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Creating Opportunities

Modelling the asymmetric effects of interest rate shocks on credit supply and aggregate demand: Evidence from South Africa

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DEDICATION

This dissertation is dedicated to my parents, Annie and Peter Madhomu.

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To Jesus Christ, my Lord and Saviour, for granting me the wisdom, knowledge and understanding to see this dissertation through.

To my parents, for always supporting and believing in me throughout my studies, and giving me the time and space to pursue my dreams, I will forever be grateful.

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ABSTRACT

Monetary policy is a key component of the complete set of any country's economic policy. Thus, it focuses on the welfare of people and aims to enhance the financial and overall wellbeing of the nation. However, understanding how monetary policy is transmitted (or its pass-through) is crucial as it reflects the policy's effectiveness in achieving its goals. Given that South Africa has faced at least a decade of sluggish economic growth, leading to persistent unemployment, inequality and poverty, the country needs enhanced economic growth. The primary aim of the study is to model the asymmetric effects of interest rate shocks on credit supply and aggregate demand in South Africa. This study therefore investigates interest rate pass-through from monetary policy to both credit supply and aggregate demand. To achieve this, the study uses the non-linear autoregressive distributed lag (NARDL) model, the study examines the asymmetric reactions of credit supply and aggregate demand to South African monetary policy shocks, using both monthly and quarterly data from 2016 to 2023. The results indicate that pass-through of monetary policy to credit supply and aggregate demand in South Africa is both incomplete and asymmetric. Decreases in the repo rate have a more significant effect on both credit supply and aggregate demand than increases in the repo rate. Including asymmetric components into the administration of monetary policy could assist in fostering a more efficient policy response.

Key Words:

Monetary policy, interest rate pass-through, asymmetric, repo rate, NARDL

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributed Lag
BRICS	Brazil, Russia, India, China and South Africa
CMPF	Comprehensive Monetary Policy Frameworks project
COVID-19	Corona Virus Disease 2019
CUSUM	Cumulative Sum
CUSUMQ	Cumulative Sum of Squares
CPI	Consumer Price Index
DF	Dickey-Fuller
ECM	Error Correction Model
ECT	Error Correction Term
EG	Engel-Granger
ERFix	Exchange Rate Fixing countries
ERTs	Exchange Rate Targeting countries
FED	Federal Reserve
FOMC	Federal Open Market Committee
GDP	Gross Domestic Product
IMF	International Monetary Fund
ITs	Inflation Targeting countries
JIBAR	Johannesburg Interbank Average Rate
LSD	Loosely Structure Discretion
LSTVECM	Logistic Smooth Transition Vector Error Correction Model
MDC	Multiple Direct Controls
MixedTs	Mixed Targeting countries
MPC	Monetary Policy Committee
MTs	Monetary Targeting countries
NARDL	Non-linear Autoregressive Distributed Lag model
OLS	Ordinary Least Squares
PI	Production Index

PP	Phillips Peron unit root test
PVAR	Panel Vector Auto-Regressive model
Repo rate	Repurchase Rate
ROE	Return on Equity
SARB	South African Reserve Bank
SSDS	Supplementary Special Deposits Scheme
STATSSA	Statistics South Africa
UD	Unstructured Controls
UK	United Kingdom
US	United States of America
VAR	Vector Auto-regressive model

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In 1998, a special commission of inquiry, the De Kock Commission, managed to successfully oversee that inflation was brought down to a rate of 2.24%, from highs of about 18% in the 1980's (Ngalawa and Komba, 2020). In order to maintain this reduced rate of inflation, the South African Reserve Bank (SARB) decided to adopt inflation targeting as the monetary policy framework in February of 2000, setting 3% to 6% as the targeted inflation range. In 2017, the Monetary Policy Committee (MPC) announced that while 3% to 6% is the target range, it generally aims for 4.5%, this being the midpoint of 3% to 6%. To date, the SARB has managed to successfully keep inflation within the target range, as average inflation between 2010 and 2022 was 5.1%, and up to 5.3% in January 2024 (Stats SA, 2024). Nonetheless, despite this accomplishment, there is often a question raised about whether the SARB might prioritise price stability excessively, potentially at the expense of economic growth.

Monetary policy has particularly received increased attention over the last few years, as the global slowdowns caused by the recent COVID-19 pandemic necessitated the evaluation of the effectiveness of monetary policy. Assessing policy is crucial, as economists see monetary policy as the primary tool to use during economic downtowns, especially when prompt measures are needed to maintain economic stability (Matemilola, Bany-Arifin and Muhtar, 2015). The central bank in South Africa, the SARB, began by lowering the repurchase (repo) rate in order to stimulate economic activity, this in response to the huge drop in economic growth that was brought about by closure of businesses during the lockdown period. However, in order to curb inflation, post the lockdown period, the Reserve Bank increased the repo rate by a total of 425 basis points from the period when "normalisation" began in November 2021 (SARB, 2023). This came as no surprise, as the Reserve Bank uses counter-cyclical monetary policy to stimulate economic growth, and maintain financial stability.

The transmission mechanism, which transmits monetary policy decisions from the SARB to the real sector, occurs through various channels, ultimately having an impact on money supply, credit and inflation. The role of banks in the transmission mechanism is crucial; as banks are the primary supplier of credit, any decisions made by the SARB must be communicated or passed through fully to consumers. This is therefore the first theoretical justification for the

asymmetric pass-through of monetary policy; it is possible that banks may not be willing to raise their interest rates significantly following increases made to the repo rate by the SARB, fearing the risk that borrowers may default on their loans.

On the other hand, another theoretical justification is that when the SARB lowers the repo rate, there is no certainty that there will be an increase in the number of borrowers, and therefore no certainty that spending will increase. Furthermore, evidence from menu cost models points to the fact that firms have a tendency to adjust their prices when inflation levels are high, but the opposite is true when inflation levels are low (Abdelsalam, 2018).

1.2 STATEMENT OF THE PROBLEM

Monetary policy is of paramount importance to South Africa, as a nation that utilises inflation targeting as the chosen framework for monetary policy. According to the 2024 budget review by National Treasury, from 2012 to 2022, the South African economy saw more than ten years of very slow growth, with annual GDP growth rate averaging just 0.8%. In order to put into perspective how significantly weak this GDP growth rate is, one can compare it to the average of 3.0% for sub-Saharan Africa over the same time period (FocusEconomics, 2024). For the year 2023, GDP growth rate was only 0.6% for South Africa (National Treasury, 2024). Such weak growth rates perpetuate unemployment, poverty and inequality in the country as GDP is not growing at levels that are sufficient enough to generate jobs. What South Africa needs is enhanced economic growth. Having a macroeconomic framework that is sound will promote stable prices and therefore lead to growth. Figure 1.1 below shows how real GDP for quarter 4 of 2023 was in fact lower than that for quarter 3 of 2022, highlighting the economic growth challenges that South Africa is currently facing.

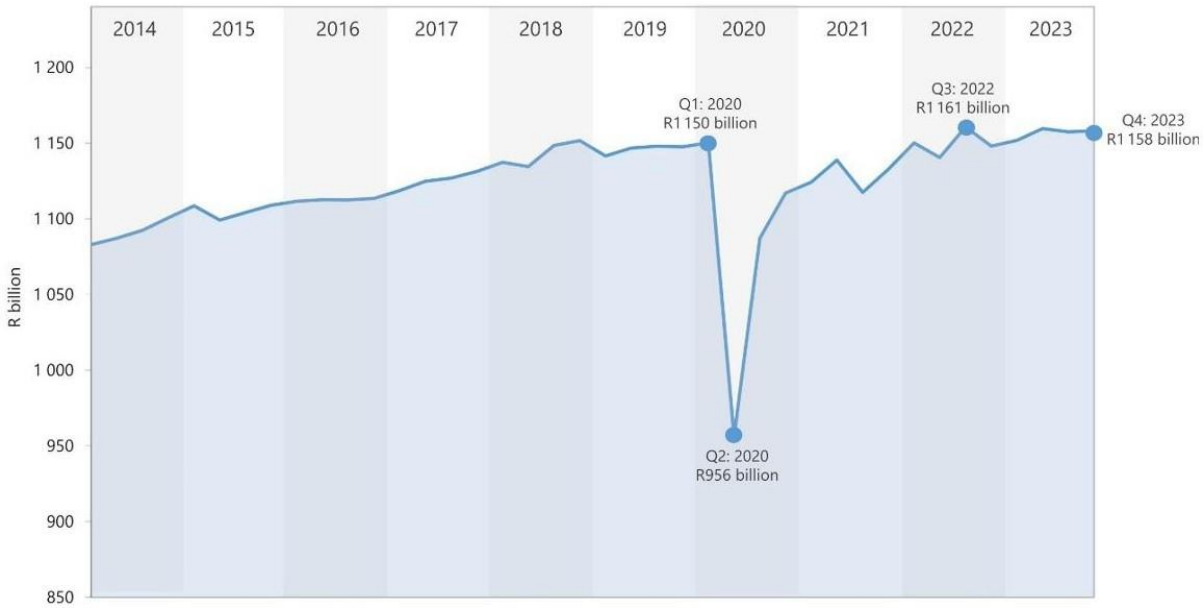


Figure 1.1: South African quarterly GDP over time

(Constant 2015 prices, seasonally adjusted) - Source: Stats SA (2023)

It is not enough for a country, particularly a developing country, to only have policies in place, without critically assessing and evaluating the policies with the intention of ensuring that they are working efficiently. If it is assumed that the effects of monetary policy are symmetric and complete, this could lead to policy decisions not yielding the targeted results.

Monetary policy drives the economic growth of any country that has implemented inflation targeting because of the influence that it has on macroeconomic variables, for example prices and inflation. Particularly in South Africa, economic growth is an essential ingredient needed to raise living standards, and alleviate poverty (Hlongwane and Daw, 2022). The implications that an asymmetric pass-through of monetary policy may have on an economy could be significant enough to necessitate adjustments in the administration of this policy. This means that monetary authorities may need to include asymmetric components into monetary policy as this may assist in fostering a more efficient policy reaction. Ultimately, this study could assist in giving more accurate predictions, as well as refine the modelling process of monetary authority decisions.

1.3 RESEARCH QUESTIONS

Main question:

What is the nature of the asymmetric effects of positive and negative monetary policy shocks on credit supply and aggregate demand in South Africa?

Sub-questions:

- What is the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply in South Africa?
- What is the degree of symmetry and completeness of interest rate pass-through from monetary policy to aggregate demand in South Africa?

The answers to these questions will provide insight into the effectiveness of monetary policy in controlling the amount of money in circulation and ultimately stimulating economic growth.

1.4 AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to unlock South Africa's growth prospects, from a monetary policy perspective.

The primary objective of this study is to model the asymmetric effects of interest rate shocks on credit supply and aggregate demand in South Africa.

1.4.1 Sub-objectives

In order to achieve this primary objective, the sub-objectives of the study are formulated accordingly:

- To estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply in South Africa.
- To estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to aggregate demand in South Africa.

1.5 HYPOTHESES OF THE STUDY

As the study will test asymmetric effects of interest rate pass-through to credit supply as well as aggregate demand, the two sets of hypotheses for this study are as follows:

Hypothesis 1:

- H_0: Credit supply responses to interest rate pass-through shocks are symmetric and statistically significant.
- H_1: Credit supply responses to interest rate pass-through shocks are asymmetric and statistically significant.

Hypothesis 2:

- H_0: Aggregate demand responses to interest rate pass-through shocks are symmetric and statistically significant.
- H_1: Aggregate demand responses to interest rate pass-through shocks are asymmetric and statistically significant.

1.6 SIGNIFICANCE OF THE STUDY

Concerns around the asymmetric effects that monetary policy may have are important for policymakers as the presence of asymmetries can greatly affect the manner monetary policy is currently administered, and how it ought to be administered. Not only will this study of asymmetries in monetary policy add to the existing body of knowledge on the topic; because the study covers the period from 2016 to 2023, the study will assess what the impact of monetary policy (testing for completeness as well as symmetry) was over the lockdown period. During this period, the SARB administered both expansionary monetary policy (decreasing the repo rate) and contractionary monetary policy, thus increasing the repo rate (Narayan and Sharma, 2020). Therefore, the study will investigate if decreases in the repo rate were passed on to consumers to the same effect as increases in the repo rate.

The results of this study will therefore assist policymakers to better understand monetary policy, and the significant role played by banks in passing through interest rate shocks to consumers, which will thus result in better modelling and forecasting for the future (Kahn and McGregor, 2019). It is not enough to only have policies in place; it is vital to analyse and assess how effective existing policies are, particularly post periods of economic downturns. This will answer the question, “Were the decisions taken by monetary policy authorities the correct ones?” as well as “What can we change or improve on going forward, should the economy face a similar situation again?”

1.7 CHAPTER CLASSIFICATION

Chapter 1: Introduction and Background of the Study: Chapter 1 introduces the topic. This is done by firstly giving a brief background of the study, which leads to the statement of the problem, describing the challenge of sluggish economic growth that South Africa presently faces. The problem statement will clarify the reasons for conducting the study, focusing on the importance of constantly assessing economic policy. Next, the aim of the study is discussed, and the research questions, research objectives and hypotheses of the study are listed. Finally, the significance of the study is stated, which explains the possible need for asymmetric components to be included in monetary policy.

Chapter 2: Overview of Monetary Policy in South Africa: The chapter discusses the trends of monetary policy over the years. It is important for a country to understand where it is coming from, as well as how it compares to other countries – both developing and developed. Chapter 2 therefore gives a comprehensive outline of the monetary policy framework used by the South African Reserve Bank. Next, the chapter discusses the different monetary policy regimes used in South Africa over the years, as well as by other countries. The chapter also discusses the interaction of fiscal policy and monetary policy, and lastly, the responses of central banks globally to the COVID-19 pandemic.

Chapter 3: Literature Review: It begins by giving an in-depth discussion of the theoretical framework around asymmetries of monetary policy transmission, including the Keynesian theory, the monetarist theory, the financial liberalisation theory, and finally gives a contrast between the customer reaction hypothesis and the collusive behaviour theory. The transmission mechanism of monetary policy, with its different channels, is also discussed as these channels are central to the conduct of monetary policy. Lastly, a critical evaluation of the empirical literature around the topic is presented, which delves into why there are so many differences in the results of previous research.

Chapter 4: Research Design and Methodology: It covers the econometric methodology employed by the study. The chapter begins with a description of the research design that the study uses. Next, the chapter discusses the data sources, as well as the sample size and period for each of the two models, followed by model specification, a discussion of the variables (together with their expected signs) and the estimation technique and procedures. This leads into the Bound test that determines if a long-run relationship exists between the variables, and

Error Correction model (ECM). The chapter also presents a description of the unit root tests and importantly, all other diagnostic tests run.

Chapter 5: Empirical estimation and discussion of results: It presents, discusses and provides literature to substantiate the results obtained from running the models discussed in the preceding chapter. An interpretation of the findings is given, by thoroughly dissecting the results and stating if these are consistent with the hypotheses stated in chapter 1, thereby forming the basis for the conclusion.

Chapter 6: Summary, recommendations and conclusion: It provides conclusions and policy recommendations based on key findings and results obtained in chapter 5. In addition, the limitations of the study, including areas for future research, are also highlighted.

CHAPTER 2
OVERVIEW OF MONETARY POLICY

2.1 INTRODUCTION

The aim of the study, as stated in the preceding chapter, is to unlock South Africa's growth prospects, from a monetary policy perspective. As monetary policy is a component of a nation's broader economic strategy, it prioritizes the welfare of citizens and seeks to improve both the financial and overall wellbeing of the nation (Auclert, 2019). Monetary policy should offer specific details regarding its impact on the country's welfare. This implies that the objectives of monetary policy need to be measurable, explicitly stating the aim of the monetary policy authorities and thus what they hope to accomplish regarding their policy goals. A clear monetary policy philosophy, along with specific tools that will be used to attain policy objectives, must also be included in monetary policy guidelines. It is thus crucial to unpack the framework for monetary policy, clearly define concepts around monetary policy, as well as monetary policy trends over the years. It is also important for a country to understand where it is coming from, as well as how it compares to other countries – both developed and developing.

In light of the above, this chapter will discuss the monetary policy framework currently utilised by the SARB. This is preceded by a discussion of the different monetary policy regimes used both in South Africa over the years, as well as by other countries, including monetary targeting, exchange rate targeting and inflation targeting. Countries, both developed and developing, select the most suitable monetary policy regime to effectively achieve their goals and objectives based on their economic requirements and framework of the nation (Dosi, Fagiolo, Napoletano, Roventini and Treibich, 2015). The chapter proceeds to discuss the interaction of fiscal policy and monetary policy, with the next section looking at monetary policy in developed countries, developing countries, African countries, and lastly, monetary policy in South Africa. Lastly, the chapter reviews the responses of central banks around the world to the COVID-19 pandemic, which sparked many studies to evaluate the effectiveness of monetary policy, as well as uncover ways that it can be improved.

2.2 MONETARY POLICY REGIMES

In the last fifty years, significant changes have occurred in monetary policy frameworks around the world. Central banks utilise monetary policy regimes to guide decision making in monetary policy by setting up a structure that offers a set of rules and objectives. The decision on which

monetary policy regime a country uses should reflect the specific requirements of the country, and is often influenced by factors such as the act/legislation that governs the central bank, economic structure of the nation, as well as the financial system of the nation. This section defines and discusses the various monetary policy regimes used globally. These include exchange rate targeting, monetary targeting, as well as inflation targeting. Inflation targeting is discussed in great detail, as it is used in South Africa. Section 2.2.4 shows a visual representation of the worldwide trends in monetary policy frameworks, as compiled by the Comprehensive Monetary Policy Frameworks (CMPF) project.

2.2.1 Exchange rate targeting

Exchange rate targeting refers to a type of monetary policy framework where the central bank interferes in market operations to keep the exchange rate at a targeted level (Haughton, 2017). It occurs through the central bank utilising net international reserves to affect the currency supply, thus maintaining a fixed currency exchange rate. However, the effectiveness of monetary policy is restricted to the exchange rate, and this means the central bank has limited capacity to respond to domestic and foreign shocks. Moreover, another significant drawback is the potential loss of autonomy in monetary policy. Because of this, most central banks have adopted flexible exchange rates instead. In emerging markets, the conditions making it possible for a country to continue to fix its exchange rate have grown more stringent, leading to increased pressure to have flexible exchange rates as the nominal anchor. There are, however, still some countries that continue to adopt this monetary policy regime, including Botswana (IMF, 2023).

A study by Abu Asab, Cuestas and Montagnoli (2018) examined and contrasted the connection between inflation and inflation uncertainty in emerging nations under both inflation targeting and the traditional fixed exchange rate system. The study found that there is a two-way or reciprocal relationship between inflation and inflation uncertainty across both monetary regimes. In addition, the study found that the fixed exchange rate regime has no effect on average inflation and inflation inertia, but inflation targeting is able to effectively reduce both average inflation and inflation persistence. Kruskovic (2020), however, argues that since fluctuations in the real exchange rate influence economic activity via external competitiveness, a central bank that chooses to utilise interest rates as its operational tool risks neglecting an essential exchange rate channel that facilitates monetary policy.

2.2.2 Monetary targeting

Monetary targeting is linked to the monetarist belief that money supply should be increased consistently, so as to support the expansion of the economy and keep inflation low (Stone and Bhundia, 2004). A monetary targeting regime allows the monetary authority to adjust monetary policy according to domestic economic conditions, as opposed to exchange rate targeting. Monetary policy independence is thus achieved, enabling the monetary authority to respond autonomously to both external and internal economic and financial disturbances in a nation. Additionally, the targets set annually act as clear signals, informing the central bank if it is on track to achieving its goals (SARB, 2017).

The monetary targeting regime was indeed found to be a step up from the exchange rate targeting regime due to central banks being held accountable for monetary targeting and having a clearly rule-based system. However, Stone and Bhundai (2004) outline the various reasons why monetary targeting was abandoned by most countries in the 1980s. Firstly, the control of money supply was not an easy task for central banks. Because money supply is set within the country (domestically), and because the instrument used to administer monetary targeting is short-term interest rates, adjusting interest rates to control money supply was expensive. Additionally, income velocity became unstable, disrupting the link between the target of monetary policy and the end objective (VanWyngaard, 2019).

2.2.3 Inflation targeting

Inflation targeting, which has increased since the 1990s, is a monetary policy regime that involves policy actions being guided by anticipated/expected future inflation compared to a set inflation target (Kim and Mehrotra, 2018). Transparency and credibility are highlighted by the International Monetary Fund (IMF) as crucial factors affecting how successful the implementation of inflation targeting in any country will be (IMF, 2002). Once a country has chosen to prioritise inflation targeting as the central goal of its monetary policy, it becomes essential for the monetary authorities to regularly communicate to the public the actions taken and the reasoning behind their choices. The Bank of Canada, for example, found that the more transparent and credible its nominal anchor (inflation target), the more effective the exchange rate was at absorbing any asymmetric macroeconomic shocks (Knight, 2002). Consequently, inflation targeting necessitates that central banks protect their credibility in meeting the inflation objective, potentially more than in other monetary frameworks. Inflation targeting

countries are thus almost always countries with central banks possessing significant operational independence (Kohler, 2002).

Mishkin (2000:105) details a comprehensive summary of "the five main elements of inflation targeting as a monetary policy framework" as follows:

i. publicly announcing the medium-term numerical for inflation;
ii. prioritizing price stability as the main objective of monetary policy, with other goals taking a lesser role;
iii. a comprehensive approach to information utilization that considers numerous factors, rather than focusing solely on monetary aggregates or exchange rates, when determining policy instrument settings;
iv. engaging in dialogue with markets, as well as with the public, with the intention of increasing transparency of monetary policy goals and choices;
v. greater accountability of central banks in meeting their inflation goals.

