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ESSAYS ON FINANCIAL MARKET DEVELOPMENT, MONETARY POLICY, AND FINANCIAL STABILITY IN SOUTH AFRICA

BY

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ABSTRACT

Like in many other countries, the South African financial markets play an important role in the transmission of monetary policy and are crucial for promoting financial stability in South Africa. The goal of financial market development is to make the financial system better able to share risks effectively by combining domestic and international savings to finance investment and consumption. This thesis examined financial market development, monetary policy, and financial stability in South Africa from 2003 and 2020. The study aimed at addressing four specific objectives. Firstly, the study gives an overview of the financial market, monetary policy conduct and financial stability in South Africa. Secondly, it investigated the dynamic interactions between financial market and monetary policy in South Africa. The nexus between financial market and monetary policy was tested BVAR. The Bayesian VAR model was estimated in addition to variance decomposition coupled with impulse responses to analyse the dynamic interaction amid financial markets and monetary policy. The findings revealed that interest rates and the rate of inflation have a direct impact on stock market capitalisation as a proxy for financial markets, while on the contrary, an inverse link was found between the stock market capitalisation and real effective exchange rate.

In the case of variance decomposition and impulse response, the findings revealed that long run changes in stock market capitalisation are largely explained by shocks in interest rates. Thirdly, the study examined the effects of financial market shocks on financial stability. The study used VECM together with Granger causality test. The findings revealed that amongst other macroeconomic variables, shocks as a result of domestic economic activity and global economic activity have a significant impact on financial stability both in the short and long term. On the other hand, Granger causality test was employed to identify the direction of causality. A bi-directional causality was established between credit to non-financial sector and the gross domestic product while a uni-directional causality was observed from credit to non-financial sector to global economic activity.

The fourth objective assessed the impact of monetary policy shocks on financial stability. The SVAR test confirmed the relationship between monetary policy and financial stability. the Johansen cointegration test revealed a long run relationship between the dependent variable and explanatory variables. In addition, the impulse response function indicated that financial market stability responds negatively to shocks because of interest rates, money supply and

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systematic risks. Further to this, the finding revealed that discrepancies in financial market stability are largely explained by its own innovations in the short run and partially by innovations in money supply and the 2008 global financial crisis at least in the long run. Lastly, a bi-directional causation was observed between broad money supply and credit to non-financial sector. Monetary policy expansion was recommended to promote macroeconomic objectives through the South African financial market to promote financial stability.

Keywords: Vector error correction model, Bayesian vector autoregression model, financial markets, monetary policy, financial stability, structural vector autoregression.

JEL Classification: C50, E52, G17 and E44

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Dedication

This thesis is dedicated to my wife Faith Sebapu and son Ethan, for giving me the opportunity, sacrificing, and standing by me until the end of this program. It is also dedicated to my mother Bertha Hlongwane as well as to all my two little sisters Zandile Hlongwane and Makungu Hlongwane who stood by me during my studies. If it was not for them, this could have not been possible.

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DECLARATION

I, Tshembhani Mackson Hlongwane (3873913), hereby declare that the thesis for DOCTOR OF PHILOSOPHY in ECONOMICS is my own work and that it has not previously been submitted to another university or for another qualification.

Name: Tshembhani Mackson Hlongwane Date: 06 September 2022

Signature: ……

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LIST OF ABBREVIATIONS

ADF - Augmented Dickey-Fuller

BIS - Bank for International Settlements

CAPM - Capital Asset Pricing Model

CPI - Consumer Price Index

ECM - Error Correction Model

EMH - Efficient Market Hypothesis

FCONS - Final consumption expenditure by the government

FM - Financial markets

F-VAR - Factor Vector Autoregressive

GDP - Gross Domestic Product

GEAI - Global economic activity index

INF - Inflation

INT – Interest rate

IS-LM - Investment saving- Liquidity preference Money supply

IT - Inflation Targeting

JSE - Johannesburg Stock Exchange

KPSS - Kwiatkowski Phillips Schmidt Shin

LM- Langrage Multiplier

M2 - Money Supply

OECD - Organization for Economic Co-operation and Development

PP - Phillips-Peron

RER - Real Exchange Rates

RGDP – Real Gross Domestic Product

SA – South Africa

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SARB - South African Reserve Bank

SVAR - Structural Vector Autoregressive

SVECM – Structural Vector Error Correction Model

VAR - Vector Autoregressive

VECM - Vector Error Correction Model

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CHAPTER 1

INTRODUCTION.

1.1 Background of the study.

The global financial crisis, which started in 2007, has slowed down the global economy and impacted financial markets. More importantly, it has triggered a deep economic decline for developing countries around the world (Thakor, 2015). As a result of the turmoil, many central banks loosened their monetary policies significantly to relieve financial market pressures, promote growth, and stabilise the economy. Even though the monetary policy has been successful in decreasing financial market volatility, production growth and inflation, many advanced economies remained lower than anticipated, and recovery was widely regarded as disappointingly slow (Pain, Lewis, Dang, Jin and Richardson, 2014). Characteristics of financial crisis that may impact monetary policy transmission include a high financial market pressure, business low trust, macroeconomic volatility, and uncertainty, amongst others. According to Pain et al. (2014), all these adverse characteristics can impede the development of financial markets.

In their study, Noumbissie and Mongale (2014) pointed out that the South African financial market facilitates the process of raising capital, allowing funds to be channelled into more productive economic activities, ultimately growing the economy, and providing job opportunities. Even though greater uncertainty about global and domestic economic policies poses a threat to financial stability, the domestic financial system continues to perform well. The Bank for International Settlements (2020) points out that macroprudential policies, standard macroeconomic and structural policies, as well as capital flow control frameworks, are among policy choices that are utilised to address the issue of financial instability.

On the other hand, the South African Reserve Bank (SARB) has been able to avoid direct intervention in the foreign exchange market due to the inflation targeting system, which has helped to mitigate the effect of exchange rate fluctuations on the monetary policy. One mandate of the SARB is to protect and enhance financial stability. This is accomplished by keeping an eye on the economy and mitigating structural threats that could destabilise the financial system. According to the SARB (2020), a stable and well-functioning financial system

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contributes significantly to healthy and sustainable economic development, and systemic events are less likely to occur when financial system risks and vulnerabilities are mitigated.

Despite numerous assessments of research in developing countries such as South Africa, the fundamental issue of the nexus between financial market developments and monetary policy, which ultimately has an impact on financial stability, appears to have been completely overlooked. Notwithstanding the importance of the established link between monetary policy and financial market developments. Economists and financial experts have advised that the central bank in discharging its monetary policy obligations must observe financial markets very closely. Very clearly therefore, the monetary policy decisions of the central bank cannot work in isolation. Monetary policy by necessity requires a channel(s) of transmission for it to realise its ultimate objective of price stability and welfare gains. No doubt, financial markets provide indispensable channels for the effective transmission of monetary policy (Bangura, 2011). With the increasing importance of emerging markets and developing countries in the global financial architecture, a lack of systematic review of the link between financial market development and monetary policy constitutes a critical lacuna in research that begs for attention.

More so, these unique characteristics imply that models required for assessing developing countries and emerging markets must be uniquely different from those applied to industrialised nations. Based on this background, the goal of this study is to investigate the relationship between financial market development, monetary policy, and financial stability in South Africa.

1.2 Problem Statement.

The lesson learned from the global financial crisis and the outbreak of 2007/8 has greatly influenced economists, researchers, and policy makers in the relationship between financial instability and monetary policy. According to Smets (2014), price stability does not guarantee financial stability, and financial instability can have major negative feedback consequences on price stability. Furthermore, keeping inflation low and stable was insufficient to avoid financial system imbalances (Cecchetti and Kohler, 2010). Financial instability has the potential to impose substantial macroeconomic costs by interfering with production, consumption, and expenditure, thereby undermining national objectives of broader economic growth and development (SARB, 2013).

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Goodhart (2006) opined that the issue of monetary policy and financial stability nexus is very fragile, particularly when it comes to operationalising issues related to financial stability to formulate an appropriate monetary policy. Despite the chaos caused by the Covid-19 pandemic, the global financial system has weathered the storm, preventing a health crisis from turning into a systemic financial crisis. This resilience can be attributed in part to international regulatory changes that have been introduced over the last decade. South Africa has experienced several downturns in the last 20 years, the most recent being COVID-19, which started with a technical recession, rising fiscal tensions, rising public sector debt and a downgrade to junk status (SARB, 2020).

According to Mishkin (2009), strong monetary policy easing is useful in times of financial instability because it reduces the likelihood of negative feedback loops. Cecchetti and Li (2008) proposed postulated that, the interest rate policy should take (procyclical) capital-adequacy requirements into account for monetary policy to be successful during financial crises. However, according to several other research, monetary policy efficiency might be hampered by financial instability. For instance, Montes (2010) and Nair and Anand (2020) claim that monetary policy is likely to be less successful in promoting economic recovery due to financial instability connected to financial market shocks and bank panics. In addition, it may reduce the efficiency of the transmission of monetary policy (Billi and Verdin, 2014).

There is no consensus in the literature on whether Central Banks should extend monetary policy beyond price stability. However, periods of financial instability and financial market shocks have shown that the direct effect of credit controls, financial regulation and the high cost of borrowing have intensified procyclicality in financial markets and business cycles. All the above events have exerted pressure on the operationalisation of the financial market, commercial banks, and economic activities. The SARB, like many other central banks, used all their resources to respond to the crisis. However, there is no consensus in the interlink relationship between financial market shocks and monetary policy. It is against this backdrop that the aim of this study is to Evaluate the financial market development, monetary policy, and financial stability in South Africa.

1.3 The objectives of the study.

The broad objective of this study is to investigate the relationship between financial market development, monetary policy, and financial stability in South Africa.

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The specific objectives are:

- To investigate the dynamic interactions between financial market and monetary policy.
- To examine the effect of financial market shocks on financial stability.
- To assess the impact of monetary policy shocks on financial stability.
- To establish causality between financial market, monetary policy, and financial stability.

1.4 Hypothesis.

Considering the abovementioned objectives, the study seeks to test the following hypotheses in each case:

H_0: There is no dynamic interaction between financial market and monetary policy.

H_1: There is a dynamic interaction between financial market and monetary policy.

H_0: The effect of financial market volatility does not have a bearing on financial stability.

H_1: Financial stability is influenced by the effects of financial market volatility.

H_0: Monetary policy shocks do not have an impact on financial stability.

H_1: Monetary policy shocks have an impact on financial stability.

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H_0: There is no causality between financial markets, monetary policy, and financial stability.

H_1: There is causality between financial markets, monetary policy, and financial stability.

1.5 Significance of the study.

The debate about whether monetary policy should also consider the financial stability objective in addition to its primary objective of price stability is still ongoing. Several questions remain unanswered to improve our understanding of how financial system shocks work and their interaction with other policies such as monetary policy. This study will contribute to ongoing research on financial market shocks and their interaction with monetary policy. The main goal of the study is to enhance our understanding and to add to the literature of how monetary policies work, their effectiveness, transmission channels and their interaction with the financial market to promote financial stability and financial market development in South Africa amid economic shocks.

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This study is important for the South African economy because it assessed the nexus between financial markets, financial stability, and monetary policy conduct in South Africa. South Africa is an emerging economy, yet it trades with some of the world's largest economies such as United States, China etc. Any economic disturbances from such economies can affect the South African economy directly through consumption or indirectly through the capital flow. The South African economy is exposed to such disturbances, and they can be reflected through both the asset markets and macroeconomic indicators. There is a need to assess how the macroeconomic indicators and the asset markets interact in the South African economy. This study is therefore relevant to the South African economy.

Furthermore, the study will provide guidance on the optimal design and implementation of monetary policy amid economic shocks. This is particularly important as policymakers across the world are in the process of designing their own macroprudential policy frameworks. It appears that this is the first study that investigates the relationship between financial market development, monetary policy, and financial stability within the South Africa context.

The study made use of a variety of modelling methodologies such as the Autoregressive Conditional Heteroscedasticity Bayesian Vector Autoregressive Model (BVAR), the Vector Error Correction Model (VECM) and the Structural Vector Autoregressive model (SVAR) to assess the interaction financial markets, monetary policy, and financial stability in South Africa. The study will therefore shed light and add to the existing literature on the methodologies used to assess the dynamics of the asset financial markets, monetary policy, and financial stability in less developed countries

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1.6 Structure of the thesis.

The remainder of the thesis contains five chapters, and they are presented as follows: Chapter two presents an overview of the Financial Markets, Financial Stability and Monetary Policy Conduct in South Africa. This gives a general picture of how the South African markets has been performing under financial market shocks experienced over the years. This chapter also presents an overview of the monetary policy conduct and the introduction of the macroprudential policy in South Africa by reviewing its establishment and its performance over time under observation. In addition, chapter two also analyses the trend analysis of selected financial market variables, providing a synopsis of its performance. Finally, monetary policy of other countries is also provided in this chapter.

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Chapter three presents the dynamic interaction between financial markets and monetary policy in South Africa. In this chapter, theoretical and empirical literature relating to financial markets and monetary policy is reviewed. Furthermore, the Bayesian Vector Autoregression Model (BVAR) was constructed to test financial market shocks nexus to monetary policy in South Africa. The data sources and empirical results are also presented. Chapter four presents the relationship between financial market shocks and financial stability in South Africa. Here the literature is reviewed, linking the financial market shocks to the financial stability. After presenting data and data sources, the Johannes cointegration test was performed to illustrates the long-run equilibrium existence amongst economic time series data. Furthermore, the Vector Error Correction Model (VECM) was applied to validate the short- and long-run relationship between the financial market and financial stability in South Africa. The empirical results of the models ran under this chapter are also presented here.

Chapter five represents the effects of monetary policy shocks on financial stability in South Africa. In this chapter, literature about the monetary policy shocks and financial stability is reviewed, theorizing, and quantifying the relation between the two. Furthermore, the Structural Vector Autoregressive Model (SVAR) was constructed and conducted to assess the effects of monetary policy and financial stability in South Arica. Thereafter, the data, data sources and the results of the model are presented. Chapter six presents the conclusion of the study. Policy recommendations based on the findings of the study with suggestions for further research are also presented.

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CHAPTER 2

AN OVERVIEW OF FINANCIAL MARKET, MONETARY POLICY CONDUCT AND FINANCIAL STABILITY IN SOUTH AFRICA.

2.1 Introduction.

A notable feature of the financial sector in comparison to other economic sectors is that it comprises of financial institutions, instruments and markets that play a crucial role in the financial development and economic growth of developing and developed countries (Adam and Tzamourani, 2016). As such, any potential deviations in financial sector conduct will adversely affect economic growth in any given country. This was evidenced by the recent fall of the Lehman Brothers in 2008 as well as the 2016 sovereign debt crisis. During the 2008 global financial crisis, global economic growth contracted from 4.5% in 2007 to -1.3% in 2009 (World Development Indicators, 2021). The biggest knock-on effect was however felt during the coronavirus induced health crisis wherein the global economy contracted from 2.6% in 2019 to a mere -3.3% in 2020. It is worth noting that economic growth depends on the level of resource mobilisation. This includes both tax revenue, foreign aid, foreign direct investment as well as internal and external debt.

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As such, financial sector development is necessary for the efficient facilitation of capital inflows and outflows and ultimately resource mobilisation (Romer and Romer, 2004). While the government is more concerned about resource mobilisation, investors are particularly interested in financial markets, which refer broadly to any marketplace where the trading of securities occurs, including the stock market, bond market and forex market (Voinea and Cojocaru, 2017). Like any other market, financial markets are prone to shocks and turbulences. The extent to which the financial system can withstand systematic risks depends on the extent of financial sector supervision and regulation. A sound supervisory system is necessary for the protection of policyholders and promoting the stability of the financial system and should address the broad set of risks within, and posed by, the insurance sector. In this section, a brief overview of selected financial market variables is provided as well as the impact of specifically the 2008 global financial crisis and 2016 sovereign debt crisis on several macroeconomic variables.

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This chapter contains a summary and analysis of the trend of the selected financial market variables in South Africa. The monetary policy conduct both in South Africa and Internationally alongside the macroprudential policy is presented in this chapter.

2.2 Monetary policy conduct in South Africa.

The central bank of South Africa is constitutionally mandated to formulate and implement monetary policy in South Africa. This constitutional mandate includes protecting the value of the South African currency in the interest of balanced and sustainable economic growth. To date, South Africa has an annual economic growth target of 5.4% as set out in the National Development Plan 2030 (Bureau for Economic Research, 2020). It is worth noting that market outcomes have been somewhat the opposite as the South African economy grew by an annualised average growth rate of 1.3% in the last decade (World Development Indicators, 2022). Nonetheless, the South African constitution further mandates the central bank of South Africa to execute its constitutional mandate without fear, bias, and prejudice (Kganyago, 2018). This is necessary to ensure the efficient operations of the central bank in conducting monetary policy.

Also, because of the crucial role played by monetary policy conduct in the overall economy, it is necessary to ensure that monetary policy conduct is free from political and social interference (Bivens, 2015). Monetary policy plays a significant role in ensuring that the economy does not experience high inflation rates as this would hamper and erode economic growth. This is done through contractionary monetary policy which involves a reduction in money supply through bond purchases in the secondary market and increases in the repurchase rate. Also, monetary policy plays a crucial role during times of economic crisis by stimulating aggregate demand and consequently the economy through expansionary monetary policy (Amaral, 2017). This includes interest rate cuts and increases in money supply. It is worth noting that money supply has adverse effects on the economy in the long run and as such, monetary authorities usually opt for electronic money injection than printing hard money (Zizzamia, 2020).

Electronic money or quantitative easing has been a common feature in most advanced market economies recently amid the 2008 global financial crisis. Naape and Masoga (2020) note that although the introduction of new money hurts the economy in the long run, quantitative easing has proved to be an effective crisis management tool, hence the wide adoption by

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several advanced markets. Although financial market stability does not guarantee optimal economic output, it is regarded as a pre-condition for potential growth output. The South African Reserve Bank promotes financial stability in several ways, including through restricting the rate of increase in money supply, promoting a general level of interest rates, and providing support to the foreign exchange market. There are several tools that the South African Reserve Bank utilises to ensure sound financial operations and target inflation in South Africa. The monetary policy tools are discussed below:

2.2.1 Open market operations.

As stated by Banda (2020), Open market operations refer to the sale and purchase of securities by the central bank in the secondary market. The most common sought securities by central banks are government bonds and treasury bills. The rationale for the central bank to purchase government bonds and treasury securities is to increase the supply of money in the economy to desired levels and equally to reduce the supply of money in the economy through selling government bonds and treasury securities in the secondary market. It is worth noting also that the central bank can manipulate interest rates through open market operations. In most cases, central banks purchase government securities in the secondary market to increase the commercial reserves, which ultimately enables commercial banks to expand their loans and investments to lenders (Campbell and Mankiw, 1989). Also, the central bank can purchase government securities to raise the price of government securities which is equivalent to reducing interest rates. Considering the covid-19 pandemic and subsequent health and economic consequences, the central bank of South Africa bought over R20 billion worth of government bonds. This was done to provide the much-needed liquidity in the financial market which would ultimately bring about financial market stability.

2.2.2 Repurchase rate.

In South Africa, the repurchase rate (hereafter repo rate) is the interest rate at which the central bank of South Africa provides credit to commercial banks at. In turn, the repurchase rate feeds into the prime lending rate, which is the interest rate at which commercial banks provide credit to individuals and non-financial firms at. Interest rates have proved to be an effective monetary policy tool than open market operations. This is because, open market operations usually have implications for the interest rate structure. Interest rates on the other hand, can be used to manage both short term and long-term discrepancies in the financial

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sector (Blanchard, 2020). In most cases, the interest rate is used to curb inflation. To put this in context, as the repo rate increases, so does the prime lending rate and ultimately bank lending rate. This makes it costly for non-financial firms to borrow money from the commercial banks and in turn, reduces the finance of new credit such as overdraft facilities, mortgage bond applications and in-house vehicle finance. As a result of the reduction in credit facilities, the inflation rate decreases. An inflation rate that has no material effects on the macroeconomic decisions of traders, consumers, lenders, investors, and other market participants is crucial to obtaining financial stability. Since the emergence of the covid-19 pandemic, the central bank of South Africa reduced the repo rate by a cumulative 275 basis points. This was done to support low domestic demand and ease credit.

2.3 Macroprudential supervision.

A core aspect of financial stability is macroprudential supervision. Macroprudential policy aims to safeguard a sound financial system and help mitigate disruptive financial cycles. This is achieved by closely monitoring the real economy and financial sector to identify upward and downside shocks. In South Africa, risks to the financial system and consequently financial stability are monitored and reviewed through the Financial Sector Regulation Act 9 of 2017. The primary goal of macroprudential policy in South Africa is to improve the strength of resilience of the financial system against economic crisis and other adverse aggregate events. Also, macroprudential policy aims to predict the likelihood of systematic risks as well as to reduce the build-up of financial system shocks (Auclert, 2019). There are two types of risks in the financial system, namely, cyclical risks and structural risks. Simply put, structural risks refer to systematic risks that are evenly spread out across the financial system at a given point in time. Cyclical risks on the other hand refer to the progression of systematic risks overtime.

Figure 2.1: The SARB's macroprudential policy framework

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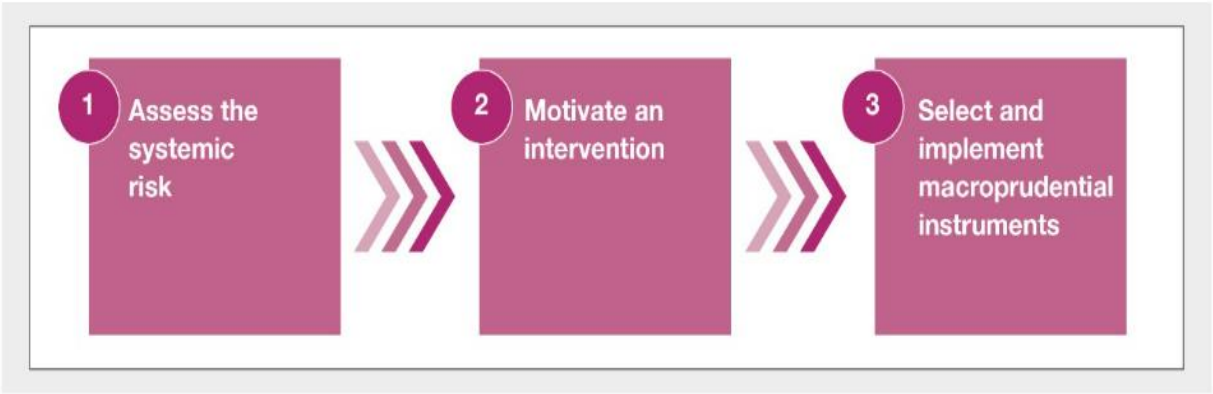

Source: SARB

Figure 2.1 above illustrates the South African Reserve Bank's macroprudential framework. The first step to macroprudential supervision is to examine the possibility of systemic risks relating to domestic and global developments. The next step involves providing motivation for intervention given the likelihood of potential systemic risks. The third step involves a selection of macroprudential instruments which are appropriate to the potential systematic risks identified.

2.4 Monetary policy conduct in other countries.

A common feature of monetary policy in both developing and developed countries is the adoption of inflation targeting as the base monetary framework. Although slight differences may exist in terms of approach, the goal of the monetary policy in any country is to protect the local currency and ensure a relatively lower inflation rate (Vissing-Jorgensen, 2002). That is, an inflation rate that does not erode gains from economic activity. Although the Taylor rule suggested that interest rates would be changed according to the deviation of inflation from a target and an output gap, the actual setting of interest rates by central banks across the world is slightly different. For example, Corbo (2002) examined monetary policy conduct in Latin American central banks and found that monetary authorities in Latin America look beyond inflation and focus on other macroeconomic objectives such as full employment and sustainable economic growth.

The rise of independent monetary authorities has also been quite notable. Independent monetary authorities are central banks that are not subject to government legislation (Cangul et al., 2017). In addition, independent central banks are not politically influenced, which is what makes them credible and efficient. During the 2008 global financial crisis, nearly all

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central banks across the globe loosened monetary policy substantially to stimulate the economy and cushion the financial shock. Naape and Masoga (2020) note that the response of advanced market economies to the 2008 global financial crisis involved the large-scale purchases of private and public assets. This approach was particularly employed to ensure that monetary policy is accommodative at the zero-lower bound of interest rates and inject the much-needed liquidity in financial markets (Leibbrandt et al., 2018). During the early Covid-19 pandemic, the approach was slightly different since most monetary authorities preferred adopting lower interest rates than large-scale asset purchases. Coulibaly (2012) notes that in previous crises episodes, by contrast, emerging market economies were generally characterised by tightened monetary policy. The main goal was to inter alia protect the value of their currencies, strengthen policy credibility and to limit capital flight. Depending on the performance of the economy and fiscal stance, monetary authorities may either employ contractionary monetary policy or discretionary monetary policy. The main difference between the two is that the former is restrictive in nature while the latter is accommodative in nature.

2.5 An overview of the trend analysis of selected financial market variables.

According to Cecchetti (2006), financial markets are the systems in charge of facilitating the flow of funds between savers and lenders, increasing the accessibility of trade in the financial industries. There are many different types of financial markets, such as primary markets that deal with new financial instruments issued by either government or corporate, securities such as, bonds or shares, and secondary financial markets institutions that facilitate the buying and selling of existing securities by investors, like the Johannesburg Stock Exchange (JSE).

In their study, Van Wyk, Botha, and Goodspeed (2012) attest that, South African economy features a well-developed financial market that operate efficiently, which enable markets to experience significant liquidity. As a result, assets can be easily changed into cash without suffering any losses in value outside those brought on by changes in market price. Subsequently, these markets maintain low transaction costs, while providing accurate information regarding market prices to market participants. In its totality, an efficient financial market system makes it simpler to establish market pricing, which subsequently enables efficient resource allocation (Beck, 2006).

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The Johannesburg Stock Exchange (JSE), the Bond Exchange of South Africa (BESA), several commercial banks, and other financial intermediaries make up the South African financial market. One of Sub-Saharan Africa's most developed and significant financial sectors is found in South Africa (Odhiambo, 2014). The Johannesburg Stock Exchange, which offers trading marketplaces for equities, derivatives, and interest rate products, is currently the 19th largest stock exchange in the world by market capitalization (Johannesburg Stock Exchange, 2016). Financial institutions are necessary to handle the risks in financial systems since they are expensive, opaque, and have too much information asymmetry. There are various operational issues that can affect the growth of the financial sector, particularly in emerging nations.

2.5.1 Credit to Non-Financial Sector.

The credit to non-financial sector has been widely used as one of the indicators of financial markets. This comprises of credit to the government sector and credit to the private non-financial sector. Financial markets as measured by the credit to non-financial sector, were heavily hit by the 2008 global financial crisis and 2016 sovereign debt crisis. During a financial crisis, as markets become volatile, financial firms are less willing to lend money to the government sector and non-financial private sector. In addition, the cost of borrowing usually increases amid high levels of uncertainty and individuals who may be faced with financial difficulties. In other instances, however, wherein a financial shock leads to a deterioration in economic performance, central banks may cut interest rates to stimulate aggregate demand and ease credit.

Figure 2.2: Credit to non-financial sector as a share of GDP.

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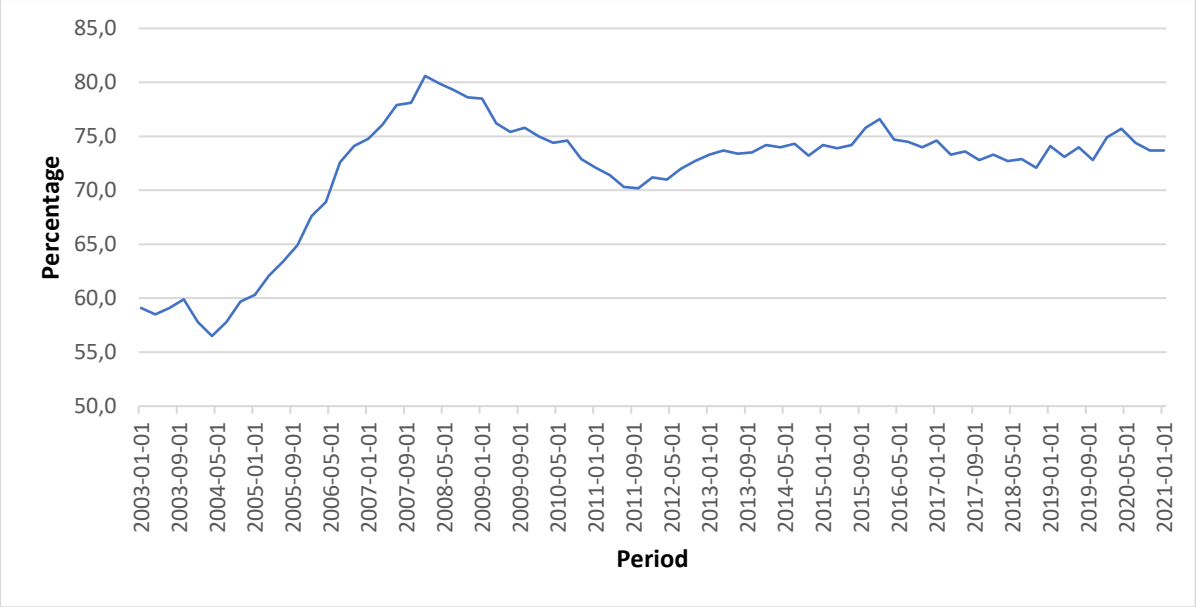

Source: Author's computations using St Louis Federal Reserve Data.

Credit to non-financial sector rose from 56 percent as share of GDP to an all-time high of 80 percent in 2008 before making a downturn in 2009 amid the emergence of the 2008 global financial crisis. While central banks injected liquidity into financial markets through large-scale asset purchases, commercial banks were less willing to extend credit to non-financial firms and individuals amid great volatility and uncertainty in financial markets, hence the decline in credit to non-financial firms. Although credit to non-financial firms deteriorated during the 2016 sovereign debt crisis, the margin of decline was relatively less than during the 2008 global financial crisis. This implies that the effects of the 2008 global financial crisis were relatively immense. It is worth noting, however, that credit to non-financial firms remains significantly high as a share of GDP (above 50%). This is indicative of the heavy reliance of non-financial firms on credit.

