

AN ASSESSMENT OF THE RELATIONSHIP BETWEEN MONEY SUPPLY AND
ECONOMIC GROWTH IN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN ECONOMICS

OF

THE UNIVERSITY OF NAMIBIA

BY

PATRICK KOMBA SIMASIKU

219039224

APRIL 2022

Supervisor: Prof. E. Ziramba (UNAM)

ABSTRACT

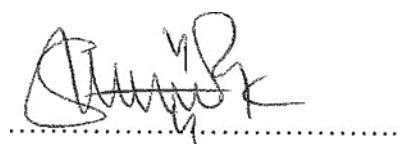
This study examined the relationship between broad money supply and economic growth in Namibia. The ARDL bounds test approach to cointegration was applied on quarterly data from 2008: Q1 to 2020: Q4. The study employed the Augmented Dickey-Fuller, and Phillip Peron tests to examine the order of integration of the variables, and the results indicated that except for M2, variables are integrated of the first order. The ARDL bounds test approach to cointegration revealed no long-run relationship between the variables under study. The granger causality results found unidirectional causality from the inflation rate to the real economic growth rate, from the real economic growth rate to money supply, from the repo rate to real economic growth rate, and evidence of bidirectional causality between money supply and the repo rate. The study did not find causality between money supply and inflation in Namibia. Taking note of the country's monetary policy conduct, this study suggests that the Bank of Namibia should initiate products or special vehicles through which money supply may be increased to stimulate growth and reduce unemployment in the short run.

DECLARATION

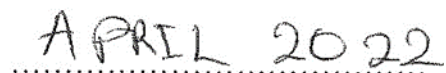
I, Patrick Komba Simasiku, hereby declare that this study is a true reflection of my own research and that this work or part thereof has not been submitted for a degree in any institution of higher education.

No part of this thesis may be reproduced, stored in any retrieval system, or transmitted in any form or by means without the prior permission of the author or the University of Namibia on that behalf.

I, Patrick Simasiku, grant the University of Namibia the right to reproduce this thesis in whole or in part, any manner or format, which the University of Namibia may deem fit, for any person or institution requiring it for study and research; providing that the University of Namibia shall waive this right if the whole thesis has been or is being published in a manner satisfactory to the University.



Patrick Komba Simasiku



Date

ACKNOWLEDGEMENTS

Firstly, I would like to thank the Almighty for being my strength and protecting me throughout my studies. I would not be where I am today if not for his grace and unconditional love. Secondly, I would like to sincerely thank my supervisor, Prof. Emmanuel Ziramba; due to his parental and professional input, this research is at this stage. Equally, I thank all my lecturers, Prof. E Kaakunga, Dr. Alfred Mukong, Dr. Jacob Nyambe, and Dr. Ronald Chifamba, for equipping me with theoretical and practical skills.

Equally, I would like to thank my classmates for their help during the academic year and valuable discussions during our studies. Equally, I thank Ms Sabina Mufika for assisting me with the data that made this research possible. More so, I thank my big sisters, Mrs. Mbongi Simasiku, Mrs. Namakando Simasiku, and my mother, Mrs. Agnes Simataa, for their financial and emotional support. I also thank my fiancée, Harriet Matengu, for her support and encouragement during my studies.

Finally, I thank the African Economic Research Consortium for providing me the opportunity to do my electives at JFE during the most challenging times globally and for the financial support that made all this possible.

DEDICATION

I dedicate this thesis to my beloved mother for her love, unwavering support, and for making me understand the importance of education.

Acronyms

ADF: Augmented Dickey-Fuller

BON: Bank of Namibia

CMA: Common Monetary Area

CPI: Consumer Price Index

CRDF: Co-integrating Regression Dickey-Fuller

D-W: Durbin-Watson

ECM: Error-Correction Model

E-G: Engle-Granger

GDP: Gross Domestic Price

CPI: Consumer Price Index

M2: Broad Money supply

NPC: National Planning Commission

NSA: Namibia Statistic Agency

Table of Contents

ABSTRACT.....	i
DECLARATION	ii
ACKNOWLEDGEMENTS	iii
DEDICATION.....	iv
ACRONYMS	v
LIST OF TABLES AND FIGURES.....	viii
1.1 ORIENTATION OF THE STUDY	1
1.1.2 MONEY SUPPLY AND OUTPUT IN NAMIBIA	2
1.2 THE PROBLEM STATEMENT	5
1.3 RESEARCH OBJECTIVES	6
1.4 HYPOTHESIS OF THE STUDY	6
1.5 SIGNIFICANCE OF THE STUDY.....	7
1.6 LIMITATIONS OF THE STUDY.....	7
CHAPTER TWO: MONETARY POLICY IN NAMIBIA	9
2.1. INTRODUCTION	9
2.2 MONETARY POLICY FORMULATION IN NAMIBIA.....	9
2.3 MONETARY POLICY TRANSMISSION MECHANISM IN NAMIBIA	10
2.3.1. Interest/repo rate channel.....	11
2.3.2. The asset price channel	12
2.3.3 The expectations channels	12
2.4 SUMMARY	13
CHAPTER THREE: LITERATURE REVIEW	14
3.1 INTRODUCTION	14
3.2. THEORETICAL LITERATURE	14
3.2.1 The Classical Quantity Theory of Money	14
3.2.2 Monetarist Theory.....	15
3.2.3 The Keynesian view on the relationship between money supply and economic growth.....	16
3.3 EMPIRICAL LITERATURE	18
3.3.1 Studies supporting the monetarist's view.....	18
3.3.2 Studies in support of the Keynesian view.....	26
3.3.3 Studies from the Southern African Customs Union.....	27
3.4 SUMMARY	30
CHAPTER FOUR: METHODOLOGY.....	32
4.1 INTRODUCTION	32

4.3 MODEL SPECIFICATION	34
4.4 DESCRIPTION AND JUSTIFICATION OF VARIABLES	35
4.5 UNIT ROOT TESTS	35
4.5.1 Augmented Dickey-Fuller Test.....	36
4.6 COINTEGRATION ANALYSIS	37
4.7 GRANGER CAUSALITY TESTS.....	39
4.8 LONG RUN MODEL.....	40
4.9 SHORT RUN MODELS.....	40
4.10 DIAGNOSTIC TESTS	41
4.11 DATA AND DATA SOURCES.....	41
4.12 DATA ANALYSIS.....	41
4.13 SUMMARY	42
CHAPTER FIVE: DATA ANALYSIS AND EMPIRICAL RESULTS	43
5.1 INTRODUCTION	43
5.2 STATIONARITY TESTS	43
5.3 OPTIMAL LAG SELECTION CRITERIA	44
5.4 COINTEGRATION TEST RESULTS	46
5.5 GRANGER CAUSALITY TEST	47
5.7 DIAGNOSTIC TEST RESULTS	50
5.8 SUMMARY	52
6.2 CONCLUSION.....	54
6.3 POLICY IMPLICATIONS.....	55
6.4 AREA FOR FURTHER RESEARCH.....	56
<i>References</i>	57
LIST OF APPENDICE.....	67

LIST OF TABLES AND FIGURES

LIST OF TABLES

Table 1: Unit root test results	41
Table 2: lag length selection criteria	44
Table 3: Bound test results	46
Table 4: Granger causality results.....	48
Table 5: Short run model	50
Table 6: Diagnostics results	51

LIST OF FIGURES

Figure 1: Trends in money supply and GDP	3
Figure 2: An overview of Bank of Namibia's monetary transmission mechanism	11
Figure 3: Model selection	45
Figure 5a: CUSUM	48
Figure 5b: CUSUMQ	49

CHAPTER ONE: INTRODUCTION

1.1 ORIENTATION OF THE STUDY

Money plays a vital role in our everyday lives. Aggregate money supply influences employment, real activity, interest rates, and prices in an economy. Monetary policy is the manipulation of the level of money supply, interest rates, and prices in an economy to achieve specific objectives of the government, such as price stability and economic growth.

Various researchers across the world view the impact of money supply on economic growth differently. Some strongly believe that money supply considerably impacts economic growth (Hicham, 2020; Olamide & Maredza, 2019; Marshall, 2016; Hüseyin & Ayşe, 2015; Prasert et al. 2015; Inam, 2014; Galawa & Veigi, 2011; Ogunmujiwa & Ekone, 2010; Mishra et al. 2010; Chuku, 2009) while others maintain that money supply does not matter for growth (Twinoburyo & Odhiambo, 2017; Bernard, 2016; Mutuku & Koech, 2014; Rahman & Qayum, 2013; Ihsan & Anjum, 2013; Ahmed & Suliman, 2011; Dele, 2007).

The long-run relationship between money supply and economic growth is essential to understand, particularly in developing countries like Namibia, where deepening the degree of regional integration is among the top priorities of the policymakers. Namibia is part of the Common Monetary Area (CMA) agreement along with South Africa, Eswatini (previously known as Swaziland), and Lesotho. Under the CMA agreement, the Namibian dollar is pegged to the South African rand at par. In circulation, each Namibian dollar should be backed by international reserves of the same value (Allwendo, 2008).

An assessment of the performance of monetary policy in Namibia under the Common Monetary Area agreement shows that monetary policy has been effective in ensuring price stability. Inflation has been between 3 to 6 percent as desired. However, the inability of the

central bank to accommodate fiscal deficits puts pressure on fiscal policy in the country. Consequently, macroeconomic conditions have aggravated over the years. The ratio of debt to Gross Domestic Product (GDP) ratio rose from 34.6% in 1992/93 to 76.2% in the financial year 2021/2022, as well as a fall of the economic growth rate from 2.0 to -8.0 in 1990/91 and 2020/21 according to the budget statements of the respective years.

Kashima (2017) holds that Namibia cannot fully develop programs to stimulate economic growth due to this agreement. Similarly, Tjirongo (1995) highlights that when the Namibian economy was exposed to external shocks between 1980 and 1992, the central bank could not use monetary policy to lessen the effect of these shocks due to the arrangements within the CMA. It is due to the above that the government deficit increased to 9.5 of GDP during the financial year 2020/2021 because of the government's adoption of expansionary fiscal policy to lessen the impact of the covid-19 pandemic on the economy (Bank of Namibia, 2020).

However, even though the Namibian dollar is pegged to the South African rand under the CMA agreement, the repo rate in Namibia can differ from that set by the South African reserve bank. This enables the Bank of Namibia to manipulate the money supply to influence economic conditions or reduce domestic inflation (Alweendo, 2008; Bank of Namibia, 2020). According to Kamati (2014), the common monetary area agreements and monetary unions are managed differently, and monetary policy conduct between them is not the same. Namibia's monetary policy rate can therefore differ from that of South Africa when necessary (Bank of Namibia, 2020).

1.1.2 MONEY SUPPLY AND OUTPUT IN NAMIBIA

Evidence from data on the broad money supply (M2) and Gross Domestic Product (GDP) displays close ties between M2 and GDP in Namibia since independence. Figure 1 shows the trends of broad money supply and economic growth in Namibia from 1991 to 2020.

Figure 1: Trends in broad money supply (M2) and GDP

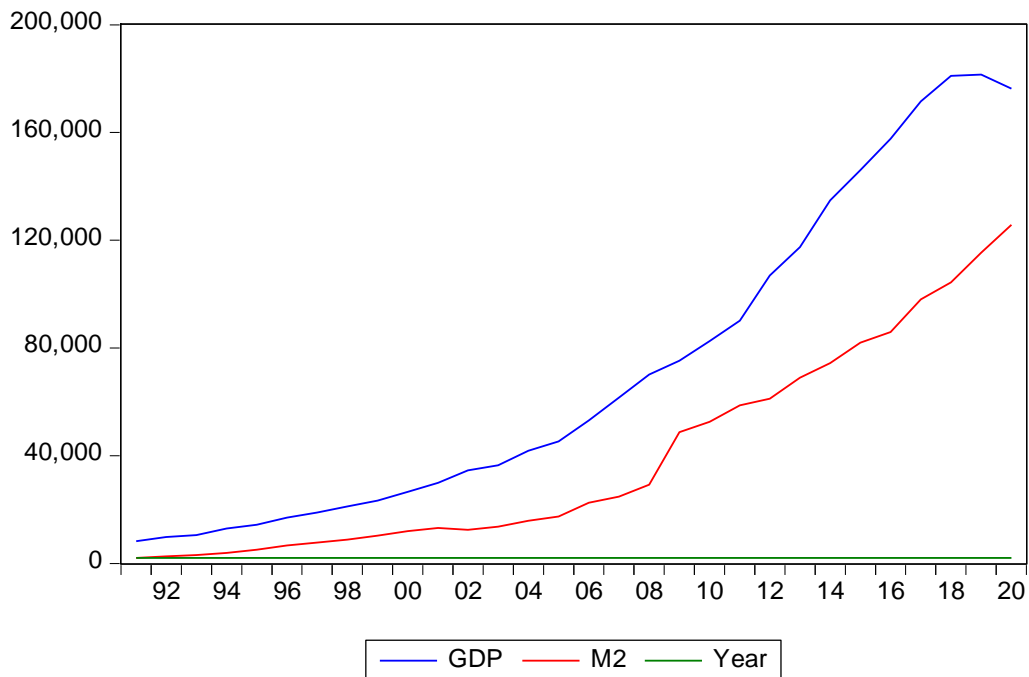


Figure 1 depicts the broad money supply and GDP trends in Namibia from 1991 to 2020. Over the period under review, the trend of GDP lies above that for the broad money supply. Furthermore, the graph shows that increases of broad money supply in the Namibian economy over the years were accompanied by higher GDP except from the years 2018 to 2020, when the trend of GDP was constant. The graph also shows that the level of economic activity in the economy fell from 2019 to 2020.

Ikhide & Katjomuise (1999) note that from 1990 to 1998, the broad money supply (M2) increased by a quarterly average of about 3.06 percent. Their study attributes the growth rate of the broad money supply from 1990 to 1996 to the increase of quasi money by 4 percent on average during that period. Additionally, the mean quarterly growth of consumer prices from 1990 to 1998 is 2.6 percent. Consumer prices rose by 3 percent between the first quarter of 1990 and the last quarter of 1991 and later fell to 2.2 percent in the last quarter of 1995.

In addition, Ikhide & Katjomuise (1999) highlight a close link between real money balances and changes in real economic activity in the country. Although the growth rate of real money balances exceeds the growth of real GDP, the trend of both variables is remarkable, particularly for the period from 1990 to 1993 and between 1996 and 1998. Real GDP growth reported a quarterly average growth rate of 0.6 percent between 1990 and 1995 and after that fell to 0.5 percent. Similarly, M2 fell from 2.2 percent during the last quarter of 1995 to 1.6 percent during the first quarter of 1996 and remained at this level until the last quarter of 1998. Accordingly, the fall of M2 between 1996 and 1998 paralleled the slowdown of economic activities.

Moreover, the data of broad money supply from the Bank of Namibia (2020) show that the highest growth of money supply was observed in 2009 due to the incorporation of money market unit trusts in M2 and the financial crisis. Hence, during 2009, the repo rate was reduced from 10 percent in January 2009 to 9 percent in February to increase domestic demand and credit extension to the private sector, which resulted in the fall in motor vehicle sales due to the impacts of the global financial crisis. It was further reduced to 8 percent and 7.50 percent in April and May, respectively, before being constant at 7.0 percent from June to December. Due to these policy actions, the broad money supply increased from N\$ 29,241 million in December 2008 to N\$ 48,730 million in December 2009. Surprisingly, inflation fell from 11.2 to 7.9 percent, and economic growth fell from 2.6 percent in 2008 to 0.3 percent in 2009.

Also, the Bank of Namibia (2020) data further indicates that the broad money supply in the economy increased by 11.4 percent in 2020 as a response to the Covid-19 pandemic, which affected aggregate demand globally. During the same period, Namibia's economic growth fell from -0.6 percent to -8.0 percent (Namibia Statistics Agency, 2021).

The possibility of influencing money supply to stimulate growth in Namibia both in the short and long run deserves special attention empirically. Sheefeni (2020) examined the money

channel of monetary policy transmission in Namibia, and the study revealed that shocks to the money supply led to improvements in national output in the country.