In economic literature, the origins of inflation targeting are linked to Wicksell (1898), emphasizing the importance of maintaining stable price levels. This concept was initially utilized in the 1930s, with Sweden aiming to avoid price fluctuations caused by the Great Depression. New Zealand first implemented the modern approach to inflation targeting in 1989 to avoid sudden increases in prices, and by the early 2000s, this approach had emerged as the leading monetary policy strategy worldwide.

When setting an inflation target, most countries under this regime typically use the already existing (and popular) national consumer price index (CPI) as the target. In addition, countries also use various data series which assist to predict inflation (Kohler, 2002).

2.2.4 Trends in monetary policy frameworks

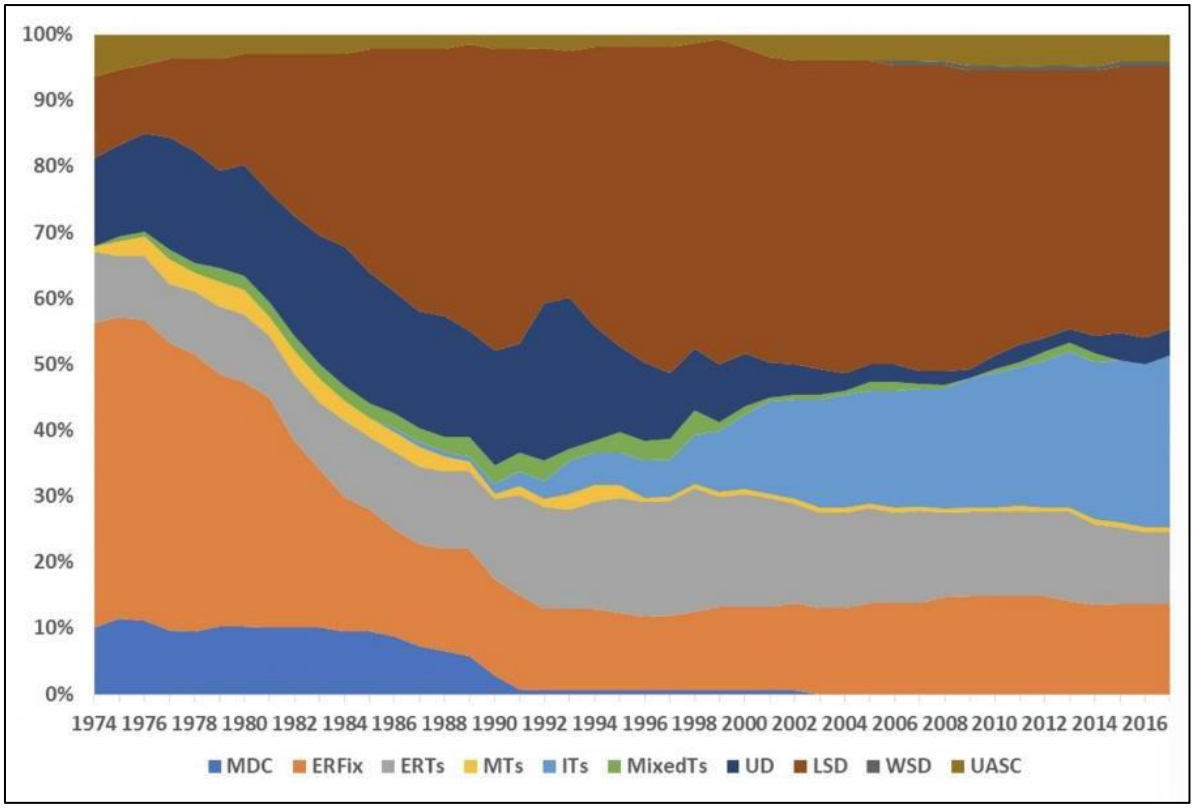
In 2018, Cobham (2022) initiated the Comprehensive Monetary Policy Frameworks (CMPF) project, with the intention of analysing advanced and emerging economies. The project provides a classification of 179 countries for each year from 1974 to 2017, and identifies trends over time, analysing the operation and impact of the most commonly used monetary policy frameworks. The classification used is shown in Table 2.1 below. The classification is divided into two broad groups; target variables aggregation, as well as degree of control aggregation.

Table 2.1: Aggregations of Monetary Policy Frameworks

Aggregation by target variable	**Framework in full menu**
Direct controls, MDC	Multiple direct controls
Exchange rate fixing, ERFix	Pure and augmented exchange rate fixing, pure currency board
Exchange rate targeting, ERTs	Augmented currency board, full and loose, converging and stationary, exchange rate targeting
Monetary targeting, MTs	Full and loose, converging and stationary, monetary targeting
Inflation targeting, ITs	Full and loose, converging and stationary, inflation targeting
Mixed targets, MixedTs	All combinations of targets for 2 or 3 out of money, exchange rate and inflation
Unstructured discretion, UD	Unstructured discretion
Loosely structured discretion, LSD	Loosely structured discretion
Well-structured discretion, WSD	Well-structured discretion
Aggregation by degree of monetary control	
Rudimentary	Multiple direct controls, pure exchange rate fixing
Intermediate	Augmented exchange rate fixing, pure currency board, unstructured discretion
Substantial	Augmented currency board, all converging targets, all loose targets, all mixed targets, loosely structured discretion
Intensive	All full targeting, well-structured discretion

Source: Cobham (2022)

Making use of the classifications shown in Table 2.1, the CMPF project analysed the global trends in monetary policy frameworks from 1974 to 2017. Figure 2.1 shows these trends by analysing target variable aggregation, while Figure 2.2 shows the trends by analysing the degree of monetary control.

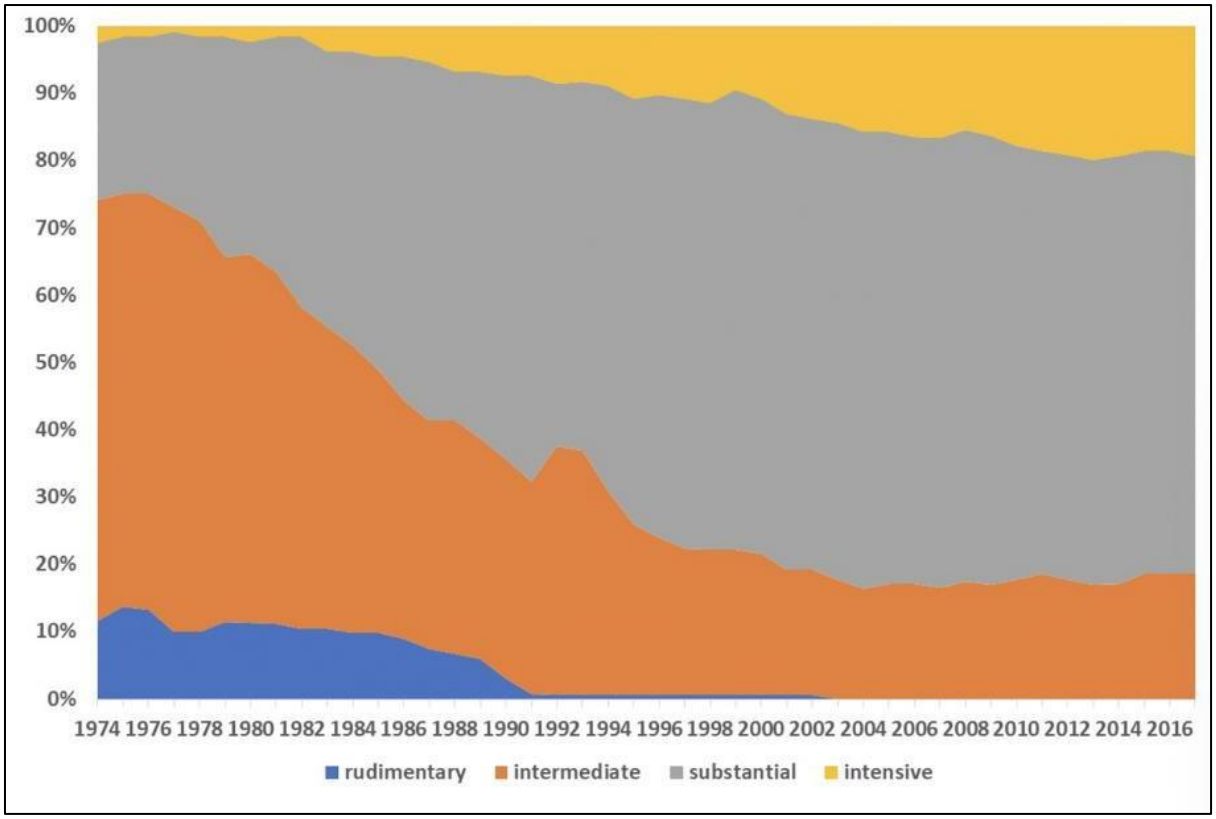


Source: Cobham (2022)

Figure 2.1: Target variable aggregation

Figure 2.1 above shows a considerable reduction in the use of exchange rate fixing (ERFix) and exchange rate targeting (ERTs) over time, falling from approximately 50% to 25% of all countries. Most of the shift occurred in the 1970s and 1980s. Loosely structured discretion (LSD) is characterised by situations where the instruments function efficiently, but the goals and trade-offs are ambiguous (or vice-versa, having goals and trade-offs that are well defined but ineffective instruments) has significantly increased in approximately 45% of countries. Inflation targeting (ITs) has increased in popularity from the early 1990s and has been adopted by well over a quarter of nations globally. Multiple direct controls (MDC) as well as unstructured controls (UD) were crucial until the 1990s, but significantly decreased in importance afterwards. Monetary targeting (MTs) was never of great significance, while mixed targeting (MixedTs) is rare, usually done by countries briefly before transitioning to the euro (which required multiple "Maastricht criteria" to be met).

Figure 2.2 below shows that there has been a continuous decline in rudimentary (basic) and intermediate (middle-level) controls, and a continuous increase in substantial (significant) and intensive monetary control frameworks. These wide-ranging patterns were already recognised in developed countries, but also, to a lesser extent, in emerging economies (Cobham, 2021).



Source: Cobham (2022)

Figure 2.2: Degree of control aggregation

2.3 THE INTERACTION OF FISCAL AND MONETARY POLICY

Monetary policy aims to manage demand so as to maintain price stability. This means the main focus of monetary policy is on ensuring stable prices, acknowledging its impact on the economy, whilst also acknowledging its limitations. Monetary policy is not able to address supply-side issues, which necessitate long-term structural policies. The long-term size of an economy, as well as its growth rate, are influenced by supply-side factors (Bwire, 2023). In addition to this, the economic impact of monetary policy is subject to lags. Therefore, it is the merging of a nation's monetary and fiscal policies that ultimately leads to greater economic growth.

With regards to fiscal policy, national governments strive to maintain economic balance in order to attain political prosperity and stability. Governments employ different tools to boost economic growth, lower unemployment rates and accomplish macroeconomic goals (Horton and El-Ganainy, 2020). The two primary fiscal tools used by governments are taxation and government spending. Tax is defined by Blouin (2014) as a compulsory payment imposed by government, applicable to both corporations and individuals. This includes taxes on income

(one of government's main sources of income), production, social contributions, imports or capital taxes, to name but a few. Government spending is funded through the tax revenue.

Government spending is thus the money that is used by the government to produce and provide essential services. These include education, healthcare, defence, as well as the procurement of goods. Maingi (2017) reports on the different channels through which government expenditure impacts economic growth. These include increasing an economy's capital stock, increasing stock of human capital (through government spending on health and education), directly impacting growth by spending on infrastructure and increasing productivity by spending on research and development. These channels are expansionary in nature. However, fiscal policy can also be contractionary. Therefore, just as the SARB uses both expansionary and contractionary monetary policy to stabilise the economy, governments use both expansionary and contractionary fiscal policy to attain various macroeconomic goals, basing their decision on the economic conditions.

But what is optimal mix of monetary and fiscal policy that an economy needs? Dosi et al. (2015) studied what the most effective combination is using an agent-based model. This model was used to reproduce a broad range of macro- and micro-empirical regularities. The simulation consisted of an economy that was made up of (1) a machine-producing sector made of firms, (2) consumption goods sector also made of firms, (3) consumers/workers, (4) a banking sector, consisting of commercial banks, (5) a Central Bank and (6) a public sector. The study mainly focused on how various mixes of monetary and fiscal policies affect a range of target variables. The simulation results indicated that a combination of unconstrained countercyclical fiscal and monetary policies aimed at employment is necessary to stabilize the economy.

Closer to home, Jawadi, Mallick and Sousa (2016) used a Panel Vector Auto-Regressive (PVAR) model to assess what the effects of monetary and fiscal policy combinations are on economic variables for the five BRICS countries (Brazil, Russia, India, China and South Africa). The study controlled for periods of extreme instability in order to provide robust results, and found that monetary policy tightening resulted in a decline in real economic activity, as well as a tightening of conditions in the liquidity market, while shocks to government spending were found to have strong Keynesian effects. Additionally, the study uncovered evidence that supports the presence of an accommodative relationship between monetary and fiscal policy that is vital for both economic and political decision-making.

A more recent study by Chugunov, Pasichnyi, Koroviy, Kaneva and Nikitishin (2021) investigated the priority areas for improving coordination of fiscal and monetary policy, which in turn promotes economic development that is sustainable. The authors developed an institutional approach to analyse the fiscal-monetary mix, and they proposed the structural-functional model that emphasizes the impact of both monetary and fiscal policies on aggregate demand. The findings indicated that there were no beneficial impacts of overall government spending on GDP per capita in 19 emerging markets between 1995 and 2018. Rather, for government spending to have a long-lasting effect on output, the quality of institutions, structure of expenditures, and fiscal design play a vital role herein. Moreover, the authors stressed that in the long-run, monetary policy needs to be fully comprehensive, ensuring effective inflation targeting conditions, using tools adaptively in order to reach both intermediate and final targets. Kaplan, Moll and Violante (2018) found a similar result, stating that the way fiscal policy reacts to monetary policy expansion determines the magnitude of the overall macroeconomic response.

On the whole, the central theme in literature is that the coordination of monetary and fiscal policies is crucial for achieving macroeconomic stability, as well as promoting economic growth that is sustainable. Fiscal goals should not greatly impact price stability, and monetary authorities should avoid causing a recession. Both fiscal and monetary policymakers need to work together to lower the volatility of important macroeconomic indicators. In so doing, it is vital that policymakers take into consideration the duration, nature and lag effects of the instruments used to stabilise the economy (Chugunov et al., 2021)

2.4 MONETARY POLICY IN DEVELOPED COUNTRIES

Monetary policy authorities aim to maintain low and steady inflation by setting a medium-term target for headline and/or core inflation within a certain range, providing room to manage unexpected shocks beyond their control. In many central bank jurisdictions, maintaining price stability is the primary objective, with output stabilisation and financial sector stability being secondary goals. The focus placed by these central banks on price stability is based on the negative effects it can have on economic growth. To explain these negative effects, Bwire (2023) describes how higher levels of inflation reduce the purchasing power of wages and savings, and this causes nominal interest rates to increase as uncertainty surrounding future price levels and relative prices heightens. As a result, the risk premium for both domestic and foreign financial markets increases in an attempt to offset the increased level of uncertainty.

Inflation thus leads to various economic distortions that hinder the economy's long-term growth potential, with savers unable to protect the value of their earnings and savings, as was the case in Zimbabwe in the early 2000s.

Monetary policy can be effective in both developed and emerging economies. However, its success in accomplishing its goals and objectives may fluctuate as a result of variations in economic conditions, institutional frameworks and structural factors within the different economies. Countries that are highly developed, for example the United States of America (US) not only have strong institutional frameworks, but have also implemented macroprudential tools, both structural and cyclical, to reduce the vulnerabilities in the banking sector (Adrian and Liang, 2018). Since the 1970s, US monetary policy has been conducted under three different regimes. During the initial period from 1970 to 1979, the primary instruments of monetary policy was the federal funds rate, which was additionally used as the target for policy (Borio, 1997). Coupled with this, was a secondary objective of focusing on borrowed reserves. Additionally, during this time, open market operations were used to ensure that the target range for the funds rate remained low, approximately 5% – 7%. In response to macroeconomic conditions, the federal funds rate would typically be increased/decreased by 25 - 50 basis points (Bernacke and Mishkin, 1992).

The Federal Reserve (FED) also began closely monitoring money supply around the 1970s, as the Federal Open Market Committee (FOMC) set weekly money supply targets (Meulendyke, 1998). The financial impact of the 1989 stock market crash and the recession that followed and ended in 1991 led the FOMC to shift its focus away from setting targets for borrowed reserves to solely targeting federal funds rate at 2 percent. Since the 1970s, the main focus of the FED has been achieving inflation that is stable, maintaining a low and steady federal funds rate, promoting growth, as well as managing unemployment (Bernacke and Mishkin, 1992).

Similar to the United States, British monetary authorities adopted a monetary targeting framework in the 1970s to address the increase in inflation that was affecting the economy. In addition to monetary targeting, interest rates were used in a similar way, being used to target the M3 money supply since the beginning of 1973 (Meulendyke, 1998). In December of 1973, the Supplementary Special Deposits Scheme (SSDS) was implemented to guarantee the effectiveness of M3 targeting (Borio, 1997). This policy aimed to lessen the increase in M3 by imposing taxes on high-interest bank deposits, which are part of M3. In spite of this, the Bank of England did not succeed in meeting M3 growth goals. Inflation, however, decreased

following the oil price crisis of 1973, only to surge again in 1978, and reached 20 percent by 1980 (Bernacke and Mishkin, 1992).

The rise in inflation led to the implementation of a Medium-Term Financial Strategy in 1980. The strategy involved slowing down M3 growth, cutting government budget deficit and removing existing controls such as the SSDS (Elhefnawy, 2021). In 1989, the United Kingdom (UK) moved from M3 targeting, and joined the then European exchange rate mechanism, setting an exchange rate that is fixed. However, this ended shortly after, and was substituted with inflation-targeting. Following this, the Bank of England has the responsibility (which began in 1997) of maintaining a 2 percent annual inflation target, together with its MPC. In 2010, the UK made the decision to switch its measure of inflation from the Retail Price Index, to CPI. (Bank of England, 2024).

2.5 MONETARY POLICY IN DEVELOPING COUNTRIES

As stated in section 2.4, the effects of monetary policy on aggregate demand change depending on circumstances in the country. This holds true, not only when comparing different countries at a given time, but also for the same country over different periods of time. Therefore, for central banks to be successful in implementing an activist monetary policy, they must have full knowledge and understanding of the manner in which monetary transmission works within their particular country as well as the circumstances within the country, both quantitatively and qualitatively. Some important factors to consider are the country's connections to global financial markets, its exchange rate regime, how big the financial sector is within the country and its institutional arrangements, the level of advancement of its money, bond and stock market, the liquidity of its real asset markets for example real estate and the competitiveness of the banking industry (Mishra, Montiel and Sengupta, 2016).

In many developing countries, monetary transmission is weak, while on the fiscal side, the fiscal multipliers are minute (Loayza and Pennings, 2020). Mishra et al. (2016) analysed how effective the transmission of monetary policy is in developing countries, utilising evidence from India. The results suggested that a rise in monetary policy caused a notable increase in bank lending rates, this along with expected changes in the exchange rate. However, the impact of monetary policy on lending rates was found to be incomplete, with mild to no effects on the exchange rate. The study additionally found that there were no notable impacts on actual production or on inflation. Apart from India, section 2.6 which follows discusses monetary policy in emerging economies on the African continent.

2.6 MONETARY POLICY IN AFRICAN COUNTRIES

Monetary policy in Africa, like in other regions, has experienced notable transformations in recent decades. Before the 1990s, the conduct of monetary policy on the African continent was influenced heavily by a strong fiscal dominance. Interest rates were mainly under administrative control and central banks had to follow the fiscal authorities' directives, which focused on using monetary policy as a means of addressing government financing needs. Additionally, a parallel foreign exchange market was prevalent at this time, indicating fixed exchange rates. However, in the early 1990s, the clear lack of success prompted efforts to dismantle control systems, open up foreign exchange markets, and implement stronger fiscal systems. In order to stabilize the economy, two important events took place. The initial step was the shift towards flexible exchange rate systems (this confirms the results documented by Cobham (2022) in Figure 2.1), while the second was formally placing price stability as the main goal of monetary policy (Bwire, 2023).

Many African countries, however, are still plagued by institutional, as well as structural issues which hinder the effectiveness of the channels in the transmission mechanism of monetary policy. Mishra, Montiel and Sengupta (2016) stress that an economy's financial structure significantly influences the channels of the monetary transmission mechanism, and it is now accepted that the advancement of the financial sector significantly contributes to economic growth (Puatwoe and Piabuo, 2017). Al-Tal and Makiwa (2024) analysed the connection between financial structure and monetary policy, considering 21 sub-Saharan African countries, using data that covered the period from 2011 to 2022. The findings found a positive and significant relationship between competition in the banking sector and the effectiveness of monetary policy impulses. Moreover, the size of the central bank also played a significant role on the effectiveness of monetary policy. Although there have been some important advancements in the many financial systems in Africa, and particularly in sub-Saharan Africa, financial systems in Africa are still significantly less developed compared to the majority of markets worldwide across various financial development indicators (Otchere, Senbet and Simbanegavi, 2017).

