreign assets show weak responsiveness to monetary tightening, especially during crises.
Feyen et al. (2020)	Examine cross-border banking activities by EMDEs and their global impact.	2000-2013, panel data	Simple regression	Cross-border banking increases risk in developing countries; calls for stronger macroprudential supervision.
Lambert et al. (2015)	Examine changes in international banking post-2008-2009 crisis and its impact on global shocks transmission.	1998-2013, bank-level panel data from 64 countries	Descriptive analysis, survey of literature, empirical analysis	Localized lending increased; international credit became more volatile, impacting global financial stability.
Lee & Bowdler (2019)	Investigate banking sector globalization's impact on monetary policy transmission in Asia.	2000-2014, data from 271 Asian banks	Fixed effects regression technique	Banking globalization weakens domestic monetary policy transmission, especially during financial crises.

Fic (2013)	analyse the influence of unconventional monetary policy in developed nations on developing economies.	Event studies for the US, UK, Eurozone, Brazil, China, India, and Russia between 2007 and 2013	Series of event studies	QE measures in developed nations impacted financial markets in developing economies, influencing yields and equity prices.
Agrippino & Rey (2020)	Examine the influence of the Global Financial Cycle, focusing on U.S. monetary policy.	Country specific panel monthly data for the period 1990 - 2012.	Dynamic factor model, Bayesian VAR analysis	U.S. monetary shocks drive global financial cycles, affecting capital flows and questioning monetary policy sovereignty.
Chileshe et al. (2018)	Assess foreign shocks' impact on Zambia's macroeconomic variables and monetary policy.	2000q1-2016q1, quarterly data	Structural VAR model	External shocks, particularly commodity price and financial shocks, significantly influence Zambia's monetary policy.
Tumala et al. (2021)	Explore monetary policy transmission from global financial centres to Nigeria and South Africa.	1979Q4-2019Q4	Global VAR model	U.S. and China monetary policy have significant impacts on Nigeria and South Africa, with different effects on inflation, interest rates, and exchange rates.
Ekeocha & Udeaja (2020)	Examine U.S. monetary policy's impact on Nigeria's macroeconomic fundamentals.	1985-2018, divided into CMP and UMP periods	Multivariate GARCH (MGARCH) technique	U.S. monetary policy has strong spillover effects on Nigeria's interest rates, currency, and inflation.
Katusiime (2021)	Investigate U.S. monetary policy spillovers on Kenya and Uganda, focusing on interest rates, exchange rates, and inflation.	Pre-2007-2008 GFC and post-GFC periods	Generalised Vector Autoregressive (GVAR) paradigm	Significant spillovers during periods of high uncertainty; emphasizes need for international policy coordination.
Abuka et al. (2019)	Examine Uganda's monetary policy's bank lending channel using microdata.	Micro bank level credit data for Uganda, 2010 – 2014.	Linear OLS with fixed effects and balance sheet controls.	Only 50% of interbank rate changes are passed to average lending rates. Sample size is small; average lending rate is unweighted despite loan volumes; OLS estimation may be inefficient due to heteroskedasticity.
Mbowe (2015)	Assess monetary policy rate pass-through to retail deposit and lending rates in Tanzania,	Monthly bank-level data for the period 2003 – 2012.	Error Correction Model (ECM).	Complete pass-through to the interbank rate, but weak and slow pass-through to retail deposit rates. Effects

	accounting for bank heterogeneity.			stronger among foreign and small banks.
Greenwood-Nimmo et al. (2022)	Evaluate interest rate pass-through to retail mortgage and deposit rates in South Africa.	Bank-level data from 5 largest banks for the period 2009 – 2020.	Nonlinear ARDL (NARDL) with controls (liquidity, credit spreads).	Heterogeneous pass-through: complete and symmetric for call deposits, incomplete and asymmetric for mortgage rates (stronger during hikes).

Following the 2007–2010 global financial crisis, there has been a growing body of research examining how monetary policy shocks in advanced economies spill over globally, particularly through banking and financial channels. Studies like Cetorelli & Goldberg (2012) demonstrate how international banks in advanced economies use internal capital markets to mitigate the impact of domestic monetary policy in host countries by reducing liquidity shocks. Employing confidential micro banking data across the UK, euro area, US, and Japan, Buch *et al.* (2018), find substantial cross-border transmission of US monetary policy, with effects varying by bank characteristics. Similarly, Degasperi *et al*. (2021), applying high-frequency identification and VAR models, show consistent US monetary spillovers to both emerging and advanced economies through financial channels, with flexible exchange rates offering limited insulation.

In recent years, literature on this subject has also become increasingly centred on emerging and developing markets. For instance, Koepke (2018), in his summary of research on capital flows highlights the significance of both local "pull" variables (such as growth and vulnerability indicators) and global "push" factors (such as interest rates and risk aversion). Due to their access to parent or cross-border capital, foreign banks in host countries are less sensitive to local monetary tightening, according to empirical research conducted in Asia and Eastern Europe such as Lee & Bowdler (2019), Denderski & Paczos, (2021) and Wu *et al. (*2011). Accordingly, Demirgüç-Kunt et al. (2020), show that the lending behaviour of foreign subsidiary banks in host county is influenced by the parent banks' financial condition, and providing insulation from local shocks and this is helpful during crises such as the 2008–2009.

In Sub-Saharan Africa (SAA), a few studies which investigate the monetary policy transmission and external spillovers mostly rely on aggregate data, limiting their ability to highlight heterogeneity across bank types and borrower categories. For instance, Tumala *et*

al. (2021) evaluates monetary policy spillovers from China, US and EU using a Global Vector Autoregressive (GVAR) for the period 1979 to 2019. Their study findings reveal cross-country differences in inflation, interest rate, and exchange rate responses to foreign policy shocks. Similarly, Ekeocha & Udeaja (2020) investigate the effect of US conventional and unconventional monetary policy on Nigeria using a multivariate GARCH technique. The results show that both conventional and unconventional monetary policy have significant spillovers to domestic interest rates, inflation and exchange rates, with effects varying by the type of policy intervention. Further, Katusiime (2021) examines international spillovers using a generalised VAR to assess US monetary policy effects on Kenya and Uganda. The analysis identifies time-varying spillovers, with increased sensitivity during periods of global uncertainty, such as the 2007–2008 financial crisis.

In Zambia, Chileshe et al. (2018), employ a structural VAR model to assess the effects of external shocks on Zambia's macroeconomic performance and monetary policy stance. Using data spanning 2000Q1–2016Q1, the study finds that external financial shocks and commodity prices have significant influence on inflation, output, and the exchange rate, resulting into pro-cyclical monetary responses. However, this macro-level focus based on aggregate and simple averaged data limits the ability of the study to highlight how these shocks are transmitted through specific types of credit markets and banks.

A few studies have employed bank-level data to examine monetary policy passthrough in SAA but with some limitations. For instance, Abuka et al. (2019), using Uganda's bank level credit registry data from 2010–2014, find that monetary contractions reduce credit supply, increase rejection rates, and tighten loan terms in Uganda. However, their study, relies on unweighted lending rates despite availability of loan volumes and does not distinguish the passthrough across specific loan products and bank types and does not account for the influence of external spillovers. Relatedly, Mbowe (2015) employs an ECM to assess monetary policy transmission in Tanzania using bank level data from 2003–2012 and finds an incomplete and weak passthrough to retail deposit rates. While this study differentiates by bank ownership and size, it relies on unweighted aggregate average lending and deposit rates which are not decomposed based on borrower categories and does not control for the impact of external factors. While Greenwood-Nimmo *et al*. (2022) reveal detailed asymmetric passthrough in South Africa using nonlinear ARDL from 2009 to 2020 on specific lending rates, their study excludes SME rates, omits the influence of external shocks and is only based on five large banks making it difficult to generalise.

This study innovates by employing bank-level data on specific type of interest rates and by incorporating global risk indicators such as the VIX and the U.S. Treasury rate, alongside parent country specific monetary policy for each foreign bank operating in Zambia.

5.3 Methodology

5.3.1 Conceptual Framework

The conceptual framework for the influence of global shocks and external monetary policies on monetary policy transmission by foreign banks operating in Zambia is grounded on key assumptions and empirical evidence. Foreign banks are assumed to be risk-averse and have three main investment options: investing in risk-free assets (such as US government bonds), acquiring Zambian dollar-denominated bonds, or lending to Zambian corporations or SMEs in the local currency. Zambia's issue of long-term Eurobonds in 2012, 2014 and 2015 supports these assumptions, as does the updated dataset from Arslanalp & Tsuda (2014)[10] which demonstrates that in 2020 foreign banks held about 11% of Zambian government bonds.

Getting insights from Ross (1976) and Bodie et al. (2014), an arbitrage relationship between risk-free assets and Zambia's dollar-denominated bonds, can be formalized as:

$$(1 - q_t)\left(1 + i_t^{Zambia,USD}\right) + q_t V = (1 + i_t^{US}) + \varphi_t q_t, \qquad 5.2$$

where q_t is the probability of default associated with bonds[11]. $i_t^{Zambia,USD}$ is 1-year interest rate associated with the Zambian dollar-denominated bonds. V is the recovery value after default, which we assume constant for simplicity. i_t^{US} is risk-free 1-year interest rate, proxied by US Treasury ten-year rate. φ_t is parameter reflecting investors' risk aversion, which captures investors' time-varying sensitivity to default probability. In the empirical exercise, this is approximated by the VIX index.

Next, we can consider the arbitrage relation between US dollar and local-currency (LC)-denominated bonds for foreign investors in line with Lustig & Adrien (2007) and Froot & Thaler (1990). Specifically,

[10] Dataset can be accessed on: https://www.imf.org/~/media/Websites/IMF/imported-datasets/external/pubs/ft/wp/2014/Data/wp1439.ashx

[11] Zambia defaulted on its foreign currency sovereign bonds in October 2020, therefore considering default is a realistic prospect (FITCH, 2020).

$$i_t^{Zambia,USD} = i_t^{Zambia,LC} - \left(\frac{E_{t+1}^e - E_t}{E_t} - \delta\right) \quad 5.3$$

where $i_t^{Zambia,LC}$ is the 1-year interest rate associated with foreign banks' lending to Zambian corporates or SMEs in local currency (LC). For simplicity, we assume that LC lending rate is the same for all agents in Zambia, including the government, corporates, SMEs, and households. E_t is the current month's exchange rate of US dollar relative to the Zambian local currency (ZMW), and E_{t+1}^e denotes investors' expected exchange rate of the US dollar relative to the ZMW one month ahead; δ (>0) reflects the assumption that the default risk of LC denominated bonds is lower than the default risk of dollar denominated bonds, because the government has the option of partial default on LC bonds (but not US dollar bonds) through inflation. We assume that δ is constant for simplicity.

The default probability can be associated with the strength of macroeconomic fundamentals of Zambia:

$$q_t = q(X_t), \quad 5.4$$

where X_t is a vector of macroeconomic fundamentals that possibly affects the default rate, including inflation and the GDP measure. Prediction on foreign banks' lending to Zambian corporates and SMEs in local currency is made by combining equations (5.2), (5.3), and (5.4), we have:

$$i_t^{Zambia,LC} = i_t^{US} + [\varphi_t + (1 + i_t^{US}) - V]\frac{q(X_t)}{1-q(X_t)} + \frac{E_{t+1}^e - E_t}{E_t} - \delta \quad 5.5$$

This is a no-arbitrage condition linking the three markets set out above. Based on this, the predictions for the equilibrium (LR) relationship are that:

1: A rise in i_t^{US} increases the lending rate charged by foreign banks in Zambia.

2: A rise in φ_t, global risk aversion, increases the lending rate.

3: A worsening of macroeconomic fundamentals (X_t) such as an increase in Zambian inflation rate, corresponding to an increase in q_t, increases the lending rate.

4: A rise in $\frac{E_{t+1}^e - E_t}{E_t}$ (expected depreciation rate) increases the lending rate.

The lending rate set by foreign commercial banks is thus modelled as:

$$i_t^{Zambia,LC} = f\left(i_t^{US}, \varphi_t, X_t, \frac{E_{t+1}^e - E_t}{E_t}\right) \quad 5.6$$

$$+\ ,\ +\ ,\ +\ ,\ +$$

where the signs below the arguments are expected impacts, holding all else equal. Equation (5.6) motivates our equilibrium (LR) relationship. While the no-arbitrage condition motivates the above relations, we can modify it by taking account of Zambia's monetary policy stance, and foreign commercial banks' balance sheet conditions. As the BoZ policy rate does not change every month, Zambia's interbank short-term rate, with monthly variation responding to the monetary policy stance, is chosen to represent the monetary policy instrument. It is plausible that, *ceteris paribus*, the lending rate increases when the interbank rate increases.