However, for effective and efficient monetary policy formulation, implementation, and design in the long run, mainly due to changes in the structure of the Namibian economy going forward, there is a need to assess the viability of Namibia's decision to remain in the CMA. For that reason, this study investigates the long-run relationship between money supply and economic growth in Namibia.

1.2 THE PROBLEM STATEMENT

Establishing a long-run relationship between money supply, economic growth, and inflation is essential in a small and open developing country. A stable long-run relationship between these variables shows the possibility of manipulating the money supply to influence economic growth. For Namibia, the condition that each Namibian dollar issued be backed by foreign reserves limits the extent to which the central bank accommodates government deficits (Tjirongo, 1995). Consequently, the budget deficit and public debt to GDP increased in recent years. As a percentage of GDP, the budget deficit rose from 4.7 percent to 8.6 percent in the financial year 2020/2021 to 2021/2022, and the public debt rose from 54.8 percent to 76.2 percent, according to the budget statements for 2020/2021 and 2021/2022. Going forward, both are expected to continue growing, which threatens the sustainability of fiscal policy in the medium to long term and encourages studies into the possible conduct of independent monetary policy.

Tjirongo (1995) further emphasizes that although Namibia currently benefits from the CMA arrangement, the reverse is true should South Africa be the source of instability to its economy. The rising debt and volatile rand in South Africa cause concern. According to South Africa's budget review for 2021, the gross loan in 2021/2022 is expected to increase to 81.9 percent of

GDP from 80.3 percent during 2020/2021. The study further notes that, although several developing countries' currencies recovered from the crisis after major lockdowns, the rand performed poorly due to country-specific risks such as weak pre-pandemic growth and sustainability concerns. The question, therefore, is, in the long run, could Namibia be better off outside the CMA?

The various channels of monetary policy transmission have been thoroughly examined in Namibia (see Uanguta & Ikhide, 2002; Kamati, 2014; Sheefeni & Ocran, 2013; Sheefeni, 2020). However, no study has investigated the long-run relationship between money supply and economic growth in Namibia. Against this background, this study wishes to fill this gap and investigate the issue using the Autoregressive Distributed Lag- bounds test approach to cointegration.

1.3 RESEARCH OBJECTIVES

The broad objective of the study is to examine the impact of money supply on economic growth in Namibia using quarterly data of broad money supply (M2), inflation rate (INF), and repo rate from 2008 to 2020. The specific objectives of the study are:

- To assess if a long-run relationship exists between money supply and economic growth.
- To evaluate if there is a causal relationship between money supply and economic growth.
- To suggest possible policy recommendations based on the findings.

1.4 HYPOTHESIS OF THE STUDY

1. H^1_0 : There is no long-run relationship between broad money supply and economic growth.

H^1_1 : There is a long-run relationship between broad money supply and economic growth.

2. H^2_0 : There is no causal relationship between money supply and economic growth.

H^2_1 : There is a causal relationship between money supply and economic growth.

1.5 SIGNIFICANCE OF THE STUDY

The nature of the long relationship between money supply and economic growth in Namibia remains a mystery. Sheefeni (2020) looked at the money channel of monetary policy transmission in Namibia while Kashima (2017) studied the impact of monetary policy conduct on economic growth in Namibia using the repo rate as the main policy instrument. In other studies, the various channels of monetary policy were examined (see Uanguta & Ikhide, 2002; Kamati, 2014; Sheefeni & Ocran, 2013).

This study intends to fill a gap that exists in the literature on Namibia. The study looks at the long-run relationship between money supply and economic growth using the Autoregressive Distributed Lag- bounds test approach to cointegration. It is the first of its kind and will be highly appreciated by the policymakers. In addition, the study will assist policymakers with future policy considerations that may lead to improvements in economic growth in the country.

Furthermore, the study may assist with monetary policy conduct in small and developing economies such as those in Africa to relieve pressure on fiscal policies constrained by higher debt to GDP ratios, few sources of revenue, and high budget deficits. Finally, the study adds to the less available literature on the relationship between money supply and economic growth on the continent.

1.6 LIMITATIONS OF THE STUDY

The first limitation of this study is that it used the data from the first quarter of 2008 to the last quarter of 2020 due to a lack of quarterly GDP for periods before 2008 and may not capture

monetary policy transmissions before and shortly after independence. Lastly, the time allocated for the study also poses a challenge.

1.7 DELIMITATIONS OF THE STUDY

The focus of this study is to examine the impact of broad money supply on economic growth in Namibia during the period 2008 to 2020. Thus, the findings are specifically for Namibia and cannot be generalized across countries that did not form part of the study.

1.8 ORGANIZATION OF THE STUDY

This study is structured as follows. Chapter one introduces the topic, followed by the problem statement, the study objectives, the significance of the research, and then the limitations and delimitations. The rest of the paper is divided into five chapters. Chapter two provides an overview of Namibia's monetary policy conduct and framework. Chapter three presents the relevant theoretical and empirical literature, followed by the methodology in chapter four. Chapter five analyzes the data and presents the findings, while chapter six provides the conclusion and recommendations based on the results.

CHAPTER TWO: MONETARY POLICY IN NAMIBIA

2.1. INTRODUCTION

This chapter looks at the common monetary area agreement's monetary policy conduct in Namibia. It begins with a discussion on monetary policy formulation in Namibia in 2.2, followed by an overview of the monetary policy transmission mechanism in 2.3 and an insight into the transmission channels of monetary policy in Namibia.

2.2 MONETARY POLICY FORMULATION IN NAMIBIA

Through its policy tools, the Bank of Namibia makes decisions about the total amount of money in the economy at any given point in time. This is done by taking account of the South African reserve bank's set repo rate, prevailing economic conditions such as the rate of inflation, and the most likely responses of the general public and commercial banks to its actions. Furthermore, the central bank determines the monetary base and the reserve requirement for commercial banks. It sets the repo rate while commercial banks decide on their actual demand for reserves alongside their demand deposit liabilities. On the other hand, the general public decides on their currency holdings relative to demand and time deposits.

The Bank of Namibia primarily uses the repo rate to influence the amount of money stock in the economy, maintain price stability and defend the currency peg between the Namibian dollar and South African rand (Bank of Namibia, 2020). When a policy action such as reducing the repo rate is made, commercial banks are encouraged to voluntarily reduce their interest rates but are not forced to do so. In Namibia, there is no official operational target of monetary policy. However, the central bank keeps a close look at official reserves. Suppose the official reserves are lower than the minimum threshold of the currency in circulation plus a buffer of three times the monthly commercial bank net foreign transfers. In that case, the board shall initiate ways to increase official reserves.

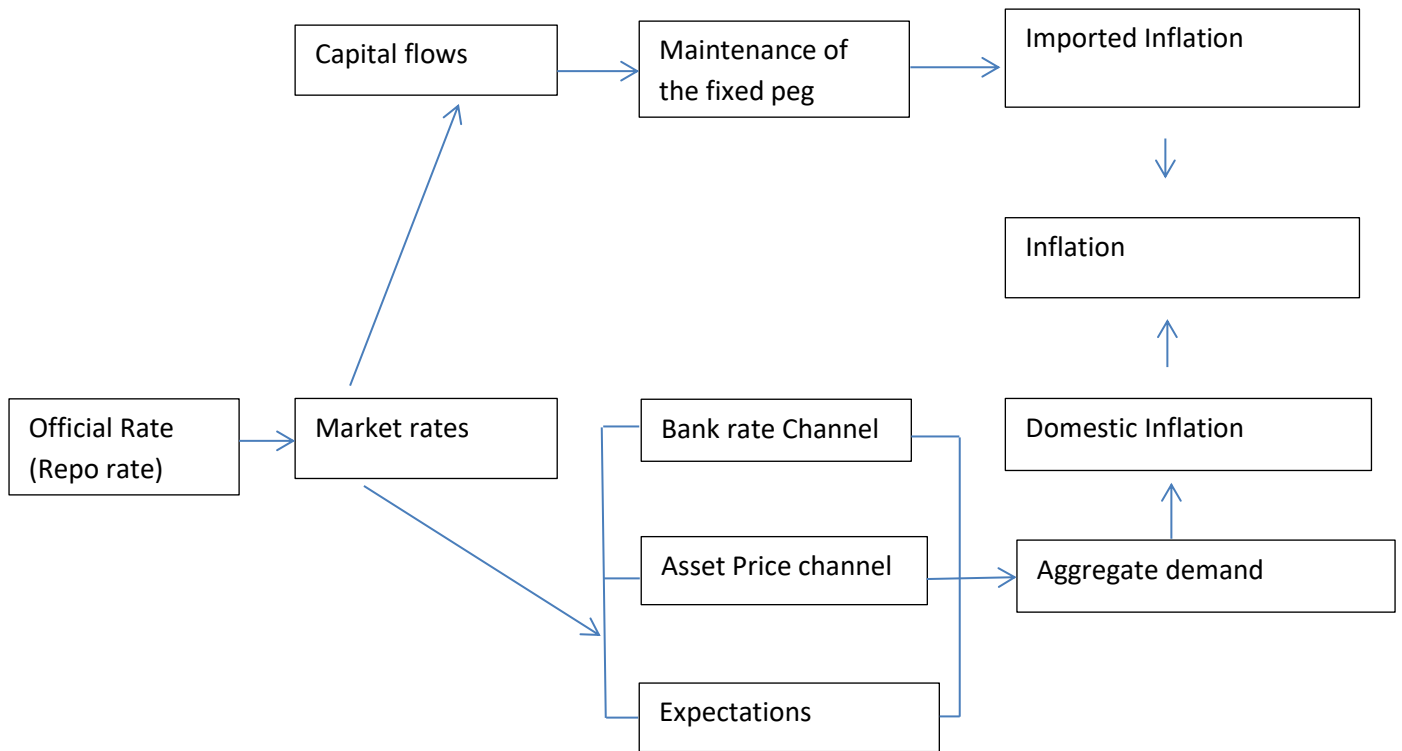
More so, given that Namibia has a fixed exchange rate regime, it has options of using sterilization operations, capital controls, regulatory barriers, prudential requirements, and other frictions to some proportion to influence short term interest rates, money supply, and credit extension to the private sector to control aggregate demand and domestically induced inflation through expectations. Due to the above, the country has a bit of monetary policy discretion (Bank of Namibia, 2020, p.4).

Ideally, an increase in inflation increases the demand for currency as more dollar units are now required to acquire the same basket of goods and services. Subsequently, to reduce inflationary pressures and maintain price stability, the central bank raises the repo rate to expect commercial banks to follow suit and increase their lending rates. However, the central bank adopted contractionary monetary policy at times in the absence of inflationary pressures or high demand for goods and services in the economy (Sheefeni, 2013). The transmission channels through which changes in the repo rate ultimately translate to the rest of the economy are discussed in greater detail below.

2.3 MONETARY POLICY TRANSMISSION MECHANISM IN NAMIBIA

Mishkin (1995) defines monetary policy transmission as ways through which monetary policy actions by central banks are spread to the whole economy through influences on investment and consumption decisions by businesses and consumers. Understanding the various channels through which monetary policy actions impact the economy is essential for effective and efficient monetary policy formulation, design, and implementation. Namibia mainly relies on the interest rate/repo rate channel, expectations, and asset price channel to mitigate domestically induced inflation (Bank of Namibia, 2020). Figure 2 gives an overview of Namibia's monetary policy transmission mechanism.

Figure 2: An overview of Bank of Namibia’s monetary transmission mechanism



Source: Bank of Namibia 2020, p. 4

2.3.1. Interest/repo rate channel

As observed in figure 2, manipulations of the repo rate by the central bank led to instant changes in market rates. For instance, an increase in the repo rate causes the commercial banks to instantaneously increase their lending rates. This increases the cost of borrowing for both firms and households. Changes in interest rates encourage economic agents to alter their investment and consumption expenditure. Therefore, these changes significantly influence the level of real economic activity in the country. Furthermore, contractionary monetary policy lowers the level of prevailing interest rates in the market. This reduces debt servicing costs of households and businesses. As a result, consumption increases and ultimately impacts nominal output. However, in Namibia, consumers react to interest rate changes more than businesses. Thus,

manipulations of the repo rate effectively influence demand in the country, enabling the Bank of Namibia to efficiently control domestic induced inflation (Bank of Namibia, 2020, p.4). Similarly, Sheefeni & Ocran (2013) found evidence for Namibia's significant bank lending channel. According to their study, manipulations of the repo rate have a noticeable impact on credit in the economy. The Bank lending channel is strongly believed to be more effective in less developed financial markets such as those in developing countries because smaller firms are more dependent on bank loans in these countries. After all, larger firms find it relatively easier to acquire funds from credit markets and the stock and bond markets (Mishkin, 1995).

2.3.2. The asset price channel

Monetary policy significantly affects asset prices such as bonds, equity, and real estate. According to the Bank of Namibia (2020), Namibia's monetary policy framework confirms that the asset price channel also plays a significant role in Namibia's monetary policy transmission mechanism. A rise in interest rates increases mortgage rates, reducing the consumer's monthly disposable income after debt servicing, reducing consumption, inflation, and output. Furthermore, the values of assets fall as interest rates rise. This reduces the wealth of individuals, and since wealth and consumption are positively related, consumption will fall, and so will output nationally.

2.3.3 The expectations channels

Economic agents are forward-looking and rational. Therefore, they pay special attention to projected changes in prices in an economy, mainly interest rates, price level, and exchange rates. An expectation of price changes encourages a change of behavior which further impacts real variables such as inflation or output in the economy. The Bank of Namibia (2020) highlights those consumers adjust their spending patterns in Namibia due to expectations of changes in interest rates more speedily than businesses. If they expect a rise in interest rates, they will reduce consumption and save more to earn a higher return. Further, consumers may

delay or rush the purchase of assets such as motor vehicles due to expectations of changes in interest rates. The cost of such assets depends on the prevailing level of interest rates in the economy since there are usually bought using borrowed funds. Similarly, businesses may put on hold their expansion plans due to expectations of changes in interest rates.

At the aggregate level, these expectations by both individuals and businesses significantly influence consumption and eventually impact the national output in an economy. According to Zgambo & Chileshe (2016), inflationary expectations are essential for twofold reasons. They are due to their effect on the real interest rate level in the economy and their role in the price money-wage setting behavior in an economy.

2.4 SUMMARY

In a nutshell, this chapter discussed the monetary policy conduct by the Central Bank of Namibia as well as monetary policy transmission channels. Based on the reviewed literature, there is evidence of the interest rate channel, asset channel, and expectations channel in Namibia. The interest rate channel of monetary policy posits that changes in consumers' and firms' spending and investment decisions are due to changes in interest rates. The expectations channel posits that households will change their spending and investment behavior due to expectations. While the asset channel acknowledges the impact of interest rates on financial assets. According to this channel, higher interest rates positively influence the value of financial support.

CHAPTER THREE: LITERATURE REVIEW

3.1 INTRODUCTION

This chapter gives an overview of the theoretical and empirical literature regarding the relationship between money supply and economic growth. The chapter is organized as follows. Section 3.2 presents the theoretical literature followed by the empirical literature in 3.3 and the conclusion in 3.4.

3.2. THEORETICAL LITERATURE

Theoretically, the link between money supply and economic growth dates back to the 19th century. Irving Fisher developed the quantity theory of money in early 1911. The theory relates the amount of money in an economy at a specific time to nominal GDP. Other theories that relate money supply to economic growth are the Keynesian and monetarists theories. These three theories are detailed in this section.

3.2.1 The Classical Quantity Theory of Money

Fisher (1911) developed the equation of exchange. According to him, in partial equilibrium, the equation of exchange is stated as:

$$M^S V = PT \dots\dots\dots (1)$$

Where; M^S is the money stock, V is the velocity of money and measures the rate at which a dollar circulates in the economy, P is the price level, and T is the level of transactions in an economy (Fisher, 1911).