Figure 2.3 below shows the state of stock markets in sub-Saharan Africa. From the figure, it is clear to see that many issues with liquidity and depth in African stock markets still exist. However, there have been improvements in capitalisation and trading activity (Al-Tal and Makiwa, 2024). Excluding South Africa and Nigeria, stock markets in sub-Saharan Africa

remain relatively small when considering factors such as market capitalisation as well as the number of companies that are listed. South African markets primarily drive the high market capitalisation as a share of GDP in the Southern African region.

Region	Variable	Market capitalisation as a percent of GDP											Number of listed domestic companies										
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Eastern Africa	Kenya	29.6	36.2	24.3	-	-	-	-	-	-	-	26.2	55	55	58	60	61	65	64	65	-	-	59
	Tanzania	-	-	11.6	20.5	19.3	22.9	25.1	20.1	19.4	15.2	12.9	-	-	-	-	-	-	-	24	-	-	-
	Rwanda	-	-	-	-	-	-	-	-	-	-	31	-	-	-	-	-	-	-	-	-	-	4
	Average	29.6	36.2	18	20.5	19.3	22.9	25.1	20.1	19.4	15.2	23.4	55	55	58	60	61	65	64	44.5	-	-	31.5
Southern Africa	Botswana	-	-	29.2	28.9	28.6	28.3	28.0	27.6	27.3	27.0	26.7	-	-	-	-	37	-	-	-	24	26	-
	Mauritius	72.1	77.5	68.1	61.5	73.7	68.3	61.9	61.9	73.48	69.4	61.3	64	62	63	60	63	66	71	75	74	99	95
	Namibia	11	10.4	9.34	9.99	14.9	15.6	17	21.9	22.88	18.3	21.1	7	7	6	7	8	8	8	8	10	10	11
	South Africa	270	246	189	229	257	266	232	321	352.2	235	301	353	352	347	338	322	322	316	303	294	289	274
	Zimbabwe	30.8	30.1	25.2	23.2	29.8	25.7	16.9	20.5	49.93	-	-	-	-	-	-	69	-	-	-	-	-	64
	Average	96	91.1	64.3	70.5	80.8	80.8	71.1	90.6	105.2	87.4	102	141.3	140	139	135	99.8	132	132	129	101	106	111
Western Africa	Ghana	9.32	9.16	7.88	-	-	-	-	-	-	-	-	31	31	29	29	29	-	-	-	-	-	-
	Nigeria	11	14	9.64	12.3	15.8	11.5	10.3	7.36	9.905	7.94	9.8	214	215	196	189	188	188	183	169	166	164	180
	Average	10.2	11.6	8.76	12.3	15.8	11.5	10.3	7.36	9.905	7.94	9.8	122.5	123	113	109	109	188	183	169	166	164	180

Source: World Bank World Development Indicators (2021)

Figure 2.3: Depth of sub-Saharan Africa stock markets

2.7 MONETARY POLICY IN SOUTH AFRICA

2.7.1 Evolution of monetary policy in South Africa

The South African Reserve Bank (SARB), as the South African central bank, is authorised to implement monetary policy. Monetary policy frameworks have continually evolved since the 1960s. A number of frameworks have been implemented - shortcomings in one framework resulted in the adoption of a new framework. Between 1960 and 1981, the SARB concentrated on managing interest rates and credit through liquid asset requirements. In the period between 1981 to 1985, the De Kock Commission (1978) was tasked with the responsibility of evaluating the monetary policy framework. The Commission began by recommending the adoption of a preannounced monetary target range.

The De Kock Commission later advised the adoption of the cash reserves-based system, recommending that monetary targets be preannounced. This was implemented between 1986 and 1998, with a goal of managing the cost of holding cash reserves, which was achieved by the SARB regulating the discount rate. Casteleijn (2005) states that at this point, the short-term interest rate had become the primary tool of monetary policy due to its impact on overnight lending costs and market interest rates, resulting in decreases in the demand for credit. Next, the eclectic approach (the equivalent of mixed targeting discussed in section 2.2.4 during a transition period) was utilised between 1998 and 1999, and entailed tracking a number of different of indicators. These included fluctuations in bank lending, overall liquidity in the

banking sector, the yield curve, adjustments in official foreign reserves, changes in the Rands' exchange rate and movements in inflation and anticipated inflation. In 2000, the Reserve Bank introduced inflation targeting framework that used interest rates as the policy instrument to attain price stability. The timeline showing all the various monetary policy frameworks over time in South Africa is summarised in Table 2.2 below.

Table 2.2: Evolution of South Africa's Monetary Policy Framework

Years	**Monetary Policy Framework**
1960 – 1981	Framework based on liquid asset ratios with quantitative regulations governing interest rates and credit
1981 – 1985	Mixed targeting during transition period
1986 – 1998	Cost of cash reserves-based system with pre-announced monetary targets (M3)
1998 – 1999	Daily liquidity tenders through repurchase transactions (repo system), plus pre-announced M3 targets and informal targets for core inflation
2000	Formalised inflation targeting

Source: Casteleijn (2005)

2.7.2 Institutional arrangements of monetary policy in South Africa

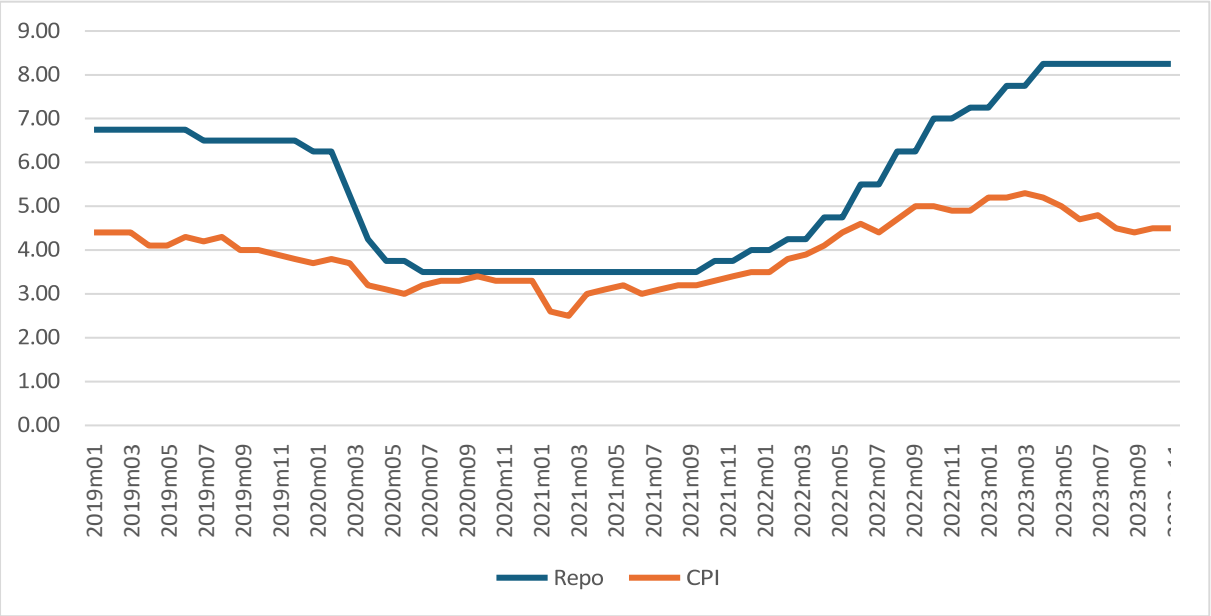
The SARB, founded in 1921, has had a significant level of independence. The autonomy of the SARB from any political interference is guaranteed by private ownership, as well as appointed non-executive board members. Moreover, the South African Reserve Bank Act (90 of 1989) stipulates the need for the SARB to remain independent. However, the role of government, which is outlined in the inflation-targeting framework (South African Reserve Bank Act 90, 1989), is to set the inflation target, by collaborating with the SARB. Practically, this means it is up to the government to set the goal of monetary policy to maintain coherence with other economic policy actions. Thus, although the SARB lacks "goal independence", it does possess "instrument independence" when working towards its objectives. This includes the SARB's authority to decide on the repo rate. However, the autonomy of the SARB in the foreign exchange market regarding instruments is limited, as it is the government that determines the extent of financial flow freedom in the local economy (Van Wyngaard, 2019).

The South African Reserve Bank Act (90 of 1989) goes into further detail to establish the individual autonomy of the SARB. It contains the appointment terms for the Governor, deputy

Governors, and all other board members. SARB's financial independence is also guaranteed as it has adequate financial resources for its operations and autonomy in budget management. Because the SARB has been given significant freedom in its operations, it must be held accountable for the decisions it makes. Bossu and Rossi (2019) emphasize that because central banks perform official duties that ultimately fall under the responsibility of government, it is essential to have strong oversight and transparency measures to balance out their significant level of independence. Therefore, for increased accountability, section 31 of the South African Reserve Bank Act (90 of 1989) requires the SARB to submit reports to the Minister of Finance regarding the execution of monetary policy. Additionally, the SARB is also required to provide monthly statements to National Treasury detailing its assets, liabilities, and financial statements.

Therefore, although the Bank has considerable autonomy, there are sufficient controls in place to guarantee its alignment with governmental policies and needs. Moreover, the SARB's accountability can be evaluated based on the government's inflation target. Although the SARB can influence the measures that target inflation, regulating inflation can be challenging as it is also heavily influenced by elements that are outside the reach of the SARB. Nevertheless, it is still responsible for its conduct and responses to both external and internal shocks to prevent triggering inflationary pressures (Bonga-Bonga, 2017).

Figure 2.4 below shows how the inflation rate responded to adjustments made to the repo rate from 2019 to 2023. This period was marked by significant, numerous adjustments to the repo rate. During this period, the SARB used countercyclical monetary policy in an attempt to stimulate economic activity during the lockdown period that started at the beginning of 2020. From the graph, it can be noted that CPI in South Africa generally does adjust, following movements in the repo rate. The SARB has therefore effectively managed to maintain inflation within the prescribed target range, demonstrating its capacity to execute monetary policy in line with its objectives. This means that the bank is successful at implementing its inflation-targeting framework. However, the question is often asked, as stated in chapter 1, if the SARB places too much emphasis on price stability at the expense of economic growth?



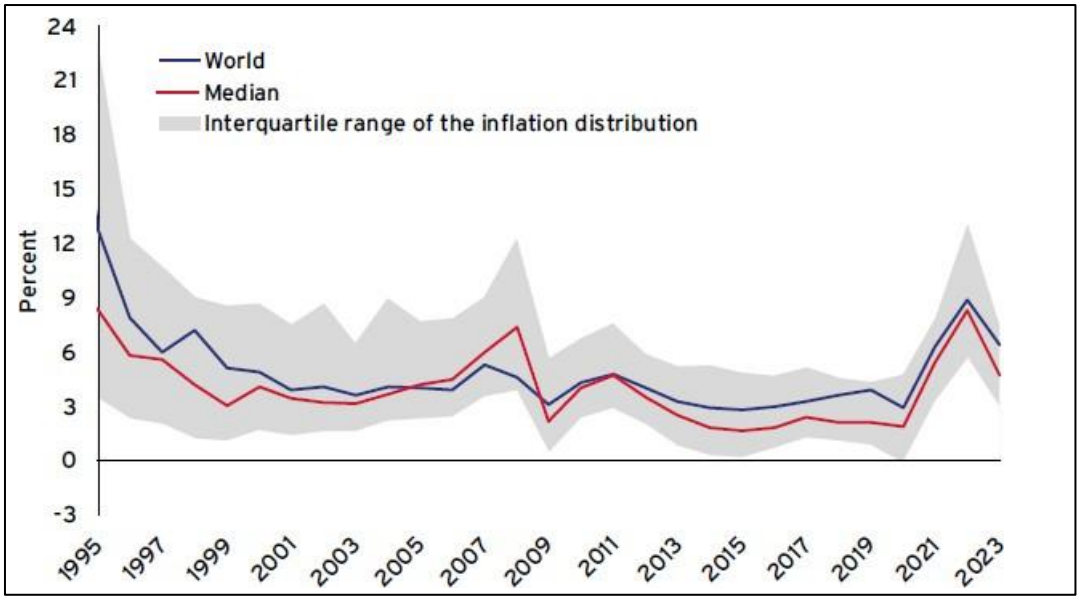
Source: Author's own compilation (Data from SARB, 2024)

Figure 2.4: Movement of CPI in response to the repo rate – 2019 to 2023

2.8 MONETARY POLICY DURING AND AFTER THE COVID-19 PANDEMIC

Central banks globally reacted to unprecedented economic challenges that came about as a result of the COVID-19 pandemic by implementing extensive and rapid policy measures, with the goal of avoiding prolonged economic fragility and reducing deflationary threats (English, Forbes and Ubide, 2021). Nevertheless, the sudden and surprising increase in demand post the pandemic, combined with disruptions in supply and geopolitical crises, resulted in inflation reaching unprecedented levels after many years. This led central banks, first in advanced and then emerging economies, to change policies by increasing interest rates sooner and more forcefully that expected, while also scaling back emergency programs related to the pandemic.

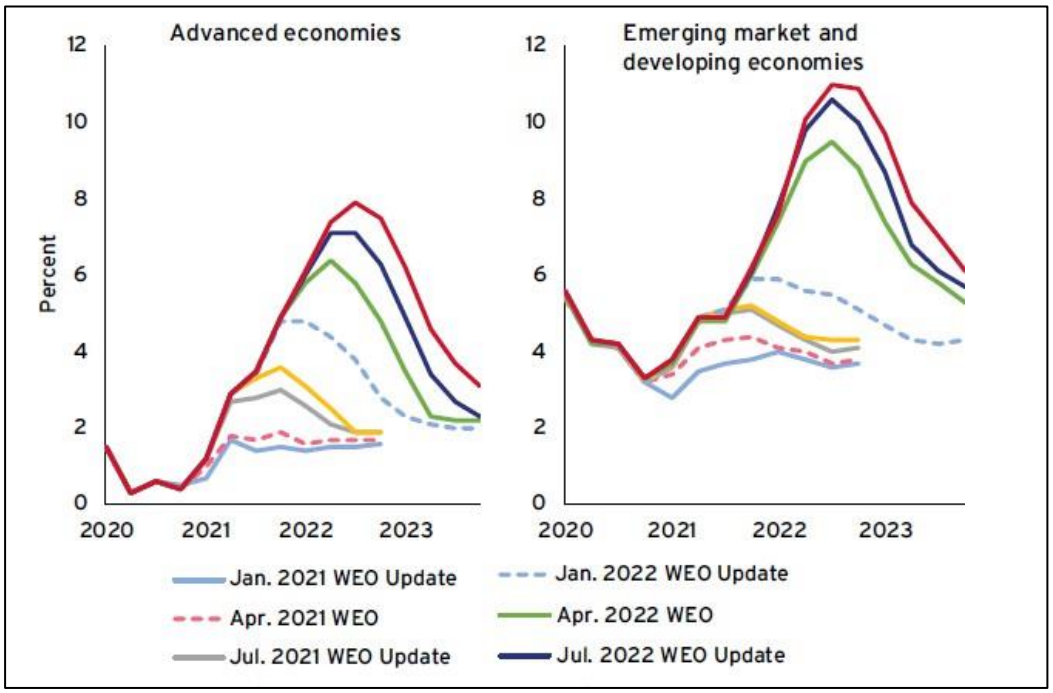
Figure 2.5 below shows how in 2022, inflation surged globally, posing a significant policy challenge. It sparked many investigations into not only the causes of inflation (such as Cerrato and Gitt, 2023) but also into the evaluation of the effectiveness of responses by monetary policy. Although inflation has been declining quite quickly and is expected to reach target levels again, there are still many economies that are yet to reach their targets (English, Forbes and Ubide, 2024). However, the strong policy response of most economies to the pandemic seems to have effectively prevented the long-lasting effects that occurred after the Great Recession, where employment and output remained low, and inflation stayed below target for years.



Source: English et al., (CEPR, 2024) – Data from IMF World Economic Outlook (2023)

Figure 2.5: World Consumer Price Inflation – 1995 to 2023

Economic models failed in forecasting the 2021-2023 spike in inflation (Koch and Noureldin, 2023). Figure 2.6 below shows that forecasts did not predict the sharp rise in inflation, with the forecast errors being both large and persistent. Some effects of the abrupt tightening in monetary policy on the actual economy are yet to be seen and might unfold in a unique manner compared to past situations (Smith and Nabil, 2024)



Source: English et al., (CEPR, 2024) – Data based on IMF World Economic Outlook (2022)

Figure 2.6: Inflation forecast vintages – January 2021 to October 2022

Therefore, although central bank actions in addressing the increases in inflation globally following the pandemic have been effective so far, the aggressive shift, first from expansionary and then contractionary monetary policy from 2021 to 2023, introduced new potential dangers (English et al., 2024). The sudden and forceful increases in interest rates are leading to financial strain for households, businesses and financial institutions; bankruptcies are rising rapidly, and housing sales have stalled in numerous countries (IMF, 2022). Many countries are facing deteriorating fiscal positions. Is it possible for central banks to have provided a smaller amount of stimulus in reaction to the pandemic, or withdrawn the stimulus earlier, leading to decreased inflationary pressure, hence allowing for less aggressive interest rate hikes but still supporting a complete recovery from the pandemic? Could the inclusion of asymmetric components in monetary policy have assisted in the modelling process?

2.9 CONCLUSION

Chapter 2 explored the development and evolution of monetary policy frameworks used around the world, and the evolution of monetary policy in South Africa, discussing both the history and institutional arrangements of the latter. Furthermore, the chapter discussed monetary policy in developed and emerging countries, with an emphasis on African countries, in an attempt to highlight the gaps in the financial structure of many African countries that hinder the effectiveness of monetary policy.

Developed economies can employ unconventional measures to address monetary policy shocks that developing economies do not have the capacity to adopt. Controlling inflation remains a challenge in every emerging market economy. The COVID-19 pandemic presented many challenges for both developed and developing economies, and economic forecasts failed to predict the spike in inflation that followed post the lockdown period, highlighting the need for improved economic modelling. The impact of decisions taken by monetary authorities during and after the pandemic has continued to affect households and businesses, and the potential risks may have a longer lasting effect on the global economy.

The chapter that follows details the theoretical framework which underpins the study. It discusses the monetary transmission mechanism in great detail, as well as presents the findings of previous empirical studies centred around the impact of interest rate shocks on both credit supply and aggregate demand, presenting the findings of previous research.

CHAPTER 3
LITERATURE REVIEW

3.1 INTRODUCTION

The primary objective of the study, set out in Chapter 1, is to model the asymmetric effects of interest rate shocks on both credit supply and aggregate demand in South Africa. In as much as a literature review is an important component of any study, this study in particular will require a thorough literature review as there has been much debate around the pass-through of monetary policy. This chapter begins by giving a definition of interest rate pass-through, followed by a discussion of the theoretical literature that underpins and frames the study. Due to the influence of both Keynesian and monetarist theories on monetary policy, the theories that will be considered include the Keynesian theory, the New Keynesian theory, the monetarist theory, collusive behaviour hypothesis, customer reaction theory and the theory of financial liberalisation. The key variation in these theories is in how they interpret what the reaction of monetary policy authorities should be in times of either full employment or in times of money supply expansion. Although the transmission mechanism of monetary policy falls under Keynesian Economics, it is discussed at length separately in order to outline the various channels that transmit adjustments made to monetary policy to the real sector.

Lastly, a critical analysis of previous empirical studies on the impact of interest shocks on both credit supply and aggregate demand concludes the section as it assists to gain a thorough understanding of existing literature, trends in existing literature, as well as assist in the modelling process.

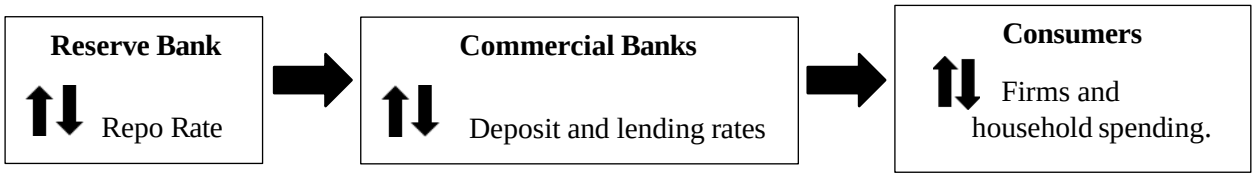
3.2 THEORETICAL FRAMEWORK

This section begins with a discussion of what interest rate pass-through entails, as it is a vital aspect of the study and affects the effectiveness of monetary policy. This is followed by a description of the transmission mechanism of monetary policy, and lastly, the theories that underpin the study are unpacked.

3.2.1 Conceptual definition: Interest rate pass-through

To be considered effective in achieving its goals, monetary policy must ensure that any changes made by the SARB to the policy rate (repo rate) are passed through or transmitted to other interest rates in the economy, such as lending and deposit rates, quickly and completely. This

process of transmission from the repo rate to other interest rates, which is embedded in the transmission mechanism of monetary policy, is what is described as interest rate pass-through. Therefore, if market interest rates do not change significantly after changes are made to the repo rate, this would suggest that monetary policy is ineffective, and thus the channels of the transmission mechanism (which are described in detail in section 3.2.2.) would not be operating at full capacity. The variations in the pass-through of interest rate that previous studies have found have either been slow/fast, incomplete/complete, more than complete, or symmetric/asymmetric (Grigoli and Mota, 2015). The diagram below assists in describing interest rate pass-through, from monetary policy, first to deposit and lending rates, and then to consumers and firms.

