An analysis of monetary policy and its effect on inflation and economic growth in South Africa

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DECLARATION

I, Devan van Wyngaard, declare that:

An analysis of monetary policy and its effect on inflation and economic growth in South Africa

….is my own work with exception to sources and quotations that are recognised by means of complete references. All sources obtained and quoted have been precisely recorded and acknowledged by means of thorough reference, and I have not previously submitted this dissertation to any other institution of higher learning to obtain any form of qualification or degree.

Signature: _____ Date: _____

DEDICATION

This work is dedicated to Simonè, the love of my life and every one of my family members. Each of you have helped make this possible.

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I give thanks to God for providing me with the opportunities and the abilities that has made this possible for me.

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ABSTRACT

Emerging market economies, such as South Africa, frequently struggle to maintain a stable and economically viable inflation rate due to economic factors of a cost-push and structural nature. These factors not only influence inflation within the economy, but also the efficacy of monetary policy in its pursuit of its many goals. The South African economy has thus long been a victim of volatile inflation, low growth and low employment creation, which are all matters that form part of the mandate of monetary policy. This could be because of the indirect measures that have been used by the South African Reserve Bank (SARB) to control both money supply as well as inflation in the economy have become increasingly inefficient over time. Therefore, the primary objective of the study was to analyse the efficiency of monetary policy in South Africa, in terms of reaching its goals as set out by the mandate of the SARB regarding inflation, employment and economic growth and in having done so, investigating the existence of cost-push and structural inflationary factors within the South African economy.

This study examined the effects of official interest rate, broad money supply, the exchange rate, government debt and government revenue on CPI inflation, as well as on the efficiency of monetary policy in reaching its objectives. It thus determines the long- and short-run relationships between the aforementioned variables from 2001 to 2017. The study further establishes the causal direction between the variables under study. Therefore, the study employed various econometric models inclusive of the Autoregressive Distributed Lag (ARDL) model, the standard ARDL bounds test to cointegration, the Error Correction Model and Toda-Yamamoto granger non-causality test. Furthermore, the study made use of a quantitative research design and included time series, macro-economic variables such as gross domestic product, employment, the repo rate, broad money supply, the nominal effective exchange rate, government debt, government revenue and consumer price inflation, quarterly from 2001 to 2017. These variables were used in two separate econometric models, one of which had consumer price inflation as its dependent variable, with all other variables as independent. The other combined gross domestic product, employment, consumer price inflation to create the Monetary Policy Success Index or MPSI.

By employing the unit root and stationarity tests, the study found that all the variables under study comprised of variables that are stationary at either I(0) or I(1), with none of the variables stationary at I(2). This allowed the ARDL model to be used, which produced results that indicated that the South African economy is consistent with cost-push and structural inflation, which leads to

inefficiency in the achievement of the objectives of monetary policy as it takes roughly 5.34 quarters for changes in monetary policy to affect the economy. Both long- and short-run relationships exist between independent and dependent variables. The study further performed the Toda-Yamamoto Granger non-causality test and found that variables such as government revenue and government debt have a short-run impact on consumer price inflation, supporting the existence of structural and cost-push inflation in the South African economy. Equally as important, the results of the residual and stability diagnostic tests, which were performed on both models of the study proved that the study models are normally distributed, none are serially correlated nor heteroscedastic and are both stable. This, in turn, ensured that the results of the study are not inaccurate or misleading.

Keywords: Broad money supply, consumer price inflation, cost-push, employment, government debt, government revenue, gross domestic product, monetary policy, nominal effective exchange rate, repo rate, structural.

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LIST OF ABBREVIATIONS

ADF	:	Augmented Dickey-Fuller
AIC	:	Akaike Information Criterion
ARDL	:	Autoregressive Distributed Lag
ARMA	:	Autoregressive Moving Averages
BLUE	:	Best Linear Unbiased Estimator
BoP	:	Balance of Payments
CPI	:	Consumer Price Inflation
CRDW	:	Cointegration Regression Durbin-Watson
CUSUM	:	Cumulative sum of recursive residuals
CUSUMQ	:	(CUSUM) and the cumulative sum of squares residuals
ECM	:	Error Correction Model
EU	:	European Union
ECT	:	Error Correction Term
FOMC	:	Federal Open Market Committee
GDP	:	Gross Domestic Product
ILO	:	International Labour Organisation
IMF	:	International Monetary Fund
KPSS	:	Kwiatkowski-Phillips-Schmidt-Shin
MPC	:	Monetary Policy Committee
NKPC	:	New Keynesian Phillips Curve
OECD	:	Organization for Economic Co-Operation and Development
SA	:	South Africa
SARB	:	South African Reserve Bank
SAMI	:	South African Market Insights
SSDS	:	Supplementary Special Deposits Scheme

STATSSA	:	Statistics South Africa
VAR	:	Vector Auto Regression
VAT	:	Value-added Tax

CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Monetary policy has become a controversial economic matter in South Africa (Davis, 2017:3). As such, high interest rates, volatile inflation, low growth and low employment creation have been some of the most pressing economic concerns for a number of years and these are all matters of which form part of the mandate of monetary policy (Mills, 2016:4). According to Matemilola, Bany-Ariffin and Muhtar (2015:54), the indirect measures that are used by the South African Reserve Bank (SARB) to control both money supply as well as inflation within the economy have become increasingly inefficient over time. These inefficiencies could be due to increased factors of a cost-push as well as the structural inflationary nature in the South African economy (Davis, 2017:3).

The monetary authority pursues price stability in the interest of achieving sustainable economic growth and an environment favourable for employment creation (SARB, 2017a). According to Friedman (1968:15), of all the goals of monetary policy, price levels are the most important and would be the best to obtain monetary and economic growth, *ceteris paribus*. However, the link between policy interactions of the monetary authority and inflation, while undoubtedly crucial, is more indirect than many of monetary policies' other available tools due to influences on inflation outside of the monetary control (Matemilola *et al*., 2015:51).

Inflation can be defined as the continual and significant rise in general price levels over time (Mohr & Fourie, 2011:495). The Consumer Price Index (CPI) is the main variable used to measure real inflation in the South African economy; however, numerous factors exist that influence the country's inflation. According to Statistics South Africa (Stats SA, 2017:2), the CPI is calculated on a monthly basis by means of a representative basket of consumer goods and services, currently containing 412 products and services on which South African households spend most of their monthly income. Inflation should be controlled based on a target range that is quantifiably acceptable in terms of what an economy requires to achieve sustainable levels of growth (Mills, 2016:2).

The South African monetary policy has set the local targeting framework for inflation to between 3 and 6 percent, based on what the SARB believes is necessary to drive economic growth and

minimise the risk of hyperinflation (Mohr & Fourie, 2011:503). This is contrary to the norm within developed economies, which have generally adopted a targeting framework of approximately two percent inflation. However, most emerging economies experience structural factors that influence inflation, economic susceptibility to exogenous shocks, as well as price setting, which require higher inflation targets to prevent deflation as well as the low inflation trap. The low inflation trap exists when a country's inflation rate continually approaches zero percent. These countries thus need effective economic policy to mitigate such factors and to minimise the risks to their economies (Du Plessis, 2015:7).

Economic policy explains the correlation between economic variables and is the act of addressing economic phenomena, thus monetary policy must be efficiently implemented to effectively control inflation, increase employment and improve economic growth (Tinbergen, 1952:2). Monetary policy consists of two major components, namely qualitative and quantitative policy (Fand, 1969:571). Qualitative policy entails changes of qualitative aspects within the economic structure, for instance monopolistic behaviour within certain industries, whereas quantitative policy deals with the parameters and instruments, which exist within the qualitative framework of the economy (Mellet, 2012:2).

Gali (2015:52) states that changes in the official interest rate influence the value of assets, the expected returns from financial assets as well as the consumption and investment decisions of households, firms and foreign investors within a country's economy and can thus be seen as a quantitative policy action by monetary authorities (Matemilola *et al*., 2015:54). According to Woodford (2003:16), central banks should follow the Taylor rule when attempting to stabilise inflation using interest rates, by raising the interest rate instrument to a one-to-one level with increases in the inflation rate. For monetary policy to be effective, it is crucial that changes in the official interest rate are transmitted efficiently to financial markets, in such a magnitude that aggregate demand is affected to the desired extent (Aziakpono & Wilson, 2015:68).

The current monetary policy system in South Africa came into existence in 1979 onwards, when the De Kock Commission prompted the adoption of market-oriented mechanisms over the previously favoured direct controls (Akiboande, Siebrits & Wamback Niedemeier, 2004:7). This system attempts to control monetary aggregates or money circulation within the economy by influencing demand for money and credit through interest rates. The mechanisms all form part of the monetary policy, which is controlled by the SARB and entails the regulation of money supply

and interest rates in South Africa. In doing so, the SARB aims to achieve a stable pricing system, full employment and as a result, economic growth (SARB, 2017a).

There are multiple instruments used to implement monetary policy, which contradict the direct measures that were used historically (Taylor, 2015:3). Modern instruments seek to inspire financial institutions to conduct themselves in such a way that it promotes the goals of monetary policy, also known as moral suasion (SARB, 2017a). However, the South African economy may need a different approach to assist in regulating price level fluctuations and maintaining inclusive economic growth. This could be due to an influx of cost-push and structural inflationary factors into the South African economy (Matemilola *et al.*, 2015:51).

The main elements that induce cost-push and structural inflation into the economy include increased wages brought on by labour union power as well as strikes, increased costs of production inputs such as raw materials, electricity and oil and the effects of imported supply of goods into South Africa (Van der Merwe, Mollentze, Leshoro, Rossouw & Vermeulen, 2010:24). In most cases, these factors occur within economies that are subjected to circumstances such as high direct and indirect taxes to increase government revenue or finance government debt, strict labour regulations, volatile exchange rates and high import costs of resources as well as final goods (Matemilola *et al.*, 2015:52). Furthermore, the existence of monopoly power in industries with inelastic demand could contribute to cost-push inflation. This occurs due to demand remaining unchanged as prices increase in certain industries such as electricity and fuel production (Barth & Bennet, 1975:393).

On the other hand, demand-pull inflation exists when the total aggregate demand in an economy exceeds the output that economy can produce. It is thus caused by increased expenditure by households and government, a rise in investment from both local and foreign sources, as well as increased exports (Du Plessis & Rietfeld, 2013:9). Research indicates that post the 2008 financial crisis, most developing countries had been experiencing inflation caused by structural factors and of a cost-push nature rather than demand-pull inflation (Mellet, 2012:147). This led to the ineffectiveness of traditional methods of inflation control such as alterations in interest rates due to other influencing factors such as capital volatility, exchange rate volatility, increased unemployment levels, destabilised capital balances, inefficient policy and, most significantly, rising costs to producers and consumers. Policy makers in these countries, such as the SARBs Monetary Policy Committee (MPC), are tasked with addressing these factors by means of a new mix of monetary policies and targets (Mellet, 2012:162).

This is especially true after the 2008 global financial crisis, which saw spill-overs and heightened capital flows into most economies cause monetary authorities to turn to unconventional monetary tools and new policy frameworks to return their respective economies, subsequently, to financial stability (Hakan-Kara, 2013:51). The International Monetary Fund (IMF) state that to reduce the impact of negative spill-overs, such as policy actions by countries that affect South Africa, monetary policies and theories should be rethought (Strauss-Kahn, 2011:2). Subsequent to international economic regulations, South Africa continually faced challenges in regaining economic and financial stability after the crisis. This led, in part, to South Africa facing a long-term foreign currency sovereign credit downgrade to sub-investment level or rather 'junk status' by both Standard & Poor as well as Fitch. The rationale behind this was the country's long-term insubstantial economic growth, unsustainably high levels of unemployment and ever-increasing political instability under former president Jacob Zuma (Curson, 2017:2).

According to Gadanecz and Jayaram (2009:3), when real economic indicators, as well as indicators from the financial sector, microeconomic sector and the external sector, all trend toward levels that are undesirable for a country's economy, the likelihood of an economy to be seen as financially unstable increases significantly. This has been the case in South Africa. All of these factors have led to widespread controversy regarding the efficiency of the current monetary policy (Mellet, 2012:3).

Earlier in 2018, South Africa was further placed in an undesirable position by fiscal policy as new minimum wage policies and high income taxes as well as increased value-added tax, all implemented from April 2018, possibly contributed to further increased inflation and decreased employment creation. It is thus important that South Africa has a sound and vigilant monetary policy with the aptitude to forecast and endure disturbances and shocks, both from internal as well as external market forces (World Bank, 2017a:1).

According to Mellet (2012:162), monetary policy alone may not be sufficient in the control of price stability and achievement of a financially sound economic backdrop in South Africa, as a coordinated strategy between the monetary authority and government policy makers may be necessary in the form of a more structuralised approach. However, the probability of such an approach in South Africa is slim, based on imprudent government behaviour in the past.

Based on the above discourse, the study is aimed at further analysing the efficiency of the current monetary policy characteristics in an attempt to determine the extent to which the monetary

authority is able to achieve a stable financial environment within the South African economy. For the purpose of this study, the consumer price index, gross domestic product (GDP) and employment level of South Africa underline the considered factors that constitute the successful implementation of monetary policy in the South African economy.

1.2 PROBLEM STATEMENT

South Africa has been experiencing low economic growth and high levels of unemployment, reaching 27.7 percent of the employable population in 2017, under the strict definition of unemployment (which excludes individuals who are not actively seeking employment) (Stats SA, 2018:1). This, along with a volatile exchange rate and inflation rate, as well as severe political instability led to two sovereign credit downgrades of the South African economy in March of 2017 to sub-investment level or 'junk status'.

This downgrade has contributed to increased economic uncertainty and led to the questioning of the current monetary policy in South Africa and whether the monetary authority should turn to a different approach such as growth targeting (Naik, Hirsch & Rossouw, 2017:2). In February of 2017 the former minister of finance announced the introduction of new tax levies on sugar products as well as increased income tax levels and a new top-income tax bracket of 45 percent annual income tax for individuals earning R1.5 million per annum or more (National Treasury, 2017:43).

This was followed by another tax announcement in February of 2018 by former Finance Minister, Malusi Gigaba, stating the increase of value added tax (VAT) from 14 to 15 percent, the first VAT increase in South Africa in 25 years (National Treasury, 2018:41). All the above increases were to be implemented from 1 April this year. Another announcement that caused some degree of economic uncertainty was the new standardised national minimum wage of R3 500 per month (Cronje, 2017). According to Javed *et al*. (2010), the aforementioned fiscal disturbances to an economy could potentially lead to increased cost-push inflation in an economy.

The national minimum wage could also very likely cause firms within the South African economy to decrease employment opportunities or further increase prices of final goods and services (Abowd *et al.*, 1999:5). Due to increased prices following the VAT increase, as well as other taxes such as sugar tax, which is to be levied on consumer products such as soft drinks and "sin tax" increased levies on tobacco and alcoholic products could decrease consumer demand and thus effect economic growth negatively (Dijkstra, 2013:32).

As previously stated, these economic indicators, which include inflation, employment creation and economic growth, all form part of the mandate of the SARB and could lead to inefficiencies of monetary policy as its current state (Mellet, 2012:160). Adusei (2013:68) showed that South African inflation is both a monetary as well as a structural phenomenon, but is mainly influenced by external factors, GDP and the size of local government. This means that changes in prices of imports, conditions in international countries, growth of the local economy and the expenditure patterns of local government are the main factors impacting inflation in South Africa.

This, in turn, suggests that continuous increases are not controlled by changes in interest rates or money supply in the local economy. Another significant structural determinant of inflation in South Africa has proven to be the cost of labour (Akinboande *et al.*, 2004:42). This indicates yet another influencing factor not accounted for in the monetary system for controlling inflation. According to Myrdal and Streeten (as cited by Sen, 2016), the structural theory of inflation should be used as an approach to inflation in emerging market economies.

The latter study further concluded that it would not be successful to implement aggregative demand-supply models to explain inflation in these countries. Structuralist theorists argue that numerous structural imbalances exist in emerging or developing economies, supporting these findings (Gali, 2015). These include supply shortages in some sectors and an under-utilisation of resources and surplus demand in others, thus making the aggregate demand-supply model of inflation unsuitable for these countries (Sen, 2016).

Fedderke and Schaling (2005) prove that the South African economy is consistent with the cost-push view of inflation, having significant implications on policy and the measures required to control inflation in the country. This study seeks to determine the short- and long-run relationships between the determined variables to determine the efficiency of monetary policy and its effect on the South African economy as a whole. In doing so, the study also aims to create an in-depth understanding and contribution to monetary policy establishments, as well as the academic environment regarding the considered study objectives.

1.3 OBJECTIVES OF THE STUDY

The following objectives have been identified and outlined for the study.

1.3.1 Primary objective

The primary objective of the study is to analyse the efficiency of monetary policy in South Africa, in terms of reaching its goals as set out by the mandate of the SARB regarding inflation, employment and economic growth and in doing so, investigating the existence of cost-push and structural inflationary factors within the South African economy.

1.3.2 Theoretical objectives

In order to achieve the primary objective, various theoretical objectives are formulated for the study:

- To provide definitions, concepts and approaches as well as a comprehensive theoretical background relating to economic growth, inflation, interest rates, employment growth, money supply, exchange rates, imported commodities and government revenue
- To establish theoretical understanding of monetary policy and its mandate
- To discuss monetary policy in developing as well as developed countries
- To provide an empirical review on studies on monetary policy as well as the variables under consideration
- To identify which type of inflation exists within the South African economy and the consequences thereof on the efficiency of monetary policy.

1.3.3 Empirical objectives

In accordance with the primary objective, the following empirical objectives are formulated:

- To determine the trends of South Africa's GDP, employment rate, consumer price inflation rate and interest rates.
- To determine the possible failures of monetary policy in terms of the South African status quo and how to improve such policy by means of foreign monetary policy theory.

- To construct a composite index, which includes GDP, employment rate and CPI as a measure of monetary policy efficiency or success in South Africa, named the Monetary Policy Success Index (MPSI).
- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, government debt and government revenue with CPI inflation.
- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, government debt and government revenue with the MPSI.
- To provide policy recommendations to the SARB based on the findings of this study.

1.4 RESEARCH DESIGN AND METHODOLOGY

This investigation is comprised of an empirical study and a literature review based on the foundations of quantitative research by means of secondary data. The data being utilised are collected from the SARB and Statistics South Africa (Stats SA).

1.4.1 Literature review

The literature review and theoretical background of this study were conducted and compiled by accessing books, journal articles, theses and other relevant sources to explain the significance of successful monetary policy in the South African economy, as well as other factors relevant to the analysis within this study.

1.4.2 Data and sample period

The study focusses on the South African economy and encompasses a collection of data of the country's GDP, consumer price inflation, employment, repurchase rate, broad money supply, exchange rate, government debt and government revenue. The data collected for this study are based on a time period of 68 observations ranging from the first quarter of 2001 to the fourth quarter of 2017, as this will account for the onset of the inflation-targeting framework by the SARB. The empirical study focusses on analysing the effectiveness of monetary policy in terms of the monetary policy's mandate of sustained economic growth, stable employment and prices.

1.4.3 Statistical analysis

In order to attain the set objectives regarding the variables in the study, an econometric analysis was conducted by making use of the econometric software E-views 9. This included the estimation of the augmented Dickey-Fuller (ADF) unit root test to ensure the stationarity of the variables in the model. This was followed by the analysis of descriptive statistics of variables, correlation analysis and the analysis of long-run relationships between dependent and independent variables by means of the auto regressive distributed lag (ARDL) bounds test for co-integration. The Aikake criterion was used to determine the most efficient lag structure for the model. A corresponding error correction model (ECM) was estimated to determine the variables speed of re-adjustment toward equilibrium, as well as the Vector auto regression (VAR) to study the short-run relationship between variables. The Toda-Yamamoto Granger non-causality test was employed to analyse the causal relationship and direction of the variables. Lastly, to ensure the robustness and validity of the results from the study generated by the ARDL model, a number of residual and stability diagnostic tests were performed on each estimated model.

1.5 SIGNIFICANCE AND CONTRIBUTION OF THE RESEARCH

The South African economy is faced with high levels of unemployment, volatile inflation and low to negative economic growth. With high levels of fiscal uncertainty, it is necessary to acquire updated knowledge on how monetary policy can improve its contribution to economic growth, employment creation and stable inflation. It is crucial, therefore, to study the subject topic in order to acquire knowledge and provide insight based on the findings of this study.

1.6 CHAPTER CLASSIFICATION

This study comprises the following chapters:

Chapter 1: Introduction and background

This chapter presented an introduction and background to the issues, concepts and definitions, which led to this study. It also presented an outline of the study and included the problem statement, the objectives of the study and the contributions and scope of the research.

Chapter 2: Theoretical and empirical literature review

This chapter reviews theory and the literature specific to the concerns of this study. It details and analyses theoretical prepositions on the relationships and correlations between the set variables of this study, as well as the effects on the economy.

Chapter 3: Monetary policy implementation and trend analysis

This chapter conducts a trend analysis of the set macroeconomic variables within the period of the study, using various models to achieve the set empirical objectives. It analyses monetary policy systems used by developed countries, developing countries, African countries as well as that of South Africa and makes use of descriptive tools such as graphs and tables in terms of CPI, GDP and employment respectively.

Chapter 4: Research design and methodology

This chapter presents the research design and modelling method used in this study. Due to notable macroeconomic fluctuations within the set variables in terms of the chosen sample period of 2001 to 2017 in South Africa, a suitable modelling layout was provided to account for possible distortions and variable dynamics.

Chapter 5: Empirical estimation and discussion of results

This chapter presents the results and findings as well as discussions regarding the empirical analysis of this study in accordance with the basic theories and recent studies.

Chapter 6: Summary, recommendations and conclusion

This chapter summarises the study and concludes on the major findings. In addition, it provides recommendations, ideas and proposals for future research

CHAPTER 2
THEORETICAL AND EMPIRICAL LITERATURE REVIEW

2.1 INTRODUCTION

The field of monetary economics studies the characteristics, circulation and influences that money has within the economy, as well as the effects of monetary relationships on decision-making processes and conduct of economic units (Van der Merwe *et al*., 2010:38). Historically, the factors influencing money were underlined over the interrelationships between nominal aggregates valued at current prices and real aggregates measured at constant prices to reflect volume changes within the economy (Cecchetti, 2006:24). In the 1950s, however, John Maynard Keynes raised issues regarding classical monetary theory as well as general equilibrium analysis, causing monetary economics to become increasingly active (Gali, 2015:8).

After constant high inflation, increased unemployment and debates regarding the monetary responsibility of government following World War II, a somewhat more comprehensive definition of monetary economics was adopted. Consequently, monetary economics became exceedingly integrated with macroeconomics, albeit a separate branch of economics focussed on correlations between real economic and nominal variables. Monetary economics is thus the study of the relationships between nominal interest rates, nominal exchange rates and the supply of money in the economy, as well as the effects thereof on inflation (Dornbusch, 1976:1169).

Monetary policy can be defined as the deliberate steps taken by the monetary authority to alter money supply, credit availability and interest rates in an attempt to influence the demand for money, expenditure patterns, production, income, the exchange rate, inflation as well as the balance of payments (BoP) within the economy (Fourie & Burger, 2009:349). The successful implementation of monetary policy and in-depth understanding of monetary instruments is thus crucial to ensure the well-being of a country's economy as well as its inhabitants (Rose & Marquis, 2006:57).

The main responsibility of monetary policy is to ensure price stability in an attempt to foster economic growth and the achievement of full employment within the economy (SARB, 2017b). However, the link between policy interactions of the monetary authority and inflation, while undoubtedly crucial, is more indirect than many of monetary policies' other available tools due to influences on inflation outside of monetary control (Matemilola *et al*., 2015:51). Monetary policy

in most countries enjoys instrument independence and thus acts in full autonomy when altering money supply and interest rates in pursuit of price stability or stable inflation (Mills, 2016:2).

To the fulfilment of the objectives of this study, this chapter presents a theoretical presentation of theories, definitions and an overview of the empirical literature to assess the success of monetary policy implementation by the SARB. Furthermore, the consumer price index, GDP and employment are considered the major indicators for successful monetary policy. This chapter will thus discuss the various factors that form part of the framework of monetary policy and its implementation in the South African economy, as well as the analysis of the existing literature regarding encompassing components thereof.

2.2 BACKGROUND TO THE STUDY

2.2.1 The financial system

There are a wide range of financial institutions that divide the financial sector in South Africa between the monetary authority and various private financial institutions. These financial institutions include banks, insurers, fund management companies, financial auxiliaries, finance companies and investment schemes (SARB, 2017a). In view of the importance of such institutions and the financial stability of the economy, most countries employ a number of institutions to regulate the functioning of their financial sector. It is thus important to understand the financial systems and markets in which these institutions operate, to ensure the comprehension of how monetary policy influences financial and price stability in the economy (Edey, 2013).

2.2.2 Financial markets

The systems responsible for the channelling of funds between savers and lenders are known as financial markets, making the trading in financial industries more accessible (Cecchetti, 2006:13). Numerous financial markets exist in various categories, such as primary financial markets that deal with new financial instruments such as new security issues by corporations or government, for instance, bonds or shares and secondary financial markets involve the buying and selling of existing securities amongst investors, such as the Johannesburg Stock Exchange (JSE).

The South African economy has efficiently functioning and well-developed financial markets, which allow markets to enjoy high liquidity. This in turn allows assets to be converted into money effortlessly, without the loss of value, other than losses caused by market price movements (Van

Wyk, Botha & Goodspeed, 2012:8). Subsequently, these markets maintain low transaction costs, while providing accurate information regarding market prices to market participants. Such an efficient financial market system eases the process of determining market prices, which then allows resources to be allocated efficiently (Beck, 2006:17).

2.2.3 Financial intermediaries

Financial intermediaries are the institutions that operate within financial markets and transfer funds between ultimate borrowers and ultimate lenders (Financial Intermediaries Association of Southern Africa (FIA), 2018). These ultimate lenders are economic units who are based locally or internationally, save a portion of their current income and extend loans to other economic units. Ultimate borrowers include firms and consumers whom either borrow to finance part of their consumption or for investment purposes (Van Wyk *et al*., 2012:15).

Financial intermediaries undertake the risks that savers are not willing to and provide savers with assets, which they prefer to hold. These assets, thus, are transformed completely, promoting the allocation of funds toward productive resources in an efficient manner, impossible without financial intermediation. Financial intermediaries also greatly reduce transaction costs. This is due to the size of these institutions, which allows for standardisation and economies of scale (Van der Merwe *et al*., 2010:43).

In South Africa, these responsibilities are performed by entities such as the Financial Services Board, which licences and regulates financial institutions other than banks, the National Credit Regulator, the Financial Intelligence Centre and the SARB. The SARB serves as South Africa's central bank and is responsible for the licensing, regulation and supervision of all banks in the country (Allen & Gale, 2004:28). Regulation and supervision of the South African financial sector is largely focussed on maintenance of financial stability of the economy, improvement of consumer protection, circumvention of financial crime and ensuring the appropriateness, accessibility and affordability of financial services within South Africa (Gordhan, 2011).

2.2.4 The central bank

As previously mentioned, the central bank in South Africa is known as the South African Reserve Bank (SARB). The SARB is responsible for monetary policy and exchange rate policy, both integral to the maintenance of financial stability within the South African economy (Fourie & Burger, 2009:349). The SARB is an independent entity and does not form part of government.

However, cooperation and policy alignment between the SARB and fiscal authorities is necessary to implement monetary policy successfully within the South African economy. There are two categories of independence within the SARB. First, goal independence, which refers to the central bank's ability to set and define its own ultimate goals in terms of production, inflation, aggregate demand, income, the exchange rate and the BoP. Secondly, instrument independence, which refers to the SARBs freedom to alter money supply, credit availability and interest rates to assist in achieving its goals (SARB). Furthermore, the SARB also has the responsibility to render services to the government, compilation and processing of statistics and research, regulation and supervision of the South African banking system and provision of its own internal management and control to ensure that the central bank functions at an effective level (South African Reserve Bank Act (90 of 1989)). The operational activities to maintain these controls revolve around the repurchase (repo) rate (Stone, 2003:23).

2.2.5 Financial stability and the role of monetary policy in its maintenance

The monetary policy function of the central bank is the objective to control inflation within the targeted framework, which is broadened in some sense to include some element of business cycle stabilisation (Edey, 2013). Monetary policy should be implemented in favour of financial stability within the economy. Financial stability in a country's economy is achieved when there are little to no fluctuations in the countries growth patterns as well as the maintenance of a low and stable inflation rate. The economy's financial system should be robust in terms of external shocks and resilient to shocks that originate from within the financial system itself. Should a country suffer from recent recessions, high and variable inflation rates, a noticeable change in business cycles as well as frequent financial crises, that country can be considered financially unstable (Wolfson, 1990:340).

Numerous theories have been developed in an attempt to explain the origins of financial instability. The theories mainly originate from one of three types of financial instability, which includes macroeconomic instability, financial fragility and contagion (Hyun-Pyun & An, 2016:233). The most apparent cause of financial crisis stems from macroeconomic instability that stems from factors such as high and variable inflation rates, booms and busts in economic activity, unsustainable fiscal or international positions or an over-valued exchange rate (Uribe, 2003:137).

Banks are unable to hedge their loan portfolios against such macroeconomic risks, which could subsequently lead to instability and destabilisation in these institutions. Economists such as Irving

Fischer recognised vulnerability within banks and that financial fragility arises after a period of economic growth and somewhat euphoric behaviour by economic entities, causing instability when unanticipated shocks occur (Fisher, 1933:340).

The second source of financial instability stems from domestic financial fragility, which is brought on by factors such as political interference in financial institutions, excessive borrowing, ineffective bankruptcy legislation, weak internal controls of financial institutions or lax supervision and finally, asymmetric information (Mishkin, 1991). The third source of financial instability is known as contagion. Contagion is transmitted from one country or region to another through trade and financial linkages. This affects investor confidence and thus affects capital flows into a country or export prices through lower international demand or lower international prices.

2.2.6 Demand for money and money supply

There are multiple factors in any economy that can influence the demand for money, including interest rates, consumer spending patterns, inflation, transaction costs and exchange rates, among other variables (Van der Merwe *et al*. 2010:78). For the purpose of this study however, focus is placed on the effects that money supply has on the economy. Money supply in the economy is mainly determined by four sources, namely the central bank that increases money supply by means of printing banknotes and minting coins. This "new money" is then used in transactions with other sectors of the economy or by increasing credit to commercial banks (Stone & Bhundia. 2004:6).

The second source stems from the increase of credit by commercial banks to the non-bank private sector or government. Thirdly, the government spends the funds that it generates through taxes and loans, which again increases money supply in the economy and finally, the increased demand for money from the private sector (Mohr & Fourie, 2015:272). The central bank then implements policy in an attempt to control money supply in the economy, and makes use of one of two theoretical approaches to the determination thereof. These are the money-supply-multiplier approach and the flow-of-funds approach. The difference in emphasis depends predominantly on whether the central bank of an economy attempts to control the quantity of money or to make use of interest rates as an operational variable (Van der Merwe *et al*. 2010:46).

2.3 THE FRAMEWORK FOR MONETARY POLICY: CONCEPTS AND DEFINITIONS

2.3.1 Monetary policy and its ultimate goal

As monetary policy forms part of the overall economic policy in any country, it is concerned with the general welfare of the population and must contribute to the financial and overall wellbeing of a nation (Adusei, 2013:60). Monetary policy must thus provide detailed specifications in terms of the contributions it makes to the nation's wellbeing. This means that the goals of monetary policy must be provided numerally, clearly indicating what the monetary author wishes to achieve in terms of its policy target. A monetary policy philosophy, as well as clear instruments to achieve policy goals, should also be part of the specifications under monetary policy.