As for foreign banks' balance sheet conditions, when foreign banks' liquidity is initially low and when manufacturing share is high, it is more likely that the lending rate is high.

Incorporating these insights, Equation (5.5) can be modified as:

$$i_t^{Zambia,LC} = f\left(i_t^{US}, \varphi_t, X_t, \frac{E_{t+1}^e - E_t}{E_t}, i_t^{Zambia,IB}, Liq_{t-1}, manu_{t-1}\right) \quad 5.7$$

$$+,\ +,\ +,\quad +\ ,\quad +,\qquad -\quad ,\quad +$$

where $i_t^{Zambia,IB}$ is Zambia's interbank rate, Liq_{t-1} is banks' liquidity measure in period $t-1$ and $manu_{t-1}$ (manufacturing share) is the share of banks' credit extended to the manufacturing sector from the total loan portfolio in period $t-1$.

5.3.2 Empirical Model

5.3.2.1 Testing for differences in coefficients: Baseline Model Chow Test

Since the aim of the study is to assess heterogeneous monetary policy passthrough between foreign and domestic banks in the presence of external shocks, the empirical analysis starts with a baseline Chow test as preliminary diagnostic. This test helps in evaluating if it is appropriate to split the total sample into foreign and domestic sub-samples by highlighting if coefficients from domestic banks are statistically different from those of foreign banks. The Chow test is complemented by t-tests to validate differences in coefficients of sub-samples.

5.3.2.2 Dynamic Fixed Effects Model with Driscoll-Kraay (DK) Standard Errors

This study employs a panel ARDL framework estimated using a dynamic fixed-effects (FE) specification with Driscoll–Kraay (DK) standard errors. The ARDL approach is well suited for monetary policy analysis, since transmission effects are not instantaneous and lending rates adjust gradually over time. By including the lagged dependent variable, the model captures this persistence, distinguishing between short-run adjustments and the long-run equilibrium response. The fixed-effects model controls for unobserved, time-invariant bank characteristics, ensuring that the estimated dynamics reflect genuine policy transmission rather than bank-specific heterogeneity.

The Panel Pooled Mean Group (PMG) estimator of Pesaran et al. (1999), often used in ARDL contexts to account for heterogeneous long-run effects, could not be employed due to the small number of banks in the sample (16) with most bank ownership sub-groups (domestic, pan-African, global) only having 5 or 3 banks. In fact, the number of banks reduces further to 14 banks as two banks do not provide SME lending while another two do not undertake corporate lending. This leaves the sample with 5 domestic banks and 9 foreign banks in each client type category. Similarly, a random-effects model with cluster-robust standard errors is not viable here: with only 14 banks, the number of clusters is too small for reliable inference (Cameron & Miller, 2015), and clustered errors do not account for cross-sectional dependence from common macroeconomic and global shocks. Neglecting such dependence can bias inference (Hoechle, 2007). The DK standard errors address these concerns by making standard errors robust to heteroskedasticity, autocorrelation, and general forms of cross-sectional dependence, and are particularly reliable in panels with large T and small N (Driscoll & Kraay, 1998).

Formally, the dynamic FE model is given by:

$$y_{i,t} = \alpha\, y_{i,t-1} + \beta ibr_t + \sum_{j=1}^{n} \gamma_j global_{j,t} + \sum_{j=1}^{n} \delta_j macro_{j,t} + \sum_{j=1}^{n} \theta_j balance_{i,j,t} + f_i + \varepsilon_{i,t} \quad 5.8$$

Where: $i(bank) = 1, \dots, 16$; $t(month) = 2012M4, \dots, 2022M7$, $y_{i,t}$: Corporate (or SME) lending rates by bank i in time t, ibr_t is the Interbank rate (proxy for monetary policy stance) and is treated as exogenous to individual banks' idiosyncratic behaviours in the empirical

analysis and this mitigates concerns about bank-level endogeneity; $global_{j,t}$ are global factors, $macro_{j,t}$are Macroeconomic variables, $balance_{i,j,t}$ are bank-specific balance sheet variables (size, capital, liquidity), and f_i are bank-fixed effects that absorb all time-invariant, bank-specific heterogeneity.

The long-run passthrough is derived from the short-run equation as:

$$\frac{\beta}{1-\alpha} \qquad 5.9$$

Here β is the coefficient of the interbank rate and α of the lagged dependent variable from 5.8.

5.3.2.3 Test for Cross Sectional Dependence

Testing for cross section dependence is a key step in implementing FE with Driscoll-Kraay (DK) Standard errors to ensure that the appropriate covariance matrix is chosen. The presence of cross-section dependence entails that the regression model residuals are correlated across clusters (banks in this case), which can bias the standard error estimates. DK standard errors are more reliable in this context as they are specifically designed to handle such cross-section dependencies (Driscoll & Kraay, 1998; Hoechle, 2007). The Pesaran (2004) Cross-Section Dependence (CD) test is used. Under the CD test, the null hypothesis (H_0) is that the residuals from a fixed effects regression are cross-sectionally independent (no correlation of residuals between banks) and the alternative hypothesis (H_1) is that the residuals are cross-sectionally dependent, suggesting that there is correlation between the residuals of banks. The decision rule is that if the test statistic is significant at 10% , 5% or 1% level of significance, we reject the null hypothesis and conclude that cross-section dependance across banks exists. If the null hypothesis is rejected,the DK standard errors become an appropriate technique for relaible inference.

5.3.3 Alternative Econometric Model for Robustness Checks

5.3.3.1 ARDL Time Series Estimation at the Bank Level

Building on the panel ARDL dynamic FE specification, which serves as the benchmark model of average monetary policy pass-through across banks, the study also undertakes bank-by-bank time series ARDL estimations as robustness checks. This approach allows the analysis to go beyond average effects and directly explore heterogeneity in pass-through at the individual bank level.

Time series regressions are estimated separately for each bank using the autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran & Shin (1999) and extended by Kripfganz & Schneider (2023). The ARDL framework is particularly suited here because it captures both short-run dynamics and long-run relationships. In addition, it is efficient for small sample sizes (some 124 monthly observations over 2012-2022 is relatively small). Employing time series data for each dividual bank over the period 2012:4 to 2022:7, the generalised ARDL (p, q) model is specified as:

$$cbr_t = C_0 + \sum_{j=1}^{p} \beta_{0j} cbr_{t-j} + \sum_{j=0}^{q} \beta_{1j} ibr_{t-j} + \sum_{j=0}^{q} \beta_{2j} X_{t-j} + \varepsilon_t \qquad 5.10$$

Where C_0 is model intercept; β_{0j} is the coefficient on the lagged dependent variable cbr_t which is commercial banks retail rates (corporate and SMES) at time t; ibr is the interbank rate (proxy for monetary policy stance). Motivated by the no arbitrage relationship in equation 5.7, X is a vector of controls which include GDP, CPI, expected exchange rate depreciation, VIX and 10-year-US treasury rate, liquidity and manufacturing share. $\beta_{1\mathrm{j}}$ and β_{2j} represent the coefficients of the lagged explanatory variables on commercial banks SME and corporate rates at a given lag structure; ε_t is the idiosyncratic error term. It is convenient to re-parameterise the generalised ARDL model into an error correcting (EC) form for better interpretability. In line with Kripfganz & Schneider (2023), the reparameterised short-run ARDL error correction form is specified as:

$$\Delta cbr_t = C_0 - \lambda ECT_{t-j} + \sum_{j=1}^{p-1} \theta_{1j} \Delta\, cbr_{t-j} + \sum_{j=0}^{q-1} \theta_{2j} \Delta\, ibr_{t-j} + \sum_{j=0}^{q-1} \theta_{3j} \Delta X_{t-j} + \theta_4 Di_{brt} + \varepsilon_t \qquad 5.11$$

Where $ECT_{i,t-1}$ represent deviations from long-run equilibrium at time $t-1$; λ is the speed of adjustment coefficient, reflecting the speed at which at which deviations from the long-run equilibrium are corrected to restore equilibrium after a shock ; $Dibr$ is a dummy equal to 1 for the months when the interbank rate diverged from the interbank corridor, more pronounced during the 2015/2016 economic shock (see chapter 2) ; θ_{1j}, θ_{2j}, and θ_{3j} are short-run dynamic coefficients while θ_4 is the dummy coefficient. Additional binary dummies are included in the model for individual banks for months in which they had unusually large

and sustained deviations from their historical lending rate trends. These months were identified by examining relative changes in lending rates, specifically focusing on episodes of extreme values where the month-on-month relative change exceeded 50% or fell below 50%. This was confirmed by visual inspection of each individual bank's time series data.

The coefficients in (5.11) can be mapped in a straightforward algebraic way to the coefficients in (5.10) to obtain:

$$\lambda = 1 - \sum_{j=1}^{p} \beta_{0j} \; ; \; \phi_1 = \frac{\sum_{j=0}^{q} \beta_{1j}}{\lambda} \quad \text{and} \quad \phi_2 = \frac{\sum_{j=0}^{q} \beta_{2j}}{\lambda} \qquad 4.12$$

The error correction term is now defined as $ECT_{i,t-1} = (cbr_{t-1} - \phi_1 ibr_{t-1} - \phi_2 X_{t-1})$.

It is more computationally convenient to fit the following ARDL model in stata:

$$\Delta cbr_t = C_0 + \pi_0 cbr_{t-1} + \pi_1 ibr_{t-1} + \pi_2 X_{t-1} + \sum_{j=1}^{p-1} \theta_{1j} \Delta cbr_{t-j} + \sum_{j=0}^{q-1} \theta_{2j} \Delta ibr_{t-j} + \sum_{j=0}^{q-1} \theta_{3j} \Delta X_{t-j} + \theta_4 Di_{brt} \qquad 5.13$$

From the above model, it is easy to recover the speed-of-adjustment coefficient:
$\lambda = -\pi_0$ and the long-run coefficients $\phi_1 = \frac{\pi_1}{\lambda}$ and $\phi_2 = \frac{\pi_2}{\lambda}$

The empirical implementation of the ARDL requires that the bounds cointegration test is undertaken to establish the long-run relationship[12]. In addition, Following Cetorelli & Goldberg (2012), Kashyap & Stein (2000) and Campello (2002), individual banks results are split into domestic and foreign sub-samples. For each sub-sample, group means (averages) for significant coefficients are calculated to assess heterogeneity and extent of the passthrough, using confidence intervals to interpret the results. To test for differences in coefficients of the averages for sub-samples (domestic and foreign), t-tests are applied. In addition, serial correlation, stability and heteroskedasticity tests are undertaken each bank separately to assess the adequacy of the estimates.

[12] Under the ARDL bounds approach, the null hypothesis is that there is no cointegration or no long-run relationship. The decision criterion is that if the F-statistics and t-statistics in absolute terms exceed the I(1) critical value, reject the null hypotheses and infer that there is a long-run association between variables, and vice versa.

5.3.4 Data and Sources

The study employs a novel monthly granular dataset collected by the author (detailed in Chapter 2). Since the Bank of Zambia only compiles aggregate retail interest rates, disaggregated SME, corporate and mortgage retail rates data were collected from 16 commercial banks. In addition, given that Zambia does not compile monthly GDP, a Monthly Index of Economic Growth (MIEG), a proxy of monthly GDP is constructed using the real sector data collected by the BoZ and Zambia Statistical Agency (details in Chapter 3). The interbank rate is used to proxy monetary policy in line with empirical best practice as it is directly affected by policy rate changes and is responsive to other monetary policy factors (and there is monthly variation). The10-Year U.S Treasury rate, VIX and foreign interbank rate were included to assess the impact of external shocks on domestic monetary policy passthrough. CPI, GDP (MCIEA) and liquidity ratio are included as controls to account for other factors that could impact retail interest rates besides monetary policy. The sample period for the study is April 2012 to July 2022 covering the period of the new monetary policy regime. Table 5.2 defines the variables used in regression and their sources and Figure 5.1 plots key variables.