2.5.2 Money Supply.

Money supply, as measured by broad money (M2), can be defined as the total quantity of currency held by the public at a specific point in time. As a standard measure, money is measured in terms of currency in circulation, although other definitions and measures of money exist such as demand deposits. Depending on the cause of the financial crisis, the stock of money in circulation decreases while interest rates increase to curb inflationary pressures (Aklin et al., 2021). However, during economic downturns that are accompanied by

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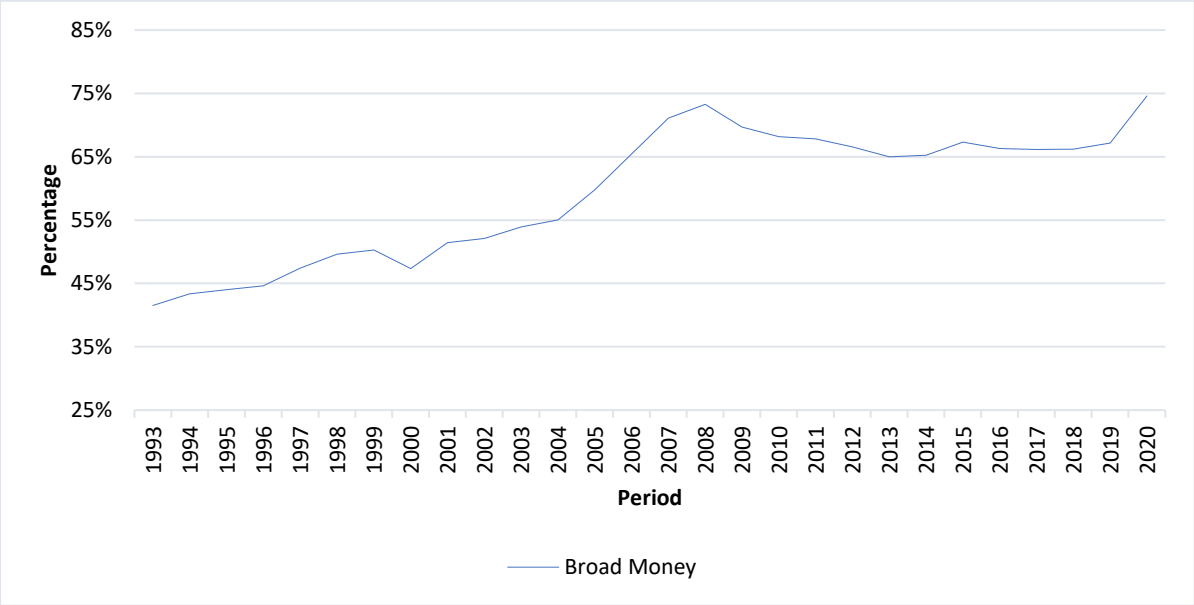
deflationary patterns, central banks, through the inflation targeting framework, make use of interest rates and open market transaction to inject electronic money into the economy.

This is particularly important for stimulating the economy and avoiding a depression phase. During the 2008 global financial crisis, the amount of money in circulation declined significantly given that the crisis was caused by supply-side shocks in the form of credit easing. Likewise, the stock of money in circulation decreased during the 2016 sovereign debt crisis although by a relatively lesser magnitude compared to the 2008 global financial crisis. While broad money supply rose from 41.5% as a share of GDP post-apartheid to an all-time high of 73% in 2008, this upward trend was hampered by the dire effects of the 2008 global financial crisis, which saw broad money supply deteriorating to 65% by 2013.

Figure 2.3: Broad Money as a share of GDP.



Source: Author's computations using World Development Indicators (2021)

2.5.3 Economic Activity.

History has shown that financial crises lead to economic downturns. Similarly, economic downturns have the potential to place systematic risks on the financial sector. During the 2008 global financial crisis, a subsequent economic downturn loomed, resulting in economic contractions in advanced and emerging market economies. During this period, the United States economy shrank by nearly 4.3%, regarded as the largest decline in the post-war era. Meanwhile in South Africa, the economy went into recession in 2008/09 for the first time in 17 years. Nearly a million jobs were lost in 2009 alone (Steytler and Powell, 2010). It is worth

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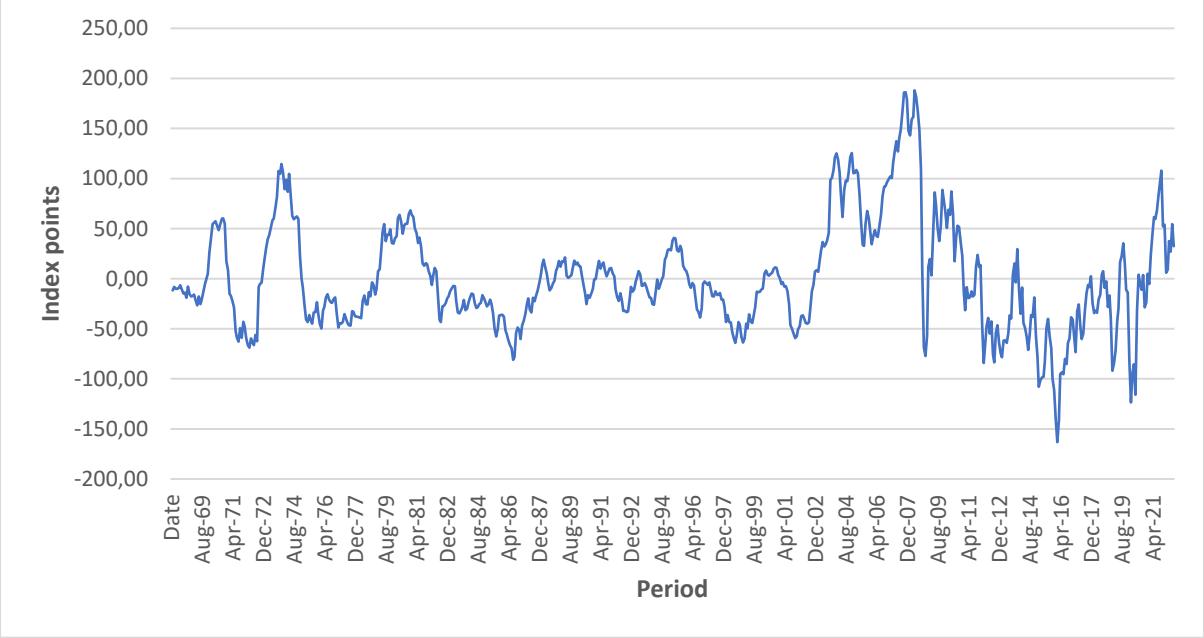
noting that the economic downturn was a result of the financial turmoil. A similar trend was observed during the 2016 sovereign debt crisis that led to a subsequent economic downturn. This saw the global economic activity index reaching the largest negative territory. Global economic activity as illustrated in Figure 2.4, shrank from 181 points mid-2008 to -77 points in late 2008. A similar trend can be observed during the 2016 sovereign debt crisis as global economic activity shrank from -58 points in late 2015 to 163 points in early 2016. To date, global economic activity hasn't returned to pre-crisis levels.

Figure 2.4 Global economic activities.



Source: Author's computations using St Louis Federal Reserve Data.

2.5.4 Exchange Rates.

The exchange rate can be defined as the rate at which one currency can be exchange for another. Exchange rates are not only volatile during financial turmoil and economic downturns but also during major news outbreaks. In fact, exchange rates are known to be the most accurate financial market indicators given their timely response to market news. Exchange rates are affected by financial turmoil in two ways. During a financial crisis, investors withdraw large amounts of funds in affected/volatile markets. This results in a depreciation of one currency against the other. The transfer of funds from one country/market to the other also results in an appreciation of one currency against the other as it becomes highly demanded.

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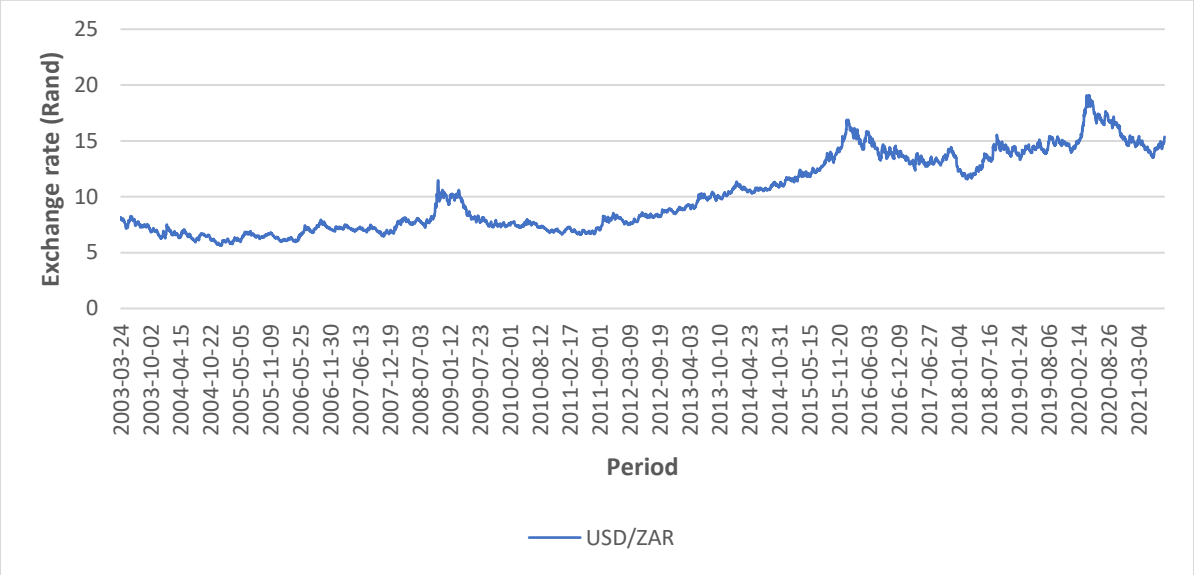
During the 2008 global financial crisis, the South African rand appreciated against the United States Dollar since investors were seeking higher returns in safe havens, South Africa being one of them. Also, because interest rates were relatively higher in emerging market economies than in advanced market economies, investors saw the transfer as a rational investment decision. It is sufficient to note that the appreciation of the South African rand against the United States dollar was relatively higher during the sovereign debt crisis than during the 2008 global financial crisis. This is particularly interesting, given that other macroeconomic indicators including credit to non-financial sector, money supply and economic activity were more responsive towards the 2008 global financial crisis than 2016 sovereign debt crisis.

Figure 2.5: US/ZAR exchange rate.



Source: Author's computations using South African Reserve Bank data

2.5.5 Interest Rates.

Interest rates refer to the rate at which the creditor lends money to the borrower. In South Africa, the most common rates are the repurchase rate and prime lending rate. The repurchase rate refers to the interest rate at which the central bank lends money to commercial banks while the prime rate refers to the interest rate at which commercial banks lend money to the government sector and non-financial sector. Central banks, as part of their macroprudential policy, which aims to safeguard a sound financial system and help mitigate

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disruptive financial cycles, make use of different monetary policy tools, including interest rates and open market operations to target inflation and ensure exchange rate stability.

In most cases, interest rates are used to curb inflation during periods of potential hyperinflation. Also, interest rates are used to stimulate spending during periods of deflation. As noted earlier, depending on the cause of the financial crisis and the response of the overall economy, the central bank can either increase or decrease interest rates as a regulatory response. In response to the 2008 financial shock, the South African Reserve Bank lowered interest rates to stimulate domestic demand and the overall economy. In contrast, during the 2016 sovereign crisis, the South African Reserve Bank hiked interest rates to attract capital inflow since the sovereign debt crisis shock had little to muted effects on the South African economy.

Figure 2.6 Interest rates.

Source: Author's computations using World Development Indicators (2022)

2.5.6 Bond Yields.

Due to its significance in the provision of an effective and reliable financial system, liquidity is a key indicator of the health and soundness of the bond market (Kapingura and Ikhide, 2011). Darkuvien (2010) describe the bond market as that type of debt market where firms or the government try to raise money for long-term projects by using the issuer's long-term borrowing instrument. In actuality, the investor lends money to a government or a corporation, with payments made to the investor while the capital's principal is repaid on the

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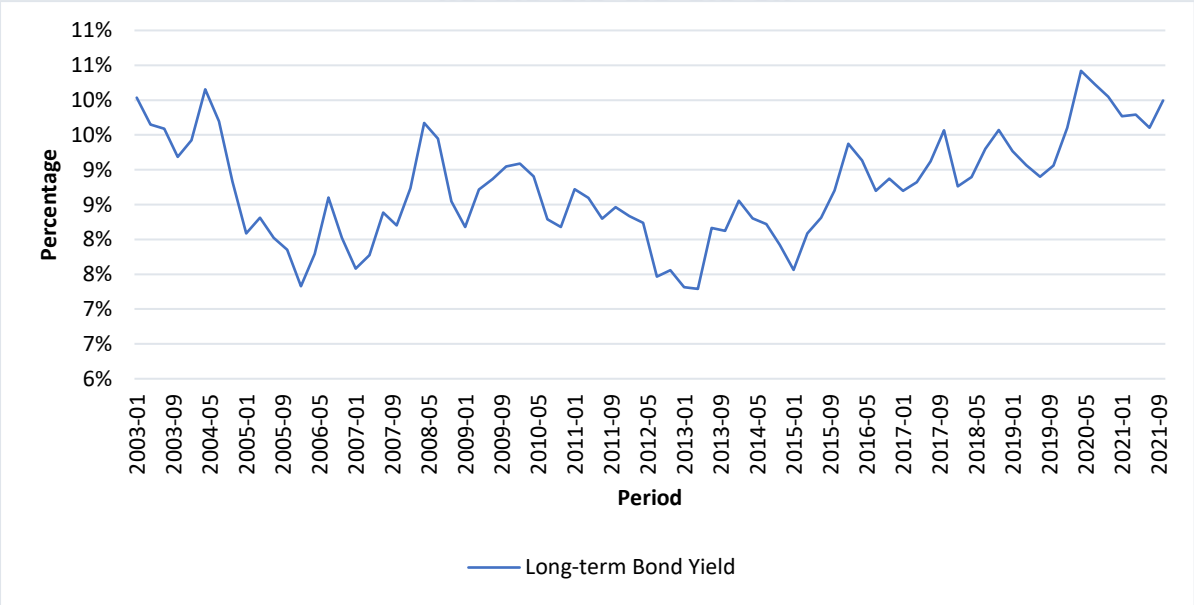
maturity date. Later, the bond's owner or investor may sell it on the secondary market (Ytterdal and Knappskog, 2015).

The significance and necessity of creating adequately liquid regional and domestic bond markets in the wake of the 2007–2008 financial crisis is further elaborated in (Adelegan and Radzewicz-Bak, 2009). This is based on the theory that encouraging local bond markets offers advantages due to improved functionality and efficiency. In other words, by allocating savings towards assets with high returns, offering additional sources of funding, and facilitating risk management through the distribution of risk among different investor groups, capital allocation is improved. According to Bae (2012), efficient capital markets are essential for economic development while also having an impact on the development of the bond market. Like how a country's level of economic growth might signify the need for capital market expansion in areas related to its financial and economic well-being.

Figure 2.7: Long term bond yields.



Source: Author's computations using St Louis Federal Reserve Data

Canzoneri et al. (2007) defines a bond as an instrument wherein the issuer owes the bearer a debt and is obligated, depending on the terms, to repay the bond's principal and interest over a predetermined period at the bond's maturity date. During a financial crisis, investors opt for bonds as they are classified as safe assets relatively to other financial securities. Thus, bond prices gain momentum while bond yields decline (Kaplan et al., 2018). This is because of the inverse relationship between bond prices and bond yields. In other cases, bond prices may

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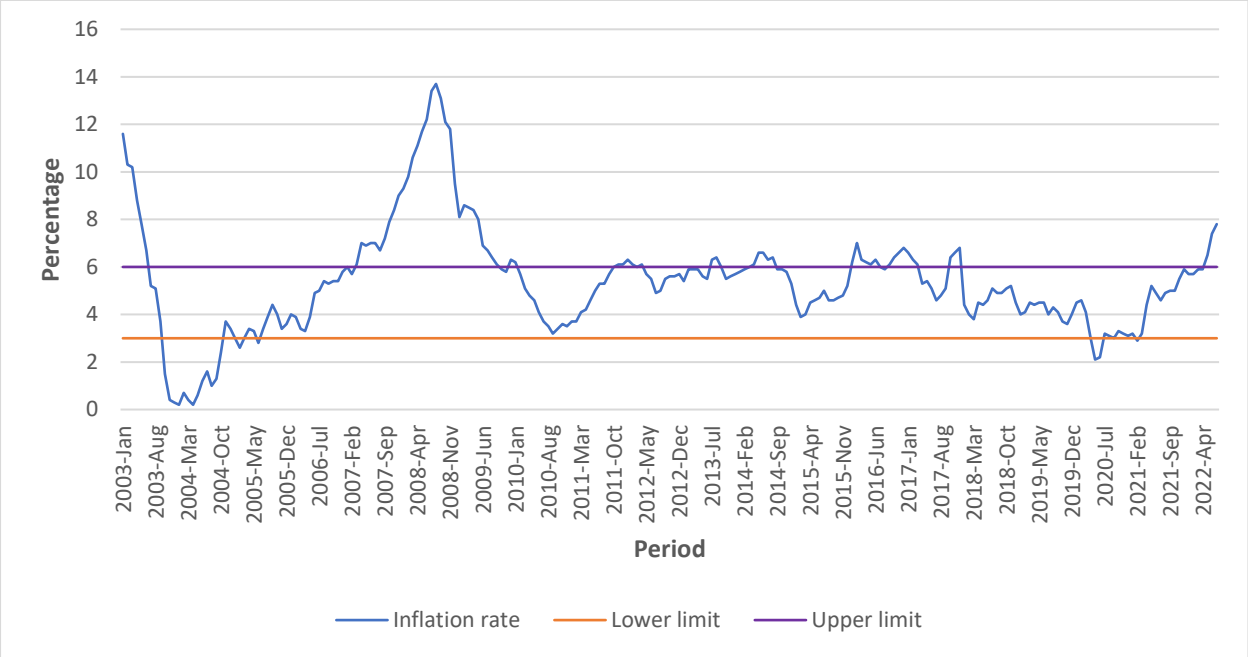
decline during a financial turmoil as individuals' cash-in their investments due to job losses and reduced incomes. This would result in a decline in bond prices and an increase in bond yields.

2.5.7 Inflation rate.

With the implementation of an inflation-targeting framework in February 2000, which aimed for a single digit inflation rate of 3% to 6%, South African monetary policy underwent a transformation. The inflation rate entered and has remained within the desired range of 3% to 6% since September 2003. Later, it picked up speed, and in 2007, it surpassed the South African Reserve Bank's 6% upper limit (SARB, 2007). Economic reasons are among those that have made a substantial contribution to current trends in consumer price inflation in South Africa. These include the cost of living, rent, transportation, health care, and medical bills. As a result of the predicted inflation rate, there was an increase in the demand for higher wages. Excessive bank lending was cited as another cause of the rise in consumer price inflation. Even though banks frequently have more exposure to firms than to families, this latter exposure is nonetheless significant (SARB, 2004).

Figure 2.8: Inflation rate.



Source: Author's computations using StatsSA data

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Food prices peaked at 20,8% in 2002, transportation costs grew to 9,6%, housing costs ranged from 8,1% to 11,3% during the same time, and medical and health-related inflation rates were 13,5% in November and December of that same year (SARB, 2004). Even if the inflation rate for these components significantly decreased (even to one-digit values) in the following years, they started to increase (SARB, 2004). The average annual inflation rate for 2020, on the other hand, was 3,3%. This is the second lowest yearly average rate (3,0%) since 1969 and the lowest since 2004 (1,4%). The South African Reserve Bank at the time claimed that one factor contributing to low inflation in 2004 was a stronger rand, which increased from R7,56/$ in 2003 to R6,45/$ in 2004. (Annual average).

2.6 Summary.

The robust and liquid financial markets in South Africa facilitate the efficient application of monetary policy and promote financial stability. The SARB periodically evaluates the efficiency of the framework it uses to implement monetary policy and has found room for improvement. The SARB is also in the midst of changing its interest rate benchmarks to enable better transparency and price discovery in the money markets, which is related to potential changes in the implementation framework. Such openness is critical to tracking and enhancing the efficiency of monetary policy transmission through the money markets.

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This chapter provided an overview of financial market instruments during the period 2003 and 2020. The impact of the 2008 global financial crisis and 2016 sovereign debt crisis were closely observed. From the analysis, it is evident that different financial market instruments respond differently during periods of financial turmoil and economic downturn. Also, it is evident that during the 2008 global financial crisis and 2016 sovereign debt crisis, economic activity and money supply were heavily hit relatively to other macroeconomic variables. However, the extent to which systematic shocks affected financial and macroeconomic variables will be dealt with accordingly in the following chapters.

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CHAPTER 3

THE DYNAMIC INTERACTION BETWEEN FINANCIAL MARKETS AND MONETARY POLICY IN SOUTH AFRICA.

3.1 Introduction.

This chapter presents the detailed empirical evidence that contributes to a greater understanding of financial markets and monetary policy in South Africa. It is in this chapter that the nexus amid financial market and monetary policy is quantified within the context of South Africa. To understand this in depth, this chapter is laid out in five parts. Firstly, the background to the South Africa's dynamic interaction between financial markets and monetary policy. The second part outline the literature review, which is bi-split into theoretical and empirical literature pertaining to financial market and monetary policy. The methodology is described in the third subsection, which defines and explains the technique and procedures that are used to answer the study's specific objectives. The empirical findings which are the results from the tests and procedures explained under the methodology section are presented in the fourth subsection. Lastly, the summary of this chapter together with the findings are conferred in the last subsection.

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3.2 Background of financial markets and monetary policy in South Africa.

In recent years the subject of monetary policy and financial market nexus has been revived following the recent global financial crises. Foreign investments fuels growth and development of a country, wherein financial markets have a positive influence on a country's economic growth and development, as well as a positive impact on the Balance of Payments, (Tchereni and Mpini, 2020). Thus, when the stock market is performing well, it usually signifies that the good performance of businesses contributes to the economy thriving. As a result, foreign investors are attracted to the security provided by well performing economies because they know that their funds are secure. The financial system in Africa has developed and evolved over the years to withstand and survive a series of banking crises. However, most central banks' monetary policies are primarily focused on ensuring the financial system's existence and development. In their study, Ma, and Lin (2016) suggest that any policy that affects the financial market development will ultimately have a concurrent effect on the

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transmission mechanism of the monetary policy. Some studies have shown that the strength of the monetary policy lies mainly on the stage and structure of financial system development (Carranza et al. 2010; Krause and Rioja, 2006). The effects of the global financial crisis and more recently Covid-19 pandemic have resulted in many economies having to adopt an expansionary monetary policy of low interest rates and because a bank cannot adopt low inflation rates; Banks can only achieve low interest rates and inflation rates given the responsiveness of the monetary policy instrument, in this case the interest rate, but these policies have not induced the aggregate demand.

Within the context of South Africa, the way the country executes its monetary policy has not changed because of recent financial market developments. In the years prior when the government implemented an inflation targeting regime as a policy response to address the aftermath of the global financial crisis such as the Asians 97/98, certain substantial changes happened in terms of the operational aim and monetary policy instruments (Bank for International Settlements, 2019). In August 1999, South Africa declared its aim to adopt an inflation targeting framework, and formally introduced inflation targeting in February 2000. Since then, inflation has been managed within a range of 3% to 6%. The SARB have also considered revising its monetary policy implementation mechanism to improve its efficacy and suitability.

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The implementation of monetary policy framework that previously gave effect to the inflation mandate of SARB has transformed to a repurchase rate (repo rate) financial system, instead of variations of a discount facility that was applied previously (BIS,2020). The SARB follows a cash reserve system, wherein it creates a money market that reserves a certain percentage of the cash for emergency situations. This system requires banks to influence the credit channel as far as monetary policy transmission is concerned (BIS, 2019).

The propensity of the financial market to monetary policy implementation is a key concern for the performance of real economic activity. According to Ruth (2017), monetary policy affects macroeconomic and financial variables constantly and the effect is more robust in the presence of high financial frictions. As stated by Chirila and Chirila (2018), financial markets in the developing market economies such as Brazil, India, South Africa, and Indonesia amongst others, have realised capital inflows in 2013 owing to the narrowing of the US quantitative easing measures i.e., reversal of unconventional monetary policy aimed at injecting liquidity

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in the financial markets. Moreover, the US financial markets experienced fluctuation and an exchange rate depreciation, because of the policy measures implemented prior.

The depth of global financial crises prompted various central banks globally, such as the Federal Reserve, European Central Bank and Bank of England to make their credit allocation system more robust, and to foster effective and smooth monetary policy transmission (Suurlaht, 2021). As a result of these policy initiatives the elasticity of financial markets to the monetary policy in international community becomes a problem in the background. It proves to be more difficult when the financial market responds less to predictable monetary policy actions, since the information would have already been taken into consideration prior to the implementation of monetary policy (Ozdagli, 2018). Nevertheless, unexpected component of changes in monetary policy can be computed to address the complexity thereof.

Horvath (2018) provides in his discussion, that financial market fragmentation has had an impact on the monetary transmission mechanism in the European context. Horvath (2018) pointed out the conduciveness of unconventional monetary policies in reducing fragmentation, albeit such policies are only a provisional solution to reducing fragmentation.

Therefore, the assessment of the nexus between the financial market development and monetary policy becomes important to make harmonised policies for many countries including but not limited to South Africa. The issue of monetary policy and financial market development has received very little attention both empirically and theoretically. These theoretical and empirical formulations of monetary policy need to consider the quantitative relevance of uncertainty because it is a constant feature of monetary policy practice (Naraidoo and Raputsoane, 2015). Against this background, this study aims to examine the dynamic interactions between monetary policy and the financial market. Therefore, to study the above, the study is further divided into specific objectives. Firstly, to assess the response of policy instruments to financial market shocks in South Africa. Secondly, to examine the dynamic interaction between financial markets and monetary policy in South Africa.

3.3 Literature review.

This section presents theoretical views relating to the topic under investigation. Thus, insights that emerge in this section can be associated with some of the results detailed in the empirical literature studies to explain, validate, and corroborate certain findings, as far as the

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interaction between financial market and monetary policy is concerned. According to Suurlaht (2021), who stipulated theoretical perspective concerning monetary policy and market sentiment, the link between stock prices and market sentiment has been found to be significant. This implies that investor sentiment has a meaningful impact on expected returns. Some of the theories regarding monetary policy and financial market are briefly discoursed in the subsections below.

3.3.1 Theoretical review.

The Taylor rule is a simple monetary policy rule that mechanically links the level of policy rate to deviations of inflation from its target and of output from its potential output. The Taylor rule as genuinely state that:

$$i^* = r^* + \gamma_t + h(\gamma_t - \gamma_\tau^*) + b(\vartheta_t - \vartheta_\tau^*) \quad (3.1)$$

Where i^* the target is nominal interest rate, r^* is the equilibrium real interest rate, γ_t is the current inflation rate, $(\gamma_t - \gamma_\tau^*)$ is the inflation gap, $(\vartheta_t - \vartheta_\tau^*)$ is the output gap. The interest rate is modified based on the output gap and current inflation rate, according to the interpretation of this form. This allows the policymakers to choose the inflation and output gap coefficients, depending on whether they want to target inflation or output stabilization. In terms of the inflation gap coefficient, Taylor (1998) argued that when the value of the coefficient is considerably over one, inflation can be stabilized. In other words, monetary authorities should raise interest rates by more than the inflation gap when inflation exceeds the target level which is called Taylor principle. Otherwise, if 1 + h does not exceed 1, a surge in inflation will lead to lower real interest rate $i - \gamma$ and this will boost inflation, stimulate aggregate demand and exacerbating instability.

Following the Taylor principle, in the event of supply shock or demand shock that boost inflation, an increase of real interest rates (since the nominal rates go up by more than inflation does) thus reduce output, which induced a rise in inflation and stabilise the economy. When real output exceeds its long-run potential, an increase in the policy interest rate is required, which is related to the output gap. Its coefficient is not so restrictive, as simply a positive value is desired. According to Garcia-Iglesias (2007), a very high value may have a negative impact on the proportion of inflation and output variability trade-off, causing inflation to rise. The advantage of a basic rule like the Taylor is that it is more robust than

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more sophisticated rules in terms of limiting swings in inflation, output, and interest rates, therefore ensuring financial market stability. The proposed form includes variables that can assist private agents to make decisions. However, central banks preferably smooth interest changes, including in Taylor rule a lagged value of the interest rate. Hence the rule indicated below, known as smoothing interest rate:

$$i_t = \psi i_{t-1} + (1-\psi) i^* \qquad (3.2)$$

where $\psi \epsilon$ [0,1] is reflecting the degree that the interest rate is smoothed. As an interpretation, when ψ = 0, the targeted interest rate changes instantly. The higher value of the interest rate is coincided with the sluggish adjustment. Different scholars such as (Goodfriend, 1991; Clarida et al., 1998; Clarida et al., 1999; Orphanides, 2003; Sack and Wieland, 2000) pointed to the fact that central banks' decision to smooth interest rates has various advantages, including preventing capital market dysfunction and maintaining credibility.