In accordance with the economic needs and structure of a country, the monetary authority must also decide on which monetary policy regime should be applied to best pursue its goals or objectives (Bain & Howells, 2003:68). Further decisions must be made regarding the use of either instrument rules or indicators, or whether the monetary authority will utilise both in terms of the operational variable of monetary policy. This also includes the decision of whether tools or operational procedures will be applied by the monetary authority. Finally, policy makers must agree on which institutional arrangements the central bank will operate in terms of autonomy, accountability and transparency in the economy (Coiran, 2014:393).

The target of monetary policy functions under the constraints of the "expectations augmented Phillips curve", which is the restriction under which target inflation has to be minimised as this constrains the choices of monetary policy makers in terms of target inflation rates and target unemployment rates (De Waal & Van Eyden, 2014:118). The objective of monetary policy is based on the view that this Phillips curve is vertical in the long run. Thus, policy makers need not decide the opportunity cost between price stability and economic growth or employment, or vice versa. No value can be added by increasing inflation over the long run as high inflation can impair economic growth, employment creation and equitable income distribution in an economy. This means that monetary policy is thus not able to influence real economic variables in the long run. Consequently, due to monetary policy's short-run effects, the ultimate goal of monetary policy is stabilising the economy (Adusei, 2013:60).

2.3.2 Rules versus discretion in monetary policy

Discretion in monetary policy exists when the monetary authority has freedom of choice regarding its actions and can act based on its own judgement (Chickeke, 2009:38). Conversely, according to Van der Merwe *et al.* (2010:218), a rule-based policy regime will consist of a target for a single intermediate variable, which would be revised on at least an annual basis and the operational variable of the monetary authority or central bank would be adjusted, primarily to achieve the targeted value of the intermediate variable. In terms of a discretion-based regime, one or more of these characteristics would be absent.

The rule-based regime would thus exercise control over the monetary authority in order to restrict its actions. Such rules directly limit the actions of the monetary authority and disallow the employment of judgement. In the South African context, the SARB has had to adopt policy measures that pursue zero percent inflation average over the long run, small variations in the short run and a stabilising effect on fluctuations in real output and employment during business cycles in the economy in a rule-based policy system. As mentioned previously, such a policy system requires certain instruments or operational variables in a framework to pursue the goals set out by monetary policy (Chickeke, 2009:39).

2.3.3 Monetary policy regimes

The choice of monetary policy regime must be based on what is most appropriate for a country's needs and in many cases is determined by the central bank act, the economic structure, as well as the financial system of the country. The regimes that monetary policy can use consist of exchange rates and monetary aggregates and can differ, should the final target of monetary policy system also be its nominal anchor. These include inflation-targeting and targeting economic growth in nominal GDP of the economy (Stone & Bhundia, 2004:4).

2.3.4 Exchange rate targeting

Although the exchange rate targeting system is not as popular as it once was, some countries still implement such a monetary policy regime. According to Stone and Bhundia (2004:5), two broad categories of countries exist that employ this regime, namely those without an independent currency or those with an exchange rate peg as their nominal anchor. Countries without independent currencies have arrangements with no separate legal tender or they have established a currency board. Another approach is that of 'dollarisation', where nations allow another currency

to serve as domestic legal tender and does not only consist of the United States dollar. However, some countries that have employed this have had to surrender monetary policy control over to the nation whose currency is used, as in the case of Zimbabwe (Sikwila, 2016:401).

2.3.5 Monetary targeting

Monetary targeting is based on the principle of monetarists that money supply should be increased at a steady rate to accommodate the potential growth rate of real GDP and to maintain low inflation (Stone & Bhundia. 2004:6). The main benefit of a monetary targeting regime is that, contrary to exchange rate targeting, the monetary authority can adjust monetary policy based on domestic economic circumstances. Monetary policy autonomy can be obtained accordingly, allowing the monetary authority to act independently to external and domestic shocks to the economy and financial system of a country. Furthermore, signals to the central banks' monetary policy are indicated clearly by the targets that are set on an annual basis (SARB, 2017b).

This regime was found to improve on the exchange rate targeting system due to the accountability of the central banks under monetary targeting, as it is a clearly rule-based system. However, the late 1980s saw the large-scale abandonment of monetary targeting due to two reasons. The first reason being that central banks experienced difficulties in controlling money supply. Money supply is determined endogenously, with the short-term interest rate used as operational variable, it was costly to adjust interest rates in order to control money supply. The second reason was that income velocity had become unstable, weakening the relationship between the monetary target and ultimate objective (Stone & Bhundai, 2004:7).

2.3.6 Employment targeting

Employment targeting would combine a nexus between inflation stabilisation and the implementation of policies focussed on the main concerns regarding employment growth. Such policies include the development of human capital and financial resources to ensure inclusive economic growth (Epstein, 2008:245). The success of such a policy requires the monetary authority to set interest rate targets to such a level that would induce overall real growth consistent with the plan with the set employment target as its foundation. This will then further entail the monetary authorities' management of credit allocation programs, which will require the central bank to work alongside financial institutions to provide and allocate credit to an extent that is effective in generating employment-creating activity within the economy. Furthermore, efficient management of the capital account is required to sustain appropriate exchange rate stability to

implement the program, as well as further macroeconomic stabilising policies to ensure that employment, inflation and economic growth are stable (Chickeke, 2009:41).

2.3.7 Inflation targeting

The basis for the concept of inflation targeting can be traced back to Wicksell (1898:14), who argued that price levels should be kept constant. This idea was first applied in the 1930's by Sweden to prevent price fluctuations as a result of the Great Depression. The modern approach to inflation targeting was initially applied by New Zealand from 1989, in an attempt to prevent sharp rises in price levels. By the early 2000s, inflation targeting had become the main monetary policy regime worldwide.

According to Van der Merwe *et al*. (2010:189), there is no universal definition for inflation targeting that is accepted by all economists. However, the substance of the various definitions does not greatly vary. Bernanke, Laubach, Mishkin and Posen (1999:4), provide the leading definition for the concept of inflation targeting and state that inflation targeting is, "a framework for monetary policy characterized by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-term good".

Svensson (1999:608) states that inflation targeting is based on three characteristics, which includes an explicit numerical inflation target that is pursued in the medium-run. However, in doing so, instability of the inflation rate is avoided. Secondly, in practice, the decision framework is 'inflation forecast-targeting' as the effects of lags on the instruments used to control inflation is inevitable. Finally, communication must be clear and concise, along with policy decisions that are motivated by published forecasts regarding inflation and output. This definition emphasises forecasts and the forward-looking approach to inflation targeting, more so than that of Bernanke *et al.* (1999:4).

The most important characteristic of inflation targeting is the official announcement of the annual numerical target that the monetary authority aims to achieve over a specified period of time. The second characteristic of inflation targeting is in direct contradiction to both monetary- and exchange rate targeting in that the target is not a strict rule. The monetary authority is afforded flexibility in achieving and maintaining the target through various instrument movements. Finally, inflation targeting is also characterised by stringent transparency and accountability. Although this also forms part of other regimes, it is crucial for inflation targeting to divulge all necessary

information regarding the monetary authorities' plans and objectives to the public (Geraats, 2002:540).

2.3.7 Theoretical approaches to monetary policy

2.3.7.1 The Taylor rule

The Taylor rule was developed in 1993 by John Taylor as a tool for the description of how the short-term interest rate of the Federal Reserve System was established. This instrument rule is designed specifically for the setting of short-term interest rates to achieve a specified inflation target. The Taylor rule has proven successful in the estimation of historical movements of official interest rates in the United States, the European Union and numerous other large, industrialised economies. However, the rule has not performed as well in the United Kingdom and smaller open economies. This is possibly because the Taylor rule does not take variables such as the exchange rate and foreign interest rates into account (Bain & Howells, 2003:12).

Although South Africa is a small open economy, the SARB has described using the Taylor rule successful in making policy decisions. Although the Taylor rule is clear, simple, easily estimated and provides a good explanation of historical movements of official interest rates, the rule has been criticised for various reasons. The first criticism is that the rule is backward-looking, which has led to the development of several modified rules to estimate forecast values, taking into account lags in the transmission mechanism. Secondly, the rule does not account for exchange rate changes, which is a crucial monetary indicator for small open economies. Thirdly, defining a neutral, real short-term interest rate is challenging and finally, measuring the output gap is difficult (Van der Merwe *et al.*, 2010:199). Some of these difficulties could be solved empirically, however, incorrect decisions regarding the output gap and the neutral rate of interest could cause significant repercussions if policy decisions are based on the Taylor rule.

2.3.7.2 The McCallum rule

Contrary to the Taylor rule, the McCallum rule makes use of the monetary base as an instrument to target nominal GDP (McCallum, 1997:16). This rule requires the monetary authority to set the nominal base in reaction to changes in nominal GDP, the deviation in growth of real GDP from potential growth and the velocity of the monetary base. The McCallum rule enjoys most of the benefits of the Taylor rule and proponents of the rule argue that the monetary base can be

controlled by the monetary authority. It is also argued that the monetary base is highly related to nominal GDP.

2.3.7.3 The New-Keynesian augmented Phillips Curve

The New Keynesian Phillips Curve (NKPC) is currently the cornerstone for inflation targeting and employment for monetary authorities in most countries. This curve explains how past and expected future inflation, along with a real marginal output gap can influence the inflation rate (Taylor, 1979:110). The foundation of the NKPC is that government can decrease the rate of unemployment if it were to accept an increase in the inflation rate. Critics of this theory, however, state that unemployment could very likely increase again in future, leaving inflation at a high rate as well. Thus making the equilibrium rate equal to the non-accelerating inflation rate of unemployment, following from the underpinnings that changes in monetary policy and aggregate demand will drive unemployment and inflation in opposite directions in the short run. Thus, when the short-run trade-off between unemployment and inflation has been noted, a certain level of unemployment, along with a stable inflation rate must occur (Ball & Mankiw, 2002:7).

2.4 THE CONCEPTS OF INFLATION, ECONOMIC GROWTH AND EMPLOYMENT

2.4.1 Inflation

2.4.1.1 Definition and measurement of inflation

Inflation is defined as a continuous rise in general price levels in the economy (Ball, 2007:28). The occurrence of inflation is also categorised into various sub-levels such as moderate inflation, which occurs when prices increase slowly and at a one-digit level annually or galloping inflation, which occurs when inflation rises at double-digit levels on an annual basis. Furthermore, inflation can be categorised as hyperinflation when inflation exceeds 50 percent on a monthly basis within any economy (Fourie & Burger, 2009:285).

On the other hand, when an economy experiences a decline in price levels over time, in other words an opposite occurrence to inflation, it is known as deflation. Deflation on a gradual scale is not a concern, however, when it causes consumers to postpone consumption due to the expectations of lower prices in future, it creates notable challenges for policy makers. Conventional monetary policy also cannot contain chronic deflation, as interest rates cannot be

dropped below zero to stimulate demand in the economy, as this will lead to the public simply holding banknotes (Calvo, 2016:22).

The Consumer Price Index (CPI) is the main variable used to measure real inflation within the South African economy, even though there are various other factors that influence inflation. The rate of change within this index on an annual basis is considered the inflation rate within the economy. Inflation should be controlled within a target range that is quantifiably acceptable in terms of what an economy requires to grow (Mills, 2016:2). This infers that inflation above this framework could lead to hyperinflation, which could drive prices too high.

Conversely, when below the target framework, it could cause deflation, which would cause prices to fall too low to allow growth within the economy (Mohr & Fourie, 2011:503). The SARB has targeted inflation in the South African economy to between 3 and 6 percent. One of the main methods that Stats SA uses to calculate inflation is through determining the monthly CPI by means of a representative basket of consumer goods and services. The basket currently includes 412 products and services that include the products that households spend the most money on (Stats SA, 2017).

2.4.1.2 Types and causes of inflation

It is important to understand the differences between the theories of inflation, namely cost-push and structural inflation stemming from supply of goods and services, as well as demand-pull inflation, in order to analyse the effectiveness of interest rate changes. Adusei (2013:64) explains that cost-push inflation takes place when the cost of production rises, even in periods of resources being underutilised. The main sources of cost-push inflation, as previously stated, include wage push due to labour strikes and labour union power, the rise in costs of raw materials and other production inputs. This also includes profit-driven forces from increased profit margins in industries, thus increasing both production costs and purchasing costs of final goods and services, both from local as well as international sources. Conversely, demand-pull inflation exists when total aggregate demand is higher than the output than can be produced by an economy and is caused by an increase in expenditure by households, government, as well as a rise in investments and exports (Du Plessis & Rietfeld, 2013:9).

2.4.1.3 Inflation and monetary policy

Inflation targeting calls for the SARB to announce an explicit target, which is set at 3 to 6 percent target range in South Africa as previously mentioned and implementing policy to directly achieve this target. Such a targeting framework allows for greater transparency of monetary policy and the target range approach provides a degree of flexibility in absorbing shocks as opposed to a point target (Mellet, 2012:153). This targeting framework allows monetary policy to create a stable financial environment, which contributes indirectly to the attainment of the goals of monetary policy, which includes employment creation and economic growth (Mohr & Fourie, 2015:428).

2.4.2 Economic growth: Definition and measurement of economic growth in a Keynesian model

Economic growth is traditionally defined as the annual growth in production or income within a given economy (Mohr & Fourie, 2015:428). This definition assumes the real measurement of growth in terms of income and production in order to exclude inflation. It also takes into account the population growth as positive economic growth can only occur when the growth in production or income exceeds population growth in the economy. Total real GDP is the measurement of real production in the economy and is measured by means of constant prices, thus not taking into account the effects of inflation on growth (Mellet, 2012:148).

There are multiple factors that contribute to total economic growth including demand factors as well as supply factors within the economy. Supply factors include those that drive growth in the potential production of the economy and consist of natural resources, labour, capital and the level of entrepreneurship in a given economy (Faulkner & Leowald, 2008:7). The demand factors include those that contribute to the total demand for produced goods and services in the economy such as domestic demand.

Domestic demand consists of consumption (C), investment (I) and government spending (G). Demand factors also include export demand (X) and imports (Z). This means that economic growth can be achieved by stimulating growth in domestic demand (C + I + G), increased exports and decreased imports. According to (Todaro & Smith, 2015:233) this is explained by the Keynesian model for aggregate economic growth, which states that aggregate production or income (Y) or aggregate spending (A), which is synonymous with aggregate GDP can be expressed as C + I + G + (X – Z).

2.4.3 Full employment: Definition and role of monetary policy

Full employment exists within an economy when there is no cyclical or deficit-demand unemployment within the economy. However, some level of structural, frictional or voluntary unemployment will occur. Full employment thus does not mean that zero percent unemployment exists, nor that all employable individuals in the economy are looking for work, but is defined as a level of employment under a specified percentage of unemployment in the economy known as the natural rate of unemployment (Dornbusch *et al*., 2014:163). The natural rate of unemployment is subject to structural characteristics of the labour marker, such as the organisation of the labour market in terms of the availability of employment agencies, services for youth employment, the demographic makeup of the labour force in an economy, as well as the desire of individuals to pursue better opportunities (Fourie & Burger, 2009:489).

Monetary policy pursues economic circumstances where full employment in the economy is possible. In doing so, monetary policy must create an environment where economic activity is increased by reducing short- and long-term interest rates. This allows firms and households to borrow at a more affordable rate and thus increases their willingness to purchase goods and services, known as an increased propensity to consume (Keynes, 1961:88).

Production is then increased by firms to accommodate the higher levels of demand, requiring firms to expand their business and hire more workers. As a result of increased employment, the wealth of households increase, which spurs even more spending. This is challenged, however, by various factors in the economy, such as when structural rigidities and imperfections occur within the labour market, causing structural employment. The incidence of structural employment occurs when the employment opportunities presented by the labour market do not match the skills of the labour force in a country, thus excluding parts of the labour force from the operation and benefits provided by the labour market (Dornbusch *et al*., 2014:491).

2.5 THE DEFINITION OF MONEY IN THE SOUTH AFRICAN CONTEXT

In the South African context, four monetary aggregates are measured and published by the SARB. These aggregates are defined as M1(A), which includes banknotes and coins in circulation outside of the monetary sector, including cheque and transmission accounts held in the monetary sector by the domestic non-bank private sector (Nell, 1999:8). M1 equals M1(A) plus all additional demand deposits held by the domestic non-bank private sector with the monetary sector. M2 equals M1 plus short- and medium-term deposits held by the domestic non-bank sector. M3 is the most

comprehensive measure of monetary aggregate and thus money supply in South Africa as it includes M2 as well as long-term deposits by the non-bank private sector with the monetary sector (Nell, 1999:11).

M3 was used as monetary target by the SARB in the 1980s when the monetary authority applied monetary targeting. M3 was favoured as a monetary target due to it being less affected by depositor preferences than the other aggregates. M3 is not directly affected by changes in interest rates, even though these changes affect other aggregates. Regulatory changes may affect the composition of M3 and could at times change its size (Van der Merwe, 1991:12). However, M3 is most favoured due to it being less sensitive to the processes of disintermediation, which is the reduction of funds into the banking system and re-intermediation, which is the process of introducing capital flows back into the banking system (Mohr & Fourie, 2015:272).

2.6 INTEREST RATES

The rates of interest charged to lenders is calculated using the cost of the interest divided by the amount borrowed and mainly expressed as an annual percentage (Dornbusch, Fischer & Startz, 2014:194). Interest in this case is thus the cost of borrowing loanable funds that a country incurs when purchasing goods and services. A distinction can also be made between long- and short-term interest rates. Short-term interest rates being interest rates on financial instruments with a lifetime of less than a year such as money markets and long-term interest rates imposed on securities with a maturity of more than one year (Aziakpono & Wilson, 2015:73).

It is generally agreed amongst economists internationally that the level of interest rates is determined by the demand and supply of loanable funds. Money creation, monetary dishoarding, domestic saving and financial flows from foreign countries determine the supply of domestic loanable funds. The demand for loanable funds, however, is determined by the demand for credit from firms, households and government, as well as the borrowing of foreigners from the domestic market (Matemilola *et al.*, 2015:56)

In South Africa, the repo rate serves as the main interest rate that commercial banks pay to borrow funds from the SARB when these banks experience short-term shortages or a lack of liquidity (Mohr & Fourie, 2015:428). The repo rate is announced by the Governor of the Reserve Bank following each of the MPC quarterly meetings, where the MPC decides on an appropriate repo rate based on information regarding the state of the economy as well as inflation trends, which are provided by the research department of the central bank. When the repo rate is raised, it increases

the cost of borrowing funds for commercial banks, forcing these banks to charge a higher rate of interest to their customers. As lending rates increase, consumers borrow less, which contracts the economy and reduces inflation. The opposite effects occur when the repo rate is lowered (SARB, 2017b).

2.7 EXCHANGE RATES

2.7.1 Definition and concepts of foreign exchange

Most countries prefer to have their own respective currencies, which leads to international transactions being subject to exchange rates. The foreign exchange market is where a county's currency is exchanged for that of another country and is referred to as a system as it consists of a communications network that operates 24 hours a day (Froot & Thaler, 1990:183). An exchange rate is a relative price that specifies the cost of purchasing another currency. The value of exchange rates is determined by the market conditions in a country and is thus subject to harm from various economic and political factors in said country and around the world.

The general definition of exchange rates assumes a nominal nature. Nominal exchange rates imply the actual rates that are charged in any foreign exchange transactions and indicate the value of foreign currency that can be purchased for an amount of domestic currency (Fourie & Burger, 2009:154). Furthermore, real exchange rates show the price comparisons of commodities between countries and are normally measured using price indices, not by comparing an item. Where these indices are used, the real exchange rate measures and compares fluctuations in price competitiveness from a given base period. Exchange rates are controlled by means of various exchange rate systems of which fixed and floating exchange rate systems are the most commonly used by most countries' monetary policies (Taylor, 2015:12).

2.7.2 Fixed and floating exchange rates

Fixed exchange rates can be kept unchanged and such a system requires a central bank to make transactions in the foreign exchange market in order to maintain the currency at a specific level or within a prescribed range. In a fixed system, a country is able to devalue its currency when it increases its fixed or parity rate, assuming that rates are quoted directly, which also applies to decreasing the fixed rate to revaluate the currency. Conversely, a floating exchange rate is left to fluctuate on a daily basis. The appreciation or depreciation of a currency under such a system is dependent on the demand and supply of the currency (Mellet, 2012:112).

The effectiveness of monetary policy under either a fixed or floating exchange rate system can be evaluated by making use of the Mundell-Fleming model. The model, which was developed in the 1960s, illustrates the way in which monetary policy and fiscal policy measures influence output as well as interest rates. Even though economists have developed ways to measure the effectiveness of exchange rates, such as the Mundell-Fleming model, there are no clear indications as to which of the systems is predominantly effective; however, there are various advantages and disadvantages to both (Frankel & Razin, 1987:40).

Exchange rates, however, have a considerable effect on monetary policy in terms of inflation. According to Gopinath (2015:36), the relationship between inflation- and exchange-rate fluctuations vary between countries and proved that the currency used by a country to set international prices has large, asymmetric effects on the influence that exchange-rate fluctuations have on domestic prices. Using the nominal effective exchange rate as a measure of international competitiveness in terms of foreign exchange and excludes inflation differentials between South Africa and its major trading partners (SARB, 2017c).

2.7.3 The relationship between monetary policy and exchange rates

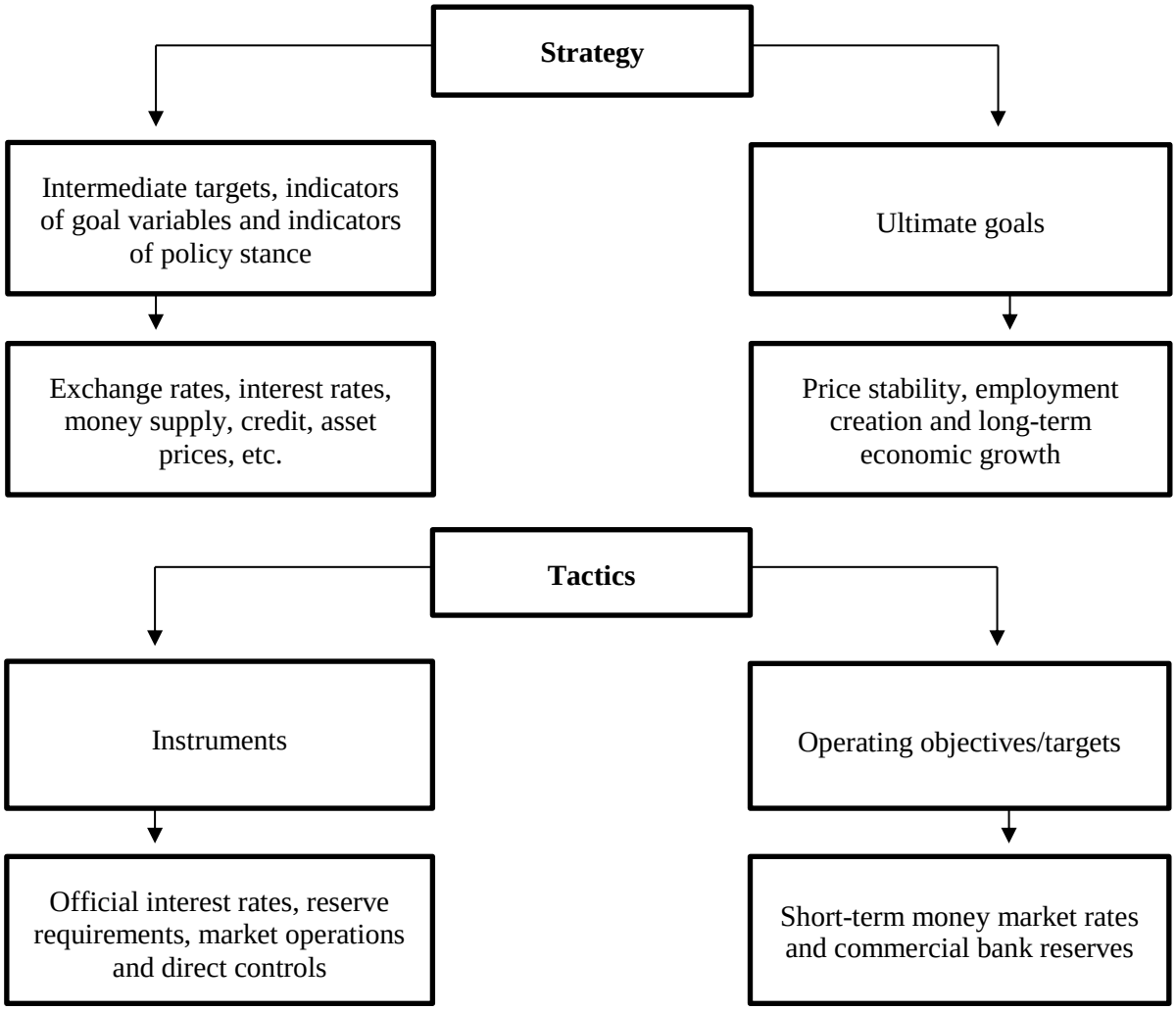
In a fairly small, open economy such as South Africa, the central bank or SARB is obligated to monitor the exchange rate and respond to changes therein as it sees fit to reach the goals of monetary policy. The effects between the exchange rate and monetary policy thus occur bi-directionally, which means that changes in either cause effects in the other. Monetary policy influences the exchange rate mostly through price and income channels within the economy. For instance, the income effect of expansionary monetary policy should cause a depreciation in the domestic currency exchange rate, strengthening the current account and weakening the financial account (Dilmaghani & Tehranchian, 2015:180).

This is also true when both price and income effects of monetary policy move unilaterally in terms of their impact on the exchange rate. This is supported by Van der Merwe *et al.* (2010:144), who state that expansionary monetary policy under a floating exchange rate regime should cause a depreciation in a nation’s currency, leading to raised demand for exports and imports that are more expensive, increased domestic expenditure and increased money supply due to increased transactional demand for money. This shows that monetary policy has an important role in maintaining a desirable exchange rate in the interest of the economy as a whole.

2.8 A SUMMATION OF THE MONETARY POLICY FRAMEWORK

The following figure provides a summary of the framework for monetary policy and shows how strategies are implemented to achieve the goals of the monetary authority as well as the tactics used to achieve operating objectives.

Figure 2.1: Monetary policy framework



Source: Adapted from Dilmaghani and Tehranchian (2015)

2.9 FISCAL POLICY INFLUENCE ON MONETARY POLICY

2.9.1 Public debt

Should government expenditure exceed the income generated by government, usually in the space of a year, a budget deficit occurs, which has to be financed by borrowing. Should deficits be consistent, they accumulate and cause further indebtedness of the public sector. The deficit, or conversely the surplus, that government incurs is a significant indicator for monetary policy, as it

shows whether government is acting in a financially sufficient manner. Should government decidedly impose a larger deficit it should indicate increased capital spending and lowered taxes, which is known as an expansionary fiscal policy action. Conversely, a surplus and increased taxes could indicate contractionary policy. These policy decisions need to be coherent with that of monetary policy to avoid contradicting policy measures between the fiscal and monetary authorities (Black, Calitz & Steenkamp, 2015:394)

Furthermore, public debt management regarding the size, composition, maturity structure and proprietorship of debt of the public sector is also important information to the monetary authority. Mainly due to the impact this has on interest rates, the exchange rate and money supply (Filardo, Mohanty & Moreno, 2011:55). This is caused by factors such as increased deposits due to government spending; increased demand for funds causing fluctuations in market interests rates; or bailing out by the central bank due to possible shortfall of market liquidity. A direct impact on the exchange rate is also plausible through government borrowing when funds are retained domestically or indirectly through increased domestic expenditure.

These factors indicate that it is crucial that public debt management be aligned with the monetary policy operations of the central bank. Some economists, however, believe that the continued application of budgetary constraints would suffice in minimising the economic impact of government deficits or government debt, which is known as the Ricardian equivalence proposition. This proposition further suggests that a tax cut would lead to increased savings by households in order to make provisions for future higher tax burdens, instead of increasing their consumption expenditure (Black *et al*., 2015:396).

2.9.2 Public revenue

Government generates revenue mainly through taxes, income from government property and transfers from households and firms. Taxes, however, remain the main source of income in most countries that are levied directly or indirectly. Direct taxes are those paid by taxpayers on their income and indirect taxes are paid on goods and services, such as value-added tax (VAT) (Filardo *et al*., 2011:58). Three broad categories for taxes exist, namely tax on income, tax on welfare and tax on expenditure.

In most cases, income tax is divided into sub-categories in the economy such as personal income tax, company tax and taxes on payroll. Taxes on welfare are levied on the assets of economic entities, including taxes on estate, property taxes, capital gains taxes and transfer duties. Finally,

taxes on expenditure are levied when economic entities are purchased, either domestically produced or imported goods and services. Such taxes include the abovementioned VAT, sales tax, import tariffs and excise taxes on certain products (Black *et al*., 2015:211)

2.9.3 Interaction and coordination between monetary and fiscal policy

The National Treasury and the central bank are collectively responsible for a country's macroeconomic management. The role of the central bank has been limited since the 1980s as it is now mainly accountable for financial and price stability within most economies internationally. Although fiscal policy has a broader economic responsibility than that of the central bank, it must take into account any and all actions that could possibly impact financial stability and must consider monetary policy in its decision making in the pursuit of government objectives.

Fiscal and monetary policy affects each other both directly and indirectly. Direct effects of fiscal policy on monetary policy include the assistance with liquidity management, managing foreign reserves and through public debt management. Whereas indirect effects of fiscal policy on monetary policy include that of fiscal influence on general economic conditions in a country (Dodge, 2002:11). Policy measures to obtain economic growth and employment creation along with price stability and equilibrium of the balance of payments could be conflicting as, for example, expansionary policy to create employment could lead to price instability or inflation (Black *et al*., 2015:404).

Due to the possibility of such conflicts, it is thus crucial for monetary and fiscal policy to be co-ordinated in its approach to economic objective setting and the actions to reach these goals. In order to achieve such co-ordination between fiscal and monetary policy, a Memorandum of Understanding exists, which provides a framework for the consultative process between these government entities. This memorandum is constructed by means of three standing committees and a technical committee to maintain the most effectual manner in which the National Treasury and the central bank must co-ordinate activities (Dodge, 2002:9).

2.10 MONETARY POLICY IN SOUTH AFRICA

2.10.1 The objective and evolution of monetary policy in South Africa

After the announcement of its intention to introduce inflation targeting in August of 1999, the SARB formally adopted the inflation-targeting system in February of 2000 (SARB, 2017b). Prior

to the introduction of the inflation-targeting framework, several methods had been used to control inflation, including exchange-rate targeting, monetary-aggregate targeting and discretionary monetary policy implemented between 1960 and 1998.

The primary goal of the reserve bank is to protect the value of the South African currency and in doing so allow for balanced and sustainable economic growth (SARB, 2017a). This is achieved when the changes that occur in the general price level have no real effect on economic decision-making processes. Even though decisions regarding investment, savings, consumption and production will still be effected by movements in price levels, the rate of inflation, or deflation, should be so low that it is not considered an important factor within economic decision making (Mboweni, 2000:57).

Price stability is closely related to a stable financial sector within the economy. Thus, disruptions in financial stability lead to the inefficient transmission of monetary policy, distorting the price formation process. Financial stability could similarly be affected by high levels of inflation in the economy. A secondary goal of monetary policy is thus to assist in the promotion of financial stability within the country's financial sector. However, this is not only influenced solely by the actions of the SARB, but by those of multiple government authorities and departments as mentioned previously.