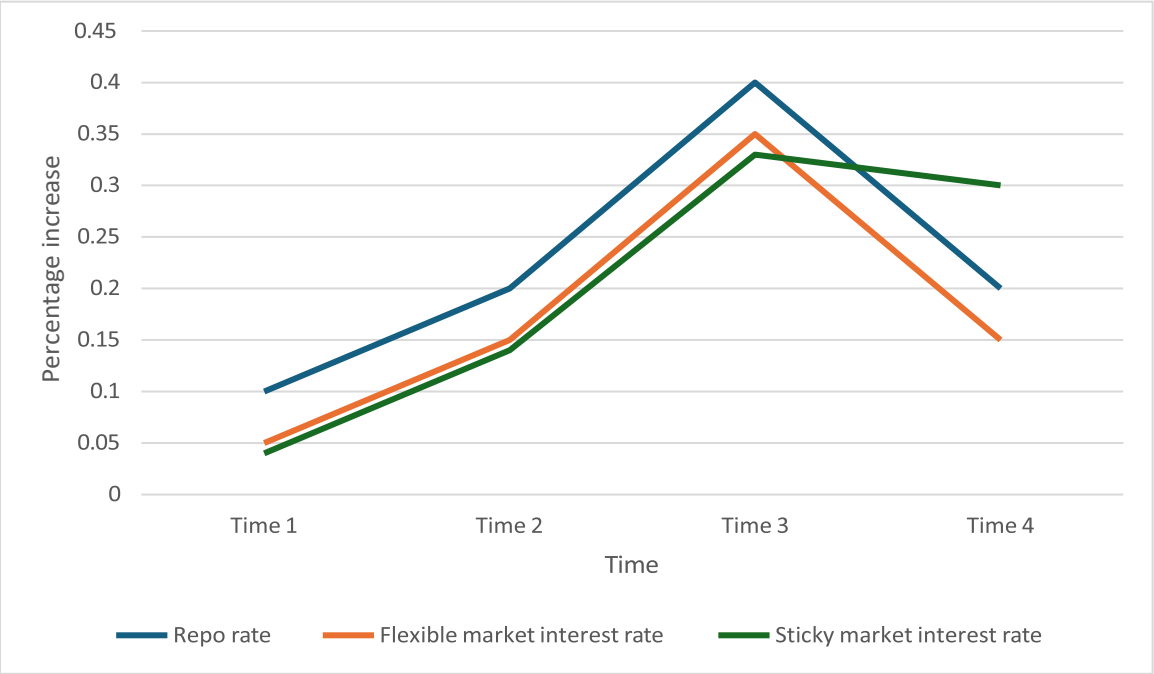


Source: Authors own compilation

Figure 3.1: Diagrammatic representation of interest rate pass-through

In literature, interest rate pass through is also described as "sticky" or "rigid" in a certain direction (Aziakpono and Wilson, 2013). These terms describe the response of market interest rates to adjustments in the repo rate. For instance, if an increase in the repo rate causes lending rates to increase by a significantly smaller degree of change, the market interest rates are described as "sticky" or "rigid".

The graph below illustrates sticky market interest rates. It goes on to illustrate asymmetries in interest rate pass-through. The graph depicts a fictional representation of the expectations of central banks when the decision is made to increase or decrease the repo rate (central bank expectations are represented by the red line, where the market interest rates increase and decrease as the repo rate increases or decreases). The green line represents a case of sticky market interest rates. In this instance, the graph shows how increases in the repo rate may cause the market interest rates to increase, and the pass-through can be described as near-complete. However, a decrease in the repo rate is not met by a "complete" decrease in the market interest rate. This is when the pass-through is described as asymmetric, meaning an increase and decrease in the repo rate are not transmitted by commercial banks to market interest rates to the same effect.



Source: Authors own compilation

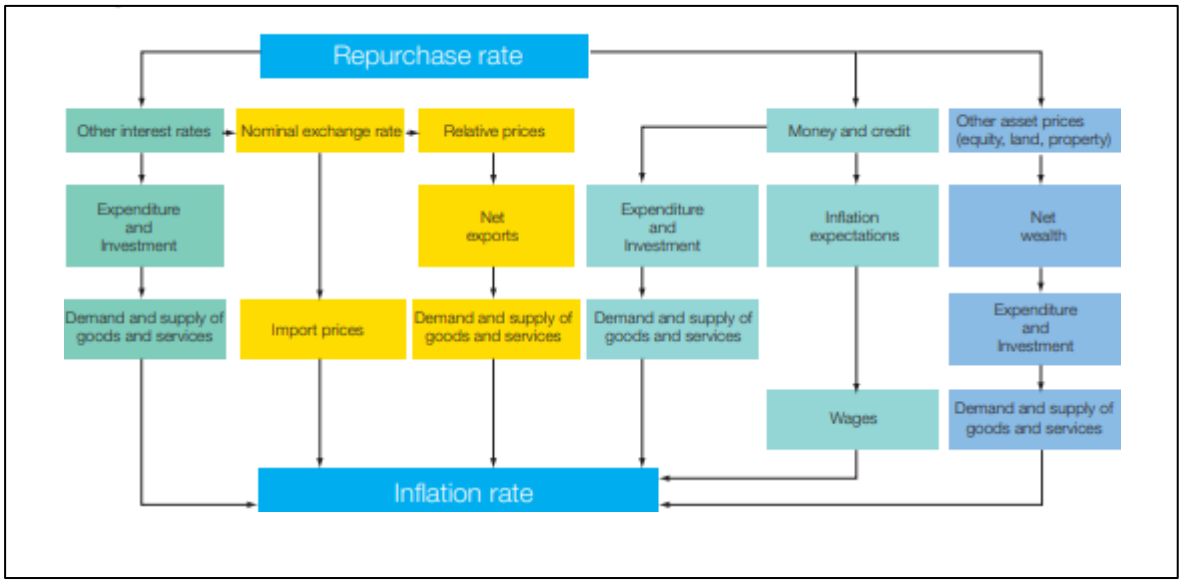
Figure 3.2: Illustration of sticky market interest rates and asymmetries in interest rate pass-through

3.2.2 The transmission mechanism of monetary policy

The transmission mechanism of monetary policy is a mechanism that explains exactly how any changes made by the central bank to the repo rate are passed on to prices, and thus inflation and economic activity. Put differently, the transmission mechanism describes the sequence of events that occur within an economy after any changes are made to the repo rate by the central bank. The mechanism plays a very important role in achieving the primary goal of the SARB of ensuring price stability and supporting economic growth (Mishchenko, Naumenkova and Mischchenko, 2021). However, it is equally important to remember that there exists a time lag between the adjustments to the repo rate being implemented and the impact of these changes being evident on inflation and price levels. These lags vary significantly, not only depending on the country of study, but also depending on the time at which the study is conducted. A paper by Smal and de Jager (2001) for the SARB estimated the lag for South Africa to be approximately one year. A more recent study by Mkhize (2019) also found that there is a significant lag of about 9 months between any monetary policy adjustments and the impact being evident on economic activity. Because there are such long lags, and also because the SARB makes changes to the repo rate as a reaction to actual, perceived or anticipated events,

the timing of these changes to the repo rate is crucial and must constantly be studied to ensure that it is yielding not only the desired effect, but the most effective outcome.

The diagram below shows the different channels through which changes to the repo rate eventually cause the desired effect on inflation and prices. Different authors categorise the channels of the transmission mechanism differently according to their understanding of the mechanism. Mishkin (1995) differentiated the channels into three; (1) the interest rate channel, (2) the other asset price channels, as well as (3) the credit channel (which can further be differentiated into the bank lending channel and the balance sheet channel).



Source: SARB Occasional Paper 16 (2001)

Figure 3.3: The transmission mechanism of monetary policy

The interest rate channel is summarised by Smal and de Jager (2001) using the chain reaction below:

$$\downarrow \text{repo} \rightarrow \downarrow \text{interest rates} \rightarrow (\uparrow I, \uparrow C) \rightarrow \uparrow y$$

Adjustments to the repo rate (in the case of the chain reaction above, a decrease in the repo rate) in theory lead commercial banks to decrease their lending rates to firms and households. The response of firms to the decrease in lending rates is to increase spending on investments, and households or consumers respond by increasing consumption. The increased spending by both households and firms would thus lead output to increase (or increased aggregate demand). Therefore, this study will test for the presence of asymmetries in output responses (aggregate

demand) to increases and decreases in the repo rate, and therefore consider if asymmetric components should be included in monetary policy.

The second channel is the asset price channel. This channel is increasingly recognised as a vital tool for reaching monetary policy goals, owing to the role it plays in the transmission of monetary policy (Adenkunle, Baba, Stephen, Ogbuehi, Idris and Zivoshiya, 2018). The assets described under this channel, apart from bond prices, are equities and foreign exchange. With regards to equities, monetary policy can impact the economy by influencing the value of stocks. For instance, when the Reserve Bank decreases the repo rate, investors are left with more disposable income which they may choose to spend on the stock market. When the demand for stocks increases, price increases. Therefore, an increase in the prices of stocks, as well as increasing investment spending would thus cause output to increase. Turning to foreign exchange, and using a similar example, a decrease in the repo rate causes the rand to become less desirable when compared to a stronger foreign currency (when it comes to deposits). A weaker rand would thus lead domestic goods to be cheaper than goods from foreign countries. Exports increase, leading output to increase (Adenkunle et al., 2018).

Lastly is the credit channel. Primarily, this channel works through its effects on bank lending (Smal and de Jager, 2001). Through the bank lending channel, alterations in monetary policy influence the lending behaviour of banks, by affecting the cost of borrowing (Hall, 2001). Because credit is mainly supplied by banks, any decreases in the repo rate cause bank reserves to increase. This leads to increases in the loans given out by banks, meaning both investment and consumption will increase, and therefore output increases. The chain reaction is illustrated below. As with the interest rate channel, this study will be testing for the asymmetric impact of increases and decreases in the repo rate on credit supply. Thus, when the repo rate is decreased and credit supply increases, how does this increase compare to repo rate increases that lead to credit supply decreases?

$$\downarrow \text{repo} \rightarrow \uparrow \text{bank deposits} \rightarrow \uparrow \text{bank loans} \rightarrow (\uparrow I, \uparrow C) \rightarrow \uparrow y$$

Section 3.2.3 that follows discusses the theories that frame the study. These theories include Keynesian economics, the New Keynesian theory, the monetarist theory, collusive behaviour theory, customer reaction hypothesis and the theory of financial liberalisation.

3.2.3 Keynesian Economics

Keynesian Economics is described by Alan Blinder (2008) as a theory of total spending in the economy, which explains what the effects of this total spending, or aggregate demand, are on both output and inflation. The Keynesian theory came about after the Great Depression which occurred in the 1930s. It is named after John Maynard Keynes, who criticised the neoclassical view, arguing that if economies really did self-correct, the Great Depression would not have occurred in the first place (Keynes, 1936). Keynes thus believed that aggressive government action is required in order for an economy to be stable (Blinder, 2008). Blinder further asserts that, to Keynesians, the focus of expansionary fiscal policy is to decrease unemployment, rather than primarily addressing inflation.

In the short term, as Thomas Palley (2015) notes, expansionary fiscal policy does indeed cause demand to increase, therefore preventing prolonged economic downturns. This is possible because spending by government is a perfect substitute for private spending. And because the Keynesian model includes a multiplier effect, output is then believed to change by a multiple of whatever the increase in government spending is (Jahan, Mahmud and Papageorgiou, 2014). However, increasing government expenditure means that the revenue collected by government must be increased, and this implies increased taxes to fund this increased government expenditure (apart from increased borrowing), leading to unwanted supply-side tax effects which are not taken into account by the Keynesian theory (Palley, 2015). In South Africa, for example, because government debt has reached unsustainable levels, the fiscal position has greatly deteriorated and the fiscal multiplier was reported to be around zero in 2019 by the SARB (Janse van Rensburg, de Jager and Makrelov, 2021).

Keynesian economists similarly argue that a significant connection exists between money supply and GDP (Hlongwane and Daw, 2022). They anticipate interest rates to drop when the amount of money available for loans through the banking sector is increased. Lowering the interest rate frequently causes overall spending on investments and goods that are affected by interest rates to increase, causing a notable growth in GDP. Consequently, real GDP can be indirectly impacted by monetary policy. However, Keynesians still question the efficacy of monetary policy. As mentioned by Hansen (1951), they claim that boosting economic policies that specifically target increasing bank reserves will not always lead to increases in money supply due to banks having the option to decline lending out their extra funds (which one can argue to be a theoretical justification for asymmetries of the impact of interest rate shocks on

aggregate demand, stated in chapter 1). Moreover, they argue decreasing interest rates may not always lead to a rise in overall investment, and that consumption may remain unaffected by interest rate cuts (Kikulwe and Asindu, 2020). Keynesians therefore prioritize fiscal policy over monetary policy because they argue that it has a more immediate impact on output, placing less importance on the efficiency of the latter.

Following the criticisms of Keynesian economics with regards to supply-side tax effects, authors have advocated for a structural Keynesian approach (Palley, 1998 and 2012). The main argument behind the structural approach is that in order to reach full employment, only managing the demand side of the economy is not enough. Economies ought to have structural policies in place that target concerns around the bargaining power in labour markets as well as globalization and its effects on the output of an economy. The structural Keynesian approach could prove useful, particularly for emerging countries like South Africa that are still face many structural issues that no fiscal policy alone can solve. However, Foster and McChesney (2010) criticised the structural approach for being "too optimistic". These authors argue that capitalism has in itself the propensity to lead to stagnation with regards to unemployment and inequality, which is a problem that simply using fiscal policy will not address. Therefore, there is a question of whether fiscal policy has the ability to fix structural imbalances that are deeply rooted.

Although there are a number of criticisms of the Keynesian theory, the key take aways for this study are that Keynes argued that during economic downturns, instead of waiting for the markets to self-correct, intervention is required in the short run to avoid extending the issue and relying on it to resolve itself over time, with his well-known quote, "In the long run, we are all dead" (Keynes, 1923:80). Keynes also advocated for countercyclical fiscal policy, which is widely used by economies worldwide, including the South African economy.

3.2.4 New Keynesian Theory

The New Keynesian approach developed as an extension of the traditional monetary theory by Keynes. The key difference between traditional Keynesian economics and the New Keynesian theory is that the latter focuses on the credit market, and the role of financial intermediaries, as opposed to the money market (Bertocco, 2004). New Keynesian economists refuse the perfect conditions and perfect elasticity of prices and wages (Hic, 2019). Instead, the theory argues that the presence of imperfect competition, and sticky or rigid prices and wages leads to a lack of effective demand and coordination failure in the market. Put simply, the theory indicates that

business cycles occur due to nominal wages and prices adjusting slowly to changes in aggregate demand.

The objective of New-Keynesian economics is to clarify why price level adjustments are slow to occur, or put differently, why price alterations do not reflect shifts in aggregate demand. Gordon (1990) contends that New-Keynesian economics fundamentally revolves around monopolistically competitive firms that perceive real sales levels as a constraint, leading them to establish their own individual prices, unlike classical economics, which features competition and price-taking firms that determine output decisions.

Unlike the Keynesian theory, the New Keynesian theory emphasizes the important role that monetary policy plays on an economy. The theory stresses the significance of monetary policy in controlling economic fluctuations, and highlight the fact that central banks, through their control of nominal interest rates, can indeed impact aggregate demand and inflation (Woodford, 2000). Because of its reference to sticky prices and wages, the New Keynesian theory recognises that the impact that monetary policy has on economic variables can be nonlinear, as the effects of policy changes are not always symmetric (Clarida, Gali and Gertler, 1999). This concept of prices and wages being sticky downward and flexible upward, which the New Keynesian theory suggests, forms the foundation for analysing asymmetries in the impact of monetary policy.

Although the macroeconomic implications of sticky prices can be quite severe, Greenwald and Stiglitz (1993) argue that even if prices and wages were not sticky, but perfectly flexible, volatility of output and employment would still be inevitable due to other causes of market failure such as incomplete contracts.

3.2.5 Monetarist Theory

High rates of inflation in developing nations are known to hinder economic growth. Numerous theories seek to explain causes of inflation. Monetarists are of the opinion that spikes in inflation occur because of increases in money supply (Danlami, Hidthiir and Hassan, 2020). This opinion is based on the assumption that money supply, which is the total amount of money in an economy, is only used as a medium of exchange. While the Keynesians believed that fiscal policy was more effective than monetary policy, monetarists are generally sceptical of the effectiveness of fiscal policy. The reality is that government spending that is funded by government borrowing and taxes, without being paired with expansionary monetary policy,

results in the crowding out effect, while causing only a slight rise in aggregate demand (Friedman, 1968).

Monetarists, however, go as far as to believe that the main focus of monetary policy should be targeted at money supply growth rate in order to attain its objectives (Jahan and Papageorgiou, 2014). This school of thought greatly assisted to lower inflation both in the UK and the US in the 1970s, when US inflation rates had reached highs of about 20 percent (as discussed in chapter 2). Monetarism and the ideas of Milton Friedman faded in the decades that followed the theory's inception, as most economic theory truly is a product of its time. However, there are some insights from monetarism that are still adopted by non-monetarist economists today.

In particular, Milton Friedman identified two significant results that monetary policy can produce. To begin with, monetary policy is able to control money supply, thus avoiding it from causing any disruptions in the economy (Jung, 2024). If economies did not have monetary authorities overseeing the supply of money, this could lead to significant economic crises. Additionally, monetary policy has the ability to establish a stable framework and environment for an economy to function within. It reassures the public that the market works, and that prices will not change significantly in upcoming times, as monetary policy aims to maintain inflation at the target level, thus supporting a stable economic environment.

3.2.6 Customer Reaction Theory versus Collusive Behaviour Hypothesis

The customer reaction theory and the collusive behaviour hypothesis are two opposing theories that were formulated as a result of the variation in results obtained in literature with regards to the asymmetric pass-through of monetary policy. The customer reaction theory describes a situation where commercial banks respond to decreases in the repo rate by adjusting their lending rates downward, but are reluctant to increase their lending rates following repo rate hikes (Matemilola, Bany-Arrifin and Muhtar, 2015). Banks do this for fear of what their customers' reactions may be to increases in interest rates, hence the name customer reaction theory. Matemilola et al. (2015) studied the pass-through of the money market rate to bank lending rates. The results suggested that commercial banks in South Africa do adjust their lending rates downwards following decreases in the repo rate. However, lending rates appeared to be rigid upwards, thus aligning with the customer reaction theory.

Conversely, other studies have found that with regards to deposit rates, banks adjust their deposit rate downwards faster than they adjust them upward. This describes the collusive behaviour hypothesis, where banks that have collusive arrangements with their competitors are

willing to rapidly lower their deposit rates following repo rate cuts, but are however sluggish to raise their deposit rates following repo rate hikes (Scholnick, 1996).

3.2.7 The theory of financial liberalisation

The impact of financial liberalisation on the economic growth was first documented by McKinnon (1973) and Shaw (1973), who emphasized that in order for repressed economies to develop, the removal of controls targeted at the flow of money and credit is necessary (Ramanathan and Samuel, 1998). While financial liberalisation has brought immense success for some countries, others have been met by failure. There are various authors who have argued against the theory of financial liberalisation. Arestis and Demetriades (1999), for instance, argued that the financial liberalisation theory, although believed in theory to promote economic development, created many problems as it was developed around assumptions of perfect information and perfect competition.

It is now generally agreed upon that for financial reforms to be successful, various factors play a role, for example how the reforms are implemented, what constitutes the reform programme, as well as whether or not the macroeconomic environment of the country in which the reforms are being implemented is conducive to accepting the reform process. This last point is especially important for developing countries to consider, as macroeconomic policy is not a "one-size-fits-all" for all economies. Special considerations must be taken into account, as what may have worked for one country may not work for another. However, there is much evidence in support for financial liberalisation. The International Monetary Fund (IMF) recently conducted a study on 33 developing and emerging countries, finding that monetary policy was more effective in countries that have more advanced financial systems (Deb, Estefania-Flores and Furceri, 2023).

All theories considered, the manner in which monetary policy operates is complex, and is affected by various financial and structural components of an economy. The interpretation provided by the aforementioned theories has greatly assisted in explaining, or rather decoding some of this complexity, albeit some theories are a product of their time. Having examined the different theories, the section that follows discusses the findings obtained by previous studies, which are used to guide the methodology in Chapter 4.

3.3 EMPIRICAL LITERATURE

The body of literature on the asymmetries of monetary policy has grown in recent decades. Although evidence from economic literature shows that monetary policy does indeed affect aggregate demand, and therefore inflation, there is much debate around the asymmetric effects of monetary policy. Previous research shows varying degrees of interest rate pass-through, first across countries, but also depending on time of study. This section is divided into two parts: the first part looks at literature dealing with the impact of interest rate shocks on credit supply, and second, literature dealing with the impact of interest rate shocks on aggregate demand.

3.3.1 Credit supply

Findings in literature indicate that there is contrasting empirical evidence on the asymmetric impact of interest rate shocks on the supply of credit. Differences seem based on the country of study, as well as the time at which the study is conducted. Beginning with a highly developed market, Chang and Jansen (2005) analysed the asymmetric effects that result from monetary policy transmission in the USA. The paper provided evidence that the role played by banks in the transmission mechanism of monetary policy is crucial. Although the study found that asymmetries are present – meaning the effects of contractionary and expansionary monetary policy on bank lending is different – the study concluded that in the US, for the period 1976 to 1993, the asymmetric responses of lending rates to monetary policy did not contribute significantly to the varying responses of output.

In contrast, a more recent study also conducted in the US by Perez-Orive, Timmer and van der Ghote (2023) found the opposite – the reaction of macroeconomic aggregates, like employment and investment by firms, was found to be stronger with regards to contractionary monetary policy, as opposed to expansionary monetary policy. This was attributed to asymmetries of the credit channel. Therefore, evidence from empirical studies on the asymmetries of interest rate shocks is indeed time dependent as the two studies done on the same country (but covering different time periods) found contrasting results.