The second theory is the monetarist theory, this theory explains that financial crises are attributable to bank failures in terms of insufficient supply of money in the economy. Contrary to the business cycle, the crises frequently result from monetary authorities' policy errors, which lead to regime transitions that risk-pricing cannot anticipate in advance. Banking panics have reportedly been recognized by monetarists as a sign of a financial crisis, according to Nurul (2009). Looking at the six major contractions in the US between 1867 and 1960, according to Friedman and Schwartz (1963), were primarily brought on by significant banking or monetary shocks. This was due to the fading of confidence by the public on the ability of Central Bank to convert deposits into currency. The deterioration of confidence on the Central bank arises when a significant institution fails in the market, and therefore signifying crisis development. Friedman & Schwartz (1963) opined that, banking panics were a significant factor in the lowering of the money supply, which caused a severe contraction in overall economic activity.

According to Schwartz (1987), inflation is a major contributor to financial instability since it is closely tied to both the interest rate and the money supply, and an increase in inflation triggers an increase in the interest rate. This causes issues for the Central Bank, especially if the bank is involved in fixed rate lending or investment projects. Even this unstable price level may result in bank insolvencies. Nurul (2009) asserts that monetarists do not exclude the

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possibility of an asset price bubble and do not perceive an essential connection between the business cycle and crises. In monetarist view, financial crisis` is mainly a shift to money that transmit to widespread run-on banks. Remarkably, banking crises occur when financial systems run out of liquidity. This type of financial crisis led to bank runs, closures, mergers, takeovers, or large-scale assistant by the government to a group of banks or to the banking systems, should the crisis turn out to be systemic.

Lastly, the financial instability hypothesis engineered by Minsky. This hypothesis states that a financial crisis can be triggered by the credit cycle after an inception of a positive shock that worsens already growing debt and overpriced perceived risk that ultimately leads to the bursting of an asset bubble. These kinds of patterns are thought to be a typical aspect of the business cycle. Similar things occurred during the recent crises that emerged in the US. Furthermore, this hypothesis is an interpretation of Keynes 'General Theory' which renders the capital system inherently unstable because of the unpredictable nature of total investments. The theoretical argument offered for the financial instability hypothesis is derived from the classification of the economy in question as a capitalist economy that is comprised of high-value capital assets and an advanced and intricate financial system. Keynes is the capital development of the economy that Minsky (1992) identifies as the economic problem.

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The focus is to manoeuvre through real calendar time while accumulating the capitalist economy. According to Minsky (1992), the emergence of an unstable financial sector is a direct consequence of an increase in the general price level and unsustainable overuse of debt deflation. A banking sector that is involved in profit-seeking activity ultimately leads to the occurrence of financial sector instability. Minsky (1992) further argues that given the fact that banks are aware of the latest profit-guarantee innovations, they make the necessary efforts to evolve the products they market and aim to sell. As a result, banks will engage in activities that make them vulnerable to shocks. According to Binaku (2009), when the economy shows signs of stability, firms seek to increase their debt against their equity, because of this, they have a limited impact on the economy. Additionally, Minsky explains the way the financial hypothesis theory describes the impact of debt on the system and the methods used to validate the debt. The three distinct income-debt relations which are identified are as follows, hedge and speculative, and Ponzi finance. In hedge financing, the cash flow is used to fulfil

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the payment obligation. Therefore, the unit in question has a greater likelihood of being a hedge financing unit if there is a greater weight of equity financing in the liability structure. On the other hand, speculative financing adheres to payment commitments on the liability as they are unable to use the income cash flows to repay the principle. These units need to issue new debt to meet the commitments on the maturity debt (rollover liabilities). Hedge units usually include a government with non-fixed debts, corporations with floating issues of commercial paper and commercial banks.

Lastly, Ponzi financing occurs when the cash flow from operation is not enough to fulfil payment obligations, either repayment of principal or interest due on the debt. Given the situation, they have two options and that is to either sell or borrow more. Both options lower the safety net available to debt holders. According to Binaku (2009), an economy that uses Ponzi and speculative financing is more likely to be deviating from an amplified system compared to an economy that utilises hedge financing and is at equilibrium seeking. Binaku (2009) further explains that an economy that uses Ponzi and speculative financing will in the long-run transit from stable to unstable. This change happens as an economy moves from hedge to speculative and ultimately Ponzi finance.

Binaku (2009) argues that an economy that uses speculative finance when the economy appears to be stable is likely to face inflation. Subsequently, if the central bank engages in monetary policy tightening to reduce inflation, the Ponzi finance will emerge from speculative finance, leading to a decline in the net worth of the operations that have been financed by the Ponzi finance. Even though the financial hypothesis model is independent of exogenous shocks, it maintains that the business cycle is a result of the capitalist economies' internal dynamics and the regulations in place that are bound to keep the economy operating within targets. The increase in innovation, advancement in the financial system and government involvement as a refinancing agent of financial institutions and businesses is the reason financial systems are unstable.

3.3.2 Empirical review.

Financial markets, both domestic and international, have increasingly become integrated, albeit the transmission mechanisms through which financial markets shocks effects remain an area of examination among scholars (Ehrmann, Fratzscher and Rigobon, 2005); (Eyuboglu and Eyuboglu, 2017). According to Onur and Ibrahim (2019) who studied the transmission

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mechanism of financial stress into economic activity in Turkey, real economic activity is adversely and significantly prone to worsening of financial conditions. As the background to this study stipulated, the variables under investigation in this study are financial market and monetary policy. Hence, this section intends to scrutinize the empirical studies on the same/similar topic to discuss the findings and ultimately the potential gaps.

Using the Dynamic Stochastic General Equilibrium (DGSE) model, Efrem and Salvatore (2010) fitted the post-World War II data into the model to investigate the reaction of stock market to monetary policy for the United States economy. The study reported a couple of considerable findings signifying that, stock prices have meaningfully affected the business cycle and real economic activity. Furthermore, the estimates also found that the Federal reserve have a counteractive and significant response to oscillations in stock price.

Having mentioned that stock prices have meaningfully affected the business cycle and real economic activity, the findings of Suurlaht (2021) suggests that during low sentiments concerning the economic stance coupled with periods of recession, unforeseen monetary policy tightening leads to negative stock market returns and elevated risk in the financial market. These results have been abridged from the study that analysed the reaction of aggregate stock market performance and risk when unanticipated changes taken place in the domestic and foreign monetary policy. This was investigated in five countries (UK, Spain, Italy, France, and Germany) using an event study method, for the period spanning from 1999 to 2018.

Koivu (2010) conducted his study on China using the structural vector auto regression model to examine the effect of monetary policy on household consumption through stock housing prices. The conclusion from the study was that an expansionary monetary policy in China results in higher asset prices (household consumption). The study shows the presence of a significant and positive relationship between household consumptions and asset prices in China. The study further revealed that there are limitations in the impact of monetary policy on impacting house behaviour in China because agents have limited access to external finances.

A similar study was also conducted for South Africa by Bonga-Bonga (2010) to examine the relationship between interest rates (short-term and long-term) and supply, demand, and monetary shocks. The impulse response function derived from the SVAR model was used with

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long-term restrictions. The study concluded that there is a positive and significant relationship between the interest rates after a monetary and demand shock happen. Inversely, there is a negative correlation between the two interest rates and supply shock. He lastly pointed out that the operation of the monetary transmission mechanism in South Africa should be effective.

Mbarek, Marfatia and Juko (2019) investigated how the nexus amid monetary policy and the treasury yield curve evolves overtime. The study employed a time-varying parameter model estimation with the data spanning from 2006 to 2016, which suggested that towards the short end of the yield curve relative to the end, the monetary policy impact is not significant. However, after revolution, such impact drop drastically across maturities and this illustrates the variation in time. Thus, highlighting the appeal of more vibrant monetary policy, notably in a blustery environment.

Noumbissie and Mongale (2014) conducted a study on South Africa analysing the financial market impact because of monetary policy with quarterly data spanning from 2000Q1 to 2013Q1. The model had five variables as policy instruments (money supply, consumer price index, discount rate, exchange rate and gross domestic product (GDP)). Market turnover and Bond market turnover were including as market related variables. After using impulse repose function (IRF), the study concluded that there was a positive relationship between money supply and stock market turnover. The stock market turnover also positively influences GDP, discount rate and real exchange rate. However, the variable of interest is negatively affected by CPI shocks. They have concluded by suggesting that policymakers must be able to forecast tightening in monetary policy that is transmitted by a proportional decline in monetary policy as government securities are sold.

Balcilar, Ozdemir, Ozdemir and Wohar (2020) examined how the US financial markets is impacted by the Fed's unconventional monetary policy using yearly data spanning from 1996 to 2018. They used the smooth transition vector autoregressive (STVAR) model which suggested robust evidence that the risk structure of the US financial market adjusts post the global financial crises of 2008 and announcement of quantitative easing measures via the portfolio balance channel.

Eyuboglu and Eyuboglu (2017) examined the interaction amid government bond markets of 3 developed and 5 emerging countries (i.e., Germany, Japan, US and Turkey, Russia, Brazil,

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China, India respectively). The period covered 2006 to 2015, with the application of A VAR analysis carried out to a monthly data to determine the link among government bond yield of 10 years. The findings indicated non-dominant impact of US bond market and an influential Japanese market. Moreover, less integration has been revealed between Chinese and Japanese bond markets.

The study by Gumata, Kabundi, and Ndou (2013) examined various channels of monetary policy shock transmission within the context of South Africa. From 1990Q1 to 2012Q2, the study looked at 165 quarterly variables. A Large Bayesian Vector Autoregressive model was utilized. The transmission channels deployed in their model includes interest rate, credit, exchange rate, asset prices, and expectations. The findings demonstrate that while all channels appear to be powerful, their magnitudes and relevance vary. The interest rate channel, followed by the exchange rate, expectation, and credit channels, is the most important shock transmitter, according to their findings. Somewhat, the asset price channel is weak considering that households are affected directly via the interest rate channel and the amplification of the shock through their balance sheets is rather lacklustre.

Tchereni and Mpini (2020) examines the way decisions by monetary policy impact on stock markets of emerging economies, focusing on South Africa for the period spanning from 2000Q1 to 2016Q4. The study utilised a two-stage approach to test the hypothesis that stock markets is not responsive to monetary policy decisions. The first test is the vector error correction model, which is used to identify the long-run relationship between variables, and the second is the GARCH model, which is used to determine the stock market volatility. The findings indicated that Johannesburg Stock Exchange (JSE) exhibits about 5.2% variations in volatility owing to monetary policy shocks. Furthermore, the results revealed a positive link amid JSE volatility and repo rate. Economically, the findings thereof are not desirable because fluctuations in repo rate influences the aggregate demand for stock investment. The expansionary monetary policy was therefore recommended to set repo rate lower in the interest of stimulating borrowing. That would help the public to have more buying power to make securities transactions in the financial market.

Even though several researchers established a link between monetary policy and stock market shocks, others came to the opposite conclusion. This includes Neri (2004), who used structural VAR to test the link on G-7 countries and discovered that it was weak and negative

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on average. In their study, Li, Iscan, and Xu (2010) analyse whether trade and financial market openness matter for the impact on the transmission of monetary policy shocks to stock prices using SVAR models with short-run restrictions appropriate for Canada and the United States. They discovered that restrictive monetary policy shock in Canada immediately triggers the response of stock prices, albeit that is insignificant, coupled with brief dynamic response. On the other hand, the immediate response of stock prices to a similar shock in the United States is relatively large and the dynamic response is relatively prolonged. They concluded that the disparities are mostly due to differences in financial market openness, which result in different dynamic reactions to monetary policy shocks across.

Hsing (2013) found a negative and positive relationship between the Polish stock market index and money supply using GARCH models. The study found that when the M3 to GDP ratio is less than 46.03 percent, the correlation is positive, and when it is greater than 46.03 percent, the link is negative. On the other hand, Atis and Erer (2017) evaluated the association between monetary policy and the stock market using the Markov switching dynamic approach and the criteria of low and high volatility periods. During the low volatility mechanism, the data demonstrated that monetary policy had a negative significant impact on stock returns

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An important observation from the discussion of various findings above is that the relationship between financial market and monetary policy has been investigated dominantly in the developed countries. There are few studies that incorporated emerging countries in their analysis. Most concerning, South Africa rarely appeared among the reviewed literature. For instance, Naraidoo and Raputsoane (2015) applied an extended monetary policy rule that allows scrutiny of the effect of uncertainty about the financial market conditions on the interest rate setting behaviour that describes decisions made by the South African Reserve Bank. This serves as a basis to further examine the variables under investigation. This suggests a need to expand research on this topic with incorporation of more emerging market countries (in particular, South Africa).

Samantaraya and Patra (2014) flagged the importance of research that is country-specific owing to the awed homogeneity assumption in countries combined in cross country research. This research will contribute to the existing scanty body of research that is country-specific pertaining to the Dynamic interaction between financial markets and monetary policy. The

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research focuses on South Africa considering country specific structural factors and institutional structures. In terms of the literature reviewed, the time frame of most studies provides a leeway for longer period data (i.e., a research gap). That is because country specific research concerning South Africa mostly deployed yearly data for a shorter time with the longest being 17 years.

In this study however, the quarterly data from 2003Q2 to 2020Q4 will be utilised (thus, filling the gap identified). Consequently, there will be more observations and ample information for results analysis. Unlike using yearly data, which triggers a loss of actualisations during the year in yearly averages, the application of quarterly data provides for within year analysis and enough information to analyse the trend. Furthermore, the study employs a Bayesian Vector Autoregressive (BVAR) model to estimate the Dynamic interaction between financial markets and monetary policy in South Africa. The accuracy of results and the relative goodness in terms of forecasting are attributed to the selection of BVAR model, to also eliminates the problem of over-parameterisation that is faced with an unrestricted VAR. This is because the BVAR model makes use of restrictions based on prior knowledge of the parameters.

3.4 Methodology.

In this section, all the pre-estimation tests, data collection process and econometric modelling applied will be discussed in detail. The methodology of the study is largely informed by the theoretical framework and earlier studies on the nexus between monetary policy and financial markets.

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3.4.1 Explanation of variables.

A financial market can be described as a marketplace where financial instruments including stocks, bonds and derivatives are traded. There are several financial indicators which have been previously used as a proxy for financial markets. This includes corporate bond spreads, volatility, house prices, equity indices and stock market capitalisation, amongst others (Gadanecz and Jayaram, 2009, Baum et al., 2017). The inclusion of interest rates, exchange rates and inflation in the model was to capture the effect of monetary policy conduct on the financial market. The primary objective of any central bank is to maintain price stability and exchange rate stability. To achieve this, central banks make use of several monetary policy instruments, the most common instrument being interest rates. Thus, both interest rates,

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exchange rates and inflation form part of monetary policy conduct and were thus included in the empirical model.

3.4.2 Model specification.

The estimated model was informed by earlier studies including Efrem and Salvatore (2010), Mbarek et al., (2019) and Balcilar et al., (2020). The estimated model, with a few modifications, can be expressed mathematically as:

$$FM = \alpha_0 + \beta_1 cpi_{t-1} + \beta_2 int_{t-1} + \beta_3 exr_{t-1} + \beta_4 dum1_{t-1} + \beta_5 dum2_{t-1} + \varepsilon_t \quad (3.4)$$

Where

FM is financial markets proxied by the domestic stock market capitalisation,

CPI is the consumer price index capturing the effects of inflation in the financial sector,

INT is the market prevailing interest rate,

EXR is the real effective exchange rate measuring changes in the foreign exchange market

$DUM1$ is a dummy variable to capture the shock of the 2008 financial crisis,

$DUM2$ is a dummy variable to capture the effects of the 2016 sovereign debt crisis and,

ε_t is the error term.

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3.4.3 Estimation Approach.

The study followed the below estimation approach in relation to achieving the primary objectives of the study; The Phillips-Perron unit root test by Phillips & Perron (1988) and Augmented Dickey-Fuller test by Dickey and Fuller (1979) were used to assess the variables for stationarity. The Pairwise correlation test was executed as a pre-estimation technique to analyse the association between the dependent variable and explanatory variables. Further to this, the optimal lag length was estimated by means of the unrestricted Vector Autoregression Model. The next point of analysis involved estimating a Bayesian Vector Autoregression Model. To ensure that the estimated model does not suffer from spurious regression, several residual diagnostic tests were performed including the autocorrelation test and heteroskedasticity test. The last point of analysis involved performing the impulse response and variance decomposition tests. This was done to identify the response of financial markets to innovations in monetary policy aggregates.

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3.4.3.1 Unit root test.

The test for stationarity is conducted through a corroborate tests of Augmented Dickey-Fuller (ADF) and the Phillips-Peron (PP) and they are as classified as the formal test

a) Augmented Dickey-Fuller.

As stated in the study by Cheng and Annuar (2012) the Augmented Dickey-Fuller test was developed to test the stationarity of variables in a time series data. The famous statisticians called Dickey and Fuller developed these techniques in the 1970s to ensure that unit root test is performed to avert spurious results within the data. Hence, this study will also be exposed to this technique for the same purpose thereof. Most importantly, the detection stationarity serves as a verification tool to ascertain the likelihood of long-run cointegrating relationship among certain variables. The estimation of this test is mathematically expressed as indicated below, regressed with trend and intercept:

$$\Delta Y_t = \alpha + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{m} \omega i \, \Delta Y_{t-1} + \varepsilon_t \qquad (3.5)$$

The ADF compares the alternative autoregressive equations to the null hypothesis. However, the decision rule is set to reject the null hypothesis in the presence of t-statistics that are higher than the necessary ADF t-statistics. On the other hand, the p-value can be produced at a level of significance that is lower than the one stated. The logging of data series takes place before differencing in cases where the data series is exponentially treading.

b) Phillips-Peron Test.

In addition to the ADF test, the study will also use the Phillips-Peron (PP) test to check for stationary. The unit root test, according to Phillips and Peron (1988), is a structural single break in the data series that disregards the normality of the residuals. It is an alternative test that controls for serial correlation in the series while testing for unit roots and it is based on the non ADF test which is a simple AR (1) of the form:

$$Y_t = \alpha Y_{t-1} + \delta X_t + v_t \qquad (3.6)$$

The hypotheses test in the PP (unlike the ADF) are written by evaluating the modified t-statistic of the coefficient α to caution against the serial correlation impact on the asymptotic distribution of the test statistic.

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3.4.3.2 Optimal lag length.

The optimal lag length is a prerequisite when dealing with VAR models (i.e., prior to the estimation of results). The lag length in this case is determined through the statistical criteria coupled with economic theory. For the statistical criteria, the VAR lag choice selection criterion is used which is incorporated in the E-views 10 statistical package.

3.4.3.3 Bayesian Vector Autoregression Model.

A modification to the traditional vector autoregressive (VAR) model is the Bayesian vector autoregressive (BVAR) (Koop & Korobilis, 2010). BVAR makes use of Bayesian approaches to implement VAR (Gefang, 2014). In contrast to traditional VAR models, the BVAR model assigns prior probability values to the model's parameters, which are believed to be random (Gefang, 2014). However, the major superiority of the BVAR model is that it is not faced with the difficulties of collinearity and over-parameterisation which are peculiar to conventional VAR models because BVAR enforces priors on the autoregressive parameters. It is widely used to forecast economic variables, but there is very little research on its usage to analyse the nexus between financial market and monetary policy. A recent study that used this approach was the study of Krol (2010), in which the author compared the performance of BVAR and VAR, the study found that BVAR performs better based on VAR.

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Bayesian reasoning was put forward by the British scholar Thomas Bayes in the 18th century. It describes the relationship between the conditional probabilities of two random events. In their study, Kenny, Meyker and Quinn (1998) postulate that, when it comes to forecasting economic time series, the Bayesian technique is commonly used with multivariate vector autoregressions instead of univariate models like the AR(p) model. A Bayesian approach to vector autoregressions has been advocated by Doan, Litterman and Sims (1984) where they proposed priors for an n-dimensional VAR of non-stationary variables. BVAR differs with standard VAR models in that the model parameters are treated as random variables, with prior probabilities, rather than fixed values.

A variety of Bayesian priors have been developed for the purpose of being applied in vector autoregressive models, such as Litterman/Minnesota, Wishart Normal, Sims-Zha Normal Wishat, Sims-Zha Norma Flat, and others. The study chooses Litterman/Minnesota and Sims-Zha Normal Wishat method to see if there is notable difference. This approach is suitable for

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emerging markets with open borders, such as South Africa, where monetary policy has come under fire for irregularities like liquidity as well as price or exchange rate conundrums (Rosoiu and Rosoiu, 2013). The second issue is over-parameterization, which Sheefeni (2017) identified as being particularly problematic when there are many parameters that need to be estimated but insufficient observations are available. Thus, the Bayesian VAR model was created as a solution to this issue (Rosoiu and Rosoiu, 2013; Mabulango and Boboy, 2016). The choice of this methodology as opposed to the standard vector autoregression utilized in most empirical studies is justified considering the aforementioned inferences. A good set of priors, on the other hand, should impose some structure on the VAR that represents the nature and process of data generation.

This study follows the study of Kenny et al. (1998). Consider the n variable vector autoregression of order p, VAR(p), given by (3.7) below,

$$Z_t = \Psi_1 Z_{t-1} + \cdots + \Psi_p Z_{t-p} + \delta + \varepsilon_t \quad (3.7)$$

Where Z_t is an *(n x 1)* vector of time series that exhibits non-stationarity, δ is an *(n x 1)* vector of constants coefficients and ε_t is an *n x 1* of error terms vector. Ψ_1 through Ψ_p represent *(n x n)* matrices of parameters to be estimated. The VAR(*p*) is thus, a set of equations in which each variable is attributed to a constant and lags 1 through *p* of all *n* variables in the system. The same number of explanatory variables is contained in each of the VAR equations and the estimation can be done via ordinary least squares (OLS). Nevertheless, the system above has exactly $n + pn^2$ parameters that needs estimation. Hence, it is not surprising that empirical results that emerged in the estimation of unrestricted VARs often yield coefficient estimates which are not precise and are insignificantly different from zero.

This problem of over-parameterisation is acute specifically in the small sample sizes which are generally available to macroeconomic forecasters. Doan, Litterman, & Sims (1984) propose using Bayesian processes to estimate the parameters of the system presented in (3.7) above to avoid over-parameterization. Each series is best defined as a random walk around an unknown deterministic component, according to the original Litterman or Minnesota prior. Hence the prior distribution is centred around the random walk specification for variable *n* given by (3.8) below.

$$Z_{n,t} = \delta_n + Z_{n,t-1} + \varepsilon_{n,t} \quad (3.8)$$

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According to this specification, the mean of the prior distributions on the first lag of variable *n with*in the equation for variable *n* equate to unity. For all other coefficients, the mean of the prior distribution equates to zero. Unless the data suggest the existence of strong effects from lags other than the first own lag or from the lags of all the other variables in the model this will be reflected in the parameter estimates. There is no prior information assumed to be known regarding the prior mean on the deterministic components. Also, the prior distributions on all the parameters Ψ_1 through Ψ_p are assumed to be independent normal. Hence, once the means have been specified, the only other prior input is some estimate of the dispersion about the prior mean.

As described in Litterman (1986), the standard error on the coefficient estimates for $\log l$ of variable *j* in equation $i$is given by a standard deviation function of the form $H(i,j,l)$ given by equation (3.8) below.

$$H(i,j,l) = \frac{[y\, f(l) g(i,j)] h_i}{h_j} \qquad (3.9)$$

Where

$$g(i,j) = 1\ if\ i = j\ and\ r_{ij}\ otherwise \qquad (3.10)$$

The hyperparameter Y and functions $f(l)$ and $g(i,j)$ determine the tightness or weight attaching to the prior in (3.9) above. Given the functional specifications of $f(l)$ and $g(i,j)$, Y can simply be interpreted as the standard deviation on the first own lag. It is also often termed the overall tightness of the prior. The function $f(l)$ determines the tightness on lag one relative to lag l. The tightness around the prior mean is normally assumed to increase with increasing lag length. This is achieved by allowing $f(l)$ decay harmonically with decay factor v, i.e. $f(l) = l^v$. The tightness of the prior on variable.

The function *f(i, j) determines j relative to variable I within the equation for I variable;* this can apply across all the equations in which case r_{ij} equate to a constant (r) and the former is said to be symmetric. Alternatively, the tightness of the former for variable *j* in comparison with variable *i* (within the equation for *i* variable) can change depending upon the specific equation and/or variable in question (i.e., called a *general* prior). Nevertheless, the flexibility inherent in the specification at the back of a general prior might sometimes be less desirable. On the one hand, as Doan (1990) stipulated, the problem of over-parameterisation is transferred to

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one of having to estimate over too many hyperparameters. Hence, in a situation where there are robust prior views of the analyst that one of the variables is exogenous, the general prior might ameliorate the performance of forecasting. The equations pertaining to exogenous variables may particularly be best specified as autoregressions that are univariate without feedback from the other variables within the system. By setting the values to be at the extreme low for the off-diagonal elements in *f(i,j)* which correspond to that particular variable, this can be achieved.

The multiplicative ratio h_i/h_j in equation (3.9) generally reflects the need to specify the prior (former) with reference to the data. It makes correction on the differences that emerge in the scale applied when measuring each variable that is within the system. As an example, the tightness of a 0.5 standard deviation on the lags of prices in an equation for the interest rate depends on whether the price index in the base period is 100 or equal unity. The relative size of unexpected movements in the two variables depends on the scale of the response of one variable to another, rather than the relative sizes of their overall standard errors (Litterman, 1986). Thus, suggesting the need to scale the standard error on the prior by the ratio of the standard deviations, as far as the residuals (h_i) from a univariate autoregression for variable *i* to the standard deviation of the residuals (h_j) are concerned from a univariate autoregression for variable *j* (both with *p* lags).

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The BVAR model of Sims & Zha (1998) has realised prevalence among the political analysist and in economic time series. According to Brandt & Freeman (2006), Litterman proposed BVAR for the reduced form of the model. However, Sims-Zha specified prior for the simultaneous equation of the model. moreover, it was noted that Sims-Zha possesses more advantage relative to Litterman's propsed BVAR. A tractable multivariate normal posterior distribution can be produced by the SimsZha BVAR considering the allowance for more general specification. As in the reduced form version, the estimation of the VAR coefficients for the Litterman BVAR is carried out equation by-equation. Nonetheless, in a multi-variety regression, the Sims-Zha BVAR estimates the parameters for the entire system. The test for BVAR with Sims-Zha prior is stipulated below. First, consider the following (identified) dynamic simultaneous equation model as;

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$$\sum_{l=0}^{p} \underset{1\text{x}m}{y_{t-l}} \quad \underset{m\text{x}m}{A_l} = \underset{1\text{x}m}{d} + \underset{1\text{x}m}{\varepsilon_t} \; ; t = 1,2, \ldots . . T$$

This is an *m*-dimensional VAR for a T sample size with a vector of observations being y_t at time *t*, A_l the coefficient matrix for the I^{th} lag; *p* the maximum number of lags (assumed known), d a vector of constant and ε_t a vector of i.i.d normal structural shocks such that

$$\mathbf{E}\left[{}^{\varepsilon_t}/_{y_{t-s}} \, , s > 0\right] = \underset{1\text{x}m}{0} \; and \; \mathbf{E}\left[{}^{\varepsilon_t'}/_{y_{t-s}} \, , s > 0\right] = \underset{1\text{x}m}{0}$$

The transformation of a structural model can be initiated into a multivariate regression by defining A_0 as the contemporaneous conditions of the series and A_+ as a matrix of the coefficients on the variables lagged by $YA_0 + XA_+ = E$ where Y is $T_{\text{x}m}$, A_0 is $m\text{x}m$, X is Tx(mp+1), A_+ is (mp+1)xm and E is $T_{\text{x}m}$ matrices.

To define the VAR in a compact form

$$\alpha_0 = vec(A_0), \alpha_+ vec\begin{bmatrix} -A_1 \\ . \\ . \\ . \\ -A_p \\ d \end{bmatrix}, A = \begin{pmatrix} A_0 \\ A_+ \end{pmatrix}, \alpha = vec(A)$$

The construction of the VAR model can thus be associated with linear projection of the residual by letting $W = [K \; Q]$ and $A = [A_0/A_+]'$ is a conformable stacking of the parameters in A_0 and A_+:

$$KA_0 + QA_+ = E$$

$$WA = E$$

The derivation of the Bayesian estimator for this structural equation model is associated with the examination of the likelihood function for normally distributed residuals.

$$\lambda({}^{K}/_{A}) \propto |A_0|^T \exp\left[-0.5tr(WA)'(WA)\right]$$

$$\propto |A_0|^T \exp[-0.5\beta'(I \otimes W'W)\alpha]$$

The prior overall of the structural parameters has the form

$$\pi(\alpha) = \pi({}^{\alpha_+}/_{\alpha_0})\pi(\alpha_0)$$

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$$\pi(\alpha) = \pi(\alpha_0) \otimes (\tilde{\alpha}, \Omega)$$

The parameters in the prior for α is denoted by $\tilde{\alpha}$, whilst Ω is the prior covariance for $\tilde{\alpha}$, and $\otimes()$ is a multivariate normal density.

Therefore, the posterior for the coefficients is then given as;

$$Z(A) \propto \lambda({}^{K}/_{A})\pi(\alpha_0) \otimes (\tilde{\alpha}, \Omega)$$

3.4.4 Autocorrelation and Residuals tests.

It is possible for the outcomes of an Ordinary Least Squares regression to be different relative to the sample statistics. The actual value of a variable for instance, may differ from the sample mean; this value is termed a "residual autocorrelation" (Greene, 2003). Autocorrelation was checked using Lagrange Multiplier (LM) Test. That being on the spotlight, the deployment of LM test is justified since an investigator is not required to estimate the data under the alternative hypothesis. Heteroscedasticity, which occurs when variations in a variable are inconsistent throughout the applied range of values to forecast it, is another issue with OLS. White test is the applied form of checking for Heteroscedasticity, which measures the residual by changing variances (Alhassan and Biekpe, 2016).