The Reserve Bank is required to carry out various actions in an attempt to maintain price and financial stability. This includes ensuring the availability of good quality currency in circulation, facilitating the development and maintenance of an efficient national settlement and clearing system. Furthermore, it provides encouragement of efficient money, capital and foreign exchange markets in the economy and monitors the financial risks faced by commercial banks, safeguarding the systems from systemic risk and liquidity shortages (Mboweni, 2000:58).

2.10.2 Institutional arrangements of monetary policy

2.10.2.1 The independence of the SARB

Since its establishment in 1921, the SARB has enjoyed a large degree of independence. The Bank's independence from political influence and decision making is also assured by private ownership and the appointment of non-executive members of the board by private shareholders. The independence of the SARB is stipulated in the South African Reserve Bank Act (90 of 1989) and the Constitution of the Republic of South Africa (108 of 1996). The Reserve Bank Act also

empowers the Board of Directors of the Bank to formulate rules regarding the governance of the Bank and business conduct. The roles of government and the SARB were clarified during the adoption of the inflation-targeting framework in South Africa (South Africa, 1989:8).

This framework stipulates that government is responsible for setting the inflation target in consultation with the SARB. This means that government determines the goal of monetary policy, which should provide co-ordination between monetary and other policy measures in the economy. Although the SARB does not enjoy goal independence, it does have instrument independence in the pursuit of its goals. This is protected by Section 10 (2) of the South African Reserve Bank Act (90 of 1989), which states that "the rates at which the Ban will discount or rediscount the various classes of bills, promissory notes and other securities shall be determined and announced by the bank from time to time" (South Africa, 1989:10).

This section also holds the SARBs right to determine the repo rate. However, the SARBs instrument independence, in the foreign exchange market, is restricted due to the decision on the level of freedom of financial flows in the domestic economy being determined by government. The personal independence of the Bank is set out by Section 4 of the South African Reserve Bank Act (90 of 1989). This section includes the terms of appointment of the Governor and deputy Governors, as well as all other members of the board. The financial independence of the SARB is also assured as it is provided with sufficient financial resources to cover its operations and has control over its own budget (Wessels, 2005:960)

2.10.2.2 The accountability of the SARB

Due to the considerable autonomy in its operations granted to the SARB, it has to be held accountable for its actions. According to Van der Merwe *et al.* (2010:236), no central bank can be completely independent, as central banks are required to report to the chosen legislative bodies that look after the banks' interests. In terms of Section 31 of the South African Reserve Bank Act (90 of 1989), the Governor of the SARB must report to the Minister of Finance on the implementation of monetary policy. In terms of Section 32, the SARB must also submit monthly statements of its assets and liabilities, as well as financial statements, to the National Treasury (South Africa, 1989:11).

The private ownership of the SARB has a crucial bearing in terms of its accountability, which central banks owned by governments do not share (SARB, 2017c). Based on the structure of ownership of the SARB, the Bank is required to arrange annual general meeting for its

shareholders, where shareholders must approve of the financial statements and the annual reports from the Bank. The Governor of the SARB is also required to appear before the Portfolio Committee on Finance periodically in order to provide explanations on the conduct of the bank in terms of monetary policy, as well as its views on economic and financial developments of late.

Despite the significant freedom of action, there are adequate balances and checks on the Bank to ensure its compliance with governments' policies and requirements. In addition, the accountability of the SARB can be measured against the governments' inflation target. Even though the bank has considerable control over measures used to target inflation, inflation is not easily controlled and is significantly influenced by external factors of which the SARB has no control over whatsoever. However, it remains accountable for its actions and reactions against exogenous and endogenous shocks to prevent inflationary pressure (Oksiutycz, 2012:8).

2.10.2.3 The transparency of monetary policy

As previously mentioned, in an inflation-targeting regime, it is important that both the public and government be continually informed about the implementation of monetary policy by the SARB. This is done by published statements in which the framework, operational procedures and stance of monetary policy are explained (Mboweni, 2000). In order to develop the understanding of how monetary policy functions, the SARB convenes Monetary Policy Forums.

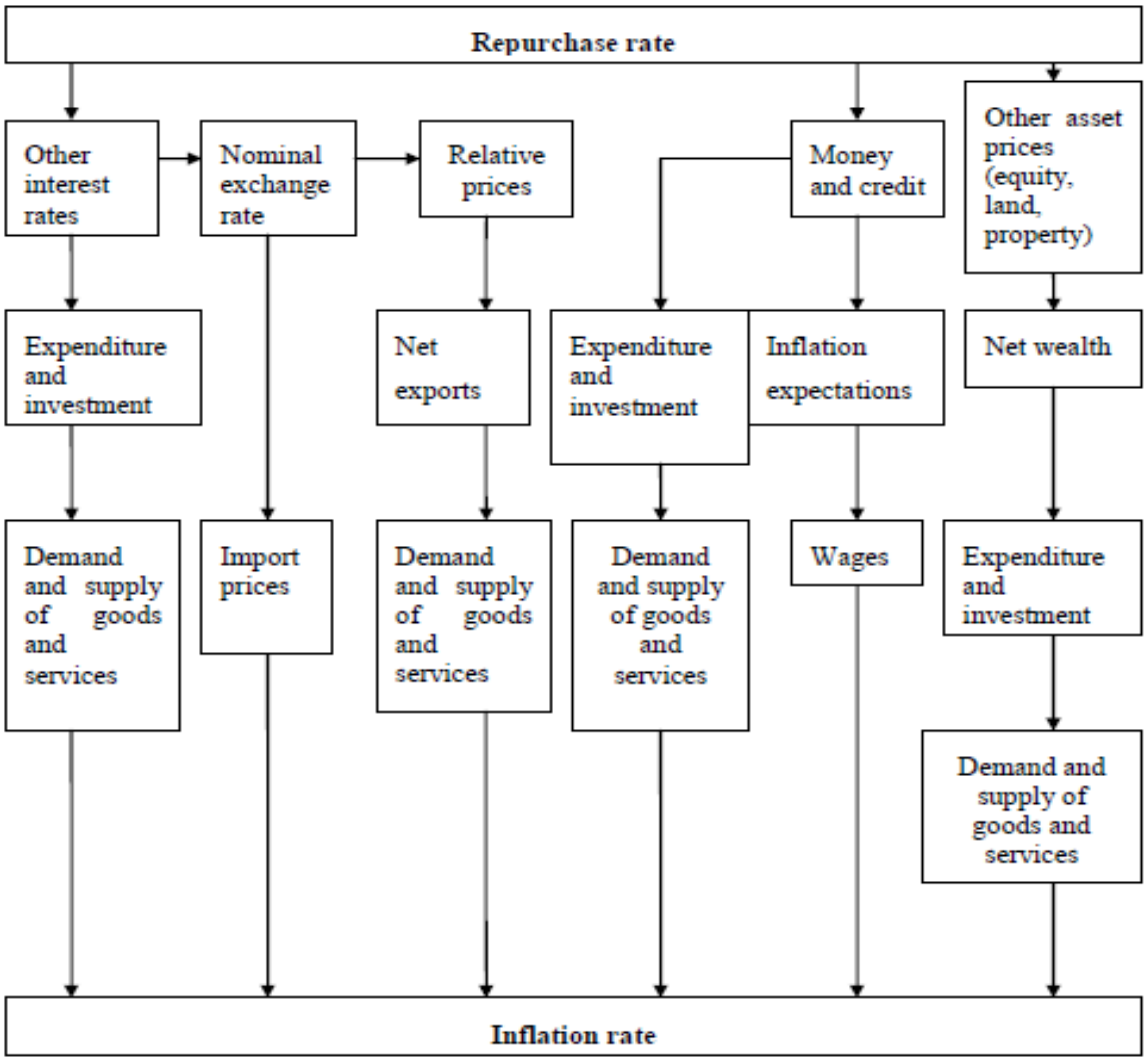
At these forums, government representatives, labour movement representatives, businesses and academic institutions are invited to attend and members of the public are invited to ask questions and are provided by an overview of recent economic developments and conditions of monetary policy. The MPC also convenes quarterly meetings and after each meeting of the MPC, a monetary statement is delivered by the Governor on public television and published for public record. The SARB also publishes a *Monetary Policy Review* bi-annually in which each edition includes the Banks' forecast of inflation (Oksiutycz, 2012:11).

2.11 THE MONETARY POLICY TRANSMISSION MECHANISM IN SOUTH AFRICA

The transmission mechanism is set into motion in financial markets via the adjustment of the repurchase rate of money by the SARB. This change in repo rate affects the prices of financial assets and the commercial rates of banks. A spill-over effect then follows in the labour, business and investment markets due to changes in the demand for money. If these repo rate changes were

expected, spill-over effects are minimal. However, if they were unexpected, it can cause a large ripple effect felt throughout the entire economy (Feddersen, 2017).

Figure 2.2: The monetary policy transmission mechanism



Source: Adapted from Smal and De Jager (2001)

Bernanke and Gertler (1995) state that the change in the repo rate also causes an often inadvertent change in the nominal exchange rate. This results due to financial markets becoming more or less attractive to both foreign and local investors should interest rates change. Investors need to buy local currency in order to enter the local market to benefit from higher exchange rate. This increase in the demand for local currency causes the price of the currency to appreciate. The opposite is also true when the interest rates decrease. Investors sell the local currency in order to move their money to other, foreign financial markets to receive a more attractive interest rate.

These currency appreciations or depreciations continue to influence exports, imports and the balance of trade of a country. These factors, including the ones previously mentioned, result in a change in total consumer demand and ultimately inflation (Mishkin, 1996). It is important to note that the monetary transmission mechanism is a long process with lags of between 18 to 24 months before the action implemented by the South African monetary authorities finally achieves a full effect on the South African economy (Feddersen, 2017). The SARB require an in depth understanding of the effects of the transmission channels, timing of the transmission mechanism process and the expectations of the South African economy in order for them to achieve their monetary policy objectives (SARB, 2017a).

Thus four phases of the transmission mechanism can be identified, namely the channels, stages, magnitude and the speed of the monetary transmission process. There are five main channels of monetary policy transmission that are generally distinguishable from the literature, these include the interest rate channel; the broad money channel; the credit channel; the exchange rate channel; and the domestic asset price channel (Chickeke, 2009:24).

2.11.1 The interest rate channel

The interest rate channel of the transmission of monetary policy is clearly defined in Keynes' General Theory (Keynes, 1961:107). The Keynesian interest rate channel shows how an increase in short-term nominal interest rate leads to an increase in long-term nominal interest rates when the changes are policy-induced. This influences the price of domestic products in comparison to foreign counterparts, mainly through of long-term interest rates and the exchange rate, which results into changes in short-term interest rates being transferred to the real cost of capital. This transmits further to firms and households cost to borrow, causing decreased expenditure and investment (Van der Merwe *et al*. 2010:240).

The interest rate channel also applies to a similar extent to consumption. Long-term interest rates have the largest impact on consumption and investment. This leads to the importance of the models emphasis on real interest rates, rather than nominal interest rates as a driver of firm and consumer decision making. This also allows for a mechanism, which monetary policy can employ to stimulate the economy, even with nominal interest rates at zero (Chickeke, 2009:25). The traditional interest rate channel can thus be presented as follows:

$$\uparrow M \Rightarrow \downarrow RIR \Rightarrow \uparrow I \Rightarrow \uparrow Y$$

Which indicates that expansionary monetary policy ($\uparrow M$) leads to a decrease in real interest rates ($\downarrow RIR$). This leads to reduced cost of capital and a rise in investment expenditure ($\uparrow I$) and finally increased aggregate demand and output ($\uparrow Y$).

2.11.2 The broad money channel

The SARB influences interest rates by controlling base money growth, which also affects aggregate demand and inflation in the economy. The Bank makes use of interest rate to signal the market of the stance of monetary policy, which leads to changes in expectations with regards to the term structure of interest rates. In South Africa, changes in short-term interest rates signal changes in the desired level of interest rates, resulting in a response dependent on whether changes in monetary policy were anticipated or not and whether changes are expected to remain constant or be reversed (Chickeke, 2009:25).

2.11.3 The credit channel

Two versions of the credit rate channel exist, namely the bank lending channel and the balance sheet channel. The bank lending channel is focussed on the impact that shocks on banks' balance sheets have on the availability and cost of finance to borrowers. This means that the balance sheet of borrowers, rather than that of lenders is what matters for finance cost in the balance sheet channel.

This means that the credit rate channel relates to asymmetric information within financial markets. This occurs primarily through effects on bank lending and then through the balance sheets of households and firms (Van der Merwe *et al*., 2010:290). The bank lending channel functions through the effects of monetary policy on the supply of bank loans, meaning the quantity of, rather than the price of credit and relies on the dual nature of banks as holders of reserve-backed deposits and as points of origin of loans.

2.11.4 The exchange rate channel

The exchange rate plays an important role in terms of domestic price developments and the economy as a whole, especially in small open economies such as South Africa. Thus the SARB is obligated, as part of its mandate, to closely monitor the exchange rate and respond to fluctuations in accordance with its goals and objectives. Although the South African exchange rate is floating and this follows flexible policy, foreign exchange interventions remain within the power of the

monetary authority, should it deem the exchange rate a threat to financial stability in the economy (Smal & De Jager, 2001:6).

The exchange rate increasingly serves as a channel for the transmission of monetary effects as South Africa becomes more globally integrated. This causes monetary policy to have a more profound effect on the exchange rate and vice versa, now more than ever. The effect of the exchange rate thus influences financial stability, net exports and the overall output of the South African economy. The exchange rate channel can be presented as follows:

$$\uparrow M \Rightarrow \downarrow RIR \Rightarrow \downarrow ER \Rightarrow \uparrow NX \Rightarrow \uparrow Y$$

Which indicates that expansionary monetary policy ($\uparrow M$) causes a reduction in real interest rates ($\downarrow RIR$), which leads to local currency dominated deposits becoming more attractive to investors, causing the exchange rate to fall ($\downarrow ER$). Domestic goods thus become more affordable compared to foreign goods, leading to increased net exports ($\uparrow NX$), which finally causes a rise in domestic output ($\uparrow Y$). However, a negative consequence of the depreciation of the South African rand directly increases the cost of imported goods, which has a negative effect on domestic inflation.

Aron and Muellbauer (2002:210) state that three main routes for the effects of interest rate differentials on the exchange rate exist. First, there is a direct effect on South Africa brought on by rises in domestic interest rates in the United States, which leads to a currency appreciation. Secondly, the current account surplus has a similar effect on local currency. This occurs through curbing demand to raise interest rates, which will increase the surplus and cause the currency to appreciate. The third route is through a reduction in expected producer price inflation by means of a rise in interest rates, which will also cause the currency to appreciate.

However true this may be, the South African currency has experienced severe volatility since the adoption of the inflation-targeting framework. Should the inflation target be credible, with stable inflation within the target range, price stability should contribute to a more stable exchange rate in South Africa. However, should the currency depreciate on a permanent basis, prices will permanently rise in the long run. This will cause inflation to rise temporarily in conjunction with the adjustment process of prices to the new long-run equilibrium, but will dissipate in the over time (Chickeke, 2009:28).

2.11.5 The domestic asset price channel

The economy is also affected by monetary policy through the valuation of assets, as is explained by "Tobin's q". There are also two other sub-channel variants known as the wealth channel and the balance sheet channel. Tobin surmised that monetary policy actions affect the value of assets such as bonds, equities, stock and fixed properties and that there is a close correlation between the value of shares and the investment of firms in physical capital stock.

This hypothesis leads to a ratio, calculated by dividing the market value of a firms' equity by a unit of the firms' existing capital stock at its replacement value (Van der Merwe *et al.*, 2010:295). A high "q" represents more affordable new plant and equipment, relative to the market value of the firm. This should lead to increased investment as the issuance of new shares can fetch a higher price, thus more investment is possible by selling a smaller number of new shares. Thus if interest rates fall through expansionary monetary policy, asset prices will rise, which leads to higher "q" and thus investment and thus increased economic output (Chickeke, 2009:28).

The theoretical approach to monetary policy and the transmission of monetary policy actions have been comprehensively scrutinised and policy in most cases is sound and efficient. However, certain structural factors such as mismanagement within government and controversial employment regulation within the economic walls of a country such as South Africa can debilitate monetary policy. Such structural challenges can also obscure and diverge the transmission of monetary policy actions. The following empirical findings secure the premise that these challenges in the economy hold a profound power over the ability of monetary policy to succeed in achieving its goals.

2.12 EMPIRICAL LITERATURE ON INFLATION, ECONOMIC GROWTH AND EMPLOYMENT CREATION RELATING TO THE SOUTH AFRICAN CASE

2.12.1 Inflation, interest rates and economic growth

Inflation is crucial as it creates an incentive for consumers to spend due to the expectations of future prices and, thus, is related to economic growth. However, according to Fischer (1993:50), inflation is negatively related to economic growth, investment and productivity. This is supported by the findings of Andrés and Hernando (1999:327), who found that the negative relationship between inflation and economic growth exists in both developing and industrialised countries. Their findings also prove that the effects of inflation are more prominent when inflation rates are

low, in that economic growth increases at a higher rate as inflation rates decrease. Moreover, capital accumulation and productivity growth is negatively affected by budget deficits in the economy.

Fischer (1993:52) proved that high levels of economic growth are not necessarily associated with low inflation and small budget deficits. This indicates that in some cases high rates of inflation are not consistent with continuous economic growth. Barro (1995:156) further states that inflation has a significant, negative impact on economic growth and investment. Bruno and Easterly (1996:144) contend that the relationship between inflation and economic growth only exists when inflation is high, stating that inflation above the threshold has a temporary negative effect on growth, which is recoverable when inflation stabilises.

Numerous studies including that of Krogh (1967:354) and Truu, (1975:433), contend that even though a stable relationship between inflation, wages and prices existed in South Africa between 1945 and 1965, the relationship became unstable in the 1970s. Further studies such as Hodge (2005:228), using data from 1970 to 2000, concluded that short-run variations in inflation and unemployment in South Africa have proven to be mostly independent from each other. The latter author further stated that the leading cause for low employment creation and increased unemployment rates was the large-scale structural change occurring in the economy, such as large increases in economically active populace.

Another study by Bauknecht (2002:19) proved that South Africa has an inelastic supply curve, allowing for aggressive reductions in inflation, with limited consequences for national output. He found a negative correlation between inflation and output growth for the period of 1982 to 1995, however, this shifted to a significant relationship between 1996 and 2002. These findings indicate that there is no long-run trade-off between inflation and output and that recent years have shown a clouded short-run negative relationship between the two variables.

Adusei (2013:68) shows that South African inflation is both a monetary as well as a structural phenomenon, but is mainly influenced by external factors, GDP and the size of local government. This means that changes in prices of imports, conditions in international countries, growth of the local economy and the expenditure patterns of local government, are the main factors impacting inflation in South Africa. This in turn suggests that continuous increases are not controlled by changes in interest rates or money supply in the local economy. Another significant structural determinant of inflation in South Africa has proven to be the cost of labour (Akinboande *et al.,*

2004:42). This indicates yet another influencing factor not accounted for in the monetary system for controlling inflation.

According to Myrdal and Streeten (as cited by Sen, 2016), the structural theory of inflation should be used as an approach to inflation in emerging market economies, concluding that it will not be successful to implement aggregative demand-supply models to explain inflation in these countries. Structuralist theorists argue that numerous structural imbalances exist in emerging or developing economies. These include supply shortages in some sectors and an under-utilisation of resources and surplus demand in others, thus making the aggregate demand-supply model of inflation unsuitable for these countries (Sen, 2016).

Fedderke and Schaling (2005) prove that the South African economy is consistent with the cost-push view of inflation, having significant implications on policy and the measures required to control inflation in the country. The hypothesis that control measures of inflation in South Africa have less significant impact than the structural and cost-push elements effecting inflation in the local economy is thus supported by the aforementioned arguments. According to Coiran (2014:400), interest rates are an efficient instrument to control inflation in a country, based on a study done in Romania using a least squares regression analysis. The latter study further found that when structural inflation is controlled through a demand-pull perspective within emerging market economies, these economies tend to experience depreciation spirals and low growth levels.

De Waal and Van Eyden (2014:135) found that by using a vector autoregressive model (VAR) and 32 of South Africa's trading partners as a proxy with variables such as broad money supply (M3), repo rate, inflation and exchange rate, that changes in monetary policy took approximately eight quarters to effect inflation rate in South Africa. Mehrara, Behzadi and Razaei (2016:163) found that in developing economies, government expenditure has a negative relationship with inflation, unless the economy is highly liquid and in a growth phase. The study also found that monetary and fiscal policies should be integrated to control inflation and stimulate aggregate demand.

According to Eichengreen (2002), inflation targeting can prove ineffective in emerging market economies due to the economies being open and thus subject to their liabilities being dollarised, as well as the possibility of policy makers in such economies lacking credibility. This opens these economies up to external disturbances, exchange rate volatility and thus increased difficulty in forecasting and inflationary control (Frenkel & Taylor, 2006:4).

2.12.2 Exchange rates, employment and fiscal policy

Zettelmeyer (2000), found that in small open economies, a monetary shock leading to a 1 percent increase in the short-term interest rate, will appreciate the exchange rate by around 3 percent. The study concluded that interest rate hikes do not fully offset the initial depreciation of the currency, suggesting that the cost of resisting exchange rate pressure by means of interest rates could be high in terms of exchange rate volatility and inflationary effects. The findings of Djivre and Robon (2000) further indicate that small open economies are affected adversely by monetary policy shocks, which lead to exchange rate depreciation in terms of the impact thereof on aggregate demand and supply.

In times of an interest rate increase, economies tend to experience a rise in unemployment and decrease in growth due to lower aggregate demand; however, this should lead to a lower inflation rate. A further risk to inflation includes the wasteful expenditure of government and increased government debt. Due to the inflationary nature thereof, a reduction in foreign investment is also likely to occur, as investors require a stable debt rating to avoid unnecessary risk. A further challenge that occurs through high government debt levels is the adverse effects on the exchange rate (Mellet, 2012:140).

Based on the findings of Chipeta, Meyer and Muzindutsi (2017:24), the effects of exchange rate fluctuations on employment creation and retention depend largely on the openness of certain sectors of the economy. This indicates that the possibility of job losses or creation can occur in industries more active in trade. The latter authors further found, however, that the South African economy shows a negative correlation between real exchange rates and employment creation in both the short- and long run, which was proven by a VAR and a multivariate co-integration test. These findings were also supported by Banerjee and Veeramani (2014:3), suggesting that labour re-allocation in the labour market is highly dependent on the effects of the exchange rate on different factors of production, including labour.

Kim (2005) further found that emerging economies such as Korea are more affected by fluctuations in the exchange rate than developed countries such as the United States. This was also supported by the findings of Ngandu (2009:126), which prove that tradable sectors in the South African economy, such as manufacturing, are adversely affected by an appreciation in the real exchange rate; however, this has a positive impact on domestic non-tradable sectors within the economy.

Chickeke (2009:106) found that the South African monetary policy is more focussed on inflationary control and the stabilisation of price levels than on job creation. The study proved that monetary policy responds faster to fluctuations in inflation than in unemployment. The South African economy has also become increasingly susceptible to external shocks posing a challenge to the conduct of monetary policy in its current form. The latter author further found that the New Keynesian Phillips Curve does not exist within the South African economy, showing a positive long-run relationship between unemployment and inflation. This indicates that employment levels decline as inflation increases.

According to Feldstein (1983:32), high corporate and personal income taxes, which are used to finance government debt, significantly alter the effects of inflation on the capital intensity of production in emerging market economies such as South Africa. This notion is supported by the findings of Utgoff and Brechling (1979:244), who found that increased income taxes, as well as other taxes used to finance social spending, lead to increased inflation and often decreased aggregate demand due to decreased exposable income. Decreased aggregate demand and high levels of inflation could further lead to reduced production, lower employment creation and reduced economic growth. A further study by Engen and Skinner (1996:635), found that tax policy has an effect on economic growth and could adversely affect overall output growth when taxes are increased to generate revenue or to pay existing debt. This leaves monetary policy in a difficult position in its aim to promote economic growth and employment creation.

2.13 SYNOPSIS

This chapter explored the literature, concepts and theories of monetary policy, relative to the mandate of the monetary authority in terms of stable price levels, employment creation and the promotion of economic growth. Thus far, the literature has shown that factors outside of the control of monetary policy, such as actions by fiscal authorities, affect the success of monetary policy in maintaining stable price levels. A further deduction made by the literature is that the South African economy is consistent with the nature of structural and cost-push inflationary factors.

The effects of the independent variables chosen in this study, namely the official interest rate, broad money supply, the exchange rate, government debt and government revenue on the dependent variables within the MPSI (inflation, employment and economic growth), have been analysed individually in various empirical studies. A consensus regarding the long- and short-run

effects of these independent variables on the dependent variables has not yet been formed and the success of monetary policy in South Africa has thus not been tested in such a manner.

Due to the dynamic nature of policy measures and the varied effects of monetary and fiscal policy actions on the economy due to uncontrollable factors that influence the economy, it is crucial to obtain information on how exactly the effects of chosen variables influence the success of monetary policy. In doing so, measures can be taken to adjust policy in such a manner that inflation, employment and economic growth are more efficiently controlled or influenced by the actions of the monetary authority.

Theoretical frameworks such as the Taylor rule, the McCallum rule, Tobin's q and the monetary transmission mechanism have sought to explain the effects of monetary policy actions on the price levels and the economy as a whole. Prior to establishing the methodological framework and empirical estimations of this study, the study will first review patterns in monetary activity within developed economies, developing economies, African economies and the South African economy to obtain a better understanding of the interrelationship between the chosen economic variables in the next chapter.

CHAPTER 3
MONETARY POLICY IMPLEMENTATION AND TREND ANALYSIS

3.1 INTRODUCTION

The previous chapter discussed the theoretical background, definitions and the empirical literature in an attempt to assess the success of monetary policy implementation in South Africa. It was concluded that the dynamic nature of policy measures and the varied effects of monetary and fiscal policy actions on the economy due to uncontrollable factors that influence the economy, call for the necessity to obtain information on how exactly the effects of chosen variables influence the success of monetary policy. Theoretical frameworks such as the Taylor rule, the McCallum rule, Tobin's q and the monetary transmission mechanism have sought to explain the effects of monetary policy actions on the price levels and the economy as a whole. It is necessary, however, to obtain further information regarding how countries have performed in the past to substantiate whether these theoretical frameworks have proven successful.

The South African economy, as with any global economy, must find an effective mix of monetary and fiscal policy measures, in favourable alignment, in order to sustain economic growth and development (Swanepoel, 2005:730). Economies internationally, especially those of developing countries, have been hampered by ongoing financial and price instability and low economic growth since the 2008 global financial crisis (Mellet, 2012:147). This creates an important narrative for monetary policy to adjust and mitigate to ongoing economic disturbances in order to achieve its objectives, primarily in achieving and maintaining price stability.

Therefore, monetary policy should be able to ensure an environment conducive for economic growth and employment creation in the economy (Meyer, 2014:75). Developing economies possess distinguishing characteristics compared to developed or industrialised economies and are more susceptible to internal and external shocks, as well as lower credibility of institutions and price stability (Frankel, 2011:3). Such economic characteristics warrant a robust and dynamic monetary policy, central bank independence and the assurance to nominal targets and appropriation of monetary or financial goals are especially crucial for these countries' economic well-being.

This chapter presents a short overview of monetary policy development in developed economies and provides a historic and trend analysis of macroeconomic variables from developing countries

or emerging market economies, African countries and, finally, South Africa. The developing countries were chosen because they share many economic similarities to the South African status quo in order to assist in the analysis.

Developed countries were investigated to indicate the differences in monetary policy approaches that are taken by more advanced, industrialised economies. The chapter provides information regarding the aforementioned countries' monetary policies and the assessment thereof in the aim of evaluating monetary policy implementation in South Africa. In doing so, the study reviews trends and policy measures in fulfilment of the empirical objectives one through three. The macroeconomic variables included in this analysis consist of employment growth, GDP, inflation and interest rates.

3.2 MONETARY POLICY IN DEVELOPED COUNTRIES

This section is focussed on monetary policy procedures and formulation within developed economies such as the United States, the United Kingdom and Germany. An overview of monetary policy and the instruments used to enforce monetary policy are provided.

3.2.1 Overview of monetary policy, instruments and implementation in developed countries

The conduct of monetary policy in the United States can be divided into three regimes since the 1970s. In the first regime, which was implemented between 1970 and 1979, the federal funds rate was the primary instrument used by monetary policy and served as the policy target (Borio, 1997:12). This was accompanied by a secondary target consisting of the targeting of borrowed reserves. Open market operations were utilised in order to maintain a narrow target band for the funds rate of around 5 to 7 percent. The federal funds rate was usually adjusted in 25 to 50 basis point instruments to respond to macroeconomic conditions (Bernanke & Mishkin, 1992:186).

The Federal Reserve (FED) also paid close attention to money supply in the economy, starting in 1970, the Federal Open Market Committee (FOMC) chose weekly tracking paths for M1, thereby indicated its preferred behaviour for M2 (Meulendyke, 1998:11). The monetary shocks from the stock market break in 1989 and the subsequent recession lasting until 1991 caused the FOMC to move away from the targeting of borrowed reserves and shifted the focus of the FED solely to targeting the federal funds rate at a target of 2 percent. The FED has focussed mainly on the

achievement of stable inflation, a low and smooth federal funds rate, output growth and controlling unemployment since the 1970s (Bernanke & Mishkin, 1992:193).

As in the U.S., British monetary policy introduced monetary targeting in mid-1970, as a remedy to mounting inflationary pressures on the economy. Interest rates were also similarly employed as operating instruments, targeting the broad aggregate M3 since 1973 (Meulendyke, 1998:13). To ensure the success of M3 targeting, the Supplementary Special Deposits Scheme (SSDS) was introduced in December of 1973 (Borio, 1997:12). This policy measure attempted to reduce the growth of M3 by taxing high-interest bank deposits, a component of M3. Despite this, the Bank of England failed to maintain M3 growth targets. Inflation fell after the 1973 oil price shock but rose sharply in the beginning of 1978, reaching close to 20 percent inflation by 1980 (Bernanke & Mishkin, 1992:210).

The occurrence of high inflation brought about the introduction of the then Prime Minister Thatcher's *Medium-Term Financial Strategy* in 1980, which included a gradual deceleration of M3 growth, a reduction of government budget deficit and elimination of various economic controls, including the SSDS (Fell, 2000:47). The M3 targeting policy was recanted in 1989 and followed by the United Kingdom joining the European exchange rate mechanism (ERM), in the form of a fixed exchange rate. However, this ended and was replaced by an inflation-targeting regime and an inflation target of, 2 percent per annum, of which the Bank of England and its MPC became solely responsible since 1997 (Meulendyke, 1998:13). In 2010, the primary measure for inflation was also changed to CPI from the Retail Price Index, which includes housing costs and mortgage payments (Bank of England (BOE), 2016).

Germany's central bank, the Bundesbank, also responded to rising inflation in 1975 by adopting a monetary targeting regime, in terms of M0. Targets were since annually announced and reviewed midyear every year, taking into account inflation, output growth and other macroeconomic developments (Bernanke & Mihov, 1996:7). Due to reoccurring periods of slow economic growth, the Bundesbank adopted M3 as a new monetary target in 1988. Although Germany adopted elements of inflation targeting, the inflation-targeting regime was formally applied as of 1995, also at a rate of 2 percent annually (Bernanke & Mishkin, 1992:212).