Further, Fisher proposed that there is a fixed relationship between the number of transactions (T) taking place and output (Y), which makes it possible to replace T with Y as follows:

$$M^S V = PY \dots\dots\dots (2)$$

Equation (2) is known as the quantity theory of money. Holding velocity constant in the short run, the quantity theory posits a direct proportion between the quantity of money and nominal income in an economy. Fisher underscores that increasing money supply raises cash balances and deposits of the public. Therefore, economic agents will increase their spending by eliminating the surplus amounts. Thus, increase nominal GDP by the same proportion. The quantity theory of money affirms a strong direct channel between money and economic growth. Furthermore, according to Mishkin (2007), Fisher acknowledged the impact of aggregate spending on the price level. He holds that because all economic agents are spending their surplus amounts such that the money one receives is spent on goods and services produced by someone else, the level of transactions in the economy will increase, and the impact this has on the price level is undeniable.

The quantity theory of money shows how the money channel of monetary policy transmission works in an economy. Like many classical theories, the quantity theory of money assumes that the economy is always at its full-employment level of output and that wages and prices are flexible.

3.2.2 Monetarist Theory

The quantity theory of money is the foundation of mainstream monetary theory. This theory originated in the 1950s. Mainstream monetary theory confirms the validity of the quantity theory of money and borrows its foundation from it. It postulates that velocity in the quantity theory of money is stable; thus, nominal income is to a large extent, determined by money supply (Friedman & Schwartz, 1965; Friedman, 1968). The monetarist's view holds that increasing money supply considerably impacts output and reduces unemployment in the short-run, whereas in the long-run, it leads to higher inflation (Twinoburyo & Odhiambo 2018). According to Mehrara & Musai (2012), monetarists strongly believe that money plays a significant role in influencing prices and output in an economy. They suggest a unidirectional

causality running from money supply to prices and output. Due to the above, inflation is generally believed to be invariably a monetary phenomenon. Mishkin (1995) provides an insight into how monetary policy affects firms listed on the stock exchange. He notes that although there is consensus on the ultimate impact of monetary policy on aggregate output through the asset channel among monetarists and Keynesians, the process is partially different for each. According to the monetarists, the contractionary monetary policy leaves the public with fewer funds, putting pressure on their spending decisions. Consequently, the general spending on goods and services and stock prices on the stock market will decline. As a result of the above, the value of the firms will fall, and so will investment and national income.

3.2.3 The Keynesian view on the relationship between money supply and economic growth

By contrast, Keynesians hold that the link between the quantity of money and output is weak. According to Khabo (2005), increasing the quantity of money indirectly impacts output such that when the money increases, money holders acquire financial instruments such as bonds. This increases the demand for bonds and lowers interest rates in financial markets. As a result, investment expenditure will increase, and so will the level of national income in the country.

This mode of transmission is referred to as the indirect transmission mechanism. For this reason, Keynes asserts contrary to the consensus among classical economists that money does not matter for growth, prices and wages are fixed in the short run. Furthermore, in his view, the classical economists' assumption of full employment does not hold, as there will always be some level of unemployment in the economy. Be that as it may, Khabo & Harmse (2005) argue that increases in money supply can only positively impact output if the portfolio disequilibria lead to a fall in interest rates. If the level of interest rates does not fall, then the liquidity trap will occur. According to Keynes, the liquidity trap is a situation when interest rates in the economy are close to zero, which makes monetary policy ineffective in stimulating economic

growth. Keynesians further believe that the impact of monetary policy on the economy occurs through the interest rate transmission channel and equally includes economic agents' housing and durable expenditure decisions (Mishkin, 1995). Furthermore, Mishkin (1995) notes that Keynesian views differ from monetarists' views on the impact of monetary policy on the economy via the asset channel. In their view, Keynesians agree that contractionary monetary policy aimed at reducing interest rates will lower bond prices. However, the differences in bonds and stock prices will reduce the firm's value, investment, and then national output in the economy.

Below is an illustration of the Keynesian view on the impact of expansionary monetary policy on the economy.

$$\uparrow M^S \rightarrow r \downarrow \rightarrow I \uparrow \rightarrow GDP \uparrow \dots\dots\dots 3$$

Where; M^S is the money supply, r is the interest rate, I is the aggregate investment, and GDP is the gross domestic product. Contradictory to classical economists, Keynes rejected the assumptions of full employment and constant velocity adopted by the quantity theory of money. Keynesians postulate that there is no direct causation between money supply, output, and prices. Contrary to monetarists, the relationship runs from income to money supply (Mehrara & Musai, 2012).

Keynes attributed the desire to hold money to three motives comprising the transactions motive, the speculative motive, and the precautionary motive. Firstly, the transactions motive is the desire to hold cash as a command for immediate liquidity. Secondly, the speculative reason is the desire to part with the command for liquidity due to fluctuations in interest rates to earn a higher return on alternative forms of holding cash such as bonds. Finally, the precautionary motive is the desire to hold cash to enable economic agents to finance emergencies. All these three motives are assumed to be directly proportional to the national income.

3.3 EMPIRICAL LITERATURE

This section reviews the literature on the relationship between money supply and economic growth. It is presented as follows. Section 3.3.1 reviews literature supporting the monetarist view. Section 3.3.2 focuses on the literature supporting the Keynesian view followed by the literature review of the Common Monetary Area literature in section 3.3.3. Finally, section 3.4 summarizes the chapter.

3.3.1 Studies supporting the monetarist's view

The monetarist view posits that money matters for growth, and causality runs from money supply to output. Several studies are in support of this view globally, which are reviewed in this section.

Most recently, Hicham (2020) embarked on a study to assess whether money supply and inflation significantly impact economic growth in Algeria. The study used yearly data of Growth Domestic Product per capita, broad money supply, and consumer price index from 1970 to 2018, which were analyzed through the application of various cointegration techniques such as the Johansen- Julius (1994) test, Hatemi-j (2008) test, and the Maki (2012) test. The Hatemi-j (2008) and the Maki (2012) tests were used due to their ability to account for structural breaks. Based on the Johansen- Julius (1994) test, the findings reveal no cointegrating relationship between the variables under study. However, when structural breaks were accounted for using the Hatemi-j (2008) and the Maki (2012) tests, the study found a long-run relationship between the variables, specifically with more than three breaks.

In the same vein, Olamide & Maredza (2019) refuted the Keynesian view in ECOWAS. Their study assessed the regional effects of monetary policy on countries' economic growth in ECOWAS. The study considered quarterly data from the first quarter of 1980 to the last quarter of 2015 of oil price, commodity price volatilities, net domestic credit, inflation rate, exchange

rate, money supply, monetary policy, and gross domestic product rate. A long-run relationship between the variables was established through a panel ARDL framework. Furthermore, according to their study, the money supply is greatly influenced by the exchange rate channel's oil and commodities price volatilities and considerably impacts economic growth. It is thus documented that money matters for ECOWAS, and the monetarist view is dominant across the surveyed countries.

Consistent with the monetarist's view, a study by Mapharing & Mosidila (2019) is premised on the quantity theory of money, regression, and correlation coefficients to deduce the nature of the association between money supply, the velocity of money, GDP, and inflation in Botswana. The study employed quarterly data from 2007: Q1 to 2016: Q4, and the results suggest a strong positive significant relationship between money supply and economic growth and statistically significant negative relationships between money supply, the velocity of money, GDP, and inflation.

In Nigeria, for the period between 2009 and 2018, it was empirically established that M2 negatively impacts economic growth, although this relationship is statistically insignificant. On the other hand, M3 and credit to the private sector proved to insignificantly impact the economy positively. These conclusions were reached by applying the ordinary least squares method on quarterly data of RGDP, M2, M3, and credit to the private sector (Omodero, 2019). These results are consistent with Inam & Ime (2017), who used the same econometrics methods. Finally, Omodero (2019) recommend a reduction in interest rates to stimulate economic growth.

Tsai & Chang (2018) waved away from commonly used cointegration techniques. They employed the wavelet-based measure of co-movement for wavelet coherency analysis on time series data of 15 Asian countries mainly, Australia, China, Fiji, Indonesia, Japan, Macao SAR,

China, Malaysia, New Zealand, Papua New Guinea, Philippines, Singapore, South Korea, Thailand, and Vanuatu. Accordingly, the results show that money supply and GDP move together in the short run, specifically between 1 to 4 years, in 11 of the 15 countries. This shows that money matters for growth in these countries. Furthermore, the results reveal evidence of long-run relationships from 5 to 8 years. In particular, the long-run relationship in Australia was found from 1982 to 1994 while in South Korea, from 1984 to 1988, in the Philippines, from 1991 to 2005, and lastly between 1993 and 2008 in Malaysia.

Analyzed differently, Hussain & Haque (2017) employed the vector error correctional model on annual data from 1974 to 2014 in Bangladesh. According to the study, there are significant short and long-run relationships between money supply and economic growth in Bangladesh. These findings are like those of Arfanuzzaman (2014). According to the authors, to promote growth and improve the livelihood of millions of people in the country, monetary authorities should adopt the Taylor rule to make it possible for the money supply to increase steadily with economic growth.

In another study, Twinoburyo & Odhiambo (2016) found evidence supporting the monetarist's view. Above all, the study looked at the efficacy of monetary policy in influencing Tanzania's economic growth using the ARDL bounds testing approach to cointegration. Relying on data from 1975 to 2013, the results suggest that monetary policy does not promote economic growth in the long run. However, in the short run, monetary policy stimulates economic growth, specifically when money supply is the key monetary policy instrument. On the other hand, the monetary policy reduces the national output when the interest rate is the choice variable.

To contribute to the debate, Chume & Chume (2016) investigated the relationship between money supply and economic growth using real gross domestic product data, inflation rate, exchange rate, monetary policy rate, interest rate, and broad money supply from 1987 to 2010

in Nigeria. In their analysis, the Augmented Dickey-Fuller and KPSS tests were applied to examine the order of integration of the variables under study. Furthermore, the Ordinary Least Squares methodology, VAR Granger causality tests, and ARDL framework were applied to evaluate the nature of the relationship between the variables under study. According to the study, there is a significant long-run relationship between M2 and economic growth. The findings of the study advocate that greater economic growth in Nigeria will be realized by steadily increasing the broad money supply. Chuku (2009), Chume & Chume (2016), and Marshall (2016) also found significant relationships between money supply and growth in Nigeria.

Denbel, Ayen & Regasa (2016) looked at the relationship between money, prices, and Gross domestic product in Ethiopia during the period 1970/71 to 2010/11. The results suggest that there is unidirectional causality from money to GDP in the short and long-run and from money, and GDP to the rate of inflation. Additionally, the Johansen cointegration test shows a long-run relationship among the variables. The study finds evidence in support of the monetarist view. In conclusion, the study recommends that monetary policy should ensure price stability.

To complement the vast literature in Nigeria, Marshall (2016) carefully analyzed the nexus using a two-variable model of broad money supply (M2) and Real Gross Domestic Product (RGDP). Based on time-series data from 1970 to 2014, the cointegration results confirm the existence of a short and long-run relationship between the variables under study. Additionally, the M2 granger causes RGDP as postulated by the monetarists.

A study by Şen & Kaya (2015) emphasized that in comparison to fiscal policy, monetary policy is more effective in promoting economic growth in Turkey. This is based on their contribution to the debate by applying the structural vector autoregression model on quarterly data from 2001: Q1 to 2014: Q2. Although both fiscal and monetary policies are relevant for Turkey, the

study indicates that monetary policy is strongly supported due to its successes shown by impulse response functions. GDP grew by 13.09% following a shock to interest rates, while a shock to budget deficits only accounted for a GDP growth rate of 4.46%.

Prasert et al. (2015) settled in support of the monetarist theory in 8 Asian countries, including Thailand, Indonesia, Singapore, Malaysia, Philippines, Vietnam, Lao People's Democratic Republic, and Cambodia. Their study used yearly data of real economic growth rates, narrow money supply (M1), and demand deposits from 1995 to 2013. The ARDL approach by Pooled Mean Group estimator and Mean Group were applied to examine the relationship among the variables in the countries under study. The results indicate a positive long-run relationship between money supply and economic growth and a negative relationship between demand deposits and economic growth for the pooled mean group estimator. Meanwhile, the Mean Group (MG) methodology found no significant long-run relationships among the variables under study. Further, the results found evidence of significant short-run relationships between money supply, demand deposits, and economic growth in Indonesia, the Philippines, Vietnam, and Laos.

Inam (2014) found that money supply considerably impacts economic growth in Nigeria. The study employed Cobb Douglas production function, cointegration, and error correction techniques on time series data from 1985 to 2014. This study lends credence to the monetarist theory and advocates that policymakers should pay extra attention to monetary policy to stimulate economic growth in Nigeria.

Consistent with the above findings, Arfanuzzaman (2014) studied the relationship between M2 and gross domestic product in Bangladesh. A semi-log model was estimated, and the study considered data of M2 and GDP from 1974 to 1989. To realize the study's objectives, the Johansen Cointegration test was applied and found evidence of the presence of a long-run

relationship between the variables. It was established that causality runs from money supply to GDP.

In another study, Hevi & Enu (2014) settled in support of the monetarist view in Ghana. They applied the ordinary least squares methodology on stationary time series data from 1980 to 2012 to econometrically examine the effect of monetary and fiscal policies on output. The study considered the real gross domestic product, total labor force, fixed capital formation, money supply, and general government consumption. The results emphasize that although both fiscal and monetary policies are essential for growth, the impact of monetary policy on output is more powerful. According to the findings, high economic growth attainment dictates that the central bank maintains steadiness in the levels of interest rates, lending rates, inflationary rates, and exchange rates to encourage a good investment atmosphere.

Using quarterly data from 1991 to 2011, Mohamadpour, Behravan, & Espahbodi (2012) embarked on a study to unleash the nature of the relationship between money supply and economic growth in Malaysia. The VECM results suggest that monetary aggregates included in the model (M1, M2, and M3) are significant and positively impact output in the long run. These results emphasize that to increase economic growth in Malaysia, the central bank should increase the quantity of money in the economy.

A study by Hameed & Amen (2011) stressed that a statistically significant positive long-run relationship between money supply and economic growth exists for Pakistan. This was reached by analyzing the impact of money supply on national output through inflation using the SPSS regression model. The study used annual time series data for GDP, M2, interest rate, and inflation rate from 1980 to 2009, and the results show that this relationship is quite strong, given a coefficient of correlation of 0.9 and a coefficient of determination of 0.81. These

findings fully support the decision by the state bank of Pakistan to use reserve money as an operational target and broad money as an intermediate target.

Tabi & Ondo (2011), (as cited in Denbel et al., 2016) refuted the Keynesian view in Cameroon. The study analyzed the nature of the association between economic growth, inflation, and money in circulation via the application of a VAR model on time series data from 1960 to 2007. The findings confirm that money supply is vital in accelerating economic growth in Cameroon, and inflation is not a monetary phenomenon. Regrettably, the results further suggest that economic growth will increase along with the price level in the economy.

Moreover, Mehrara & Musai (2012) studied the relationship between money supply and economic growth in Iran from 1960 to 2008. The study employed the Zivot & Andrews (1992) unit root tests and the Gregory and Hansen (1996) cointegration technique due to their ability to account for structural breaks in the data. The Granger causality test results show a significant unidirectional causality from output and prices to the money supply in the short and long-run. This is consistent with the Keynesian view on the relationship between the variables under study. Finally, the study finds weak causality from money to prices in the short run.

Employing monthly data from 1988 to 2005, Ngalawa & Veigi (2011) took an in-depth look into the dynamic effects of monetary policy in Malawi. The variables under consideration were real output, consumer price level, commercial bank lending, exchange rate, aggregate money supply (M2), bank rate, and reserve money. The authors relied on the Structural Vector Auto Regression model and found that increasing the bank rate by 2.2% reduces output and increases prices ultimately faced by consumers. Impulse response functions indicate that output initially falls due to an increase in the bank rate until the fifth month. Notably, the study shows that M2 responds to output fluctuations for almost a year.

Similarly, Ogunmujiwa & Ekone (2010) examined the money supply and economic growth of nexus in Nigeria using time series data from 1980 to 2006. The study applied the ordinary least squares technique, causality tests, and ECM accordingly to assess the impact of money supply on economic growth. The results show that the broad money supply considerably improves economic growth. However, regarding the choice between contractionary and expansionary monetary policy, the money supply is insignificant in influencing output in the country.