Zooming in on South Africa, an increasing amount of literature discusses monetary policy, its effectiveness and asymmetries. Aziakpono, Wilson and Manual (2007) studied interest rate pass-through using data from 1973 to 2004, and with the repo rate as the monetary policy variable. The study found weak evidence of asymmetries, and results showed that the pass-through of monetary policy to other interest rates (lending rate and deposit rates), was complete and fast. These results confirmed those obtained by De Angelis, Aziakpono and Faure (2005)

whose study period overlapped that of Aziakpono et al. (2007) who also found that interest rate pass-through is mostly complete in South Africa, using data from1983 to 2004.

Matemilola et al. (2015), however, found contrasting results for South Africa. Their study spanned from 1978 to 2012, and the findings suggested that commercial banks lower their lending rates following decreases in the repo rate, but lending rates appeared to be sticky upwards. The paper goes into the detail of how the structure of the banking industry in South Africa changed after Apartheid, to become one that is more competitive, with a number of foreign banks opening branches in the country (Banking Association of South Africa, 2012). Thus, as with the US, empirical findings in South Africa also vary depending on the time the study is conducted, as banks operate in a macroeconomic environment which is ever changing. The table below summarizes the empirical literature discussed in this section.

Table 3.1: Summary of empirical findings on credit supply

Author(s)	**Country**	**Model**	**Data Frequency**	**Key Findings**
Chang, J. and Jansen, D. (2005)	USA	Nonlinear VAR	Quarterly data (1976Q1 to 1999Q3)	The findings showed that the asymmetry in bank lending responses to monetary policy does not significantly help explain why output responds differently to contractionary and expansionary policy.
Perez-Orive A. et. al (2023)	USA		Quarterly data (1990Q1 to 2021Q4)	Employment and investment by firms responds strongly to contractionary monetary policy, but not as strong to expansionary monetary policy; the paper attributed this to the

				asymmetries in the credit channel.
Aziakpono et al. (2007)	South Africa	Asymmetric ECM	Monthly series (Jan-1973 to Aug-2004)	The study found weak evidence of asymmetry. Long-run pass through was very high and the speed of adjustment of market rates to changes in the repo rate was found to be very fast.
De Angelis et al. (2005)	South Africa	Guisa (2001) mixed dynamic model	Monthly series (Mar-1983 to Nov-2004)	Results showed that pass-through was mostly complete for all interest rate studied.
Matemilola et al. (2015)	South Africa	Momentum threshold autoregressive and asymmetric error correction models	Monthly series (Jan-1978 to Dec-2012)	Commercial banks were found to adjust their lending rates downwards, yet the lending rates appear sticky or rigid upwards; customer reaction hypothesis.

3.3.2 Aggregate demand

Empirical evidence on the impact of interest rate shocks on aggregate demand has also been found to vary. In Egypt, Abdelsalam (2018) used non-linear autoregressive distributed lag (NARDL) to analyse the effect of unanticipated monetary policy shocks on inflation and aggregate demand. The findings suggested that only small monetary policy shocks have sizeable impacts on both inflation and aggregate demand. Concerning the direction of policy changes, the results further suggested that positive shocks had significant impacts on both variables of interest, with the Wald test confirming this result. The study thus concluded that monetary policy in Egypt was effective only under certain circumstances, as there was sufficient evidence showing the asymmetric effect of monetary policy in Egypt. Staying with

emerging economies, Bayat et al. (2021) analysed the impact of monetary policy shocks on output in BRICS countries (Brazil, Russia, India, China and South Africa). The findings confirmed that the impact of monetary policy on output in these countries is not symmetrical.

Deb et al. (2023) went a step further by conducting a comparison of the heterogeneity in monetary policy transmission across a number of different countries. Specifically, the paper compared the transmission of monetary policy in 33 developed and emerging economies. The study notes the difficulties that come with isolating responses of the macroeconomic variables of interest to monetary policy and away from other exogenous factors. The findings suggested that monetary policy transmission occurs most effectively in countries that have financial systems that are more developed. The paper also found that the transmission of monetary policy is stronger when the decisions of monetary policy authorities are coordinated with those of fiscal policy authorities – therefore, when both policies move in the same direction.

In order to test if monetary policy transmission is indeed more efficient in developed markets, Hendricks and Kempa (2008) addressed the question of whether monetary policy is transmitted symmetrically or asymmetrically by the European Central Bank. The findings showed that heterogeneity in the transmission of monetary policy is indeed present in the Euro area, particularly in Netherlands and in the UK. Table 3.2 below summarises the studies discussed in this section, as well as their findings.

Table 3.2: Summary of empirical findings on aggregate demand

Author(s)	**Country**	**Model**	**Data Frequency**	**Key Findings**
Abdelsalam M. (2018)	Egypt	NARDL (Wald test)	Monthly series (Jan-2002 to Aug-2016)	The study found evidence supporting the notion of asymmetric effects of monetary policy on inflation and output.
Bayat, T., Tutgun, S. and Tasar, I. (2021)	BRICS	Hidden panel data method	Annual data (1997 to 2019)	The impact of monetary policy on output is not symmetrical.
Deb, P. et al. (2023)	33 advanced and	Hidden panel data method	Quarterly data (1991 Q2 – 2023 Q2)	Across the different countries, it was found that monetary policy is

	emerging markets			more effective in nations with flexible exchange rate systems, advanced financial structures and trustworthy monetary policy frameworks.
Hendricks, T. and Kempa, B.	The UK, Italy, France, Netherlands and France.	Markov switching model		Heterogeneity of monetary policy transmission was found in both Netherlands and the UK; provided convincing reason as to why European Commission actively pushes for financial markets to further be liberalized.

The contrasting findings in literature regarding the asymmetric impact of interest rate shocks on credit supply and aggregate demand underscore the complex and context-dependent nature of monetary policy transmission. Studies across different countries, such as the USA and South Africa reveal that the effects of interest rate changes can vary based on time periods and the structural characteristics of financial systems. This variability emphasizes the importance of considering structural factors when analysing the effectiveness of monetary policy, especially in diverse economic environments. Furthermore, these contrasting findings stress the need for tailored monetary policy strategies that account for the unique characteristics of each economy.

3.4 CONCLUSION

This chapter began by providing a comprehensive definition of interest rate pass-through, followed by an exploration of the theories forming the foundation of the study. Numerous theories were discussed, including the Keynesian theory, the New Keynesian theory, monetarist theory, collusive behaviour hypothesis, customer reaction theory and the theory of financial liberalisation. The transmission mechanism of monetary policy, although rooted in Keynesian economics, was also discussed separately and in detail, with the different channels being

dissected to get a better understanding of how changes made by the Reserve Bank to monetary policy impact economic activity. Lastly, a critical analysis of the previous studies around the impact of interest rate shocks on both credit supply and aggregate demand concludes the chapter. This analysis aids in understanding existing trends and debates within existing literature, while also contributing to the modelling process.

The next chapter outlines the econometric methodology employed by the study to achieve its secondary objectives; to estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to both credit supply and aggregate demand in South Africa.

CHAPTER FOUR
RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

Monetary policy is vital in facilitating the creation of jobs and boosting economic growth, mainly by ensuring price stability within the economy (Anyanwu, 2014). The empirical literature in the previous chapter proves that, for many countries, including South Africa, there is evidence of asymmetries in the pass-through of monetary policy from the repo rate to market interest rates, ultimately affecting firms and household spending. The empirical literature also validates that there is a gap that exists in South Africa to evaluate the efficiency of monetary policy during the COVID-19 pandemic, studying if the asymmetries in the transmission of monetary policy are significant enough to warrant asymmetric components being included in monetary policy decisions. The primary objective of this study is to ascertain the asymmetric effects of interest rate shocks on credit supply and aggregate demand in South Africa, and this is done with the aim to provide evidence-based policy recommendations for unlocking South Africa's growth prospects from the monetary policy perspective.

In pursuit of the aim above, chapter 4 outlines the methodology employed in an attempt to achieve the study's objectives, which are to estimate the degree of symmetry and completeness of interest rate pass-through from the repo rate to both credit supply and aggregate demand in South Africa. To achieve these objectives, the chapter begins by describing the research design utilised by the study. The sources used to obtain data for the study are listed, followed by model specification and tables that describe the variables, as well as their expected signs for both models run by the study. The estimation technique and procedures are also discussed. Next, the chapter provides an explanation of the importance of running unit root tests (the study runs two unit root tests) on each of the variables used. Lastly, the chapter presents a comprehensive definition of the complete set of diagnostic tests to be run. These include tests for multicollinearity, heteroskedasticity, autocorrelation and stability tests.

4.2 RESEARCH DESIGN

The study is quantitative in nature. It takes on a correlational research design. The primary objective of correlational research is to evaluate and quantify a hypothesised relationship between the variables of interest (Mishi and Maredza, 2024). It thus explains, for instance, by

how much variable “y” will change when variable “x” changes (in this case, by how much aggregate demand and credit supply change when the repo rate changes).

It must be noted that a correlational research design does not test for the cause-and effect relationship between variable, but rather the strength and/or direction of such a relationship (Devi, Lepcha and Basnet, 2023). It is a non-experimental research approach, utilised to examine the relationship between variables through statistical analysis.

4.3 MODEL SPECIFICATION AND VARIABLES

This study makes use of the nonlinear Autoregressive Distributed Lag (NARDL) model adopted from Shin and Greenwood-Nimmo (2014). NARDL decomposes the interest rate shocks into positive and negative components, in order to test if increases in the repo rate exhibit the same effect on the dependent variable as decreases in the repo rate of the same magnitude. Shin and Greenwood-Nimmo (2014) argue that the NARDL model is often preferred over other models that account for symmetric responses to interest rate changes due to its flexibility and ability to model both short-term and long-term asymmetries simultaneously. Unlike other models, it allows for the distinction between positive and negative shocks to both the short-run and long-run dynamics of the variables involved.

For better regression, the monetary policy variable used as a proxy variable for the repo rate is the Johannesburg Interbank Average Rate (JIBAR). The JIBAR is a money market interest rate that is used in South Africa, which reflects the rate at which banks lend to each other in the interbank market, typically for periods ranging from overnight to 12 months. Similarly, the repo rate is the rate at which the SARB lends to commercial banks for short-term borrowing. The repo rate and JIBAR are closely related because the repo rate sets the baseline for the interest rates in the money market, including interbank rates. As a result, JIBAR tends to move in tandem with changes in the repo rate. JIBAR is easily accessible, published daily and is used as a benchmark in financial markets in South Africa. This makes JIBAR a practical choice as a proxy for modelling or financial analysis as it is highly responsive to the market’s perception of central bank policy. The responsibility for administering the JIBAR, as well as maintaining its integrity, rests on the SARB.

The study runs two models to model the asymmetric effects of interest rate shocks on (1) credit supply to corporates and (2) aggregate demand.

Model 1:

Mathematical equation:

$$CSC = f(JIBAR, BSI, FSI, rGDP, GDI) \quad \textbf{(4.1)}$$

Econometric equation:

$$CSC_t = \beta_0 + \beta_1 JIBAR_t + \beta_2 ROE_t + \beta_3 LC_t + \beta_4 DEBT_t + \beta_5 PI + \beta_6 GINF_t + \varepsilon_t \ldots \quad \textbf{(4.2)}$$

BSI FSI rGPD GDI

Through the NARDL model, the JIBAR is decomposed into a partial sum of its positive and negative changes. These partial sums are included as separate regressors in the model. The final NARDL model is thus as follows:

NARDL model:

$$CSC_t = \beta_0 + \beta_1 JIBAR\_POS_t + \beta_2 JIBAR\_NEG_t + \beta_3 ROE_t + \beta_4 LC_t + \beta_5 DEBT_t + \beta_6 PI_t + \beta_7 GINFL_t + \varepsilon_t \quad \textbf{(4.3)}$$

In model 1, CSC is the dependent variable and denotes credit supply to corporates. Included in the model as the independent variable of interest is JIBAR, which is the Johannesburg Interbank Average Rate and is a proxy for the repo rate. The supply of credit is, however, affected by a variety of other factors apart from the interest rate. There are two variables which are included under BSI, which stands for "Banking Sector Indicators. These are ROE, an acronym for Return on Equity, and LC, an acronym for Liquidity Coverage. FSI stands for "Fiscal Sustainability Indicator" and is represented in the econometric equation as DEBT. rGDP is a measure of real GDP and is represented in the econometric equation as PI, which stands for Production Index and is used as a proxy for GDP. GDI stands for Global Development Indicators and is represented in the econometric equation as GINF, which is Global Inflation.

Table 4.2 below explains what each of the variables in the econometric equation of models 1 are, as well as the signs expected.

Table 4.2: Description of variables and expected signs – Model 1

Symbol	Variable	Indicator of	Expected sign
CSC	Credit supply to corporates/firms	Volume of corporate/firms credit supply	N/A
JIBAR	Johannesburg Interbank Average Rate	Proxy for repo rate – a monetary policy variable	+/-
ROE	Return on Equity	Profitability of banks	+
LC	Liquidity Coverage Ratio	Exposure to liquidity risk	+
DEBT	Public Debt/Tax Revenue	A measure of fiscal stability or fiscal risks	-
PI	Production Index	Proxy for GDP – indicator of the macro-environment in which banks operate.	+
GINF	Global Inflation	Global financial constraints	-

Model 2:

Mathematical equation:

$$AD = f(JIBAR, BSI, GFCF, LP, FSD, OPEN) \quad \textbf{(4.4)}$$

Econometric equation:

$$AD_t = \beta_0 + \beta_1 JIBAR_t + \beta_2 GFCF_t + \beta_3 LP_t + \beta_4 FSD_t + \beta_5 OPEN_t + \varepsilon_t \quad \textbf{(4.5)}$$

Similar to model 1, NARDL will decompose the JIBAR into its partial sums, and these partial sums are included in the model as separate regressors. The final NARDL model is thus as follows:

NARDL model:

$$CSC_t = \beta_0 + \beta_1 JIBAR\_POS_t + \beta_2 JIBAR\_NEG_t + \beta_3 GFCF_t + \beta_4 LP_t + \beta_5 FSD_t + \beta_6 OPEN_t + \varepsilon_t \ldots \quad \textbf{(4.6)}$$

In model 2, AD is the dependent variable and denotes aggregate demand. Included in the model as the independent variable of interest is JIBAR, which is the Johannesburg Interbank Average Rate and is a proxy for the repo rate. As with the supply of credit, there are various factors other than the interest rate that affect aggregate demand, and must therefore be included in the model.

GFCF is Gross Fixed Capital Formation. LP denotes Labour Productivity, and FSD is a measure of Financial Sector Development. Finally, OPEN denotes trade openness. Table 4.3 below explains what each of the variables in model 3 are, what they indicate as well as what their expected signs are.

Table 4.3: Description of variables and expected signs – Model 2

Symbol	Variable definition	Indicator of	Expected sign
AD	Aggregate Demand	Economic Growth	N/A
JIBAR	Johannesburg Interbank Average Rate	Proxy for repo rate – a monetary policy variable	+
GFCF	Gross Fixed Capital Formation	AKA Investments, defined as the acquisition of new assets	+
LP	Labour Productivity	Output per worker	+
FSD	Financial Sector Development Index	M3/GDP – Indicates how developed the financial sector is	+
OPEN	Trade Openness	(Exports + Imports)/GDP	+

4.4 DATA SOURCES AND SAMPLING

The primary objective of the study is to model the asymmetric impact of interest rate shocks on credit supply and aggregate demand in South Africa. Various factors influence the credit supply in any country, apart from the repo rate. Many of these factors have to do with the profitability and efficiency of banks (as the main suppliers of credit), as well as how the global economy as a whole is performing.

The study uses data obtained from the SARB with the exception of one variable, Global Inflation (GINFL), which is sourced from the World Bank. Potential biases are often of concern when it comes to public datasets. However, as the central bank, the SARB is known to collect and report economic and financial statistics that are not only of high quality, but also reported on against international best practice as they are used to make policy decisions for the economy as a whole (SARB, 2024). The World Bank also produces data that is reliable, as it is an institution that follows globally recognised guidelines and approaches to guarantee accuracy. For model 1, the study makes use of monthly data, which covers the period from January 2019

to December 2023 (having a total of 60 observations). For model 2, the study uses quarterly data, which covers the period from 2016 Q1 to 2023 Q4 (having a total of 32 observations).

It is essential to note that because GDP data is only available in yearly and quarterly series, Production Index (PI) is thus used as a proxy for monthly GDP. In foreign studies, industrial production is often used as a proxy variable for monthly GDP (Cuche and Hess, 1999; Stanger, 2020). Although GDP measures overall economic output including services and government spending, production index can be a useful indicator, providing valuable insights into economic trends (Sedillot and Pain 2003).

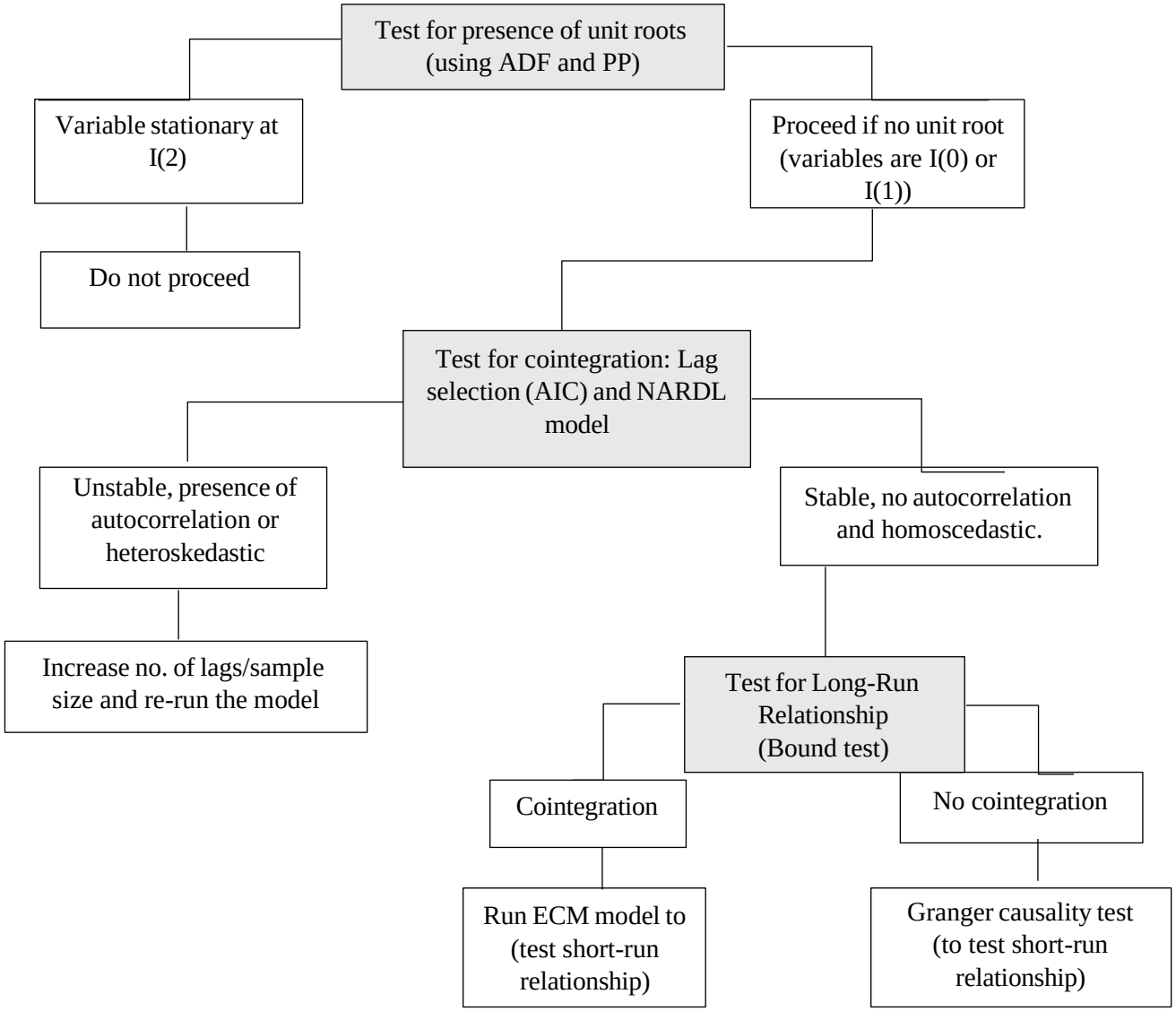
Table 4.1: Description of variables and data sources

Symbol	Variable definition	Indicator of	Units of measurement	Source
CSC	Credit supply to corporates/firms	Volume of corporates credit supply	R millions	SARB
AD	Aggregate Demand (Proxied by unemployment rate)	Demand of final goods and services	Rate	SARB
JIBAR	Johannesburg Interbank Average Rate	Proxy for the REPO rate	Rate	SARB
ROE	Return on Equity	Profitability of banks	Ratio	SARB
LLC	Liquidity Coverage Ratio	Exposure to liquidity risk	Ratio	SARB
LDEBT	Public Debt-GDP ratio	Crowding out effect	Ratio	SARB
LPI	Production Index	Proxy for GDP monthly	R millions	SARB
GINFL	Global Inflation	Global financial constraints	Rate	World Bank
LGFCF	Gross Fixed Capital Formation	AKA Investments, defined as the acquisition of new assets	R millions	SARB
LLP	Labour Productivity	Output per worker	Index	SARB

FSD	Financial Sector Development Index	M3/GDP – Indicates how developed the financial sector is	Index	SARB
OPEN	Trade Openness	Country's integration into world economy	Ratio	SARB

4.5 ESTIMATION TECHNIQUE AND PROCEDURES

The nonlinear Autoregressive Distributed Lag (NARDL) model is the preferred estimation technique that will be used by this study. Developed by Shin et al. (2014), it captures the probable asymmetric response of credit supply and aggregate demand to South African monetary policy shocks. The figure below explains the estimation technique in more detail.