3.2.2 Unconventional monetary policy after the 2008 global financial crisis

The conventional conduct for monetary policy as discussed is to purchase and sell short-term debt securities or to target short-term nominal interest rates (Dornbusch *et al*., 2014:66). However,

when interest rates reach zero, monetary policy cannot influence asset prices, price levels and exchange rates through lowering short-term interest rates. Furthermore, increasing the monetary base is not considered an effective stimulus in the case of an interest rate at the zero lower bound. Thus, in cases where developed economies have been faced with near-zero short-term interest rates, the central banks for many of these economies turned to unconventional monetary policy measures (Fawley & Neely, 2013:53).

In the cases concerning the United States, the United Kingdom and Germany, the 2008 global financial crisis led to these economies turning to unconventional monetary policy. These economies implemented quantitative easing, which is concerned with the introduction of new funds into a country's money supply and usually leads to increased magnitude of central bank liabilities, which includes currency as well as bank reserves, especially at the zero lower bound (Dornbusch *et al*., 2014:66). Such policies are thus not viable in the case of emerging market economies, but bring with them many spillover effects to these developing countries. This occurs mostly through capital flows, bank leverages and credit growth in these countries (Christensen & Rudebusch, 2012:386).

3.3 MONETARY POLICY IN DEVELOPING COUNTRIES

This section is focussed on monetary policy procedures and formulation within developing economies such as those of Latin America, specifically Brazil, as well as Russia and China, amongst others outside of the African continent. An overview of monetary policy and the instruments used to enforce monetary policy is provided, as well as a detailed summation of the chosen economic variable trends within these countries between 2001 and 2017 by means of figures and graphs.

3.3.1 Overview of monetary policy, instruments and implementation in developing countries

Over time, developing economies globally have become more open, which was followed by successive capital inflows and the need to adjust policy measures to the evolution of the monetary sectors within such economies (Frankel, 2011:5). Developing economies require an alternative approach to the mitigation of monetary shocks as these countries, almost by definition, tend to have less developed institutions and more particularly lower central bank credibility (Edwards, 1994:237). This is inherent, likely due to a history of price instability and sometimes

hyperinflation, which leads to seignorage in an attempt to finance government expenditure (Fatima, 2013:6). Many other symptoms of financial instability occur within developing nations such as uncompetitive banking systems and the influence of external shocks to, for instance, the goods market in a developed economy, more so than that of developed countries (Ononugbo, 2012:87).

Further implications to financial stability and the effectiveness of monetary policy in emerging markets from a domestic perspective are linked to political instability, corruption, macroeconomic and fiscal policy inefficiencies and futile financial structures (Laxton & Pesenti, 2003:1111). Volatility, which stems from demand- and supply shocks is more predominant in developing countries due to the nature of their primary products, such as agriculture, which in turn leads to a more dramatic effect on GDP and employment than in industrialised economies (Levin, Wieland & Williams, 1999:269). The general result of policy inefficiencies with regards to monetary control thus leads to the incapability of achieve the single most important objective of monetary policy, which, as mentioned, is to maintain price stability (Levin *et al.*, 1999:270).

The traditional hypothesis of monetary policy expansion, along with inflationary pressures, induces higher levels of output and employment within an economy (Frankel, 2011:14). This becomes questionable, however, when taking into account the effects that price instability has had on output growth and employment in developing economies in the past. Based on the findings of Edwards (1994:257), the modelling approach for monetary policy in controlling inflation in developing economies has shifted from starting with an exogenous rate of money growth and interest rates, to androgenised (more assertive) monetary policy through public finance and political economy. These countries suffer from unstable political structures, inefficient tax collections and are likely to resort to seignorage, which is the issuance of additional currency in an attempt to finance expenditure. This in turn causes disinflationary pressure on the real value of tax receipts (Cukierman, Edwards & Tabellini, 1991:552).

The result of excessive money growth, which stems from seignorage, is failure to obtain inflationary targets due to the failure to address the underlying fiscal and monetary issues. Another explanation is inflation inertia, which is inherent to exchange-rate-based stabilisation attempts, which tends to lead to recessionary effects associated with disinflation in the long run (Calvo & Vegh, 1994:41). A third explanation for the failure of maintaining stable price levels is that the target, whether it be in an exchange rate pegging or inflation-targeting regime, is not committed to, fully and credibly.

Such cases require rigid institutional restrictions that are more binding, such as the dollarisation that replaced the failed Argentinian quasi-currency-board (Mishkin & Savastano, 2002:61). However, a firmer nominal anchor than full dollarisation does not exist. Yet there are still some instances in developing economies, such as when Ecuador transitioned to dollarisation, which did not lead to price levels or inflation converging to the levels in the United States, due to underlying monetary and fiscal inefficiencies (Frankel, 2011:15).

As previously stated, developing countries suffer from underdeveloped institutions, low central bank credibility and are commonly associated with low inflation-fighting capabilities, low growth and low employment levels (Eichengreen, 2002). This has led to standardised prescriptions for emerging market economies to commit to two crucial rules regarding their monetary authorities. The first being that their central banks should be absolutely independent and, secondly, that these institutions regularly make their nominal targets transparent and public as explained in the previous chapter (Stone, 2003:23). This trend, formed by developed economies, began to become apparent in the 1990s in Latin America, starting with Chile, Colombia, Mexico and Venezuela (Cukierman, Webb & Neyapti, 1992:377). This was also adopted by Korea in 1998, after the country's currency crisis and has now become commonplace within developing economies globally (Cukierman *et al.*, 1992:378).

Central banks or otherwise monetary authorities within developing countries require more stringent legal independence than developed economies (Cukierman, *et al*., 1992:395). The study states furthermore that the turnover of central bank governors is also highly correlated with inflationary pressure in developing countries. This means that even though independence is important for central banks in any economy, a distinction must be made between *de jure* (officially/legally sanctioned) independence and *de facto* (factual but not legally sanctioned) independence when referring to emerging market economies. Some studies contend this statement, such as Mas (1995:1650), which states that central bank independence is of little consequence when fiscal or political forces within an economy dictates budget deficits regardless of monetary policy input.

The final element in the determination of a developing economy achieving its objectives lies within the choice of nominal monetary policy targets that these countries choose to adopt (Mishkin & Savastano, 2002:62). In a non-stochastic model, the choice of target variable has little weight, however, in a realistic stochastic model; the nominal variable to which monetary authority commits its target carries widespread economic implications (Chang & Velasco, 2001:497).

Inflation reached a peak in median developing countries overall around 1990, which was around 10 years prior to the peak for developed economies.

Most stabilisation programs for price levels in developing countries within the 1980s failed, which brought about the extinction of monetarism by the end of that decade. This was mainly due to M1 targets proving restrictive in the largest developed economies at that time. When price stability was improved, following an era of high inflation, the success factor proved to be the adoption of exchange rate targeting regimes over the previous monetary targeting regimes in emerging and developed economies alike. These plans include the likes of Argentina's Convertibility Plan, Chile's Tablita and Brazil's Real Plan (Mishkin & Savastano, 2002:62).

Further challenges were brought on by globalisation, subsequent contagion, capital flows and so forth. This led to a series of emerging economies' currencies falling into crises between December of 1994 and January of 2002 (Frankel, 2011:17). The result was a widespread adaptation of more flexible currency regimes than that provided by exchange rate targeting such as outright floating and dollarisation. This change from the exchange rate as nominal target led to the requirement for a new nominal anchor in emerging economies by the end of the 1990s (Mishkin & Savastano, 2002:63). This was realised in the form of inflation targeting. Between 1999 and 2000 Brazil, Columbia, Mexico, Korea and Thailand, to name a few, all relinquished their exchange rate targeting regimes and adopted inflation targeting. According to Gonçalves and Salles (2008:316), most of the developing economies that adopted inflation targeting experienced greater declines in inflation as well as reduced growth volatility.

New challenges were then, yet again, posed following the events of the 2008 global financial crisis, leading to strenuous inflationary pressures that challenged and in some cases still challenge emerging economies today (Aizenman & Jinjarak, 2009:84). The inflation-targeting regime has now become challenged by a mix of somewhat new nominal economic variables that have an increasing effect on developing economies globally. These include international commodity prices, which lead to trade shocks in these economies, the prices of agricultural and mineral products, asset and equity prices and of course the ever unavoidable uncertainty emergent from volatility of exchange rates (Mendoza & Terrones, 2008:6). All of which culminates in the threat of price instability for developing countries on an international scale.

Fraga, Goldfajn and Minella (2003:386), in fact, found that due to such disturbances, monetary authorities within emerging market economies tend to miss their inflation targets by much more

and experience much higher rates of inflation volatility than those in developed economies. According to the latter study, inflation targeting is more suitable for developed economies than emerging economies in several respects. Primarily, theoretical models, such as the Taylor rule or McCallum rule, do not naturally possess a place for exogenous shocks within trade, nor for disturbances from external accounts. Such theoretical models assume that international markets function efficiently enough to normalise consumption when faced with external shocks, thus neglecting the necessary apprehension of financing international deficits (Mishkin & Savastano, 2002:81).

However, in the case of emerging economies, international capital markets tend to intensify the severity of external shocks (Fraga *et al*., 2003:387). Economic booms due to capital inflow, disproportionate currency overvaluation and the usual current account deficits that occur in such situations are generally followed by economic busts, drastic reductions or halts of capital inflow and ultimately recession (Kaminsky, Reinhart & Vegh, 2005:63). Inflation targeting is thus vulnerable in the face of supply shocks, external influences and structural inefficiencies, especially within emerging market economies (Mishkin & Savastano, 2002:81).

Before the introduction of the current Brazilian currency, the Real in 1994, the economy suffered from severe hyperinflation, high levels of foreign debt and a lack of fiscal discipline. Once the economy settled into what is known as the "Real plan", inflationary pressures became more controlled and both external and internal public accounts more balanced (Afonso, Araújo & Fajardo, 2016:42). In 1999, Brazilian monetary policy introduced an inflation-targeting monetary framework and a target of 4.5 percent inflation, to replace the exchange rate anchor. This led to what is referred to as the "Macroeconomic Tripod", a combination of three fiscal and monetary policy measures consisting of a floating exchange rate, a primary surplus target and the inflation target (Afonso *et al*., 2016:42).

This was supported by institutional reform and modernisation, assisting the process of these fiscal and monetary adjustments through measures such as privatisation and control of government expenditure (Afonso *et al*., 2016:43). Brazilian fiscal and monetary policy did not meet the global financial crisis, as it traditionally would with institutional reforms, but instead implemented expansionary fiscal policy in an attempt to accelerate growth and exit the crisis (Gaddy, & Ickes, 2010:283). This was unsuccessful, however, leaving economic growth during and after the crisis well below the average of other emerging economies. Furthermore, unemployment increased,

which led to significant increases in current expenditure, especially on social and welfare systems, ahead of tax collections and the economy (Tabak, Tiaz, & Cajueiro, 2010:10).

Russia started its economic reform process from a centrally managed economy, known as the Soviet Union, into a market economy in 1992 (Rutland, 2014:3). This included liberalisation of prices and business, trade reform, privatisation, structural economic reform and macroeconomic stabilisation programs (Hoskisson, Eden, Ming Lau & Wright, 2000:255). As with almost all monetary policies, that of Russia is also focussed on maintaining internal and external price stability. The reform, however, did bring with it disastrous declines in GDP growth as well as hyperinflation by 1999 (Gaddy & Ickes, 2010:285). The Central Bank of Russia (CBR) seeks to control inflation primarily through interest rate adjustments and, should that prove difficult, adjust M2 money as a secondary nominal target (Gaddy & Ickes, 2010:283). The CBR has thus not abandoned monetary targets completely as is the case with many other emerging economies in favour of focussing solely on price inflation (currently targeted at around 4%), but still implements secondary targets such as exchange rates when required (Frankel, 2011:42).

Between 2000 and 2008, the Russian economy experienced high output growth, reduced poverty and unemployment due to risen commodity prices, but inflation remained high (Trading Economics, 2018e). After the global financial crisis in 2008, Russia entered a brief recession and began its recovery by 2009, gaining aid in growth through membership acceptance into the World Trade Organisation (WTO) in 2011. This was followed by exponential economic performance by 2012, but was cut short due to the imposition of sanctions, reduced commodity prices and subsequent reduction in capital inflow, leading again to recessions by 2014 (Mudronova, 2016:12).

China is significantly more economically successful than most of its developing counterparts and has experienced remarkable economic growth and social development since its market reforms from a centrally planned to a market-based economy in 1978 (World Bank, 2018a). Nonetheless, the country has yet to be classified as a developing economy due to factors such as low per-capita income levels and high rates of income inequality. From a monetary policy perspective, however, China has been formulating policy actions according to a so-called prudent monetary policy since 1998.

Herein, the primary objective is to maintain a stable currency with the aim of rapid and sustainable economic growth (Burdekin & Siklos, 2005:14). Monetary policy has been successful in many aspects in China since the onset of the current system in terms of the regulation of money supply

and credit in the economy, effective maintenance of financial stability and the exchange rate, as well as sustainable inflation (targeted at 3%). Thus proving the success of open market operations and inflation targeting in the Chinese economy since its onset 20 years ago (Berkelmans, Kelly & Sadeghian, 2016:47).

The economic occurrences in terms of monetary policy decision making and procedural implementation within Brazil, Russia and China over the past few years, coincide with the norm under most developing economies globally. A comparison between economic variables of these countries should establish a clear impression of how developing countries monetary policy actions have influenced their economies respectively. The following section will thus provide trends within inflation, economic growth, employment and interest rates in terms of these emerging market economies.

3.3.2 Inflation, economic growth, employment and interest rate trends in Brazil, China and Russia

This section will analyse the trends in inflation, economic growth, employment and interest rates from Brazil, Russia and China as developing or emerging market economies. The aim thereof is to determine whether monetary policy in these developing countries has been successful in achieving and maintaining pre-determined inflation targets. These countries were chosen due to their economic similarities to South Africa, as well as the availability of necessary data. Moreover, it provides a view on whether these countries are reaching their secondary objectives, namely the achievement of economic growth and employment creation. The section starts by first analysing the Brazilian case, thereafter Russia and finally China.

3.3.2.1 Brazil

At the onset of the Brazilian inflation-targeting system, up until recent developments in Brazil's inflationary-targeting framework, the inflation target has been at 4.5 percent since 1999. However, this has been cut by the National Monetary Council of Brazil to 4.25 percent for 2019, but leaving the tolerance range for inflationary fluctuations at 1.5 percentage points (Banco Central Do Brasil (BCD), 2018). Figure 3.1 shows that inflation in Brazil experienced turbulence during 2002 and 2003, mainly due to external market conditions and adverse shocks.

The inflation rate, thereafter, declined to close to 4.5 percent target, but was again influenced adversely during the 2008 global financial crisis. Inflation has since remained above the 4.5

percent target, on average at around 6 percent up until 2016/17, where the inflation rate reached levels below the target range due to growth in the domestic agricultural sector (United States Department of Agriculture (USDA), 2017). This indicates that monetary policy has not been successfully controlling inflation in the Brazilian economy since the global financial crisis

Figure 3.1: Inflation in Brazil

Source: Trading Economics (2018a)

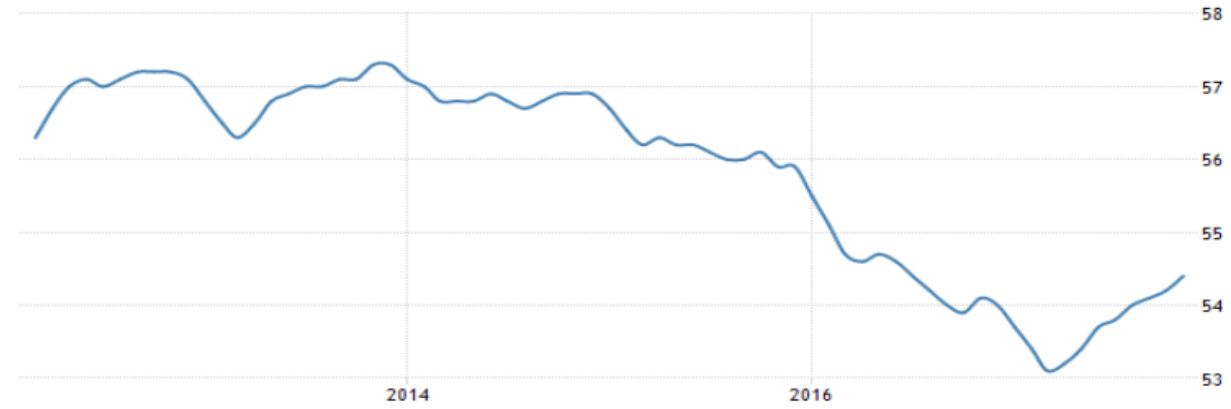
Figure 3.2 shows that the Brazilian economy has experienced modest growth with periods of economic contraction since 2001. The 2008 global financial crisis caused contraction of the Brazilian economy by -0.2 percent for the year of 2009. The economy was reduced to a 2-year recession between 2015 and 2016. This was due to a number of economic factors such as reduced personal consumption, decreased investment due to a worsened sovereign credit rating by Moody's, reduced government spending, depreciation of the Brazilian Real, increased unemployment and political uncertainty due to the unpopularity of president Dilma Rousseff (Reuters, 2017). The economy, however, regained modest growth in 2017. The primary response by the Brazilian Monetary Policy Council to induce growth and stabilise the economy in such cases is to ease monetary policy by lowering the Selic rate (local bank lending rate) and increasing interbank market liquidity (Filho, 2011:12). This has proved unsuccessful, however, as economic growth remains very low.

Figure 3.2: Economic growth in Brazil

Source: Trading Economics (2018b)

Based on Figure 3.3, employment in Brazil has been on a declining trend for a number of years. The employment figure averaged around 55.72 percent of the labour force between 2012 and 2017 with negative growth. The country experienced its highest recorded unemployment rate of 13.7 percent under the formal definition in 2017, following an ongoing recession after the impact of the global financial crisis (Filho, 2011:9).

Figure 3.3: Employment in Brazil



Source: Trading Economics (2018c)

Historically, Brazil has experienced a relatively high real interest rate (Selic rate) compared to many other inflation-targeting, emerging market economies. Based on Figure 3.4, the Selic rate averaged around 10 percent between 2000 and 2005, which caused increased cost of borrowing and reduced domestic investment spending and was lowered to an average of 8 percent between 2006 and 2009 (Segura-Ubiergo, 2012:4). The Selic rate has remained around 6.5 percent since

the beginning of 2017. Figure 3.4 indicates that when the Selic rate was adjusted to combat inflation (see Figure 3.1), it had a deflationary effect on the economy as intended.

Figure 3.4: Interest rate in Brazil

Source: Trading Economics (2018d)

3.3.2.2 Russia

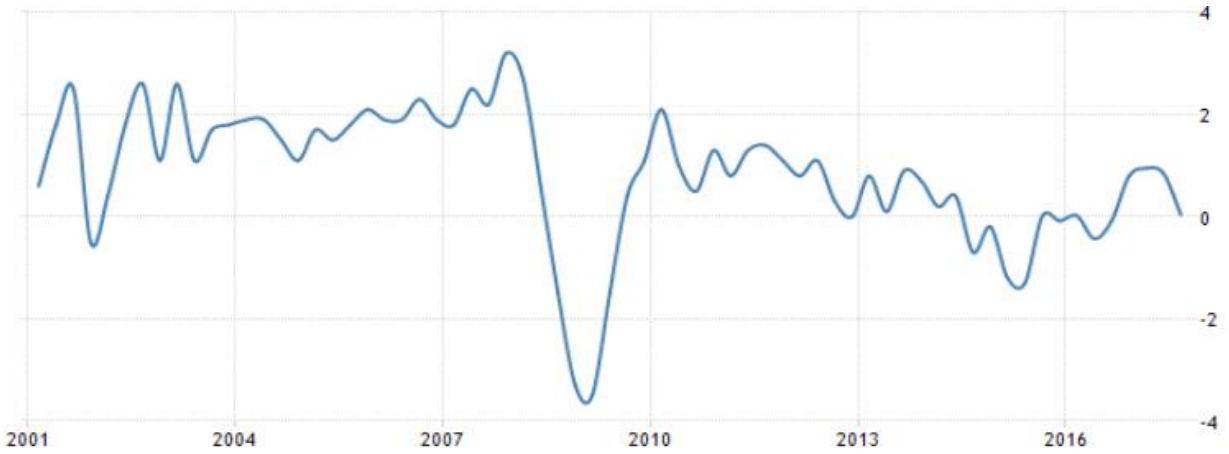
Figure 3.5 indicates that since the adoption of the stabilisation fund of the Russian Federation in January of 2004, Russia regained investor confidence and achieved high levels of capital inflow, which assisted in reducing inflationary pressures in the economy (Mudronova, 2016:10). Since then, even though volatile, inflation has averaged above the 4 percent inflation target. The effects of the 2008 financial crisis, which saw Russia's foreign exchange reserves fall by 210 billion US dollars, weakening the Russian ruble by approximately 35 percent, increasing inflation yet again. Russia remains in an ongoing financial crisis due to oil price reductions in 2014, capital outflow and economic sanctions, as well as military intervention in the Ukraine (Rutland, 2014:2). The sanctions were imposed by the US and the European Union (EU), amongst other countries, against individuals, organisations and officials from Russia and the Ukraine, following the Russian Federation's annexation of Crimea (Mudronova, 2016:13).

Figure 3.5: Inflation in Russia

Source: Trading Economics (2018e)

It is clear from Figure 3.6 that the Russian economy, as with most global economies, experienced the reoccurring decline in economic activity and thus contraction of the economy post 2008. However, policy measures such as promoting increased foreign-direct investment and reduced taxes in the non-primary materials sector were put in place after the financial crisis that led to improved economic growth by 2010 (Kudrin, 2015:38). The collapse of the Russian ruble in 2014, caused by declined confidence due to low oil prices, as well as adverse economic effects of the economic sanctions imposed against Russia, however, has also had a significant visible impact on economic growth since (Mudronova, 2016:12).

Figure 3.6: Economic growth in Russia



Source: Trading Economics (2018f)

Employment data for Russia are limited and thus the analysis only includes data from 2013 onward. Based on Figure 3.7, Russia has been experiencing volatile employment rates since 2013. The country experienced very low employment figures after the financial crisis, reaching a 9.4 percent unemployment peak in 2009 under the formal or strict definition. Skill deficits in certain sectors and constraints in economic policy, as well as modernisation of the economy pose many a threat to employment creation in Russia (Gaddy & Ickes, 2010:283).

Figure 3.7: Employment in Russia

Source: Trading Economics (2018g)

Based on Figure 3.8, the repo rate in Russia was increased in 2008 to counteract the contagion and domestic economic effects of the global financial crisis. This followed a constant repo rate of 6.25 percent due to strong economic performance following pro-growth economic reforms such as tax reforms, deregulation for business development and rising commodity prices between 2000 and 2007. Rates stabilised after the global financial crisis between 2010 and 2014, however, they increased dramatically during 2014, following economic uncertainty stemming from the aforementioned sanctions imposed against Russia (Mudronova, 2016:12).

Figure 3.8: Interest rate in Russia

Source: Trading Economics (2018h)

3.3.2.3 China

Figure 3.9 shows that inflation in China has been averaging between 3 and 5 percent since 2001, varying slightly around the three percent inflation target. The 2008 financial crisis also caused inflation in China to reach an 11 year high in 2007 at around 8 percent, which was speedily reduced after the Chinese "Stimulus Plan", which was implemented directly during 2007 (Burdekin & Siklos, 2005:14). In 2010, inflation peaked yet again mainly due to food prices resulting from poor agricultural performance, increased money supply into the economy and the fluctuations in the price of fuel (Berkelmans, *et al.*, 2016:43). Although volatile, inflation has been averaging within the target framework since 2013.

Figure 3.9: Inflation in China

Source: Trading Economics (2018i)

Based on Figure 3.10, China has experienced unprecedented growth rates, averaging up to 10 percent per annum in the early 2000's (Berkelmans, *et al*., 2016:46). After the onset of the financial crisis, China launched its Economic Stimulus Plan in 2008/9, which increased domestic investment into infrastructure and developmental economic stimulus. The economy, however, was still negatively affected by the crisis due to a global slow-down in exports. Furthermore, 2008 saw China experiencing several natural disasters. The economy's growth, however, has been substantially higher overall than its developing counterparts have, globally.

Figure 3.10: Economic growth in China

Source: Trading Economics (2018j)

China has experienced similar trends in employment fluctuation to its developing counterparts. Enough data are not available to compile a graph; however, previous studies indicate that the global financial crisis caused job losses due to reduced global demand for exports as previously mentioned (Burdekin & Siklos, 2005:13). Since 2009, China has been steadily increasing its employment rate through its various growth strategies and policy plans (Burdekin & Siklos, 2005:14). This has led to an unemployment rate as low as 3.9 percent in the last quarter of 2017 (Trading Economics, 2018k).

According to Figure 3.11, China reacted similarly to most of its developing counterparts in 2007 to the financial crisis and raised the domestic real interest rate to increase economic activity and reduce inflationary pressures (Frank & Hesse, 2009:14). This assisted in stabilising inflation and assisting in increasing economic growth in 2009. Another increase took place in 2010 to counteract inflationary pressures due to increased public debt levels and a trade deficit. However, inflation

has been on a declining trend since 2013. Based on Figure 3.11, inflation has remained a challenge for the Chinese economy as inflation moves in conjunction with interest rate movements.

Figure 3.11: Interest rate in China

Source: Trading Economics (2018l)

3.3.3 Conclusion drawn from trend analysis of developing countries

Based on the data gathered from these emerging economies, monetary authorities act according to the international status quo with regards to combating inflation, inducing economic growth and increasing employment creation in each economy respectively. The effects of interest rate changes seem to have the desired effect on inflation in both Brazil and Russia; however, China shows evidence of structural inflation due to the somewhat positive relationship between its real interest rate and inflation between 2001 and 2017. Monetary policy has been challenged in these countries by the occurrence of the global financial crisis and been proven unsuccessful in consistently maintaining inflation within the target ranges. This requires the re-evaluation of policy implementation and the tools used to enforce monetary policy to ensure its efficiency.

3.4 MONETARY POLICY IN AFRICAN COUNTRIES

This section is focussed on monetary policy procedures and formulation within African economies other than South Africa. An overview of monetary policy, as well as a short summary of the challenges for monetary policy is provided, as well as a brief summation of the chosen economic variable trends within Nigeria and Kenya between 2013 and 2017. These two countries were

chosen as African representatives due to their developed monetary policy approaches and the size of their respective economies, thus making them comparable to the South African case.

3.4.1 Overview and challenges of monetary policy and its implementation in African countries

Monetary policies in African countries have been adopting interest rates as a monetary policy instrument and inflation targeting as ultimate monetary objective at an increasing rate in recent years (Ononugbo, 2012:4). The optimality of this approach in monetary objective in African countries, which are mainly emerging market economies, is completely dependent on its effectiveness and cost. This is completely divergent from that in developed countries. African economies such as Nigeria have undergone much of the same transitions in monetary policy conduct and regimes as their international developing counterparts.

In the 1950s, these countries made use of an exchange rate targeting approach, transitioning to direct monetary targeting between the 1970s and 1980s and eventually to inflation-targeting regimes in the 1990s (International Monetary Fund (IMF), 2016). Although most African countries have been following the status quo amongst international developing countries concerning monetary policy reform, many African economies face challenges. Some of these challenges have become universal under African countries and the conduct of monetary policy within their respective economies (Khan, 2011:34).

According to Ncube (2005:17), the absence and liquidity of financial markets in most African countries between the 1980s and 1990s, has caused a lack of implementation of essential instruments in indirect monetary control. This, among other economic difficulties, has strained the success of monetary policy measures in African countries. A comprehensive set of studies by the Bank of International Settlements (BIS) (1995:219) provides empirical evidence that suggests that monetary policy is more effective in economies where larger portions of wealth are held in the form of interest-sensitive assets and have larger shares of securities in total credits, as well as larger shares of adjustable rate debt. Thus, the structure of the financial systems within African countries, in this regard, poses challenges to the efficacy and efficiency at which monetary policy operates.

Ownership structures of central banks in most African countries have also followed the international status quo for emerging market economies in recent years. For example, there was a reduction of government controlled interest of central banks in sub-Saharan African countries from 106 in 1982 to only 76 in 1992 (Ncube, 2005:21). However, imperfect information, lack of

transparency, low regulatory action and a host of other market imperfections plague central banks and financial markets within most African economies. As previously mentioned, these factors could pose dire consequences for monetary policy success in any economy, let alone that of an emerging market economy such as that of African countries (Stone, 2003:23).

Besides the inherent macroeconomic, political and policy-related flaws and challenges, which many African economies face, the global economic outlook, especially for developing countries, was adversely affected by the recent global financial crisis (IMF, 2016). This occurrence brought forward numerous weaknesses in monetary policy, financial regulation and overall international macroeconomic and financial architecture, especially within emerging market economies and the African continent. The crisis made it clear that not only should these countries focus on stable inflation and a sustainable output gap, but policy makers should focus on various targets, including the behaviour of asset prices, the composition of output and the leverage of numerous economic agents (Claesens, Dell'Ariccia, Igan & Laeven, 2010:28).

Further challenges for monetary policy exist within the economic composition within African countries. Structural and cost-push inflationary pressures are prominent in most emerging economies, including African countries. This, in part, leads to various economic deficiencies such as low output growth as mentioned in Section 1.1 (Coiran, 2014:400). African countries also face low levels of employment creation, which could be addressed by the correct monetary policy measures. Such measures should aim to promote production by reduced costs in order to stimulate job creation, especially in labour-intensive settings such as African economies (International Labour Organisation (ILO) (2016). The following section describes trends within two prominent African economies in an attempt to provide a simple description of the performance of monetary policy in African countries over the past five years.

3.4.2 Inflation, economic growth, unemployment and interest rate trends in Nigeria and Kenya

This section provides a brief summation of inflation trends, economic growth trends, interest rate movements and the trends in unemployment in Kenya and Nigeria. Formal unemployment is used due to the availability of data to analyse whether employment creation has been taking place within these countries. Table 3.1 indicates that Kenya has kept inflation within their prescribed medium term target of 2.5 to 7.5 percent between 2013 and 2016; however, 2017 saw a rise in inflation above the target, despite the high interest rate.

Table 3.1: Economic indicators in Kenya in the last five years

Indicator	2013	2014	2015	2016	2017
Inflation rate	5.72	6.88	6.58	6.30	7.98
GDP growth rate	5.88	5.35	5.7	5.85	4.7
Interest rate (Bank lending rate)	8.5	8.5	11.5	10.0	10.0
Unemployment	11.9	11.9	11.9	11.3	11.0

Source: Compiled by the author (Focus Economics, 2018a; World Bank, 2018b)

These high interest rates were imposed in order to reduce inflation and reduce commercial borrowing to the private sector, especially those who cannot afford repaying their loans, in an attempt to reduce debt in the banking sector caused by forfeited repayments (Reuters, 2018). GDP growth has remained, on average, above 5 percent for the past five years, declining slightly in 2017 due to political uncertainty.

The political uncertainty was subsequent to the presidential election, based on the amended constitutionally tenured judiciary and electoral body, but was nullified in September of 2017 and re-opened in October (World Bank, 2018c). Unemployment, however, has been reduced in the last three years, mainly due to a robust and quickly developing private sector and new fiscal and monetary prudence policies. However, drought, security concerns, oil prices, weak credit growth and high levels of public debt could adversely affect growth and employment creation in the near future, all aspects that are outside of the control of monetary policy (Gaye, 2016).

According to Table 3.2 GDP growth has declined dramatically since 2015 and has seen the Nigerian economy enter a recession in 2016.