Table 5.2: Variable Definitions and Sources

Variable	Definition	Source
Interbank Rate	Interest rate that banks lend each other on the interbank market with 5 days maturity	Bank of Zambia
Corporate retail rate	Interest rates that commercial banks or other financial institutions charge to corporate clients	Commercial banks survey
SME corporate retail rate	Interest rates that commercial banks charge to SMEs	Commercial banks survey
VIX	It is the Chicago Board Options Exchange Volatility index that measures the volatility that investors anticipate in the US stock market and acts as a global risk indicator	FRED DATA
10-Year U.S Treasury Rate	The interest rate on U.S. government bonds with a 10-year maturity, serving as a key benchmark for long-term risk-free interest rates	FRED DATA
Expected exchange rate depreciation	Ratio of the Non-Deliverable Forward (NDF) rate to the prevailing spot rate. This approach provides a forward-looking measure of depreciation expectations[13]	Bloomberg and BoZ
Foreign Interbank Rate	Interbank rate (monetary policy reference rate) in countries of origin for foreign banks and Fed rate for global banks	FRED DATA, home country central banks of foreign banks
Liquidity ratio	Ratio of bank liquidity assets to total bank assets	Commercial banks survey

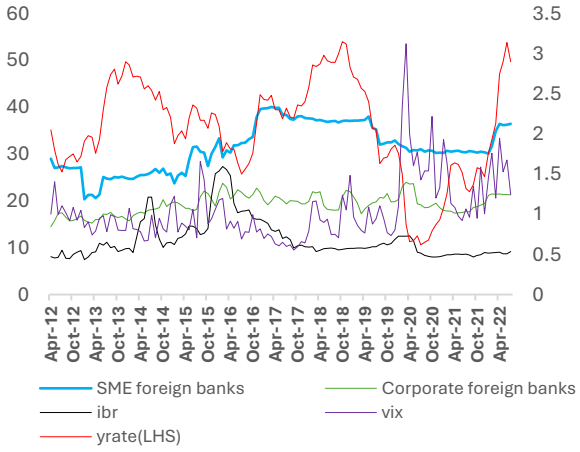
[13] This measure directly reflects market-based expectations and, therefore, did not require instrumentation.

GDP	Monthly composite index of economic activity calculated using real sector data from BoZ and Zamstats. 2012 is used as a base year	Compiled by author
CPI	Consumer price index measures the average change in prices over time and reflects inflation	Zamstats
Manufacturing Share	Ratio of credit to manufacturing sector to total banking sector credit	Commercial banks survey
Capital	Log of total bank regulatory capital	Commercial banks survey
Size	Log of total bank assets	Commercial banks survey

Note: NDFs are useful as a proxy for exchange rate depreciation as they are a contractual agreement between two parties to exchange cash at a predetermined rate on a future date. The calculated interbank rate is uniform across all banks in the panel and reflects a policy-driven benchmark that equally applies to all banks. This rate is treated as pre-determined within each month and exogenous to individual banks' idiosyncratic behaviours in the empirical analysis and this mitigates concerns about bank-level endogeneity.

Figure 5.1: SME, Corporate, Interbank Rate, VIX & 10-Year-US-Treasury Rate

Foreign Banks



Domestic Banks

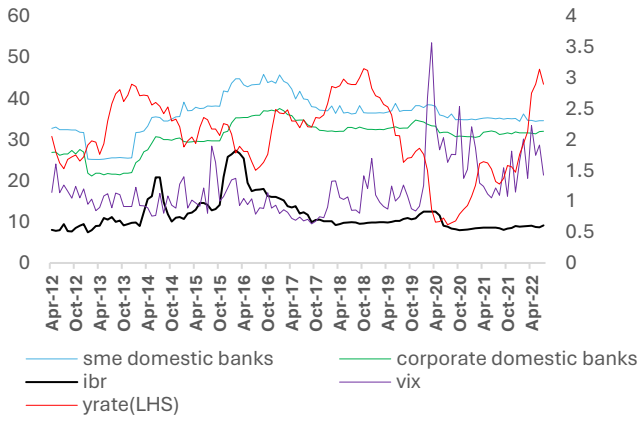


Figure 5.1 shows how the SME and corporate rates by foreign and domestic banks trend in reference to movements in interbank rate (*ibr*), VIX and US-10-year-treasury rate over the sample period. Both the corporate rate and SME rates by foreign and domestic banks seem to follow movements in the interbank rate. It is noted that foreign and domestic SME seem to react differently to movements in the 10-year-US treasury rates and the VIX. The foreign SME rate does not follow VIX closely but moves in line with the US-10-year treasury rate for most of the time (May 2013 to August 2015 and September 2016 to December 2019). In contrast, the foreign corporate rate does not follow the US-10-year treasury rate but follows VIX for most of the period leading up to December 2019, before a huge spike in global uncertainty. For domestic banks, neither the SME nor corporate rate follow the VIX and the US-10-year treasury rate save for the period before 2015 and between December 2019 and

June 2020. The period 2015 to 2016, is marked with significant domestic economic shocks to the Zambian economy, mainly due to El Nino- induced droughts. This resulted in hydroelectricity rationing, reduced economic activity, particularly the mining sector, subsequent reduced forex earnings and high inflation. These observations are empirically tested using appropriate methodologies and econometrics techniques discussed in the preceding sections.

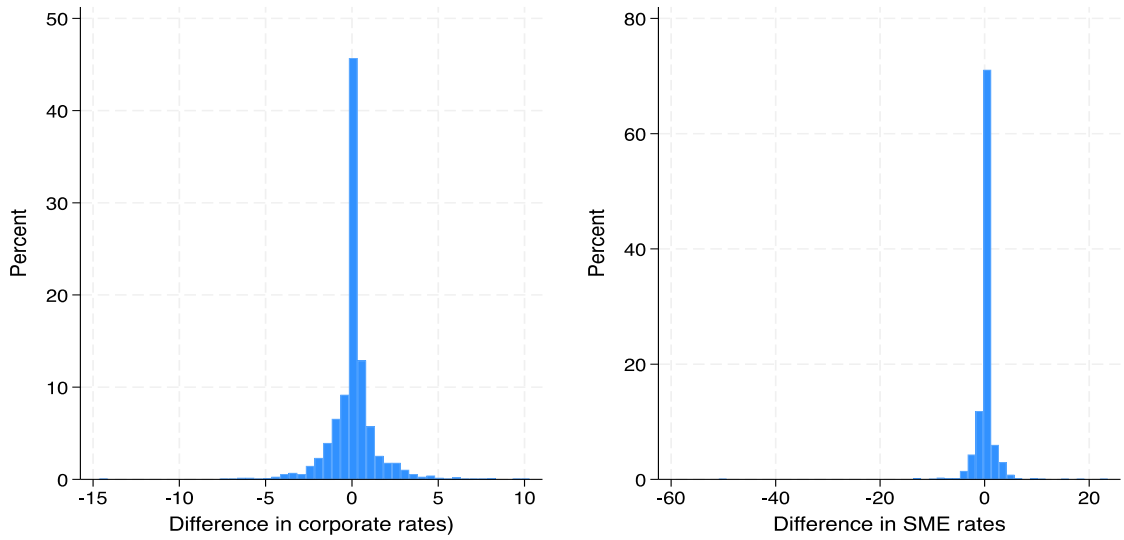
5.3.4.1 Presence of Outliers in Data

Sudden jumps and sustained increase in lending rates are observed in some banks even in periods when most of the banks seem to align their rates with credit markets fundamentals. Table 5.3 provides summary statistics of absolute changes in percentage points for SME and corporate rates while Figure 5.2 visually represents these changes.

Table 5.3: Interest Rate Changes: Summary Statistics (Percentage Points)

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	Max
Absolute change in corporate rates	1,722	0.050	1.429	-14.640	10.302
Absolute change in SME rates	1,722	0.044	2.108	-50.852	23.553

Figure 5.2 Detecting Unusual Absolute Changes in Lending Rates (Percentage Points)



Changes in absolute values of corporate and SME rates are month-to-month changes in the lending rates charged by bank *j* in month *t* minus lending rates charged in the previous month. The absolute change in the mean of both SME and corporate rate is close to zero, and this is

expected due to an offsetting effect of the increases and declines in lending rates. However, the standard deviation, minimum and maximum changes are non-trivial, particularly driven by some extreme changes especially in the SME rate. This is largely driven by two outlier banks which are relatively new in the sample and exhibited large drops and increases during their initial years of operation.

To try and account for the impact of these outliers, robustness checks are conducted by an ARDL analysis includes bank-specific dummy variables for selected banks to explicitly control for episodes of unusually large and sudden changes in lending rates.

5.4 Presentation and Discussion of the Results

5.4.1 Baseline Model Chow Test Results

The baseline model Chow test diagnostics confirm the existence of significant differences in the coefficients of foreign and domestic banks as shown in Table 5.4. This justifies the use of split regressions for each bank category to allow for heterogenous analysis, the core of the study.

Table 5.4: Chow Test Results for Selected Key Variables

	SME F-statistic	Corporate F-statistic
Interbank Rate	56.490 (0.000)	18.890 (0.000)
VIX	0.030 (0.870)	26.480 (0.000)
10-year US Treasury Rate	8.080 (0.012)	8.110 (0.012)
Joint	35.810 (0.000)	18.890 (0.000)
Observations	1,722	1,722

The Chow test null hypothesis of no statistically significant differences is rejected, and coefficients are different between foreign and domestic banks.

5.4.2 Testing for Cross Section Dependency

The results in Table 5.5 show the presence of cross-section dependence; the residuals are cross-sectionally correlated among banks supporting the application of fixed effects regression with DK standard errors.

Table 5.5: Pesaran's Cross-Sectional Dependency Test

	SME Rate F-statistic	Corporate Rate F-statistic
Pesaran's CD Test	35.620 (0.000)	25.329 (0.000)
Average absolute correlation value	0.381	0.299
Observations	1,722	1,722

Note: p-value for significance in parentheses.

5.4.3 Estimation Results

The empirical strategy proceeds in five stages. First, a full-sample unconditional dynamic fixed effects (FE) panel model that distinguishes between SME and corporate lending rates is estimated. Second, the dynamic FE model is extended conditional on bank-specific characteristics, namely ownership, liquidity, size, and capital. Third, a full-sample dynamic panel model that separates foreign and domestic banks is estimated to establish domestic vs foreign benchmark passthrough estimates for both SME and corporate lending rates. Fourth, the analysis refines the dynamic FE model by splitting foreign banks into Pan-African and global banks, allowing for ownership-based heterogeneity within foreign banks. Finally, an assessment of parent-country monetary policy spillover effects evaluates how foreign banks in Zambia respond to home-country monetary policy shocks. The full baseline model is estimated by sequentially incorporating domestic macroeconomic factors, followed by external global factors and finally bank-specific characteristics. Table 5.6 presents the full sample baseline dynamic panel regression results for the full sample, examining the unconditional effects of the interbank rate on SME and corporate lending rates before accounting for interactions with bank-specific factors.

Table 5.6: Full Sample Baseline Dynamic Panel Results

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**SME RATE**			**CORPORATE RATE**		
Lagged Dep. Variable	0.845***	0.842***	0.829***	0.678***	0.683***	0.678***
	(0.040)	(0.041)	(0.047)	(0.044)	(0.043)	(0.041)
Interbank Rate	0.218***	0.225***	0.216***	0.180***	0.184***	0.280***
	(0.068)	(0.064)	(0.061)	(0.032)	(0.034)	(0.042)
CPI	0.008***	0.010***	0.005	0.005**	0.004*	0.002
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
GDP	0.012	0.006	-0.005	0.025*	0.025*	0.023*
	(0.027)	(0.025)	(0.020)	(0.015)	(0.014)	(0.013)
VIX		0.007	0.003		0.050**	0.049**
		(0.015)	(0.015)		(0.019)	(0.019)
10-Year-US-Treasury.rate		0.963***	1.088***		0.343	0.362
		(0.208)	(0.243)		(0.259)	(0.257)
Expected Exchange Rate		0.040	0.041		0.039	0.039
		(0.027)	(0.029)		(0.027)	(0.026)
Manufacturing Share			0.011			0.001
			(0.011)			(0.003)
Liquidity			-0.004			0.004
			(0.006)			(0.005)
Capital			-0.001			0.001
			(0.000)			(0.000)
Size			1.030			0.147
			(0.646)			(0.199)
Long-run Passthrough	**1.41**	**1.42**	**1.26**	**0.56**	**0.58**	**0.87**
Constant	-0.390	-6.249	-18.443	1.623	-3.948	-0.152***
	(2.895)	(4.814)	(11.242)	(1.747)	(3.403)	(0.045)
Observations	1,694	1,694	1,694	1,694	1,694	1,694
No.of Banks	14	14	14	14	14	14

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Columns (1)/(4) only consider the interbank rate and domestic macro factors, columns (2)/(5) add external factors and columns (3)/(6) add bank-specific factors. Columns (1) to (3) are for the SME rate while columns (4) to (6) are for the corporate rate. Column (7) shows the Chow test result for full model results in columns (3) and (6). CPI, Liquidity and manufacturing share are lagged as an attempt to mitigate the endogeneity issue. The lagged dependent variables of SME and Corporate lending rate are strongly significant across all models, reflecting persistent lending rate behavior over time. The interbank rate coefficients are consistently positive and statistically significant, with slightly larger effects observed for SMEs. Inflation is positively significant in both the SME and corporate rate. GDP appears more relevant to corporate lending, while VIX is significant only in corporate rate models, suggesting that global risk sentiments have a greater influence in corporate loan pricing. The

U.S. 10-year yield significantly affects SME lending but not corporate rates. Expected exchange rate movements and bank-specific controls such as liquidity, capital, size, and manufacturing share are not statistically significant in either set of models.