3.4.5 Impulse response function and forecast error.

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An impulse response, in general, denotes the response of any dynamic system to some external perturbations. Impulse reactions in VAR focus on how the dependent variables respond to shocks from each independent variable by properly summing the coefficients of the impulse response functions, the cumulative effects of unit impulses are calculated (Lin 2006). The classic impulse response analysis, according to Lutkepohl and Reimers (1992), calls for the orthogonalization of shocks. Additionally, the outcomes differ depending on the VAR's variable ordering. The significance of the variable ordering increases with the residual correlations. Pesaran and Shin (1998) created the generalized impulse response functions to address this issue by adjusting the impact of different variable orderings on impulse response functions. The generalized impulse responses are represented graphically using historical correlation trends because it minimizes the biasedness toward any school of thoughts while ordering the variables.

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Only the graph of each financial series in reaction to numerous shocks is displayed in this section. It makes no mention of any generalized impulse response function calculations. However, it is challenging to see how external shocks affect the variables in VAR models with additional equations or lags. Variance decompositions analysis would be used to demonstrate how the equations interact with one another. Variance decompositions show what percentage of changes in the dependent variables are caused by their own shocks as opposed to shocks to other variables (Brooks 2002). Thus, the study regard variance decomposition as a confirmation of impulse responses. Generally, impulse responses analysis and variance decompositions offer very similar information.

3.4.6 Data and Sources.

The data was sourced from several reliable databases including the South African Reserve Bank online statistical query and St Louis Federal Reserve database. The frequency of the data was quarterly, spanning from 2003: Q2 to 2020: Q4. This brought the total number of observations to 71. McCleary et al. (1984) note that, the length of time series can vary, but are generally at least 20 observations long, and many models require at least 50 observations for accurate estimation, of which this makes the study's observation of 71 sufficient to produce sound results.

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3.5 Empirical Results.

3.5.1 Descriptive Statistics.

The pre-estimation analysis of this study involved performing descriptive analysis to examine the individual characteristics of the variables in question. This includes the mean, median, standard deviation, minimum and maximum values. The output is provided in table 3.1.

Table 3.1: Descriptive analysis output.

	MKP	INT	EXR	CPI
Mean	6.16	8.67	0.08	-1.25
Median	6.19	8.70	0.54	0.68
Maximum	6.56	10.42	13.47	130.53
Minimum	5.71	7.29	-11.80	-173.13
Std. Dev.	0.26	0.73	0.82	0.15
Skewness	-0.14	0.19	-0.19	-1.32
Kurtosis	1.61	2.56	3.61	14.07
Jarque-Bera	5.98	1.02	1.52	383.14
Probability	0.05	0.59	0.47	0.00

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Sum	437.14	615.81	5.68	-88.43
Observations	71	71	71	71

Source: Author's computations

There are no statistical differences in the variables, as shown in table 3.1. The variables' mean and median values are within the range of their values at both maximum and minimum. All variables exhibit the standard deviations of near to zero, therefore signifying that the deviation of the values from their means is at minimal. The data points are said to be spread out and closer to the mean when the values of standard deviation are higher and lower respectively. Additionally, it is important to note on the one hand, the least variability of MKP and CPI, while on the other hand, INT and EXR have the most variability. Hence, a high level of consistency as far as the statistical properties are concerned. The estimation of Kurtosis and Skewness signifies normal distribution for all variables concerned. The negative estimates regarding the Skewness for MKP, EXR, and CPI implies the leftward skewness of the distributions of the variables. However, the Skewness estimates for INT are positive, implying the rightward skewness. Hence, there is high level of consistency that is prevalent in the statistical properties.

3.5.2 Correlations Matrix Analysis.

The pairwise correlation test was performed as a pre-estimation test to observe the statistical relationships between the variables in the regression analysis. The estimated coefficients range from -1 to +1; the closer the estimate is to -/+1, the greater the association. The direction of the correlation is indicated by the sign of the correlation coefficients; a positive sign (+) denotes positive correlation, while a negative sign (-) denotes negative correlation. The results are provided in table 3.2.

Table 3.2: Correlation Matrix.

Probability	MKP	INT	EXR	CPI
MKP	1.00	0,34	0.89	-1.34
INT	0.489	1.00	-0.93	0.44
EXR	0.138	-0.27	1.00	0.33
CPI	-0.383	0.118	-0.09	1.00

Source: Author's computations.

From the analysis provided in table 3.2, a positive correlation can be observed between stock market capitalization and interest rates as well as between stock market capitalization and

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inflation. On the contrary, a negative but statistically insignificant association was found between stock market capitalization and the real effective exchange rate. Thus, table 3.2 shows that some variables have substantial correlations, implying that the variables are multicollinear. Multicollinearity, on the other hand, does not imply that the model is incorrectly described, because the estimators are still best linear and unbiased (BLUE), and standard errors are still valid (Gujarati, 2004).

3.5.3 Stationarity Analysis.

The analysis of unit root is presented in Table 3.3, reflecting the time series data that is assumed to be non-stationary and stochastic. Therefore, in the interest of averting the spurious regressions outcome, determination of the stationary properties of the data is essential. The PP test and ADF test were used to determine the existence of a unit root in the time series for the variables under investigation.

Table 3.3: Stationarity results.

Variable	M.S	ADF		PP		O.I
		Level	1st diff	Level	1st diff	
MKP	Intercept	-0.95	-7.20*	-0.96	-7.21*	I(1)
	Trend & Intercept	-1.6	-7.21*	-1.47	-7.19*	
CPI	Intercept	-3.87*	-4.97*	-9.05*	-29.57*	I(0)
	Trend & Intercept	-4.78*	-5.04*	-8.90*	-30.20*	
EXR	Intercept	-7.98*	-11.04*	-7.98*	-31.31*	I(0)
	Trend & Intercept	-7.92*	-10.97*	-7.91*	-35.46*	
INT	Intercept	-2.46	-7.68*	-2.33	-8.13*	I(1)
	Trend & Intercept	-2.77	-7.83*	-2.53	-13.08*	

*Source: Author's computations, Note: asterisk *,**,*** indicate significance at 1%, 5%, & 10%*

There is a mixture of I(0) and (1) order of integration for the variables observed in table 3.3 above. The unit root analysis confirmed the stationarity of real effective exchange rate and consumer price index at level both in the Augmented Dickey Fuller and Philips Perron unit root tests. On the contrary, the study found that stock market capitalization and interest rates are stationary after first differencing.

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3.5.4 Lag order.

One of the common problems in the estimation of an unrestricted vector autoregression is the over-parameterization of the VAR model. Thus, to overcome this challenge, determining the appropriate optimal lag length was crucial to our analysis. The results are provided in table 3.4.

Table 3.4: Optimal lag length selection.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-567.52	NA	1.85	17.64	17.85	17.73
1	-173.67	702.86	3.09e-05	6.64	8.04*	7.19*
2	-133.82	63.75*	2.82e-05*	6.52*	9.13	7.55
3	-105.05	40.72	3.79e-05	6.74	10.55	8.24
4	-68.05	45.54	4.24e-05	6.71	11.73	8.68
5	-39.02	30.36	6.78e-05	6.92	13.15	9.38
6	-10.37	24.68	0.00e-30	7.15	14.57	10.08

*Source: Author's computations, Note: asterisk * indicate the selected lag length*

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The findings from the estimated VAR model recommended the use of two lags in our model. This was informed by the Akaike Information Criterion. Following the pre-estimation analysis, the proceeding step was to perform a Bayesian VAR model.

3.5.5 Bayesian VAR.

The derivation of impulse response functions as stated earlier, emerged from the Bayesian VAR estimates based on the prior of KoKo Minnesota/Litterman (2010) and Sims and Zha (1998) prior. A Bayesian VAR was estimated to examine the dynamic interaction between monetary policy and financial markets in South Africa. The results are provided in below.

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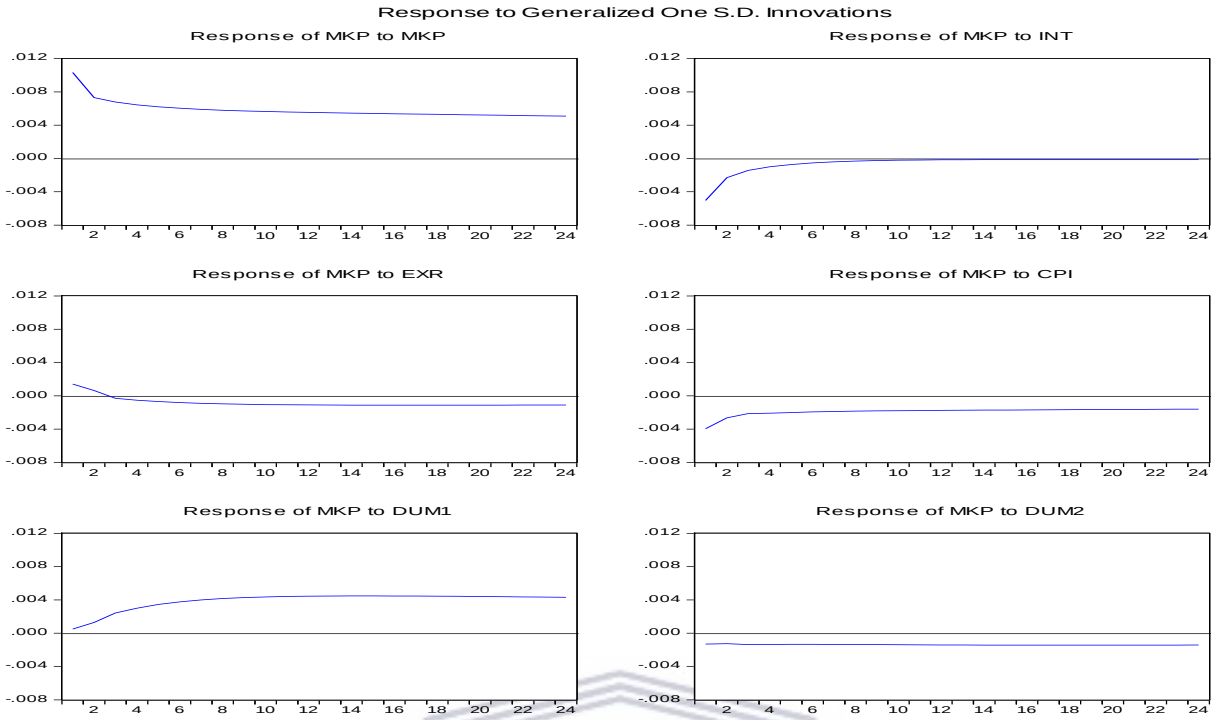
Figure 3.1: Minnesota/ Litterman.



Source: Author's computations

Figure 3.1 shows the results of the financial market and monetary policy. The findings from the estimated BVAR model indicates that the response of stock market capitalisation (MKP) to a one standard deviation of its own value was found to be positive during the short run and long run as a proxy for financial market. The effect of shocks appears to be permanent for stock market capitalisation since the blue line does not go back to its initial equilibrium which is the zero line for the steady state. Meaning the new equilibrium has been formed. As such, when interest rates are reduced, the domestic financial market suffers due to capital outflows as investors seek higher returns in other countries. The opposite holds when interest rates are increased domestically. These outcomes are comparable to those obtained by Sheefeni (2017) using time horizons with quarterly frequency. Changes in interest rates (INT) largely influence the decision to borrow and invest.

In the same vein, the reaction to interest rate suggests that the effect of the shocks is transient because no new equilibrium has emerged since the blue line returned to the initial equilibrium. This study defers with that conducted by Bonga-Bonga (2010), who found positive and significant relationship between the interest rates after a monetary and demand

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shock happen using the impulse response function derived from the SVAR model with long-term restrictions. Hence this study used a different model BVAR.

Real effective exchange rate (EXR) responded negatively and the effects wear after 2 quarter. Worth noting, when the domestic currency weakens, the stock market appreciates given that domestic stocks become relatively cheaper. As shown above, the response to exchange rate shows that the effect of shocks is permanent. In contrast, the consumer price index (CPI) was found to have a positive impact on stock market capitalisation. This is because, a stable and sustained inflation rate is necessary for preserving the value of stocks. During periods of hyperinflation, the value of domestic stocks decreases while during periods of deflation, the value of domestic stocks appreciates thus making them attractive. In this case, the effect to shocks is temporary.

The dummy (DUM1) for the 2008 financial crisis was found to have a positive effect on stock market capitalisation. It can be assumed that the 2008 financial crisis affected advanced market economies adversely, especially in relation to emerging market economies and as a result, emerging market economies were regarded as safe havens for investment. The dummy (DUM2) for the 2016 sovereign debt crisis was found to have a negative impact on stock market capitalisation as well with permanent effect of shocks. The exercise was repeated with additional prior of Sim's-Zha to compare whether the results differ.

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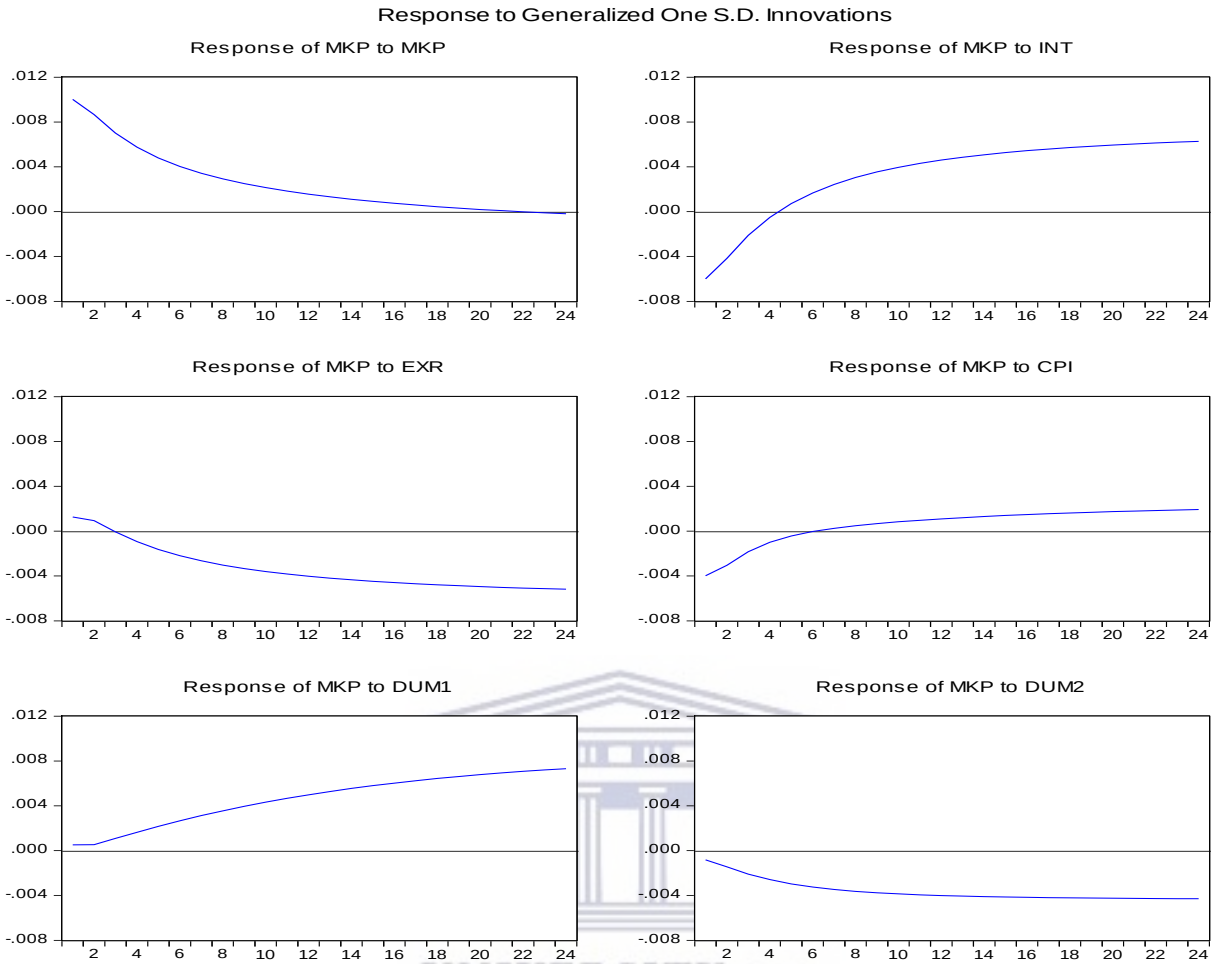
Figure 3.2: Sim's-Zha (WishartNormal).



Source: Author's computations.

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Similarly, the response of stock market capitalisation to a one standard deviation in interest rates was likewise found to be positive during the entire quarters. This assumes that higher interest rates are linked to higher returns. As a result, potential investors seek returns in countries with higher prevailing market interest rates. The same is true for the exchange rate. A weak exchange rate attracts capital inflows and thus driving liquidity into the domestic financial market. This can be observed in figure 3.2. Stock market capitalisation responds negatively to a one standard deviation shock in the exchange rate. The response of stock market capitalisation to a one standard deviation in inflation is positive in the short run but muted in the long run. This is because the effects of inflation on domestic stocks are only temporary and thus muted in the long run which one can conclude that monetary policy does have effect on inflation rate in the long run. The effect of shocks in all cases are permanent.

3.5.6 Variance Decomposition.

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Like impulse responses, the variance decomposition is used to illustrate the forecast error discrepancy of each variable in relation to its own shocks. The findings are provided in *table 3.5*

Table 3.5: Variance Decomposition.

Period	S.E	MKP	CPI	INT	EXR	DUM1	DUM2
1	0.010	100.000	0.000	0.000	0.000	0.000	0.000
2	0.013	98.500	0.102	1.082	0.023	0.128	0.162
3	0.015	93.950	0.530	4.161	0.040	0.769	0.547
4	0.017	87.051	1.100	8.648	0.184	1.952	1.062
5	0.018	78.983	1.641	13.726	0.460	3.576	1.611
6	0.020	70.718	2.083	18.749	0.827	5.497	2.124
7	0.022	62.871	2.414	23.328	1.239	7.579	2.566
8	0.023	55.749	2.650	27.294	1.660	9.717	2.926
9	0.025	49.456	2.810	30.617	2.068	11.837	3.208
10	0.027	43.977	2.916	33.339	2.450	13.894	3.421
11	0.029	39.242	2.983	35.535	2.800	15.859	3.578
12	0.030	35.164	3.021	37.286	3.117	17.718	3.689
13	0.032	31.652	3.041	38.670	3.403	19.467	3.765
14	0.034	28.622	3.047	39.753	3.658	21.104	3.812
15	0.036	26.002	3.044	40.593	3.887	22.633	3.839
16	0.037	23.726	3.035	41.236	4.091	24.059	3.849
17	0.039	21.744	3.022	41.722	4.275	25.380	3.848
18	0.041	20.009	3.007	42.082	4.439	26.622	3.837
19	0.042	18.486	2.989	42.340	4.588	27.773	3.821
20	0.044	17.144	2.971	42.517	4.721	28.845	3.799
21	0.0465	15.955	2.952	42.630	4.842	29.844	3.775
22	0.047	14.899	2.933	42.690	4.952	30.775	3.748
23	0.049	13.957	2.914	42.710	5.052	31.644	3.721
24	0.0508	13.114	2.895	42.698	5.143	32.455	3.693

Source: Author's computations

The variance decomposition results show that in the short run, variations in stock market capitalisation are explained by changes in its shock. For example, in the first period, 100% of the variations in stock market capitalisation are explained by its own shock although this share declines to 87% in period 4 and 62% in period 7. Over the long run, variations in stock market capitalisation are largely explained by shocks in interest rates and to a small extent by shocks in the real effective exchange rate and inflation rate. This is indicative of the significant role played by various monetary policy tools to maintain price stability, exchange rate stability and overall financial stability.

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3.5.7 Residual Analysis.

The execution of diagnostic tests including the autocorrelation, roots graph and heteroskedasticity tests was conducted to validate the results. See the presentation of results in table 3.6.

Table 3.6: Residual diagnostic results.

Residual Test	Chi-square	p-value
Auto Correlation LM	20.82	0.19
Heteroskedasticity Test: White	643.04	0.17

Source: Author's computations

The findings in table 3.6 confirm that the estimated model is not susceptible to autocorrelation and heteroskedasticity. This is because, the corresponding probability values of the chi-square for both the autocorrelation test and heteroskedasticity test are above the 5% significance level. The probability value for the autocorrelation test equates to 19% while the probability value for the heteroskedasticity test equates to 17%. As a result, there is a rejection of null hypothesis for heteroskedasticity and autocorrelation at the 5% level of significance. The inverse roots analysis was also conducted. The findings are provided in figure 3.3 below.

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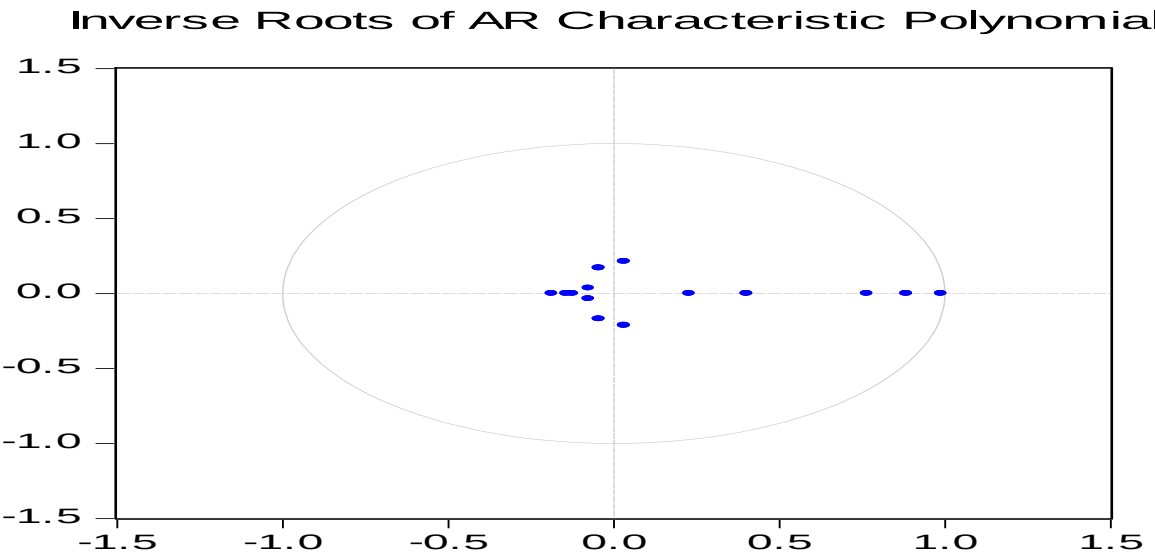
Figure 3.3: Inverse Roots of AR.



Source: Author's computations

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According to Lütkepohl (1991), the estimated VAR model is stationary when all variables have a modulus that is less than one or lie inside the unity circle. In the analysis, it was found that all the modules lie inside the unity circle.

3.5.8 Summary

This study primarily aimed was to scrutinize the dynamic interaction amid monetary policy and financial markets. This was achieved by means of economic analysis. The quarterly time-series data for the period 2003/Q2 to 2020/Q4 was employed. The Augmented Dickey Fuller test and Philips Perron test were utilised to examine the order of integration of the variables concerned, among various econometric techniques. In addition, the pairwise correlation test was employed to investigate the association between the dependent variable and explanatory variables. Further to this, a Bayesian VAR model was estimated in addition to variance decomposition coupled with impulse responses to analyse the dynamic interaction amid financial markets and monetary policy. The findings revealed that interest rates and the rate of inflation have a direct impact on stock market capitalisation as a proxy for financial markets, while on the contrary, an inverse link was found between the stock market capitalisation and real effective exchange rate. In the case of variance decomposition and impulse response, the findings revealed that long run changes in stock market capitalisation are largely explained by shocks in interest rates.

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CHAPTER 4

FINANCIAL MARKET SHOCKS AND FINANCIAL STABILITY IN SOUTH AFRICA.

4.1 Introduction.

This chapter is laid out in five sections. The first section presents the background on financial markets and financial stability. The second section outline the theoretical framework and empirical literature. The methodology adopted to assess the effect of financial market shocks on financial stability in South Africa is displayed and discussed in section three. The analysis of empirical results is presented in section four, and section five presents the conclusion of this chapter.

4.2 Background of financial market and financial stability in South Africa.

The effective functioning of the economy can be associated with financial markets forming an integral part in ensuring good economic prospects (Evans and Moten, 2011). In Sub-Saharan Africa, South Africa is amongst the countries that experienced the deepening of financial systems and a surge in prominence of the financial market, noting the past years. This was somewhat driven by amelioration in the institutional finance framework, coupled with a surge in demand (Andrianaivo and Yartey, 2010). However, there are elevated uncertainties on the investment landscape globally, including financial market in South Africa. These can be attributed to geopolitical factors amid obstruction of social and economic justice (EY, 2017). Moreover, the blame can be on a relatively moderate growth in South Africa and sluggish recovery following the global financial crisis of 2008/9 (Mminele, 2017).

As a result of the public health measures implemented to contain Covid-19 and uncertainties in terms of the scope and duration of the measures thereof, the level of economic activity was negatively affected. Most concerning was the volatility of the financial markets in reaction to such policy measures. Hence, the large and sudden changes realised for a range of financial asset prices. Schnabel (2019) attested that, deterioration in market liquidity and volatility experienced had greater impact than during the global financial crisis. In financial markets, a flight to safety devolved into an abrupt and dramatic rush for cash, in which

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investors sold off even safe assets like long-term government bonds in favour of short-term, highly liquid assets. This represented several fundamental market difficulties.

There were attempts by non-banks to raise cash to satisfy margin calls on derivative positions as the Bank of England (2020) stated. Additionally, leveraged investors made withdrawals from government bond markets, while dealers resisted from repo markets. As a result, an acute selloff pressure was experienced within the bond markets. The demand for liquidity by most investors is attributable to the sale of assets thereof, to make redemptions from money market funds. There were also signs of potential incentives to redeem investments before others prevalent in other open-ended funds which experienced large redemptions.

The presence and persistence of shocks that affect the economy and financial stability includes political, monetary and macroprudential shocks. According to Greenwood-Nimmo and Tarassow (2016), financial fragility is prone to contractionary monetary policy shock. While it is necessary to have easy financial conditions for a protracted period to sustain economic recovery, this may lead to extreme stretch of asset valuations and could exacerbate financial vulnerabilities (International Monetary Fund, 2021). This study examines the impact of financial market shocks on financial stability in South Africa with the following specific objectives respectively, to examine the effect of shocks in the financial market on financial stability and to provide an overview causal relationship between financial market shocks and financial stability in South Africa.

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4.3 Literature Review.

This section discusses the literature pertaining to financial market shocks and financial stability to assess various theories and empirical studies relating to the variables under scrutiny. The studies conducted within Africa and globally will be considered. As a note, Africa is among the most vulnerable countries, requiring robust monetary and fiscal policies to support the financial system and foster economic recovery (Shipalana and O'Riordan, 2021). Therefore, the analysis of this literature shall pave a way for relevant policy recommendations following the research techniques applied in this study.

4.3.1 Theoretical literature.

In the theoretical context of macroeconomic administrative capacity, Schinasi (2006) indicated that real economic performance depends on stability of the financial system.

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Moreover, if the state of financial system is stable, it can offer administrative solutions in controlling risks of financial imbalance that may result amid adverse phenomena. Despite the likelihood of economic shocks, it is imperative to safeguard the functioning and performance of real economic system, as far as the macroeconomic administrative capacity is concerned (Mishkin, 1999). Also, the normal flow of economic activities is susceptible to macroeconomic financial shocks, therefore preventing the financial system motion of channelling funds towards productive opportunities. Seitan (2015) contends that the ability of the financial system to tolerantly absorb the real economic and financial shocks is one of its defining features. Aside from that, financial risks need to be accurately measured, evaluated, and managed.

Theoretically, financial markets are intended to serve the real economy. However, the pursuit of market efficiency pertaining to completeness might erode financial market stability as Marsili (2014) argues, after observing the conditions of perfect competition and symmetric information in the market. According to Jacobs and Swilling (2015), financial markets recently seem to be separated from the real economy, albeit their initial evolvement was to source the resources required for industrial investments and commercial enterprises. That being on the spotlight, according to Seitan (2016), liberalization of the capital account in economies with stiff real wages was what caused an excessive number of resources to be directed toward the highly capitalized industries. As a result, replacing labour with capital during industrial activities will make resource allocation worse.

Against the theoretical background discussed thereof, Schinasi (2006) cited the need to prevent imbalances and instability in the financial market by identifying and analysing stability risks, and potential sources and vulnerability in the financial system. Thus, suggesting the availability of relevant mechanisms and policy tools to remedy the situation and ensure financial market stability, considering that shocks may arise at any time without even being anticipated. In supplement to the discoursed theoretical background thereof, the selected theories discussed below are, the legal theory of finance; the market hypothesis theory; and the Capital Asset Pricing Model.

According to the legal theory of finance contended by Katharina Pistor, financial markets are constructed in a legal manner. As Weber (2016) has observed, during times of crisis the financial system's hierarchy embodies the characteristics of a hierarchy pertaining to the

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vindication of property rights. Therefore, financial stability is regarded as a public good. Which suggests there should be robust social responsibility in financial markets. According to Goodhart and Tsomocos (2006), it is important to incorporate the probability of default and bankruptcy into the analysis of financial stability. The author highlighted the dynamic implications of financial distress and bankruptcy law, indicating that endogenous cycles are triggered by the impact of liquidations on the capital goods price awing to financial imperfections.

The financial market theory termed efficient market hypothesis stipulates that the market price of a financial asset reflect all known information incorporated into the system. Hence, Burton (2003) coined out the idea of random walk pertaining to efficient market hypothesis, implying that unimpeded flow of information reflects immediately in stock prices. According to Bankoti (2017), the financial market behaves in a random way. Hence the association with the random walk theory. Therefore, it is somewhat not possible for any of the investors to utilize historical prices of the stock/security to predict future prices nor profit via technical analysis (Amoah, 2020). As Bankoti (2017) stated, demand and supply are the key factors that influence the asset prices in the competitive market with rational investors. The unpredictability of stock market prices is attributed to new information, particularly news which by nature are not predictable.