Mishra, Mishra, & Mishra (2010) took data to the test to assess the short and long-run dynamics between broad money supply (M3), wholesale price index, and India's output from 1950-51 to 2008-09. Granger causality tests revealed unidirectional causality in the short run from the price level to money supply and output and from output to the level of prices in the economy. In addition, money supply and output were found that they Granger cause each other. Likewise, the Johansen cointegration test found evidence of a long-run equilibrium relationship between money supply and economic growth. In conclusion, the study recommends that coordination between fiscal and monetary policies is necessary to enjoy sustainable economic growth and price stability simultaneously.

In addition, Chuku (2009) studied the effects of monetary policy innovations in Nigeria. The study applied the Structural Vector Autoregressive (SVAR) approach on quarterly data from 1986Q1 to 2008Q4. The findings suggest that the stock of money has the greatest impact on output among monetary policy instruments. Chuku (2009) recommends that the central bank frequently use monetary aggregates. Therefore, the study confirms that the decision to use reserves as an operational target and broad money as the intermediate target to ultimately impact national output and the general price level by the central bank of Nigeria is indeed viable. This study also fully backs the monetarist view.

3.3.2 Studies in support of the Keynesian view

Contrary to the monetarists, the Keynesians postulate that money does not matter for growth. According to the Keynesians, the impact of money on output is weak, and causality runs from output to money supply. A few studies have found support for this view, as they are presented in this section.

In their study, Twinoburyo & Odhiambo (2018) supported the findings of Mutuku & Koech (2014) in favor of the Keynesians that money does not matter for growth in Kenya. The study used the ARDL-bounds testing approach to cointegration on annual data from 1973 to 2013, and the results show that money is neutral in stimulating output both in the short-run and long-run. According to the authors, the neutrality of money is precipitated by some concerns such as the monetary regime, the dominance of fiscal policy, the characteristics of the financial sector, the banking sector's dominance of the financial sector, and the oligopolistic nature of the banking industry.

Furthermore, Njindan (2016) employed the sign restricted SVAR model to best understand the relevance of monetary disturbances in Ghana. He used quarterly data from the first quarter of 1990 to the third quarter of 2015. According to this study, after a contractionary monetary policy disturbance, output and the price level fell while short-term interest rates increased. These results are consistent with the Keynesian view on the impact of money supply on interest rates and eventually on national output.

Mutuku & Koech (2014), (as cited in Twinoburyo & Odhiambo, 2018), support the Keynesian assertion that money does not matter for growth. The study applied the recursive VAR methodology to annual data from 1997 to 2010, and the findings indicate that money supply and interest rates are not important policy tools for stimulating economic growth in Kenya.

In Pakistan, Ihsan & Anjum (2013) conclude in favor of the Keynesian view. Their study set out to investigate the impact of money supply on economic growth using a regression model in SPSS. Their study used GDP, consumer price index, interest rate, and inflation rate from 2000 to 2011. The findings showed that interest rates are the only statistically significant factor of output in the economy. Consistent with these findings, a study by Ahmed and Suliman (2011) scrutinized the relationship between inflation, money supply, and the Gross Domestic Product of Sudan for the period 1960 to 2005. According to the Granger causality results, there is unidirectional causality from GDP and money supply to the price level. At the same time, no causal relationship was found between money supply and real GDP. Furthermore, the study found a long-run association between the macroeconomic variables examined. Above all, their study further adds to the Keynesian view.

In the final analysis, Dele (2007) found support for the Keynesian assertion in West African Monetary Zone countries. His study thoroughly investigated West African Monetary Zone Countries' monetary and macroeconomic stability perspective. For the investigation, the study employed quarterly data from the first quarter of 1991 to the last quarter of 2004 and adopted econometrics techniques such as the autoregressive and distributed lag single equation regression estimation and simultaneous equations estimation procedures. The results indicate that monetary policy precipitates national output stagnation in these countries. Country-specific assessment of the results shows that expansionary monetary policy and exchange rate devaluations elevate the price level and minimally impact national output.

3.3.3 Studies from the Southern African Customs Union

The Southern African Customs Union (SACU) was established in 1910. It comprises Botswana, Lesotho, Namibia, South Africa, and Eswatini. Studies on the relationship between money supply and economic growth in SACU countries are reviewed in this section. It is, however, worth noting that most studies are based on the South African economy, and no

studies have to date been done in Botswana and Lesotho to the best of the researcher's knowledge.

Seoela (2020) stresses the need for policymakers in Namibia, Eswatini, and Lesotho to increase measures to reduce the impact on their financial markets brought about by South Africa's monetary policy conduct. The author applied the structural vector autoregressive model on monthly data from the second month of 2000 to the last month of 2012 to examine the effect of an unexpected monetary policy shock in the Common Monetary Area. The study's findings show that when South Africa's repo rate increases, the price level in NLE increases, and national output falls.

In Namibia, Sheefeni (2020) found that shocks to the money supply considerably impact output. His study set out to assess the existence and effectiveness of the money channel of monetary policy transmission in Namibia. The data were analyzed using structural vector-auto regression model based on quarterly data from 2000: Q1 to 2016: Q4. The findings suggest that surprisingly increasing the broad money supply increases output up to the second year. Furthermore, the results provide evidence of the existence of an effective money channel of monetary policy transmission in Namibia.

Monamodi (2019) examined the impact of fiscal and monetary policies on countries in the Southern African Customs Union by employing the Panel Auto-Regressive Distributed lag model on annual data from 1980 to 2017. According to the results, both the fiscal and monetary policies greatly impact output in these countries in the long run. However, increases in government spending led to a higher government deficit which hurts private sector investment. Hence, the author advises that government should increase money supply simultaneously with the adoption of expansionary fiscal policy to reduce the need for governments to finance

deficits through increased borrowing. As a result, the interest rate will not be severely impacted, enabling the private sector to grow and significantly contribute to the national output.

In Eswatini, Mashinini, Dlamini & Dlamini (2019) analyzed the effects of monetary policy on agricultural output. The study applied the vector error correctional model on annual data from 1980 to 2014. The findings indicate that broad money supply and agricultural credit negatively impact growth. The authors recommended that monetary policy should ensure that farmers have access to credit at affordable rates of interest to increase economic growth.

In another study, Dingela & Khobai (2017) note that adopting the Taylor rule in South Africa is of considerable importance. This is based on their study that thoroughly examined the impact of broad money supply (M3) on economic growth from 1980 to 2016 via the ARDL framework. The findings confirmed the existence of a positive association between M3 and economic growth in both the short and long-run in South Africa.

Seleteng (2016) uses the panel vector autoregressive model to discover the spillovers of the monetary policy conducted in South Africa on Namibia, Lesotho, and Eswatini. The study employed data from 1980 to 2012. Accordingly, the results show that manipulation of the repo rate in SA causes changes in economic growth, inflation, and lending rates in all CMA countries. The results correspond to the findings of Ikhide & Uangata (2010) regarding the reaction of LNS countries' prices and lending rates to SA's repo rate. However, the results further show that even though most of the banks in the LNS countries originate from South Africa, the repo rate for South Africa has no influence on interest rate spread, credit extension to the private sector, and broad money supply in these countries.

Regrettably, Chipote & Palesa (2014) present evidence to the contrary that, although an equilibrium relationship exists between money supply, repo rate, price level, exchange rate, and economic growth, only the price level meaningfully determines output in South Africa.

Their study applied the Johansen cointegration technique on quarterly data from 2000 to 2010. Based on the findings, the study advocates for expansionary fiscal policy, and a change of direction of monetary policies towards ensuring a good environment exist to enable local and foreign investments to flourish.

3.4 SUMMARY

The relationship between money supply and economic growth has been extensively examined in the literature from the perspective of developing and developed countries. However, the literature is inconclusive regarding the impact of monetary policy on economic growth. Many studies found that monetary policy is vital to promote economic growth, while few presented evidence to the contrary.

Most empirical studies on Namibia investigate the transmission channels of monetary policy and pay no attention to the long run relationship between money supply and economic growth or the possible impact of the latter on the other. To the best of the researcher's knowledge, there is only one study, particularly by Sheefeni (2020) that examined the money channel of monetary policy transmission in Namibia. Nevertheless, no study that attempted to assess whether a short or long-run relationship exists between the variables could be traced. The implication of this is that the prerequisite for the success of any monetary policy framework depends on a strong and significant relationship between broad money supply and the selected target of monetary policy and the goal of monetary policy, which may be either inflation or output (Zgambo & Chileshe, 2014). Against that, this study wishes to fill this gap and assess the nature of the long-run relationship between money supply and economic growth.

CHAPTER FOUR: METHODOLOGY

4.1 INTRODUCTION

This study follows the quantitative approach. It subjects secondary data to economic analysis to understand the nature of the long-run relationship between the variables and organized as follows. Section 4.2 outlines the theoretical framework, 4.3, presents the specification of the model, description of variables in section 4.4, unit roots and cointegration tests in sections 4.5 and 4.6, respectively. Moreover, the section outlines the Granger causality tests in 4.7 as well as the long run model and short-run symbolized model in sections 4.8 and 4.9, correspondingly. In section 4.10, diagnostic tests are discussed followed by the data and data sources in 4.11 and then the analysis in section 4.11, model specification and lastly, section provides a summary of the chapter.

4.2 THEORETICAL FRAMEWORK

The theoretical framework for this study is the version of monetary growth proposed by Tobin (1965) on the relationship between money supply, inflation, and output. Tobin (1965) asserts that, given two assets, money, and physical capital. The real return on money falls when the price level rises, economic agents will then substitute cash into capital which stimulates output in the economy. In this model the decision is between money and physical assets. The starting point of the model is a production function of the classical type expressed as:

$$y_t = f(k_{t-1}) \dots\dots\dots 4$$

Thus, in line with the Solowian growth theory under the assumption of fixed savings rate out of real income, asset accumulation will be equal to savings rate, s , times household income:

$$\Delta K_t = \Delta \frac{M_t}{P_t} = s \left(y_t + \tau_t N_t - \frac{\pi_t M_t}{1 + \pi_t P_{t-1}} \right) \dots\dots\dots 5$$

Equation 2 above is then expressed in per capita term to yield:

$$\Delta K_t = k_t - k_{t-1} = \Delta \frac{K_t}{P_t} - \frac{n_t}{1+n_t} k_{t-1} \dots\dots\dots 6$$

$$\Delta k_t = \left[s \left(y_t + \tau_t - \frac{\pi_t}{1+\pi_t} \frac{m_t}{1+n_t} \right) - \left(\Delta \frac{M_t}{P_t} \right) \left(\frac{1}{N_t} \right) \right] - \frac{n_t}{1+n_t} k_{t-1} \dots\dots\dots 7$$

$$\Delta k_t = s \left(f(k_{t-1})_t + \tau_t - \frac{\pi_t}{1+\pi_t} \frac{m_t}{1+n_t} \right) - \left(\frac{\theta_t - \pi_t}{(1+\pi_t)(1+n_t)} \right) M_t - \frac{n_t}{1+n_t} k_{t-1} \dots\dots\dots 8$$

$$\Delta k_t = s f(k_{t-1})_t - (1-s) \left(\frac{\theta_t - \pi_t}{(1+\pi_t)(1+n_t)} \right) M_{t-1} - \frac{n_t}{1+n_t} k_{t-1} \dots\dots\dots 9$$

In the steady state, $\Delta k^* = \Delta m^* = 0$

$$\Delta m^* = \frac{m^* - \theta m^*}{(1-\pi^*)(1+n_t)} - m^* \left[\frac{1+\theta}{(1+\pi^*)(1+n)} - 1 \right] m^* = 0 \dots\dots\dots 10$$

Since the growth of nominal money and population are constant in the steady state, inflation will also be constant. Thus equation 9 becomes.

$$f(k^*) = (1-s) \frac{\theta - \pi^*}{(1+\pi^*)(1+n_t)} m^* + \frac{n}{1+n} k^* \dots\dots\dots 11$$

$$f(k^*) = (1-s) \frac{\theta - \pi}{1+\theta} m^* + \tilde{n} k^* \dots\dots\dots 12$$

$$f(k^*) = (1-s) \frac{\theta - \pi}{1+\theta} \varphi k^* + \tilde{n} k^* \dots\dots\dots 13$$

$$f(k^*) = [(1-s)\varphi + 1] \tilde{n} k^* \dots\dots\dots 14$$

Tobin's framework shows that a higher inflation rate leads to a permanent rise in the output. Thus, capital accumulation will rise as the price level rises. The same is true for output until the return on capital starts to fall. Simply, Tobin (1965) affirms that inflation makes individuals put funds into capital assets which increases capital accumulation and economic growth.

4.3 MODEL SPECIFICATION

The theoretical framework presented showed how money supply and inflation can impact economic growth. This study includes real gross domestic product as a dependent variable and broad money supply, repo rate and inflation as independent variables.

Following Marshal (2016), this study hypothesizes real gross domestic product to be a function of independent variables. This is algebraically expressed in the equation below.

$$RGDP = f(M2, INF, R) \dots\dots\dots 15$$

The model can thus be presented as follows.

$$LNY_t = \beta_0 + \beta_1 LNM2_t + \beta_2 LNF_t + \beta_3 LNR_t + \varepsilon_t \dots\dots\dots 16$$

Where:

$LNRGDP$ symbolized as Y_t is the real gross domestic product.

$LNM2_t$ - is quarterly real money supply data.

LNF_t - is the inflation rate.

LNR_t - is the repo rate

β_0 - is a constant

Where β_1, β_2 and β_3 are the respective coefficients. All variables were transformed to logarithms. According to Bellemare & Wichman (2020) transformation of variables to logarithms is common practice in literature. It is done to simplify the process of interpretation, make the relationship between variables nonlinear, normalize highly skewed variables and reduce heteroscedasticity.

4.4 DESCRIPTION AND JUSTIFICATION OF VARIABLES

Real Gross domestic product: The Gross Domestic Product (GDP) is defined as the value of all final goods and services produced within the borders of a country during a specified period adjusted for inflation (Mohr et al. 2001). The study uses RGDP as a proxy for the real economic growth.

Inflation rate: is the rate of increase of prices of goods and services in a country (Mohr et al. 2001). Higher rates of inflation are detrimental to growth.

Broad Money Supply: in Namibia, the broad money supply is also known as M2. M2 is a measure of money supply that includes currency in the hands of the public, checking deposits, money market, unit trusts, and forms of near money that can be easily changed to cash (Mohr et al. 2001). This study uses data of real money supply that is expected to positively impact real economic growth.

Repo rate: is the rate at which the central bank of a country (Bank of Namibia in the case of Namibia) lends money to commercial banks. It is the primary instrument used by the Bank of Namibia to control inflation. Banks adjust their interest rates when the central bank increases its policy rate, this makes borrowing more expensive and encourages saving. Investment falls and since it is a component of real GDP, economic growth will also fall (Mohr et al. 2001).

4.5 UNIT ROOT TESTS

There exist several ways through which an econometrician may assess the presence of unit root in variables. Regressions of non-stationary data lead to spurious regressions, which is the case when the results obtained advocate that there are statistically significant relationships between variables in the regression model when in fact, all that is obtained is evidence of contemporaneous correlations rather than meaningful causal relations from which we can draw consistent conclusions. Therefore, to avoid spurious regression it is critical to examine whether

a variable is stationary before commencing with any econometric work. This study makes use of the Augmented Dickey-Fuller Test (ADF) and the Philips Peron test for unit root for this purpose. Both tests are implemented in their three forms for more reliable results.

4.5.1 Augmented Dickey-Fuller Test

The ADF was chosen because of its ability to include maximum lags of the depended variable to correct for autocorrelation in the error term. To test for unit root, the following forms of the ADF were used in the most standard way.

$$\Delta Y_t = Y_{t-1} + \sum_{t-1}^m \beta_t \Delta Y_{t-1} + \mu_t \quad \text{(none).....17}$$

$$\Delta Y_t = \beta_1 + \beta_2 Y_{t-1} + \sum_{t-1}^m \beta_t \Delta Y_{t-1} + \mu_t \quad \text{(intercept).....18}$$

$$\Delta Y_t = \beta_1 + \text{¥ T} + \beta_2 Y_{t-1} + \sum_{t-1}^m \beta_t \Delta Y_{t-1} + \mu_t \quad \text{(intercept and trend)19}$$

Where:

ΔY_t - is the variable of interest.