Table 3.2: Economic indicators in Nigeria in the last ten years

Indicator	2013	2014	2015	2016	2017
Inflation rate	8.5	8.1	9.0	15.7	16.5
GDP growth rate	5.5	6.2	2.8	-1.6	0.8
Interest rate (Bank lending rate)	12.0	13.0	11.0	14.0	14.0
Unemployment rate	3.7	4.6	4.3	7.1	7.0

Source: Compiled by the author (Focus Economics, 2018b)

These low growth figures are mainly due to a faltering currency and decreased revenue from oil (Ikechukwu et al., 2016:58). The Nigerian government imposed a fixed exchange rate to counteract capital outflow, but was followed by a currency overvaluation and ultimately led to reduced foreign investment and currency devaluation. Monetary policy has since re-introduced a floating exchange rate, however, investor confidence remains low (Kazeem, 2016). According to (Olisaemeka, 2018:105), the floating exchange rate regime has outperformed the fixed exchange rate in terms of inflation, money supply and oil revenue contribution to economic growth in Nigeria.

Interest rates have increased to reduce inflation and promote foreign investment; however, this has led to reduced domestic private investment and lower credit extension due to high cost of credit (Obi-chukwu, 2018). This in turn has caused reduced economic activity as well as reduced employment creation, leading to increased levels of unemployment in the economy. The monetary policy in the case on Nigeria can be held partially responsible for economic downturn due to inefficiency and substandard policy actions (Ikechukwu *at al*., 2016:59).

3.4.3 Conclusions from trend analysis of African countries

It is clear that African countries such as Kenya and Nigeria face many of the same obstacles in terms of economic performance and monetary policy efficacy as many of their international developing counterparts. In some cases, a monetary policy has been more effective in maintaining stable price levels and inducing economic growth and employment creation than other African countries, such as Nigeria and the like. The data indicate that when monetary policy is efficient, in coherence with effective fiscal policy, economic indicators show positive economic effects. However, when a monetary policy fails to control inflation, many other aspects of the economy tend to suffer in these African countries.

3.5 MONETARY POLICY IN SOUTH AFRICA

3.5.1 Inflation, economic growth, employment and interest rate trends

As Section 2.10 has already sufficiently explained the implementation and evolution of South African monetary policy and Section 3.3.1 has elaborated on the premise for monetary policy in developing countries, the focus in this section is shifted solely to the variable trends within the South Africa economy between 2001 and 2017. A detailed summation of data trends is provided by means of graphs. The findings are then compared to the data from other developing economies

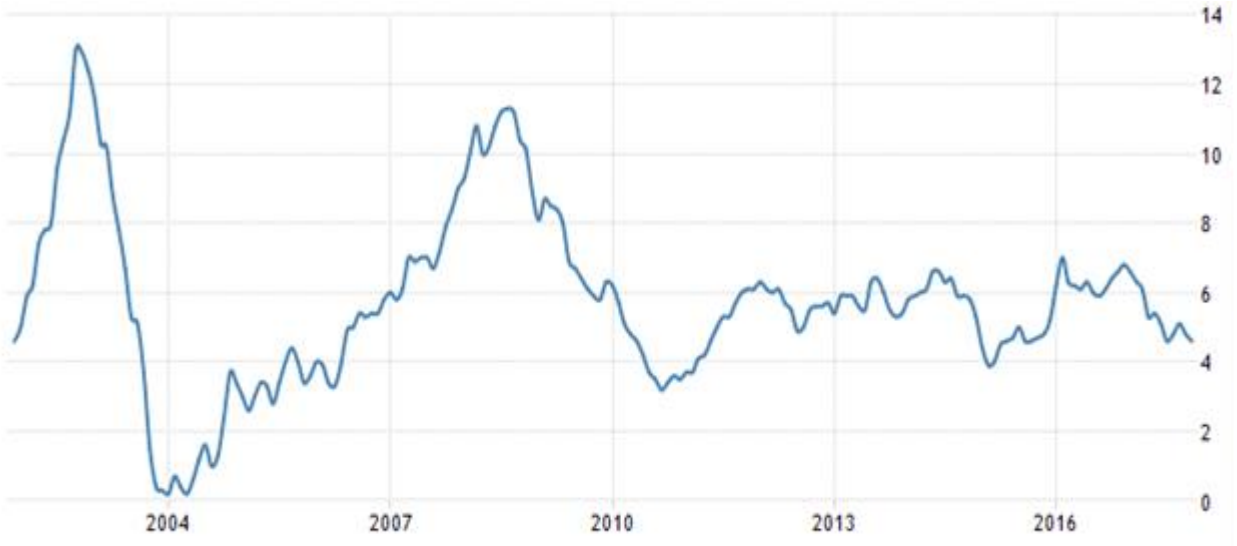
in order to determine the level of success at which monetary policy in South Africa has been controlling inflation and in doing so creating a conducive environment for economic growth and job creation.

3.5.1.1 Inflation and the interest rate in South Africa

As discussed in Section 2.10, the SARB adopted an inflation-targeting framework in 2000 and set the nominal target for inflation at 3 to 6 percent in 2003. Figure 3.12, indicates that inflation rose to a peak by the end of 2002, which was mainly due to an error made by the SARB in the rebasing of the residential rent component in the CPI basket, which subsequently led to this component being overestimated (Rossouw, 2007:87). Along with a domestic financial crisis at the time, the inflation rate rose to 14.01 percent on an annual basis in November 2002.

After correction of the error in the CPI calculation, as well as the stabilisation of financial markets, inflation was drastically reduced in 2004, followed by an upward trend until another peak following the effects of the global financial crisis (Naraidoo & Raputsoane, 2013:18). Inflation has remained volatile ever since, reaching highs of over the 6 percent top band of the targeting framework throughout 2014 and 2016. This volatility in the inflation rate has had numerous economic consequences, such as uncertainty under consumers and enterprises, reduced international competitiveness of producers and adverse effects on real standards of living (Burger, 2014:587).

Figure 3.12: Inflation in South Africa

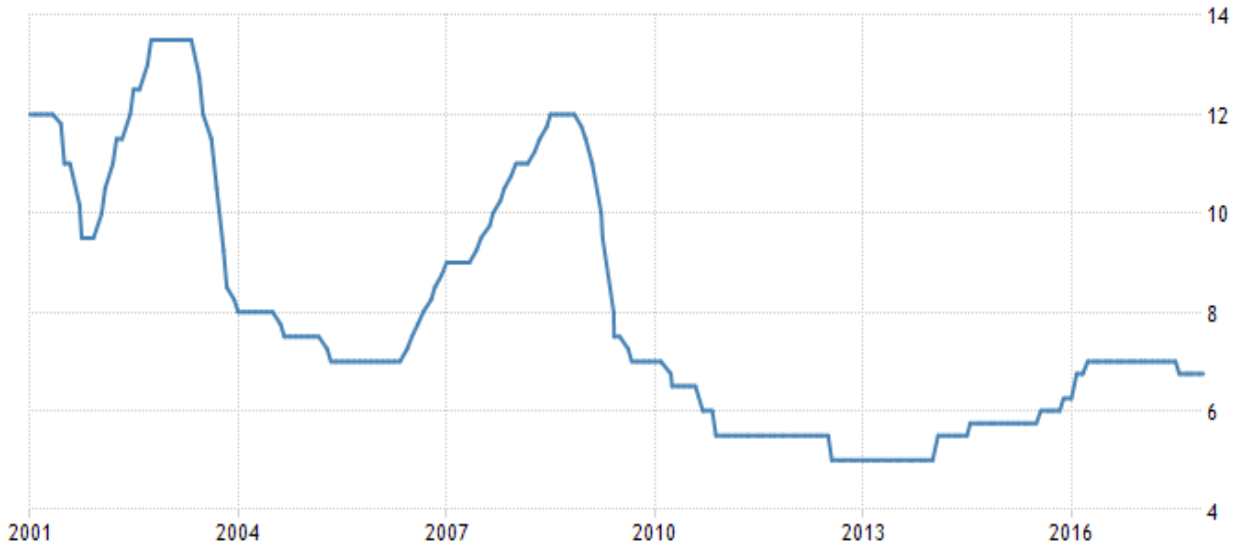


Source: Trading Economics (2018m)

According to Naraidoo and Raputsoane (2013:18), the inflationary pressures in 2007 and 2008 were due to uncertainty and inflation expectations, the output gap in the domestic economy and the contagion effect on financial markets. This also put upward pressure on interest rates as is evident in Figure 3.12. The effects on inflation, mainly from contagion, increased commodity prices and depreciation of the rand, was met by increased interest rates by the monetary authority in order to stave off inflation and increase capital inflow from the foreign sector (Kganyago, 2012:7).

Theoretically, the repo rate has a negative correlation with inflation based on the "Fisher Effect" (Mohr & Fourie, 2011:501). This means that when the repo rate is increased by the SARB, it should result in a decrease in the inflation rate as was discussed in Section 2.10. However, as is evident from Figure 3.12 and Figure 3.13, South Africa has been facing a fluctuating inflation rate in contrast to this theory. The increasing interest rate has not shown any significant reduction in inflation between 2014 and 2016, which indicates that the South African economy is consistent with cost-push or structural inflationary pressures. This coincides with the findings of Javed *et al*. (2010); Mellet (2012:147); Matemilola *et al.* (2015:51) and Davis (2017:3).

Figure 3.13: Interest rate in South Africa



Source: Trading Economics (2018n)

3.5.1.2 Economic growth and employment in South Africa

Between 2001 and 2007, South Africa experienced stable growth due to high international demand for commodities (mainly driven by China) and low levels of volatility and vulnerability of

industries (South African Market Insights (SAMI), 2018). South Africa has been facing low and volatile growth levels since 2007, as is evident from Figure 3.14. The effects of the global financial crisis led the South African economy into a recession in the first quarter of 2009.

This was followed by modest economic growth in 2010, which can mainly be attributed to capital inflow from the 2010 FIFA World Cup that was hosted locally. However, soaring levels of public debt saw South Africa in another technical recession in 2014 and yet again in 2017, subsequently leading to two sovereign credit downgrades by the rating agencies Standard & Poor and Fitch to sub-investment or 'junk' status by the end of 2017 (Trading Economics, 2018o). This was mainly due to extensive levels of political instability under the leadership of former president Jacob Zuma, high levels of unemployment, high income inequality and ever-increasing public debt (Donnelley, 2017).

Figure 3.14: Economic growth in South Africa

Source: Trading Economics (2018p)

According to Meyer (2014:66), South Africa has been affected by structural unemployment in most economic sectors and job creation is hindered by barriers to market entry, employment legislation and government's inability to create a conducive environment for business. Based on Figure 3.15, although employment levels have been on a slight upward trend since 2010, unemployment levels in the economy are still three times the average of most emerging market economies internationally (Meyer, 2014:75).

Figure 3.15: Employment in South Africa

Source: Trading Economics (2018q)

3.6 SYNOPSIS

This chapter explored the history and evolution of the monetary policy within developed and developing countries, also emphasising such developments in African countries. Furthermore, data analyses have been provided for these countries in an attempt to compare monetary policy and its affects in these countries to that of the South African economy, in-line with the empirical objectives of this study. It is evident that the South African economy has been experiencing similar symptoms to its developing counterparts in terms of high inflation, low economic growth, low employment creation and high interest rates.

Developed economies have the ability to make use of unconventional approaches to remedy monetary shocks, which emerging economies would not be able to utilise. Inflation proves to be difficult to control in all emerging market economies. Inflation rates remain volatile and high in most of these economies with South Africa seeing similar symptoms of cost-push and structural inflation to that of the Chinese economy, as increased interest rates struggle to influence inflation in the desired manner. These findings assist in the fulfilment of the theoretical and empirical objectives of this study.

South Africa's economic growth rate has been similar to that of Brazil, Russia and Nigeria since the onset of the global financial crisis, however, Kenya has been experiencing relatively high growth rates. China's economic growth has been surpassing that of all of its developing counterparts the world over. Employment creation has also been a challenge for many emerging

market economies; however, this has been especially true for South Africa and Brazil, which both have much higher unemployment rates than the average amongst developing countries. Monetary policy has thus been a challenging concept in many emerging economies, either in terms of a lack of efficient policy actions, time lags in economic reaction to policy measures or a lack of implementation of existing policies altogether.

The next chapter presents the research design and methodology of the study. It discusses the origin of the data, the sample size of the data and the variables used within the econometric model for this study. Moreover, the next chapter will discuss the model used in the econometric approach and will explain the formulation of the econometric approach adopted by this study.

CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

Monetary policy plays an integral role in an economy's ability to create employment opportunities and increase economic output, by primarily maintaining stable price levels in the economy (Mohr & Fourie, 2011:503). The literature reviewed in Chapter 2 establishes that a relationship exists between efficient monetary policy and an economy's ability to mitigate financial shocks, stabilise price levels, create employment and achieve economic growth. Chapter 2 also indicated the importance of controlling the various types of inflation with the correct monetary policy tools and procedures. Nonetheless, the reviewed empirical literature from Chapter 2 substantiates that a gap exists in research that investigates the efficiency of monetary policy, particularly in the South African context.

Subsequently, questions exist of whether South African monetary policy is effective in its application and procedural approaches in maintaining stable price levels, creating employment and achieving economic growth, as well as explaining which type of inflation exit within the economy. In response to these questions, this chapter presents the econometric approach adopted in an attempt to analyse the efficiency of monetary policy in reaching its objectives, as well as ascertaining whether the South African economy experiences demand-pull inflation or cost-push and structural inflation. With this considered, this chapter describes the econometric methodology used to address the following empirical objectives of this study:

- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, the price of government debt and government revenue with CPI inflation
- To construct a composite index, which includes GDP, employment rate and CPI as a measure of monetary policy success in South Africa, named the Monetary Policy Success Index (MPSI)
- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, the price of government debt and government revenue with the MPSI.

This chapter is divided into three main sections to achieve these objectives; the first section specifies the origin of the data, the sample size of the data and the variables used within the

econometric model for this study. The second section elucidates on the model that is used in the econometric approach; and the third section explains the formulation of the econometric approach adopted by this study.

4.2 DATA ORIGIN, SAMPLE SIZE AND VARIABLE SPECIFICATION

In achieving the specified empirical objectives, the study focusses on the South African economy and encompasses a collection of data of the country's GDP, consumer price inflation, employment, repurchase rate, broad money supply, exchange rate, government debt and government revenue. The data collected for this study are based on a time period of 68 observations ranging from the first quarter of 2001 to the fourth quarter of 2017, as this will account for the onset of the inflation targeting framework by the SARB.

The data being utilised in this study are collected from two credible sources, namely the South African Reserve Bank (SARB) and Statistics South Africa (Stats SA). It should be noted that the data used in the study are transformed to a natural logarithm (L), in order to ensure that the data used in the study do not vary in orders of magnitude, while also reducing variation within the data set and adjusting for scale effects. This also ensures that the growth rates of the variables are determined correctly. The specified variables used within the study, include GDP, consumer price inflation, employment, repurchase rate, broad money supply, exchange rate, government debt and government revenue, as shown in Table 4.1.

Table 4.1 Variable specification

Denotations	Variable specification
The Symbol (L)	Natural logarithm
GDP	Gross domestic product (economic growth)
CPI	Consumer price inflation
EMPL	Employed individuals (proxy for employment)
REPO	Repurchase rate
M3	Broad money supply
EXCH	Nominal effective exchange rate
GOVD	Government debt
GOVR	Government revenue

Table 4.1 specifies the variables that are used in the study. The dependent and independent variables of the study are explained as follows:

4.2.1 Dependent variable specification

The study primarily investigates the efficiency of monetary policy in reaching its goals as set out by the mandate of the SARB. This is done by analysing the impact of the independent variables on, initially CPI inflation itself and, thereafter, on the MPSI, which is constructed using a combination of CPI, GDP and employment data in equal weighting. In other words, each variable in the MPSI is given a score out of one, where a full score of one is allocated to the highest observation value in each variables' data set and all other observations in that data set are divided by the highest value. The MPSI is then constructed by using the sum of each value from the three variables, in a total score out of three. As part of the MPSI, employment is measured using an index (2000 = 1) and GDP is measured using real values, which are seasonally adjusted at an annual rate at constant 2010 prices.

4.2.2 Independent variable specification

In order to determine whether monetary policy is successful in the South African economy, as well as whether inflationary pressures are predominantly demand-pull or cost-push and structural, a set of independent variables have been compiled using the existing literature and theoretical approaches. When conducting the analysis using the MPSI, independent variables will include the repurchase rate (REPO), broad money supply (M3), the nominal effective exchange rate (EXCH), government debt (GOVD) and government revenue (GOVR). However, when analysing CPI as a single dependent variable, employment and GDP will be included as independent variables along with the aforementioned.

4.3 MODEL SPECIFICATION

This study makes use of a dynamic model approach in order to capture the behaviour of a system over time, making the model consistent and accurate. The dynamic model allows for a concurrent relationship between the variables in the study in order to test whether changes in one or more independent variable cause an instantaneous change in the dependent variable at time *t* (Brooks, 2014:158). Moreover, these dynamic models can be extended by introducing lags and such a model that has specifications of lags for both the dependent and independent variables is known as an

autoregressive distributed lag (ARDL) model. This study thus employs an ARDL model to capture the impact of independent variables on dependent variables.

To achieve the primary objective, as well as the set empirical objectives of the study, two equations are estimated. The equations are as follows:

$$LCPI_t = f\ (LREPO_t + LM3_t + LEXCH_t + LGOVD_t + LGOVR_t + LGDP_t + LEMPL_t) \quad (4.1)$$

$$MPSI_t = f\ (LREPO_t + LM3_t + LEXCH_t + LGOVD_t + LGOVR_t) \quad (4.2)$$

Both equations 4.1 and 4.2 will make use of the ARDL approach. Equation 4.1 measures the impact of independent variables on consumer price inflation; whereas, equation 4.2 measures the impact of independent variables on the MPSI.

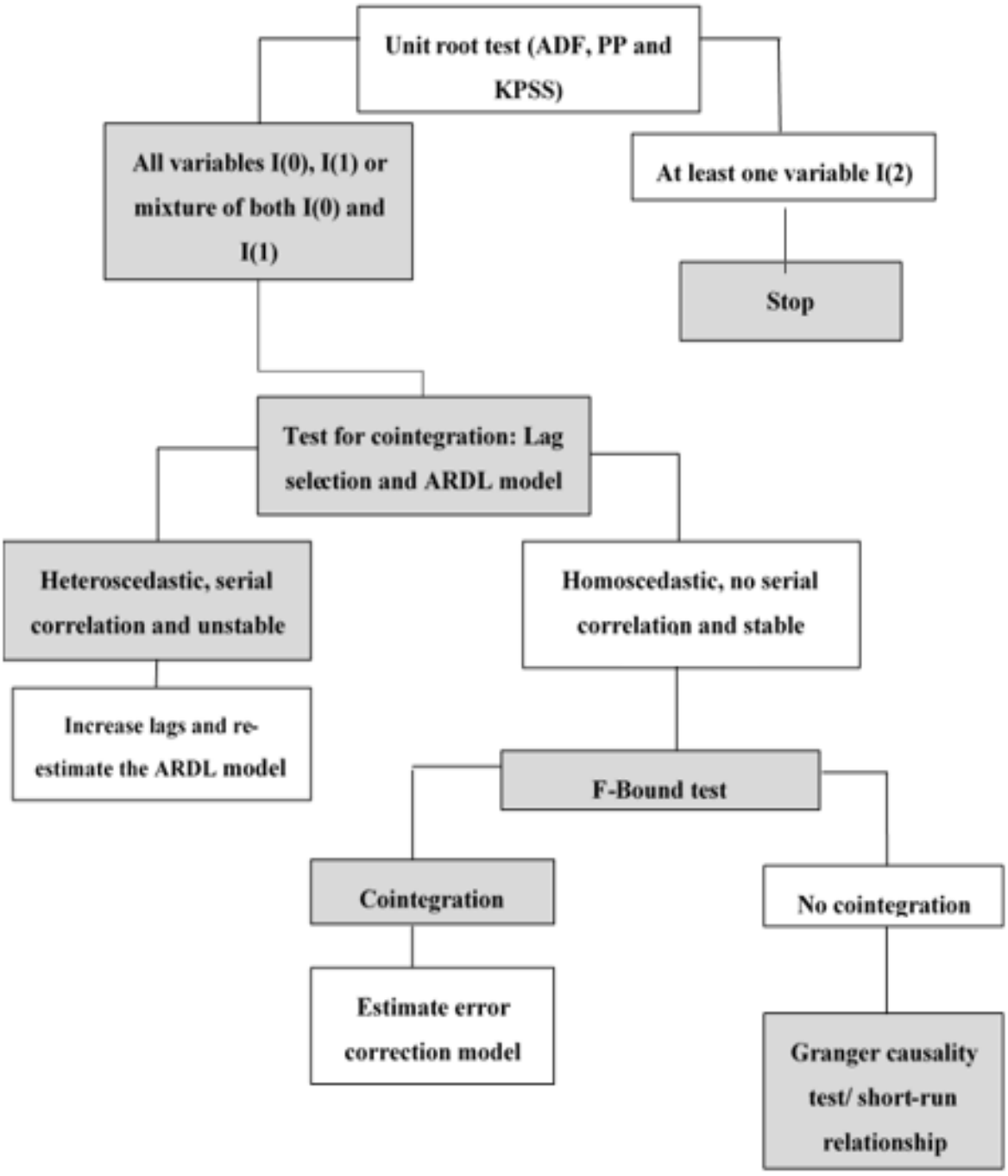
4.4 ECONOMETRIC ESTIMATION APPROACH

The methodology of this study is based on quantitative methods in support of a functionalist approach to economics. According to Bredemeier (1955:174), this approach constitutes the investigation of economic and social dynamics, whilst functionalists attempt to understand economic phenomena with regards to the relationship to a particular economic system. Paul Lazarsfeld established that a functionalist approach is employed to determine the role of x in maintaining y, assisted by t (Platt, 1986:503). Thus, the study examines the impact of independent variables on inflation, employment and economic growth in the South African economy by means of the econometric software E-Views 9.

As mentioned in Section 4.3, this study will employ the ARDL estimation model in its analysis of the data. Thus, all required statistical tests to ensure stationarity of data and stability of the model will be performed. This includes lag selection tests, unit root tests, as well as residual and stability diagnostic tests. This econometric approach was chosen due to its aptitude to produce dependable results, as it is capable to recognise multicollinearity, serial correlation and non-stationarity in the data (McCamel, 2017:102). The ARDL approach is considered a useful approach to econometric testing where variables are considered endogenous as well as explanatory (Dritsakis, 2011). The ARDL model is also flexible in terms of cointegration and accommodates various optimal lags to be allocated to each variable used in the analysis. It can be employed irrespective of how variables are integrated, whether they are of a mixed order of integration, meaning a mixture of I(0) and I(1) variables, or purely integrated in the same order. However, the ARDL model does not allow for non-stationary variables integrated at I(2) order of integration (Dube & Zhou, 2013:203). In order

to make the approach taken in this study more conceivable, the ARDL model estimation approach adopted in this study is described in Figure 4.1 below.

Figure 4.1: ARDL model estimation approach



Source: Compiled by the author

4.4.1 Stationarity/ unit root test

In order to ensure that the analysis of time series data leads to viable results, it is important that the data be tested for the order of integration, in other words, stationarity (Harris & Sollis, 2003:108). Stationarity tests serve as an imperative prerequisite in estimating long-run equilibrium relationships between variables when making use of cointegration techniques (Gujarati & Porter, 2008:762). Gujarati (2004:793) states that time series data can only be considered as stationary if no systematic disparities in covariance and mean exist over time. Thus, the purpose of unit root test is to ensure that time series auto-covariance, variance and mean are stable over time.

Econometric studies generally make use of two approaches to ensure stationarity of data; these include parametric and non-parametric approaches. The parametric approach is applied commonly in economic studies, which focus on the domain, whereas non-parametric approaches are applied in engineering studies which focus on frequency domain (Bethea & Rhinehart, 1991:124). This study will thus take a parametric approach in the diagnosis of the data to ensure that the data used in the study are stationary.

Ogbokor (2015:114) states that various techniques are employed conventionally in the attempt to identify unit roots and ensure stationarity of data. Such techniques include the ADF unit root tests, the cointegration regression Durbin-Watson (CRDW) test, the Phillips-Perron (PP) unit root test, the Kahn and Ogaki test as well as the Kwiatkowski-Phillips-Schmidt and Shin (KPSS) stationarity test. Although the ADF unit root test is commonly used, it is regarded as unreliable in assessing data consisting of small sample sizes and could lead to poor unit root estimations (Brooks, 2008:331). Therefore, the PP unit root test and KPSS stationarity test will be used in order to assess the robustness of the results from the ADF unit root test. This study will thus employ the ADF and PP unit root tests, as well as the KPSS stationarity test to identify unit roots and order of integration in the data to avoid erroneous results.

4.4.1.1 Augmented Dickey-Fuller (ADF) unit root test

The ADF test is an enhanced version of the basic or original Dickey-Fuller (DF) test, also known as the autoregressive unit root test (Dickey & Fuller, 1981:1058. The ADF was improved by Said and Dickey (1984), by developing the accommodation of autoregressive moving averages (ARMA) ordered at p or q in circumstances where orders are unknown. This test is used to evaluate the existence of unit roots and the order of integration within time series data.

The hypothesis testing for the ADF unit root test can be defined as follows:

$\boldsymbol{H_0}$: $\lambda 1 = \lambda 2 = \lambda 3 = \lambda 4 = 1$

Then Yt consists of a unit root, I(1) and is thus not stationary

$\boldsymbol{H_1}$: $\lambda 1; \lambda 2; \lambda 3$ and $\lambda 4 < 1$

Then Yt has no unit root, I(0) and is thus stationary

With this considered, the conclusion of stationarity or no unit root is reached when the ADF unit root test results prove statistically significant at 1 or 5 percent significance level and only then can the null hypothesis (H_0) be rejected. This then allows for the acceptance of the alternative hypothesis (H_1), provided that the p-value is statistically significant. However, should the p-value not be statistically significant at either 1 or 5 percent significance level, the H_0 of unit root in the series is not rejected. Habanabakize (2016:53) provides that an ADF unit root test assumes that the regressed (Y) follows a simple test equation of the order *p*. This test equation can be expressed as follows:

$$\Delta Y_t = \propto Y_{t-1} + \varphi x_t + \lambda_1 \Delta Y_{t-1} + \lambda_2 \Delta Y_{t-2} + \ldots + \lambda_n \Delta Y_{t-n} + u_t \quad (4.3)$$

Where:

Δ - Represents the first difference operator;

Y_{t-n} - Variables that rectify serial correlation errors (by means of introducing lags);

x_t - Exogenous variable (or constant);

φ - Coefficient; and

u_t - The error term

Furthermore, based on Equation 4.3, the null hypothesis (H_0) for the ADF unit root test states that the coefficient is equal to zero, while the alternative hypothesis (H_1) states that the coefficient is less than zero. Thus, concisely:

$\boldsymbol{H_0}$**:** $\propto = 0$

$\boldsymbol{H_1}$**:** $\propto < 0$

In this case, the null hypothesis is rejected on the condition that the coefficient is lower than zero, which implies that the variable does not have a unit root. This means that H_1 is not rejected, which suggests that the variable is stationary. Contradictory thereto, H_0 is not rejected in the event that the coefficient is equal to zero, which implies that the variable has a unit root and is thus non-stationary.

4.4.1.2 Phillips-Perron (PP) unit root test

Similar to the ADF unit root test, the PP unit root test is used to evaluate the unit root in time series data. The PP unit root test follows an identical hypothesis-testing framework as the ADF unit root test and, in most cases, generates the same results (Brooks, 2014:331). The difference, however, according to Phillips and Perron (1988:342), is where the ADF unit root test introduces lags of Y_t as repressors in its simple test equation in an attempt to address serial correlation and the PP unit root test addresses serial correlation by imposing non-parametric rectification to the t-statistic. The simple test process for the PP unit root test can be expressed as follows:

$$Y_t = \propto Y_{t-1} + \varphi x_t + u_t \quad (4.4)$$

$$Y_t = \beta_0 + \beta_{1yt} + \beta_{2t} + u_t \quad (4.5)$$

Where t represents the trend and β_0 represents a constant, consequently, when β_1 is equal to zero, the series is non-stationary and thus has unit root. Conversely, should β_1 be less than zero, the series is stationary and has no unit root. Moreover, the ADF unit root test and the PP unit root test employ the same hypothesis-testing framework under the conditions of Equation 4.5 as basis for the null hypothesis for the PP unit root test, the coefficient is equal to zero, whilst the alternative hypothesis states that the coefficient is less than zero. Concisely:

$\boldsymbol{H_0}$**:** $\beta_0 = 0$

$\boldsymbol{H_1}$**:** $\beta_0 < 0$

As with the ADF unit root test, H_0 in the PP unit root test is rejected provided the coefficient is less than zero, which implies that the variable has a unit root and is thus non-stationary. Therefrom, H_1 is accepted, leading to the conclusion that the variable is stationary. Nonetheless, H_0 is not rejected in the event that the coefficient is equal to zero, which implies that the variable has a unit root and is non-stationary.

4.4.1.3 Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity test

Kwiatkowski, Phillips, Schmidt and Shin (1992) developed the KPSS stationarity test as an alternative approach to test for stationarity. Contrasting the ADF and PP unit root tests, the KPSS stationarity test includes a plain sailing test of the null hypothesis (H_0) of no unit root or stationarity, as opposed to the alternative hypothesis (H_1) of unit root and no stationarity. The test carries the following hypothesis:

$\boldsymbol{H_0}$: Yt is stationary, I(0)

$\mathbf{H_1}$: Yt has a unit root, I(1)

The null hypothesis H_0 states that the variable is stationary when it does not consist of a unit root. Therefore, the null hypothesis cannot be rejected. Conversely, when the variable is $I(1)$, it consists of a unit root and is considered non-stationary, which leads to the H_0 being rejected in favour of the H_1. In the case of the variable with the non-stationary series that has a unit root, however, may be transformed or differenced to be stationary and fit for cointegration tests (Gujarati, 2004:820). According to Deb (2004:210) the KPSS stationarity test is useful confirmatory test, which can be used to supplement the ADF unit root test, provided the low power of the ADF test. The decision to employ the KPSS test was confirmed by the evidence that tests configured on the foundation where the null hypothesis supports that a series I(1), shows low power towards the rejection of H_0.

4.4.2 Cointegration test

After conducting the unit root tests, the study will proceed in testing for cointegration. The most effectual way to test for cointegration in this study is by employing the ARDL model estimation approach as the study has two single equations, the ARDL makes use of an OLS (ordinary least squares) technique. This allows the study to proceed to test for cointegration regardless of whether the study consists of variables that are stationary at I(0), I(1) or a mixture of I(0) and I(1) variables (Pesaran & Shin, 1997). Thus in determination of whether long-run impacts exist between the dependent and independent variables, an ARDL model is used.