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The efficient market hypothesis is categorized into weak form, semi-strong form, and strong form; based on the level of information reflected in the market prices. Firstly, the weak form implies that stock prices incorporate all past price information quickly, and that everyone has the knowledge of past movement of market price. Secondly, semi-strong form states that market prices incorporate information that is publicly available. Therefore, making it impossible for technical analyst nor fundamental analyst to assist investors to outperform the market. Thirdly, the strong form implies that all private and public information is incorporated into market prices.

Nonetheless, the efficient market hypothesis remains under debate amid some controversies and criticism. For instance, Loredana (2019) posited the theoretical framework where empirical evidence rejected the validity of semi-strong and strong forms of efficiency. Moreover, Amoah (2020) conducted meta-analysis of existing research reports that involved efficient market hypothesis theory in frontier and emerging markets to establish the efficacy

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of the theory thereof. Consequently, it was indicated that the theory works well in developed markets than in most frontier and emerging markets. Some of the factors attributable to the theory not working in some markets thereof includes small market size and liquidity, coupled with less awareness concerning the financial market products and activities.

The Capital Asset Pricing model (CAPM) focuses on the investment decisions, which depends on the macroeconomic environment. The idea is that prices of the assets are not affected by all risks. According to Perold (2004), the development of CAPM emerged during a period when theoretical foundations of decision making under uncertainty were comparatively new. The CAPM relates the asset return, discounted at a risk averse rate, and is explained by the market return with the same discount rate (Ganz, Schlotefeltd, & Rodrigues, 2020). The equation below represents the CAPM, which was developed by Sharpe, Mossin and Lintner in 1960s:

$$E(Ri) = r + \beta i[E(Rm) - r]$$

Where $E(Ri)$ is the expected rate of return, and R is the rate of return.

This equation provides the expected return of a security in terms of its risk, expected market return and the riskless rate. As discovered by Horenstein (2021), assets that exhibits low realised CAPM alphas outperform those with high alphas. Alpha is an estimator of the future performance of an asset post-adjustment for risk. An investor realizes higher returns at lower risk by holding an index when alpha is positive.

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Financial fragility and financial instability are frequently used synonymously. The real emergence of issues in the financial system is referred to as financial instability. Financial instability "occurs when shocks to the financial system interfere with information flows so that the financial system can no longer fulfill its function of routing funds to those with productive investment possibilities, according to Mishkin's (1997) model (Mishkin, 1997). The term "financial fragility," on the other hand, describes how susceptible the entire financial system is to future crises within the system. It is an inevitable result of a dynamic capitalist state, claims Calomiris (1995). Fisher (1933) and Keynes (1937), who vehemently argued that the financing of investment through credit would potentially have disastrous implications on the economy, are credited with first introducing the concept of financial fragility. These observations of the great depression and later global bank panics served as the foundation for their argument. Minsky (1976) advanced the theory that modern capitalistic economies

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shifted from strong to fragile and unstable financial systems because of their excessive reliance on debt to support investment in later years, adding to the discussion of financial fragility and instability. Wolfson (2002) added that the financial crisis was a reaction to increased fragility of the financial system over the course of the business cycle expansion.

4.3.2 Empirical literature.

This section provides the review of empirical literature to capture various results discovered regarding financial market shocks and financial market stability. As revealed in the literature, financial shock as one of the key macroeconomic variables that gained traction amid policy debates, especially post the global financial crisis. The discussion of relevant studies in the below paragraphs ultimately lead to the provision of the research gap.

Takawira and Mwamba (2021) examined the effects of sovereign ratings on financial stability in South Africa for the period spanning from 1999 to 2018, using quarterly data. The study thereof made use of stepwise linear regression model, complemented by the Structural Vector Auto-Regression (SVAR) model to appraise the effect of shocks that were not expected. The chief shock to financial stability discoursed by Takawira and Mwamba (2021) concerns the sovereign credit ratings. Therefore, to establish the rating outlook and the indices for sovereign credit rating (SCRI) the Principal Component Analysis (PCA) was additionally applied. Consequently, financial stability was reported to be less influenced by SCRI and significantly affected by foreign debt and gross domestic product (GDP), also noting unemployment, household debt, balance of payment and interest rates as important variables of concern in this regard.

Mehmet, Rangan and Theshne (2021) assessed the connection between uncertainty in the economy and conditions of the financial market in South Africa, using non-linear VAR. The study acknowledged that macroeconomic implications of an uncertainty shock is different across financial regimes. It was found that deterioration of output because of uncertainty shock is critically important during normal periods than during stressful periods. Nevertheless, uncertainty shocks have been discovered to be inflationary in both regimes, with the impact being greater in the stress regime. While the study did not specify the period assessed and the type of data incorporated into the model, the findings are important and relevant for the analysis of literature. According to Ilesanmi and Tewari (2020), the financial stress indicator (FSI) reflects the systemic nature of financial instability and measures the

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system's vulnerability to internal shocks and external shocks. This has been highlighted in their study that developed a financial stress indicator for the financial market in South Africa using the principal component analysis (PCA). Additionally, a recursive Vector Autoregression (VAR) model was applied to estimate how financial stress can affect investment and output. The findings revealed that investment and economic growth are negatively affected by the manifestation of financial stress. Hence, the FSI serves as a useful tool to gauge the effectiveness of government policies aimed at mitigating the impact of financial stress.

Globally, Carvallo and Pagilacci (2016) investigated shocks that illuminates financial stability and house prices in Venezuela. The study observed that tight monetary conditions appreciated domestic currency and skyrocketing interest rates are associated with a surge in financial instability. Though, the methodology applied, and period of analysis were not clearly signified, the findings suggested the need for macroprudential prescription to stabilize the bank funding.

Since shocks to the financial markets lead to volatility, it is important and relevant to review the study relating to the impact of financial development on volatility and channels through which such volatility is influenced by finance. Thus, Ibrahim and Alagidede (2017) assessed 23 countries in the sub-Saharan African for the period spanning 1980–2014. The newly developed panel cointegration estimation strategy was adopted in that regard. The results discovered that, financial developments affect volatility of business cycle in a non-linear fashion, and that volatility can be dampened by well-developed financial sectors. The strengthening of supervision within the financial sector and cross-border oversight emerged as key recommendations of the study, indicating the cruciality of those two in examining the right levels of price and finance stability in the interest of faltering economic fluctuations.

Among the empirical studies in relation to the variables under investigation, some have used a theoretical approach. A couple of them are discussed in this paragraph. Firstly, Leventides, Loukaki and Papavassiliou (2019) evaluated the financial systems' resilience to exogenous shocks, deploying the techniques from the theory of complex networks. The fragility of several network topologies was investigated by means of Monte Carlo simulation using a simple default model of contagion applied on interbank networks of sizes that vary. An important contribution of the theoretical study thereof was the analyses of the interplay amid crucial drivers at the back of interbank contagion, like inter alia, network topology,

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interconnectedness, leverage, and heterogeneity. Secondly, Sary, Dror, Adam, Eugene, and Shlomo (2015) used the network theory to develop a dynamic model that applies a bipartite network of banks including their assets, in which the sensitivity of the system was analyzed to assess its reaction to external shocks among the individual asset classes. The case study of Venezuela banking system from 1998 – 2013 was applied into the model, capturing changes monthly within the systemic structure and the sensitivity of bank portfolios to multiple external shock scenarios as well as to identify vulnerabilities of the system and time evolution.

Alluding to lessons from the periods of financial instability, Genberg (2017) posited that, when financial markets are increasingly integrated and globalised, there might be potential threads for policy spill-over effects and transmission of shocks that may further jeopardise stability in the financial market. That being on the spotlight, a well-known global financial crisis (GFC) event that occurred in 2007/08 can be used as an example. In response to the crisis thereof, central banks in advanced economies (such as European central bank and US Federal reserve) have implemented expansionary polices to ensure that financial market is injected with liquidity to remain functional. As such, emerging market economies experienced capital inflows attributable to the "search for yield" phenomenon (Genberg, 2017). Thus, attesting to the point that, integrated financial markets are prone to policy spill-over effects and transmission of shocks. To reiterate, Mahajan (2018) have also made a point that, in the presence of robust global financial linkages, emerging markets are prone to an increased exposure to external shocks.

While multiple shocks to the financial system can be identified and discussed, the ultimate impact on the economy and financial market stability appears to be common. According to Zhou and Tewari (2019), various studies have utilised stock market index data in the context of GVAR model to simulate financial shock transmissions across national borders. As per Mahajan (2018) study, an attempt was made to gauge the nature and degree of integration of equity market in India, with the global financial market at the back of 2008 external shock. Zhou and Tewari (2019) cited a shadow banking system as a threat to financial stability.

The coronavirus disease (Covid-19) emerged as a health shock and transmitted to the global macroeconomy. Therefore, prompting the need for expansionary policies. However, a concurrent surge in global search for yield as stipulated by the Central Bank of Ireland (2021), causes valuations in certain market segments to be stretched and susceptible to vulnerability

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as far as adjustments in the global growth expectations are concerned. This provides evidence that shocks have greater impact on the financial market stability. Most importantly, it is worth mentioning the fact that financial markets are naturally fragile and volatile. In reaction to domestic and international news, there could be a dramatic rise/drop of prices in the financial market. It may even be worse when the news is politically related.

The identification of research gap is based on the inadequacy regarding the specific periods and type of data utilized by most studies that contributed to the literature on various shocks to financial market stability. It is challenging to reach a conclusion noting the limitation of data and models applied in the recent literature. Therefore, there is a leeway to clearly incorporate specific type of data into various econometric techniques. Hence, this study utilizes the quarterly time-series data, incorporated into multiple econometric techniques to ensure that results are relatively more robust.

4.4 Methodology.

Considering the literature reviewed in the previous section, the current section offers a detailed discussion of the research methodology and econometric procedures that were executed in analysing the impact of shocks on financial market stability in South Africa. The various econometric tools and data collections methods are briefly discussed.

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4.4.1 Description of variables

Financial stability refers to the ability of the financial system to withstand foreseen and unprecedented turbulences in the financial and economic sectors. There are several financial market indicators which have been previously used as a proxy for financial stability. This includes credit to non-financial firms, capital adequacy, liquidity ratio and market volatility, amongst others (Gadanecz and Jayaram, 2009, Baum et al., 2017). The inclusion of interest rates, money supply and inflation in the model was to capture the effect of monetary policy conduct on financial market stability. Similarly, the inclusion of final consumption expenditure by the government was to capture the influence of government conduct on financial stability. Economic activities taking place at a global level may likewise have an influence on the domestic financial system through spill-over effects, hence the inclusion of the Global economic activity index developed by Lutz Kilian.

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4.4.2 Model specification.

The estimated model was informed by recent empirical studies including Hoque et al., (2019), Mahajan (2018), Zhou & Tewari (2019). The estimated model, with a few modifications, can be expressed as:

$$FS = \alpha_0 + \beta_1 cpi_{t-1} + \beta_2 ms_{t-1} + \beta_3 gdp_{t-1} + \beta_4 geai_{t-1} + \beta_5 int_{t-1} + \beta_6 fcons_{t-1} + \beta_7 dum1_{t-1} + \beta_8 dum2_{t-1} + \varepsilon_t \quad (4.1)$$

Where

FS is financial stability proxied by credit to non-financial sector,

FM is financial markets proxied by the domestic stock market capitalisation

CPI is the consumer price index capturing the effects of inflation in the financial sector,

MS is money supply measured by broad money (M2),

GDP is the gross domestic product measuring the impact of domestic economic activity,

$GEAI$ is the global economic activity index measuring the influence of the international economic activities,

$DUM1$ is a dummy variable to capture the shock of the 2008 financial crisis,

$DUM2$ is a dummy variable to capture the effects of the 2016 sovereign debt crisis on the South African financial system and,

ε_t is the error term.

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4.4.3 Estimation Approach.

The study followed the below estimation approach applied to achieve the primary objectives of the study. Unit root is the first test used assess stationarity in the interest of averting spurious results. To achieve the intended results, Augmented Dickey-Fuller Test (ADF) and Phillips-Peron Test (PP) are employed, followed by Johansen cointegration test, VAR model and VECM. The robustness of the model in the study is detected through the diagnostic tests, lastly the study also considered impulse response analysis and variance decomposition

4.4.3.1 Unit root test.

The visual inspection shall be used to test for stationarity. This is commonly viewed as informal way of testing for stationary among variables. Thereafter, corroborate and

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performed test with the Augmented Dickey-Fuller (ADF) and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test as they are classified as the formal tests will be employed.

a) Augmented Dickey-Fuller Test.

As Cheng and Annuar (2012) stated, the development of Augmented Dickey-Fuller test emerged in the 1970s. The famous statisticians called Dickey and Fuller developed the test for the purpose of testing time series data for stationarity among the variables. Therefore, the variables concerned in the study will be subjected to unit root test. The common purpose of the test is to cushion against and avert spurious results within the applied data. Additionally, the data shall be subjected to verification of the likeliness of long-run cointegrating relationship among other variables to ascertain them in this regard. In mathematical terms, the estimation of the equation is mirrored through the regression with intercept and trend:

$$\Delta Y_t = \alpha + \beta_1 t + \delta Y_{t-1} + \sum_{i=1}^{m} \omega i \, \Delta Y_{t-1} + \varepsilon_t \quad (4.2)$$

The ADF tests the null hypothesis against the alternative autoregressive equations. In terms of the decision rule, rejection of null hypothesis is set, given t-statistics of greater than the ADF t-statistics at the critical level. As an alternative, the obtained p-value can be attained at a lesser than specified level of significance. In a case where the data series is exponentially treading, the series of data would be logged prior to differencing.

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b) Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test.

The limitation confronting the ADF test is its low power, that needs to be circumvented. Hence the proposition by Kwiatkowski, Phillips, Schmidt, and Shin (1992), of an alternative test which λ_t is assumed to be stationary under the null. The KPSS test is a Lagrange multiplier test, and the computation of test statistic can be done by firstly regressing the dependent variable λ_t on a constant or a constant and a time trend t. And then save the OLS residuals Ψ_t and compute the partial sums $Y_t = \sum_{y=1}^{t} \Psi_y$ for all t. Further the test statistic is given by (Verbeek 2004):

$$LM = \sum_{t=1}^{T} Y_t^2 \Big/ \chi_{\Psi}^2 \quad (4.3)$$

Where; $Y_t = \sum_{y=1}^{t} \Psi_y$ and χ_{Ψ}^2 is the estimated error variance from the regression.

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$$\lambda_t = \delta + \Psi_t \; or \; \lambda_t = \delta + \beta t + \Psi_t \quad (4.4)$$

The utilisation of unit root test and the stationary test jointly in this study is attributable to the need for a robust conclusion. To confirm if the conclusion derived is the same, both tests are compared. In a situation where the results are contradictive, at the back of ADF and KPSS tests, it will therefore be preferable to deploy the KPSS test owing to the drawbacks of ADF tests.

4.4.3.2 Lag length selection.

The VAR models requires the optimal lag length to be determined prior to the conduct of results estimation. That being on the spotlight, the combination of economic theory and statistical criteria is applied to determine the lag length. The statistical criteria use VAR lag choice selection criterion which is incorporated in the E-views 10 statistical package.

4.4.3.3 Johansen Co-integration test.

Following the ADF and KPSS tests of unit root, the study will then employ Johansen test of cointegration. Cointegration is well described as an econometric concept that illustrates the long-run equilibrium existence amongst economic time series data. According to Sjö (2008) the Johansen cointegration test is regarded as the most robust test with statistical properties. Assuming that z is the vector variables which are under consideration, the test can be written as:

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$$z_t = V_1 z_{t-1} + V_2 z_{t-1} + \cdots + V_p z_{t-p} + \mu_t \quad (4.5)$$

$$\Delta z_t = \pi z_{t-1} + \sum_{i=1}^{p-1} \pi \Delta z_{t-1} + \mu_t \quad (4.6)$$

Where $\pi = -(I - \sum_i^P V_i) \; and \; \pi_i = -\sum_{i+1}^{p} V_j \sim \pi \; is \; the \; rank$

The long run coefficient matrix is represented by π of which its rank equals to the number of vectors that are cointegrated. It follows that if the rank (π) = 0, we have the null matrix, which means variables are non-stationary at first differences as in VAR. However, if (π) = 1, there exist πz_{t-1} which is a single unit cointegrating vector, as the error correctional term. Then if the rank (π) = n, then there exists a stationary vector process. Furthermore, if for instance 1< (π) < n, that will mean that there exist vectors which are multiple cointegrated.

Johansen test derived the maximum likelihood estimation using two statistical tests, namely trace test and maximum eigenvalue test which is presented as follows:

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$$\lambda \text{trace} = -\text{T} \sum_{\text{i=r+1}}^{\text{n}} \ln(1 - \phi\text{i}) \quad (4.7)$$

$$\lambda \text{max} = -\text{T}\,(1 - \phi_{\text{r+1}}) \quad (4.8)$$

For trace test in equation (4.7), the null hypothesis of the cointegrated vectors as represented by r is tested alongside the n cointegrating vectors alternatively. The maximum eigenvalue test in equation (4.8) shows the t-statistics, and the null hypothesis of r cointegrated vectors is tested on (r + 1) cointegrating vectors which is the alternative hypothesis. The test statistics is given by the sample size T, and ϕ_i represent the ith largest canonical correlation (Gujarati et al, 2009).

4.4.3.4 Vector Error Correction Model (VECM).

The VECM measures the adjustment of the speed to the equilibrium of the last period and has very good implications economically. The error correction modelling allows the study to trace the dynamic interaction between the chosen variables. According to Mishra (2011), the VECM infer a good purpose in measuring the adjustment speed towards the long run equilibrium from short run equilibrium. This model also takes into consideration and tends to solve the issue of spurious regression when the variables trends are express at first deference. Furthermore, if the relationship amongst the variables is confirmed to be cointegrated, then we can estimate the ECM multiple equation. To derive the VECM, the study will start by illustrating the VAR model from its originality. Since $Z_t = (Z_{1t}, Z_{2t}, Z_{3t})$ is a vector, then assume the three variables to be potentially endogenous:

$$Z_t = Y_i Z_{t-1} + \cdots + L_k Z_{t-k} + \mu_t \qquad \mu_t \sim N(0, \Sigma) \quad (4.9)$$

As stated by Harris & Sollis (2003) Equation (4.9) above can be rewritten into a VECM as follows:

$$\Delta Z_t = \Gamma_i \Delta Z_{t-1} + \cdots + \Gamma_{k-1} Z_{t-k+1} \prod W_{t-1} + \mu_t$$

Where Γ_t= - (I-$Y_1 - \cdots - Y_i$), (i= 1… k-1) and $\prod$ = -(I- $Y_1 - \cdots - Y_k$)

Through changes in Z_t the adjustment of the short and long run relationship can be seen via the estimates Γ_t and $\prod . \prod$ which is a 3x3 matrix that informs the existence of long run relationships in the equation. Therefore, the matrix can be expressed as ($\prod$=$\partial\gamma$) wherein ∂ represent the disequilibrium point of speed adjustment and γ represent the long run coefficients matrix. The below is the matrix formulation.

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$$\begin{bmatrix}\Delta Z_{1t}\\ \Delta Z_{2t}\\ \Delta Z_{3t}\end{bmatrix} = \Gamma_1 \begin{bmatrix}\Delta Z_{1t-1}\\ \Delta Z_{2t-1}\\ \Delta Z_{3t-1}\end{bmatrix} + \begin{bmatrix}\partial_{11} & \partial_{12}\\ \partial_{21} & \partial_{22}\\ \partial_{31} & \partial_{32}\end{bmatrix} \begin{bmatrix}\gamma_{11} & \gamma_{12} & \gamma_{13}\\ \gamma_{21} & \gamma_{22} & \gamma_{23}\end{bmatrix} \begin{bmatrix}Z_{1t-1}\\ Z_{2t-1}\\ Z_{3t-1}\end{bmatrix}$$

The equation for ΔZ_{1t} , ΔZ_{2t} and ΔZ_{3t} shows two cointegration vectors which is associated with the speed-of-adjustment terms and is given by:

$$\partial_{11}(\gamma_{11}Z_{1t-1} + \gamma_{12}Z_{2t-1} + \gamma_{13}Z_{3t-1}) + \partial_{12}(\gamma_{21}Z_{1t-1} + \gamma_{22}Z_{2t-1} + \gamma_{23}Z_{3t-1})$$

$$\partial_{21}(\gamma_{11}Z_{1t-1} + \gamma_{12}Z_{2t-1} + \gamma_{13}Z_{3t-1}) + \partial_{22}(\gamma_{21}Z_{1t-1} + \gamma_{22}Z_{2t-1} + \gamma_{23}Z_{3t-1})$$

$$\partial_{31}(\gamma_{11}Z_{1t-1} + \gamma_{12}Z_{2t-1} + \gamma_{13}Z_{3t-1}) + \partial_{32}(\gamma_{21}Z_{1t-1} + \gamma_{22}Z_{2t-1} + \gamma_{23}Z_{3t-1})$$

The VECM takes into consideration the two cointegrating connections to go into every one of the three ECMs with varying speed of change. The issue of asymmetric adjustment is taken into consideration amongst the variables, based on the diversification of speed adjustment from one equation to another. On the VECM matrix above, the speed at which ΔZ_{1t} adjusts towards the long-run cointegration relationship of the first and second respectively, is represented by ∂_{11} and ∂_{12}. Furthermore, the speed at which ΔZ_{2t}, adjusts to the two cointegration relationships is shown by ∂_{21} and ∂_{22}. Ultimately, ∂_{31} and ∂_{32} represent two long run cointegrated relationship when the speed at which ΔZ_{3t} react to short-run disequilibrium. The *priori* assumption that can be drawn is that there exist significant adjustment coefficients. Changes in the parameters ought to be in the vicinity ratio 0< r < 1 such that the deviation in the short-run converges to that of the long-run equilibrium.

4.4.4 Variance Decomposition and Impulse Response Functions.

Swanson & Granger (1997) opined that, when analysing the vector auto regression (VAR), it is important to compute the impulse response function and forecast error variance decomposition to track the possibility of the economic shock evolution through the system. The dynamic interaction amid the investigated variables will be tested by generating VDCs and IRFs. Henceforth, the applicability in the sample period, as afar as the validity of causality tests as postulated by Soytas & Sari (2003) is concerned. The application of variance decomposition aimed to access the validity of causal relation beyond the sample period. The variance decomposition allows for examination of the out-of-sample causality between the variables in the system of VAR.

The variance decomposition measures the percentage as forecasted on the examination of the out-of-sample causality amid the variables in the VAR system. It expresses the

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comparative influence of one variable on another variable as Alam and Ahmed (2010) noted. The variable can further be partitioned into four concerning the innovations including their own and public debt, investment, as well as government deficit. Even so, the variance decomposition can be mirrored as out of sample test of causality.

4.4.5 Diagnostic Checks.

Most if not all econometric models are examined using several statistical tests, such as Vector Error Correction Model, Cointegration test, Wald test and Granger causality test amongst others. According to Ekaterini (1998) these test statistics results, become invalid or bias if in the model estimated there exist contemporaneous correlation between errors and regressors. Hence, the importance of performing the diagnostic checks of normal distribution, heteroskedasticity and serial correlation. To ensure that the result on the estimated statistical model yields robust estimates, the study will perform some diagnostic checks.

a) Residual normality test.

The normal distributed residuals need to have a zero mean and constant variance as per the assumption underlying the Classical Linear Regression Model (CLRM). Wherein, the idea coined out by Jarque & Bera (1980) indicate that the violation of this restriction will induce the invalidation of t-statistics and F-statistics. Moreover, the study make use of Jarque-Bera normality test to assess the goodness of fit distribution. This test uses skewness and kurtosis measurements to match a normal distribution of sample data.

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b) The test of Serial Autocorrelation.

The test of serial autocorrelation refers to the correlation of one observation's error term with itself. The result of Serial autocorrelation in a model can be a result of statistical issues such as omitted variables, model misspecification, non-linearity, and measurement errors. One more other thing that can lead to serial autocorrelation is data manipulation. Griliches (1961) hold the fact that, when there is serial correlation within the disturbances, it implies that systematically the model did not assimilate the data accurately. With that said, the study will adopt Breusch-Godfrey LM test to address the issue of serial autocorrelation.

c) Heteroscedasticity test.

The OLS assumes that $V(\mu_J) = \sigma^2 for\ all\ j$. The implication thereof is that the variance of the error term is required to be homoscedasticity. Consequently, if the error term is not

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constant then there exists heteroscedasticity. The existence of heteroscedasticity in modelling yields the results that mislead, and the consequence will make OLS estimators and regression predictions to be inefficient, thus not BLUE any longer. It is of this reason that the study will employ the Breusch-Pagan test for heteroscedasticity.

4.4.6 Data Collection.

The study utilised quarterly time-series data collected from several secondary data servers including the South African Reserve Bank statistical query from online and St Louis Federal Reserve database. The period ranged from 2003: Q3 to 2020: Q4.

4.5 Empirical Results.

This section presents the findings obtained from various econometric tests performed to achieve the objective of the study, which is to estimate the impact of shocks on financial stability.

4.5.1 Descriptive Statistics.

The first point of analysis was to examine the individual characteristics of the variables employed in the study. To achieve this, we made use of descriptive analysis, which provides an overview analysis of the characteristics of the data including the mean, median, standard deviation, minimum and maximum values. The output is provided in table 4.1.

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Table 4.1: Descriptive analysis output.

	CNFS	CPI	FCONS	GDP	GEAI	INT	M2	DUM1	DUM2
Mean	0.34	-1.25	2.73	2.67	12.33	8.67	10.17	0.69	0.25
Median	0.39	0.68	2.40	2.20	-1.93	8.70	8.57	1.00	0.00
Maximum	5.29	130.53	14.50	68.30	185.32	10.42	22.67	1.00	1.00
Minimum	-3.62	-173.13	-6.70	-53.40	-146.23	7.29	-0.27	0.00	0.00
Std. Dev.	1.72	35.15	3.52	10.67	76.04	0.73	5.63	0.46	0.44
Skewness	0.29	-1.32	0.68	1.26	0.37	0.19	0.45	-0.82	1.13
Kurtosis	3.10	14.07	4.46	31.85	2.33	2.56	2.28	1.68	2.28
Probability	0.59	0.00	0.00	0.00	0.23	0.59	0.14	0.00	0.00
Observations	71	71	71	71	71	71	71	71	71

Source: Author's computations

Given the set variables and time frame, the total number of observations is 71. On average, annual GDP growth amounts to 2.6, domestic stock market capitalisation amounts to 0.34, interest rates amount to 8.67, money supply amounts to 10.1 and global economic activity

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index amounts to 12.33, being the highest average for the period. The standard deviation for the variables in question also varies greatly. For example, inflation has a standard deviation of 35.15 and global economic activity index at 76.04. This indicates that the data points are spread out. In contrast, interest rates have a standard deviation of 0.73 and money supply 5.63, indicating that the data points are closer to the mean.

4.5.2 Correlations Analysis.

The correlations matrix has become a common econometric procedure given its ability to reveal the association between two or more variables. In this subsection the correlation between the dependent variable and explanatory variables are discussed in detail. The output is presented in table 4.2 below.

Table 4.2: Correlation output.

	CNFS	CPI	FCONS	GDP	GEAI	INT	M2	DUM1	DUM
CNFS	1.00	0.16	0.98	0.43	0.66	1.04	1.44	0.34	2.31
CPI	-0.17	1.00	0.55	-0.89	1.13	0.43	-1.32	0.84	0.46
FCONS	0.18	0.07	1.00	0.78	1.78	1.11	2.11	1.34	2.33
GDP	-0.08	0.07	0.04	1.00	-1.90	0.49	0.33	1.10	1.23
GEAI	0.13	0.00	0.35*	0.192	1.00	2.23	1.88	0.49	0.09
INT	-0.31*	-0.13	-0.07	0.00	0.05	1.00	2.76	-1.22	0.42
M2	0.41*	0.12	0.42*	0.13	0.54*	-0.08	1.00	0.12	0.71
DUM1	-0.41*	-0.01	-0.42*	-0.12	-0.78*	0.02	-0.81*	1.00	0.51
DUM2	-0.13	-0.02	-0.27*	-0.03	-0.34*	0.48*	-0.29*	0.39*	1.00

Source: Author's computations, Note: Asterisk *,**,*** indicate significance at 1%, 5% & 10%

From table 4.2, a weak and negative correlation can be observed between domestic stock market capitalisation and inflation. The assumption is that an increase in the general price level would trigger a hike in interest rates, thus making it expensive for non-financial firms to borrow money. This is likewise in line with the negative correlation (-0.31) between interest rates and credit to non-financial firms. Final consumption expenditure by government is positively associated with the dependent variable along with money supply and global economic activity. The reasoning is that final consumption expenditure stimulates the economy in the short run, leading to a more stable growth path and reducing the likelihood of an economic crisis and consequently financial crisis. Money supply, likewise, has a similar

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role to play in terms of creating stability in the financial sector in the short run. The long run consequence however is an overheated economy. Both the dummy variables are negatively associated with the dependent variable. This is because, dummy variables serve as shocks to the financial system and the ability of the financial sector to absorb shocks depends on many factors including the monetary framework and regulatory response.

4.5.3 Unit root tests.

The third step involved analyzing the variables for unit root. This was done to ensure that all variables are stationary since performing regression analysis with non-stationary variables may lead to spurious regression. The results are provided in table 4.3.

Table 4.3: Stationarity results.