Table 5.7: Baseline Model: Dynamic Panel Estimates with Interaction Terms

	(1)	(2)	(3)	(4)
VARIABLES	**SME RATE**		**CORPORATE RATE**	
	Foreign Dummy Interaction	**All Bank-Specific Interactions**	**Foreign Dummy Interaction**	**All Bank-Specific Interactions**
Lagged Dep. Variable	0.821***	0.825***	0.678***	0.677***
	(0.049)	(0.045)	(0.041)	(0.041)
Interbank Rate	0.330***	1.727**	0.281***	0.366*
	(0.064)	(0.741)	(0.042)	(0.186)
IBR*foreign dummy	-0.172**	-0.157**	-0.152***	-0.162***
	(0.069)	(0.071)	(0.045)	(0.045)
IBR*SIZE		-0.127**		-0.014
		(0.054)		(0.018)
IBR*CAPITAL		0.046**		0.008
		(0.023)		(0.014)
IBR*LIQUIDITY		-0.002*		0.000
		(0.001)		(0.000)
Liquidity	-0.015	0.013	0.002	-0.001
	(0.012)	(0.012)	(0.004)	(0.007)
Capital	-0.000	-0.000*	0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Size	1.031	2.134**	0.154	0.303
	(0.650)	(1.038)	(0.200)	(0.279)
VIX	0.003	0.008	0.049**	0.049**
	(0.015)	(0.014)	(0.019)	(0.020)
10-Year-US-Treasury.rate	1.079***	1.078***	0.364	0.365
	(0.243)	(0.234)	(0.256)	(0.257)
Long-run Passthrough	**1.84**	**9.87**	**0.87**	**1.13**
Constant	-17.817	-35.447**	-5.942	-7.753
	(11.380)	(17.561)	(4.227)	(5.434)
Observations	1,694	1,694	1,694	1,694
Number of groups	14	14	14	14

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; GDP, CPI, manufacturing share and expected exchange rate are all controlled for.

Table 5.7 extends the baseline model by estimating the conditional effects of the interbank rate on lending rates, allowing its impact to vary according to specific bank characteristics such as ownership (foreign vs domestic), size, and capital. This allows the model to capture potential heterogeneity in monetary policy pass-through, in line with the study's theoretical conjecture that foreign and domestic banks may not respond uniformly to changes in monetary policy.

Columns (1)/(3) focus on the inclusion of bank ownership interactions only, interacting the interbank rate with a foreign bank dummy for the SME and corporate rate, respectively. This captures whether the monetary policy pass-through differs between foreign and domestic banks in the SME segment, without controlling for other bank characteristics. Columns (2)/(4) include a full set of interactions between interbank rate and additional bank-specific factors (capital, size, liquidity) controlling for heterogeneous effects of bank-specific characteristics.

Across all specifications, coefficients of lagged dependent variables on SME and corporate rate are highly significant and positive, confirming strong persistence in lending rates over time. This indicates that current lending rates are strongly influenced by their past values. In addition, the coefficient on the interbank rate is positive and statistically significant for both SME and corporate rates across all models, confirming the presence of monetary policy pass-through.

The interaction terms in columns 2 and 4 further highlight heterogeneity in monetary policy transmission. For SMEs, the interbank rate and size interaction is negative and significant, indicating that larger banks adjust SME lending rates less in response to interbank rate changes. In addition, the interbank and liquidity interaction is also negative and significant, suggesting that banks with higher liquidity reduce pass-through to SME rates. The interbank rate and capital interaction is positive and but is weakly significant. However, these interaction effects are not significant in the corporate rate models.

Considering global controls, the VIX is significant only in corporate models, suggesting that global risk sentiment influences corporate loan pricing more than SME loans. In contrast, the US 10-year treasury rate is strongly significant in SME models but not in corporate models, implying that SME lending rates are more sensitive to external interest rate movements. As shown below, these results are driven by foreign banks.

The foreign bank dummy interaction is consistently negative and statistically significant in all models, suggesting that foreign banks exhibit a weaker response to monetary policy changes compared to domestic banks, for both SME and corporate lending. This finding suggests segmentation in the transmission mechanism based on ownership structure and this lends supports to the bank ownership sub-sample analysis that is employed in this study.

Table 5.8 presents a sub-sample analysis comparing the passthrough between foreign and domestic banks.

Table 5.8. Sub-Sample Analysis: Dynamic Panel Estimates for Foreign vs Domestic Banks

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**SME RATE**			**CORPORATE RATE**		
	Domestic Banks	**Foreign Banks**	**Chow Test**	**Domestic Banks**	**Foreign Banks**	**Chow Test**
Lagged Dep. Variable	0.744***	0.824***	1.08	0.516***	0.517***	8.48
	(0.054)	(0.060)	(0.300)	(0.071)	(0.071)	(0.400)
Interbank Rate	0.354***	0.170**	6.40**	0.278***	0.153***	4.80**
	(0.064)	(0.074)	(0.013)	(0.047)	(0.042)	(0.030)
CPI	0.000	0.010	1.11	0.006**	-0.005	4.92
	(0.004)	(0.007)	(0.294)	(0.002)	(0.004)	(0.028)
GDP	0.026	-0.011	2.37	0.028*	0.018	0.25
	(0.021)	(0.024)	(0.126)	(0.017)	(0.015)	(0.615)
VIX	0.018	-0.010	0.99	-0.031**	0.097***	15.53***
	(0.016)	(0.024)	(0.321)	(0.014)	(0.026)	(0.000)
10-Year-US-Treasury.rate	0.333	1.373***	5.15***	0.149	0.551*	1.37
	(0.232)	(0.394)	(0.003)	(0.171)	(0.329)	(0.244)
Liquidity	0.020	-0.022	4.57	0.009	-0.001	1.05
	(0.014)	(0.013)	(0.035)	(0.010)	(0.005)	(0.308)
Capital	0.000	-0.000	2.25	0.000	0.000***	0.01
	(0.000)	(0.000)	(0.136)	(0.000)	(0.000)	(0.910)
Size	0.299	1.272	0.78	-0.041	0.674**	3.42
	(0.191)	(1.098)	(0.378)	(0.273)	(0.280)	(0.06)
Long-run Passthrough	**1.38**	**0.97**		**0.57**	**0.32**	
Constant	-8.044	-21.519		-5.524	-9.271*	
	(6.306)	(16.373)		(6.483)	(5.121)	
Observations	605	1,089		605	1,089	
No.of Banks	5	9		5	9	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

A consistent result is the statistically significant and positive relationship between lending rates to firms (SMEs and corporates) and the interbank rate (proxy for monetary policy). This confirms the presence of the interest rates channel of monetary policy transmission in Zambia consistent with Ngoma & Chanda (2022) using aggregate data (and Chapter 4) and in line with Bernanke & Blinder (1992). The results highlight bank ownership heterogeneity with the short-run and long-run pass-through coefficients higher for domestic banks compared to foreign banks. For domestic banks, a 1 percentage point increase in the interbank rate results in a rise of about 0.354 (0.278) percentage points in the SME (corporate) rates in columns (1) and (4). In contrast, for foreign banks, the corresponding passthrough of the interbank rate is 0.170 percentage points for SME and 0.153 for the corporate rate in columns (2) and (5). This is associated with a long-run passthrough of about 1.38 (0.57) for domestic SME (corporate) rates and 0.97 (0.32) for foreign SME (corporate) rates.

The observed differences in the coefficients of lending rates charged by foreign and domestic banks are confirmed by the Chow test. This underlines the stronger response of domestic banks in response to monetary policy changes and their relevance in supporting effective monetary policy transmission.

Regarding global factors, results show the higher responsiveness of foreign banks to global financial conditions. The 10-year US Treasury rate and VIX, have a greater impact on foreign banks. The greater sensitivity of foreign banks to global shocks could be attributed to connections to international financial markets and global capital markets and this has a greater effect on their lending rates in Zambia (Wu, et al., 2011; Ananchotikul & Seneviratne, 2015; Cetorelli & Goldberg, 2012). The 10-year-US Treasury rate has a positive, statistically significant effect on both SME and corporate rates for foreign banks while it remains insignificant for domestic banks. When the 10-year US treasury yield rises, the cost of funds also rises in international financial markets. The VIX has a positive and significant effect on foreign banks' corporate lending rates, while it has a negative and significant effect on domestic banks. The negative effect observed among domestic banks may reflect a competitive response, possibly driven by an awareness that foreign banks tend to raise lending rates during periods of heightened global risk, prompting domestic banks to lower or hold rates to retain market share. The Chow test confirms the differences between foreign and domestic banks' response to global shocks.

This aligns with the evidence in literature that shows that banking capital flows are impacted by global risk aversion, and this could negatively impact monetary policy transmission in host countries (Milesi-Ferretti & Tille, 2011; Fratzscher,2012; Broner et al., 2013; Rey, 2013; Ananchotikul and Zhang, 2014; Koepke, 2014; Bruno & Shin, 2015; Koepke, 2018; Agrippino & Rey 2020, Cetorelli & Goldberg, 2012; Jeon & Ji,2014). The tendency of investors to seek safe haven assets during times of high-risk aversion, causing capital outflows from risky developing economies to stable markets could explain this. Capital flight to safe havens diminishes liquidity in host nations' financial markets and tightens lending conditions, limiting the efficacy of monetary policy transmission via the credit market. From a policy perspective, these results underscore the significant role that domestic banks play in the effectiveness of domestic monetary policy transmission via the interest rates channel, especially in countries with less developed financial markets like Zambia. This can be attributed to domestic banks' deeper knowledge, connection and dependence on local conditions compared to their foreign counterparts who maintain strong ties with their parent

banks. This is in line with the findings of Cetorelli & Goldberg (2012) on US banks, Jeon (2014) on Asian banks and Arena et. al (2006) for Latin American and Asian banks.

Movements in expected exchange rate seem not to be important for foreign banks but significant for domestic banks' corporate rate. The absence of an effect on interest rates for foreign banks may be because they have exchange rate risk mitigation strategies. Corporate rates of domestic banks may have a response because the banks have less ability to manage exchange rate volatility than the foreign banks. The significance of GDP and CPI on domestic corporate rates is consistent with the importance of macroeconomic stability in credit markets (Bank of England, 1999; Bank of Zambia, 2024).

Concerning bank specific characteristics, they are all broadly insignificant except for bank size which has a positive effect on domestic corporate lending rate. This might be explained by higher risk premiums associated with the types of corporate borrowers these domestic banks serve, or differences in loan contract structures tied to these borrowers.

Comparing the magnitude of passthrough between SME and corporate rates, both the short-run and long-run passthrough seem higher in SME rate compared to the corporate rate and this validates the findings of the aggregate analysis.

Next the study shows if the passthrough is different among foreign banks, comparing between Pan-African banks and other foreign banks (mostly global).