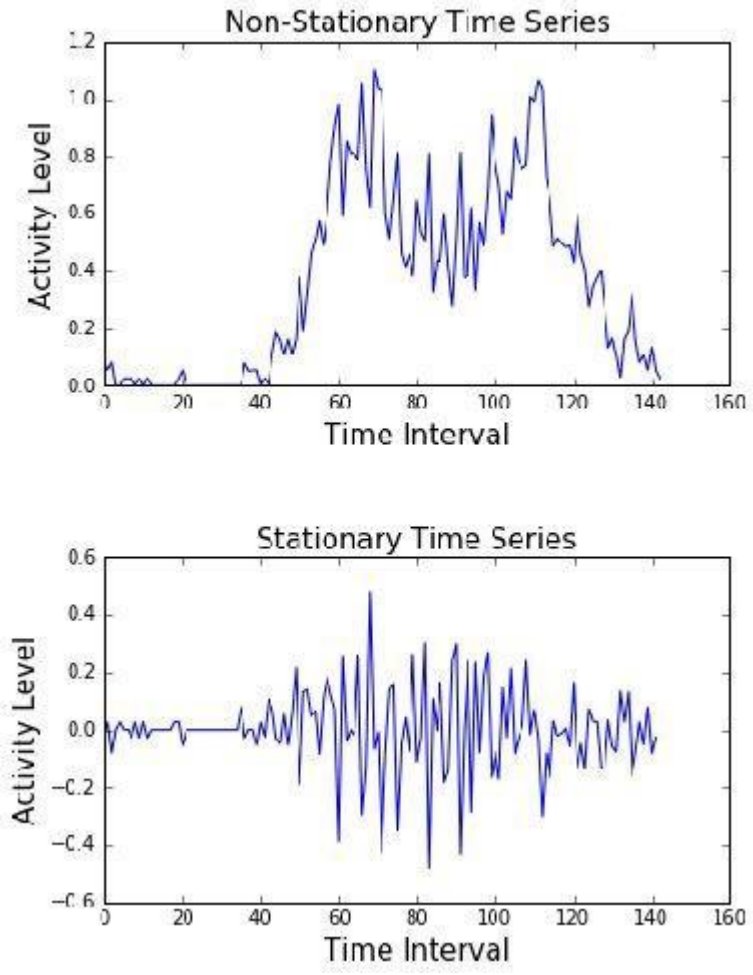


Source: Author's own compilation (adopted and modified from: VanWyngaard, 2019)

Figure 4.1: NARDL model estimation approach

4.6 UNIT ROOT TEST

Before attempts are made to model any data set, it is of utmost importance to test for stationarity. This is because a time series that is stationary displays statistical properties that are consistent over time, which will make both analysis and modelling easier and more reliable (D'Amico, 2023). Unit root tests are performed to assess if time series variables are stationary. Figure 4.2 below gives a graphical presentation of the difference between a stationary and a non-stationary time series.



Source: Rana, Mir, Dwivedi, Nagpal and Mehrotra, 2023.

Figure 4.2: Graphical representation of stationary and non-stationary time series

Several methods can be employed to test for stationarity. These include the Augmented Dickey-Fuller unit root tests, Phillips Peron unit root tests, Kahn and Ogaki test, the cointegration regression Durbin-Watson test and the Kwiatkowski-Phillips-Schmidt and Shin stationarity test (Ogbokor, 2015). This study will perform not only the Augmented Dickey-Fuller test (ADF),

but also the Phillips Perron (PP) test to determine the presence of unit roots in the data used. This is done to increase the robustness of the results obtained.

4.6.1 Augmented Dickey- Fuller unit root test (ADF)

The Augmented Dickey-Fuller test (an improved iteration of the original Dickey-Fuller (DF) test, known as the autoregressive unit root test (Dickey and Fuller, 1981)) is employed to test for the existence of unit roots, as well as the order of integration in time series data.

The ADF unit root test hypothesis testing can be described as follows:

H_0: $\lambda 1 = \lambda 2 = \lambda 3 = \lambda 4 = 1$; Denoting the presence of a unit root, therefore non-stationary.

H_1: $\lambda 1; \lambda 2; \lambda 3$ and $\lambda 4 < 1$; Denoting that Y_t does not consist of a unit root, and is thus stationary.

To conclude that time series data is stationary (and thus the absence of unit root) the ADF unit root test must yield results that are statistically significant, either at a 1 or 5 percent significance level, thus accepting the null hypothesis (H_1). If, however, the p-value is not found to be statistically significant at a 1 or 5 percent level of significance, the null hypothesis of a unit root in the series cannot be rejected.

4.6.2 Phillips-Perron unit root test (PP)

The hypothesis testing framework for the Phillips-Peron unit root test is similar to that of the ADF unit root test, typically producing similar outcomes (Brooks, 2014). However, Phillips and Perron (1988) explain that ADF unit root test uses lagged Y_t variables in the equation in order to address the issue of autocorrelation, while the Phillips-Peron unit root test corrects for autocorrelation through the application of a non-parametric correction to the t-statistic. The basic procedure for the Phillips-Peron unit root test can be stated as follows:

$$Y_t = \alpha Y_{t-1} + \varphi \chi_t + u_t \quad (4.7)$$

$$Y_t = \beta_0 + \beta_{1\gamma t} + \beta_{2t} + u_t \quad (4.8)$$

In the equations above, t represents the trend. β_o is the constant. This means that when β_1 is zero, the series is non-stationary, and therefore has a unit root. If, however, β_1 is less than zero, the series is stationary and thus does not contain a unit root.

4.7 COINTEGRATION TEST

The long-run bound test is used by the study to test for cointegration. When running the NARDL model, the ARDL model estimation approach is the most effective method to test for cointegration since there are two separate equations in the study, with the ARDL utilizing the ordinary least squares (OLS) technique. This enables the research to move forward with testing for cointegration, irrespective of the variables being stationary at I(0), I(1), or a combination of the two (Pesaran and Shin, 1997).

The hypothesis testing framework proposed by the ARDL model is as follows:

H_o: No cointegration – indicating no long-run relationship between the independent variables and the dependent variable.

H_1: Cointegration – indicating that the independent variables have a long-run impact on the dependent variable.

In order to test the above hypotheses, the Bound test uses the F-test, together with two critical bounds; the upper and the lower bound. H_o (no long-run impact) is rejected when the F-statistic is greater that both the upper and lower bound values, meaning that the independent variables have a long-run impact on the dependent variable (McCamel, 2017). On the other hand, if the F-statistic is lower than the upper and lower bound values, the null hypothesis of no long-run impact cannot be rejected, meaning that the independent variables do not have a long-run impact on the dependent variable. According to Pesaran, Shin and Smith (2001), the same will apply if the F-statistic lies between the lower and upper bound values.

This leads to the error correction term (ECT). If the null hypothesis is rejected and the variables are found to be cointegrated, the ECM is estimated, which is described by Alimi (2014:106) as "a measure by which the long-run disequilibrium of the dependent variables is corrected throughout each month" (or year/quarter depending on the data used).

4.8 DIAGNOSTIC TESTS

If an estimated model does not satisfy its underlying assumptions, it is considered to be unreliable (Mishi and Maredza, 2024). This means that the results obtained cannot be used to make any inferences. Therefore, in order to confirm that the model is specified correctly, this section discusses the relevant diagnostic tests.

4.8.1 Multicollinearity

Multicollinearity occurs when there is a violation of classical assumption VI which states that there is no perfect linear relationship between the explanatory variables. In order to detect the severity of multicollinearity in a given model, a correlation matrix is utilised to test the pairwise correlation between the explanatory variables. Therefore, pairwise correlation is used by this study to test the severity of multicollinearity in the model. The rule of thumb is that if the correlation is less than 0.8, there is no severe multicollinearity.

4.8.2 Heteroskedasticity

Heteroskedasticity occurs with a violation of classical assumption IX which states that the error term has constant variance. Heteroskedasticity can be caused by a number of reasons, one of which is the omission of an important variable, which is then captured by the error term (Mishi and Maredza, 2024). To test for heteroskedasticity, this study uses the Breusch-Pagan Godfrey test. The hypotheses are as follows:

H_0: The variance of the residuals is homoscedastic.

H_1: The variance of the residuals is heteroscedastic.

4.8.3 Autocorrelation

Classical assumption VIII states that errors should be uncorrelated with each other. When there is autocorrelation or serial correlation in time series data, it means that the errors from previous periods affect future periods (Wooldridge, 2012). Although estimators obtained can still be unbiased and consistent even if autocorrelation is present in the model, one of the most severe consequences of autocorrelation is reflected in a goodness of fit R^2 that is very high (Mishi and Maredza, 2024). This study uses the Breusch-Godfrey Lagrange Multiplier test to test for autocorrelation. The hypotheses for the Breusch-Godfrey Lagrange Multiplier test are as follows:

H_0: The residuals are not serially correlated.

H_1: The residuals are serially correlated.

4.8.4 Stability tests: Cumulative sum (CUSUM) and Cumulative sum of Squares (CUSUMQ) tests

In addition to the residual diagnostic tests, the study assesses the stability of the parameters of the model in order to ensure consistency of all the parameters over time (Seddighi, Lawler and

Katos, 2000). The study uses both the cumulative sum of recursive residuals (CUSUM) test and the Cumulative sum of squares (CUSUMQ) to test for stability. In the CUSUM and CUSUMQ tests, the null hypothesis (H_o) stating that the parameters are stable is rejected when residuals fall outside the critical standard error lines.

4.8.5 Normality test

When estimating a model, normal distribution of the residuals is essential, especially when the sampled data is finite (Mishi and Maredza, 2024). A normal distribution is one that is symmetric or bell-shaped around its mean. Ruxanda and Botezatu (2008) stress that there are also several other econometric tests, such as t-tests and parametric tests, that require the residuals to be normally distributed for reliable conclusions to be drawn. The Jarque-Bera test (Gujarati, 2003) is used by the study to test for normality. The hypotheses for the Jarque-Bera test are as follows:

H_o: Residuals are normally distributed

H_1: Residuals are not normally distributed

4.9 CONCLUSION

This chapter outlined the methodology employed by the study in order to estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to both credit supply and aggregate demand in South Africa. The chapter began by describing the research design used by the study. The sources used to obtain data for the study are listed. This was followed by model specification, explaining in detail the two models that are run by the study, and tables that describe the variables and their expected signs for both models run by the study.

Section 4.5 explained the NARDL estimation technique and presented a figure that detailed the procedure to be followed. To ensure that each of the models are correctly specified, section 4.6 then followed by giving a comprehensive definition of the complete set of diagnostic tests to be run. These include tests for multicollinearity, heteroskedasticity, autocorrelation and stability tests. The section that followed explained the importance of running unit root tests on each of the variables, detailing the ADF and PP unit root tests. Lastly, the process of testing for cointegration was explained, as well as the corresponding ECM that must be estimated should cointegration be found to exist between the variables. The specified models, procedures and tests are estimated and performed using EViews, and the results are reported, interpreted and discussed in the subsequent chapter.

CHAPTER FIVE
EMPIRICAL ESTIMATION AND DISCUSSION OF RESULTS

5.1 INTRODUCTION

The preceding chapter explained the research methodology employed by this study in order to model the asymmetric impact of monetary policy shocks on both credit supply and aggregate demand in South Africa. The NARDL model was systematically established as a dynamic model as it allows for the decomposing of chosen variables into their positive and negative reactions, allowing for the partial sum of positive changes in repo rate to be denoted by "repo_pos" and the negative changes of the repo rate to be denoted by "repo_neg"(in the case of this study, it is JIBAR_POS and JIBAR_NEG as the JIBAR rate is used as a proxy for the repo rate). In addition to this, all the necessary diagnostic tests, unit root tests, and the ECM are also run to improve the reliability of the models. Consequently, this chapter employs the NARDL model to achieve the secondary objectives established by the study and to thoroughly examine the findings obtained by each of the two statistical model.

Chapter 5 begins with descriptive statistics for each variable. These are provided both in tabular form, as well as in a graphic format, which gives a clearer picture of the movement of each variable. Thereafter, results of the unit root tests are reported for each of the models, to ensure that all variables are stationary, either at level, I(0), first difference, I(1) or a mix of the two. Testing for stationarity, as outlined in Chapter 4, is a prerequisite for applying the Bound test that tests for cointegration. Additionally, this study runs two models presented in equations 4.3 and 4.6. Therefore, the following section introduces and analyses the findings from the NARDL models in evaluating each equation. It is structured as follows:

Firstly, the results obtained from running the NARDL model are interpreted and discussed to ascertain if asymmetries are indeed present. This is followed by a presentation and discussion of the long-run bound test results. Subsequently, the corresponding results of the ECM are also presented. Next, the outcomes of the diagnostic tests are reviewed for each of the two models, confirming that the findings produced are homoscedastic, not serially correlated and stable. Lastly, results from the multicollinearity tests are presented.

5.2 DESCRIPTIVE STATISTICS: VISUAL DEPICTION OF VARIABLES OVER TIME

This section contains two parts; section 5.2.1 presents the descriptive statistics for model 1 (CSC as the dependent variable), while section 5.2.2 presents the descriptive statistics for model 2 (AD as the dependent variable).

5.2.1 Descriptive statistics for model 1 – Credit supply to corporates model

Figure 5.1 shows how the supply of credit to corporates (CSC) increased quite significantly in 2019, through to the beginning of 2020. The drop in CSC in 2020 occurred at the time of the COVID-19 pandemic, where many companies either retrenched many of their employees, or did not survive the pandemic and were forced to close their doors. Figure 5.1 also indicates how the repo rate (proxied by the JIBAR) fell significantly following the decision made by the Reserve Bank to lower the repo rate to stimulate the economy, and then raised the repo rate from the fourth quarter of 2021 in an attempt to combat inflation.

Figure 5.1: Movement of variables – Model 1

Table 5.1: Descriptive Statistics – Model 1

Variable	CSC	JIBAR	ROE	LLC	LDEBT	LPI	GINFL
Mean	12.7841	5.71628	13.0731	4.98238	13.83008	4.5302	365.0749
Median	12.7762	6.0475	14.3650	4.9843	13.8117	4.5416	370.4168
Max.	12.9891	8.4880	16.6900	5.0912	14.0239	4.6405	463.2325
Min	12.6081	3.3460	6.9300	4.8669	13.5794	3.8732	237.9501
Std. Dev.	0.0994	1.8009	2.7464	0.0422	0.0986	0.1043	56.51402
Observations	60	60	60	60	60	60	60

5.2.2 Descriptive Statistics for model 2 – Aggregate demand model

Figure 5.2 below shows how aggregate demand in South Africa also fell sharply following the lockdown period during the COVID-19 pandemic. This led the SARB to decrease the repo rate as it attempted to stimulate economic activity, which is shown by the drop in the JIBAR rate in figure 5.2. The figure also illustrates how GFCF and LP followed the drop in AD during the pandemic.

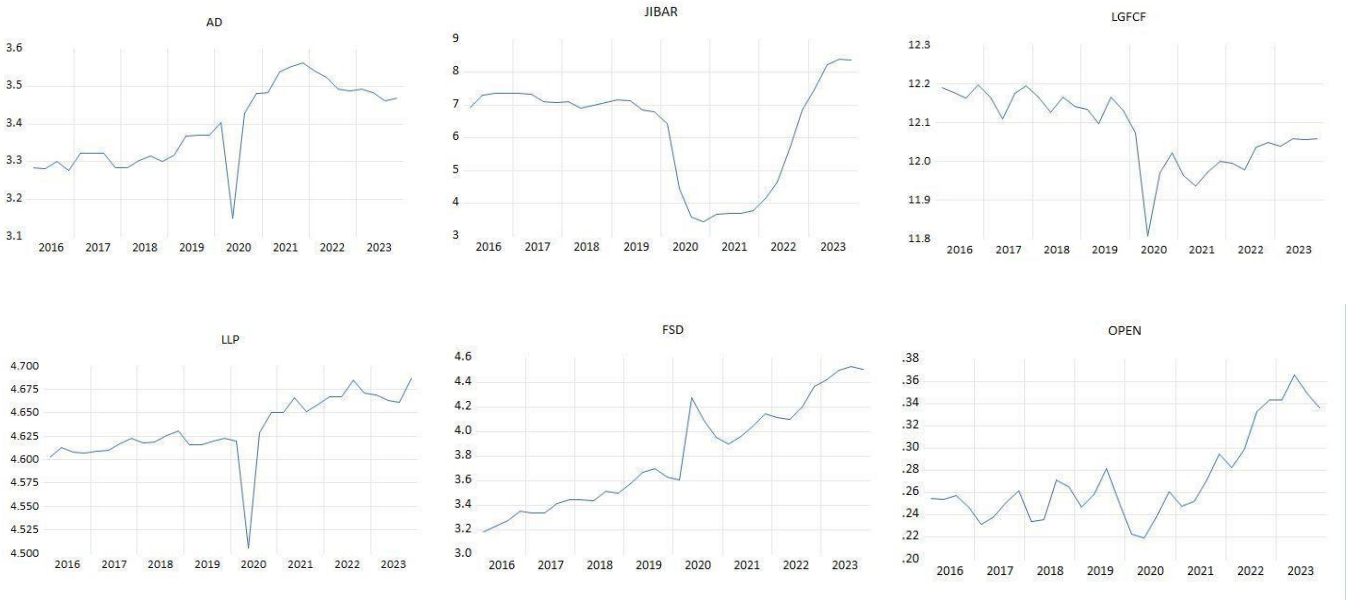


Figure 5.2: Movement of variables – Model 2

Table 5.2: Descriptive Statistics – Model 2

Variable	AD	JIBAR	LGFCF	LLP	FSD	OPEN
Mean	3.3929	6.2585	12.0776	4.6331	3.8025	0.2720
Median	3.3707	6.9573	12.0839	4.6244	3.6796	0.2581
Max.	3.5638	8.4007	12.1970	4.6867	4.5268	0.3661
Min	3.1484	3.4276	11.8056	4.5053	3.1812	0.2190
Std. Dev.	0.1070	1.5980	0.0939	0.0344	0.4250	0.0402
Observations	32	32	32	32	32	32

5.3 UNIT ROOT TESTS RESULTS

This section presents the results obtained from running the unit root tests, which are performed to determine the order of integration of each of the variables. Unit Root tests must be conducted before running the model, to avoid spurious results. This study uses both the Augmented Dickey-Fuller test and the Phillips-Perron test to test for the presence of unit roots in the variables. Table 5.3 reports the results for variables in model 1, while table 5.4 reports the results for model 2. The tables also shows that there are certain variables (LC, PI, DEBT, GFCF, LP) that have been converted to natural logarithm (L) to maintain consistency and minimise variation between data points, as well as to account for scale effects.

Table 5.3: Unit Root test results – Model 1

Variables	ADF		ORDER	PP		ORDER
	STATISTIC	P-VALUE		STATISTIC	P-VALUE	
CSC	-8.331081	0.0000	I(1)	-8.333428	0.0000	I(1)
JIBAR	-2.251489	0.0247	I(1)	-5.733896	0.0000	I(1)
ROE	-3.161462	0.0276	I(1)	-5.895370	0.0000	I(1)
LC (LLC)	-4.491578	0.0006	I(0)	-4.500193	0.0006	I(0)
PI (LPI)	-4.048511	0.0023	I(0)	-3.993488	0.0028	I(0)
GINFL	-4.703083	0.0019	I(0)	-3. 954423	0.0157	I(0)
DEBT(LDEBT)	-6.142394	0.0000	I(1)	-6.118708	0.0000	I(1)

Source: Author's own compilation using results from EViews

The results shown in Table 5.3 show that three of the variables, namely the LC, PI and GINF are stationary at I(0), whilst the other variables are stationary at I(1). These findings were achieved using the conventional method for unit root testing. Therefore, the variables were initially evaluated at level, I(0), without trend. If found to be non-stationary, trend is subsequently used. For the variables that continued to show non-stationarity at level with and without trend, the last step would be to apply first differencing. The results obtained from running the Phillips-Peron unit root test confirm those of the ADF test for all variables in both table 5.3 and 5.4.

Table 5.4: Unit Root test results – Model 2

Variables	**ADF**		**ORDER**	**PP**		**ORDER**
	STATISTIC	P-VALUE		STATISTIC	P-VALUE	
AD	-5.519227	0.0006	I(0)	-9.615078	0.0000	I(0)
JIBAR	-2.599398	0.0112	I(1)	-2.577943	0.0118	I(1)
GFCF(LGFCF)	-6.334701	0.0000	I(1)	-10.21266	0.0000	I(1)
LP(LLP)	-4.011580	0.0188	I(0)	-4.002554	0.0192	I(0)
FSD	-4.027432	0.0181	I(0)	-3.879835	0.0253	I(0)
OPEN	-6.160750	0.0000	I(1)	-5.083897	0.0003	I(1)

Source: Author's own compilation using results from EViews

5.4 NON-LINEAR AUTOREGRESSIVE DISTRIBUTED LAG (NARDL) MODEL RESULTS: LONG AND SHORT-RUN IMPACTS

Section 5.3, which presents the unit root test results, shows that the variables analysed are all stationary either at level or at first difference. None of the variables are I(2) variables. This allows the study to proceed running the NARDL model. The NARDL model allows the study to decompose the impact of the repo rate on credit supply and aggregate demand into its positive and negative impacts. Thus, the study is able to achieve its secondary objectives stated in section 1.4.1; to estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply, as well as to estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to aggregate demand in South Africa.