Variable	M.S	ADF		KPSS		Output
		Level	1st diff	Level	1st diff	
CNFS	Intercept	-3.75*	-8.43*	0.26*	0.24*	I(0)
	Trend & Intercept	-4.04**	-8.38*	0.08*	0.16*	
CPI	Intercept	-3.87*	-4.98*	0.16*	0.10*	I(0)
	Trend & Intercept	-4.78*	-5.04*	0.13*	0.09*	
FCONS	Intercept	-4.68*	-10.34*	0.46*	0.29*	I(0)
	Trend & Intercept	-5.02*	-10.27*	0.04*	0.29*	
GDP	Intercept	-2.95**	-8.17*	0.21*	0.30*	I(0)
	Trend & Intercept	-8.90*	-8.09*	0.11*	0.30	
GEAI	Intercept	-2.29	-8.82*	0.81	0.15*	I(1)
	Trend & Intercept	-3.47**	-8.75*	0.15**	0.15*	
INT	Intercept	-2.46	-7.68*	0.27	0.33*	I(1)
	Trend & Intercept	-2.77	-7.83*	0.19	0.27*	
MS	Intercept	-1.75	-4.44*	0.49	0.14*	I(1)
	Trend & Intercept	-1.42	-4.41*	0.12	0.06*	

Source: Author's computations, Note: Asterisk *,**,*** indicate significance at 1%, 5% & 10%

As stated earlier, the study made use of the Augmented-Dickey Fuller and Kwiatkowski, Phillips, Schmidt, and Shin tests since there is no uniformly better test. Several variables, including credit to non-financial firms, consumer price index, final consumption expenditure by government and GDP were found to be stationary at level under both stationarity tests.

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On the contrary, the global economic activity index, interest rates and money supply were found to be stationary after first differencing. Although the order of integration of the variables suggests that the Auto Regressive Distributed Lag (ARDL) econometric technique would be appropriate, the technique would not suffice in achieving the objective of the study which seek to see the responses of the variable to the various shocks (impulses).

4.5.4 Lag order.

Following stationarity and correlations analysis, the next step was to determine the optimal lag length for the specified model. This process is extremely crucial in econometric analysis to ensure that the correct number of lags is specified in the model as well as to ensure that the model is not overfitted. The results are provided in table 4.4.

Table 4.4: Optimal lag length selection.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1452.16	NA	2.71e+08	44.96	45.26	45.08
1	-1156.14	500.96	371090.1	38.34	41.35*	39.53
2	-1066.48	126.91	325632.1	38.07	43.79	40.33
3	-987.37	90.06	506398.9	38.13	46.56	41.46
4	-872.83	98.68	421026.8	37.10	48.24	41.49
5	-652.87	128.59*	33970.16	32.83	46.68	38.29
6	-343.89	95.07	1643.80*	25.81*	42.37	32.35*

*Indicates lag order selected by the criterion
LR: sequential modified LR statistic test, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

Source: Author's computations, Note: Asterisk *,**,*** indicate significance at 1%, 5% &10%

The three common information criterions utilized in econometrics include the Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion. For the purposes of this study, the study makes use of the Schwarz information criterion. The number of lags recommended by the Schwarz information criterion is one. The downside of utilizing information criterions with a higher lag length is a loss in degrees of freedom.

4.5.5 Johansen Cointegration Analysis.

An interesting aspect of time series analysis involves establishing a long relationship between the dependent variable and explanatory variables. This was achieved by means of the Johansen Cointegration test. The results are given in table 4.5 below.

Table 4.5: Cointegration output.

Unrestricted Cointegration Rank Test (Trace)

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Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.77	257.36	197.37	0.00
At most 1	0.54	155.61	159.52	0.08
At most 2	0.37	102.51	125.61	0.52
At most 3	0.31	71.40	95.75	0.67
At most 4	0.19	46.31	69.81	0.78
At most 5	0.18	31.32	47.85	0.64
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.77	101.76	58.43	0.00
At most 1 *	0.54	53.09	52.36	0.04
At most 2	0.36	31.12	46.23	0.71
At most 3	0.31	25.08	40.08	0.76
At most 4	0.19	14.99	33.87	0.97
At most 5	0.18	13.67	27.58	0.84
At most 6	0.14	10.25	21.13	0.72
At most 7	0.10	7.29	14.26	0.45
At most 8	0.00	0.11	3.84	0.74
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's computations, Note: Asterisk *,**,*** indicate significance at 1%, 5% & 10%

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It is worth noting that cointegration is established when the trace statistic is greater than the critical value at the 5% significance level. From table 4.5 above, the study found that the trace statistic value of 256.37 is greater than the critical value of 197.37 at the 5% significance level. This is indicative of a long run relationship between the dependent variable and explanatory variables. Thus, the null hypothesis of no cointegration is rejected against the alternative hypothesis of cointegration at the 5% significance level. Given these findings, the appropriate econometric procedure would be to estimate the vector error correction model.

4.5.6 Vector Error Correction Model.

Results from the vector error correction model are discussed below. This includes the estimated speed of adjustment to equilibrium, short run and long run coefficients. Based on findings, the consumer price index, which is a proxy for price stability, has a negative impact on financial stability. Meanwhile, final consumption spending by government and gross domestic product are found to have a positive impact on financial stability. To make sense of

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this, government spending stimulates the economy bringing about balanced and sustainable growth, at least in the short run. When the economy is performing well, market participants rely less on credit and more on generated income. This places less pressure on the financial system. In the long run however, the consequence of increased government spending is an increase in the general level of prices, provided national output fails to match the monetary injection by government.

Table 4.6: Vector Error Correction Model output.

Variable	Short-run coefficients	Long-run coefficients
CPI	-0.03 (0.00) [-2.67]	-0.10 (0.01) [-10.42]
FCONS	0.01 (0.07) [0.20]	0.21 (0.06) [3.47]
GDP	0.13 (0.05) [2.81]	0.30 (0.10) [3.20]
GEAI	-0.00 (0.01) [-0.10]	0.00 (0.00) [0.37]
INT	0.30 (0.58) [0.52]	1.34 (0.44) [3.06]
MS	0.00 (0.12) [0.01]	0.31 (0.09) [3.38]
D1	1.63 (2.59) [0.63]	6.79 (1.36) [4.98]
D2	-0.34 (1.91) [-0.18]	-0.85 (0.48) [-1.76]
C	-0.03 (0.22) [-0.12]	-20.96
ECM	-0.37 (0.13) [-2.80]	

Source: Author's computations, Note: Standard errors in brackets ( ) & t-stat in parenthesis [ ]

Money supply and interest rates as monetary policy instruments were likewise found to exhibit a positive impact on financial stability. This is indicative of the effectiveness of

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monetary policy tools in maintaining price and exchange rate stability, and consequently, financial market stability. Dummy 1, which is a proxy for the 2008 global financial crisis, has a positive impact on financial market stability. The reasoning is that, during the 2008 global financial crisis, interest rates in emerging market economies, South Africa included, were relatively competitive than those in advanced market economies. As a result, capital inflows increased significantly and this to some extent, might have minimized the turbulence triggered by the financial crisis and provided relief to the South African financial system. The estimated speed of adjustment is 37%, indicating that 37% of disequilibrium are corrected in the long run. The R-squared value of 52% implies that at least 52% of the variations in financial stability (proxied by credit to non-financial firms) are explained by the independent variables. Thus, given the high r-squared value, the study concludes that the model fits the data well.

4.5.7 Impulse Responses.

The impulse response function was performed to determine the reaction of endogenous variables when a shock is added to the error term. The findings are presented in Figure 4.1. From our analysis, the findings reveal that credit to non-financial firms responds positively to a one standard deviation shock although the response is minimal.

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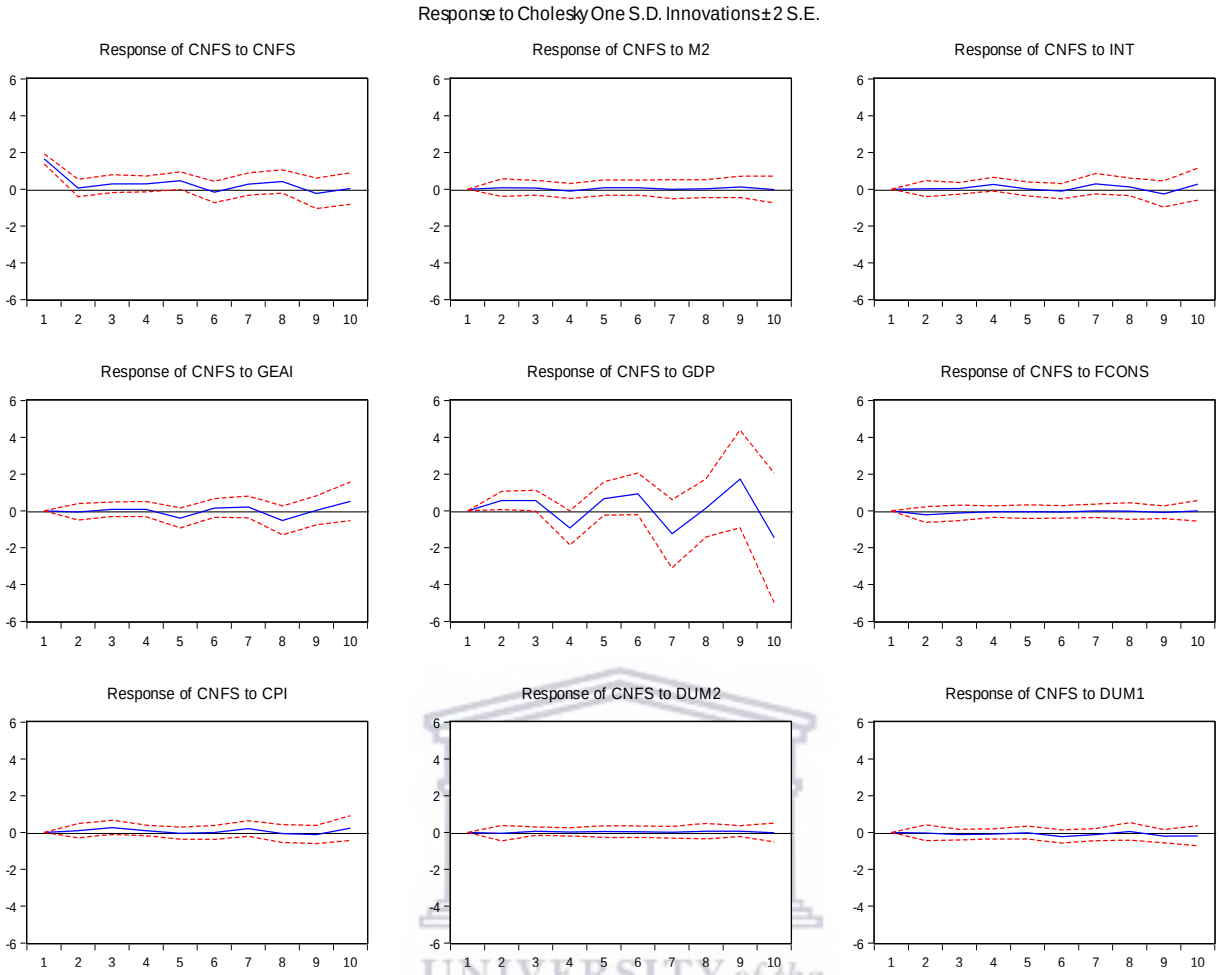
Figure 4.1: Impulse responses.



Source: Author's computations

Over a 10-years period, the response of domestic stock market capitalisation to a one standard deviation shock on inflation and money supply remains muted. This indicates that inflationary shocks have little to no effect on financial market stability. High inflation influences the financial market by eroding the value of returns. A similar trend can also be observed in respect of government conduct. Although there is a coordination between monetary policy and fiscal policy, it appears that shocks because of government conduct have a minimal impact on financial stability. In contrast, the response of domestic stock market capitalisation to a one standard deviation shock on interest rates is somewhat different. In the short run, the response is muted although in the long run the response is negative. The effects of the shocks in all cases appear to be temporary as they blue line always goes back to the initial equilibrium.

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Interestingly, shocks as a result of economic activity as measured by the gross domestic product and global economic activity index are found to have a significant impact on financial stability both in the short run and long run. This is because during economic downturns, the domestic country usually experiences capital flight as investors seek returns in competitive countries. This can have a huge knock-on effect on the financial system of the domestic country. Furthermore, a larger proportion of the population, especially the working class, relies heavily on credit facilities during economic downturns which can weigh heavily on the financial system due to an influx of credit applications and payment defaults. Thus, we can conclude that in South Africa, shocks as a result of economic conduct have a significant impact on financial market stability.

4.5.8 Variance Decomposition.

Like impulse responses, the variance decomposition is used to illustrate the forecast error discrepancy of each variable in relation to its own shocks. The findings are provided in table 4.7 below.

Table 4.7: Variance Decomposition.

Period	S.E.	CNFS	M2	INT	GEAI	GDP	FCONS	CPI	DUM2	DUM1
1	1.65	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.76	87.64	0.18	0.01	0.11	10.28	1.42	0.27	0.06	0.02
3	1.90	77.53	0.29	0.06	0.27	17.42	1.55	2.28	0.18	0.39
4	2.16	61.81	0.48	1.56	0.38	31.91	1.24	2.00	0.15	0.44
5	2.34	56.43	0.52	1.34	3.07	35.25	1.09	1.73	0.18	0.37
6	2.54	48.35	0.54	1.32	3.00	43.08	0.98	1.47	0.18	1.06
7	2.88	38.71	0.43	2.07	2.87	52.35	0.76	1.66	0.14	1.00
8	2.96	38.51	0.41	2.10	5.79	49.68	0.73	1.60	0.19	0.97
9	3.46	28.66	0.42	2.12	4.25	61.43	0.58	1.28	0.18	1.06
10	3.81	23.61	0.34	2.26	5.34	65.26	0.48	1.45	0.15	1.10

Source: Author's computations

In period 1, all the variations in domestic stock market capitalisation are explained by its own shocks. This trend however gradually declines with time. For example, in period 3,77% of the variations in credit to non-financial firms are explained by its own shocks while in period 5, only 56% of the variations in domestic stock market capitalisation are explained by its own innovation and 44% of the variations are explained by explanatory variables. In period 10, typically the long run, 65% of the variations in financial stability are explained by shocks in domestic economic activity while 5% of the variations are explained by shocks in global

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economic activity. This indicates that shocks as a result of economic activity have a significant contribution to financial stability. Money supply and interest rates are found to explain a relatively smaller share of the shocks in credit to non-financial sector.

4.5.9 Residual Analysis.

To validate the results, several diagnostic tests were executed including the serial correlation test, heteroskedasticity test and stability test. The results are presented in table 4.8.

Table 4.8: Residual diagnostic results.

Residual Test	Chi-square	p-value
Serial Correlation LM	81.17	0.47
Heteroskedasticity Test: White	1531.24	0.49

Source: Author's computations

The serial correlation test confirms that the variables are not serially correlated. This indicated by the corresponding probability value of the chi-square. The probability value of 47% is greater than 5%, which in econometric analysis, confirms that there is no serial correlation amongst the variables in question. Further to this, the corresponding probability value of the chi-square under the White heteroskedasticity test also confirms that the model is free from heteroskedasticity. This is because, the probability of 49% is greater than 5%, which, once again, confirms the absence of heteroskedasticity in the model.

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4.5.10 Residual Graphs.

The representation of residuals by means of graphs helps the researcher in analyzing and understanding the trends in residuals as well as the impact that economic crisis and subsequent shocks might have had on the trend. The graphical representation of residuals is provided in figure 4.2 below.

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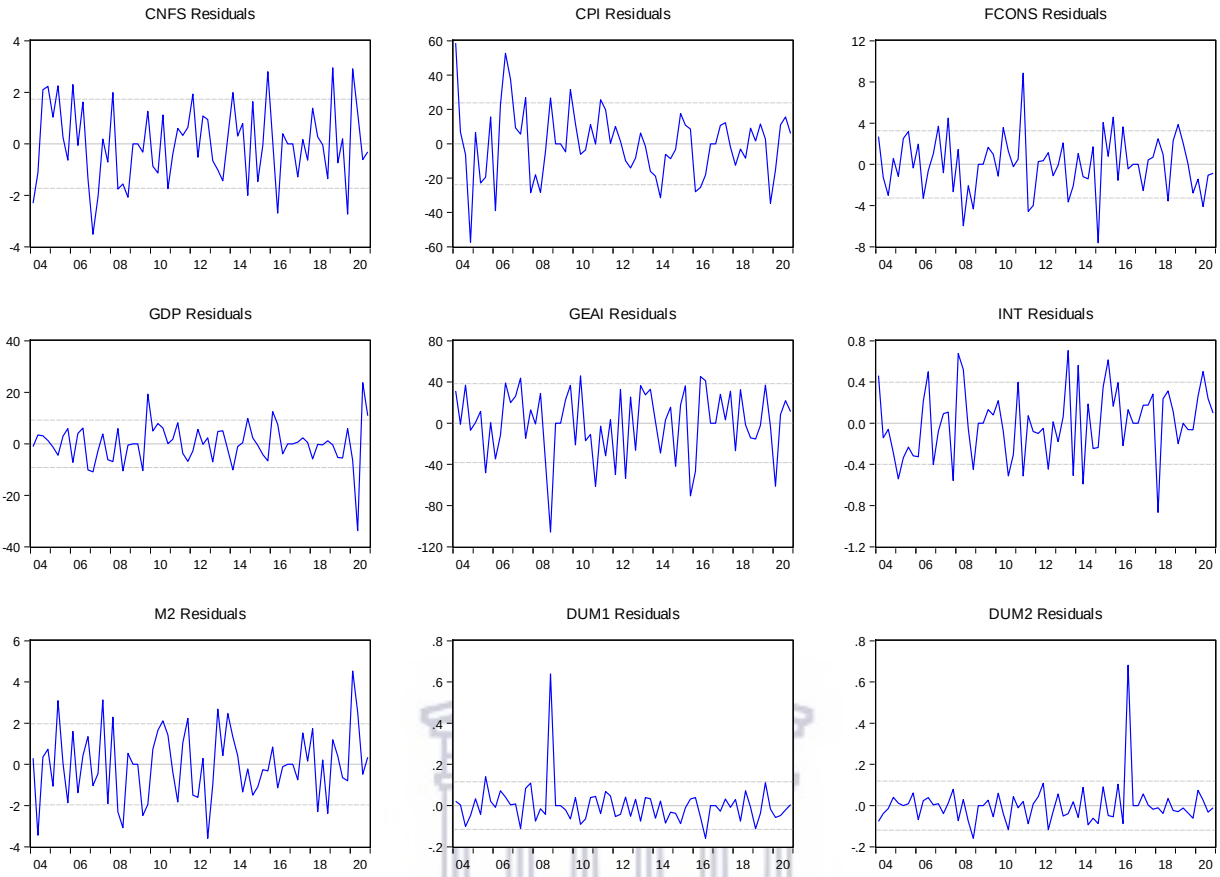
Figure 4.2: Residual representation.



Source: Author's computations

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From the above analysis, it is evident that all the computed residuals hover around the mean. This is indicative of stationary residuals and none of the residuals appear to have characteristics of a linear trend. Also, the impact of both the 2008 financial crisis, 2016 debt sovereign crisis and 2019 coronavirus crisis can be clearly observed from the residual trends.

4.5.11 Causality Analysis.

The last segment of the analysis involved identifying the direction of causality between the dependent variable and explanatory variables, if any. The results are provided in Table 4.9.

Table 4.9: Granger causality output.

Null Hypothesis:	F-Statistic	Prob.
M2 does not Granger Cause CNFS	0.92	0.41
CNFS does not Granger Cause M2	5.57	0.00*
INT does not Granger Cause CNFS	1.25	0.29
CNFS does not Granger Cause INT	0.56	0.57
GEAI does not Granger Cause CNFS	0.91	0.40
CNFS does not Granger Cause GEAI	2.61	0.08***

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GDP does not Granger Cause CNFS	4.91	0.01*
CNFS does not Granger Cause GDP	5.33	0.00*
FCONS does not Granger Cause CNFS	0.06	0.94
CNFS does not Granger Cause FCONS	1.97	0.14
CPI does not Granger Cause CNFS	1.36	0.26
CNFS does not Granger Cause CPI	6.14	0.00*

Source: Author's computations, Asterisk *,**,*** denote significance at 1%, 5% & 10%

The Granger causality test revealed a uni-directional causality from domestic stock market capitalisation to money supply. A similar trend is observed from domestic stock market capitalisation to global economic activity. More interesting, a bi-directional causality was established between credit to non-financial sector and the gross domestic product. Lastly, a uni-directional causality running from domestic stock market capitalisation to the consumer price index was established. As such, the null hypothesis of non-causality is rejected against the alternative hypothesis of causality in all instances that are statistically significant.

4.5.12 Summary.

The primary goal of this study was to analyze the impact of shocks on financial market stability. The goal was achieved by employing quarterly time-series data that span from 2003Q1 to 2020Q4 on various econometric techniques. The initial analysis involved testing the variables for stationarity and correlation. Following this, the estimation of long run relationship amid the dependent variable and explanatory variables were conducted by means of the Johansen cointegration test. The results revealed the existence of long run relationship amongst the variables examined in the study. In addition, the impact of selected macroeconomic variables on financial stability was estimated by means of the vector error correction model although most of the findings were muted. The speed of adjustment to equilibrium was found to be 37% which is high.

Further to this, the validity of the model was tested by means of the LM serial correlation test, White heteroskedasticity test. The results deemed the model valid since no presence of serial correlation nor heteroskedasticity was found. The impulse response function was utilized to measure the impact of a one standard deviation shock to financial stability while the proportion of shocks in financial stability was estimated by means of variance decomposition. The findings revealed that amongst other macroeconomic variables, shocks because of domestic economic activity and global economic activity have a significant impact on financial

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stability both in the short and long term. Lastly, the Granger causality test was employed to identify the direction of causality. A bi-directional causality was established between credit to non-financial sector and the gross domestic product while a uni-directional causality was observed from credit to non-financial sector to global economic activity.

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CHAPTER 5

ASSESSING THE IMPACT OF MONETARY POLICY SHOCKS ON FINANCIAL STABILITY IN SOUTH AFRICA.

5.1 Introduction.

This chapter's objective is to provide in-depth empirical evidence that aids in understanding monetary policy shocks and South Africa's financial stability. Additionally, the chapter quantifies the impact of monetary policy on South Africa's financial stability. To better understand this in more detail, the chapter is broken into five sections. Firstly, the background to the South Africa's monetary policy shocks and financial stability. The second part outlines the literature review, which is divided into two, theoretical and empirical literature related to financial market and monetary policy. The methodology is described in the third subsection, which defines and explains the technique and procedures that are used to answer the study's specific objectives. The empirical findings which are the results from the tests and procedures explained under the methodology section are presented in the fourth subsection. Lastly, the summary of the chapter together with the findings are conferred in the last subsection.

5.2 Background and Problem statement.

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A crucial component of macroeconomic policy, monetary policy is seen as essential to the health and future of the economy. Therefore, it is generally acknowledged amongst academics that achieving and sustaining price stability is the core goal of monetary policy. There are various schools of thought regarding how to properly accomplish this goal, though. According to Dlamini (2020), several central banks have implemented various regimes, including exchange rate targeting, monetary targeting, eclectic monetary targeting, and inflation targeting, to achieve and maintain price stability. A rising number of nations have embraced inflation targeting as their monetary policy framework in recent years. The adoption of this framework has marked a positive change in how central banks from around the world conduct monetary policy. Other central banks in developed and emerging markets then adopted this new framework after New Zealand, which had introduced it in 1990. Many more are currently considering doing so. Like other nations, South Africa implemented the IT monetary policy framework in February 2000 through its central bank, the South African

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Reserve Bank. The South African IT framework is forward-looking in that a specified inflation target must be fulfilled within a given time because it is based on inflation forecasts (Dlamini).

Moreover, the financial system in the real economy plays a key role in sustaining a healthy economic growth through the provision of funds for investment opportunities, enhanced capital accumulation and improvements in the allocation of risks. Prior to the global economic crisis of 2007/2008, the global financial system witnessed very rapid, but unsustainable growth, which distortions were exacerbated by the crisis (Ioana, 2013). Indeed, the crisis initially manifested in developed economies because emerging markets, like South Africa are relatively less susceptible to subprime assets. As the impact of the crisis extended to emerging markets, global de-leveraging and increased risk aversion sparked by the world-wide liquidity crisis, caused severe price volatility (International Organization of Securities Commissions, 2009). The economic literature identifies a macro-prudential framework as a 'missing ingredient' in the regime that preceded the economic and financial crisis. According to the Bank of England (2009), the current framework, with its micro-prudential orientation, cannot handle a severe crisis.

Many studies have argued that monetary policy should concentrate on achieving price stability. For instance, Borio and Lowe (2004) point out that when inflation is stable, there can be no build-up of financial imbalances; and Bernanke and Gertler (2001) argue that monetary policy should only focus on inflation. Other studies have maintained that macro-prudential policy, which is implemented for financial stability, should be coordinated with monetary policy. For example, Mishkin (2009) argues that aggressive monetary policy easing during financial instability is effective as it minimizes the probability of negative feedback loops. Cecchetti and Li (2008) suggest that for monetary policy to be effective during financial distress, the interest rate policy should account for (procyclical) capital-adequacy requirements. However, several other studies maintain that financial instability can hinder the effectiveness of monetary policy. For instance, Montes (2010) and Nair and Anand (2020) state that financial instability related to asset price crashes and bank panics is likely to make monetary policy less effective in promoting economic recovery. Furthermore, it can hinder the effectiveness of monetary policy transmission (Billi and Verdin, 2014).

There is no consensus in the literature on whether Central Banks should extend monetary policy beyond price stability. However, periods of financial instability have shown that the

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direct effect of credit controls, financial regulation and the high cost of borrowing have intensified procyclicality in financial markets and business cycles (Angeloni and Faia, 2013; Liu and Seeiso, 2012). The 2007/2008 global financial crisis is an example of how financial instability can disrupt the functioning of the real economy. As a small, open economy, South Africa is susceptible to uncertainty and risk from the global financial environment (SARB, 2016). After the 2007/2008 financial crisis, policy rate differentials between advanced economies and emerging markets led to capital inflows (in the latter) that created a risk for macroeconomic and financial stability (Unsal, 2013). The primary aim of macro-prudential policy is financial stability, which calls for mechanisms to influence the economic outcomes of different countries. All over the world, the authorities are experiencing challenges in implementing macro-prudential policy. However, the objective of monetary policy and macro-prudential policy is clear in terms of how each affects credit growth. Credit growth can emanate from households' loans (house prices) and corporate loans.

There is insufficient understanding of macro-prudential policy in terms of its transmission mechanisms, effectiveness and impact on the financial sector and the real economy. These policies remain an open question especially in emerging markets such as South Africa. The South African financial system is under stress but has remained resilient in the face of a challenging environment (SARB, 2019). The level of stress mainly originates from the household sector, sluggish income growth reflects the fragility of a particular class of borrowers. As a result, housing market changes and developments are crucial financial stability indicators of the strength of the financial system and of the confidence of the economy. According to estimates, home loans make up 60% of all loans, and advances in South Africa (SARB, 2016). However, from the start of 2016, the cost of home ownership (such as taxes and rates) and the repayment burden has increased, leading to an increase in the ratio of mortgage payments to average rent in South Africa. An investor in buy-to-rent real estate with heavy leverage might feel even greater stress because of this.

The "Tinbergen principle" states that policymakers should ensure a minimum of one policy tool per policy objective. However, the policy instruments of monetary and macro-prudential policies are interrelated (Schoenmaker and Weirts, 2011), and remain an open question especially on their implications on the overall economy. This emerged from Central Banks globally including the South African Reserve Bank on expanding its objective by incorporating

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financial stability. This presents a new challenge to the SARB due to the mutual dependence of both the monetary policy and macroprudential policy goals. South Africa is an emerging market economy that is susceptible to global and idiosyncratic risk that affects its financial market. It has the most advanced and sophisticated financial system in Africa and hence the focus of this research. It is against this backdrop that this study investigated the effect of monetary policy shocks in financial stability in South Africa. To the best of the researcher's knowledge, this is the first study in South Africa to assess monetary policy shocks on financial stability using quarterly data using the latest data spanning from 2003 to 2020.

5.3 Literature review.

This section analyzes the theoretical and empirical literature relevant to monetary policy and financial stability in South Africa to foster a better understanding of the framework used in the analysis and interpretation of the study's findings.

5.3.1 Theoretical Framework

5.3.1.1 Monetary policy transmission mechanism

The theoretical framework for monetary policy is rooted in the monetary policy transmission mechanism. There are two such mechanisms, namely, non-neoclassical channels and neoclassical channels (Boivin et al, 2011). Neoclassical channels of monetary policy are founded on Friedman's (1956) monetarist characterization of the transmission mechanism. These channels mainly operate through the interest rate channel. Non-neoclassical channels, also known as credit channels, are founded on frictions in the credit market that are the result of asymmetric information between borrowers and lenders. According to Lacoiello and Minettiz (2008). The importance of these channels before the global financial crisis was mixed.

However, Cecchetti et al. (2009) and Mishkin (2009) showed that financial frictions affect the transmission of monetary policy and distort the real economy. During the global financial crisis, the interest rate channel was weakened (Gambacorta et al., 2015), suggesting that the monetary policy might have changed. According to Angelis et al. (2005), the transmission mechanism of monetary policy explains the complex process whereby changes in the monetary policy stance are transmitted to the real sector of the economy to achieve its objective, such as economic growth and a low and stable inflation rate.

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The interest rate influences the decisions made by investors, firms, financial institutions, and households, which changes the price level and economic activities. For instance, when the monetary authorities adopt tight monetary policy by raising the repo rate, this directly affects the money market by increasing the banks' interest rates (Arestis and Sawyer, 2004). Thus, the cost of capital increases, causing investment expenditure to fall, and thereby leading to a decrease in aggregate output and demand. Five different channels generalize the transmission process, namely, the interest rate channel, exchange rate channel, money effect channel, asset price channel and credit channel.

a) The interest rate channel.

Mishkin (1995) argues that monetary policy shocks are transmitted to the real economy using the interest rate channel. Mollentze (2000) elucidates that a rise in the repo rate is transmitted to other short-term money market rates, resulting in a higher cost of borrowing and hence a decrease in consumption and investment. The Central Bank loans money to banks and charges interest, which determines the interest rate in the real economy. The banks lend to investors who transfer the interest rate level to output and prices. The major characteristic of the interest rate channel is that it drives investment and consumption decisions. Policymakers respond to shocks using monetary policy instruments. Keynes points out that this channel operates through business decisions on investment expenditure. However, Mishkin (1995) argues that consumers' decisions about durable expenditure and housing are inherent in investment decisions.

b) The exchange rate channel.