Table 5.9: Sub-Sample Analysis: Dynamic Panel Estimates for Global vs Pan-African Banks

	(1)	(2)		(3)	(4)	
VARIABLES	**SME RATE**			**CORPORATE RATE**		
	Global	**Pan-African**	**Chow Test**	**Global**	**Pan-African**	**Chow Test**
Lagged Dep. Variable	0.656***	0.811***	1.16	0.477***	0.395***	7.89**
	(0.054)	(0.070)	(0.282)	(0.065)	(0.089)	(0.006)
Interbank Rate	0.104	0.116*	6.83*	0.217***	0.091*	5.39**
	(0.090)	(0.065)	(0.010)	(0.045)	(0.049)	(0.022)
CPI	-0.002	0.002	1.06	-0.006*	-0.001	3.07*
	(0.007)	(0.010)	(0.305)	(0.004)	(0.006)	(0.082)
GDP	-0.001	-0.008	1.99	0.023	0.016	0.36
	(0.024)	(0.026)	(0.161)	(0.017)	(0.016)	(0.549)
VIX	0.007	-0.007	0.71	0.089***	0.115***	16.23**
	(0.027)	(0.029)	(0.402)	(0.030)	(0.025)	(0.001)
10-Year-US-Treasury.rate	2.093***	1.453***	4.62**	0.539	0.613*	1.25
	(0.377)	(0.514)	(0.034)	(0.348)	(0.328)	(0.265)
Expected Exchange Rate	-0.011	0.089	0.16	0.026	0.028	0.08
	(0.026)	(0.054)	(0.692)	(0.031)	(0.045)	(0.772)
Manufacturing Share	-0.036	0.041	2.04	-0.002	0.012	5.67**
	(0.037)	(0.030)	(0.156)	(0.003)	(0.014)	(0.018)
Liquidity	0.003	-0.062*	2.15	-0.009	-0.010	5.75
	(0.010)	(0.031)	(0.145)	(0.007)	(0.012)	(0.100)
Capital	-0.001*	-0.001	2.78*	0.000	0.001*	0.020
	(0.000)	(0.000)	(0.092)	(0.000)	(0.000)	(0.897)
Size	1.239	3.141	0.82	0.615**	1.060	4.21**
	(0.753)	(2.063)	(0.367)	(0.258)	(0.721)	(0.042)
Long-run Passthrough	**N/A**	**0.61**		**0.41**	**0.15**	
Constant	-11.030	-48.168*		-7.717*	-12.631	
	(10.479)	(27.975)		(4.395)	(11.015)	
Observations	363	726		605	484	
No.of Banks	3	6		5	4	

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; N/A means long-run passthrough could not be calculated as it requires a significant short-run interbank rate coefficient.

Table 5.9 provides further evidence of heterogeneity in monetary policy pass-through among foreign banks, indicating that not all foreign banks respond the same to changes in monetary policy. This is particularly evident when comparing global versus Pan-African foreign banks. For SME lending, the coefficient on the interbank rate is insignificant for global banks (Column 1) but becomes positive and statistically significant for Pan-African banks (Column 2) in both the long-run and short run. This suggests that the earlier observed significant response of SME lending rates to monetary policy impulses among foreign banks is primarily driven by Pan-African banks. These banks may be more embedded in the Zambian economy and thus more responsive to domestic monetary policy signals than their globally oriented

counterparts, who may rely more on internal funding or operate under different strategic mandates. However, a different pattern is observed when looking at the reaction of the corporate rate where the magnitude of the interbank rate is stronger for global banks. This might be because most global banks seem to focus on corporate lending. The Chow test results confirm these differences.

Table 5.10: Foreign Interbank Spillovers

VARIABLES	(1) SME RATE	(2) CORPORATE RATE	(3) SME RATE	(4) SME RATE	(5) CORPORATE RATE	(6) CORPORATE RATE
	JOINT	JOINT	GLOBAL	PAN-AFRICAN	GLOBAL	PAN-AFRICAN
Lagged Dep. Variable	0.822***	0.548***	0.687***	0.805***	0.578***	0.430***
	(0.060)	(0.066)	(0.056)	(0.070)	(0.064)	(0.084)
Foreign Interbank Rate	0.039*	0.034**	0.017	0.049	0.031*	0.048***
	(0.022)	(0.013)	(0.019)	(0.035)	(0.016)	(0.015)
CPI	0.003	-0.009**	-0.004	-0.003	-0.011***	-0.006
	(0.007)	(0.004)	(0.006)	(0.009)	(0.004)	(0.006)
GDP	-0.009	0.018	-0.001	-0.009	0.025	0.015
	(0.024)	(0.015)	(0.024)	(0.026)	(0.017)	(0.016)
VIX	-0.008	0.099***	0.009	-0.003	0.091***	0.120***
	(0.026)	(0.028)	(0.029)	(0.029)	(0.034)	(0.024)
10-Year-US-Treasury.rate	1.367***	0.520	1.996***	1.463***	0.477	0.654*
	(0.415)	(0.368)	(0.380)	(0.502)	(0.407)	(0.342)
Expected Exchange Rate	0.036	0.018	-0.017	0.081	0.020	0.022
	(0.039)	(0.035)	(0.032)	(0.057)	(0.029)	(0.042)
Manufacturing Share	0.018	0.001	-0.032	0.049	-0.003	0.018
	(0.014)	(0.003)	(0.037)	(0.030)	(0.003)	(0.013)
Liquidity	-0.022*	0.001	0.010	-0.068**	0.003	-0.019
	(0.013)	(0.005)	(0.010)	(0.030)	(0.007)	(0.012)
Capital	-0.010*	0.001***	-0.001	-0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size	1.555	0.717**	1.159	3.587*	0.632**	1.566**
	(1.169)	(0.330)	(0.749)	(1.962)	(0.288)	(0.789)
Long-run Passthrough	**0.22**	**0.08**	**N/A**	**N/A**	**0.07**	**0.08**
Constant	-21.486	-7.819	-9.097	-51.300*	-7.021	-18.172
	(17.806)	(5.966)	(10.931)	(27.934)	(5.162)	(11.133)
Observations	1,089	1,089	363	726	605	484
No.of Banks	9	9	3	6	5	4

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; N/A means long-run passthrough could not be calculated as it requires a significant short-run interbank rate coefficient.

Table 5.10 shows that foreign banks respond positively to monetary policy shocks in their country of origin (or the US for global banks), although the foreign monetary policy spillover varies across SME and corporate borrowers. Jointly, in the short run, a 1 percentage point rise in the foreign monetary policy rate is associated with an increase of 0.039 percentage points in SME rates and 0.034 percentage points in corporate rates, with corresponding long-run pass-through estimates of 0.22 percentage points for SME rates and 0.08 percentage points for corporate rates. Corporate rates are slightly less responsive to home country monetary

policy shocks, perhaps because larger firms are less risky or have access to alternative sources of funding, which makes them less sensitive to shifts in funding costs originating in foreign banks' home countries. When accounting for heterogeneity among foreign banks, both Global and Pan-African banks pass on their home country monetary policy shocks to the corporate lending rate while the spillover effect is statistically insignificant for the SME lending rate. This suggests the importance of corporate lending to foreign banks' loan portfolios.

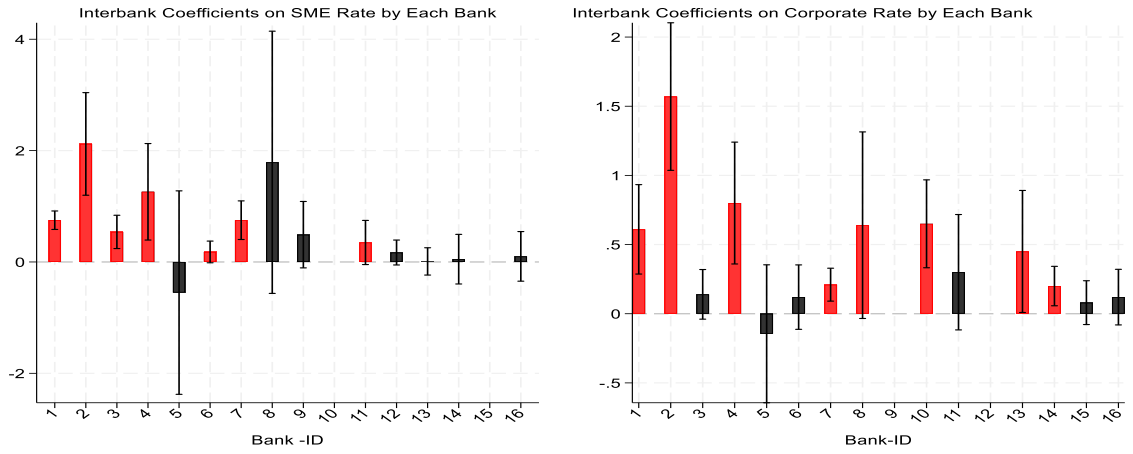
Foreign monetary policy spillover to domestic lending by foreign banks in Zambia reflects access to funds in internal group banking capital markets (Wu *et al*., 2011; De Haas & Van Lelyveld, 2014). Foreign banks are able to reallocate capital and liquidity between the parent and subsidiaries, contributing to international transmission of foreign monetary policy shocks and dampening the effect of domestic monetary policy (Cetorelli & Goldberg, 2012 for US banks and Peek & Rosengren, 1997 for Japanese banks operating in the US).

5.4.4 Robustness Checks: Bank-Level ARDL

5.4.4.1 Long-Run Analysis

Broadly, the ARDL bounds cointegration test result for most of the banks indicate the existence of long run relationships as the calculated F-statistics in absolute terms are larger than F-Bounds test critical values at I (1) in line with Pesaran et al. (2001) and Narayan (2005). The ARDL lag structure is based on AIC selected using Stata's automatic lag selection procedure. The bank-by-bank ARDL estimates reinforce the panel ARDL dynamic FE findings and reveal bank-specific differences. Figure 5.3 summarises the long-run coefficients, with the full set of results reported in Appendix 5.1.

Figure 5.3: Long-run ARDL Coefficients for Each Bank



***Notes*:** Red bars refer to significant coefficients at 10% level while black bars are insignificant. Bank Ids 1-5 are domestic banks and 6-16 are foreign banks

Consistent with the dynamic sub-sample panel regressions in Table 5.8, most domestic banks show a stronger and more significant pass-through of the interbank rate to lending rates than foreign banks. Bank by bank ARDL results show that within the domestic banks group, SME rates generally display higher responsiveness than corporate rates.

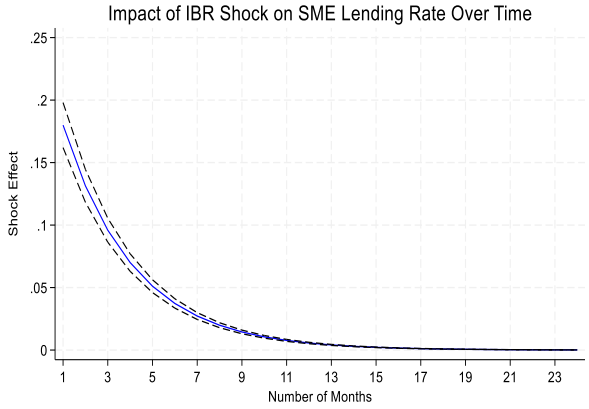
In addition, Figure 5.3 shows that banks are not homogeneous even within the same category (foreign or domestic). For instance, within domestic banks, some are more reactive to domestic monetary shocks while others are not even significant and the same is noted for foreign banks. On the other hand, most foreign banks adjust corporate rates more than SME rates, suggesting that corporate lending is their primary channel of monetary policy transmission. Comparing between Pan-African and global banks, it has been revealed that Pan-African banks exhibit significant reactions of SME rates to interbank changes while global banks do not and this is consistent with the sub-sample panel results in Table 5.9. This supports the earlier panel evidence that SME responsiveness among foreign banks is largely driven by Pan-African banks, whereas global banks maintain a stronger focus on corporate lending.

5.4.4.2 Short-Run Analysis

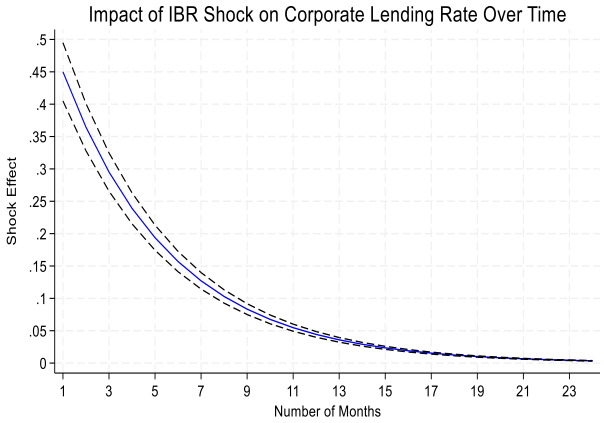
Given that the short-run time series ARDL specification captures potentially complex dynamic adjustments, we visualise the short-run responses of lending rates to interbank rate shocks for representative banks from each of the three groups (Global, Pan-African and Domestic). The rest of the impulse response plots are reported in appendix 5.2 (only banks with positive coefficients on both on both SME and corporate lending rates are considered). Visualising ARDL-based short-run dynamics is a common practice in applied macroeconomic analysis. For instance, Gemmell et al. (2011) provide a comparable illustration by examining how changes in fiscal variables affect real GDP per capita. We focus on the dynamics of the SME and corporate rates in response to the domestic interbank rate shocks. Figure 5.4 presents plots of the short-run dynamics of the SME and corporate rates in response to 1 percentage point increase in the interbank rate on domestic, global, Pan-African and other foreign banks. To try and match the Bank of Zambia's short- to medium-term horizon of 3 to 24 months, a 24-month horizon for the impulse response functions is adopted.