Y_{t-1} - is its one-period lag.

β_1 – is a constant and T is the time trend.

The null hypothesis that the variable is non-stationary against the alternative hypothesis that the variable is stationary is tested. The null hypothesis is rejected if the calculated t statistics is more negative than the critical t statistics at 5% (Gujarati et al., 2012). A rejection of the null hypothesis implies that the variable is indeed stationary.

4.5.2 The Phillips Perron test

The Phillips Perron test has the added advantage of correcting for heteroscedasticity in the errors and any serial correlation. Below are the forms of the Phillips Perron test by employed the study.

$$\Delta Y_t = Y_{t-1} + \mu_t \quad (\text{none}) \dots\dots\dots 20$$

$$\Delta Y_t = \beta_1 + \beta_2 Y_{t-1} + \mu_t \quad (\text{Intercept}) \dots\dots\dots 21$$

$$\Delta Y_t = \beta_1 + \gamma T + \beta_2 Y_{t-1} + \mu_t \quad (\text{Intercept and trend}) \dots\dots\dots 22$$

The hypotheses to be tested are:

$$H_0: \sigma_{\varepsilon}^2 = 0, Y_t \sim I(0)$$

$$H_1 : \sigma_{\varepsilon}^2 > 0, Y_t \sim I(1)$$

Similarly, the null hypothesis is that a variable has a unit root, implying that the variable is non-stationary against its alternative that the variable has no unit root. If a variable has a unit root, it is not stationary in levels and needs to be differenced. The null hypothesis is rejected if the calculated test statistics are more negative than the critical test statistics (Gujarati et al., 2012).

4.6 COINTEGRATION ANALYSIS

The study employs the autoregressive distributed lag model bounds testing approach to cointegration to examine the long-run relationship between variables. ARDL models are deemed superior to other methods of examining long run relations between variables and have been extensively applied in literature by scholars such as: Olamide & Maredza 2019, Sunde 2017 and Ziramba & Moyo 2013. The ARDL model developed by Peresan & Shin (1999) and further amended by Peresan et al. (2001) is best due to its ability to perform well when the sample size is small such as the one considered in this study. In addition, this model can be used irrespective of the order of integration of variables, and equally applicable even if variables are I(1) or I(0) or a mixture of both. However, the model may not be ideal if variables are I(2) since the F statics computed may be invalid. Accordingly, this study employed the

following ARDL model to assess the nature of cointegration between money supply and economic growth in Namibia.

$$\begin{aligned} \Delta \ln Y_t = & \alpha_0 + \beta_1 \ln Y_{t-1} + \beta_2 \ln M2_{t-1} + \beta_3 \ln R_{t-1} + \beta_4 \ln INF_{t-1} \\ & + \sum_{i=1}^{q1} \alpha_{1i} \Delta \ln Y_{t-i} \\ & + \sum_{i=0}^{q1} \alpha_{2i} \Delta \ln M2_{t-i} \\ & + \sum_{i=0}^{q2} \alpha_{3i} \Delta \ln INF_{t-i} + \sum_{i=0}^{q3} \alpha_{4i} \Delta \ln R_{t-i} + u_{1t} \dots \dots \dots 23 \end{aligned}$$

Here:

Δ denotes the first difference operator

ϵ_t – is the random error term t is the time period.

α_0 - is the constant.

α_{1i} - is the coefficient of the dependent variable lagged from one.

α_{2i} To α_{4i} - are the coefficients of the independent variable lagged from zero.

β_1 to β_4 - are the coefficients of the level lagged value of the variables.

The other variables are as stipulated before. The appropriate values for the maximum lags are p , $q1$, $q2$ and $q3$. These were established using the Akaike Information Criterion (AIC). The summation operator implies that in each case, summation ranges from 1 to p , 0 to $q1$, 0 to $q2$ and 0 to $q3$, respectively.

The null hypothesis of the F test is that there is no long run relationship between all the series, that is, $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$; against the alternative hypothesis that $H_1: \beta_1 \neq 0$ or $\beta_2 \neq 0$ or $\beta_3 \neq 0$ or $\beta_4 \neq 0$. The computed F statistics is compared to the critical values tabulated by Narayan (2005) to determine whether cointegration exists. There is cointegration if the

computed F statistics is greater than Narayan's (2005) upper critical values. Moreover, the null hypothesis cannot be rejected if the F statistics is lower than the lower critical bound. If the F statistics is between the lower and upper bounds tabulated by Narayan (2005), then the test is inconclusive. In the event of cointegration, an error correctional model shall be estimated to examine short run dynamics of the model.

4.7 GRANGER CAUSALITY TESTS

The Granger causality Wald test was employed to provide a comprehensive answer to the second objective of the study. Granger causality is established when one variable causes the other (Engle & Granger, 1987). The following VAR system was estimated in Eviws9 to examine the nature of causality between the variables.

$$Y_t = \alpha_0 + \sum_{i=1}^k \beta_{1i} Y_{t-i} + \sum_{i=1}^k \beta_{2i} M2_{t-i} + \sum_{i=1}^k \beta_{3i} I_{t-i} + \sum_{i=1}^k \beta_{4i} R_{t-i} + e_1 \dots\dots\dots 24$$

$$M2_t = \alpha_1 + \sum_{i=1}^k \sigma_{1i} M2_{t-i} + \sum_{i=1}^k \sigma_{2i} Y_{t-i} + \sum_{i=1}^k \sigma_{3i} I_{t-i} + \sum_{i=1}^k \sigma_{4i} R_{t-i} + e_2 \dots\dots\dots 25$$

$$I_t = \alpha_2 + \sum_{i=1}^k \gamma_{1i} Y_{t-i} + \sum_{i=1}^k \gamma_{2i} M2_{t-i} + \sum_{i=1}^k \gamma_{3i} I_{t-i} + \sum_{i=1}^k \gamma_{4i} R_{t-i} + e_3 \dots\dots\dots 26$$

$$R_t = \alpha_3 + \sum_{i=1}^k \psi_{1i} Y_{t-i} + \sum_{i=1}^k \psi_{2i} M2_{t-i} + \sum_{i=1}^k \psi_{3i} I_{t-i} + \sum_{i=1}^k \psi_{4i} R_{t-i} + e_4 \dots\dots\dots 27$$

In the initial case when RGDP as the dependent variable, the hypotheses to be tested are:

$$H_0^1: \beta_{21} = \beta_{22} = \beta_{23} \dots = \beta_{2k} = 0$$

H_1^1 : There is causality between broad money supply and RGDP.

$$H_0^1: \beta_{31} = \beta_{32} = \beta_{33} \dots = \beta_{3k} = 0$$

H_1^2 : There is causality between inflation and RGDP.

$$H_0^1: \beta_{41} = \beta_{42} = \beta_{43} \dots = \beta_{4k} = 0$$

H_1^3 : There is causality between repo rate and RGDP.

The hypothesis testing for the Granger causality process is repeated for each of the variables in the system of equations. The null hypothesis of no Granger causality will be rejected if the probability value is less than 5%.

4.8 LONG RUN MODEL

After it has been found that variables are cointegrated, the long run relationships between variables shall be examined using the ARDL approach based on the following long-run model.

$$\ln Y_t = \alpha_0 + \sum_{i=1}^p \alpha_1 \ln Y_{t-i} + \sum_{i=0}^{q1} \psi_i \ln M2_{t-i} + \sum_{i=0}^{q2} \sigma_i \ln INF_{t-i} + \sum_{i=0}^{q3} \beta_i \ln R_{t-i} + e_t \dots\dots\dots 28$$

Where α_0 , is the constant and α_1 , ψ_i , σ_i and β_i are long run coefficients. A variable significantly impacts economic gross if its associated probability value is less than 10%.

4.9 SHORT RUN MODELS

Following the empirical evidence of cointegration, the following ECM shall be estimated to examine the short-run dynamics of the model. Error correctional models yield improved short-run forecasts and offer the short run dynamics necessary to attain long-run equilibrium (Granger, 1986). The error correctional model shall be estimated is as follows:

$$\Delta \ln Y_t = \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta \ln Y_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta \ln M2_{t-i} + \sum_{i=0}^n \alpha_{3i} \Delta \ln INF_{t-i} + \sum_{i=0}^n \alpha_{4i} \Delta \ln R_{t-i} + \psi ECM_{t-1} + u_{2t} \dots\dots\dots 29$$

Where, α_0 is a drift component, α_{2i} , α_{3i} , α_{4i} , are the short-term dynamic coefficients and ψ is the speed of adjustment. According to Gujarati et al. (2012), it tells us how much of the

adjustment to equilibrium takes place in each period, or how much of the equilibrium error is corrected. Consider the following cases:

(a) If $\psi = 1$ then 100 percent of the adjustment takes place within a given period, or the adjustment is instantaneous and full.

(b) If $\psi = 0.5$ then 50 percent of the adjustment takes place in each period.

(c) If $\psi = 0$ then there is no adjustment.

4.10 DIAGNOSTIC TESTS

To be completely certain that the model is correctly specified and there is no autocorrelation or heteroscedasticity and that it is stable, the following tests shall be executed; Breusch-Godfrey LM test, and the Breusch-Pagan test for serial correlation and heteroscedasticity. Autocorrelation results when residuals are associated over time while heteroscedasticity occurs when the variance of the errors is not constant over time. Lastly, the Ramsey reset test will be used to test for model specification, the Jarque-Bera for normality, as well as the CUSUM and CUSUMQ tests for model stability.

4.11 DATA AND DATA SOURCES

Data was sourced from the Bank of Namibia (BoN) statistical bulletins (various Issues) and from the Namibia Statistics Agency (NSA). The study collected quarterly data from the first quarter of 2008 to the last quarter of 2020 on broad money supply (M2), repo rate, inflation, and real GDP for the analysis.

4.12 DATA ANALYSIS

The study used Eviews9 to analyze the data. The study employed the Augmented Dickey-Fuller test (ADF), and the Philips Peron (PP) to test for unit root. In addition, the Autoregressive

Distributed Lag (ARDL)-bounds testing approach to cointegration was used to examine long-run relationship and short-run dynamics of the model.

4.13 SUMMARY

This chapter discussed the methodology adopted by the study. Eviews9 was used to analyze the data. Briefly, the ADF test and PP tests were applied to check the presence of unit root while the ARDL-bounds test for cointegration was adopted to test for long-run relationships. Furthermore, the AIC criterion was used to select the appropriate lag length. In the next chapter, the findings and analysis of the results are discussed.

CHAPTER FIVE: DATA ANALYSIS AND EMPIRICAL RESULTS

5.1 INTRODUCTION

This chapter presents the empirical results for the study. Following this introduction section, are the results from unit root tests presented in section 5.2, the lag length selection criteria in section 5.4, and cointegration results in section 5.5. More to that, the chapter presents the Granger causality results, diagnostic tests results, and finally the summary presented in sections 5.6, 5.7, and 5.8, respectively.

5.2 STATIONARITY TESTS

Before any econometric analysis, the variables under study should be subjected to unit root tests to examine their order of integration. For the bounds testing approach to be successful, the variables in the model should either be I (0), I (1), or a mixture of both. The presence of I (2) variables invalidate the bounds testing approach. To get a perfect view of the order of integration of variables, this study tested for unit root using all the forms of the ADF and PP tests. Table 1 presents the unit root results.

Table 1: Unit root tests

Name of variable	Model Specification	Unit root test				Order of integration
		ADF test		PP test		
		Levels	First differences	Levels	First differences	
GDP	None	-2.124	-7.121***	4.634	-7.136***	I (1)
	Intercept	-0.685	-7.862***	-0.516	-10.470***	I (1)
	Intercept and trend	-2.112	-6.100***	-2.265	-11.619***	I (1)
M2	None	-3.346	-5.865***	3.346	-6.031***	I (1)
	Intercept	-0.761	-5.015***	-2.690	-7.204***	I (1)

	Intercept and trend	-3.620**	-5.01***	-5.50***	-7.50***	I (0)
Repo rate	None	-1.523	-4.26***	-1.840*	-4.299***	I (1)
	Intercept	-2.059	-4.494***	-1.307	-4.491***	I (1)
	Intercept and trend	-2.297	-4.444***	-1.569	-4.441***	I (1)
Inflation	None	-1.04	-5.506***	-1.014	-5.543***	I (1)
	Intercept	-1.24	-5.535***	-1.738	-5.524***	I (1)
	Intercept and trend	-2.11	-5.468***	-2.669	-5.459***	I (1)

Source: Author's computation using eviews9

Note: The level of significance is indicated by stars such that a star indicates significance at 10%, two stars at 5%, and three stars at 1%.

Based on the above results, with the exception on M2 which is I (0) with intercept and trend, all the other variables are integrated of the first order. It is therefore possible to examine whether a long-run relationship exists between the variables by employing the bounds test approach to cointegration. Before doing so, the optimal lag length was selected in the following section.

5.3 OPTIMAL LAG SELECTION CRITERIA

The Akaike information criterion was used to select the optimal lag length of variables. The appropriate number of lags was automatically chosen in Eviews9, and the results are presented in table 2.

Table 2: Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	61.05157	NA	1.09e-06	-2.377149	-2.221215	-2.318221
1	244.7206	329.0736	1.01e-09	-9.363357	-	-
2	261.9612	28.01603	9.75e-10	-9.415050	8.583690*	9.068720*
3	278.1689	23.63615	1.00e-09	-9.423702	-8.011649	-8.884703
4	300.8416	29.285*	8.17e-10*	-9.7017*	-7.396568	-8.657645

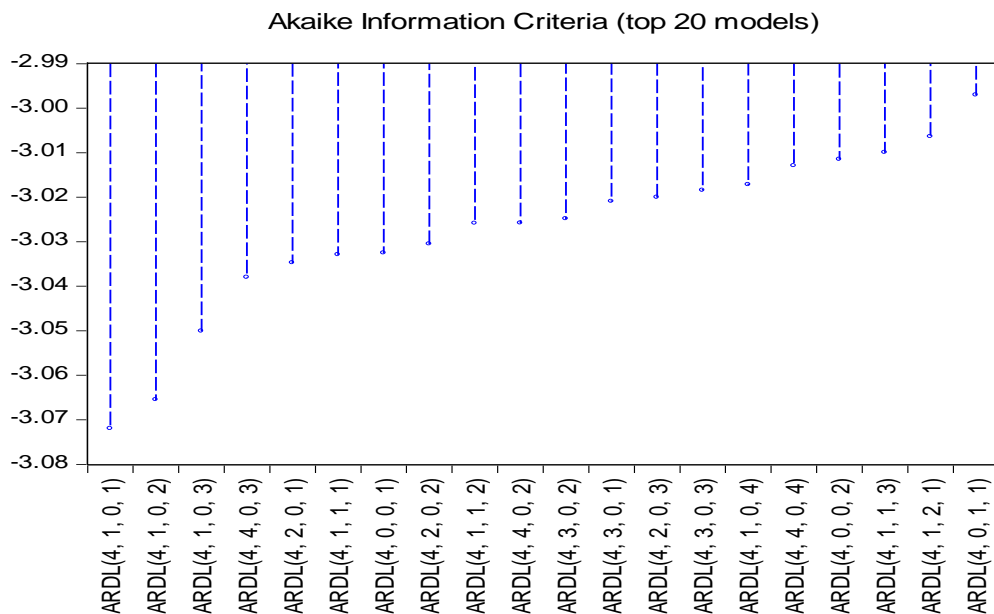
Source: Author's computation using Eviews9

It can be seen on the above table that the appropriate lag length is four since it minimizes the value of the AIC. This information can then be used to determine the appropriate model to be adopted by the study.

5.3 MODEL SELECTION

The appropriate lag length is used to select the best model. Figure below shows the top 20 models.

Figure 5a: model selection



Source: Author's computation using eviews9

Equally, the appropriate model should be one that minimizes the value of the AIC. The best model is therefore ARDL (4, 1, 0, 1).