The exchange rate channel focuses primarily on monetary policy considering the impact of the currency rate on net exports (Mishkin, 1995). Interest rates are a tool used by monetary policy to affect the exchange rate. The native currency strengthens as interest rates rise because local currency deposits become more desirable than foreign currency deposits. When the value of the home currency increases, imports become more expensive than exports, which leads to a drop in output. Conversely, Sheefeni (2013) attest that when the local currency is devalued relative to other currencies, local exports are more affordable than imports, which leads to an increase in output.

c) The money effect channel.

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According to the monetarist theory, when the amount of money in circulation declines, consumers become more aware of how little money they have at a given rate of interest and hence lower their spending (Mishkin, 1995). The effects of interest rates and the adjustment of liquid assets is moderated by the money effect, which gradually reduces the direct correlation between changes in aggregate money supply and absorption (Bolnick, 1991). Because consumers and investors view the effects of past and present activities imperfectly, it is assumed that output and prices respond to monetary shocks (Meltzer, 1995). This could be because of the delay between the impulses' detection and the chance to distinguish between nominal and actual shocks, as well as temporary and permanent impulses (Ngalawa and Viegi, 2011).

d) The asset price channel.

An expansionary monetary policy may cause a company's physical and financial value to increase as customers spend their extra cash. The price of equities is under pressure to increase as a result. A company's net worth increases because of lower interest rates (a growth in the money supply), which also increases the company's cash flow, creditworthiness, and the value of its collateral (Norris and Floerkemeier, 2006). As a result, output, investment costs, lifetime income, consumption, and financial wealth all rise.

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e) The credit channels.

The agency issues that develop in the credit markets are transferred through the balance sheet and bank lending channels (Norris and Floerkemeier, 2006). The latter channel focuses on money-transfer agents who give borrowers access to capital. This channel develops because of asymmetry in credit market information. However, because of procedures like third-party financing, the channel performs poorly (Norris and Floerkemeier, 2006). The bank lending channel is utilized to give borrowers access to capital. In this case, instead of increasing the rate of credit, the central bank expands the money supply by issuing bank loans, which results in an increase in the quantity of money velocity. Banks' ability to provide loans to investors will be significantly impacted by declining bank deposits brought on by contracting interest rates (Mishkin, 1995).

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5.3.1.2 The Inflation Targeting Regime and the Taylor Rule.

The regime of inflationary targets derives from the work that permeated the debate on rule-based versus discretionary monetary policy in the 1970s and 1980s, with the contributions of Kydland and Prescott (1977) and Barro and Gordon (1983), as well as the emergence of rational expectations with and Sargent and Wallace (1975). Later, in addition to the operability of monetary policy, Taylor (1993) joined this debate, giving support pillars of the so-called new monetary policy consensus. The idea is to use the microeconomic fundamentals within a macroeconomic model of general equilibrium, while still considering a range of hypotheses of rigidities in the adjustment process but incorporating rational expectations to explain the effects of monetary policy to the real variables of the economy, so that its effects are only transitory (long-term neutrality of the currency). This unified the neoclassical and new Keynesian theories. In this sense, Woodford (2011) added that although monetary policy is not considered irrelevant to explain fluctuations, its most important sources are real. Thus, monetary policy is important to contain inflation, whose dynamics have monetary roots. Therefore, following Friedman's monetarist idea, monetary policy should be used exclusively to control the price level, since it has no lasting effect on the real economy. The proponents of the inflation targeting regime rescued the quantity theory of money (QTM) regarding monetary control of inflation by the monetary authorities (exogenous currency) to defend the hypothesis of monetary policy neutrality. From there, more appropriate prescriptions can be extracted, which are the use of rules or practices of commitment of governments to monetary policy [Cukierman (1994); Walsh (1995); Mishkin (2000)], avoiding the own bias of inflation Kydland and Prescott (1977).

Despite its origin in the QTM, the rule the inflation targeting operates through the interest rate and not through control of the monetary aggregate, as advocated by monetarist theory. This is a result of discrediting the hypothesis that the velocity of money circulation is constant. According to the new consensus, it is the exact opposite. That is, the velocity of the currency that is unstable, which makes it difficult for central bank intervention regarding the currency, and consequently involving inflation. Over time, Friedman's monetarism, which prescribed price control by intervening in monetary aggregates, was gradually abandoned. In this sense, in a more modern version, monetary policy focused on the intervention of the interest rate as an instrument to control inflation. Although this change was considered a Keynesian victory

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over the monetarists, the theoretical and institutional framework is far from being a Keynesian theory. According to Arestis and Sawyer (2004), in the long run the inflation rate is the only macroeconomic variable that monetary policy can affect. Thus, in the long run monetary policy cannot affect economic activity, economic output, employment and so on. The inflation targeting regime is therefore based on the premises of the new macroeconomic consensus.

Taylor (1993) presented a proposition as part of the effort to obtain an interest rate rule, and a rule for monetary policy to replace monetary rules. He explained that monetary policies based on rules of interest rates related to inflation variations and product variations are more stable, achieving better control than other types of policy that may be adopted. In other words, he argued that well-enforced rules are compatible with changes in interest rates in response to changes in prices or economic activity, without compromising the expectations of other agents.

5.3.1.3 The Post-Keynesian approach.

In Keynes's sense, the debate gained scope with de contribution of post-Keynesian authors. According to TPK, the monetary system is not able to avoid, by its own methods, the inflationary process. On the other hand, it becomes mandatory to identify the causes and origins of inflation and then work on them. Therefore, in the Keynesian world, acting on the origins of this process allows monetary issues to validate the causes of inflation instead of suppressing them. Unlike the conventional theory, under monetarist auspices, money is, neither in the short run nor the long run, neutral. Consequently, Keynes's general theory analysis suggests that any monetary policy that effects the quantity of money in the system or the rate of interest (and therefore the market value of liquid financial assets) will impact directly on real economic outcomes (Davidson, 2006). The assumption behind this argument is supported by one of the main pillars of the construction the Keynesian theory: uncertainty.

In Keynes's view, agents' decisions are made in an environment where the future does not have perfect predictability (nonergodicity), so it goes without saying that money is never neutral. Additionally, according to Davidson (2006), in the real world, one of the main functions of the central bank is the provision of liquidity, instead of determining the rate of inflation. In opposition to classical theory, in Keynes's view the banking system has an important role of assuring liquidity continues to oil the gears of the productive sector, through

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credit. As a result, “this first function of any central bank, as controller of the banking system, is to encourage bankers to make credit (liquidity) available as cheaply as possible while the economy has significant idle resources. Furthermore, this function, necessarily implies other one, namely, to assure stability in the financial market. First, it is necessary to understand the inflation process in a Keynesian world. According to Davidson (1978) and Davidson (2006), the causes of the inflationary process have origins in the productive process, involving commodity inventories, productivity, and the market structure. Consequently, the types of inflation can be classified as:

- wage inflation.
- profit inflation.
- decreasing returns inflation; and
- shock inflation.

Regarding the wage, profit and decreasing return types of inflation, their origin is linked to wage increases, monopoly status and labor productivity, respectively. Briefly, regardless of the size of the employment gap, increases in wages unaccompanied by increased productivity cause inflation. The solution of this problem was developed by Weintraub (1977), through an anti-inflation policy called TIP (tax-based income). The proposal was to penalize firms that increase wages and profits beyond the national productivity growth rate. The main cause of inflation shocks (spot or commodity inflation) is a sudden and unforeseen change in demand or available supply for immediate delivery (Davidson, 2006). This type of inflation can easily be avoided if there is some institution that is not motivated by self-interest but instead maintains a ‘buffer stock’ to prevent unforeseen changes in spot demand and supply from inducing spot price movements, (Ibid, 1995). The proposal was to protect society from changes in demand and supply that would induce significant spot price movements. The maintenance of the buffer stock consists of a public policy where the government buys the excess output from the market in good years to ensure supplies during hard times.

5.3.1.4 Macroprudential Policy.

According to Rooplall (2016), the use of macroprudential policy gained popularity since the global financial crisis of 2007/8. Even though macroprudential tools have been used for some decades, its widespread use is more recent. The introduction of a macroprudential view to regulation started with the September 2010 reform of the international regulatory framework

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(SARB, 2013). At that time, the Basel Committee for Banking Supervision (BCBS) proposed several reforms to reinforce not only microprudential regulation but also to introduce a macroprudential focus to address system-wide risks, given the interaction between the business cycle and the financial system and institutions (SARB,2013). It has represented a necessary response to the lack of instruments to help predict and face the build-up of financial imbalances, which usually turn out to have severe macroeconomic consequences. Macroprudential policy's main objective is generally financial stability, though this has not been given a clear and precise definition (like for price stability); also, the set of potential instruments is large, and no standard taxonomy has been identified. Regarding the risks that macroprudential policy aims to mitigate, these include:

- Excessive credit growth and asset price inflation particularly fuelled by credit expansion.
- Extreme leverage from financial institutions.

Against this background, macroprudential policy works on two dimensions: reducing the tendency of the banking system to amplify the business cycle, both the booms and the busts, and increasing the resilience of the financial system. Even though the distinction identifies theoretically the targets, in practice there is still uncertainty regarding the appropriate macroprudential instruments to deal with each dimension. According to Lim et al. (2011) some of the most frequent tools are capital conservation buffers, countercyclical capital buffer, loan to value and debt to income. Regarding the second dimension, efficient tools are still under debate. According to Beau et al. (2014), considering the complex interconnection of the companies within the system, possible solutions could consist in the combination of capital overcharge, contingent capital, and bail-in debt for significantly important financial institutions. Galati and Moessner (2013) distinguish between macroprudential tools orientated on the time dimension (procyclicality of the financial system) and tools focused on the cross-sectional dimension (how risk is distributed within the financial system and by how much each institution contributes to systemic risk). With respect to the first dimension, effective instruments are countercyclical capital requirements, (forward-looking) provisioning schemes as well as LTV ratios. Regarding the cross-sectional dimension, one of the major sources of risk is correlated to large share of short-term liabilities in banks' balance sheets: to

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counteract these vulnerabilities, tools such as net stable funding ratio or liquidity coverage ratio are notable examples.

5.3.2 Empirical literature.

Bergman and Hansen (2002) examined empirically the relationship between financial instability and monetary policy in Sweden using quarterly data from the first quarter from 1982 to the third quarter of 2001. They used measures of financial instability in a standard vector autoregressive (VAR) framework with output, prices, and interest rate, and then extended it to include measures of credit expansions. The measures of financial stability constructed used firm bankruptcies and excess return on housing. They found that there was a significant effect of higher interest rates and lending expansions on financial instability, and a strong impact of price shocks as well. They concluded that price stability and financial stability cannot be rejected as mutually consistent goals for monetary policy.

In their study, Granville and Mallick (2009) investigated the nexus between monetary stability and financial stability twelve European Monetary Union countries over the period fourth quarter 1994-second quarter 2008. In analyzing the nexus relationship, they used the following variables: interest rates, share prices, exchange rates, property price inflation and the deposit–loan ratio of the banking sector (proxies for financial stability) to changes in the consumer price level and ECB policy rate (proxies for monetary stability). They used a sign-restriction-based VAR approach, we find that there is a pro-cyclical relationship between monetary and financial stability in the long-run. With a positive inflation shock, they further found that on average a 2% estimated decline in share prices. In conclusion, they suggest that the interest rate instrument used for inflation targeting is conducive to financial stability.

Khataybeh and Al-Tarawneh (2016) analyzed the relationship between financial stability and monetary policy in Jordan. They have used an impulse function using a VAR framework together with Granger causality test to explore the impact of monetary policy shocks on a financial stability index. Their findings emphasize that changes in the excess reserves impact positively on the financial stability index, however, the effect is small in magnitude. On the same direction, changes in domestic credit have a significant impact on the financial stability index. These findings support the explanation that monetary policy has a significant effect on the financial stability through affecting its medium target, using its instruments, mainly excess reserves.

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To study the impact of monetary policy and macroprudential policy coordination on financial stability and sustainability, Jiang et al (2016), used the yearly data spanning from 2003 to 2017. They used the System Generalized Method of Moments (System GMM) method to analyze the monetary policy and macroprudential policy coordination effect on 88 commercial banks' risk-taking; from the macro level, they used the Structural Vector Autoregression (SVAR) method to analyze the two policies coordination effect on housing prices and stock price bubbles. They found that for regulating bank risk-taking, monetary policy and macroprudential policy should conduct counter-cyclical regulation simultaneously; secondly, for regulating housing prices, tight monetary policy and tight macroprudential policy should be implemented alternately; thirdly, for regulating stock price bubbles, macroprudential policy should be the first line of defense and monetary policy should be the second one.

Using a time-continuum changing parameter model, Baxa, Horvath, and Vasicek (2013) investigated how specific authorities responded to financial stress events over the previous 30 years. The findings imply that the government is most likely to alter interest rates, mostly by lowering them during times of extreme stress. These results are in line with those of (Lamers et al., 2019), who discovered that weaker banks gain from low interest rates at the expense of future financial stability concerns rising. Bank stress and stock market stress are the forms of stress that the authorities are most likely to respond to. In line with study taken by (Martinez-Miera and Repullo, 2019; Jiang et al., 2019), monetary policy through open market sales of government debt by a central bank is effective when improving banks monitoring incentives through an increase in the intermediation margin. Tight monetary policy, however, discourages investment from both safe and hazardous businesses. Consequently, a monetary policy without considering the function of credit and asset prices may not have a robust cost-benefit analysis (Adrian and Liang, 2018).

To explores the connection between Asian economies' inflation targeting (IT) and financial instability, Sethi and Acharya (2019) used data from 1990 to 2015. A multidimensional financial conditioning index is created to gauge financial instability using the ECB's methodology. The study disproves the "conventional knowledge" notion by demonstrating that the adoption of IT policy in Asian nations has a negative influence on financial stability.

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The Vector Autoregression (VAR) result further demonstrates how an IT regime boosts housing returns and encourages investors to take bigger risks.

Dlamini (2020) studied financial stability and monetary policy in South Africa with monthly frequency time series data spanning from 2000:2 to 2017:8. Markov Switching Vector Autoregression (MSVAR) model was estimated together with Bayesian methods to investigate this dynamic relationship. The results show that interest rates react negatively to a severe financial stress shock, which causes credit growth to expand. Real GDP growth somewhat rises despite the expansion of credit before steadily declining. It is concluded that monetary policymakers must take financial stability into account given the complimentary nature of the objectives of financial stability and monetary policy. Furthermore, monetary policy has an impact on more than simply interest rate changes; it also has an impact on things like loan risk functions.

To understand the effects of South Africa's Unexpected Monetary Policy Shocks in the Common Monetary Area, Seoela (2020) used a structural vector autoregressive (SVAR) using monthly data spanning from the period 2000M2 to 2018M12. The major findings demonstrate that a positive shock to the South African repo rate is often followed by a decline in economic output and a rise in price levels, with a 90% level of confidence across all Common Monetary Area nations. In addition, the study found that, a positive repo rate shock causes an asymmetric response in the money supply, domestic credit, and lending rate spread between Lesotho, Eswatini, and Namibia countries and South Africa. According to these results, the governments of Lesotho, Eswatini, and Namibia must take additional measures to lessen the negative effects of South Africa's monetary policies on their financial sectors.

The study by Yalçinkaya, Celik, and Emsen (2021) highlighted how price and financial stability are related in monetary policy designs that have evolved since the 1990s and conducted an empirical analysis of how price and financial stability are related in US monetary policy designs. To this end, the study uses the TVP-SVAR model to examine the time-varying structure of the relationship between price and financial stability in the US, where monetary policies are intended to achieve price stability, full employment, and targets for moderate long-term interest rates. The study used monthly data spanning from 1993:12 to 2020:12. These findings essentially indicate the need to restructure US monetary policy in light of the new environment hypothesis while also taking into account the changing pattern of

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symmetrical or asymmetrical linkages between monetary and financial stability factors over time.

In general, the scant empirical literature lends itself to the idea that financial markets development is key to determining the effectiveness of monetary policy. The impact, however, could be facilitative or dampening. In one dimension, a well-developed financial system provides the structures for the transmission of policy to the economy, thus contributing to effectiveness. On another dimension, well-developed financial markets could also provide insulation against monetary policy shocks by providing numerous media/innovations by which economic agents can counter the effects flowing from monetary policy shocks.

As shown above, number of studies tried to explore the relationship between monetary policy and financial stability. They used different models and got different results. Herein, the study tests the existence of such shocks and policy response in South Africa, unlike that of Dlamini (2020), which did not look at shocks but interested in the relationship. Again, the study made use of quarterly latest data from 2003 to 2020 as opposed to high frequency data such as monthly where we know very well that monetary policy conduct has lag effects. Thus far, there is a gap in the literature on this area in South Africa. The model used should serve the study objectives. And answer the study question: does monetary policy affect the financial stability in South Africa?

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5.4 Methodology.

After reviewing the literature in the preceding section, the current section provides a thorough explanation of the research methodology and econometric techniques used to assess monetary policy shocks and financial stability. There is a brief discussion of the different econometric instruments and data collection techniques.

5.4.1 Model specification.

The estimated model was informed by recent empirical studies including Dlamini (2020), and Mahajan (2018). The estimated model, with a few modifications, can be expressed as:

$$FS = \alpha_0 + \beta_1 cpi_{t-1} + \beta_2 ms_{t-1} + \beta_3 geai_{t-1} + \beta_4 int_{t-1} + \beta_5 dum1_{t-1} + \beta_6 dum2_{t-1} + \varepsilon_t \quad (4.1)$$

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Where

FS is financial stability proxied by credit to non-financial sector,

CPI is the consumer price index capturing the effects of inflation in the financial sector,

MS is money supply measured by broad money (M2),

$GEAI$ is the global economic activity index measuring the influence of the international economic activities,

INT is Interest rate,

$DUM1$ is a dummy variable to capture the shock of the 2008 financial crisis,

$DUM2$ is a dummy variable to capture the effects of the 2016 sovereign debt crisis on the South African financial system and,

ε_t is the error term.

5.4.2 Unit root.

The theory behind the estimation of unit root test centered around the stationary time series data. In its totality, the empirical analysis begins by looking at the statistical properties of these economic variables because the model generates time series by nature. A series is stationary if the mean and auto covariance of the series do not depend on time. According to Austeriou and Hall (20110), the goal of examining these qualities is to determine whether the model's variables are stationary to avoid spurious regression that might lead to the misleading results. Furthermore, Banda, et al (2014) note that, the other reason for running stationarity tests is that non-stationary time series results can only be applied to that specific time and cannot be extrapolated to future periods. Therefore, the variables in this study will be tested for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips Peron (PP) tests. Usually, when variables are determined to be stationary in a model, they are often expected to have a fixed variance and some components of autocorrelation over time (Mosikari, 2013).

b) Augmented Dickey-Fuller.

A Dickey Fuller test assumes that all the error terms are uncorrelated. Due to the possibility of the error terms being correlated Dickey & Fuller (1976) went beyond their first estimation technique and improved the simple Dickey Fuller test to obtain and apply the now recognized

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Augmented Dickey-Fuller (ADF) unit root test. The Augment Dickey Fuller unit root test is applied on models that incorporate the lagged values of the dependent variables to control the serial correlation in the error term. For the ADF test, the following regression is estimated for each variable in the model as used by Mosikari (2013) and Madito and Khumalo (2014).

$$\Delta Y_t = \pi_0 + \beta_t + \alpha_1 Y_{t-1} + \sum_{i=1}^{t} y_i \, \Delta Y_{t-i} + \varepsilon_t$$

Where π_0 is a constant, β_t the coefficient on a time trend and α_1 is the parameter to be estimated and ε_t is the error term which is assumed to be normally distributed.

The null hypothesis to be tested using the ADF test is the existence of a unit root in the time series. The critical value should be greater than the test statistics and the probability value (PV) should be less than 1%, 5% and 10% levels of significance for a variable to be stationary. The Augmented Dickey-Fuller statistic used in the test is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of significance (Dickey, 1988).

b) Phillips-Perron.

The Phillips-Perron test is an alternative procedure for testing the presence of a unit root in a general time series setting. The Phillips & Perron (1988) included the linear trend in their specification. The ADF unit root test alters the Dickey-Fuller test to take into consideration the possibility of serial correlation in the error terms by including the lagged differenced terms of the independent variables. Phillips & Perron (1988) go beyond this by using non-parametric statistical methods in order to pay attention to serial correlation in the error terms without adding the lagged differenced terms (Gujarati & Porter, 2008).

$$\Delta \mathrm{K}_t = \lambda_0 + \lambda_1 \mathrm{K}_{t-1} + \omega_t$$

For the PP test, the following regression is estimated for each variable in the model:

Where λ_0 and λ_1 are parameters estimates and ω_t is error term. The null hypothesis that a unit root exists in the time series is tested using the PP test and when critical value is greater than the test statistics and the probability value (PV) is less than 1%, 5% and 10% levels of significance, then the time series is stationary.

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5.4.3 Structural Vector Autoregression (SVAR).

This study employs the Structural Vector Autoregressive (SVAR) model of seven variables to assess the effect of monetary policy shocks on financial stability. There are two reasons for adopting SVAR for this study instead of other time-series modelling approaches. Given the objectives of the study, shock to the structural innovation to study policy response is important. In this case, SVAR offers the more appropriate approach for the study. Secondly, SVAR offer rooms to examine the contemporaneous effect of variables on the dependent variable which Vector-Autoregressive Regression is less effective in doing so except explaining endogenous relationships from past values (Pfaff, 2008). It is worth noting that the VAR's residuals do not lend themselves to any economic interpretation. However, the SVAR models typically result from macroeconomic models, and hence restrictions are broadly consistent with economic theory and outcomes that make economic sense (Brischetto and Voss, 1999).

Now, assuming there are *n* endogenous variables, a structural or primitive vector auto regression (VAR) model can be expressed as follows with one lag in the model variables, as their relationship is independent of lag length. The constant terms are suppressed for simplicity

$$A\lambda_t = \Gamma_1\lambda_{t-1} + \Gamma_2\varepsilon_t \qquad (5.1)$$

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In terms of matrix algebra equation (5.1) can be rewritten as follows.

$$\begin{bmatrix} 1 & \alpha_{12} \dots & \alpha_{1n} \\ \vdots & \ddots & \vdots \\ \alpha_{n1} & \alpha_{n2} & 1 \end{bmatrix} \begin{bmatrix} x_{1t} \\ \vdots \\ x_{nt} \end{bmatrix} = \begin{bmatrix} y_{11} & \dots & y_{1n} \\ \vdots & \ddots & \vdots \\ y_{n1} & \dots & y_{nn} \end{bmatrix} \begin{bmatrix} x_{1t-1} \\ \vdots \\ x_{nt-1} \end{bmatrix} + \begin{bmatrix} \kappa_{11} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & \kappa_{nn} \end{bmatrix} \qquad (5.2)$$

It is assumed that structural shocks are normally distributed with zero mean and constant variance. In other words, the variance–covariance matrix assumes the form $\sum_{\varepsilon t} \sim E(\varepsilon_t \varepsilon_t') =$ $\chi_n \Gamma \ where \ \chi_n$ is an n dimensional identity matrix and $\sum_{\varepsilon t} \begin{bmatrix} \nu_1^2 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & \nu_n^2 \end{bmatrix}$ is an (*nxn*) square matrix, whose off diagonals

Indicate zero covariance of the structural errors, and the principal diagonal indicates their constant

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Also, $A = \begin{bmatrix} 1 & v_{12} & v_{1n} \\ \vdots & \ddots & \vdots \\ v_{n1} & v_{n2\ldots} & 1 \end{bmatrix}$ is an (*nxn*) matrix containing the contemporaneous coefficients relating the endogenous variables and $\Gamma_2 = \begin{bmatrix} \beta_{11} & \ldots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \ldots & \beta_{nn} \end{bmatrix}$ is a diagonal matrix including structural parameters.

$z_t = \begin{bmatrix} x_{1t} \\ \vdots \\ x_{nt} \end{bmatrix}$ is an (*nx1*) vector of endogenous model variables.

$\Gamma_1 = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{n1} & \cdots & r_{nn} \end{bmatrix}$ is an (nxn) matrix containing the coefficients of lagged endogenous variables

$z_{t-1} = \begin{bmatrix} x_{1t-1} \\ \vdots \\ x_{nt-1} \end{bmatrix}$ is an (nx1) vector of lagged endogenous variables.

Finally, $\varepsilon_t = \begin{bmatrix} e_t \\ \vdots \\ e_{nt} \end{bmatrix}$ is an (nx1) vector of residual errors of the reduced form model.

The Ordinary Least Squares (OLS) method, which is applied to each individual equation in the system, is used to estimate VAR models, producing accurate parameter estimations. However, because the error components are correlated with the right-hand side contemporaneous variables, equation (5.2) cannot be calculated using the OLS method. A simplified form VAR model is constructed as of equation (5.3), where the error terms are no longer linked with the right-hand side contemporaneous variables, by remultiplying both sides of equation (5.1), by, and following rearrangement of the resulting matrices. As a result, the OLS approach can be used to efficiently estimate the parameters of individual equations.

$$\mathrm{A}^{-1}\mathrm{A}\lambda_t = \mathrm{A}^{-1}\Gamma_1\lambda_{t-1} + A^{-1}\Gamma_2\varepsilon_t$$

$$y_t = Gy_{t-1} + e_t \qquad (5.3)$$

Utilizing the fact that $A^{-1}A = 1$ and letting $A^{-1}\Gamma_1 = G$, and $A^{-1}\Gamma_2\varepsilon_t$=$e_t$, equation (5.1) is rewritten as of equation (5.3). Using matrices and vectors, equation (3) is more explicitly expressed as equation (4). Equation (3) is a reduced form of model (5.1), where it stands for the contemporaneous variable and for the lagged endogenous variable.

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$$\begin{bmatrix} y_{1t} \\ \vdots \\ y_{nt} \end{bmatrix} = \begin{bmatrix} 1 & \alpha_{12} & \alpha_{1n} \\ \vdots & \ddots & \vdots \\ \alpha_{n1} & \alpha_{n2} & 1 \end{bmatrix}^{-1} \begin{bmatrix} y_{11} & \cdots & y_{1n} \\ \vdots & \ddots & \vdots \\ y_{n1} & \cdots & y_{nn} \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ \vdots \\ y_{nt-1} \end{bmatrix} +$$

$$\begin{bmatrix} 1 & \alpha_{12} & \alpha_{1n} \\ \vdots & \ddots & \vdots \\ \alpha_{n1} & \dots & 1 \end{bmatrix}^{-1} \begin{bmatrix} \beta_{11} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & \beta_{nn} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \vdots \\ \varepsilon_{nt} \end{bmatrix} \quad (5.4)$$

As the VAR models are over-parameterized, some of the model parameters may not be found to be statistically significant. Except for short-term forecasting, VAR models are estimated for monetary and fiscal policy analysis. From this standpoint, obtaining parameter estimates is not the main purpose of VAR modeling. Instead, the main objective of estimating the VAR models is identifying the structural shocks from the estimated error terms of the reduced form models. Structural shocks of the theoretical models are related to the estimated error terms of the reduced form models, as reflected by the equation $A^{-1}\Gamma_2\varepsilon_t$.

5.5.4 Granger causality test.

Granger (1969) holds the fact that The Granger causality test considers the causal connection between the variables which are depended on and independent. However, the causation does not mean the existence of relationship among variables, but rather the variables predict each other. The study will make use of this test to check if the variables do granger causes each other. A variable P is causal to variable Q if P is the cause of Q. Now, on our VAR model estimate we have Z_{2t} and Z_{3t} which fails to Granger cause Z_{1t} if $\omega_{12}^{c} = \omega_{13}^{c} = 0$ for all c: Below is the matrix explanation of granger causality.

$$\begin{bmatrix} Z_{1t} \\ Z_{2t} \\ Z_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \omega_{11}^{1} & 0 & 0 \\ \omega_{21}^{1} & \omega_{22}^{1} & \omega_{23}^{1} \\ \omega_{31}^{1} & \omega_{32}^{1} & \omega_{33}^{1} \end{bmatrix} \begin{bmatrix} Z_{1t-1} \\ Z_{2t-1} \\ Z_{3t-1} \end{bmatrix} + \cdots + \begin{bmatrix} \omega_{11}^{x} & 0 & 0 \\ \omega_{21}^{x} & \omega_{22}^{x} & \omega_{23}^{x} \\ \omega_{31}^{x} & \omega_{32}^{x} & \omega_{33}^{x} \end{bmatrix} \begin{bmatrix} Z_{1t-x} \\ Z_{2t-x} \\ Z_{3t-x} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix}$$

The below metrics show the failure of two variables Z_{1t} and Z_{3t} to Granger cause variable Z_{2t} given $\omega_{21}^{c} = \omega_{23}^{c} = 0$ for all c.

$$\begin{bmatrix} Z_{1t} \\ Z_{2t} \\ Z_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \omega_{11}^{1} & \omega_{12}^{1} & \omega_{13}^{1} \\ 0 & \omega_{22}^{1} & 0 \\ \omega_{31}^{1} & \omega_{32}^{1} & \omega_{33}^{1} \end{bmatrix} \begin{bmatrix} Z_{1t-1} \\ Z_{2t-1} \\ Z_{3t-1} \end{bmatrix} + \cdots + \begin{bmatrix} \omega_{11}^{x} & \omega_{12}^{x} & \omega_{13}^{x} \\ 0 & \omega_{22}^{x} & 0 \\ \omega_{31}^{x} & \omega_{32}^{x} & \omega_{33}^{x} \end{bmatrix} \begin{bmatrix} Z_{1t-x} \\ Z_{2t-x} \\ Z_{3t-x} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix}$$

Similarly, if given $\omega_{31}^{c} = \omega_{32}^{c} = 0$ for all c then variables Z_{1t} and Z_{2t} does not Granger causeZ_{3t}.