Figure 5.4: Cumulative Short-Run Dynamics of Interbank Shocks on SME and Corporate Rates by Bank Type

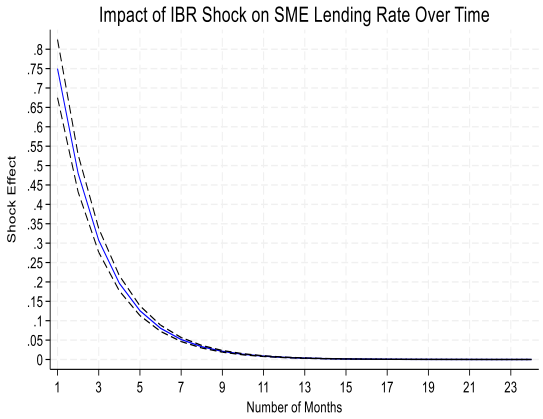
Global Bank SME



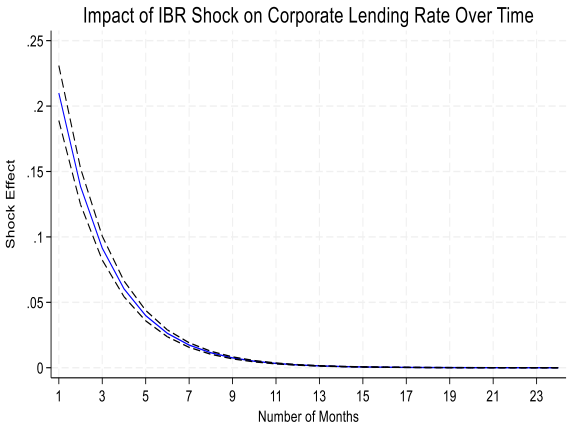
Global Bank Corporate



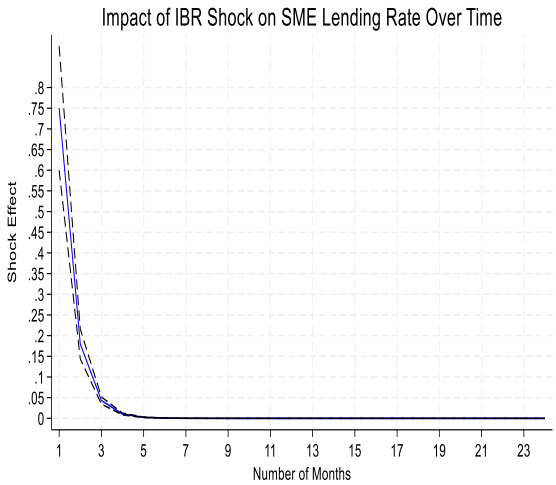
Pan-African Bank SME



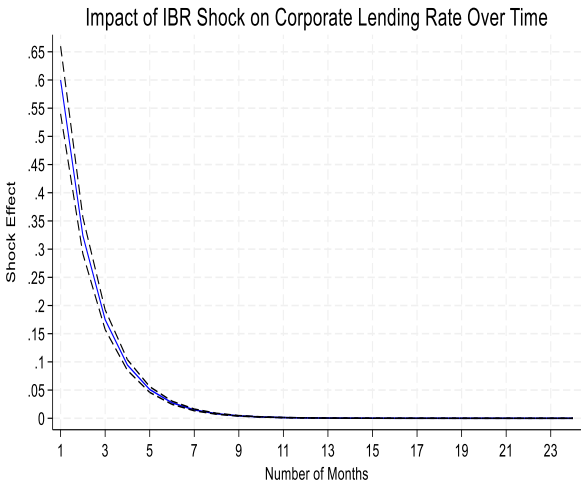
Pan-African Bank Corporate



Domestic Bank SME



Domestic Bank Corporate



The results highlight clear differences across bank types. For domestic banks, the adjustment is rapid: the SME rate converges fully within 4 months (half-life of about 2 months), while the corporate rate converges in 9 months (half-life of 4.5 months). This speed of adjustment is in line with the panel short-run coefficients, where the interbank rate effect is for domestic banks is 0.354 on the SME rate compared to 0.278 on the corporate rate. The larger short-run coefficients and faster half-lives together indicate that domestic banks quickly reflect monetary policy changes are quickly reflected in their bank lending rates and this strengthens the effectiveness of monetary policy in the short run.

On the other hand, foreign banks display slower and weaker adjustments. These slightly slower speeds of adjustment observed align with the smaller panel coefficients of 0.170 for SMEs and 0.153 for corporates for the foreign group overall. Importantly, the heterogeneity across foreign banks is evident: Among global banks, the cumulative effects on SME rate takes around 13 months (half-life of 6.5 months), while it is 20 months (half-life of 10 months) for the corporate rate. Pan-African banks however somewhat adjust faster, with the cumulative SME pass-through converging in 11 months (half-life of 5.5 months) and 12 months (half-life of 6 months) for corporate rates similar to the dynamic fixed effects model short-run coefficients.

Diagnostic tests confirm the adequacy of the estimated ARDL models (see Appendix 5.2 for full results). The Breusch-Godfrey LM test fails to reject the null hypothesis of no serial correlation in the residuals, while the Breusch-Pagan-Godfrey test indicates homoskedasticity, with p-values exceeding the conventional 5% significance level for both tests. In addition, the CUSUM test indicates coefficient stability over the sample period, as the cumulative sum of residuals remains within the 5% significance bounds.

5.6 Conclusions and Policy Recommendations

The study investigates the heterogeneous response of commercial bank SME and corporate lending rates to monetary policy changes incorporating the presence of foreign banks in Zambia. Specifically, it examines how these commercial bank interest rates react to changes in domestic monetary policy, global factors and foreign monetary policy spillovers. Using a novel bank level panel dataset with monthly data from 2012:04 to 2022:07, the study employs panel ARDL dynamic fixed effects model with Driscoll-Kraay (DK) standard errors and bank-by bank time series ARDL model.

The results shows that monetary policy passthrough to lending rates in Zambia is incomplete for both domestic and foreign banks and this limits the full efficacy of monetary transmission via the interest rates channel. In addition, the analysis reveals considerable heterogeneity, within and between domestic and foreign banks. The results show that domestic monetary policy passthrough is stronger in domestic banks compared to foreign banks, whereas foreign banks are more responsive to global shocks and also respond to their country-of-origin monetary policy impulses (parent country monetary policy spillovers). The high sensitivity of subsidiaries of foreign banks to global developments can be explained by their participation in parent-bank internal capital markets and their access to cross-border funding. The presence of foreign banks, which hold about 75% of total banking assets in Zambia and whose lending activities are more responsive to foreign and global factors, weakens the domestic transmission of Zambia's monetary policy. These foreign banks are key conduits through which external monetary policy shocks are transmitted to the domestic economy, constraining the host country's monetary policy activities in achieving price and financial system stability (Gelos & Sahay, 2023; Cesa-Bianchi et.al., 2021). The higher passthrough of domestic monetary policy in domestic banks underscores the relevance of domestic banks in effective monetary policy transmission.

These findings highlight the need for coordinated monetary policymaking and the use of a variety of strategies to mitigate the negative spillover effects of global shocks and enhance monetary policy efficacy in Zambia. Achieving this requires a comprehensive analysis of external monetary policies and macroeconomic developments at both the global level and regional level, including the specific conditions in each country of origin for the 11 foreign banks operating in Zambia. The results also advocate for policies aimed at fostering the development and growth of local banks to enhance their role in the process of monetary policy passthrough and macroeconomic stability.

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Chapter 5 Appendices

Appendix 5.1: ARDL Bank Level Long-run and Short-run Results

Table 5.11: ARDL Long-Run and Short-Run Results-SME Rate for Domestic Banks

Bank ID	(1)	(2)	(3)	(4)	(5)
LONG-RUN					
Interbank Rate	0.75***	2.12***	0.54***	1.26***	-0.55
	(8.87)	(4.51)	(3.54)	(2.85)	(-0.59)
CPI	0.01*	-0.02	-0.03**	-0.01	-0.17
	(1.74)	(-0.57)	(-2.37)	(-0.19)	(-1.54)
GDP	0.12**	0.03	0.02	-0.01	0.58
	(2.26)	(0.29)	(0.49)	(-0.09)	(1.33)
Expected Exchange Rate	-0.01	0.04	0.36*	-0.14	0.01
	(0.04)	(0.10)	(0.21)	(0.36)	(0.04)
10-year-US-Treasury Rate	-0.04	-0.25	0.02	0.24	0.32
	(-1.13)	(-1.51)	(0.27)	(1.12)	(0.96)
VIX	-0.51	-0.53	1.34**	2.15	7.33
	(-1.34)	(-0.39)	(2.41)	(0.86)	(1.13)
Manufacturing Share	-0.03	-0.002	0.01	-0.207	0.47*
	(-0.94)	(-0.02)	(0.07)	(-0.278)	(1.68)
Liquidity	0.18*	-0.43	0.36***	-0.510	-0.04
	(1.71)	(-1.53)	(2.69)	(-1.319)	(-0.13)
SHORT-RUN					
ECT	-0.76***	-0.15***	-0.21***	-0.134***	-0.06*
	(-14.10)	(-3.73)	(-5.47)	(-3.359)	(-1.71)
Dummy_ibr	-0.06	-0.22	-0.01	1.258***	0.74**
	(-0.12)	(-0.63)	(-0.04)	(2.852)	(2.02)
Dummy_binary	-12.48***				
	(-13.51)				
Constant	-12.48***	-17.59***	-4.01	-9.893	-13.836*
	(-13.51)	(-2.82)	(-0.94)	(-1.275)	(-1.935)
Bounds Test	23.99	5.79	4.33	1.81	4.675
	[3.31]	[3.30]	[3.31]	[3.29]	[3.30]
LM Test	39.65	0.707	0.52	0.35	1.29
	[0.10]	[0.50]	[0.47]	[0.70]	[0.28]
Het	50.64	72.48	1.98	189.31	31.92
	[0.00]	[0.00]	[0.16]	[0.00]	[0.00]
Cusum	0.96	0.34	0.51	0.58	0.45
	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}
Observations	119	119	119	119	119

Cusum critical values in {}; Dummy_ibr is the dummy variables accounting for the period when the interbank rate deviated from its corridor mainly in 2015/2016 while Dummy_binary is a bank-specific binary dummy variable accounting for periods when a particular bank's lending rate movements diverged significantly from its historical pattern.

Table 5.12: ARDL Long-Run and Short-Run Results --SME Rate for Foreign Banks

	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)	(16)
LONG-RUN									
Interbank Rate	0.18*	0.75***	1.79	0.49	0.35*	0.17	0.01	0.05	0.10
	(1.81)	(4.24)	(1.49)	(1.61)	(1.73)	(1.49)	(0.08)	(0.22)	(0.44)
CPI	-0.02	-0.05**	-0.011	-0.05*	-0.03	-0.02	-0.04	-0.05	-0.09**
	(-1.56)	(-2.31)	(-0.11)	(-1.98)	(-1.56)	(-1.36)	(-1.24)	(-1.09)	(-2.14)
GDP	0.04	0.04	-1.29	0.71***	-0.10	-0.12*	-0.15	-0.54*	0.14
	(0.86)	(0.62)	(-1.06)	(3.29)	(-1.01)	(-1.76)	(-1.10)	(-1.93)	(1.26)
Expected Exchange Rate	-0.00	0.00	1.61**	0.05***	-0.15	-0.02	-0.06	0.72	0.04
	(0.06)	(0.15)	(0.46)	(0.27)	(0.12)	(0.03)	(0.06)	(0.58)	(0.05)
10-year-US-Treasury Rate	0.13*	0.13	-1.09	0.63***	0.05	-0.05	-0.01	-0.18	0.11
	(1.83)	(1.08)	(-1.10)	(3.32)	(0.48)	(-0.92)	(-0.05)	(-1.56)	(0.79)
VIX	3.69***	4.21***	19.38	4.52***	3.50***	2.31***	4.72***	1.40	2.54
	(5.71)	(3.75)	(1.54)	(3.21)	(3.58)	(3.83)	(3.81)	(0.85)	(1.49)
Manufacturing Share	-0.04	0.02	0.23	0.05	-0.03	0.11**	0.04	-0.26**	0.08*
	(-0.79)	(0.37)	(1.15)	(0.63)	(-0.92)	(2.06)	(0.60)	(-2.57)	(1.83)
Liquidity	0.02	0.17**	5.30	5.79**	-0.02	0.002	-0.15	-0.15	-0.16
	(0.78)	(2.01)	(1.12)	(2.23)	(-0.15)	(0.001)	(-1.07)	(-0.94)	(-1.02)
SHORT-RUN									
ECT	-0.27***	-0.36***	-0.05	-0.63***	-0.28**	-0.25***	-0.17**	-0.29**	-0.21***
	(-4.32)	(-5.26)	(-1.44)	(-10.39)	(-4.16)	(-4.05)	(-2.73)	(-5.69)	(-3.25)
Dummy_ibr	-0.35	-1.80***	-0.57	-3.16**	-0.88*	0.38	0.31	0.35	0.02
	(-1.19)	(-2.83)	(-1.27)	(-2.08)	(-1.93)	(1.23)	(0.84)	(0.55)	(0.04)
Dummy_binary				-29.25**				5.47***	
				(-9.13)				(5.87)	
Constant	-11.13**	-37.15**	-12.75	12.54	-15.78	-9.15	0.22	-55.14*	-18.66
	(-2.41)	(-2.56)	(-1.64)	(0.39)	(-1.51)	(-0.70)	(0.02)	(-3.31)	(-1.45)
Bounds Test	2.77	4.26	2.77	14.78	2.99	3.00	1.14	5.51	1.96
	[3.29]	[3.30]	[3.31]	[3.33]	[3.30]	[3.31]	[2.30]	[3.31]	[3.31]
LM Test	0.14	0.96	0.38	1.58	2.41	1.21	0.35	2.61	1.87
	[0.71]	[0.38]	[0.68]	[0.21]	[0.12]	[0.27]	[0.55]	[0.11]	[0.16]
Het	4.81	0.40	2.33	53.55	0.21	3.98	0.24	2.76	0.53
	[0.03]	[0.53]	[0.13]	[0.00]	[0.65]	[0.05]	[0.63]	[0.10]	[0.46]
Cusum	0.49	0.53	0.52	0.42	0.48	0.40	0.52	0.38	0.55
	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}
Observations	119	119	119	119	119	119	119	119	119