4.4.2.1 Autoregressive distributed lag (ARDL) model

The ARDL model has become increasingly popular in its application due to the aforementioned fact that it allows for variables in a data series to be stationary at I(0), I(1) or as a simultaneous mixture of I(0) and I(1) variables (Pesaran & Shin, 1997); thus, dealing with difficulties in data series such as non-stationarity and varied data. Nonetheless, it does not allow for data that are stationary at the second difference I(2). According to Harris and Sollis (2003:110), ARDL also produces long-run impartial estimates for causalities tested, which are coupled with a plausible t-statistic, even in the case of endogenous data series. Thus, the ARDL model has the ability to distinguish between the dependent and independent variables. Moreover, the ARDL model does not utilise conventional system equations in its cointegration methods, it instead adopts an OLS technique that simplifies the application of the model in the estimation of relationships between

the chosen variables (Pesaran, Shin & Smith, 2001:296). This leads to the ARDL model proposing the following hypothesis-testing framework in cointegration tests:

$\boldsymbol{H_0}$: No cointegration, (no long-run impact)

$\mathbf{H_1}$: Cointegration, (long-run impact)

Thus, in testing these two hypotheses, the ARDL model incorporates an F-test, along with a set of two critical bounds, which include the upper- and the lower bound. Where I(0) represents a lower bound and I(1) represents an upper bound. With the condition that the F-statistic is found to be greater than both these critical bound values, the H_0 of no long-run cointegration can be rejected. This implies that a long-run impact from the study's independent variables on the dependent variables does exist (McCamel, 2017:109). Conversely, should the F-statistic be less than both the critical bound values, the H_0 of no long-run cointegration cannot be rejected, which implies no long-run impact from the study's independent variables on dependent variables.

This decision will remain the same even in the situation where the F-statistic is lower than the critical value of the upper bound and greater than that of the lower bound (Pesaran *et al.*, 2001:308). With this said, the ARDL model does not only bequeath efficient and unbiased estimation of the long-run impacts, but also does so with short-run impacts. Thus, the ARDL model also generates the ECM, which takes into account both the short-run adjustments and long-run equilibrium, whilst presenting the error correction term (ECT).

The ECT is the short-run adjustments coefficient and represents the measure by which the long-run disequilibrium of the dependent variables is corrected throughout each quarter (Alimi, 2014:106). Thus, should cointegration exist between chosen variables, the study will proceed in estimating the ECM. However, should cointegration not exist between variables, the study will proceed in estimating the Toda-Yamamoto Granger non-causality test in an attempt to detect the causal patterns and short-run relationships that exist between the variables.

The ARDL model also allows for the use of several optimal lags. This implies that the ARDL model makes use of a general-to-specific approach to modelling and is done by taking into account all the sufficient lags (Harvey, 1981:174). In econometric modelling, the optimal number of lags are selected based on lag-selection criterion, which include: Akaike information criterion (AIC), Schwarz information criterion (SIC), likelihood ratio (LR), Hannan-Quinn (HQ) and final prediction error (FPE) (McCamel, 2017:110). However, out of the five lag selection criterions, the

study makes use of the SIC in determining the maximum number of lags to include in estimating the two models of the study.

Empirical studies have identified that the SIC has more power and a higher degree of consistency over the other lag-selection criterion when dealing either with small or larger sample sizes (Asghar & Abid, 2007; Javed & Mantalos, 2013:1925). Furthermore, the SIC also addresses the issues of over fitting by introducing a penalty term for the number of parameters within the ARDL models of the study (McCamel, 2017:210). In view hereof, this study investigates whether a long- and short-run relationship between independent variables (repo rate, broad money supply, nominal effective exchange rate, government revenue, government debt) on dependent variables (inflation, GDP and employment) using the ARDL model. As mentioned in Section 4.3, the study will first regress the independent variables under the study of CPI and thereafter on the MPSI, namely equations 4.1 and 4.2:

$$\Delta LCPI_t = \alpha_0 + \sum_{j=1}^{k} \pi_j \, \Delta LREPO_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LM3_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LGOVD_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LGOVR_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LGDP_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LEMPL_{t-j} + \varphi_1 LREPO_{t-1} + \varphi_2 LM3_{t-1} + \varphi_3 LEXCH_{t-1} + \varphi_4 LGOVD_{t-1} + \varphi_5 LGOVR_{t-1} + \varphi_6 LGDP_{t-1} + + \varphi_7 LEMPL_{t-1} + e_t \quad (4.6)$$

$$\Delta MPSI_t = \alpha_0 + \sum_{j=1}^{k} \pi_j \, \Delta LREPO_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LM3_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LGOVD_{t-j} + \sum_{j=1}^{k} \pi_j \, \Delta LGOVR_{t-j} + \varphi_1 LREPO_{t-1} + \varphi_2 LM3_{t-1} + \varphi_3 LEXCH_{t-1} + \varphi_4 LGOVD_{t-1} + \varphi_5 LGOVR_{t-1} + e_t \quad (4.7)$$

Where L represents the natural logarithm for each of the variables in the models. The variables combined to form the MPSI is also in the natural logarithm form. While $\pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6$ and π_7 denote the coefficients representing short-run dynamics and φ_1, φ_2, φ_3, φ_4, φ_5, φ_6 and φ_7, denote the long-run relationship. Both 4.6 and 4.7 were tested using the ARDL hypothesis test:

$\boldsymbol{H_0}$: $\varphi_1=\varphi_2=\varphi_3=\varphi_4=\varphi_5=\varphi_6=\varphi_7= 0$ (No cointegration)

$\boldsymbol{H_1}$: $\varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq \varphi_5 \neq \varphi_6 \neq \varphi_7 \neq 0$ (Cointegration)

The rejection of H_0 implies a long-run impact running from independent variables on the dependent variables, which will, as discussed, approbate the study to perform the ECM. The equations for the ECM, 4.8 and 4.9, are expressed as follows:

$$\Delta LCPI_t = \alpha_0 + \sum_{j=1}^{k} \pi_j \Delta LREPO_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LM3_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LGOVD_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LGOVR_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LGDP_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LEMPL_{t-j} + \varphi_1 LREPO_{t-1} + \varphi_2 LM3_{t-1} + \varphi_3 LEXCH_{t-1} + \varphi_4 LGOVD_{t-1} + \varphi_5 LGOVR_{t-1} + \varphi_6 LGDP_{t-1} + + \varphi_7 LEMPL_{t-1} + \delta ECT_{t-j} + e_t \quad (4.8)$$

$$\Delta MPSI_t = \alpha_0 + \sum_{j=1}^{k} \pi_j \Delta LREPO_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LM3_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LEXCH_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LGOVD_{t-j} + \sum_{j=1}^{k} \pi_j \Delta LGOVR_{t-j} + \varphi_1 LREPO_{t-1} + \varphi_2 LM3_{t-1} + \varphi_3 LEXCH_{t-1} + \varphi_4 LGOVD_{t-1} + \varphi_5 LGOVR_{t-1} + \delta ECT_{t-j} + e_t \quad (4.9)$$

The ECT, which represents the error correction term, captures the speed of adjustment to equilibrium for ARDL model equations 4.6 and 4.7. Moreover, the formulated hypotheses for the ARDL model that regressed inflation and the efficiency of monetary policy along with the respective independent variables of the study can be expressed as follows:

H_0: There is no short- and long-run impact on inflation and the efficiency of monetary policy from the independent variables.

H_1: There is a short- and long-run impact on inflation and the efficiency of monetary policy from the independent variables.

4.4.3 Toda-Yamamoto Granger non-causality test

The study then employed the Toda-Yamamoto procedure in order to uncover the causal relationships between the variables under study. The primary distinction between the Toda-Yamamoto causality tests and the standard Granger non-causality test is the application of the block exogeneity Wald test in an augmented VAR model. This test can thus be estimated irrespective of the order of integration of the variables (Hacker & Hatemi, 2006; Lach, 2010:170). Conducting the Toda-Yamamoto approach first involves determining the lag length (*k*) and identifying the maximum order of integration (*d*) of all variables within the system. This is determined by means of the Hannan-Quinn Information Criterion and the unit root- and stationarity tests such as the ADF, PP and KPSS tests discussed in Section 4.4.1.

4.4.4 Model diagnostic tests

Section 4.4.2 of this chapter methodised the ARDL model used in the study, therefore, it is crucial that following the estimation of the ARDL model, the model residual and stability diagnostics tests are performed on the estimated ARDL model before conclusions can be drawn. This is done in

order to ensure that all the model assumptions are valid, including normality in distribution, serial uncorrelated homoscedasticity and stability. Should the model assumptions not be valid, the conclusions reached with the help of that model will be problematic and misrepresentative. Therefore, model residual and stability diagnostics tests that were performed on all estimated ARDL models in the study are methodised as follows:

4.4.4.1 Residual diagnostic tests

In this study, the residual diagnostic tests including normality, serial correlation and heteroscedasticity tests will be employed to evaluate the propriety of assumptions underlying the econometric modelling procedure and to identify the irregular features of the ARDL model that can lead to false conclusions (Pesaran *et al.*, 2001:309). This study methodised the normality, serial correlation and heteroscedasticity residual diagnostic tests as follows:

- *Normality test*

Statistical errors commonly occur within econometric literature, this makes it imperative that normality, along with other assumptions as mentioned, are regulated. Several statistical procedures, including correlation, regression, t-tests and parametric tests, are dependent on the data being normally distributed in order to draw reliable conclusions (Ruxanda & Botezatu, 2008:51). Thus, the study employs the Jarque-Bera test to assess whether the study models, in fact, are distributed normally. The Jarque-Bera test estimates the difference in skewness and kurtosis of each variable when compared to a normal distribution (Chen & Kuan, 2003:8). For this test, the following hypotheses are formulated:

$\boldsymbol{H_0}$**:** Normal distribution

$\boldsymbol{H_1}$: Non-normal distribution

A test statistic assists in the decision of whether or not variables are normally distributed:

$$JB = \frac{N-k}{6}\left[s^2 + \frac{(K-3)^2}{4}\right] \quad (4.10)$$

In Equation 4.10, *N* represents the number of captured observations and, *k* represents the number of estimated parameters. Whilst *K* represents variable kurtosis and *S* represents variable skewness. Thus, should JB be greater than $X^2(2)$ or if the p=value is less or equal to the significance level, the H_0 is rejected. This will suggest that variables are not normally distributed, in contrast,

variables are normally distributed if the p-value is greater than the significance level or JB is smaller than $X^2(2)$.

- *Serial correlation test*

In terms of time series data, a serial correlation exists when the error terms of the earlier period carry over into the future periods (Wooldridge, 2012:412). Specifically, serial correlation occurs when a correlation exists between the error terms from various time periods in the data series. This is a consequence of dependent or independent variables that are not stationary, or in the case of data manipulation through interpolation or extrapolation (McCamel, 2017:114). Such an occurrence will most likely result in unreliable ARDL model estimates, thus making it crucial for data within an ARDL model to be free from serial correlation. In order to assess whether residuals have serial correlation up to any order *k*, the Ljung-Box test was developed (Ljung & Box, 1978:301). For this, the following hypothesis-testing framework is formulated:

$\boldsymbol{H_0}$**:** No serial correlation up to order *k*

$\boldsymbol{H_1}$: Serial correlation up to order *k*

The test statistic assists in the decision of whether residuals are serially correlated:

$$Q_{LB} = T(T+2)\sum_{j=1}^{k}\frac{r_j^2}{T-j} \quad (4.11)$$

From Equation 4.11, *T* represents the number of captured observations, whereas *k* represents the tested elevated order of serial correlation. The r_j^2 represents the j^{th} serial correlation. In this test the H_0 of no serial correlation is rejected should the p-value be less or equal to the significance level. This will then suggest that the residuals indeed are serially correlated. Conversely, should the P-value be greater than the significance level, it will suggest that residuals are not serially correlated.

- *Heteroscedasticity test*

Heteroscedasticity is the occurrence of error terms in a model not being homogenous in their nature, thus implying an inconsistency of variance in error terms (Brooks, 2014:181). This is usually caused by the presence of an outlier in the data set. Heteroscedasticity may also occur due to the manipulation of data by means of interpolation or extrapolation, causing ARDL estimators not to be the best linear unbiased estimators (BLUE) and could lead to unreliable conclusions being drawn. Consequently, it is required that the existence of heteroscedasticity

within data be tested by means of the Engle's arch LM test. For this, the following hypothesis-testing framework is formulated:

$\boldsymbol{H_0}$**:** Homoscedasticity

$\boldsymbol{H_1}$: Heteroscedasticity

The test statistic assists in the decision of whether heteroscedasticity exists:

$LM_E = nR^2$ ..... (4.12)

From Equation 4.12, *n* represents the number of captured observations, whilst R^2 represents the augmented residual regression resolution coefficient. Should the P-value be less or equal to the significance level, the H_0 of homoscedasticity is rejected. This will suggest the existence of heteroscedasticity in the data. Conversely, should the P-value be greater than the significance level, it will suggest that no heteroscedasticity exists.

4.4.4.2 Stability diagnostic tests

Supplementary to the residual diagnostic tests, the study also performs a number of stability diagnostic tests on both of the ARDL models that are estimated. This is done to ensure consistency of all the parameters of the ARDL models over time (Seddighi, Lawler & Katos, 2000:82). Thus, the recursive residual tests are performed to test the stability diagnostics. The recursive residual tests illustrate the plots of recursive residuals around zero, along with standard errors at each point (Brooks, 2014:232). Thus, the residuals that reside within the critical lines of the standard errors indicate stability, whilst those outside indicate instability. The study, therefore, will employ two tests for stability, namely the cumulative sum of recursive residuals (CUSUM) test and the cumulative sum of squared of recursive residuals (CUSUMSQ) test (Seddighi *et al.,* 2000:83). These tests are methodised below.

- *Cumulative sum of recursive residuals (CUSUM) test*

According to Brooks (2014:232), the CUSUM statistic found in the normalised form of recursive residuals is tested on the null hypothesis of quintessential parameter stability. Therefore, the CUSUM statistic is often zero due to the anticipated value of interference usually being zero (Brown, Durbin & Evans, 1975:153). Thus, in the CUSUM test, the null hypothesis of quintessential parameter stability is rejected when residuals reside outside of the standard error critical lines.

The CUSUM test is expressed as follows (Brown *et al*., 1975:153):

$W_t = \sum_{k+1}^{t} {}^{1}/_{s}$ ..... (4.13)

Where: t = k + 1,…,T and $s = S_T$ / (T-k)

From Equation 4.13 W_t represents the recursive residual, whilst s represents the calculated standard deviation and t is the time it takes for a constant to diverge. Consequently, should δ denote a constant and δ persist to be constant at times, then E (W_t) will be equal to zero. Nonetheless, in the event where δ diverges, then W_t will congruently diverge from the critical line of its zero mean value (E (W_t) =0). Thus meaning that the significance of divergence from the critical line of zero mean value will be estimated by making use of two critical lines of 5 percent confidence interval, which will measure the level of stability. This will determine whether the null hypothesis of quintessential parameter stability should be rejected (Brown *et al*., 1975:154).

- *Cumulative sum of squared of recursive residuals (CUSUMSQ) test*

According to Brooks (2014:233), the CUSUMSQ statistic originates in the normalised form of the cumulative sum of squared residuals and is also tested on the basis of the null hypothesis of quintessential parameter stability. The CUSUMSQ and CUSUM thus possess analogous features; nonetheless, the fact that the CUSUMSQ plots the cumulative sum of squared residuals is the distinguishing characteristic between the two, as the CUSUM test plots the cumulative sum of the recursive residuals (Brown *et al.*, 1975:153). Being based on the aforementioned null hypothesis of quintessential parameter stability, the CUSUMSQ statistic can be expressed as follows:

$S_t = {}^{S_t}/_{S_T} = (\sum_{j=k+1}^{t} w_j^2) / (\sum_{j=k+1}^{T} w_j^2)$ ..... (4.14)

From this equation t= t = k + 1,…, T and the projected value of S_t for the null hypothesis of parameter stability is E(S_t) = (t - k) / (T- k). The most effective manner in which to capture the values of significance is to start from zero at $t = k$ and to join at $t = T$. Thus, the significance of the divergence of S from the projected value is estimated using a set of two diagonal critical lines. Both these lines are estimated at 5 percent confidence interval and are parallel to each other around the projected value (Brown *et al*., 1979:154).

4.5 SYNOPSIS

This chapter aimed to specify the set of data that is used in the study, as well as to methodise the econometric estimation approach employed to investigate the efficiency of monetary policy in controlling inflation and assisting in employment creation and economic growth in South Africa. As stipulated in Section 4.2 of this chapter, the study makes use of secondary data covering a period of 68 quarterly observations, starting from the first quarter of 2001 and ending in the final quarter of 2017. The choice of the specified period was prompted by both the availability of the data and the adoption of the inflation-targeting regime in South Africa in February 2000.

Furthermore, Section 4.3 specifies that the models shown by equations 4.1 and 4.2 (where CPI and the MPSI are dependent variables) regress the independent variables of the study. The methodology of this study is based on quantitative methods that support a functionalist approach, in an attempt to understand the efficiency of monetary policy in the South African economy. Therefore, the study employs an ARDL model due to it being applicable, irrespective of whether the variables in the data series are stationary at I(0), I(1) or a mixture of I(0) and I(1) variables. Before the estimation of the ARDL model, two separate unit root tests, as well as a stationarity test was performed (i.e. the ADF, PP and KPSS respectively) in order to detect unit roots in the data and determine the order of integration.

Moreover, should a series of second order integration exist, the ARDL model cannot be estimated. However, should the analysed series consist of I(0), I(1) or a mixture of I(0) and I(1) variables, the ARDL model is estimated to determine long-run impacts of independent variables on the dependent variables. Thereafter, corresponding ECM is estimated to obtain the speed of adjustment to equilibrium. Thus, the hypothesis-testing framework for the ARDL models in the study were presented in this chapter and are mainly based on whether or not there exists a short- or long-run impact between the independent and dependent variables. Finally, the study estimates residual and stability diagnostic tests (i.e. normality, serial correlation, heteroscedasticity and stability tests) to assess the reliability of the results generated by the ARDL models. The following chapter, Chapter 5, thus reports, interprets and discusses the empirical results that were obtained in application of the methodised econometric approach herein discussed.

CHAPTER 5
EMPIRICAL ESTIMATION AND DISCUSSION OF RESULTS

5.1 INTRODUCTION

The preceding chapter methodised the econometric estimation approach that has been employed by this study in order to analyse the long- and short-run impact of independent variables on inflation and the overall efficiency of monetary policy in South Africa. Chapter 4 specifically methodised the ARDL model as a dynamic model that is applied in order to achieve the empirical objectives of the study. Furthermore, other necessary econometric techniques (i.e. unit root and stationarity tests, the ECM and residual diagnostic tests), which are conditional to ensure reliable ARDL estimation results are run. Therefore, this chapter applies the ARDL model to estimate the set empirical objectives of the study, as well as to discuss the results provided by each statistical model in detail. First, the chapter provides descriptive statistics of variables in a graphical format.

Thereafter, the chapter reports the correlation results and the unit root and stationarity test results, which outlines the mutual relationships between variables and determine the order of integration of variables. Determining the order of integration, as discussed in Chapter 4, is a condition of the application of the ARDL bounds test approach to cointegration. Moreover, the study consists of two ARDL models that are shown in equations 4.1 and 4.2. Thus, the subsequent section of this chapter presents and discusses the results from the ARDL model in estimating each equation as follows:

First, the results acquired when estimating long-run impacts by using the ARDL bounds test approach to cointegration are presented. Thereafter, the corresponding results of the ECM and the results of each estimated bounds test is reported. Then, the Toda-Yamamoto approach to the Granger non-causality test is employed in order to determine the short-run causality between the variables under study. Lastly, the results of the residual and stability diagnostic tests for each ARDL model are discussed, which assures that the results generated by the ARDL models of the study are unsusceptible to heteroscedasticity, serial correlation as well as instability.

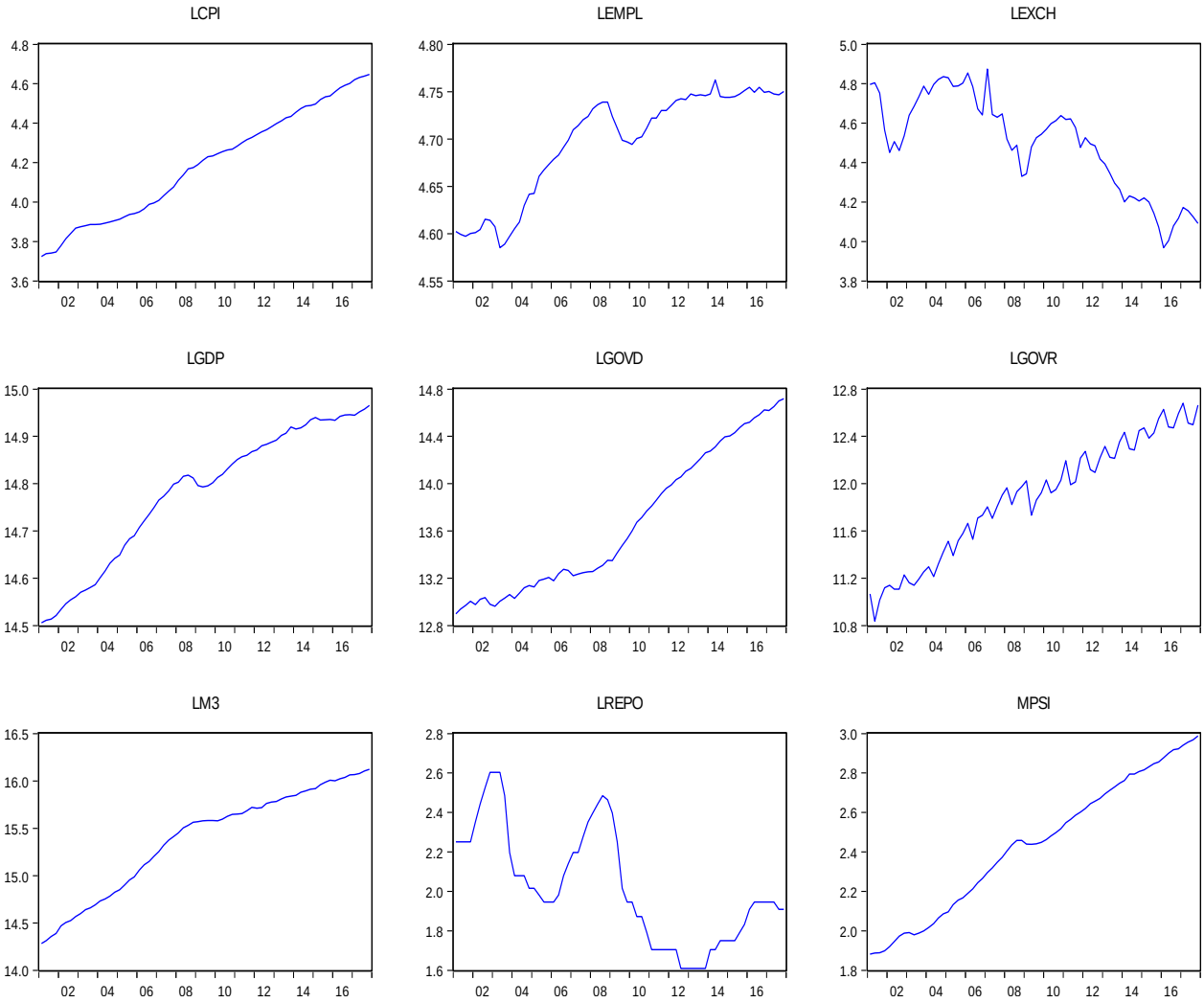
5.2 GRAPHIC REPRESENTATION OF VARIABLES OVER TIME

According to Figure 5.1, based on the raw data of each variable of the study, LCPI has been increasing since 2001, coinciding with a trend of decline in the LREPO. LGDP and LEMPL

indicate increases since 2001; however, LEMPL shows a declining trend toward 2017. M3 has been increasing over time and the results indicate that the LEXCH has been depreciating since 2011. LGOVD shows a significant increase over time, especially since 2008, despite an increasing trend in LGOVR.

The following set of graphs, shown in Figure 5.1, illustrates the movement of variables over time, based on raw data.

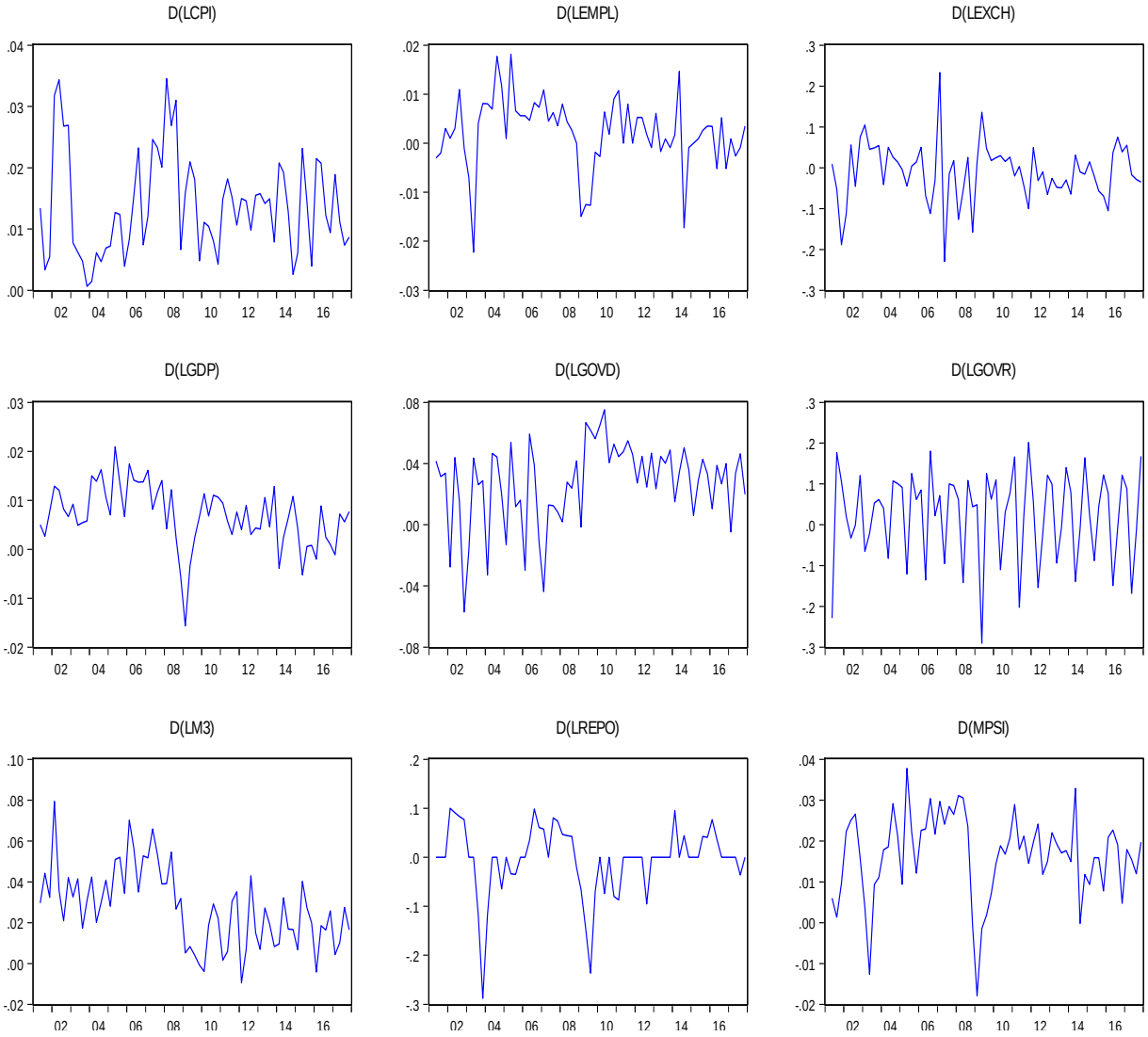
Figure 5.1: Movement of variables (raw data)



According to Figure 5.2, based on differenced data of the variables of this study, peak LCPI is followed by a slowdown in LGDP and thus declined LEMPL in 2008, mainly due to the Global Financial Crisis as discussed in Section 3.5.1 (Naraidoo & Raputsoane, 2013:18). LCPI and LM3 show corresponding movements, while data indicate that increases in LREPO are followed by declines in LCPI, which is in line with theory (Fischer, 1993:50). LGOVD shows a positive correlation in movement with LGOVR, indicating that despite an increase in LGOVR, LGOVD

continues to increase. This indicates that the South African government continually spends more than it collects from taxes and other sources of government income. The following set of graphs, Figure 5.2, illustrate the movement of variables over time, based on differenced data.

Figure 5.2: Movement of variables (differenced data)



5.3 CORRELATION, UNIT ROOT TESTS AND STATIONARITY TEST RESULTS

According to Ogbokor (2015:124), the correlation analysis and unit root tests form the basis for any form of statistical estimation, such as a regression. Therefore, this section will present the correlation matrix results, the unit root test results, as well as that of the stationarity test respectively. As discussed in Section 4.2, the data of the variables in the study have been transformed to natural logarithm (L) in order to ensure that growth rates of the variables are determined and to reduce variation within the data sets.

5.3.1 Correlation matrix results

Table 5.2 shows the correlation coefficient matrix and includes all the variables that are under study.

Table 5.1: Estimated correlation matrix results

Variable	LCPI	LEMPL	LEXCH	LGDP	LGOVD	LGOVR	LM3	LREPO	MPSI
LCPI	1.000 ----- [-----]								
LEMPL	0.8912 15.9636 [0.000]*	1.000 ----- [-----]							
LEXCH	-0.8468 -12.9343 [0.000]*	-0.6887 -7.7188 [0.000]*	1.000 ----- [-----]						
LGDP	0.9651 29.9384 [0.000]*	0.9696 32.1995 [0.000]*	-0.7464 -9.1126 [0.000]*	1.000 ----- [-----]					
LGOVD	0.9745 35.3207 [0.000]*	0.8176 11.5389 [0.000]*	-0.8569 -13.506 [0.000]*	0.9097 17.7983 [0.000]*	1.000 ----- [-----]				
LGOVR	0.9726 34.0148 [0.000]*	0.9418 22.77696 [0.000]*	-0.7971 -10.7274 [0.000]*	0.9827 43.21367 [0.000]*	0.9338 21.21636 [0.000]*	1.000 ----- [-----]			
LM3	0.97106 33.0342 [0.000]*	0.959050 27.50815 [0.000]*	-0.76130 -9.53869 [0.000]*	0.995730 87.63199 [0.000]*	0.906359 17.42753 [0.000]*	0.980762 40.81677 [0.000]*	1.000 ----- [-----]		
LREPO	-0.6675 -7.2839 [0.000]*	-0.6139 -6.3192 [0.000]*	0.3451 2.9879 [0.003]*	-0.6843 -7.6252 [0.000]*	-0.7159 -8.3311 [0.000]*	-0.6640 -7.2148 [0.000]*	-0.6552 -7.0477 [0.000]*	1.000 ----- [-----]	
MPSI	0.9941 74.8752 [0.000]*	0.9298 20.5305 [0.000]*	-0.8326 -12.2143 [0.000]*	0.9824 42.8436 [0.000]*	0.9647 29.7767 [0.000]*	0.9850 46.5017 [0.000]*	0.9825 42.923 [0.000]*	-0.6684 -7.3010 [0.000]*	1.000 ----- [-----]

Note: [ ] indicates P-values
(*) P-value significant at 1% significance levels

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The results given by Table 5.1 report the correlation along with their corresponding t-statistic and probability values of each variable under study. It should, therefore, be noted that the strength of the correlation or relationship between variables is determined quantitatively by means of the

correlation coefficients. In other words, the correlation between variables is determined by the value of the correlation coefficient, between -1 and one. Where the correlation coefficient with a value adjacent to -1 indicates a strong inverse or negative linear correlation, whilst a correlation coefficient with a value adjacent to one indicates a strong positive linear correlation between variables. Conversely, when a correlation coefficient is zero, it indicates that there exists no correlation between variables. This would suggest no rationale for further investigation of that relationship.