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$$\begin{bmatrix} Z_{1t} \\ Z_{2t} \\ Z_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \omega_{11}^{1} & \omega_{12}^{1} & \omega_{13}^{1} \\ \omega_{21}^{1} & \omega_{22}^{1} & \omega_{23}^{1} \\ 0 & 0 & \omega_{33}^{1} \end{bmatrix} \begin{bmatrix} Z_{1t-1} \\ Z_{2t-1} \\ Z_{3t-1} \end{bmatrix} + \cdots + \begin{bmatrix} \omega_{11}^{x} & \omega_{12}^{x} & \omega_{13}^{x} \\ \omega_{21}^{x} & \omega_{22}^{x} & \omega_{23}^{x} \\ 0 & \omega_{32}^{x} & 0 \end{bmatrix} \begin{bmatrix} Z_{1t-x} \\ Z_{2t-x} \\ Z_{3t-x} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix}$$

If found that the p-values of the test are below 0.05, then presence of Granger causality will be concluded at the significance level of 5%. Vice versa, if the test shows that the p-values are more than 0.05 that will mean that the presence of Granger causality is identified.

5.4.5 Impulse response and variance decomposition.

The impulse response function (IRF) in modelling is usually examined to determine how the dependent variable responds to a shock in the error term directed to one or several equations included in the VAR system. As the individual coefficients that are estimated in the VAR models tend to be difficult to interpret, so the impulse response including the variance decomposition are calculated for the estimated VAR (Gujarati, 2004; Brooks, 2008). According to Ahmad (2015), the IRF does not only measure each variable time profile, how each variable responses to shocks, but it does so also in other variables over a period of time. Furthermore, states that, shocks to every individual variable may not be appropriately represented due to shocks in one variable contemporaneously correlated with another variable innovation. But such a problem can be solved by using the cholesky decomposition, even though this approach can be sensitive to ordering of variables (Ahmad, 2015; Sims, 1980).

Brooks (2008) stipulates that the variance decompositions examine the VAR system dynamics differently and thus provide relevant information about the relative significance of each random innovation in affecting the VAR variables. It also separates the endogenous variable variation into the component shocks to the VAR. The variance decomposition provides a proportion of the dependent variables movements that are normally due to their own shocks versus shocks to other variables (Gujarati, 2004; Brooks, 2008).

5.4.6 Diagnostic testing.

To ensure the goodness fit of the model the diagnostic tests are conducted to examine the model for serial correlation/autocorrelation and heteroskedasticity. Diagnostic check will be used to extract information about the structure of data, particularly in the Breuch-Godfrey test.

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5.4.6.1 Serial correlation.

Serial correlation occurs when error term from time periods, usually from adjacent periods is correlated. If we ignore the serial correlation in error, the impacts on the OLS estimates are unbiased and consistent even if the error terms are serially correlated. The problem is with the efficiency of the estimates (Gou, Cheng, and Dong, 2013).

5.4.6.2 Heteroskedasticity.

The classical linear regression assumes that the variance of the error term is constant over time, that is, the error term is homoskedastic. If the variance of the error term is changing over time, then the assumption of homoskedastic is violated leading to heteroskedasticity. Ordinary Least Squares estimates are consistent in the presence of heteroskedasticity, but the conventional computed standard errors are no longer valid (Green, 2000). In this study heteroskedasticity test is conducted using the Breusch-Pagan-Godfrey, Harvey, Glejser and Arch test method where the null hypothesis is that the variance of the error term is constant

5.4.7 Stability test.

The stability of the stationary VAR system is tested using an inverse of roots AR features of polynomials. If no roots fall outside the unit circle, the VAR is said to satisfy the stationarity requirement. Hence, the study will apply this test to check if the model is stable.

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5.4.8 Data sources.

The study made use of quarterly time-series data collected from several secondary data servers including the South African Reserve Bank online statistical query and St Louis Federal Reserve database. The period ranged from 2003: Q3 to 2020:Q4.

5.5 Empirical Results.

5.5.1 Descriptive Statistics

This study's pre-estimation analysis includes using descriptive analysis to look at the distinct traits of the variables in question.

Table 5.1: Summary statistics.

	CNFS	CPI	GEAI	INT	M2
Mean	0.33	-1.24	12.32	8.67	10.17
Median	0.39	0.67	-1.92	8.70	8.57

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Maximum	5.28	130.52	185.31	10.42	22.67
Minimum	-3.61	-173.13	-146.22	7.29	-0.26
Std. Dev.	1.71	35.15	76.03	0.73	5.63
Skewness	0.29	-1.32	0.37	0.19	0.45
Kurtosis	3.10	14.06	2.32	2.56	2.27
Jarque-Bera	1.06	383.14	2.95	1.02	3.95
Probability	0.58	0.00	0.22	0.59	0.13
Sum	23.90	-88.43	875.39	615.80	722.24
Observations	71	71	71	71	71

Source: Author's computations

Table 5.1 above provide a summary of descriptive statistics such as the median, average, standard deviation, minimum and maximum values. The total number of observations is 71, based on quarterly data spanning from 2003Q2 to 2020Q4. During the entire period, credit to non-financial sector averaged 0.33, consumer price inflation (-1.24), global economic activity index (12.32), interest rates (8.67) and broad money supply (10.17). In addition, the consumer price index and global economic activity had relatively higher discrepancies as measured by the standard deviation, amounting to 35.15 and 76.04, respectively. In contrast, credit to non-financial sector and interest rates had relatively lower discrepancies, at 1.72 and 0.73, respectively. This indicates that the data points are closer to the mean values. In respect of normality, credit to non-financial sector, global economic activity, interest rates and money supply are skewed to the right while the consumer price index is skewed to left.

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5.5.2 Unit root analysis.

Table 5.2 below provides a summary of the stationarity analysis. This includes both the Augmented Dickey-Fuller and Philips Perron tests. In general, the findings reveal that the variables are stationary at different levels. For example, credit to non-financial sector and the consumer price index are stationary at level while, on the contrary, global economic activity, interest rates and broad money supply are stationary after first differencing. Further to this, the findings reveal that in all instances, the Augmented Dickey-Fuller and Philips Perron stationarity tests agree.

Table 5.2: ADF and PP Output.

Variable	M.S	ADF		PP		Output
		Level	1st diff	Level	1st diff	

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CNFS	Intercept	-3.75	-8.43	-6.68	-28.85	I(0)
	Trend	-4.04	-8.38	-6.85	-29.18	
CPI	Intercept	-3.87	-4.97	-9.05	-29.57	I(0)
	Trend	-4.78	-5.04	-8.90	-30.20	
GEAI	Intercept	-2.29	-8.82	-2.14	-10.39	I(1)
	Trend	-3.47	-8.75	-3.43	-10.28	
INT	Intercept	-2.46	-7.68	-2.32	-8.13	I(1)
	Trend	-2.77	-7.83	-2.52	-13.08	
MS	Intercept	-1.75	-4.43	-2.00	-7.68	I(1)
	Trend	-1.41	-4.40	-1.82	-7.776	

Source: Author's computations

5.5.3 Optimal lag length.

Table 5.3 below provides a summary of the results from the lag order selection. This is particularly important when utilizing Vector autoregressive models. The Akaike information criterion recommends six lags while the Schwarz information criterion and Hannan-Quinn information criterion recommend one lag. For the purposes of this study, the Schwarz information criterion will be utilized to avoid the loss in degrees of freedom which might result from a higher number of lags.

Table 5.3: Lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1038.71	NA	222074.3	32.17	32.41	32.26
1	-767.52	475.62	240.55*	25.33	27.21*	26.07*
2	-719.08	74.52	257.38	25.35	28.86	26.74
3	-680.94	50.46	411.51	25.69	30.84	27.72
4	-623.06	64.11	413.40	25.41	32.20	28.09
5	-545.44	69.26*	284.97	24.53	32.96	27.86
6	-467.23	52.94	283.94	23.63*	33.70	27.61
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Source: Author's computations

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5.5.4 Johansen Cointegration.

An interesting aspect of time series analysis involves establishing a long relationship between the dependent variable and explanatory variables. This was achieved by means of the Johansen Cointegration test.

Table 5.4: Johansen Cointegration output.

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.67	153.58	125.61	0.00
At most 1	0.38	76.86	95.75	0.47
At most 2	0.21	43.97	69.81	0.86
At most 3	0.16	27.27	47.85	0.84
At most 4	0.11	15.34	29.79	0.75
At most 5	0.09	7.16	15.49	0.55
At most 6	0.00	0.06	3.84	0.79
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.67	76.72	46.23	0.00
At most 1	0.38	32.89	40.07	0.25
At most 2	0.21	16.69	33.87	0.93
At most 3	0.16	11.93	27.58	0.93
At most 4	0.11	8.181	21.13	0.89
At most 5	0.09	7.09	14.26	0.47
At most 6	0.00	0.06	3.84	0.79
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source : Author's computations

Table 5.4 above provides a summary of findings from the Johansen cointegration test. The test was performed to determine if a long run relationship exists between the dependent variable and explanatory variables. The results in Table 5.4 indicate that a long run relationship exists between the dependent and explanatory variables. This is because, the trace statistic value of 153.58 is greater than the critical value of 125.61 at the 5% significance level. As such, at least one cointegrating relationship exists at the 5% significance level.

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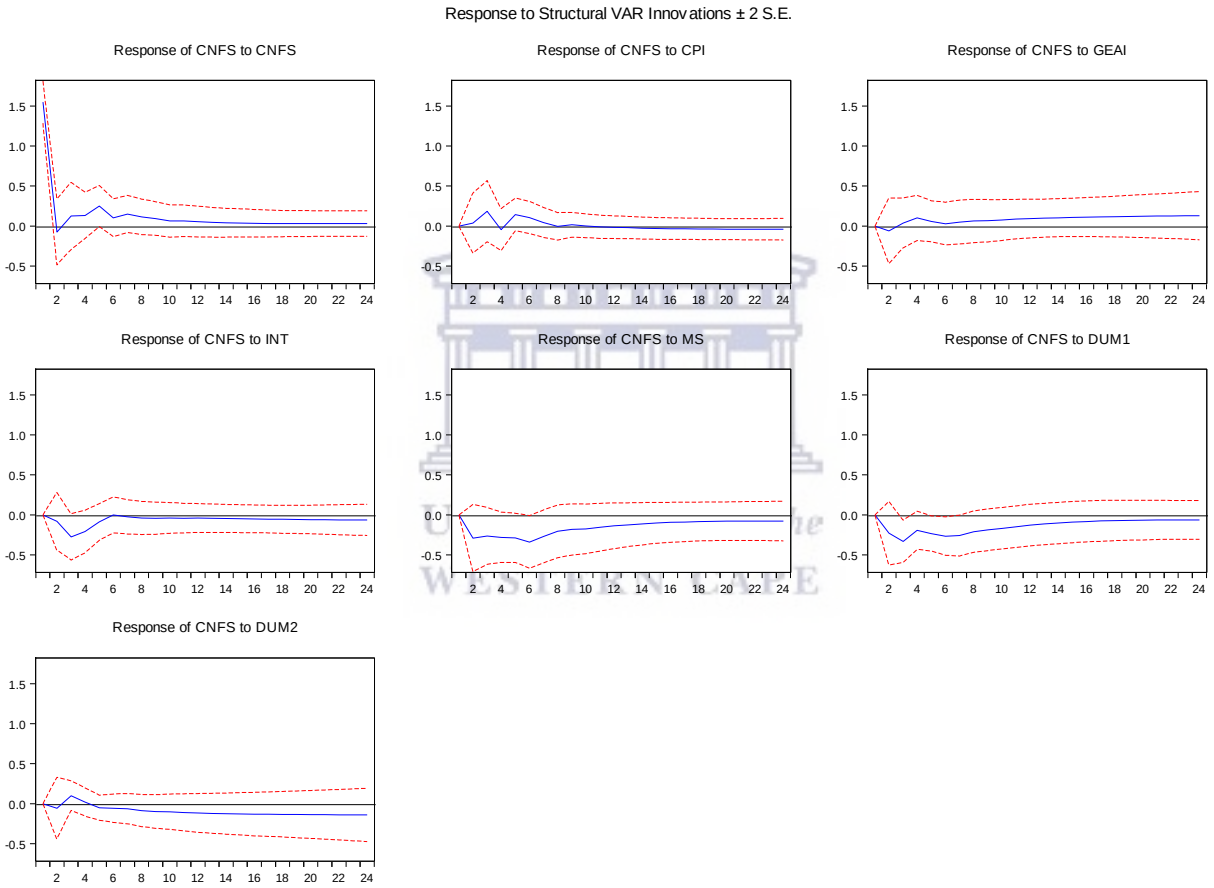
Similarly, the maximum eigenvalue of 76.72 is greater than the critical value of 46.23 at the 5% significance level. This indicates that both the trace test and maximum eigenvalue confirm that at least one cointegrating relationship exist at the 5% significance level

5.5.5 Structural VAR analysis.

The impulse response function was estimated through structural factorization to account for structural shocks in the financial system. The primary goal of impulse responses is to determine the response of endogenous variables to a one standard deviation

Figure 5.1: SVAR Impulse response output.



Source: Author's computations

Figure 5.1 above illustrates the response of credit to non-financial sector to shocks in interest rates, consumer prices index, money supply, global economic activity, the 2008 global financial crisis and 2016 sovereign debt crisis. Credit to non-financial sector responds negatively to its own innovations in the short and positively to its own innovations in the medium to long term. Also, the response is found to be permanent during this period. Meanwhile, credit to non-financial sector responds negatively to shocks in interest rates and

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money supply during the entire period. Also, the response is temporary overtime. Similarly, the findings reveal that credit to non-financial sector responds negatively to systematic risks, that is, shocks induced by poor financial conduct. Likewise, the shocks are found to be permanent overtime. Systematic risks create disturbances in the financial market, and this hampers financial market stability. This implies that enhancements in global economic activity result in a more stable financial market whereas a deterioration in global economic activity would result in a more volatile financial market.

The response of credit to non-financial sector to shocks in the consumer price index is found to be positive in the short run although this trend becomes negative overtime. This is largely because as inflation rises, monetary authorities employ contractionary monetary policy which involves hiking interest rates or reducing the quantity of money in circulation through bond purchases in the secondary market. As a result, credit to non-financial sector decreases given the increased cost of borrowing by non-financial firms. These results are like those of Dlamini (2020) though the time horizons in which the shocks effects wore out differs. In contrast, credit to non-financial sector responds positively to shocks in global economic activity and this response is found to be permanent. As the economy recovers and expands, central banks are more likely to keep interest rates and the quantity of money the same. This creates a favorable lending environment to non-financial firms to expand their operations and capacity.

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5.5.6 Variance decomposition.

In line with impulse responses, the variance decomposition was executed to measure forecast errors of each variable in relation to its own shock which was estimated using structural factorization.

Table 5.5: Structural variance decomposition.

Period	S.E.	CNFS	CPI	GEAI	INT	MS	DUM1	DUM2
1	1.54	100.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.59	94.14	0.05	0.13	0.24	3.26	2.03	0.11
3	1.69	84.30	1.26	0.17	2.85	5.33	5.61	0.46
4	1.75	79.70	1.24	0.50	4.06	7.56	6.47	0.44
5	1.81	75.93	1.79	0.56	4.01	9.53	7.66	0.49
6	1.87	71.66	2.01	0.55	3.76	12.23	9.20	0.55
7	1.91	68.95	1.97	0.59	3.60	13.64	10.59	0.63
8	1.94	67.25	1.91	0.68	3.54	14.35	11.42	0.81
9	1.97	65.88	1.87	0.78	3.50	14.86	12.05	1.03

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10	1.99	64.64	1.83	0.91	3.46	15.33	12.51	1.27
11	2.00	63.61	1.80	1.08	3.44	15.65	12.83	1.54
12	2.02	62.72	1.78	1.28	3.43	15.87	13.04	1.85

Source: Author's computations

The results indicate that in the short run, a larger proportion of the variations in credit to non-financial sector are explained by its own innovations and to a small extent by innovations in interest rates, money supply and the 2008 global financial crisis. In the medium to long term however, approximately 50% of the discrepancies in credit to non-financial sector are explained by its own innovations and to a relatively larger extent by innovations in the money supply and the 2008 global financial crisis. Global economic activity, the consumer price index and the 2016 sovereign debt crisis are relatively less effective in explaining discrepancies in credit to non-financial sector.

5.5.7 Residual Diagnostics.

Residual diagnostics were performed by means of the auto-correlation test, heteroskedasticity test and inverse roots test. The estimated auto-correlation test revealed a chi-square value of 58.11 and a corresponding p-value of 17%. This indicates that the estimated residuals by means of structural VAR do not suffer from serial correlation since the corresponding p-value is greater than 5%. Further to this, the corresponding probability value of the chi-square under the White heteroskedasticity test also confirms that the model is free from heteroskedasticity. This is because, the probability of 23.5% is greater than 5%, which, once again, confirms the absence of heteroskedasticity in the model.

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Table 5.6: Residual Analysis and Stability.

Residual Test	Chi-square	p-value
Auto Correlation LM	58.115	0.174
Heteroskedasticity Test: White	740.025	0.235

Source: Author's computations

Figure 5.2 below graphs the inverse roots of AR polynomial. As can be seen, the estimated VAR is stable since all roots have modulus less than one and lie inside the unit circle.

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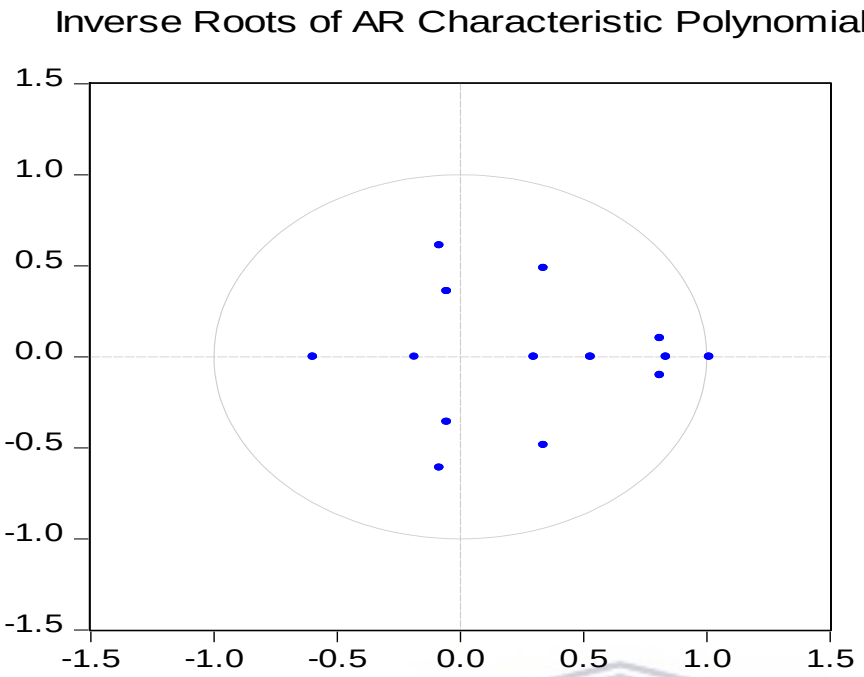
Figure 5.2: Stability test.



In the analysis, it was found that all the modules lie inside the unity circle, which is in line with Lütkepohl (1991), who argued strongly that the VAR estimated model is said to be stationary when all variables have a modulus that is less than one or lie inside the unity circle.

5.5.8 Granger causality output.

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Table 5.7 below provides a summary of findings from the granger causality analysis. A uni-directional causation can be observed between credit to non-financial sector and global economic activity at the 5% significance level. Similarly, uni-directional causation can be seen between the 2008 global financial crisis dummy and credit to non-financial sector at the 1% statistical significance level. Interestingly, a bi-directional causality was established between broad money supply and credit to non-financial sector at the 1% and 5% statistical significance levels, respectively. This implies that past values in broad money supply contain information that can help predict values in credit to non-financial sector and vice versa.

Table 5.7: Granger causality output.

Null Hypothesis:	**Obs.**	**F-Statistic**	**Prob.**
CPI does not Granger Cause CNFS	70	1.29	0.25
CNFS does not Granger Cause CPI		1.16	0.28
GEAI does not Granger Cause CNFS	70	2.36	0.12
CNFS does not Granger Cause GEAI		4.41	0.03**
INT does not Granger Cause CNFS	70	2.56	0.11

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CNFS does not Granger Cause INT		0.43	0.51
M2 does not Granger Cause CNFS	70	4.01	0.04**
CNFS does not Granger Cause M2		10.04	0.00*
DUM1 does not Granger Cause CNFS	70	8.84	0.00*
CNFS does not Granger Cause DUM1		1.47	0.22
DUM2 does not Granger Cause CNFS	70	0.75	0.38
CNFS does not Granger Cause DUM2		2.71	0.10

Source: Author's computations

5.6 Summary.

The above study examined the monetary policy shocks on financial market stability. This was achieved by means of econometric analysis. The study made use of quarterly time series macroeconomic data spanning from 2003Q2 to 2020Q4. While the variables were found to be stationary at different levels, the Johansen cointegration test revealed a long run relationship between the dependent variable and explanatory variables. In addition, the impulse response function indicated that financial market stability responds negatively to shocks as a result of interest rates, money supply and systematic risks. Further to this, the finding revealed that discrepancies in financial market stability are largely explained by its own innovations in the short run and partially by innovations in money supply and the 2008 global financial crisis at least in the long run. Lastly, a bi-directional causation was observed between broad money supply and credit to non-financial sector.

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CHAPTER 6

CONCLUSION AND POLICY RECOMMENDATIONS.

6.1. Introduction.

In this chapter, the study summarizes the entire overview of the thesis. Firstly, the chapter presents the empirical findings from chapter three, four and five. These findings play an important role in advising policy makers with some policy recommendation thereof. Secondly, a summary of the study's contributions to the literature on this topic and recommendation for policies are provided. This chapter's final section covers the limitation and potential areas for additional research.

6.2. Summary of findings.

This researcher investigated financial market development, monetary policy, and financial stability in South Africa between 2003 and 2020, using quarterly data. Before the relationship financial market development, monetary policy and financial stability was tested, the study gave an overview of financial market, financial policy conduct and monetary policy conduct in South Africa. The selected eight macroeconomic activity indicators had been fluctuating between 2000 and 2022. Chapter two presents the monetary policy conduct in South Africa and abroad as well as the macroprudential supervision. Similarly, an overview of the trend analysis of selected financial market variables are presented in chapter two, where the overall outlook of the financial markets as well as the performance is presented. The first overall objective was to investigate the dynamic interaction between financial markets and monetary policy in South Africa.

This part of the study investigated two specific objectives, linked to the main objective of chapter three. Firstly, to assess the response of financial market shocks on policy instruments in South Africa. Secondly, to examine the dynamic interaction between financial markets and monetary policy in South Africa. The Bayesian Vector Autoregression Model estimates based on the prior of KoKo Minnesota/Litterman (2010) and Sims & Zha (1998) prior was conducted to assess the response of financial market shocks on policy instruments. The findings revealed that interest rates and the rate of inflation have a direct impact on stock market capitalisation as a proxy for financial markets, while on the contrary, an inverse link was found between the

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stock market capitalisation and real effective exchange rate. In case variance decomposition and impulse response, the findings revealed that long run changes in stock market capitalisation are largely explained by shocks in interest rates. The results from the econometrics tests conducted in chapter three confirmed and quantified that there was indeed a dynamic interaction between financial markets and monetary policy in South Africa. This relationship ran from the short run toward the long run. The Null hypothesis of no relationship between financial markets and the monetary policy was therefore rejected.

Chapter four investigated the effect of financial market shocks on financial stability in South Africa. The main objective of this chapter was to examines the impact of financial market shocks on financial stability in South Africa. Chapter four had two specific objectives aimed at quantifying the effect of financial market shocks on financial stability. The first objective to examine the effect of shocks in the financial market on financial stability. To test for the effects, the cointegration and VECM alongside impulse response Models were used as informed by literature. The results indicated that money supply and interest rates as monetary policy instruments were likewise found to exhibit a positive impact on financial stability. This is indicative of the effectiveness of monetary policy tools in maintaining price and exchange rate stability and consequently, financial market stability. With the presence of cointegration, the second specific objective was to provide an overview causal relationship between financial market shocks and financial stability in South Africa. The granger causality test was used. The Granger causality test revealed a uni-directional causality from credit to non-financial sector to money supply. A similar trend is observed from credit to non-financial sector to global economic activity. More interesting, a bi-directional causality was established between credit to non-financial sector and the gross domestic product. Lastly, a uni-directional causality running from credit to non-financial sector to the consumer price index was established. As such, the null hypothesis of non-causality is rejected against the alternative hypothesis of causality in all instances that are statistically significant.

Chapter five of the thesis assess the impact of monetary policy shocks on financial stability in South Africa. The main objective here was to assess the impact between the monetary policy shocks and the financial stability as well as the direction of the impact. The SVAR model was adopted to assess the existence of the relationship in South Africa. Additionally, the Johansen Co-integration Test was conducted to determine whether the variable converges to the

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equilibrium in the long run. The results indicated that there was convergence of the variables considered in this chapter in the long run.

After the co-integration test, the SVAR test was conducted. The idea behind conducting the SVAR test was to obtain the impulse response and the forecast error variance decomposition. The impulse response test was conducted to assess how the financial stability responded to monetary shocks in the macroeconomic activity indicators adopted in this chapter. It turned out that the credit to non-financial sector responds negatively to its own innovations in the short and positively to its own innovations in the medium to long term. Also, the response is found to be permanent during this period. The response of credit to non-financial sector to shocks in the consumer price index is found to be positive in the short run although this trend becomes negative overtime

Furthermore, the forecast error variance decomposition tests the results indicate that in the short run, a larger proportion of the variations in credit to non-financial sector are explained by its own innovations and to a small extent by innovations in interest rates, money supply and the 2008 global financial crisis. In the medium to long term however, approximately 50% of the discrepancies in credit to non-financial sector are explained by its own innovations and to a relatively larger extent by innovations in the money supply and the 2008 global financial crisis. Global economic activity, the consumer price index and the 2016 sovereign debt crisis are relatively less effective in explaining discrepancies in credit to non-financial sector.

The Granger Causality Test was also used. A uni-directional causation can be observed between credit to non-financial sector and global economic activity at the 5% significance level. Similarly, uni-directional causation can be seen between the 2008 global financial crisis dummy and credit to non-financial sector at the 1% statistical significance level. Interestingly, a bi-directional causality was established between broad money supply and credit to non-financial sector at the 1% and 5% statistical significance levels, respectively. This implies that past values in broad money supply contain information that can help predict values in credit to non-financial sector and vice versa.

In conclusion, all these empirical results indicates that financial market development, monetary poly and financial stability in South Africa are interrelated.

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6.3. Policy Implications.

The empirical results of the study indicated that financial market development, monetary policy and financial stability in South Africa are interdependent. Like any other economy, South Africa strives to reduce unemployment through the promotion of productivity and a stable financial environment, amongst other macroeconomic goals. The empirical results of this thesis indicated that macroeconomic objectives can therefore be promoted through the financial markets in the South African economy. Similarly, stable financial asset markets can be promoted through macroeconomic activities in the South African economy. When policymakers want to promote macroeconomic activities through the stock market, they can focus on real interest rates in the short run. According to empirical data, the stock market helps to explain the macroeconomic activities through real interest rates in comparison to other indicators in South Africa. Specifically, the results indicated a negative relationship between the interest market and the stock market. An increase in the stock prices of the Johannesburg Stock Exchange should be accompanied by a contraction monetary policy where the SARB reduces the repo rate. The reduction in the repo rate will increase credit availability, which in turn will increase consumption and improve industrial production. The increase in money supply and industrial production will increase investments in the Johannesburg Stock Exchange, which will consequently improve the South African stock exchange.

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Similarly, the South African economy can improve the JSE through the real exchange rate. The results indicated a positive relationship between the prices and the real exchange rates. This is an indication that an appreciation of the South African dollar will make the stocks in the South African financial markets more attractive to investors, as explained by the CAPM theory. Although the JSE is a non-profit oriented entity for growth, the expansion of the Bank of Namibia can increase the real exchange rate to attract investors into the JSE. This decision has to be made in line with the common monetary area regulations. An improvement in the JSE can earn profits for the local companies registered. In the process, this will increase employment through an increase in the real gross domestic product. Macroeconomic objectives can also be promoted by the foreign market in South Africa.

Bonga-Bonga (2019) stated that countries with high import dependency, such as South Africa, could benefit from currency appreciations. Evidence from Nigeria and Egypt showed that

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currency appreciation causes current account surpluses. On the one hand, contractionary monetary policy will promote economic growth through currency appreciation and investment. On the other hand, a reduction in interest rate would stimulate economic growth through domestic consumption. This is however contributing to the current account deficit, especially for economies with a weak currency (BongaBonga, 2019). Fasoye (2019) indicated that fiscal policy is one of the imports tools the government can use to promote macroeconomic objectives. This is most applicable to economies vulnerable to external shocks. High government expenditure crowd-out private investment through its impact on the interest rate (Das, 2018). Although that is the case, Das (2018) found that contractionary fiscal policy reduced investment in most of the states in India. All these scholars quantify the use of the monetary policy, the exchange rate policies as well as the monetary policy.

6.4. Limitations of the Study and Areas for Further Research.

The limitation of this study was that the study made use of data from 2003 to 2020. This was mainly because data availability for some variables started only after 2000. Furthermore, there were many macroeconomic indicators of which not all could be used and/or incorporated in this study alone. Thus, the results might not have given a full reflection of the macroeconomic activity reaction because the study did not make use of all the macroeconomic indicators.

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That being the case, the findings of the thesis raised three concerns regarding the South African economy. There was an indication that the financial markets shocks had been increasing over time. An increase in financial market shocks creates a bubble, which, if it bursts, will lead to financial instability. So far, studies on the financial market shocks nexus financial stability in South Africa are limited. There is a need to research testing for the feasibility and the possibility of the financial market shocks bubble in South Africa.

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