Cusum critival values in {}; Dummy_ibr is the dummy variables accounting for the period when the interbank rate deviated from its corridor mainly in 2015/2016 while Dummy_binary is a bank-specific binary dummy variable accounting for periods when a particular bank's lending rate movements diverged significantly from its historical pattern.

TABLE 5.13: ARDL Long-Run and Short-Run Results -Corporate Rate for Domestic Banks

	(1)	(2)	(3)	(4)	(5)
LONG-RUN					
Interbank Rate	0.61***	1.57***	0.14	0.80***	-0.148
	(3.70)	(5.77)	(1.53)	(3.56)	(-0.574)
CPI	0.04***	-0.07***	-0.01	0.00	-0.120***
	(2.80)	(-3.13)	(-0.92)	(0.04)	(-3.560)
GDP	0.07*	0.09	0.01	0.02	-0.039
	(1.66)	(1.39)	(0.54)	(0.17)	(-0.418)
Expected Exchange Rate	0.00	-0.01	0.13**	0.03	0.12
	(0.06)	(0.05)	(0.05)	(0.03)	(0.25)
10-year-US-Treasury Rate	-0.02	-0.14	-0.06	0.16	-0.028
	(-0.34)	(-1.42)	(-1.46)	(0.93)	(-0.235)
VIX	1.59	0.71	0.70*	1.43	1.277
	(1.65)	(0.75)	(1.85)	(1.17)	(0.835)
Manufacturing Share	-0.30***	0.05	0.08	-0.08	0.220***
	(-4.27)	(0.73)	(1.62)	(-0.18)	(3.433)
Liquidity	-0.39**	-0.07	0.14*	-0.37**	-0.189
	(-1.99)	(-0.27)	(1.75)	(-2.04)	(-1.502)
SHORT-RUN					
ECT	-0.46***	-0.09***	-0.51***	-0.29***	-0.151***
	(-9.44)	(-5.29)	(-5.53)	(-2.77)	(-3.548)
Dummy_ibr					
	-0.16	-0.15	-0.47	0.62	0.722**
	(-0.32)	(-0.96)	(-1.32)	(1.46)	(2.227)
Dummy_binary	-7.19***				
	(-9.16)				
Constant	66.53	-16.73***	-13.09*	-20.51**	-21.22***
	14.63	(-5.13)	(-1.83)	(-2.53)	(-3.670)
Bounds Test	13.47	7.33	4.47	3.05	4.00
	[4.45]	[3.31]	[3.29]	[3.32]	[3.30]
LM Test	2.77	0.54	0.01	1.31	2.27
	[0.05]	[0.46]	[0.91]	[0.30]	[0.13]
Het	9.07	1.18	0.10	11.39	0.60
	[0.02]	[0.27]	[0.75]	[0.00]	[0.03]
Cusum	0.78	0.31	0.45	0.42	0.48
	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}
Observations	119	119	119	119	119

Cusum critival values in {}; Dummy_ibr is the dummy variables accounting for the period when the interbank rate deviated from its corridor mainly in 2015/2016 while Dummy_binary is a bank-specific binary dummy variable accounting for periods when a particular bank's lending rate movements diverged significantly from its historical pattern.

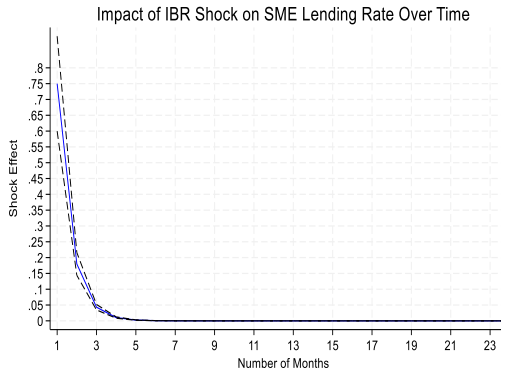
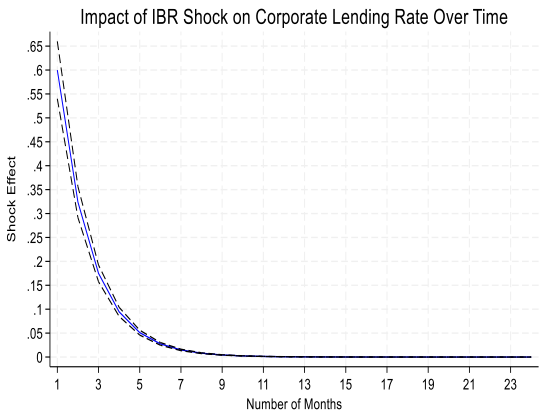
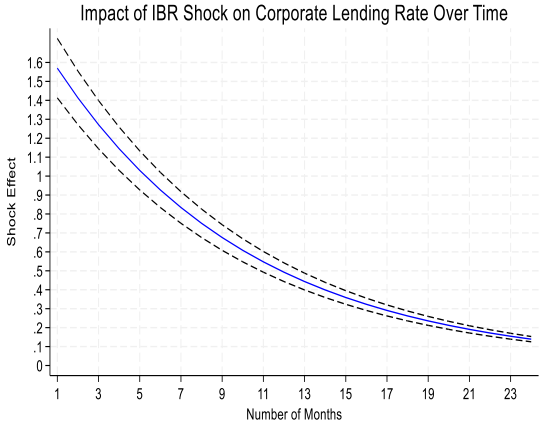
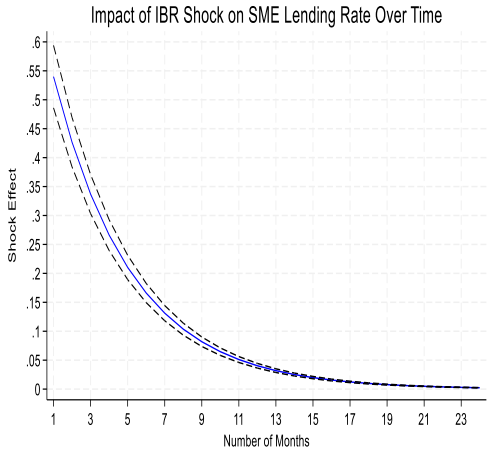
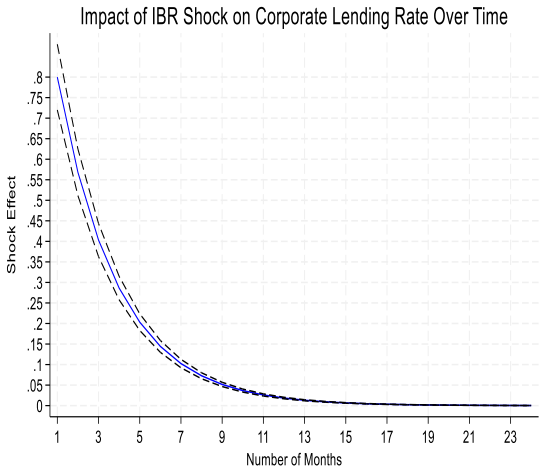
TABLE 5.14: ARDL Long-Run and Short-Run Results -Corporate Rate for Foreign Banks

	(6)	(7)	(8)	(10)	(11)	(13)	(14)	(15)	(16)
LONG-RUN									
Interbank Rate	0.122	0.21***	0.64*	0.65***	0.30	0.45**	0.20***	0.08	0.12
	(1.015)	(3.46)	(1.86)	(4.01)	(1.41)	(2.00)	(2.75)	(0.99)	(1.17)
CPI	0.031	0.01	0.00	0.02	-0.06**	-0.09*	0.01	-0.02**	-0.05**
	(1.441)	(0.55)	(0.06)	(0.76)	(-2.05)	(-1.92)	(0.99)	(-2.23)	(-2.14)
GDP	0.362*	0.06*	-0.04	0.04	-0.07	0.10	0.10*	-0.07	-0.06
	(1.878)	(1.67)	(-0.28)	(0.58)	(-1.13)	(0.64)	(1.75)	(-0.95)	(-1.20)
Expected Exchange Rate	0.21**	0.063	0.44*	0.160	0.12	0.24	-0.01	0.08*	0.18***
	(0.08)	(0.06)	(0.24)	(0.12)	(0.09)	(0.14)	(0.10)	(0.05)	(0.04)
10-year-US-treasury rate	-0.025	-0.04	-0.42	0.04	-0.07	-0.05	0.07	-0.11	-0.00
	(-0.163)	(-0.71)	(-1.20)	(0.29)	(-0.51)	(-0.27)	(1.39)	(-1.34)	(-0.02)
VIX	0.876	-0.98*	-1.44	-0.57	-0.00	2.58	0.97**	-0.59	1.10
	(0.973)	(-1.77)	(-0.45)	(-0.52)	(-0.00)	(1.47)	(2.15)	(-0.98)	(1.43)
Manufacturing Share	-0.189*	-0.08***	0.00	-0.03	-0.07	0.21*	-0.01	0.03	0.04**
	(-1.723)	(-3.33)	(0.04)	(-0.56)	(-1.62)	(1.79)	(-0.55)	(0.89)	(2.13)
Liquidity	0.039	-0.09**	-1.28	0.15	0.11	-0.03	-0.03	-0.00	0.06
	(0.998)	(-2.31)	(-0.91)	(0.77)	(1.06)	(-0.17)	(-0.60)	(-0.54)	(0.81)
SHORT-RUN									
ECT	-0.214**	-0.34***	-0.16**	-0.23***	-0.32***	-0.19***	-0.48***	-0.33***	-0.33***
	(-2.539)	(-5.70)	(-2.32)	(-4.11)	(-4.85)	(-2.95)	(-6.48)	(-4.82)	(-2.93)
Dummy_ibr									
	-0.346	-0.03	0.61	0.78*	-1.21**	0.40	-0.39	0.46	-0.43
	(-1.170)	(-0.12)	(0.92)	(1.82)	(-2.51)	(0.78)	(-1.25)	(1.65)	(-1.15)
Dummy_binary							-0.80***		
							(-2.82)		
Constant	3.052	-2.27	-6.24	-0.12	-42.58**	-17.32	-1.52	-7.17	-13.32
	(0.589)	(-0.41)	(-0.67)	(-0.01)	(-2.80)	(-1.26)	(-0.25)	(-1.00)	(-1.22)
Bounds Test	3.52	4.98	2.31	2.652	3.937	3.017	6.31	4.93	2.365
	[3.31]	[3.32]	[3.31]	[3.305]	[3.32]	[3.31]	[3.31]	[3.31]	[3.33]
LM Test	1.23	0.13	1.28	1.73	0.32	0.54	1.43	1.12	1.85
	[0.26]	[0.88]	[0.28]	[0.12]	[0.51]	[0.58]	[0.23]	[0.33]	[0.14]
Het	2.92	0.01	0.06	0.66	0.04	5.87	2.25	0.53	0.25
	[0.09]	[0.91]	[0.81]	[0.42]	[0.84]	[0.02]	[0.13]	[0.47]	[0.25]
Cusum	0.64	0.49	0.41	0.43	0.46	0.39	0.42	0.45	0.50
	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}	{1.22}
Observations	119	119	119	119	119	119	119	119	119

Cusum critival values in {}; Dummy_ibr is the dummy variables accounting for the period when the interbank rate deviated from its corridor mainly in 2015/2016 while Dummy_binary is a bank-specific binary dummy variable accounting for periods when a particular bank's lending rate movements diverged significantly from its historical pattern.