5.4 COINTEGRATION TEST RESULTS

To examine the long run equilibrium relationship among the variables, the F statistics were computed using the Wald test to inspect the significance of β_1 , β_2 , β_3 and β_4 in equation (12). The computed F statistics are less than the critical values of Narayan (2005) and Pesaran et al. (2001). Table 3 presents the cointegration results.

Table 3: Cointegration results

Variables		F-Statistics		Result
F(RGDP, M2, Repo rate, Inflation)		1.073614		No cointegration
	Narayan (2005)		Pesaran et al. (2001)	
Critical value	Lower bound	Upper bound	Lower bound	Upper bound
1%	4.865	6.360	4.29	5.61
5%	3.500	4.700	3.23	4.35
10%	2.873	3.973	2.72	3.77

Source: Author's computation using Eviews9

As depicted in table 3, the computed F statistics is 1.073614, which is lower than both the lower bound values of Narayan (2005) and Pesaran et al. (2001) at all levels of significance. In that essence, the study fails to reject the null hypothesis of no cointegration and concludes that there are no long-run equilibrium relationships between the variables. These results concur with

				LNREPO
LNRGDP	LN2	9.155302	(0.0001)	LN2 → LNRGDP
LN2	LN2	0.582600	(0.6775)	LN2 → LNRGDP
LNINF	LN2	1.116704	(0.3664)	LNINF → LN2
LN2	LNINF	0.510590	(0.7283)	LN2 → LNINF
LNREPO	LN2	3.932595	(0.0107)	LNREPO → LN2
LN2	LNREPO	3.246900	0.0246	LN2 → LNREPO
LNGDP	LNREPO	0.773215	(0.5510)	LNGDP → LNREPO
LNREPO	LNGDP	2.945501	(0.0357)	LNREPO → LNGDP
LNINF	LNREPO	1.424168	(0.2493)	LN2 → LNREPO
LNREPO	LNINF	0.230163	(0.9193)	LNREPO → LNINF
LN2	LNREPO	3.246900	(0.0246)	LN2 → LNREPO
LNREPO	LN2	3.932595	(0.0107)	LNREPO → LN2

Source: Author's computation using *evIEWS9*

The null hypothesis that a variable does not Granger causes another is rejected if the associated p value is less than 10%. In the initial case, when RGDP is the dependent variable, the Wald test found evidence of Granger causality from the rate of inflation to the real gross domestic product. This supports the findings of Mishra et al. (2010) that found Granger causality from the price level to output in India. In addition, Chimobi (2010) found evidence of unidirectional from inflation to GDP in Nigeria using the data from 1970 to 2005. While a study by Sindano (2014) showed evidence of bidirectional causality between output and inflation in Namibia.

This study found no causality between the repo rate and the price level in Namibia. This is not in agreement with the study of Kashima (2019) that found bidirectional causality between these variables. Moreover, this study shows evidence of causality from the repo rate to the real gross domestic product given a p-value of 0.0357. These findings are consistent with those of Kamati (2014) who found Granger causality from the repo rate to GDP in Namibia at 1%. The results further show that GDP does not Granger cause the repo, which is corresponding to the findings of Habanabakize & Meyer (2018) on the South African economy.

Furthermore, the study found evidence of Granger causality from output to broad money supply at a 1 percent significant level. These results are not in agreement to those by Andreas (2018); Arfanuzzaman (2014); Danbel, Ayen & Regasa (2016) who present evidence of Granger causality from M2 to RGDP in Namibia, Bangladeshi, and Ethiopia, respectively.

Lastly, the study found causality from repo rate to money supply at 1 percent and from money supply to the repo rate at 5 percent. Therefore, there is bidirectional causality between money supply and the repo rate in Namibia. The results of this study show that monetary policy is effective at influencing money supply in the economy through the repo rate. This supports the study by Fadiran & Adebisi Edun (2013) that found unidirectional causality from the repo rate to the money supply in South Africa at 5 percent level of significance.

5.6 SHORT RUN MODEL

No long run relationship was found among variables. The table 5 below presents the short run results. Table 5 shows that, except for the repo rate which is significant at 5% level of significance all the other variables are insignificant.

Table 5: Short run model

Variable	Coefficient	Std. Error	t-statistics	Prob
DLNINFL	-0.029741	0.039349	-0.755811	0.4535
LNLM2	-0.000339	0.020246	-0.016720	0.9867
DLNREPO	0.226172	0.113395	1.994547	0.0519
C	0.024	0.2261	0.1062	0.9158

Source: Author's computation using eviews9

This means that in the short run, variations in real GDP in Namibia are only explained by the repo rate. Equally, the coefficient of determination (R^2) is 0.084, which indicates that, the repo rate, inflation rate and broad money supply explain only about 8 % of the variations in real GDP.

5.7 DIAGNOSTIC TEST RESULTS

The table below presents the diagnostics test result for the adopted model which is ARDL (4, 1, 0, 1) informed by the adopted lag selection criteria.

Table 6: Diagnostics test results

TEST	TEST- STATISTICS	PROBABILITY

Breusch-Pagan-Godfrey	1.691836	0.1074
Breusch-Godfrey Serial Correlation LM Test	0.251431	0.9052
Ramsey RESET test	1.538256	0.1307
Jarque Bera test	0.6768	0.71290

Source: Author's compilation using eviws9

According to the Breusch-Pagan-Godfrey and Breusch-Godfrey serial correlation LM tests results above, the study fails to reject the null hypothesis of no heteroskedasticity and that of no autocorrelation given the observed probability values for both tests greater than 5 percent. Therefore, the residuals are free from heteroskedasticity and autocorrelation. Based on these results, it is safe to accept the chosen model subject to stability tests.

When tested for stability, the probability value of the Ramsey reset test was found to be greater than 5 percent. Thus, the null hypothesis that the model is stable is not rejected, which confirms the stability of the model. Furthermore, a probability of 0.71290 for the Jarque Bera test indicates that residuals are normally distributed.

The stability of the coefficients was further confirmed by the cumulative sum (CUSUM) and the CUSUM of squares (CUSUMQ) of recursive residuals. The results are presented in figure 5b and 5c, respectively.

Figure 5b: CUSUM

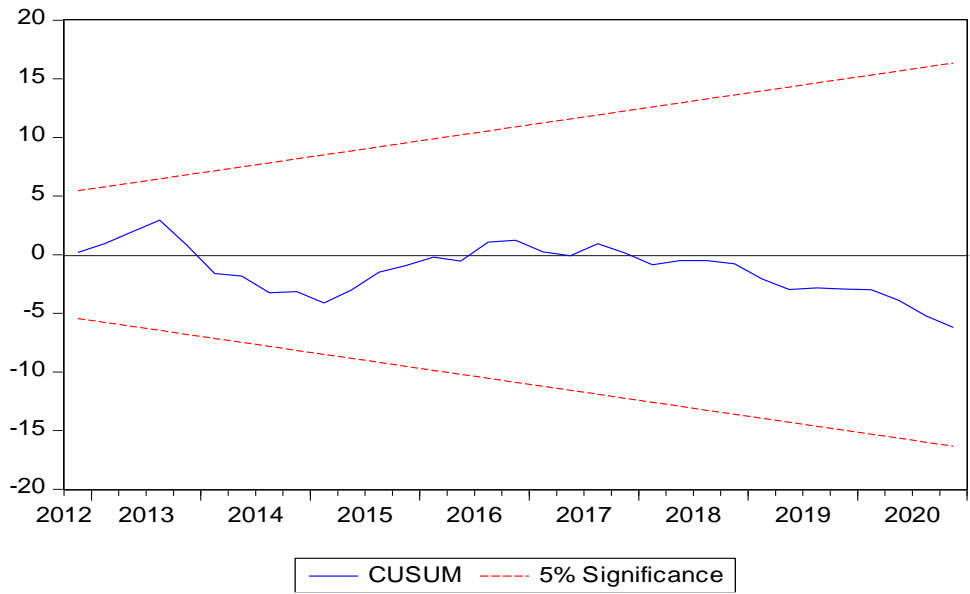
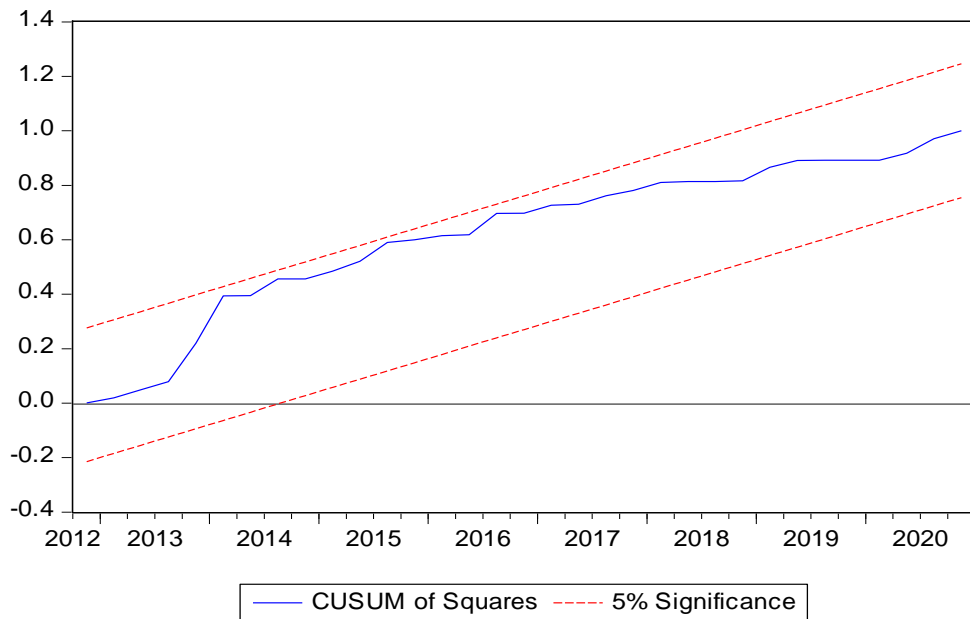


Figure 5c: CUSUMQ



The CUSUM test in figure 5b indicates that the model is stable since it lies between the 5 percent significant level. This is supported by the CUSUMQ test in 5c.

5.8 SUMMARY

This chapter aimed at establishing the nature of the relationship between money supply and economic growth. The Augmented Dickey-Fuller and Phillip Perron tests of cointegration were employed to examine the order of integration of the variables. Using these methods, variables

were found to be integrated of the first order. The AIC criteria indicated the optimal lag length for all differenced variables to be 4. No long-run relationship was found between the variables under study. Finally, the model was found to be stable and not suffer from autocorrelation and heteroskedasticity. The next chapter presents the conclusion and recommendations of the study.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY OF THE STUDY AND CONCLUSION

This study looked at the relationship between money supply and economic growth in Namibia. Regional integration is at the top of policy agendas of developing countries. Therefore, a good understanding of the nature of the relationship between money supply and economic growth is of great importance particularly for small and open economies like Namibia for future policy considerations. According to Ikhide & Katjomuise (1999), there is a close link between real money balances and changes in real economic activity in the country. Their study shows that real GDP and money supply move in the same direction and real GDP increased every time broad money supply was increased.

Furthermore, the study explored the various channels of monetary policy transmission and presented literature that showed the presence of these channels in the country. Bank of Namibia (2020) acknowledges the presence of the asset and expectation channels of monetary policy in Namibia. In the same vein, Sheefeni & Ocran (2013) found evidence for the presence of a significant bank lending channel in Namibia. These channels are simplified and shown diagrammatically in figure 2.

Theoretically, the link between money supply and economic growth dates to 1911. The impact of money supply on economic growth is perceived differently by scholars around the world. Some believe that money matters for growth (Inam, 2014; Galawa & Veigi, 2011; Ogunmujiwa & Ekone, 2010; Mishra et al. 2010; Chuku, 2009). Others present evidence to the contrary (Mutuku & Koech, 2014; Rahman & Qayum, 2013; Ihsan & Anjum, 2013; Ahmed & Suliman, 2011 and Dele, 2007). Most of the reviewed literature supports the monetarists view that money matters for economic growth. The best model was chosen based on the AIC criterion.

The unit root test results show that all the variables are integrated of order 1 using the AIC, the appropriate lag length was selected and the ARDL model of 4 lags of each differenced variable was chosen. After non-significant variables were eliminated, the best model was ARDL (3, 3, 4, 2). The computed F statistics is 2.471504, which is lower than the critical values for Narayan (2005) and Pesaran et al. (2001) at all levels of significance. Thus, the study concludes that there are no long run relationships among the variables under study.

Moreover, the study results further showed that there is a unidirectional causality from the inflation rate to RGDP, from RGDP to money supply, and from repo rate to RGDP as well as a bidirectional causality between money supply and the repo rate. The study does not find evidence of causality between money supply and inflation in Namibia, suggesting that inflation is not a monetary phenomenon in Namibia.

6.2 CONCLUSION

Specifically, the main objective of the study was to examine the nature of the long-run relationship between money supply and economic growth, and to further assess the nature of causality among the variables under study. The study fails to reject the null hypothesis of no long-run relationship between broad money supply and economic growth and rejected the null hypothesis of no causal relationship between money supply and economic growth. The study

finds a unidirectional causality from RGDP to M2 and a bidirectional causality between the repo rate and M2.

6.3 POLICY IMPLICATIONS

The study found that there is Granger causality from gross domestic product to the broad money supply, bidirectional causality between the repo rate and money supply, and no Granger causality between inflation and money supply. These results have major policy implications for Namibia.

No Granger causality between money supply and inflation implies that increasing money supply may not cause inflation in the short run. Kashima (2019) noted that there is agreement among monetary economists that money supply stimulates growth in the short run but raises prices in the long run. Bank of Namibia can use the repo rate to stabilize the price level. Kamati (2014) showed that Namibia's repo rate is very effective at influencing output per quarter, the price level, as well as the domestic credit.

Moreover, evidence of bidirectional causality between broad money supply and the repo rate shows that the repo rate is an effective tool for influencing the stock of money in the economy. Taking note of the country's monetary policy conduct, this study suggests that the Bank of Namibia should initiate products or special vehicles through which money supply may be increased to stimulate growth and reduce unemployment in the short run. This may be done in collaboration with the banking sector by creating new products for small and medium enterprises, extend banking services to rural areas, and decentralize the banking services in the economy to improve efficiency.

As a result of the above, commercial bank's intermediation role will rise, as well as their contribution to real GDP. According to Deloitte (2019), an increase in bank funding due to a large inflow of external funds into the local economy and banking system as well as a large

transaction between the Government Institutions Pension Fund and commercial banks from 2015 to 2019 resulted in the highest contributions of the financial sector to real GDP with the highest contribution of 7.7% recorded in 2017.

6.4 AREA FOR FURTHER RESEARCH

Researchers are invited to investigate the impact of money supply on economic growth using different methods, as well as to conduct studies in monetary economics to assess the possibility of the independent monetary policy conduct in Namibia. Moreover, the study invites researchers to conduct research on financial markets and include Namibian fiscal policy variables, the South African repo rate, domestic inflation rate, interest rates in Namibia, and South Africa are highly recommended. Finally, the study invites researchers to conduct studies focusing on examining the relationship between money supply and other macroeconomic variables such as the foreign exchange rate, unemployment rate, and budget deficit or government debt.

References

- Abbas, K. & Rizavi, S. S., 1991. 'Causality Test between Money and Income: A Case Study of Selected Developing Asian Countries (1960-1988)' [with Comments]. *The Pakistan Development Review*, 30(4), pp.919-929.
- Agenor, R.P., Alper, K. & da Silva, L.P., 2018. 'Capital regulation, monetary policy, and financial stability'. *32nd issue (September 2013) of the International Journal of Central Banking*.
- Ahmed, A. E. M. & Suliman, S. Z., 2011. 'The Long-Run relationship between money supply, Real GDP and price level: Empirical evidence from Sudan', *Journal of Business Studies Quarterly*, 2(2), 68-79.
- Alweendo, T. K., 2008. '2008 Annual address: Namibia's Monetary Policy Framework'. Windhoek: Bank of Namibia. *BIS Review 152/2008*.
- Andreas, A., 2018. *Examining the causal relationship between private sector credit extended and economic growth in Namibia* (Master's thesis, University of Namibia).