This section therefore begins by presenting the NARDL results for model 1, to outline the positive and negative changes of credit supply to corporates in response to negative and

positive changes in the repo rate. The degree of completeness and symmetry will thus be discussed. Thereafter, the cointegration results (Bound test) as well as the ECM results will be presented and discussed for each of the models. The section ends with the diagnostic tests, as well as the stability tests. The same is done for model 2 in section 5.4.2.

5.4.1 Credit supply to corporates as the independent variable

The Shwarz information criterion (SIC) is used to determine the highest number of lags to include in this model. The SIC indicated 2 as the highest number of lags for the study to include when regressing CSC as the dependent variable. Thus, the variable model sequence for equation 4.3 is NARDL (1,2,1,1,0,1,0,0). Table 5.5 below sets out the details for the optimal NARDL model for equation 4.3.

Table 5.5: Optimal NARDL model – Model 1

NARDL Model	Trend Specification	Max. no. of lags	Optimal model	R-Square	Adj. R-Square
Credit Supply to Households	Constant level	2	(1,2,1,0,0,0,1,1)	90.84%	88.07%

The optimal NARDL model, as described in the table above, is estimated at a constant level, without trend. The R-squared value of 90.84% implies that 90.84 percent of the variation in credit supply to corporates (CSC) can be explained by the regression. The adjusted R-squared only considers the independent variables that are statistically significant in explaining the variation of credit supply. The value of the adjusted R-squared implies that 88.07 percent of the variation in Credit supply to households can be explained by the regression.

5.4.1.1 NARDL estimation results – Model 1

The table below shows the results obtained after running the NARDL model. Each component of JIBAR (JIBAR_POS and JIBAR_NEG) is included in the regression as a separate regressor/explanatory variable.

Table 5.6: NARDL Estimation Results – Model 1

	NARDL	
Variable	**Coefficient**	**p-value**
Constant	10.43844***	0.0026
CSC(-1)	0.406401***	0.0095
JIBAR_POS	-0.117839**	0.0268
JIBAR_POS(-1)	0.235507**	0.0123
JIBAR_NEG	-0.231608**	0.0189
JIBAR_NEG(-1)	0.203448**	0.0355
ROE	-0.005538	0.1994
LLC	-0.292732*	0.0763
LDEBT	-0.191387*	0.0877
LPI	0.178954*	0.0864
LPI(-1)	0.075303	0.2128
GINFL	-0.000205	0.5329
GINFL(-1)	0.000494	0.1225

Notes: [***]/(**)/* indicates significance at 1%, 5% and 10% respectively
Source: Author's own compilation using results from EViews

The estimation results suggest firstly that interest rate pass-through tends to be incomplete, in the case of both a repo rate increase and decrease. The results suggest that when the repo rate increases by 1%, the supply of credit decreases by 0.11% statistically significant at 5% (0.0268). However, when the repo rate decreases by 1%, the supply of credit continues to decrease, and after 1 lag (JIBAR_NEG(-1)), the supply of credit then responds by increasing by 0.20%, statistically significant at 5% (0.0355). The estimation results for model 1 therefore not only suggest an incomplete pass-though, but an asymmetric pass-through as well. The results obtained are consistent with the customer reaction hypothesis, which states that commercial bank interest rates are rigid upwards, as was found by Matemilola et al. (2015) in South Africa.

5.4.1.2 Bound test results: Long-run impacts on Credit Supply

The results obtained from running the bound test are presented in this section, and are used to determine the existence of a long-run relationship between the independent variables and Credit supply to corporates in South Africa.

Table 5.7: Estimated Bound test results – Model 1

NARDL model	**Estimated F-value**	
	5.285447	
Critical Value Bounds		
Significance levels	**Lower bound I(0)**	**Upper bound I(1)**
10%	1.92	2.89
5%	2.17	3.21
2.5%	2.43	3.51
1%	2.73	3.9
Long-run (Levels) equation: CSC =17.5850 - 0.0276*JIBAR_POS - 0.0474*JIBAR_NEG + 0.4283*LPI – 0.0093*ROE + 0.0005*GINFL – 0.4931*LLC – 0.3224*LDEBT)		

Source: Author's own compilation using results from EViews

The table above shows that the estimated F-value of (5.285447) is greater than the lower bound and upper bound values at a 5% level of significance. Thus, the null hypothesis that states that there is no long-run impact is rejected, indicating that long-run impacts running from the monetary policy, GDP, ROE, Global inflation, Liquidity Coverage and Fiscal Stability do exist in South Africa. However, the impact of contractionary monetary policy on the supply of credit in the long run is shown to be weak (with a coefficient of only 0.0276).

The aforementioned empirical finding is consistent with literature; in the long-run, monetary policy has traditionally been seen as having a "neutral" effect. The long-run effects of monetary policy are believed to affect nominal variables, such as prices and nominal interest rates (Jorda, Singh and Taylor, 2023; Cerra, Fatas and Saxena, 2023). The negative sign obtained for JIBAR_NEG in the long-run (levels) equation suggests that decreasing the repo rate by 1 percent will actually lead to a decrease in the supply of credit by 0.0474 percent in the long-run. This means in the long-run, the repo rate is not the most effective tool that can be used to stimulate the economy. This finding is supported by literature (Bernanke, 2020). Section 2.3 also reports on a study performed on BRICS countries by Jawadi, Mallick and Sousa (2016) that found that monetary contractions caused a fall in real economic activity and a tightening of conditions in the liquidity market, while shocks to government spending were found to have strong Keynesian effects.

The long run (levels) equation further suggests that GDP has a significant long-run impact on credit supply in South Africa. This finding is also supported by studies (Koju, Koju and Wang,

2020) that found that developing different sectors of an economy is an important driver of loan performance. LDEBT (measure of fiscal stability or fiscal risk) has also yielded the expected sign, showing that as fiscal stability decreases, the supply of credit will also decrease.

5.4.1.3 Error Correction Model (ECM) Analysis

The short-run dynamic parameters obtained from running the ECM are presented below, following the results of the bound test in the previous section.

Table 5.8: Error Correction Model (ECM) Short-Run Results for Credit Supply to Corporates

NARDL model				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prod.**
D(JIBAR_POS)	-0.117839	0.041010	-2.873444	0.0063***
D(JIBAR_POS(-1))	0.134080	0.041542	3.227583	0.0024***
D(JIBAR_NEG)	-0.231608	0.030338	-7.634269	0.0000***
D(LPI)	0.178954	0.044848	3.990268	0.0003***
D(GINFL)	-0.000205	0.000229	-0.894358	0.3761
ECT(-1)	-0.593599	0.079028	-7.511263	0.0000***

Notes: [***]/(**)/* indicates significance at 1%, 5% and 10% respectively
Source: Author's own compilation using results from EViews

The results found the coefficient of the error correction term to be negative and statistically significant at a 1% significance level. Therefore, approximately 59% of any disequilibrium between credit supply and the independent variables is corrected monthly.

5.4.1.4 Diagnostic Test Results – Model 1

The results from the NARDL regression, bound test and ECM have been reported and discussed for model 1, using literature to support these findings. This section reports and interprets the results obtained from running the residual and diagnostic tests for model 1. This is done to ensure that the regression and the results thereof are accurate and not misleading. The table below presents the results obtained from the diagnostic tests.

Table 5.9: Table of Residual Diagnostic Tests – Model 1

Diagnosis & Null Hypothesis	Tests	p-value	Inference
Serial correlation H_0: No serial correlation.	Breusch-Godfrey LM Test	0.0970	Fail to reject H_0
Normality H_0: Residuals are normally distributed.	Jarque-Bera Test	0.8424	Fail to reject H_0
Heteroskedasticity H_0: Residuals are homoscedastic.	Breusch-Pagan-Godfrey Test	0.5756	Fail to reject H_0

Section 4.6 specified the acceptance criterion for each of the diagnostic tests run in this section. The null hypothesis for the Breusch-Godfrey LM test is that there is no serial correlation, while the null hypothesis for the Jarque-Bera normality test is that the residuals are normally distributed. Lastly, the null hypothesis for the Breusch-Pagan-Godfrey test is that the residuals are homoscedastic. Therefore, table 5.9 shows that for each of the three diagnostic tests run, the study fails to reject the null hypotheses, concluding that the there is no serial correlation present, the residuals are normally distributed and are homoscedastic.

For the coefficient diagnostic tests, the correlation matrix is used to test the severity of multicollinearity between the explanatory variables. The results are shown in the table below.

Table 5.10: Table of pairwise correlations – Model 1

Variables	CSC	JIBAR	ROE	LLC	LDEBT	LPI	GINFL
CSC	1.00000	-0.67417	-0.78854	-0.31786	0.00590	-0.48798	0.22405
JIBAR	-0.67417	1.00000	0.78178	0.40077	-0.48925	0.19409	0.19236
ROE	-0.78854	0.78178	1.00000	0.29973	-0.25752	0.19213	0.03080
LLC	-0.31786	0.40077	0.29973	1.00000	-0.09433	0.20360	0.27407
LDEBT	0.00590	-0.48925	-0.25752	-0.09433	1.00000	0.34342	0.07612
LPI	-0.48798	0.19409	0.19213	0.20360	0.34342	1.00000	-0.12390
GINFL	0.22405	0.19236	0.03080	0.27407	0.07612	-0.12390	1.00000

Source: Author's own compilation using results from EViews

Section 4.6.1 outlined that the rule of thumb is that if the correlation is less than 0.8, there is no severe multicollinearity. The results in the table above suggest that there is no severe

multicollinearity, and therefore no perfect linear relationship between the explanatory variables.

One of the critically important tests is the stability test of the estimated model. The figures below present the results obtained from running the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) stability tests. The results show that the residuals of the model are stable, with the blues line falling within the critical lines at a 5% level of significance.

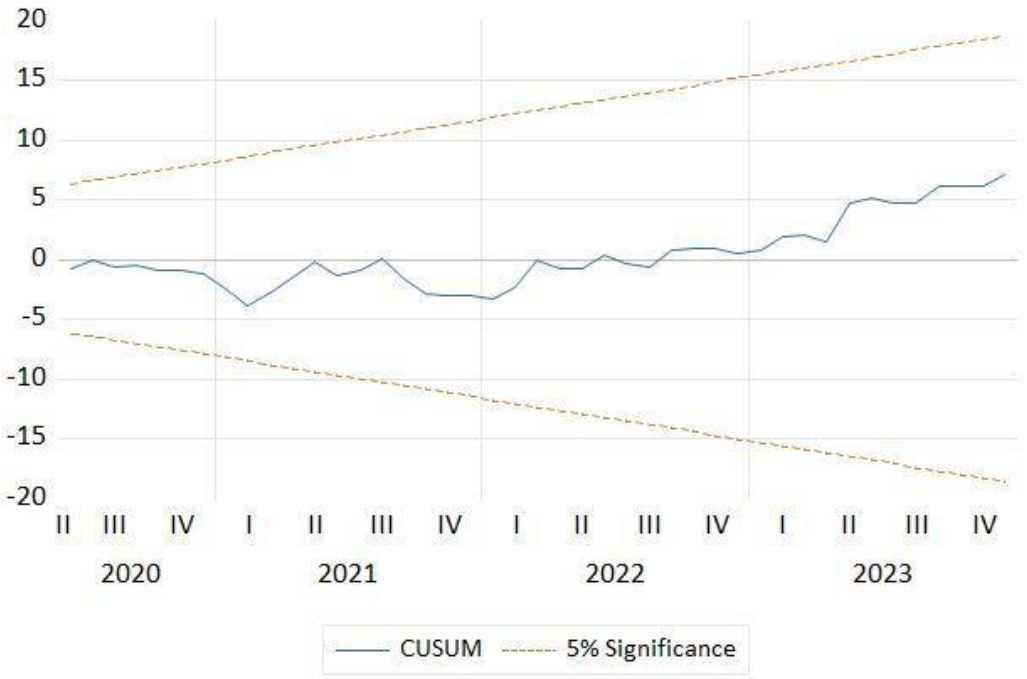


Figure 5.3: Cumulative Sum (CUSUM) stability test result – Model 1

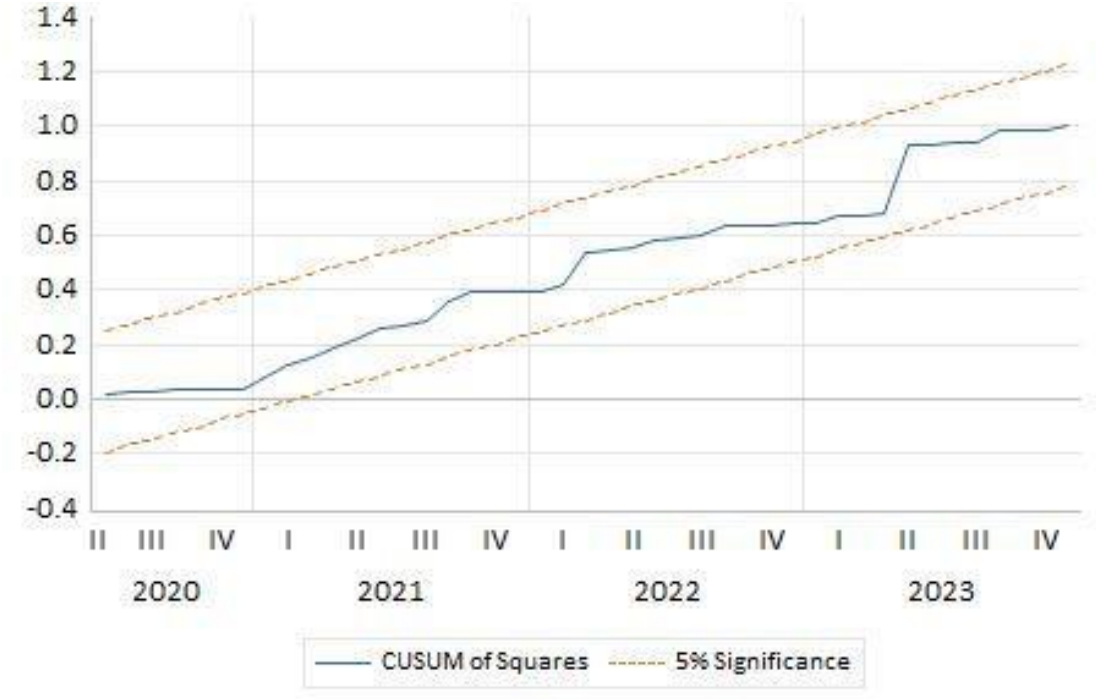


Figure 5.4: Cumulative Sum of Squares (CUSUMQ) stability test results – Model 1

The section that follows discusses the results obtained for model 2 - modelling the impact of the independent variables on aggregate demand.

5.4.2 Aggregate Demand as the dependent variable

For the second model, the maximum number of lags to include is also determined using the Shwarz information criterion (SIC). The SIC selected 2 as the highest number of lags to include when regressing AD as the dependent variable. Thus, the variable model sequence for equation 4.6 was NARDL (1,2,2,2,2,1,1). Table 5.11 below sets out the details for the optimal NARDL model for equation 4.6.

Table 5.11: Optimal NARDL model – Model 2

NARDL Model	Trend Specification	Max. no. of lags	Optimal model	R-Square	Adj. R-Square
Aggregate Demand	Constant level	2	(1,2,2,2,2,1,1)	98.94%	97.30%

The optimal NARDL, as described in the table above, is estimated at a constant level, without trend. The R-squared value of 98.94% implies that the regression explains 98.94 percent of the variation in aggregate demand (AD). The adjusted R-squared, as mentioned in section 5.4.1, only takes into account the independent variables that are statistically significant in explaining the variation of aggregate demand. The value of the adjusted R-squared implies that the regression explains 97.30 percent of the variation in Aggregate Demand.

5.4.2.1 NARDL Estimation Results – Model 2

The table below shows the results obtained after running the NARDL model. Each component of JIBAR (JIBAR_POS and JIBAR_NEG) is included in the regression as a separate regressor/explanatory variable.

Table 5.12: NARDL Estimation Results – Model 2

	NARDL	
Variable	**Coefficient**	**p-value**
Constant	12.09022*	0.0837
AD(-1)	0.642515***	0.0056
JIBAR_POS	0.075861**	0.0191
JIBAR_POS(-1)	-0.007451	0.8331
JIBAR_POS(-2)	-0.041281	0.1129
JIBAR_NEG	0.151651***	0.0052
JIBAR_NEG(-1)	-0.008541	0.9049
JIBAR_NEG(-2)	-0.101501*	0.0703
LGFCF	0.358248	0.1737
LLP	-0.082953	0.8856
FSD	0.034402	0.8093
FSD(-1)	0.297437***	0.0099
OPEN	-2.076118***	0.0035

Notes: [***]/(**)/* indicates significance at 1%, 5% and 10% respectively
Source: Author's own compilation using results from EViews

The estimation results suggest firstly that interest rate pass-through tends to be incomplete, in the case of both a repo rate increase and decrease. The results suggest that when the repo rate increases by 1%, aggregate demand increases by 0.07% statistically significant at 10%

(0.0609). However, when the repo rate decreases by 1%, aggregate demand increases by 0.15%, statistically significant at 1% (0.0023). Therefore, the findings suggest that the pass-through of monetary policy to aggregate demand is not only incomplete, but also asymmetric, as a decrease in the repo rate (expansionary monetary policy) causes a greater increase in aggregate demand than an increase in the repo rate (contractionary monetary policy). Similar to results obtained in section 5.4.1.1, these results are once again consistent with the customer reaction hypothesis, which states that commercial bank interest rates are rigid upwards and flexible downwards, as was found by Matemilola et al. (2015) in South Africa, as a decrease in the repo rate led to a higher increase in aggregate demand compared to the increase in the repo rate.

An interesting result is the negative, statistically significant relationship between trade openness and aggregate demand. Section 4.4 presented the expected sign for the relationship between trade openness and aggregate demand to be positive. However, the study found it to be negative. This result is, in fact, consistent with findings in literature. Anyanwu (2014) conducted a study on the factors that affect economic growth in Africa, comparing current African polies with those of China, as a country that managed to grow exponentially within the space of a few decades. The study found that while Africa is almost twice as open as China, openness does not positively and significantly affect Africa's growth as it does in China. The main reason for this is that Africa imports more (mostly consumer goods) than it exports, whereas China does the opposite. Furthermore, Africa's export structure leans heavily towards traditional primary commodity exports, whereas China has transitioned towards manufacturing.

5.4.2.2 Bound test results: Long-run impacts on Aggregate Demand

The results obtained from running the bound test are presented in this section, and are used to determine the existence of a long-run relationship between the independent variables and Aggregate Demand in South Africa.

Table 5.13: Estimated Bound test results – Model 2

NARDL model	**Estimated F-value**	
	5.805299	
Critical Value Bounds		
Significance levels	**Lower bound I(0)**	**Upper bound I(1)**
10%	1.99	2.94

5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99
Long-run (Levels) equation: AD = 33.8202 – 0.0759*JIBAR_POS + 0.1164*JIBAR_NEG – 1.7800*LGFCF – 2.0439*LLP + 0.9283*FSD – 10.1146*OPEN		

Source: Author's own compilation using results from EViews

The table above shows that the estimated F-value (5.805299) is greater than the lower and upper bound values at a 5% significance level. Therefore, the null hypothesis of no long-run impact is rejected, which indicates that long-run impacts running from the monetary policy, GFCF, LP, FSD and OPEN do exist in the South African economy. However, the impact of contractionary monetary policy on aggregate demand in the long run is once again shown to be weak (with a coefficient of only 0.0759).

The aforementioned empirical finding is consistent with literature; in the long-run, monetary policy has traditionally been seen as having a "neutral" effect. The long-run effects of monetary policy are believed to affect nominal variables, such as prices and nominal interest rates (Jorda, Singh and Taylor, 2023; Cerra, Fatas and Saxena, 2023). As mentioned above in section 5.4.1.2, this indicates that in the long-run, the repo rate is not the most effective tool that can be used to target aggregate demand, as it rather has lasting effects on prices. This finding is supported by literature (Bernanke, 2020).

5.4.2.3 Error Correction Model (ECM) Analysis

This section, similar to section 5.4.1.3, the short-run dynamic parameters obtained from running the ECM are presented below, following the results of the bound test in the previous section.

Table 5.14: Error Correction Model (ECM) Short-Run Results for Aggregate Demand

NARDL model				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prod.**
D(JIBAR_POS)	0.075861	0.015464	4.905656	0.0005***
D(JIBAR_POS(-1))	0.041281	0.013365	3.088676	0.0103**
D(JIBAR_NEG)	0.151651	0.023817	6.367240	0.0001***
D(JIBAR_NEG(-1))	0.101501	0.028839	3.519605	0.0048***
D(LGFCF)	0.358248	0.103139	3.473442	0.0052***

D(LGFCF(-1))	0.440144	0.132668	3.317630	0.0069***
D(LLP)	-0.082953	0.334548	-0.247956	0.8087
D(LLP(-1))	-0.587634	0.192230	-3.056928	0.0109**
D(FSD)	0.034402	0.058458	0.588487	0.5681
D(OPEN)	-2.076118	0.304425	-6.819801	0.0000***
ECT(-1)	-0.357485	0.041007	-8.717605	0.0000***

Notes: [***]/(**)/* indicates significance at 1%, 5% and 10% respectively
Source: Author's own compilation using results from EViews

The results found the coefficient of the error correction term to be negative and statistically significant at a 1% significance level. Therefore, approximately 35% of any disequilibrium between aggregate demand and the independent variables is corrected quarterly.