Appendix 5.2 Short-run Results

Figure 5.5: Short-Run Dynamics-All Banks Results

ID	SME RATE	ID	CORPORATE RATE
1		1	
2		2	
3		4	

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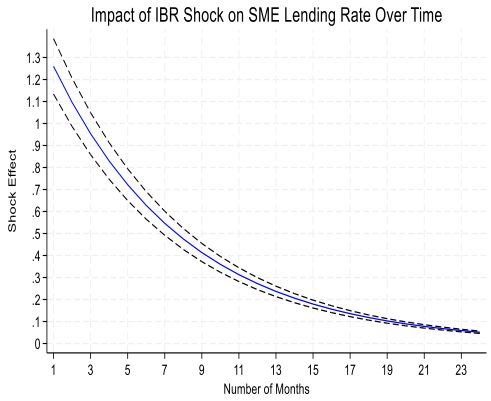
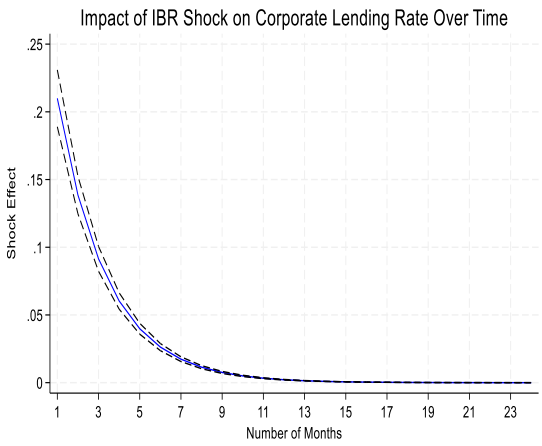
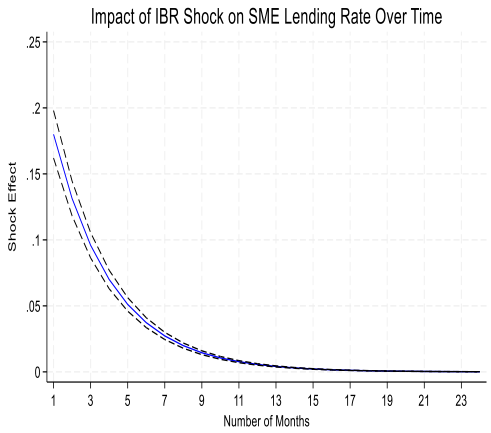

Impact of IBR Shock on SME Lending Rate Over Time
Shock Effect
Number of Months

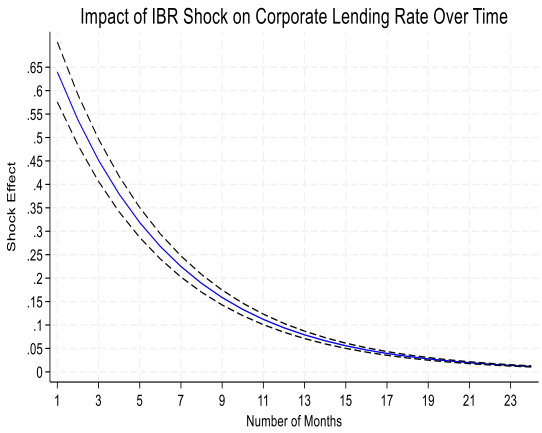
7


Impact of IBR Shock on Corporate Lending Rate Over Time
Shock Effect
Number of Months

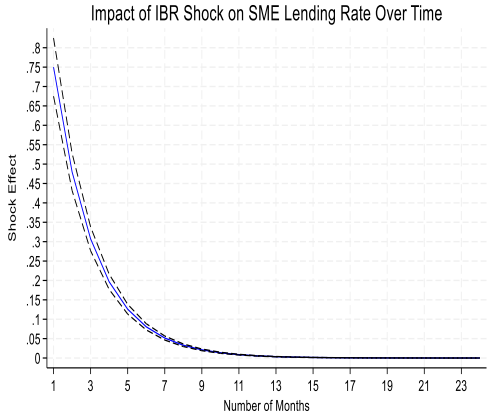
6


Impact of IBR Shock on SME Lending Rate Over Time
Shock Effect
Number of Months

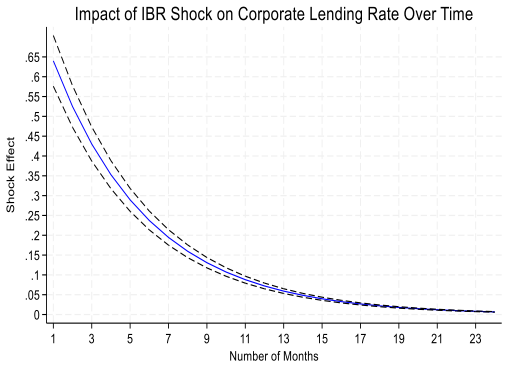
8


Impact of IBR Shock on Corporate Lending Rate Over Time
Shock Effect
Number of Months

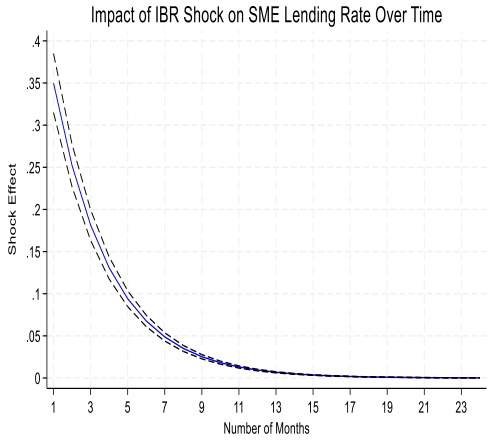
7


Impact of IBR Shock on SME Lending Rate Over Time
Shock Effect
Number of Months

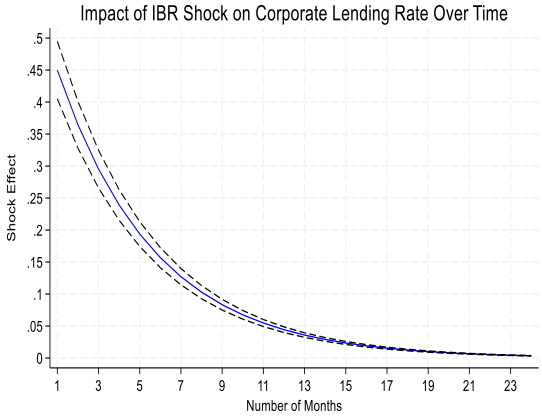
10


Impact of IBR Shock on Corporate Lending Rate Over Time
Shock Effect
Number of Months

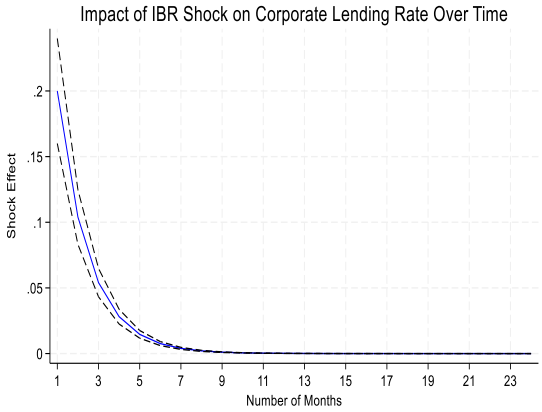
11



13



14



Note: Bank Ids 1-5 are domestic banks while 6-16 are foreign banks

Chapter 6: Conclusions and Policy Recommendations

6.1 Summary

The aim of this study is to investigate the extent of monetary policy passthrough via the interest rates channel, with a focus on heterogeneity across different borrower segments (SMEs, corporates, mortgage, and personal loans) and across banks (domestic vs foreign; global vs Pan-African). It further examines the influence of global financial conditions, global risk sentiments and foreign monetary policy spillovers on monetary policy passthrough in Zambia. A significant contribution lies in the use of a novel dataset collected directly from commercial banks comprising of granular bank-level data, unlike previous studies that relied on aggregate data. This facilitated a more detailed analysis of monetary policy transmission in Zambia. In addition, the study constructed a Monthly Indicator of Economic Growth (MIEG) as a proxy for monthly GDP, a key variable used in the empirical analysis that was previously unavailable. Employing various econometric techniques including Johansen cointegration, Panel ARDL dynamic fixed effects with DK standard errors and bank-by-bank time series ARDL on monthly data spanning April 2012 to July 2022, the study establishes insightful results.

First, the study found that monetary policy passthrough via the interest rates channel of monetary policy in Zambia is incomplete and varies across borrower segments and bank types. In particular, the passthrough is highest for SME lending rates, followed by personal loan rates, while it is weaker for mortgage and corporate lending rates. This suggests that monetary policy changes are more effectively transmitted to SMEs and individual borrowers than they are to corporates and real estate borrowers. The differences in passthrough strength reflect variations in loan tenures, pricing strategies, risk perceptions, and market structures across these credit segments.

In addition, the results reveal that domestic banks exhibit a significantly higher interest passthrough than foreign banks. Foreign banks are also quite sensitive to movements in the US Treasury rate and global risk sentiments (VIX) than domestic banks and the majority of them react to monetary policy spillovers from their countries of origin. This suggests that the strength of Zambia's monetary policy is highly diluted by the huge presence of foreign banks

whose lending decisions tend to be aligned to global capital markets and their parent country monetary conditions besides the Zambian monetary policy. Therefore, there is need for policy makers to adopt a more coordinated monetary policy approach by closely monitoring monetary developments in countries of origin of all highly influential foreign banks, in addition to assessing global trends so as to enhance the efficacy of monetary policy transmission. In addition, there is also need for policy makers to promote the establishment and growth of more domestic banks in order to expand their market share within the credit market sector. This would help strengthen the efficacy of monetary policy since monetary policy passthrough is stronger among domestic banks in comparison to foreign banks.

Further, the empirical results suggest a notable structural shift in Zambia's SME and personal credit market after 2016. Monetary policy passthrough to lending rates weakened after 2016, coinciding with the time of several macroeconomic challenges such as rising inflation, persistent exchange rate depreciation, elevated sovereign debt levels, and external shocks, most recently the COVID-19 pandemic. This structural shift may have hindered the effective transmission of monetary policy, limiting the ability of Bank of Zambia to achieve its objectives. There is need for policy makers to investigate the underlying causes of these structural rigidities in the credit market and devise strategies to address them.

6.2 Limitations of the Study and Directions for Future Research

Despite this study providing valuable insights into monetary policy pass-through in Zambia, several limitations should be acknowledged. To start with, while the study uses the interbank rate to proxy monetary policy stance, it does not explore the interbank market microstructure heterogeneity. In addition, while chapter 2 documents that Zambia's banking system is highly concentrated, it does not incorporate time-varying concentration and competition measures into the empirical models. As a result, it's not possible to quantify how changes in market structure shape the magnitude and speed of interest-rate pass-through. Also, despite the study relying on novel bank-level data, this excludes the influence of non-bank financial lending institutions whose activities can also have an impact on monetary policy transmission. The study does not incorporate the growing role of fintech innovations such as mobile money which is reshaping Zambia's credit market and could also significantly affect monetary policy effectiveness. Despite considering external financial conditions, it does not directly model cross-border banking flows to get a deeper understanding of foreign banks' role in monetary

policy transmission in Zambia. Finally, while the MIEG constructed in this study serves as a useful proxy for GDP, it requires further refinements by employing robust machine learning (ML).

Given these limitations, future research should consider undertaking a dedicated interbank market microstructure study using trade-level or bank-day data to see how this affects the magnitude and speed of monetary policy pass-through. In addition, is a need to construct time-varying indicators of market structure such as the Herfindahl–Hirschman Index (HHI) from assets and deposits and directly assess how these affect the pass-through. Also, it might be interesting to explore the impact of non-banking credit and fintech innovations on monetary policy transmission in Zambia. In addition, further studies should also assess how international capital flows affect monetary policy passthrough in Zambia and other similar economies with a strong presence of foreign banks. Finally, the MIEG should be refined further by incorporating additional real-sector indicators that are missing in the BoZ database to enhance its accuracy and applicability.