Arfanuzzaman, M. D., 2014. 'The long-run dynamic relationship between broad money supply and the GDP of Bangladesh: A VECM approach', *Developing Country Studies*, 4(14), pp.167-179.

Aydin, B. & Volkan, M.E., 2011. *Incorporating financial stability in inflation targeting frameworks*. International Monetary Fund.

Babatunde, M.A. & Shuaibu, M.I., 2011. 'Money supply, inflation and economic growth in Nigeria'. *Asian-African Journal of Economics and Econometrics*, 11(1), pp.147-163.

Bank of Namibia., 2020. *Namibia's monetary policy framework*, published by Bank of Namibia. Windhoek, Namibia.

Balogun, E. D., 2007. 'Monetary policy and economic performance of West African monetary zone countries. *Munich Personal RePEc Archive*, MPRA Paper No. 4308.

Bank of Namibia 2009, *Bank of Namibia Annual Report*, Windhoek, Namibia, Retrieved from <http://www.bon.com.na>

Bank of Namibia., 2020. *Bank of Namibia annual Report*, Windhoek, Namibia, Retrieved from <http://www.bon.com.na>

Bellemare, M.F. & Wichman, C.J., 2020. 'Elasticities and the inverse hyperbolic sine transformation'. *Oxford Bulletin of Economics and Statistics*, 82(1), pp.50-61

Chude, N. P. & Chude, D. I., 2016. 'Impact of broad money supply on Nigerian economic growth', *IIARD International Journal of Banking and Finance Research*, 2(1), pp.46-52.

Chuku, A. C., 2009. 'Measuring the Effects of Monetary Policy Innovations in Nigeria: A Structural Vector Autoregressive (SVAR) Approach', *African Journal of Accounting Economics, finance, and Banking Research*, 5 (5), 112 – 129.

Chume, N. P. & Chume, D. I., 2016. 'Impact of broad money supply on Nigerian economic growth, *IJAR*', *International Journal of Banking and Finance Research* ISSN 2695-186X Vol. 2 No.1 2016.

Chimobi, O.P., 2010. Inflation and economic growth in Nigeria. *Journal of sustainable Development*, 3(2), p.159.

Cyrus, M. & Elias, K., 2014. 'Monetary and Fiscal Policy Shocks and Economic Growth in Kenya: VAR Econometric Approach', *Journal of World Economic Research*, Vol: 3(6), pp. 95-108.

Dingela, S. & Khobai, H., 2017. 'Dynamic impact of money supply on economic growth in South Africa. An ARDL approach', MPRA Paper No. 82539.

Denbel, F. S., Ayen, Y. W. & Regasa, T. A., 2016. 'The relationship between inflation, money supply and economic growth in Ethiopia: Cointegration and Causality analysis', *International Journal of Scientific and Research Publications*, 6(1), 556 – 565.

Dele, B. E., 2007. 'Monetary Policy and Economic Performance of West African Monetary Zone Countries', *Munich Personal RePEc Archive*, Vol.4308.

Deloitte., 2019. *Namibia Banking Sector Dynamics report*. October 2019. Retrieved from: <https://www2.deloitte.com/content/dam/Deloitte/na/Documents/finance/na-Deloitte-Thought-Leadership-Bank-Dynamics-and-Funding-3.0.pdf>

Engle, R. F., & Granger, C. W. J., 1987. "Cointegration and error correction: Representation, estimation and testing", *Journal of Econometrica* 55, 251-276.

Fisher, I., 1911. 'The Equation of Exchange', 1896-1910. *The American Economic Review*, 1(2), pp. 296-305.

- Fadiran, G.O. & Edun, A., 2013. 'An overview of the repo rate in an inflation targeting economy'. *African Development Review*, 25(4), pp.621-635.
- Friedman, M., 1968. 'The role of monetary policy', *American Economic Review*, Vol. 58, No.1, pp. 1-17.
- Friedman, M. & Schwartz, A. J., 1965, 'Money and business cycles. In The state of monetary economics', *National Bureau of Economic Research*, NBER. pp. 32-78.
- Habanabakize, T. & Meyer, D.F., 2018. 'An investigation of the dynamic effect of foreign direct investment (FDI) and interest rates on GDP in South Africa'. *Journal of Economics and Behavioral Studies*, 10(5 (J)), pp.29-37.
- Hameed, I. & Amen, U., 2011. 'Impact of monetary policy on gross domestic product (GDP)', *Munich Personal RePEc Archive*, MPRA Paper No. 35562.
- Granger, C. W. J., 1986. 'Developments in the Study of Cointegrated Economic Variables', *Bulletin*, Vol. 48, pp. 213-28.
- Gujarati, D.N., Porter, D.C. & Gunasekar, S., 2012. *Basic econometrics*. Tata mcgraw-hill education.
- Havi, E. D. K. & Enu, P., 2014. 'The effect of fiscal policy and monetary policy on Ghana's economic growth: which policy is more potent', *International Journal of Empirical Finance*, 3(2), pp.61-75.
- Hicham, A., 2020. 'Money Supply, Inflation and Economic Growth: Co-Integration and Causality Analysis', *Studia Universitatis Babes Bolyai-Oeconomica*, 65(2), pp.29-45.

Hussain, M. E. & Haque, M., 2017. 'Empirical analysis of the relationship between money supply and per capita GDP growth rate in Bangladesh', *Journal of Advances in Economics and Finance*, 2 (1), pp.54-66.

Ihsan, I & Anjum, S. 2013., 'Impact of money supply (M2) on GDP of Pakistan', *Global Journal of Management and Business Research*. Volume 13 Issue 6, 1-7.

Ikhide, S. I. & Katjomuise, K., 1999. *Estimating the demand for money in Namibia*. Bank of Namibia, Windhoek, Namibia,

Ikhide, S & Uanguta, E 2010, 'Impact of South Africa's monetary policy on LNS economies', *Journal of Economic Integration* 25(2), June, 324-352.

Inam, U. S. & Ime, B. S., 2017. 'Monetary policy and economic growth in Nigeria: Evidence from Nigeria'. *Advances in Social Sciences Research Journal*, 4(6), 41-59. DOI: 10.14736/assrj.46.2806.

Inam, U., 2014. 'Money supply and economic growth in Nigeria: An econometric analysis (1985-2011)', *Journal of Economics and Sustainable Development*, 5(12), pp.149-155.

IMF., 2009. *Lessons for Monetary Policy from Asset Price Fluctuations*. *International Monetary Fund World Economic Outlook, October, Chapter*

Kamati, R., 2014. *Monetary policy transmission mechanism and interest rate spreads*, Doctoral dissertation, University of Glasgow.

Kashima, G., 2017. *Analysis of the impact of monetary policy on economic growth in Namibia*, thesis, university of Namibia.

Khabo, V. & Harmse, C., 2005. 'The impact of monetary policy on economic growth of a small open economy: the case of South Africa', *South African Journal of Economic and Management Sciences*, Vol. 8, No.3.

Mapharing, M. & Mosidila, B. L., 2019, 'Inflation, money and economic growth in Botswana', *International Journal of Economics, Business and Management Research*, Vol. 3, No. 09, pp.30-44.

Mashinini, M. S. Dlamini, S. G. & Dlamini, D. V., 2019. 'The Effects of Monetary Policy on Agricultural Output in Eswatini'. *International Journal of Economics and Financial Research*, 5(5), pp. 94-99.

Marshal, I., 2016. 'The link between money supply and economic growth in Nigeria: An econometric investigation'. *International Journal of Economics and Business Management*, 2(3), pp.42-51.

Mehrara, M. & Musai, M., 2012. 'The dynamic causal relationships among money, output and price in Iran', *Asian Journal of Business and Management*, 1(5), pp. 31-37.

Mishkin, F. S., 1995. 'Symposium on the monetary transmission mechanism', *Journal of Economic perspectives*, 9(4), pp.3-10.

Mishkin, F. S., 2004. Symposium on the monetary transmission mechanism', *Journal of Economic perspectives*, 9(4), pp.3-10.

Mishkin, F. S., 2007, *The economics of money, banking, and financial markets*. Pearson education.

Mishra, P. K., Mishra, U. S. & Mishra, S. K., 2010, 'Money, price and output: A causality test for India', *International Research Journal of Finance and Economics*, 53(2), pp.26-36

- Mohamadpour, B., Behravan, N., Espahbodi, S. & Karimi, R., 2012. 'An empirical study of relationship between monetary policy and stock market: Performance in Malaysia', *Australian Journal of Basic and Applied Sciences*, 6(12), 142-148
- Mohr, P., Fourie, L. & associates., 2008. *Economics for South African students*. 8th Edition. Van Schaik, Pretoria, South Africa.
- Monamodi, N. E., 2019. *The impact of fiscal and monetary policy on economic growth in Southern African Custom Union (SACU) member economies between 1980 and 2017: a panel ARDL approach*. Thesis, North-West University, South Africa.
- Narayan, P. K., 2005. 'The saving and investment nexus for China: evidence from cointegration tests', *Applied economics*, 37(17), pp.1979-1990.
- Ngalawa, H. & Vieg, N., 2011. 'Dynamic effects of monetary policy shocks in Malawi', *South African Journal of Economics*, 79(3), pp.224-250.
- Namibia Statistics Agency., 2021. *Annual National Accounts 2020*, Windhoek, Namibia.
- Njindan I. B., 2016. 'Are Monetary Policy Disturbances Important in Ghana? Some evidence from Agnostic Identification'. *MPRA Paper No. 70205*.
- Ogunmuyiwa, M. S. & Ekone, A. F., 2010. 'Money supply –economic growth nexus in Nigeria', *Journal of Social Sciences*, Vol. 22, No. 3, pp. 199 –204.
- Olamide, E. G. & Maredza, A., 2019. 'Regional Effects of Monetary Policy on Economic Growth of Ecowas: An S-Var Approach', *The Journal of Developing Areas*, 53(1), p. 205-223.
- Omodero, C. O., 2019. 'The role of money supply in economic growth enhancement: The case study of Nigeria', *Journal of Business School*, 2(2), pp.71-78.

- Peresan, M., Shin, Y. & Smith, R., 2001. 'Bounds Testing Approaches to The Analysis', *Journal of Applied Econometrics*, pp.289-326.
- Pesaran, M. H., Shin, Y. & Smith, R. P., 1999. Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, Vol 94(446), pp. 621–34.
- Philips, P. & Perron, P., 1988. 'Testing for a unit root in times series regression', *Biometrika*, Vol (75), p.335-346.
- Prasert, C, Kanchana, C, Chukiat, C & Monekeo, K 2015, 'Money supply influencing on Economic growth wide phenomena of AEC open region', *Procedia Economics and Finance*, 24(2015), 108-115.
- Rahman, M. J. & Qayum, M. A., 2013. 'Testing the Hypothesis of Long-Run Neutrality of Money in Bangladesh', *International Journal of Statistical Sciences*,(2013), pp.39-54.
- Republic of Namibia., FY 1990/1991 Budget statement. Retrieved from: www.mof.gov.na
- Republic of Namibia., FY 2021/2022 Budget statement. Retrieved from: www.mof.gov.na
- Sambo, M.C., 2021. *Policy adjustment, convergence and monetary integration in a common monetary area* (Doctoral dissertation, North-West University (South Africa)).
- Sheefeni, J. P. S. & Ocran, M., 2013. 'Monetary Policy Transmission in Namibia: The Credit Channel', *Journal for development and leadership*, p.115.
- Sheefeni, J. P. S., 2020. 'Money Channel of Monetary Policy Transmission in Namibia', *Economia Internazionale/International Economics*, 73(1), pp.131-150.
- Sindano, A.N., 2014. *Inflation and economic growth: an estimate of an optimal level of inflation in Namibia* (Master's degree thesis).

Şen, H. & Kaya, A., 2015. 'The relative effectiveness of Monetary and Fiscal Policies on growth: what does long-run SVAR model tell us?', *Munich Personal RePEc Archive*, MPRA Paper No. 65903.

Seoela, B. N., 2020. *The Effects of South Africa's Unexpected Monetary Policy Shocks in the Common Monetary Area*, thesis, Boise State University.

Sunde, T., 2017. 'Foreign direct investment, exports and economic growth: ADRL and causality analysis for South Africa', *Research in International Business and Finance*, 41, pp.434-444.

Tabi, N. & Ondo, A., 2011. 'Inflation, Money and Economic Growth in Cameroon', *International Journal of Financial Research*, Vol. 2, pp. 45-56.

Tsai, S. L. & Chang, T., 2018. 'The co-movement between money and economic growth in 15 Asia-pacific countries: Wavelet coherency analysis in time-frequency domain', *Romanian Journal of Economic Forecasting*, 21(2), pp.63-79.

Tjirongo, M. T., 1995. 'Short-term stabilization versus long-term price stability: evaluating Namibia's membership of the Common Monetary Area', *Oxford: University of Oxford*, WPS/95-18

Twinoburyo, E. N. & Odhiambo, N. M., 2018. 'Monetary policy and economic growth: A review of international literature', *Journal of Central Banking Theory and Practice*, 7(2), pp.123-137.

Uanguta, E. & Ikhide, S., 2002. *Monetary policy transmission mechanism in Namibia*. Bank of Namibia Research Department.

Xie, C., Tang, H. & Cui, Y., 2009. Money supply, economic growth, and inflation of China: 1998-2007. In *2009 International Joint Conference on Computational Sciences and Optimization* (Vol. 2, pp. 562-566). IEEE.

Zgambo, P. & Chileshe, P. M., 2014. Empirical analysis of the effectiveness of monetary policy in Zambia. Prepared for the *COMESA Monetary Institute*.

Ziramba, E. & Moyo, B., 2013. 'Aggregate outbound tourism demand in South Africa: an econometric analysis', *Journal of Economics and Behavioral Studies*, 5(5), pp.260-267.

LIST OF APPENDICE

APPENDIX 1: UNIT ROOT TEST RESULTS

ADF unit root tests for GDP in levels

Null Hypothesis: LNGDP has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			2.124186	0.9912
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LNGDP has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.685498	0.8411
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	

	10% level		-2.597905	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LNGDP has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.112761	0.5265
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	
*MacKinnon (1996) one-sided p-values.				

ADF unit root tests for GDP at first differences

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.121062	0.0000
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	

	10% level		-1.612650	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-7.862311	0.0000
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 2 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.098883	0.0000
Test critical values:	1% level		-4.161144	
	5% level		-3.506374	
	10% level		-3.183002	
*MacKinnon (1996) one-sided p-values.				

Phillip Perron unit root tests for GDP in Levels

Null Hypothesis: LNGDP has a unit root				
Exogenous: None				
Bandwidth: 50 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			4.634851	1.0000
Test critical values:	1% level		-2.611094	

	5% level		-1.947381	
	10% level		-1.612725	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LNGDP has a unit root				
Exogenous: Constant				
Bandwidth: 50 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-0.515929	0.8793
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	
	10% level		-2.597905	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: LNGDP has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-2.264695	0.4448
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	
*MacKinnon (1996) one-sided p-values.				

Phillip Perron test of GDP at first differences

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: None				
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel				

			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-7.135698	0.0000
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: Constant				
Bandwidth: 49 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-10.46945	0.0000
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 49 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-11.61924	0.0000
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	
*MacKinnon (1996) one-sided p-values.				

ADF test for Inflation in levels

Null Hypothesis: LNINFL has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.038908	0.2655
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	

Null Hypothesis: LNINFL has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.239812	0.6502
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	
	10% level		-2.597905	

Null Hypothesis: LNINFL has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.107608	0.5292
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.506206	0.0000
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.534585	0.0000
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.467635	0.0002
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	

Phillip Perron test for inflation in levels

Null Hypothesis: LNINFL has a unit root				
---	--	--	--	--

Exogenous: None				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-1.014216	0.2751
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	

Null Hypothesis: LNINFL has a unit root				
Exogenous: Constant				
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-1.738054	0.4065
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	
	10% level		-2.597905	

Null Hypothesis: LNINFL has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-2.669221	0.2533
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	

PP test for inflation at first differences

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: None				
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-5.543476	0.0000
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	
*MacKinnon (1996) one-sided p-values.				