Considering the latter, Table 5.1 shows LCPI, LEMPL, LEXCH, LGDP, LGOVD, LGOVR, LM3, LREPO and the MPSI as denotations of the natural logarithms of consumer price inflation, employment, the nominal effective exchange rate, GDP, government debt, government revenue, broad money supply and the repo rate, respectively. As the MPSI is an index of between one and three, there is no need to convert it to its natural logarithm. With respect to the correlations between variables, Table 5.1 shows that all the variables under study have significant p-values at 1 percent level of significance. This implies that all the variables have either a positive or a negative correlation toward each other. LCPI has a strong positive correlation with LEMPL (0.891229), LGDP (0.965099), LGOVD (0.974554), LGOVR (0.972643) and LM3 (0.971066). This suggests that as employment, economic growth, government debt, government revenue or broad money supply increases in the South African economy, consumer price inflation increases as well. Furthermore, the results suggest that fiscal movement, such as increased government debt and government revenue, play a significant role in the increase of consumer price inflation in the economy.

This, in turn, correlates with the causes of structural or cost-push inflation in the South African economy, as government increases direct and indirect taxes to finance government debt and current expenditure (Matemilola *et al*., 2015:54). However, LCPI has a strong negative correlation with LEXCH (-0.86818) and a moderate negative correlation with LREPO (-0.667560), which implies that a higher nominal effective exchange rate (appreciation of the rand) and a higher repo rate will coincide with a decreased consumer price inflation level. The strong negative correlation between LCPI and LEXCH indicates that increased cost of imports and thus higher production costs due to more expensive imported raw materials, lead to increased inflation. This again implies the presence of cost-push or structural inflation in the economy (Van der Merwe *et al*., 2010:24). It should, however, also be noted that the most important tool in controlling inflation by the SARB is the repo rate, which according to the results indicate the weakest correlation with inflation when

compared to the other variables under study. This, combined with the symptoms of cost-push inflation in the South African economy, could lead to inefficient monetary policy under the current conditions.

The MPSI, which includes CPI, employment and GDP, also has a strong positive correlation with GOVD (0.964738), GOVR (0.985080) and LM3 (0.982556). These results indicate that although increased fiscal influence such as increased government debt and revenue, as well as increased money supply in the economy might stimulate economic growth and employment creation, it has a negative effect on inflation. As this study focusses on the success of monetary policy in controlling inflation, it can be deducted that such influence on inflation has an adverse effect on monetary policy in reaching its primary objective of maintaining low and stable inflation (Edey, 2013).

The MPSI also has a strong negative correlation with LEXCH and a moderate negative correlation with LREPO. An increase in the nominal effective exchange rate (appreciation of the rand) will coincide with a lower rate of consumer price inflation. The results, however, indicate that an increased nominal effective exchange rate coincides with decreased economic growth and employment in the South African economy between 2001 and 2017. This implies that despite increased international competitiveness in terms of trade, the South African economy still suffers from low economic growth and low employment creation.

5.3.2 Unit root and stationarity test results

This section will present the results of the unit root tests and the stationarity test performed in the study in order to determine the order of integration of each of the variables under study. As estimation of the ARDL model is dependent on variables to be integrated as I(0), I(1) or a mixture of I(0) and I(1) variables, it is necessary to conduct these tests beforehand; thereby avoiding specious or illogical results from the ARDL model. The ADF and PP unit root tests are employed to determine the unit roots and the KPSS stationarity test in order to determine the variables' order of integration. The decision to do so is motivated by the literature that expressed the existence of inconsistencies in terms of the power and features of unit root tests alone.

As discussed in Section 4.4.1, the ADF and PP unit root tests tend to produce similar results, thus both being biased toward the non-rejection of the null hypothesis. This leads to the employment of the KPSS stationarity test to confirm and assess the robustness of the ADF and PP unit root test results. The unit root tests follow, structured as Table 5.2, which reports the ADF unit root test

results and Table 5.3, which reports the PP unit root test results and Table 5.4, reporting the KPSS stationarity test results.

Table 5.2: Augmented Dickey-Fuller (ADF) unit root test results

Variables	At Level I(0)				At 1st Difference I(1)		Results (order of integration)
	Without trend		With trend		Without trend		
	T-stat	P-value	T-stat	P-value	T-stat	P-value	
MPSI	-0.422630	0.8985	-2.590819	0.2858	-4.839391	0.0002***	I(1)
LCPI	-0.364389	0.9085	-3.153820	0.1033	-3.674959	0.0068***	I(1)
LREPO	-2.060223	0.2612	-2.725570	0.2301	-4.003104	0.0025***	I(1)
LM3	-3.327472	0.0175**	-1.391126	0.8542	----	----	I(0)
LGOVD	-0.043535	0.9505	-2.746473	0.2224	-6.545640	0.0000***	I(1)
LGOVR	-1.588766	0.4824	-1.606829	0.7793	-4.454488	0.0006***	I(1)
LGDP	-2.278157	0.1820	-1.157657	0.9106	-4.486174	0.0005***	I(1)
LEMPL	-1.462101	0.5466	-1.878345	0.6543	-3.895311	0.0035***	I(1)

(***) The rejection of the null hypothesis of not stationary at the 1% significance level

(**) The rejection of the null hypothesis of not stationary at the 5% significance level

(*) The rejection of the null hypothesis of not stationary at the 10% significance level

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The ADF unit root test results as presented in Table 5.2 show that one of the variables, namely LM3 is stationary at level, whilst the rest of the variables are stationary at first difference. These include the MPSI, the natural logarithm of consumer price inflation (LCPI), the natural logarithm of the repo rate (LREPO), the natural logarithm of government debt (LGOVD), the natural logarithm of government revenue (LGOVR), the natural logarithm of gross domestic product (LGDP) and the natural logarithm of employment (LEMPL).

These results were obtained by employing a conventional approach to unit root testing. Thus, all variables were first tested at a level without trend and when testing as not stationary, trend is then considered. If the variables still proved to be non-stationary at level without trend, the final step is to difference them to first difference. Section 4.4.1.1 provides the methodised decision rule for the ADF unit root test, which was also taken into consideration whilst obtaining the ADF unit root test results. The following table, Table 5.3, reports the PP unit root test results.

Table 5.3: Phillips-Perron (PP) unit root test results

Variables	At Level I(0)				At 1st Difference I(1)		Results (order of integration)
	Without trend		With trend		Without trend		
	T-stat	P-value	T-stat	P-value	T-stat	P-value	
MPSI	-0.187815	0.9342	-2.215445	0.4733	-4.839391	0.0002***	I(1)
LCPI	-0.273291	0.9226	-2.110090	0.5307	-4.870645	0.0001***	I(1)
LREPO	-1.607285	0.4733	-2.015735	0.5821	-4.072497	0.0020***	I(1)
LM3	-3.352681	0.0163**	-0.956661	0.9427	----	----	I(0)
LGOVD	1.638743	0.9995	-1.608148	0.7794	-6.536998	0.0000***	I(1)
LGOVR	-0.534562	0.8771	-5.430059	0.0002***	----	----	I(0)
LGDP	-2.452763	0.1316	-0.743132	0.9653	-4.454401	0.0006***	I(1)
LEMPL	-1.397263	0.5786	-1.355544	0.8649	-5.925861	0.0000***	I(1)

(***) The rejection of the null hypothesis of not stationary at the 1% significance level

(**) The rejection of the null hypothesis of not stationary at the 5% significance level

(*) The rejection of the null hypothesis of not stationary at the 10% significance level

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The results from the PP unit root test correspond with that of the ADF unit root test for all the variables under study, except for LGOVR. The PP shows that LGOVR is integrated at level with trend rather than at first difference as reported by the ADF unit root test. As such, Table 5.3 shows

that LM3 is also stationary at I(0), without trend, whilst all other variables (MPSI, CPI, LREPO, LGOVD, LGDP and LEMPL) are stationary at I(1) without trend.

These results have been obtained by following the same aforementioned conventional unit root testing approach, as well as the methodised decision rule for the PP unit root test discussed in Section 4.4.1.2. Table 5.4 presents the KPSS stationarity test results.

Table 5.4: Kwiatkowski, Phillips, Schmidt and Shin (KPSS) stationarity test results

Variables	At Level I(0)				At 1st Difference I(1)		Results (order of integration)
	Without trend		With trend		Without trend		
	LM-stat	Crit. Value	LM-stat	Crit. Value	LM-stat	Crit. Value	
MPSI	1.072352	0.463000	0.112490	0.146000	0.067103*	0.739000	I(1)
LCPI	1.080064	0.463000	0.080666*	0.146000	----	----	I(0)
LREPO	0.628404	0.463000	0.080018*	0.146000	----	----	I(0)
LM3	1.038607	0.463000	0.259225	0.146000	0.656802*	0.739000	I(1)
LGOVD	1.043721	0.463000	0.234159	0.146000	0.453772*	0.739000	I(1)
LGOVR	1.057944	0.463000	0.246899	0.146000	0.080019*	0.739000	I(1)
LGDP	1.032755	0.463000	0.244856	0.146000	0.451430*	0.739000	I(1)
LEMPL	0.916284	0.463000	0.193054	0.146000	0.163577*	0.739000	I(1)
(*) The null hypothesis of stationarity is rejected if LM < Critic.Value							

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The KPSS stationarity test contradicts the ADF and PP unit root tests. Instead of the proposed null hypothesis of a unit root in the unit root tests, the KPSS stationarity tests' null hypothesis states there is no unit root or stationarity as methodised in Section 4.4.1.3. Table 5.4 thus reports that MPSI, LM3, LGOVD, LGOVR, LGDP and LEMPL are not stationary at I(0) with or without trend, however, became stationary at I(1) without trend after being differenced. LCPI and LREPO,

however, are stationary at I(0) with trend. These results indicate, along with that of the ADF and PP unit root tests, that the study can indeed move forward in estimating the ARDL model.

5.4 AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) MODEL RESULTS: LONG- AND SHORT-RUN IMPACTS

As the unit root tests and stationarity test results in Section 5.3 indicate that all the variables under study consist of a mixture of I(0) and I(1) variables and none of the variables are stationary at I(2), it permits the study to move forward with the ARDL model approach. The ARDL bound test approach to cointegration is used to determine the long-run impacts of fiscal movements, structural changes and monetary policy movements on consumer price inflation, employment and economic performance in South Africa. In doing so, the study will determine whether monetary policy has been efficient in reaching its set objectives. This is done by testing the impacts of independent variables on both CPI and the MPSI as discussed in Section 4.2.1. Subsequent to determining the long-run impacts, the corresponding ECMs will then be reported and discussed, in order to identify the short-run impact of independent variables on CPI and the MPSI in South Africa.

5.4.1 Independent variables on CPI

This section will start by detailing the optimal ARDL model, followed by the ARDL model bound test and discussion of the ECM results of the model. Thereafter, the model residual and stability diagnostics tests are performed. The maximum number of lags to include in the ARDL model is determined by employing the Schwarz information criterion (SIC). This is due to the ability of the SIC to address any issue of over-fitting, by means of introducing a penalty term for the number of parameters. Thus, the SIC selected three lags as the maximum to include in the ARDL model regressing CPI as dependent variable. Therefore, the model sequence of the variables for Equation 4.6 was ARDL model (1,0,1,0,0,3,0,0). Table 5.5 details the optimal ARDL model for Equation 4.6.

Table 5.5: Optimal ARDL model selected

ARDL Model	Trend Specification	Max. no. of lags	Optimal model	R-Square	Adj. R-Square
Independent variables on CPI	Constant level	4	(1,0,1,0,0,3,0,0)	99.97%	99,96%

The optimal ARDL model is estimated at a constant level without trend as described in Table 5.6 with its corresponding R-square and adj. R-square values. The R-square value for the model

implies that 99.97 percent of the variation in CPI can be explained by the regression with independent variables. The R-square value is inefficient in increasing as more independent variables are added, regardless of the significance of said variables. Therefore, the study also reported the models corresponding adj. R-square, which only considers the independent variables that are statistically significant in explaining variation in the dependent variables under study. The adj. R-square value for the ARDL model implies that 99.96 percent of the variation in CPI can be explained by the regression with independent variables. Now that the optimal ARDL model used to regress the independent variables with CPI is profiled, the next step was to report, interpret and discuss the results obtained when estimating the bound tests and their corresponding ECMs for this optimal ARDL model.

5.4.1.1 ARDL bound test results: Long-run impacts on CPI

This section shows the ARDL bound test approach to cointegration, which is used to determine whether a long-run impact exists between the independent variables and CPI in the South African economy. Therefore, the ARDL bound test results with lower- and upper bound, the corresponding F-value and long-run equation are provided in Table 5.6.

Table 5.6: Estimated ARDL model (1,0,1,0,0,3,0,0) bound test results

ARDL model	**Estimated F-value**	
ARDL model (1,0,1,0,0,3,0,0)	6.56	
Critical Value Bounds		
Significance levels	**Lower bound I(0)**	**Upper bound I(1)**
10%	2.03	3.13
5%	2.32	3.5
1%	2.96	4.26
Long-run equation: LCPI = 0.4483 + 0.1144*LREPO + 0.6471*LM3 - 0.0874*LEXCH + 0.3909*LGOVD + 0.5245*LGOVR - 0.8548*LGDP + 1.6022*LEMPL		

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

- **Analysis and parameter estimation of the long-run impact of independent variables on CPI**

Table 5.6 shows that the estimated F-value for the ARDL model (1,0,1,0,0,3,0,0) is 6.56, which exceeds the corresponding critical value bounds at 1 percent significance levels. Therefore, the

null hypothesis of no long-run impact is rejected. This indicates that long-run impacts running from fiscal movements, structural changes and monetary policy movements to consumer price inflation do exist in the South African economy. This suggests that although inflation is affected by changes made by monetary policy in terms of the repo rate and money supply, inflation is also affected by structural and cost-push factors brought forth by increased government debt, higher taxes, employment, economic growth, as well as cost of and competitiveness in trade.

The aforementioned empirical finding is consistent with various studies (Akinboande *et al.,* 2004; Fedderke & Schaling, 2005; Adusei, 2013; Sen, 2016) that proved that the South African economy is affected by cost-push and structural inflation. The finding of this study is also in line with other studies (Utgoff & Brechling, 1979; Feldstein, 1983; Chickeke, 2009; Mellet, 2012) that investigated the correlations running from government debt, taxation, employment and monetary policy to inflation in emerging market economies such as South Africa. The finding of this study also corresponds with studies (Zettelmeyer, 2000; Eichengreen, 2002; De Waal & Van Eyden, 2014; Frenkel & Taylor, 2006) that investigated the effects of exchange rate of inflation in small open economies. These studies were conducted in the context of various countries but encountered similar results.

The long-run equation, which corresponds with the long-run impact that was determined by the bound test results for the ARDL model (1,0,1,0,0,3,0,0) presented in Table 5.6, shows that broad money supply, government debt, government revenue and employment all have a positive long-run impact on consumer price inflation in South Africa. The nominal effective exchange rate and GDP all have a long-run negative impact on consumer price inflation in the South African economy, mainly due to the influence of structural and cost-push factors on inflation.

The long-run equation further shows that a 1 percent increase in the repo rate will actually lead to an increase in consumer price inflation by 0.114 percent in the long run. This indicates that the repo rate is ineffective controlling inflation in South Africa and does not have a negative correlation with inflation as desired. This finding is supported by studies (Strauss-Kahn, 2011; Mellet, 2012; Du Plessis & Rietfeld, 2013) that found that since the 2008 global financial crisis, many countries, including South Africa, suffer from symptoms of cost-push and structural inflation, which cannot be controlled by conventional methods that are used to control demand-pull inflation. This causes monetary policy to be inefficient in controlling inflation in the South African economy in a consistent and long-term manner. Money supply in the economy also has a

positive long-run impact on inflation and a 1 percent increase in money supply leads to a 0.65 percent increase in consumer price inflation in the long run.

An appreciation in the exchange rate and thus an increased nominal effective exchange rate by 1 percent, will cause consumer price inflation to decrease by 0.09 percent in the long run. This indicates that increased cost of imports and thus cost of production, has an adverse effect on inflation in the long run. Furthermore, increased government revenue by 1 percent, leads to an increase in consumer price inflation by 0.52 percent. This corresponds with studies (Utgoff & Brechling, 1979; Feldstein,1983) that prove that increased income taxes, as well as other taxes, lead to increased inflation.

5.4.1.2 Error correction model (ECM) results and short-run impacts on CPI

This section reports the short-run dynamic parameters obtained from the ECM, after the long-run impacts have been determined by the bound test in the preceding section. Brooks (2014:376) states that the ECM estimates the speed to adjustment for discrepancy in the previous period between variables to return to equilibrium in the long run. Furthermore, Gujarati and Porter (2008:764) highlight that the ECM, to a certain extent, rectifies disequilibrium that occurred in the previous period, in terms of short-term equilibrium. Therefore, the previous short-run disequilibrium can be corrected and the speed of adjustment can be estimated, provided that the ECT included in the ECM is negative, as well as statistically significant. With this in mind, Table 5.7 presents the ECM results for the ARDL model (1,0,1,0,0,3,0,0).

Table 5.7: Estimated ECM results

ARDL model (1,0,1,0,0,3,0,0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LREPO)	0.021446	0.007696	2.786747	0.0074***
D(LM3)	0.006879	0.062099	0.110778	0.9122
D(LEXCH)	-0.016376	0.009567	-1.711776	0.0929*
D(LGOVD)	0.073245	0.021544	3.399771	0.0013***
D(LGOVR)	-0.025649	0.012898	-1.988658	0.0520**
D(LGOVR(-1))	-0.008695	0.013465	-0.645720	0.5213
D(LGOVR(-2))	0.056639	0.013582	4.170116	0.0001***
D(LGDP)	-0.160189	0.102788	-1.558433	0.1252

D(LEMPL)	0.300238	0.112282	2.673949	0.0100**
ECT(-1)	-0.187395	0.053685	-3.490654	0.0010***
(***) denotes significance at 1% level, (**) denotes significance 5 % level and (*) denotes significance 10 % level				

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The estimated ECM results with the short-run dynamic coefficients for the ARDL bound test results for the ARDL model (1,0,1,0,0,3,0,0) is provided by Table 5.7. The ECT coefficient is -0.187395 and is significant at the 1 percent significance level, which indicates that around 18 percent of any previous disequilibrium between CPI and independent variables is re-established back to long-run equilibrium in each quarter. Thus, it takes roughly 5.34 (1/0.187395) quarters for any changes in independent variables to have an impact on CPI. This result supports the notion of De Waal and Van Eyden (2014) that changes by monetary policy take too long to effect inflation in the South African economy. The finding of this study infers that increased inflation is detrimental to economic growth, which is supported by studies such as Fischer (1993); Barro (1995); Andrés and Hernando (1999); and Bauknecht (2002).

Therefore, in the long run, causality runs through the ECT from independent variables to CPI. This result confirms that fiscal movements, structural changes and monetary policy movements have a long-run impact on CPI in the South African economy. In the short run, LREPO, LGOVD and LEMPL have positive and statistically significant short-run coefficients, meaning that increases in LREPO, LGOVD and LEMPL will increase CPI by 0.021 percent, 0.073 percent, 0.30 percent respectively, in the short run. However, LEXCH and LGOVR have a negative and statistically significant short-run coefficient, meaning that increases in LEXCH and LGOVR will decrease LCPI by 0.016 percent and 0.026 percent respectively, in the short run. To test whether the bound test and ECM results estimated by the ARDL model (1,0,1,0,0,3,0,0) are not inaccurate or misleading, the following section will present the model residual and stability diagnostic test results obtained in assessment of the ARDL model.

5.4.1.3 ARDL model diagnostic test results

The bound test and ECM results generated by the ARDL model (1,0,1,0,0,3,0,0) have been reported, interpreted and discussed. This section will report and interpret the results that were obtained by means of the residual and stability diagnostic tests performed on the ARDL model.

These tests indicate that the results are not inaccurate or misleading. Therefore, Table 5.8 reports the residual diagnostic test results.

Table 5.8: Residual diagnostic test results

Residual diagnostics tests	**ARDL models**	
	ARDL (1,0,1,0,0,3,0,0)	
	P-value	Decision
Normality Test	0.5027*	Do not reject H_0
Serial-correlation Breusch-Godfrey (LM test)	0.7834*	Do not reject H_0
Heteroscedasticity Test: ARCH	0.9664*	Do not reject H_0

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

As discussed in Section 4.4.3.1, the null hypothesis for the Lagrange multiplier (LM) serial-correlation test is no serial correlation, while the null hypothesis for the Jarque-Bera (JB) normality test is normal distribution. The null hypothesis for the Engle's arch heteroscedasticity test is homoscedasticity. Thus, Table 5.8 shows that variables in the ARDL model are normally distributed, are unsusceptible to serial-correlation and are homoscedastic. This means that none of the aforementioned null hypotheses are rejected, which implies that both the bound test and ECM results for the ARDL model (1,0,1,0,0,3,0,0) are accurate and not misleading.

Figures 5.3 and 5.4 show the results of the CUSUM and the cumulative sum of squared recursive residuals (CUSUMQ) that were performed on the ARDL model. These results show the outside critical lines at 5 percent level of significance, while the blue (crooked) lines denote the statistics of CUSUM and CUSUMQ. Therefore, it can be deduced that there is little to no instability of residuals as the CUSUM and CUSUMQ statistics lines remain inside the lines of stability and only slightly exits, during the 2007 statistics, however, returns to equilibrium level inside of the lines of stability.

Figure 5.3: Stability diagnostic test results (CUSUM)

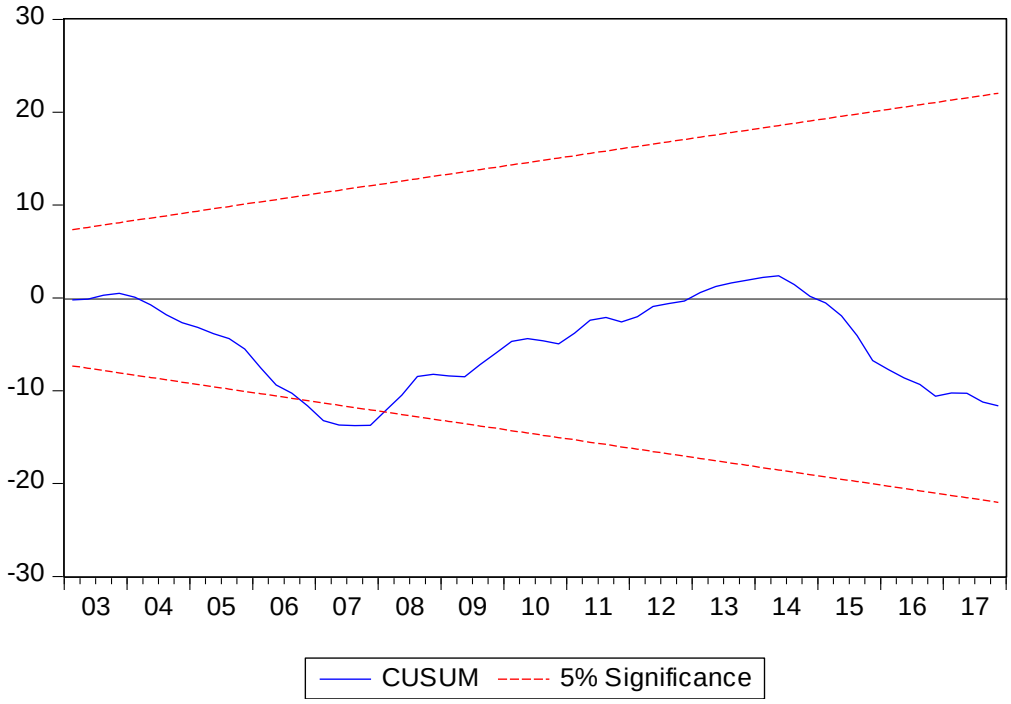
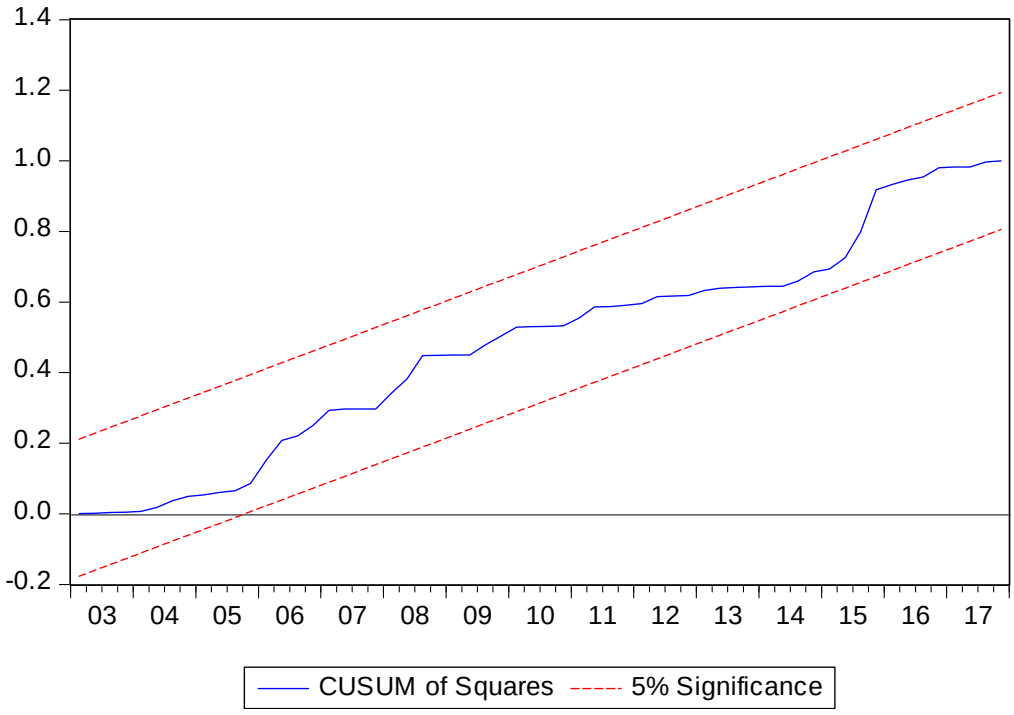


Figure 5.4: Stability diagnostic test results (CUSUMQ)



The next section of this chapter will interpret and discuss the results that were obtained by estimating the impact of independent variables on the MPSI.

5.4.2 Independent variables on MPSI

This section will start by detailing the optimal ARDL model (2,0,0,0,0,2), followed by the ARDL model bound test and discussion of the ECM results of the model. Thereafter, the model residual and stability diagnostics tests are performed. The maximum number of lags to include in the ARDL model is determined by employing the Schwarz information criterion (SIC). The SIC selected two (2) lags as the maximum to include in the ARDL model regressing MPSI as dependent variable. Therefore, the model sequence of the variables for Equation 4.7 was ARDL model (2,0,0,0,0,2). Table 5.9 details the optimal ARDL model for Equation 4.7.

Table 5.9: Optimal ARDL model selected

ARDL Model	Trend Specification	Max. no. of lags	Optimal model	R-Square	Adj. R-Square
Independent variables on MPSI	Constant level	4	(2,0,0,0,0,2)	99.95%	99.94%

The optimal ARDL model is estimated at a constant level without trend as described in Table 5.9 with its corresponding R-square and adj. R-square values. The R-square value for the model implies that 99.95 percent of the variation in the MPSI can be explained by the regression with independent variables. The R-square value is inefficient in increasing as more independent variables are added, regardless of the significance of said variables. Therefore, the study also reported the models corresponding adj. R-square, which only considers the independent variables that are statistically significant in explaining variation in the dependent variables under study. The adj. R-square value for the ARDL model implies that 99.94 percent of the variation in CPI can be explained by the regression with independent variables. Now that the optimal ARDL model used to regress the independent variables with the MPSI is profiled, the next step was to report, interpret and discuss the results obtained when estimating the bound tests and their corresponding ECMs for this optimal ARDL model.

5.4.2.1 ARDL bound test results: Long-run impacts on MPSI

This section shows the ARDL bound test approach to cointegration, which is used to determine whether a long-run impact exists between the independent variables and the MPSI in the South African economy. Therefore, the ARDL bound test results with lower- and upper bound; the corresponding F-value and long-run equation is provided in Table 5.10.

Table 5.10: Estimated ARDL model (2,0,0,0,0,2) bound test results

ARDL model	Estimated F-value	
ARDL model (2,0,0,0,0,2)	4.33	
Critical Value Bounds		
Significance levels	**Lower bound I(0)**	**Upper bound I(1)**
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.28
Long-run equation: MPSI = - 6.235 + 0.0238*LREPO + 0.1674*LM3 - 0.0067*LEXCH + 0.1756*LGOVD - 0.3110*LGOVR		

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

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Table 5.10 shows that the estimated F-value for the ARDL model (2,0,0,0,0,2) is 4.33, which exceeds the corresponding critical value bounds at 1 percent significance levels. Therefore, the null hypothesis of no long-run impact is rejected. This indicates that long-run impacts running from fiscal movements, structural changes and monetary policy movements to the MPSI and thus the objectives of monetary policy in terms of inflation, economic growth and employment creation does exist in the South African economy. This suggests that the success or efficiency of monetary policy in achieving its objectives of low and stable inflation, sustained economic growth and full employment in the economy are all effected by the repo rate, money supply in the economy, the exchange rate, the level of government debt and the level of government revenue in terms of taxation. The aforementioned empirical finding is consistent with various studies (Ngandu, 2009; Banerjee & Veeramani, 2014; Chipeta, Meyer & Muzindutsi, 2017) that found that sectors of the economy active in trade or otherwise effected by fluctuations in the exchange rate could suffer deterioration in employment creation and retention should the exchange rate depreciate. The results also agree with Coiran (2014); the study found that emerging economies that control inflation from a demand-pull inflation perspective and suffer from structural inflation, as is the case in South Africa, could experience depreciation spirals and low growth levels.

The long-run equation which corresponds with the long-run impact that was determined by the bound test results for the ARDL model (2,0,0,0,0,2) presented in Table 5.10 shows that the repo rate, broad money supply, government debt and government revenue all have a positive long-run impact on the MPSI. However, the nominal effective exchange rate has a negative long-run impact on the MPSI. The results show that a 1 percent increase in government debt and government revenue will lead to a 0.18 percent and a 0.31 percent respectively in the MPSI. This means that these variables will lead to increased economic growth and employment in the economy, but concurrently causes increased inflationary pressure in the economy in the long run, which goes against the primary and ultimate goal of monetary policy.

5.4.2.2 Error correction model (ECM) results and short-run impacts on MPSI

This section reports the short-run dynamic parameters obtained from the ECM, after the long-run impacts have been determined by the bound test in the preceding section. Table 5.11 presents the ECM results for the ARDL model (2,0,0,0,0,2).

Table 5.11: Estimated ECM results

ARDL model (2,0,0,0,0,2)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MPSI(-1))	0.404990	0.100814	4.017215	0.0002***
D(LREPO)	0.008533	0.008501	1.003796	0.3198
D(LM3)	0.060030	0.030343	1.978404	0.0528*
D(LEXCH)	-0.002394	0.011668	-0.205210	0.8382
D(LGOVD)	0.062957	0.019376	3.249192	0.0020***
D(LGOVR)	0.040463	0.014873	2.720673	0.0087***
D(LGOVR(-1))	-0.037339	0.016056	-2.325615	0.0237**
ECT(-1)	-0.358508	0.078855	-4.546398	0.0000***
(***) denotes significance at 1% level, (**) denotes significance 5 % level and (*) denotes significance 10 % level				

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

The estimated ECM results with the short-run dynamic coefficients for the ARDL bound test results for the ARDL model (2,0,0,0,0,2) is provided by Table 5.11. The ECT coefficient is −0.358508 and is significant at the 1 percent significance level, which indicates that around 35 percent of any previous disequilibrium between the MPSI and independent variables is re-established back to long-run equilibrium each quarter. Thus, it takes roughly 2.79 (1/0.358508) quarters for any changes in independent variables to have a positive impact on the MPSI. This means that any change in terms of independent variables will take approximately 2.8 quarters before effecting CPI, GDP or employment in the South African economy.