5.4.2.4 Diagnostic Test Results

The results from the NARDL regression, bound test and ECM have been reported and discussed for model 2, using literature to support these findings. This section reports and interprets the results obtained from running the residual and diagnostic tests for model 2. This is done to ensure that the regression and the results thereof are accurate and not misleading. The table below shows the results obtained from the residual diagnostic tests.

Table 5.15: Table of Residual Diagnostic Tests – Model 2

Diagnosis & Null Hypothesis	**Tests**	**p-value**	**Inference**
Serial correlation H_0: No serial correlation.	Breusch-Godfrey LM Test	0.2962	Fail to reject H_0
Normality H_0: Residuals are normally distributed.	Jarque-Bera Test	0.3977	Fail to reject H_0
Heteroskedasticity H_0: Residuals are homoscedastic.	Breusch-Pagan-Godfrey Test	0.6153	Fail to reject H_0

The null hypothesis for the Breusch-Godfrey LM test is that there is no serial correlation, while the null hypothesis for the Jarque-Bera normality test is that the residuals are normally distributed. Lastly, the null hypothesis for the Breusch-Pagan-Godfrey test is that the residuals

are homoscedastic. Therefore, table 5.15 shows that for each of the three diagnostic tests run for model 2, the study fails to reject the null hypothesis, concluding that the there is no serial correlation present, the residuals are normally distributed and are homoscedastic.

For the coefficient diagnostic tests, the table of correlation matrix is used to test the severity of multicollinearity between the explanatory variables. The results are shown in the below.

Table 5.16: Table of pairwise correlations – Model 2

Variables	AD	JIBAR	LGFCF	LLP	FSD	OPEN
AD	1.000000	-0.448779	-0.490087	0.865148	0.678899	0.593546
JIBAR	-0.448779	1.000000	0.713767	-0.084619	-0.249877	0.250956
LGFCF	-0.490087	0.713767	1.000000	-0.114738	-0.727629	-0.139224
LLP	0.865148	-0.084619	-0.114738	1.000000	0.521884	0.717955
FSD	0.678899	-0.249877	-0.727629	0.521884	1.000000	0.728998
OPEN	0.593546	0.250956	-0.139224	0.717955	0.728998	1.000000

Source: Author's own compilation using results from EViews

Section 4.6.1 outlined that the rule of thumb is that if the correlation is less than 0.8, there is no severe multicollinearity. The results in table 5.16 above suggest that there is no severe multicollinearity, and therefore no perfect linear relationship between the explanatory variables.

One of the critically important tests is the stability test of the estimated model. Figure 5.5 and 5.6 below show the result obtained from running both the cumulative sum (CUSUM) and CUSUM Square (CUSUMQ) stability tests. The results show that the residuals of the model are stable, with the blue lines falling within the critical lines at a 5% level of significance.

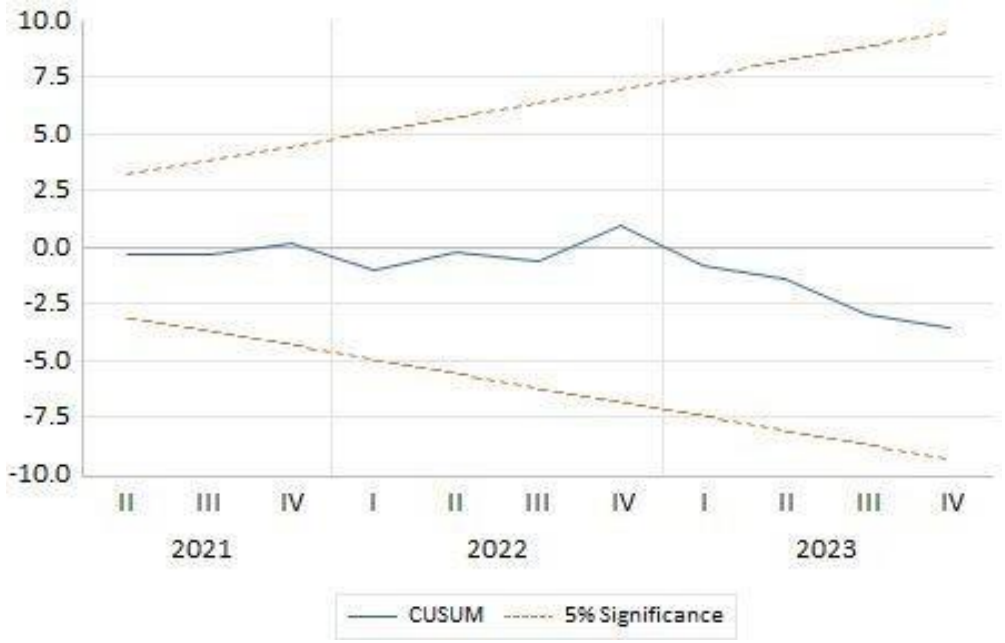


Figure 5.5: Cumulative Sum (CUSUM) stability test results – Model 2

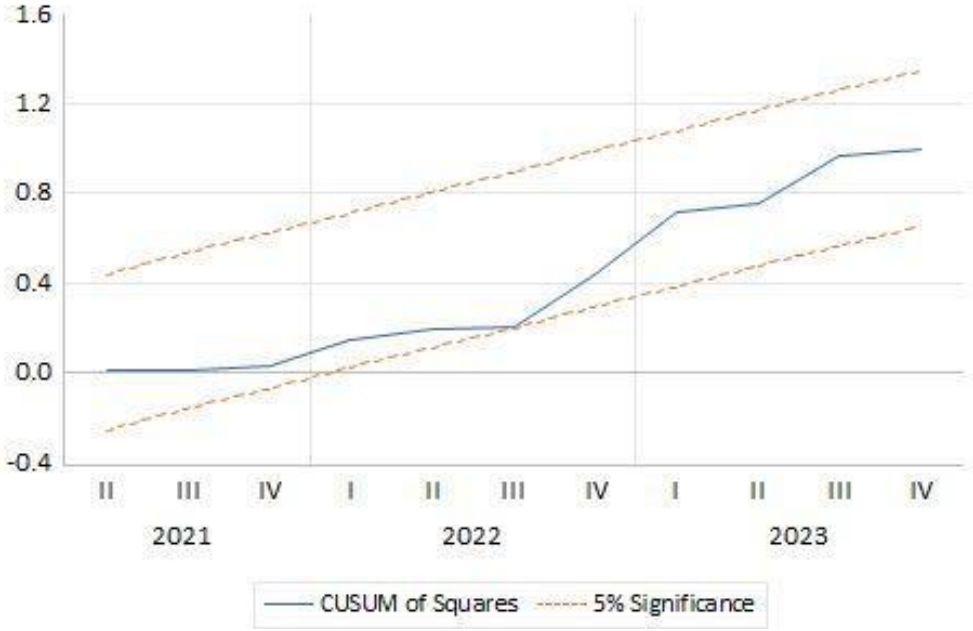


Figure 5.6: Cumulative Sum of Squares (CUSUMQ) stability test results – Model 2

5.5 CONCLUSION

The primary aim chapter 5 was to present and discuss the results obtained from modelling the asymmetric effects of interest rate pass-through from monetary policy to both credit supply and

aggregate demand in South Africa. The chapter investigated both the symmetric and asymmetric effects, as well as the completeness of monetary policy pass-through. In order to achieve these objectives, the NARDL model was employed. Other econometric techniques, such as unit root testing, ECM and the relevant diagnostic tests were also run in order to ensure that the model is correctly specified and yields reliable results. The impact of the independent variables on the dependent variables was analysed both in the short run and in the long run.

The chapter began giving a graphic representation of the movement of the variables, as well as presenting the descriptive statistics of each of the variables in a table. This was followed by a presentation of the results obtained from both the ADF and Phillips-Peron tests that were run in order to confirm that all the variables were stationary either at I(0) or I(1), or a mixture of the two. As all the variables were stationary either at I(0) or I(1), this allowed the study proceeded to run the NARDL model, to test for completeness and symmetry/asymmetry. The results proved that the pass-through of monetary policy in South Africa is incomplete, in the case of both credit supply and aggregate demand. The results also suggested that asymmetry of pass-through does exist, with a decrease in the repo rate being passed-though to a greater extent than an increase in the repo rate to both credit supply and aggregate demand.

The study proceeded to run the Bound test to test the long-run relationship between monetary policy and the dependent variables, and the ECM was employed to test the short-run relationship between the independent variables and the dependent variables for each of the two models. The results suggest that for both models, short-run and long-run impacts exist. However, the impact in the long-run was found to be weak, confirming the findings in literature that monetary policy is "neutral" in the long-run with regards to its effect on aggregate demand, rather affecting nominal variables such as prices. Lastly, the chapter presented and discussed the results obtained from all the relevant diagnostic run on both of the NARDL models, confirming that both models are correctly specified and reliable.

The following chapter summarises the study, providing policy recommendations based on the findings obtained in this chapter.

CHAPTER 6
SUMMARY, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

This study was driven by the persistent lack of economic growth, as well as the high levels of unemployment in South Africa. This necessitated a review of monetary policy; its intrinsic characteristics, its evolution, as well as how it is administered in both developed and emerging countries. It was concluded that because emerging economies experience structural pressures, monetary policy alone is not effective in controlling inflation and achieving its goals (Chapter 2: Section 2.3). For this reason, it is essential for a strong and long-lasting monetary policy, along with coordination between fiscal and monetary authorities, to be in place.

With this in mind, the aim of the study was to provide evidence-based policy recommendations for unlocking South Africa's growth prospects, from a monetary policy perspective. The primary objective of the study was to model the asymmetric effects of interest rate shocks on both credit supply and aggregate demand in South Africa. Therefore, the two central questions answered by the study are:

- What is the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply in South Africa?
- What is the degree of symmetry and completeness of interest rate pass-through from monetary policy to aggregate demand in South Africa?

These two questions are in line with the primary objective. Hence, this study examined the theoretical and empirical literature around asymmetries in monetary policy, taking note of the results obtained by previous research on what affects the efficiency of monetary policy and hinders it from achieving its goals. Finally, the econometric methodology implemented by the study was discussed, and the two models were run to obtain the results of the study. In this chapter, a summary of these findings is presented, as well as policy recommendations for improving the effectiveness of monetary policy in South Africa.

6.2 SUMMARY OF THE STUDY

Section 6.2 summarises how the study was conducted. This study consists of six chapters; these chapters together address the aim, primary objectives and sub-objectives of the study. Chapter 1 focused primarily on providing a foundation and blueprint that guided the rest of the study. Hence, Chapter 1 provides the background of the study, the problem statement, objectives, hypotheses of the study, significance of the study and chapter classification. Chapter 2 looked at the monetary policy frameworks used in developed countries, emerging countries and that of South Africa, clearly defining concepts around monetary policy. Thereafter, chapter 3 presented the theoretical literature that underpins and frames the study, as well as provided a critical analysis of the empirical literature on the impact of interest rate shocks on both credit supply and aggregate demand in order to not only gain an understanding of trends in existing literature, but also to assist in the modelling process. Chapter 4 and Chapter 5 went on to explain the methodology employed by this study and presented the results, and interpretations of the results. This final chapter, Chapter 6, presents an overall summary of the study, including conclusions and policy recommendations.

6.2.1 Summary on the Overview of Monetary Policy

Because the efficiency of monetary policy is central to this study, Chapter 2 gave a broad overview of monetary policy globally. The chapter examined the various monetary policy regimes employed by developed countries, emerging economies and in South Africa over time, such as monetary targeting, exchange rate targeting and inflation targeting. Countries choose the appropriate monetary policy regime to successfully meet their goals and objectives according to their economic needs and the framework of the nation. The chapter further examined the interaction of fiscal and monetary policy, finding that the coordination of the two policies is essential for achieving macroeconomic stability and promoting economic growth that is sustainable.

The final section of chapter 2 presented findings of how central banks around the world reacted to the COVID-19 pandemic. An interesting find was the fact that economic models failed to forecast the 2021-2023 spike in inflation post the pandemic. This has led to numerous studies on the efficiency of monetary policy, and ways to enhance it.

6.2.2 Summary of Literature Review

Chapter 3 began by giving a definition of a key concept around symmetry/asymmetry in monetary policy transmission: interest rate pass-through. This was done to ensure that the reader fully comprehends the use of this word as it is essential and used right through the study. Secondly, the chapter discussed the transmission mechanism of monetary policy, fully unpacking the different channels through which adjustments in the Reserve Bank's monetary policy settings affect economic activity and inflation. The chapter then presented the various theories that frame the study, including the Keynesian theory, the New Keynesian theory, the monetarist theory, collusive behaviour hypothesis, customer reaction theory and the theory of financial liberalisation. The main difference among these theories lies in how they each perceive what should be the appropriate response of monetary policy authorities during periods of either full employment or money supply expansion.

Lastly, Chapter 3 presented an analysis of the empirical literature on the impact of interest rate shocks on both credit supply and aggregate demand. Previous research shows varying differences in interest rate pass-through, first across countries, and also depending on the time of study. This is true across the world, and in South Africa, with the various studies referenced in Chapter 3 all finding different results for completeness and symmetry/asymmetry.

6.2.3 Summary of Research Design and Methodology

Chapter 4 outlined the econometric methodology employed by the study in order to estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to both credit supply and aggregate demand in South Africa. The study is quantitative in nature, and takes on a correlational research design, which seeks to investigate and quantify a hypothesised relationship between variables. The data used by the study is obtained from the South African Reserve Bank and the World Bank. The study runs two models: model 1 used monthly data which covers the period from January 2019 to December 2023, and model 2 used quarterly data which covers the period from 2016 Q1 to 2023 Q4.

In order to study asymmetries, the NARDL model was employed in order to decompose the interest rate shocks into its positive and negative components. For better regression, the JIBAR, a money market interest rate, was used as a proxy for the repo rate. Chapter 4 therefore methodised the NARDL models for both credit supply and aggregate demand, as well as all the various econometric techniques (including the unit root tests, Bound test, the ECM, the residual

and coefficient diagnostic tests and stability tests) that guarantee the accuracy of the study's findings.

6.2.4 Summary of Empirical estimation and discussion of results

In Chapter 5, the results obtained by the study are presented, interpreted and discussed. The results obtained from the unit root tests (both ADF and PP) confirmed that all the variables were stationary either at level or at first difference, allowing the study to continue to run the NARDL model. The results suggested that the pass-through of monetary policy in South Africa is incomplete, in the case of both credit supply and aggregate demand. The results also suggested that asymmetry of pass-through does exist, with a decrease in the repo rate being passed-through to a greater extent than an increase in the repo rate to both credit supply and aggregate demand.

For both models, the results found that the independent variables have both long- and short-run relationships with the dependent variables. Lastly, the diagnostic test results were also performed on both models, together with the stability tests, to ensure that the results are not misleading or inaccurate

6.3 ACHIEVEMENT OF STUDY OBJECTIVES

The objectives of this study, which are listed in section 1.4, were divided into the primary objective and two sub-objectives. This section details how the study has achieved these objectives.

6.3.1 Primary objective of the study

The primary objective of study was to model the asymmetric effects of interest rate shocks on credit supply and aggregate demand in South Africa. The study achieved this primary objective as detailed in section 6.2.4.

6.3.2 Sub-objectives of the study

To achieve the primary objective, the following sub-objectives were formulated accordingly:

- To estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply in South Africa.
- To estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to aggregate demand in South Africa.

These two sub-objectives are both empirical objectives, and were both addressed in Chapter 5. The first sub-objective is addressed in section 5.4.1, while the second sub-objective is addressed in section 5.4.2.

6.4 RECOMMENDATIONS

Evidence-based policy recommendations are key to improving the effectiveness and efficiency of existing policies.

6.4.1 Improved transparency and development of the South African banking system

The results obtained in section 5.4.1 and section 5.4.2 found that the pass-through of interest rates from monetary policy to both credit supply and aggregate demand is not only incomplete, but also asymmetric. Increasing not only the transparency, but also the development of the banking system in South Africa could help to reduce costs associated with information asymmetry in the lending markets. If the costs of information asymmetry are minimal, banks may be open to quickly increasing their loan rates by a considerable amount. Monetary policy impacts the overall economy by influencing factors like interest rates, credit availability and inflation expectations. A well-functioning banking system, with increased transparency, guarantees that adjustments in the central bank's policy are more effectively (completely and symmetrically) passed through to the rest of the economy.

Additionally, transparency within the banking system builds trust among investors and consumers. In a transparent and regulated setting, the risks associated with financial institutions become more predictable, resulting in increased confidence in the financial system.

6.4.2 Better coordination of monetary and fiscal policy

The results obtained from running the Bound test for both models showed that the impact of contractionary monetary policy on both credit supply and aggregate demand is weak. This empirical finding is consistent with literature; in the long-run, monetary policy has traditionally been seen as having a "neutral" effect. The long-run effects of monetary policy are believed to affect nominal variables, such as prices and nominal interest rates. Section 2.3 discussed the interaction of fiscal and monetary policy in great detail. While monetary policy mainly aims to manage inflation and impact economic activity using interest rates and money supply, fiscal policy, through government spending and taxation, also has a significant impact on economic activity. Better coordination of the two policies will ensure that they are aligned and not conflicting each other. In this regard, it is important to know what type of inflation the country

is experiencing, as cost-push inflation (rather than demand-pull inflation) would require fiscal rather than monetary solutions.

6.4.3 Macroprudential regulation, sectoral development of the economy and financial stability

The long-run (levels) equation obtained in section 5.4.1 suggests that GDP has a significant long-run impact on credit supply in South Africa. Developing different sectors of the economy is thus an important driver of loan performance. Additionally, Mishra, Montiel and Sengupta (2016) stress that the channels of the monetary transmission mechanism are influenced by the financial structure of an economy. Monetary policy is thus most efficient when the overall financial system is stable. Macroprudential regulation involves monitoring the overall financial system to minimise systemic risks such as too much borrowing, inflated asset prices, or the spread of financial disturbances from one country to another (financial contagion). Macroprudential regulation prevents financial system instability from hindering the effectiveness of monetary policy by addressing the risks in the financial sector ahead of time.

6.4.4 Flexibility in monetary policy tools

The estimation results for both models suggest that interest rate pass-through tends to be incomplete, in the case of both a repo rate increase and decrease. In the case of aggregate demand, expansionary monetary policy causes a greater increase in aggregate demand than contractionary monetary policy. Thus, it is important for central banks to have a diverse set of tools available to address a range of economic conditions. Interest rate pass-through is frequently not evenly distributed among different sectors of the economy. For example, although low interest rates may encourage more borrowing and spending in certain sectors such as housing, they may not be as successful in boosting investment in other areas such as business investment or specific parts of the credit market. Other instruments such as lending initiatives and credit easing can be beneficial in channelling funds to specific areas that require it most, thereby mitigating some of the asymmetric effects that may arise when a generalised strategy is not effective across the board.

6.4.5 Improving data collection and economic modelling

Section 2.8 discusses how, globally, economic modelling failed to predict the spike in inflation that occurred from 2021 to 2023. Effective monetary policy requires strong data collection and economic modelling. Policymakers require reliable and up-to-date data on economic indicators like inflation, unemployment and economic growth to evaluate the state of the economy.

Economic modelling must be timely and as accurate as possible. This will increase the reliability of forecasts and build consumer confidence in the decisions made by the central bank.

6.5 LIMITATIONS OF THE STUDY AND FURTHER RESEARCH

The main challenge or obstacle to the study was the time limit. This led the study to focus on specific factors influencing monetary policy rather than considering all aspects, for example examining what the impact of government expenditure would be on the models, as well as how this compared to the impact of monetary policy on the two dependent variables. However, the primary objective of the study could still be met even with the time restriction and by utilising the chosen variables. To address the constraints of this study, subsequent research ought to take into account the following:

- Including other variables into the model, for example government expenditure.
- Future research could also assess if the 3 percent to 6 percent inflation target truly is the best approach for promoting economic growth and development in the country.

6.6 CONCLUSIONS

The primary objective of study was to model the asymmetric effects of interest rate shocks on credit supply and aggregate demand in South Africa, and in so doing, estimate the degree of symmetry and completeness of interest rate pass-through from monetary policy to credit supply and aggregate demand in South Africa. The findings of the study show that the pass-through of monetary policy to both credit supply and aggregate demand in South Africa is incomplete, and asymmetric, with decreases in the repo rate being passed-through to both credit supply and aggregate demand to a greater extent than an increase in the repo rate. Specifically, the findings suggested that a 1 percent increase in the repo rate would cause credit supply to decrease by 0.11 percent, while a 1 percent decrease in the repo rate would cause credit supply to increase by 0.20 percent (after a lag of one month). In the case of aggregate demand, a 1 percent increase in the repo rate increases aggregate demand by 0.07 percent, while a 1 percent decrease in the repo rate increases aggregate demand by 0.15 percent.

This asymmetric and incomplete response of credit supply and aggregate demand to monetary policy shocks hinders the efficiency of macroeconomic policy, which in turn hinders the growth of the economy, which is evidenced by the significantly low growth rates experienced over the last decade. The study shows that although the current monetary authority in South Africa,

operating within the current inflation targeting system and policy mandate, has some influence in managing inflation, the presence of asymmetries in the pass-through of monetary policy leads to the outcomes of monetary authorities being inefficient with regards to achieving sustainable economic growth and fostering full employment levels in the economy. This implies that monetary authority should adjust the administration of its monetary policy tools, to incorporate asymmetric components that may assist in fostering a more efficient policy response.

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