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: Constant				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-5.524722	0.0000
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	

Null Hypothesis: D(LNINFL) has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-5.458678	0.0002
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	

ADF test for m2 levels

Null Hypothesis: LNM2 has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			3.346307	0.9997
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	

Null Hypothesis: LNM2 has a unit root				
Exogenous: Constant				
Lag Length: 8 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.760993	0.8199
Test critical values:	1% level		-3.592462	
	5% level		-2.931404	
	10% level		-2.603944	

Null Hypothesis: LNM2 has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.620929	0.0378
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	

ADF test for m2 first differences

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: None				
Lag Length: 3 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.864862	0.0000
Test critical values:	1% level		-2.615093	
	5% level		-1.947975	
	10% level		-1.612408	

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: Constant				
Lag Length: 7 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.014584	0.0002
Test critical values:	1% level		-3.592462	
	5% level		-2.931404	
	10% level		-2.603944	

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 7 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.010375	0.0011
Test critical values:	1% level		-4.186481	
	5% level		-3.518090	
	10% level		-3.189732	

PP test for M2 in levels

Null Hypothesis: LNM2 has a unit root				
Exogenous: None				
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			3.346307	0.9997
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	

Null Hypothesis: LNM2 has a unit root				
Exogenous: Constant				
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-2.690324	0.0827
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	
	10% level		-2.597905	

Null Hypothesis: LNM2 has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 24 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-5.501012	0.0002
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	

Phillip Perron for M2 at first differences

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: None				
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-6.030782	0.0000
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: Constant				
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-7.204175	0.0000
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	

Null Hypothesis: D(LNM2) has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-7.507385	0.0000
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	

--	--	--	--	--

ADF test for the repo rate in levels

Null Hypothesis: LNREPO has a unit root				
Exogenous: None				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic				
			-1.522586	0.1187
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	

Null Hypothesis: LNREPO has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic				
			-2.059279	0.2616
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	

Null Hypothesis: LNREPO has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 1 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic				
			-2.296785	0.4278
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	

ADF test for the Repo rate at first differences

Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: None				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.261856	0.0001
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	

Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.494039	0.0007
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	

Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic - based on SIC, maxlag=10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.444101	0.0045
Test critical values:	1% level		-4.152511	
	5% level		-3.502373	
	10% level		-3.180699	

Phillip Perron the repo rate in levels

Null Hypothesis: LNREPO has a unit root				
Exogenous: None				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-1.840123	0.0630
Test critical values:	1% level		-2.611094	
	5% level		-1.947381	
	10% level		-1.612725	

Null Hypothesis: LNREPO has a unit root				
Exogenous: Constant				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-1.307770	0.6192
Test critical values:	1% level		-3.565430	
	5% level		-2.919952	
	10% level		-2.597905	

Null Hypothesis: LNREPO has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-1.569754	0.7911
Test critical values:	1% level		-4.148465	
	5% level		-3.500495	
	10% level		-3.179617	

Phillip Perron test repo rate at first differences

Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: None				
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-4.299497	0.0001
Test critical values:	1% level		-2.612033	
	5% level		-1.947520	
	10% level		-1.612650	

Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: Constant				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-4.491234	0.0007
Test critical values:	1% level		-3.568308	
	5% level		-2.921175	
	10% level		-2.598551	
*MacKinnon (1996) one-sided p-values.				

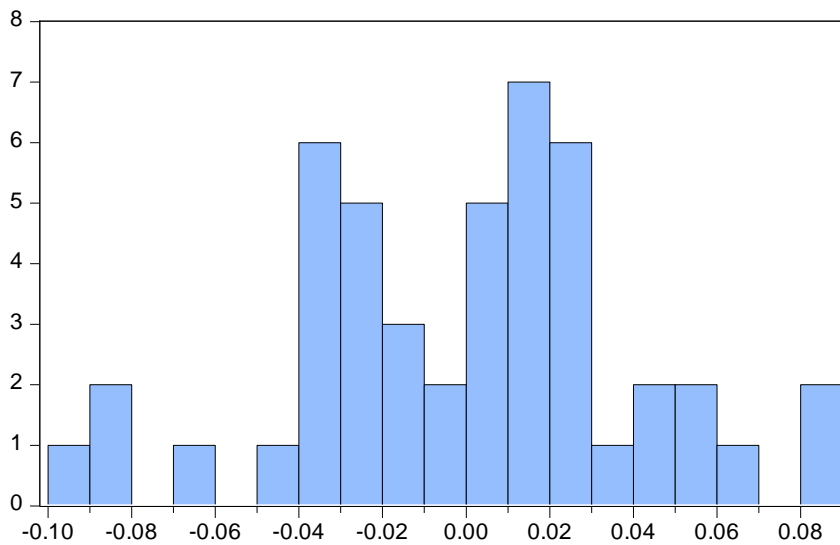
Null Hypothesis: D(LNREPO) has a unit root				
Exogenous: Constant, Linear Trend				
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel				
			Adj. t-Stat	Prob.*
Phillips-Perron test statistic			-4.441188	0.0045
Test critical values:	1% level		-4.152511	

	5% level		-3.502373	
	10% level		-3.180699	

APPENDIX 2: NORMALITY TEST

Ramsey Reset Test

Ramsey RESET Test			
Equation: UNTITLED			
Specification: DLNGDP C LNGDP(-1) LNINFL(-1) LNM2(-1) LNREPO(-1)			
DLNGDP(-1) DLNGDP(-2) DLNGDP(-3) DLNGDP(-4) DLNINFL			
DLNM2 DLNREPO DLNINFL(-1) DLNREPO(-1)			
Omitted Variables: Powers of fitted values from 2 to 3			
	Value	df	Probability
F-statistic	1.558114	(2, 31)	0.2266
Likelihood ratio	4.501941	2	0.1053



Series: Residuals	
Sample 2009Q2 2020Q4	
Observations 47	
Mean	8.96e-17
Median	0.006824
Maximum	0.088866
Minimum	-0.091648
Std. Dev.	0.040421
Skewness	-0.136120
Kurtosis	2.959406
Jarque-Bera	0.148367
Probability	0.928501

APPENDIX 3: AUTOCORRELATION AND HETEROSKEDASTICITY TEST

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.073444	Prob. F(2,31)	0.9293
Obs*R-squared	0.221650	Prob. Chi-Square(2)	0.8951

--	--	--	--	--

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.957199	Prob. F(13,33)	0.0059
Obs*R-squared	25.29056	Prob. Chi-Square(13)	0.0211
Scaled explained SS	12.21476	Prob. Chi-Square(13)	0.5101

APPENDIX 4: SPECIFICATION OF UECM

Dependent Variable: DLNGDP				
Method: Least Squares				
Date: 03/05/22 Time: 23:37				
Sample (adjusted): 2009Q2 2020Q4				
Included observations: 47 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.451874	0.638910	0.707258	0.4842
LNGDP(-1)	0.047097	0.196258	0.239977	0.8118
LNINFL(-1)	0.048392	0.028508	1.697482	0.0987
LNLM2(-1)	-0.066052	0.216499	-0.305093	0.7622
LNREPO(-1)	-0.131384	0.109814	-1.196427	0.2398
DLNGDP(-1)	-0.367261	0.255174	-1.439255	0.1592
DLNGDP(-2)	-0.276522	0.205393	-1.346302	0.1871
DLNGDP(-3)	-0.425668	0.189127	-2.250702	0.0310
DLNGDP(-4)	0.148640	0.184554	0.805399	0.4262
DLNINFL(-1)	-0.018065	0.044335	-0.407463	0.6862
DLNM2	0.167756	0.300093	0.559013	0.5798
DLNREPO	0.191650	0.150864	1.270356	0.2126
DLNREPO(-1)	0.058439	0.149321	0.391368	0.6980
R-squared	0.428852	Mean dependent var		0.019021
Adjusted R-squared	0.227270	S.D. dependent var		0.054530
S.E. of regression	0.047935	Akaike info criterion		-
				3.008535
Sum squared resid	0.078124	Schwarz criterion		-
				2.496792
Log likelihood	83.70057	Hannan-Quinn criter.		-
				2.815962
F-statistic	2.127432	Durbin-Watson stat		2.059499
Prob(F-statistic)	0.041885			

APPENDIX 5: SHORT RUN MODEL

Dependent Variable: DLNGDP
 Method: Least Squares
 Date: 03/11/22 Time: 17:52
 Sample (adjusted): 2008Q2 2020Q4
 Included observations: 51 after adjustments

Variable	Coefficient	t	Std. Error	t-Statistic	Prob.
C	0.024029	0.226131	0.106262	0.9158	
DLNINFL	-0.029741	0.039349	-0.755811	0.4535	
LNLM2	-0.000339	0.020246	-0.016720	0.9867	
DLNREPO	0.226172	0.113395	1.994547	0.0519	
R-squared					0.084755
Adjusted R-squared					0.05413
S.E. of regression					0.053421
Sum squared resid					0.134131
Log likelihood					79.12369
F-statistic					1.450789
Prob(F-statistic)					0.240057
Mean dependent var					0.01629
S.D. dependent var					2.94602
Akaike info criterion					2.79451
Schwarz criterion					2.88812
Hannan-Quinn criter.					2.26277
Durbin-Watson stat					0.9158

APPENDIX 6: BOUNDS TEST USING WALD

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	1.073614	(4, 33)	0.3853
Chi-square	4.294458	4	0.3676

APPENDIX 7 : GRANGER CAUSALITY TEST RESULTS

LNGDP is the dependent variable

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	25.58063	(4, 31)	0.0000
Chi-square	102.3225	4	0.0000

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	2.367714	(4, 31)	0.0743
Chi-square	9.470857	4	0.0503
Null Hypothesis: C(5)=C(6)=C(7)=C(8)=0			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	0.582600	(4, 31)	0.6775
Chi-square	2.330401	4	0.6752
Null Hypothesis: C(9)=C(10)=C(11)=C(12)=0			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	2.945501	(4, 31)	0.0357
Chi-square	11.78200	4	0.0190

Null Hypothesis: $C(13)=C(14)=C(15)=C(16)=0$
--

Inflation is the dependent variable

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	0.493391	(4, 31)	0.7406
Chi-square	1.973563	4	0.7406
Null Hypothesis: $C(18)=C(19)=C(20)=C(21)=0$			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	19.31531	(4, 31)	0.0000
Chi-square	77.26122	4	0.0000
Null Hypothesis: $C(22)=C(23)=C(24)=C(25)=0$			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	0.510590	(4, 31)	0.7283
Chi-square	2.042360	4	0.7280
Null Hypothesis: $C(26)=C(27)=C(28)=C(29)=0$			

Wald Test:			
Equation: Untitled			

Test Statistic	Value	df	Probability
F-statistic	0.230163	(4, 31)	0.9193
Chi-square	0.920652	4	0.9216
Null Hypothesis: C(30)=C(31)=C(32)=C(33)=0			

When the M2 is the dependent variable

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	9.155302	(4, 31)	0.0001
Chi-square	36.62121	4	0.0000
Null Hypothesis: C(35)=C(36)=C(37)=C(38)=0			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	1.116704	(4, 31)	0.3664
Chi-square	4.466817	4	0.3465
Null Hypothesis: C(39)=C(40)=C(41)=C(42)=0			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	5.571449	(4, 31)	0.0017
Chi-square	22.28580	4	0.0002

Null Hypothesis: $C(43)=C(44)=C(45)=C(46)=0$

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	3.932595	(4, 31)	0.0107
Chi-square	15.73038	4	0.0034
Null Hypothesis: $C(47)=C(48)=C(49)=C(50)=0$			

When the repo rate is the dependent variable

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	0.773215	(4, 31)	0.5510
Chi-square	3.092860	4	0.5424
Null Hypothesis: $C(52)=C(53)=C(54)=C(55)=0$			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	1.424168	(4, 31)	0.2493
Chi-square	5.696671	4	0.2230
Null Hypothesis: $C(56)=C(57)=C(58)=C(59)=0$			

Wald Test:			
Equation: Untitled			

Test Statistic	Value	Df	Probability
F-statistic	3.246900	(4, 31)	0.0246
Chi-square	12.98760	4	0.0113
Null Hypothesis: C(60)=C(61)=C(62)=C(63)=0			

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	27.20414	(4, 31)	0.0000
Chi-square	108.8165	4	0.0000

APPENDIX 8: SEEMINGLY UNRELATED REGRESSION OF THE LEVEL VAR MODEL

$$\text{LNGDP} = \text{C}(1)*\text{LNGDP}(-1) + \text{C}(2)*\text{LNGDP}(-2) + \text{C}(3)*\text{LNGDP}(-3) + \text{C}(4)*\text{LNGDP}(-4) + \text{C}(5)*\text{LNINFL}(-1) + \text{C}(6)*\text{LNINFL}(-2) + \text{C}(7)*\text{LNINFL}(-3) + \text{C}(8)*\text{LNINFL}(-4) + \text{C}(9)*\text{LNM2}(-1) + \text{C}(10)*\text{LNM2}(-2) + \text{C}(11)*\text{LNM2}(-3) + \text{C}(12)*\text{LNM2}(-4) + \text{C}(13)*\text{LNREPO}(-1) + \text{C}(14)*\text{LNREPO}(-2) + \text{C}(15)*\text{LNREPO}(-3) + \text{C}(16)*\text{LNREPO}(-4) + \text{C}(17)$$

$$\text{LNINFL} = \text{C}(18)*\text{LNGDP}(-1) + \text{C}(19)*\text{LNGDP}(-2) + \text{C}(20)*\text{LNGDP}(-3) + \text{C}(21)*\text{LNGDP}(-4) + \text{C}(22)*\text{LNINFL}(-1) + \text{C}(23)*\text{LNINFL}(-2) + \text{C}(24)*\text{LNINFL}(-3) + \text{C}(25)*\text{LNINFL}(-4) + \text{C}(26)*\text{LNM2}(-1) + \text{C}(27)*\text{LNM2}(-2) + \text{C}(28)*\text{LNM2}(-3) + \text{C}(29)*\text{LNM2}(-4) + \text{C}(30)*\text{LNREPO}(-1) + \text{C}(31)*\text{LNREPO}(-2) + \text{C}(32)*\text{LNREPO}(-3) + \text{C}(33)*\text{LNREPO}(-4) + \text{C}(34)$$

$$\text{LNM2} = \text{C}(35)*\text{LNGDP}(-1) + \text{C}(36)*\text{LNGDP}(-2) + \text{C}(37)*\text{LNGDP}(-3) + \text{C}(38)*\text{LNGDP}(-4) + \text{C}(39)*\text{LNINFL}(-1) + \text{C}(40)*\text{LNINFL}(-2) + \text{C}(41)*\text{LNINFL}(-3) + \text{C}(42)*\text{LNINFL}(-4) + \text{C}(43)*\text{LNM2}(-1) + \text{C}(44)*\text{LNM2}(-2) + \text{C}(45)*\text{LNM2}(-3) + \text{C}(46)*\text{LNM2}(-4) + \text{C}(47)*\text{LNREPO}(-1) + \text{C}(48)*\text{LNREPO}(-2) + \text{C}(49)*\text{LNREPO}(-3) + \text{C}(50)*\text{LNREPO}(-4) + \text{C}(51)$$

$$\begin{aligned} \text{LNREPO} = & C(52)*\text{LNGDP}(-1) + C(53)*\text{LNGDP}(-2) + C(54)*\text{LNGDP}(-3) + C(55)*\text{LNGDP}(-4) + C(56)*\text{LNINFL}(-1) + \\ & C(57)*\text{LNINFL}(-2) + C(58)*\text{LNINFL}(-3) + C(59)*\text{LNINFL}(-4) + C(60)*\text{LNM2}(-1) + C(61)*\text{LNM2}(-2) + C(62)*\text{LNM2}(- \\ & 3) + C(63)*\text{LNM2}(-4) + C(64)*\text{LNREPO}(-1) + C(65)*\text{LNREPO}(-2) + C(66)*\text{LNREPO}(-3) + C(67)*\text{LNREPO}(-4) + \\ & C(68) \end{aligned}$$