Therefore, in the long-run, causality runs through the ECT from independent variables to the MPSI. This result confirms that fiscal movements, structural changes and monetary policy movements have a long-run impact on the MPSI. Increases in LM3, LGOVD and LGOVR will increase the MPSI by 0.06 percent, 0.63 percent and 0.04 percent respectively, in the short run. LREPO also has a positive coefficient, but is not statistically significant. This indicates that the repo rate has no real short-run effect on the MPSI and, thus, does not influence the success or efficiency of monetary policy in reaching its objectives in the short run.

Furthermore, LEXCH has negative and a statistically insignificant short-run coefficient, meaning that changes in the exchange rate also do not affect the success or efficiency of monetary policy in reaching its objectives in the short run. These results indicate that only money supply and fiscal movements have an impact on monetary policy success in the short run in South Africa, based on the variables used in this study. To ensure that the bound test and ECM results estimated by the ARDL model (2,0,0,0,0,2) are not inaccurate or misleading, the following section will present the model residual and stability diagnostic test results obtained in assessment of the ARDL model.

5.4.2.3 Toda-Yamamoto Granger non-causality test

The study employed the Toda-Yamamoto causality test to analyse the causal relationships between the CPI and the various independent variables under study. This test does not include the MPSI as all variables included in the index are tested independently. Accordingly, the Toda-Yamamoto Granger non-causality approach tests the null-hypothesis of non-causality against an alternative hypothesis of the existence of causality between variables. Table 5.12 shows the results of this test:

Table 5.12: Toda-Yamamoto results

Dependent Variable: LCPI		
Independent Variable	**P-Value**	**Result**
LEMPL	0.5749	No causal relationship
LEXCH	0.6705	No causal relationship
LGDP	0.8480	No causal relationship
LGOVD	0.1495	No causal relationship
LGOVR	0.0598*	Causal relationship exits
LM3	0.1366	No causal relationship
LREPO	0.5486	No causal relationship
ALL VARIABLES	0.0228**	Causal relationship exits

Dependent Variable: LEMPL		
Independent Variable	**P-Value**	**Result**
LCPI	0.3995	No causal relationship
LEXCH	0.1729	No causal relationship
LGDP	0.1628	No causal relationship
LGOVD	0.9452	No causal relationship
LGOVR	0.4296	No causal relationship
LM3	0.7767	No causal relationship
LREPO	0.6322	No causal relationship
LEMPL	0.3995	No causal relationship
ALL VARIABLES	0.0000***	Causal relationship exits

Dependent Variable: LEXCH		
Independent Variable	**P-Value**	**Result**
LCPI	1.0000	No causal relationship
LEMPL	0.4957	No causal relationship
LGDP	0.5156	No causal relationship
LGOVD	0.5922	No causal relationship
LGOVR	0.1909	No causal relationship
LM3	0.8886	No causal relationship
LREPO	0.7060	No causal relationship
ALL VARIABLES	0.0615*	Causal relationship exits

Dependent Variable: LGDP		
Independent Variable	**P-Value**	**Result**
LCPI	0.6615	No causal relationship
LEMPL	0.1317	No causal relationship
LEXCH	0.2034	No causal relationship
LGOVD	0.2014	No causal relationship
LGOVR	0.3521	No causal relationship
LM3	0.4898	No causal relationship
LREPO	0.1395	No causal relationship
ALL VARIABLES	0.1224	No causal relationship

Dependent Variable: LGOVD		
Independent Variable	**P-Value**	**Result**
LCPI	0.1402	No causal relationship

LEMPL	0.4095	No causal relationship
LEXCH	0.9383	No causal relationship
LGDP	0.2838	No causal relationship
LGOVR	0.6813	No causal relationship
LM3	0.0888*	Causal relationship exits
LREPO	0.0453**	Causal relationship exits
ALL VARIABLES	0.0000***	Causal relationship exits

Dependent Variable: LGOVR		
LCPI	0.2466	No causal relationship
LEMPL	0.1063	No causal relationship
LEXCH	0.8499	No causal relationship
LGDP	0.2831	No causal relationship
LGOVD	0.0046***	Causal relationship exits
LM3	0.0227**	Causal relationship exits
LREPO	0.7916	No causal relationship
ALL VARIABLES	0.0000***	Causal relationship exits

Dependent Variable: LM3		
Independent Variable	**P-Value**	**Result**
LCPI	0.3566	No causal relationship
LEMPL	0.1262	No causal relationship
LEXCH	0.2831	No causal relationship

LGDP	0.1271	No causal relationship
LGOVD	0.1971	No causal relationship
LGOVR	0.0309**	Causal relationship exits
LREPO	0.3168	No causal relationship
ALL VARIABLES	0.0000***	Causal relationship exits

Dependent Variable: LREPO		
Independent Variable	**P-Value**	**Result**
LCPI	0.0006***	Causal relationship exits
LEMPL	0.5359	No causal relationship
LEXCH	0.0280**	Causal relationship exits
LGDP	0.1712	No causal relationship
LGOVD	0.4774	No causal relationship
LGOVR	0.5903	No causal relationship
LM3	0.2587	No causal relationship
ALL VARIABLES	0.0000***	Causal relationship exits
(***) denotes significance at 1% level, (**) denotes significance 5 % level and (*) denotes significance 10 % level		

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

Table 5.12 indicates the short-run causal relationships between individual variables as well as the short-run causal relationship between each variable compared to all other variables as a group. The results show that government revenue has a significant, unilateral causal relationship with consumer price inflation in the short-run at 10 percent. Which indicates that fiscal influences such as increased taxes lead to inflation in the South African economy in the short run, which is a symptom of structural and cost-push inflation. All variables as a group also indicate a significant

short-run causal relationship with consumer price inflation. Neither employment nor exchange rate indicate a causal relationship with either of the variables individually, however, all variables as a group Granger cause employment and exchange rate in the short run.

Government debt Granger cause both money supply and the repo rate in the short run, whilst all variables as a group also shows a causal relationship with government debt at 1 percent level of significance. Government revenue has a unilateral causal relationship with government debt, whilst government revenue and broad money supply show a bilateral causal relationship in the short run both at 5 percent level of significance. These findings further support the existence of structural inflation in the South African economy. All variables as a group also show a significant causal relationship with government revenue and broad money supply in the short run. The repo rate shows a short-run, significant, unilateral, causal relationship with consumer price inflation at 1 percent and the exchange rate at 5 percent, whilst all variables as a group granger cause the repo rate in the short run.

5.4.2.4 ARDL model diagnostic test results

The bound test and ECM results generated by the ARDL model (2,0,0,0,0,2) have been reported, interpreted and discussed. This section will report and interpret the results that were obtained by means of the residual and stability diagnostic tests performed on the ARDL model. Therefore, Table 5.13 reports the residual diagnostic test results.

Table 5.13: Residual diagnostic test results

Residual diagnostics tests	**ARDL models**	
	ARDL (2,0,0,0,0,2)	
	P-value	**Decision**
Normality Test	0.1108*	Do not reject H_0
Serial-correlation Breusch-Godfrey (LM test)	0.4152*	Do not reject H_0
Heteroscedasticity Test: ARCH	0.6006*	Do not reject H_0

Source: Compiled by the author (Data from SARB, 2001Q1-2017Q4)

Table 5.13 shows that variables in the ARDL model are normally distributed, are unsusceptible to serial-correlation and are homoscedastic. This means that none of the aforementioned null hypotheses are rejected, which implies that both the bound test and ECM results for the ARDL

model (2,0,0,0,0,2) are accurate and not misleading. Figures 5.5 and 5.6 show the results of the CUSUM and the CUSUMQ that were performed on the ARDL model. It can be deduced that there is no instability of residuals as the CUSUM and CUSUMQ statistic lines remain inside the lines of stability.

Figure 5.5: Stability diagnostic test results (CUSUM)

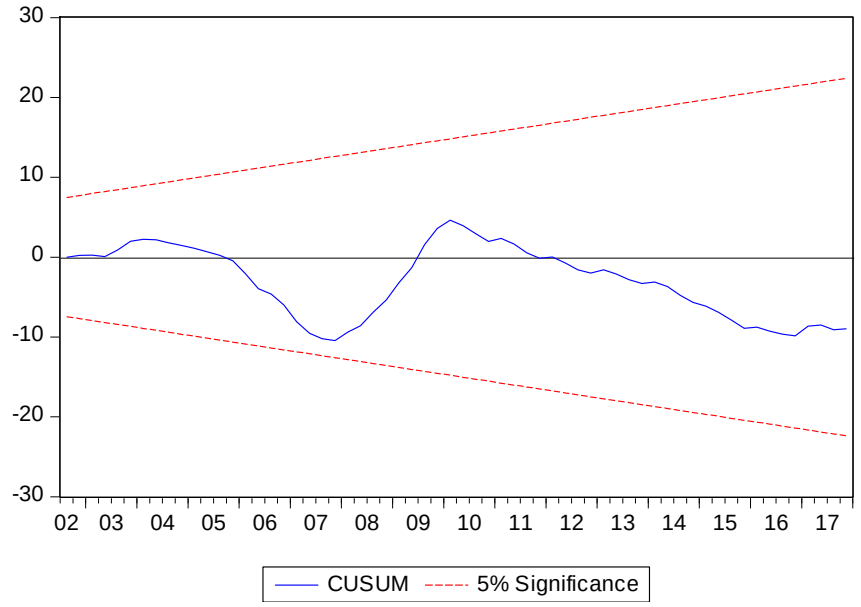
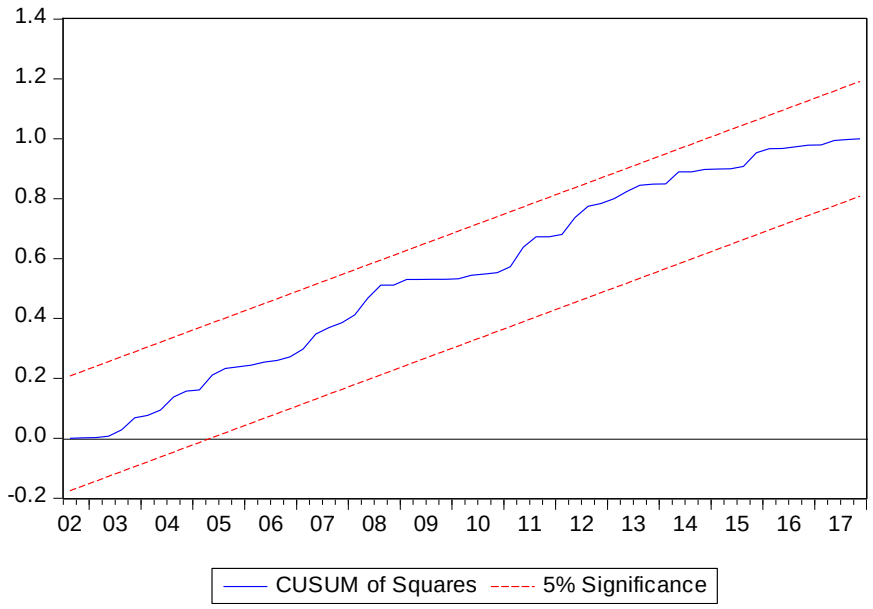


Figure 5.6: Stability diagnostic test results (CUSUMQ)



5.5 SYNOPSIS

The primary objective of this chapter was to empirically present the impact of fluctuations in the repo rate, broad money supply, GDP, employment, the exchange rate, government debt and government revenue on the success of monetary policy in achieving its ultimate objective, which is controlling inflation. It also investigates the effects of fluctuations in the repo rate, broad money supply, the exchange rate, government debt and government revenue in the overall efficiency of monetary policy in terms of its other set goals, which includes sustainable economic growth and employment creation. In achieving these objectives, the ARDL model, as well as other econometric techniques such as unit root tests, a stationarity test, the ECM and diagnostic tests were employed. This was done in order to estimate the short- and long-run impact of the independent variables on the dependent variables under study. Thus, the chapter started by graphically presenting the movement of variables.

This was followed by a correlation matrix, used to assess the correlations or relationships between the variables of the study. This indicated that all the variables under study, except for the nominal effective exchange rate, had a positive and statistically significant correlation with consumer price inflation. The chapter continued to present the unit root test and stationarity test results generated by use of the ADF unit root test, the PP unit root test and the KPSS stationarity test, in order to confirm that all variables under study consisted of I(0) or I(1) variables, or a mixture of I(0) and I(1) variables. A common conclusion was reached that all variables integrated at either I(0) or I(1) and none of the variables are stationary at I(2). Subsequently, the ARDL models were estimated to determine the long- and short-run impact of independent variables on consumer price inflation and the MPSI (dependent variables). The results proved that both long- and short-run impacts exist between independent variables and dependent variables under study.

These results showed that broad money supply, government debt, government revue and employment all have a positive long-run impact on consumer price inflation in South Africa. Whilst the repo rate, nominal effective exchange rate and GDP all have a long-run negative impact on consumer price inflation in the South African economy. Furthermore, the repo rate, broad money supply, government debt and government revenue all have a positive long-run impact on the MPSI; however, the nominal effective exchange rate has a negative long-run impact on the MPSI. The chapter further performed the Toda-Yamamoto Granger non-causality test and found that variables such as government revenue and government debt have a short-run impact on consumer price inflation, supporting the existence of structural and cost-push inflation in the South

African economy. Lastly, the chapter presented residual and stability diagnostic tests on both the ARDL models and the results revealed that the ARDL models under study are not inaccurate or misleading.

CHAPTER 6
SUMMARY, RECOMMENDATIONS AND CONCLUSION

6.1 INTRODUCTION

The study was motivated by the unremitting volatility of inflation, low economic growth and high unemployment levels in the South African economy. Therefore, the intrinsic features of monetary policy and structural influencers to these factors were reviewed and it was deduced that monetary policy alone cannot efficiently control inflation and reach its other objectives when faced with structural and cost-push inflationary pressures in an emerging market economy (Chapter 2: Section 2.12). It is, therefore, crucial that a resilient and durable monetary policy, as well as coordination between fiscal and monetary authorities exists (Chapter 2: Section 2.9). As such, many empirical studies have investigated the phenomenon of high and volatile inflation and the role of monetary policy in the context of various economies, however, not many empirical studies exist that tested this in terms of the South African economy.

With this in mind, this study had an objective to determine the extent to which the monetary authority is able to achieve a stable financial environment within the South African economy in terms of low and stable inflation as the ultimate objective of the monetary authority. The study thus had the intention to answer two central research questions:

- Is monetary policy efficient and successful in reaching its goals as set out by the mandate of the SARB regarding inflation, employment and economic growth?
  and;
- Is the South African economy consistent with structural and cost-push inflation, or with demand-pull inflation?

Both questions link back to the primary objective of the study. Therefore, in response to these questions, the study reviewed the theoretical and empirical literature, which reinforces the importance of efficient monetary policy for financial stability, economic growth and employment creation. This was followed by a review of the performance of various international countries, as well as that of the South African economy, related to the variables of the study. Lastly, the econometric estimation approach was methodised and applied in order to determine the conclusions of this study. Chapter 6 presents these conclusions, a summary and recommendations for improved performance of monetary policy in the South African economy.

6.2 SUMMARY OF THE STUDY

This section of the study provides a summary of how the study was conducted. The study is thus categorised into six chapters, which collectively address the primary objective, theoretical objectives and the empirical objectives of the study. Chapter 1 primarily portrays the foundations of the study. Therefore, Chapter 1 presents the introduction and background, problem statement, objectives and layout of the study. Thereafter, chapters 2 and 3 presented the theoretical and empirical literature related to the study as well as trend analyses of the variables relevant to the performance of monetary policy in South Africa and abroad. Chapters 4 and 5 explained the methodology that was adopted by the study and provided interpretations and discussions of the results obtained. Finally, Chapter 6 provides an overall summation of the study, the conclusions and achievements of the study, as well as suggested recommendations.

6.2.1 Summary of Chapter 2: Theoretical and empirical literature review

Chapter 2 presented the theoretical and empirical literature that provided a background to the study. The chapter first provided a framework for monetary policy and defined key concepts that are related to the study to ensure that the reader is enabled to understand and comprehend the use of these concepts within the study. Secondly, the chapter presented the theoretical literature pertaining to the function and objectives of monetary policy, globally as well as in the case of South African economics. Herein, inflation, economic growth and employment were discussed with regards to the various types of inflation that exist, theories regarding economic growth and the role of monetary policy in employment in a country. The role of fiscal policy in terms of the monetary sector was elucidated and the institutional layout of the SARB was discussed. Thereafter, the chapter presented the empirical literature regarding inflation, economic growth and employment creation vis-à-vis the South African case.

The most significant findings from the empirical literature from this chapter explained that inflation in the South African economy is mostly of a structural and cost-push nature. These empirical studies also indicate that variables such as the repo rate, broad money supply, the exchange rate, GDP, the level of government debt, government revenue and employment all have a significant impact on the inflation rate and thus the efficiency of monetary policy in small open economies such as South Africa.

6.2.2 Summary of Chapter 3: Monetary policy implementation and trend analysis

Chapter 3 reviewed the performance and implementation method of monetary policy within developed countries (the US, UK and Germany), developing countries, (Brazil, Russia and China) African countries (Nigeria and Kenya) and South Africa. Specifically, the countries were analysed in terms of monetary policy implementation and instruments, as well as an analysis of the trends within inflation, economic growth, employment and interest rates in each respective country. Thereafter, the findings of the South African case were compared to that of the other countries in order to attain where South African monetary policy could improve, based on international standards.

This chapter found that the South African economy has been experiencing similar symptoms to its developing counterparts in terms of high inflation, low economic growth, low employment creation and high interest rates, especially since the 2007 Global Financial Crisis. It was also found that developed economies have the ability to make use of unconventional approaches to remedy monetary shocks, which emerging economies would not be able to utilise. Inflation thus proves to be difficult to control in all emerging market economies. It is evident from the findings of this chapter that monetary policy has been a challenging concept in many emerging economies, either in terms of a lack of efficient policy actions, time lags in economic reaction to policy measures or a lack of implementation of existing policies altogether.

6.2.3 Summary of Chapter 4: Research design and methodology

Chapter 4 presented the research design and methodology adopted by the study in order to investigate the impact of the various structural and fiscal factors on the success of or efficiency in which monetary policy in terms of its objectives in the South African economy. The study thus made use of secondary data ranging from the first quarter of 2001, until the final quarter of 2017. The data used in the study were obtained from the SARB and Stats SA and encompassed a collection of data of the country's GDP, consumer price inflation, employment, repurchase rate, broad money supply, exchange rate, government debt and government revenue. Independent variables were first analysed in relation to consumer price inflation, followed by an analysis using a new index called the MPSI, which consisted of a combination of consumer price inflation, employment and GDP.

The study followed a functionalist approach and seeks to comprehend economic phenomena regarding the latter and a specific economic system. Therefore, the ARDL model was employed

in order to capture the response of consumer price inflation, as well as the MPSI to changes in the independent variables of the study. The study methodised the ARDL models and all the encompassing econometric techniques (unit root tests, stationarity tests, the bounds test, the ECM and a number of residual and stability diagnostic tests) that are conditional to ensure that results obtained by the study are accurate.

6.2.4 Summary of Chapter 5: Empirical estimation and discussion of results

Chapter 5 presented, interpreted and discussed the results obtained from the econometric techniques employed by the study. By employing the unit root and stationarity tests, the study found that all the variables under study comprised of variables which are stationary at either I(0) or I(1), with none of the variables stationary at I(2). This allowed for the ARDL model to be used, which produced results that indicated that the South African economy is consistent with cost-push and structural inflation, which leads to inefficiency in the achievement of the objectives of monetary policy as it takes roughly 5.34 quarters for changes in monetary policy to affect the economy. Both long- and short-run relationships exist between independent and dependent variables.

The chapter further performed the Toda-Yamamoto Granger non-causality test and found that variables such as government revenue and government debt have a short-run impact on consumer price inflation, supporting the existence of structural and cost-push inflation in the South African economy. Equally as important, the results of the residual and stability diagnostic tests, which were performed on both models of the study proved that the study models are normally distributed, none are serially correlated nor heteroscedastic and are both stable. This, in turn, ensures that the results of the study are not inaccurate or misleading.

6.3 ACHIEVEMENT OF STUDY OBJECTIVES

The objectives of the study were presented in Section 1.3 and were placed into three categories namely the primary, theoretical and empirical objectives. The following section of Chapter 6 reviews these objectives and will indicate the manner in which the objectives were addressed by the study.

6.3.1 Primary objective of the study

The primary objective of the study was to analyse the efficiency of monetary policy in South Africa, in terms of reaching its goals as set out by the mandate of the SARB regarding inflation, employment and economic growth and in doing so, investigating the existence of cost-push and structural inflationary factors within the South African economy. The manner in which the primary objective of the study was addressed is provided in Section 6.2.4.

6.3.2 Theoretical objectives of the study

- To provide definitions, concepts and approaches as well as a comprehensive theoretical background relating to economic growth, inflation, interest rates, employment growth, money supply, exchange rates, imported commodities and government revenue
- To establish theoretical understanding of monetary policy and its mandate
- To discuss monetary policy in developing as well as developed countries
- To provide an empirical review on studies on monetary policy as well as the variables under consideration
- To identify which type of inflation exists within the South African economy and the consequences thereof on the efficiency of monetary policy.

The five theoretical objectives were all achieved in chapters 2 and 3. Theoretical objectives numbers one through three were addressed in sections 2.2 to 2.11 of Chapter 2. Theoretical objective number four was addressed in Section 2.12 of Chapter 2 and objective number five was addressed in Section 3.4 of Chapter 3.

6.3.3 Empirical objectives of the study

- To determine the trends of South Africa's GDP, employment rate, consumer price inflation rate and interest rates
- To determine the possible failures of monetary policy in terms of the South African status quo and how to improve such policy by means of foreign monetary policy theory
- To construct a composite index, which includes GDP, employment rate and CPI as a measure of monetary policy efficiency or success in South Africa, named the Monetary Policy Success Index (MPSI)
- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, government debt and government revenue with CPI inflation

- To determine the long-run and short-run interrelations and causal effects between the official interest rate, broad money supply, the exchange rate, government debt and government revenue with the MPSI
- To provide policy recommendations to the SARB based on the findings of this study.

Of the six empirical objectives, objectives one through five were all addressed in chapters 3, 4 and 5, whereas objective number six will be addressed in this chapter, Chapter 6. Empirical objectives one and two were addressed in sections 3.2 through 3.5 of Chapter 3. Empirical objective number three was addressed in Section 4.2 of Chapter 4. Finally, empirical objectives numbers four and five were achieved in Section 5.4 of Chapter 5.

6.4 RECOMMENDATIONS

Based on the findings of this study, a number of recommendations are formulated to address the existing shortcomings of monetary policy within the South African economy. These recommendations are listed as follows:

6.4.1 Monetary- and fiscal policy integration and regulatory adjustments

Based on the findings of this study, as is supported by other studies such as that of Van Aardt and Van Tonder (2011), the South African economy predominantly suffers from symptoms of structural and cost-push inflation rather than that of demand-pull inflation. Therefore, monetary policy alone is inefficient in controlling inflationary pressures in the economy and thus requires assistance from fiscal policy in order to regulate macroeconomic conditions. It is thus recommended that integration between monetary policy and fiscal policy be implemented and managed more stringently. Fiscal policy should assist in controlling the symptoms of structural and cost-push inflation by, for instance, absorbing the high cost of production brought forth by a weak rand by means of subsidisation for small to medium enterprises in South Africa. This will regulate the cost of production. Further assistance could be provided by easing the rigid labour legislation in South Africa and in doing so reducing costs to companies brought on by the negative impacts of red tape, labour unions and labour strikes. Such adjustments to regulation could increase production and offset inflationary pressures in the economy brought forth by either supply shortages or high sales prices, which increase the likelihood of increased (cheap) imports.

6.4.2 Promotion of exports and exchange rate stability

The export sector in the South African economy should undergo radical structural transformation in the form of diversified exports and globally competitive value-added manufacturing. This will be accompanied by high capital inflows to assist in controlling inflation, as monetary policy based on a targeting framework is only capable of addressing the symptoms of structural and cost-push inflation but not the root cause thereof. Such a policy should be accompanied by the formulation of new and innovative measures of stabilising the exchange rate by policy makers, at a sustainable level. This will reduce the high levels and costs of import activity in South Africa and minimise volatility brought forth by exchange rate fluctuations. Such policy measures could include, for example, regulation of political instability through legal mitigation.

6.4.3 Alternative measures to control consumer price inflation

The SARB makes use of a fixed-weight based methodology in order to measure inflation and prepare for inflationary related shocks to the economy. Policy is thus adjusted accordingly by means of the CPI basket of goods and services. It, therefore, is recommended that the SARB address the existing substitution bias regarding said CPI basket and the high inflation related items involved therein, as this exudes upward pressure on inflation over the long run. The SARB could thus rebase the CPI series without changing the weights or basket goods, having a lowering impact on inflation of around 1.2 percentage points, or reweighting the basket completely, which could lower inflation by around 2 percentage points (Mellet, 2012).

The SARB should, therefore, consider reducing the time between rebasing and reweighting the CPI basket to enable more effective reduction of inflation in the economy. Van Aardt and Van Tonder (2011) agree with this statement as the study proved that 53 percent of the CPI basket in South Africa is completely insensitive to changes in the repo rate, which means that increasing the repo rate to combat inflation and reduce price levels in the economy is inefficient. Thus alternative methods to the repo rate to control inflation, as discussed above, should be implemented.

6.4.4 Formulation of separate inflation targeting frameworks

Another recommendation to the SARB would be to formulate two separate inflation-targeting frameworks in order to better control the inflation rate in the South African economy and reduce uncertainty. Due to the evidence from this study, amongst others, proving that the South African economy is affected predominately by structural and cost-push inflation, a higher targeting

framework, with an independent measurement tool, as well as a differentiated indicative basket based on structural and cost-push inflationary factors could be more effective in the pursuit of stable inflation and controlled inflation expectations. Another representative basket and unique measurement tools can then be used to control aspects of demand-pull inflation.

6.4.5 Promoting job creation through fiscal input

In terms of employment creation as an objective of monetary policy, fiscal policy and other divisions of government should assist in creating an employment-enabling environment in the South African economy. The implementation thereof could be through necessitating or prioritising the need for economic growth in order to stimulate employment growth. This could be made possible through stabilising the South African currency; reducing strict labour regulations; regulating the mismatch between skills and the labour market through skills training; promoting small business development and entrepreneurship; reduction of marginal tax rates; indexation to allow for wage increases to decline as inflation declines and thus accommodating employers to permit increased job creation; and the endorsement of labour-intensive public and private sector programmes.

6.4.6 Implementing rule-based monetary policy

The SARB employed discretion based monetary policy. Such discretion should be limited, in order to reduce its use to create inflation in the economy. A rule-based approach to monetary policy should be implemented, which requires policy makers to follow a pre-specified plan in order to mitigate monetary shocks in the economy. This provides for time-consistent, long-run solutions, rather than short-term answers. With this, monetary authorities could expand money supply gradually and at a steady rate in the economy over time, thus reducing increased inflation brought on by sudden increases in monetary stock in circulation. Such rule-based policy provides for time-consistent outcomes due to increased credibility of policy-makers' pronouncements.

6.5 LIMITATIONS OF THE STUDY AND FURTHER RESEARCH

The predominant challenge to the study was the time limit, which caused the study to focus on only certain factors of influence in terms of monetary policy as opposed to incorporating all the factors, such as the international trade aspect as a structural influence on monetary policy. With this said, the study's primary objective could still be achieved regardless of the time limit imposed

on the study and by use of the selected variables. Thus, in response to the limitations of this study, future research should consider the following:

- Incorporating other variables such as trade openness of the South African economy.
- Analysing the impact of all influencing factors on the efficiency of monetary policy and the effect on inflation in the SA economy.
- Studying further international monetary policies in order to obtain all the best practice principles.
- Further research is also required to ascertain the extent to which structural inflation effects the South African economy and to determine whether the current 3 to 6 percent inflation target is the most efficient framework for inflation to ensure economic growth and development in the country.

6.6 CONCLUSIONS

The primary objective of this study was to analyse the efficiency of monetary policy in South Africa, in terms of reaching its goals as set out by the mandate of the SARB regarding inflation, employment and economic growth and, in doing so, investigating the existence of cost-push and structural inflationary factors within the South African economy. The findings of the study show that although inflation is affected by changes made by monetary policy in terms of the repo rate and money supply, inflation is also affected by structural and cost-push factors brought forth by increased government debt, higher taxes, employment, economic growth, as well as cost of and competitiveness in trade. This clearly indicates that the South African economy suffers from symptoms of structural and cost-push inflation.

When independent variables were tested against consumer price inflation, the study found that, it takes roughly 5.34 quarters for any changes in independent variables to have a positive impact on CPI, which proves that monetary policy takes too long to effect inflation in the South African economy and is thus inefficient in the short run. Further findings suggest that a 1 percent increase in the repo rate will actually lead to an increase in consumer price inflation by 0.45 percent in the long run. This indicates that the repo rate is ineffective in controlling inflation in South Africa and does not have a negative correlation with inflation as desired. This causes monetary policy to be inefficient in controlling inflation in the South African economy in a consistent and long-term manner. When the study tested independent variables against the MPSI, it found that any change in terms of independent variables will take approximately 2.8 quarters before effecting CPI, GDP

or employment in the South African economy. In the long run, the success or efficiency of monetary policy in achieving its objectives of low and stable inflation, sustained economic growth and full employment in the economy are all effected by the repo rate, money supply in the economy, the exchange rate, the level of government debt and the level of government revenue in terms of taxation. This again confirms the existence of cost-push and structural factors influencing the success and efficiency of monetary policy in reaching its objectives.

These occurrences in the South African economy lead to high and volatile inflation rates, which, in turn, cause inefficiencies of macroeconomic policy and often result in the hindered growth of the economy, as has been evident in recent years. The study indicates that, although current monetary authority, under the existing inflation targeting regime and policy mandate, provides some control over inflation in South Africa, the existence of structural and cost-push inflationary symptoms in the economy leads to inefficiency of the monetary authority in effectively controlling inflation, ensuring sustainable levels of economic growth and assisting in creating full employment in the economy, thus filling the gap in the research. This implies that the monetary authority should adjust policy measures and the tools it uses to achieve its goals according to what the economy requires at this point in time.

Low economic growth levels and high unemployment rates may suggest expansionary policy measures to be taken, however, with the nature of inflation in South Africa, this could lead to rapid inflation or depreciation spirals when inflation reaches levels close to the optimal rate. Evidence, however, suggests that in current circumstances and with the existence of structural and cost-push inflation, in developing economies such as South Africa, inflation should not necessarily be kept at the lowest possible rate. Furthermore, when structural and cost-push inflation is controlled through policies intended to control demand, economic growth could suffer, regardless of minimal inflation. It is thus crucial that policy makers understand that some inflation could be regarded as a result of growth and development in developing economies and that when faced with the type of inflation that South Africa exhibits, it should be controlled through the correct policy measures in order to be efficient.

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APPENDIX A: LETTER FROM THE LANGUAGE EDITOR

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22 October 2018

To whom it may concern

This is to confirm that I, the undersigned, have language edited the dissertation of

D van Wyngaard

for the degree

Masters of Commerce in Economics

entitled:

An analysis of monetary policy and its effect on inflation and economic growth in South Africa

The responsibility of implementing the recommended language changes rests with the author of the dissertation.

Yours truly,

Linda Scott