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FISCAL DEFICIT, INFLATION, MONEY SUPPLY AND EXCHANGE RATE IN SOUTH AFRICA

BY

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ABSTRACT

This study empirically investigates the relationship between fiscal deficit, inflation, M3 money supply and the exchange rate in South Africa. The study makes use of quarterly macroeconomic time-series data sets comprising 84 observations, covering the period from 1994Q1 to 2015Q4. The unit root tests conducted employed the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The results reveal that the variables become stationary at first difference. The Johansen co-integration technique suggests that there is at least one co-integrating equation among the variables. The results of the Engle-Granger approach, which is residual based, show that the residuals are stationary, thus validating the existence of a long-run relationship between the model variables.

The study carried out a Granger causality test. The results indicate that there is a strong Granger causal relationship between the variables (IF) and (FD). Another strong causal relationship emerges between inflation and money supply. The ECM model was employed to identify the speed of adjustment as a response to the departures from the long-run equilibrium path. The estimated coefficient of the ECM error term has the required sign and is statistically significant at the five per cent level of significance. The error term indicates a quick convergence to equilibrium. The study concludes that the dependent variable (FD) is jointly caused by all the independent variables in the long-run. The results of the variance decomposition of the variable (FD) to innovations resulting from IF, MS and RER indicate that own shocks remain the dominant source of total fluctuations in the forecast error of the variables.

The findings of the study are efficient and reliable as the estimated model passed all the major diagnostic tests. By implication the findings suggest that the estimated model show high goodness of fit and is thus reliable for policy making. The study recommends a fiscal adjustment that will enhance economic growth. Additionally, a fiscal policy that will aim at identifying and mitigating other possible leakages that narrow the tax base should be considered.

Keywords: Fiscal deficit, Error Correction Model, Impulse response function

ABBREVIATIONS AND ACRONYMS

ADF - Augmented Dickey Fuller

ARDL - Autoregressive Distributed Lag

Asgi-SA - Accelerated and Shared Growth Initiative for South Africa

DW - Durban-Watson

ECM - Error Correction Model

EME - Emerging Market Economies

FTPL - Fiscal Theory of the Price Level

GDE - Gross Domestic Expenditure

GDP - Gross Domestic Product

GEAR - Growth, Employment and Redistribution strategy

NDP - National Development Plan

OLS - Ordinary least squares

SARB - South African Reserve Bank

VAR - Vector auto-regression

VECM - Vector error correction model

TABLE OF CONTENTS

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATION

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter provides the rationale and background to the study, followed by a description of the problem, aim of the research and the objective of the study. Mohr (2015) stated that a major objective of macroeconomic policies is to foster economic growth. Semosa and Mongale (2016) argued that economic growth of a country depends to a larger extent on the nature and quality of economic policies such as fiscal and monetary policies. In managing the economy, government uses both fiscal and monetary policies. The fiscal policy is used to maintain economic growth rates and employment levels. Al-Khulaifi (2012) posited that the use of fiscal policy in addition to achieving its macroeconomic goals, is to achieve economic and social development, to promote and attain the government's economic goals through directing government expenditure towards building infrastructure, education, healthcare and housing to raise the standard of living.

The Keynesian school are of the view that expansionary or contractionary fiscal policies affect the aggregate demand for goods and services in an economy at a particular point in time (McConnell & Brue 1996). Fiscal policy is expansionary, when government increases its public spending or cutting taxes, it leaves individuals and businesses with more money to purchase goods and services and businesses to invest in more equipment. The multiplier effect would lead to an increase in aggregate consumption, requiring an increase in production, creating jobs and generating more spending. The ultimate result is higher employment and a growing economy.

The quest of every purposeful and responsible government is to achieve high levels of economic growth, reduce unemployment, and alleviate poverty, equal distribution of income, price stability and a stable balance of payment. Fiscal deficit targeting has become the focus of many governments; both in developed and developing countries, hence the introduction of fiscal consolidation strategies and fiscal deficit targeting in South Africa.

Since the 1990s the widening fiscal deficit in both developing and developed countries has generated concerns largely because it is among the main indicators of fiscal policy imbalances as well as country fiscal weakness. Al-Khulaifi (2012) noted that large fiscal deficits combined with uncertainties relating to the pace of economic growth, could raise concerns about governments' ability to service debts, hence a rise in credit risk. From what has been said above it also follows that a country's creditworthiness depends largely on its fiscal strength.

As evidenced in the case of South Africa where its fiscal deficit is greater than the economic growth rate, the country is unable to effectively address the issue of unemployment. This affects the country's credit rating, which caused South Africa to be downgraded from stable to negative (above junk status) in late 2011 and early 2012, by two large international credit ratings agencies, Moody's and Standard and Poor. A deficit can move an economy out of recession, thereby triggering economic growth. For South Africa, economic growth plays a crucial role as a way to create the much needed growth in employment levels, which in turn contributes to the long-run growth prospects of the economy.

1.2 Rationale and background to the study

Burger, Siebrits and Calitz (2016) emphasised that there has been considerable debate over the importance of fiscal stability, with recent arguments that fiscal instability, is fundamentally justifiable. Subsequently, it can also signal eminent macroeconomic and public finance mismanagement problems. Fiscal deficit threatens fiscal stability hence; a sound fiscal policy is likely to contribute to better public finance systems through the allocation of resources. In addition, fiscal deficit exposes a country and creates a vulnerable environment for investors. It bears mentioning that since 1994, the aim of fiscal policy of the South African government has been to achieve fiscal sustainability in the medium term by gradually reducing government's deficit before borrowing, as well as reducing debt repayment in manageable proportions.

Oludele (2004) noted that in the early 1990s South Africa witnessed increasing demand in government services due to the pressures of political transition resulting to the budget deficit rising to beyond eight per cent of the Gross Domestic Product

(0GDP). Policies have been implemented, to address the issue of unemployment and economic growth, yet the unemployment level remains high and the economy is growing at a slower pace, affecting South Africa's credit rating status. This suggests that it is important therefore, to have assistance that will guide a more systematic prioritisation and sequencing of intervention strategies. It is therefore the intention of this study to investigate the existing relationship between fiscal deficit, inflation, money supply (M3) and the exchange rate**.**

This study aims to make a contribution by shedding light on the relationships between fiscal deficit, inflation, money supply M3 and the exchange rate**.** Moreover, the study should benefit students of macroeconomics in understanding the interaction between fiscal and monetary policies. In addition, this study will add to the existing literature and benefit international trade students to gain an insight into how the mechanisms of macroeconomic policies interact, and provide a better understanding of the inter-relatedness of the macroeconomic variables. This study will further provide students of public administration and public sector finance with an understanding of the importance of public finance management since sound public finance management is likely to contribute to a better fiscal policy through the allocation of public financial resources.

A further benefit of the study would be to assist policy makers to gain insight into the type of relationship that exists between fiscal deficit and the three selected macroeconomic variables: inflation, M3 money supply and the exchange rate. This could guide policy makers to formulate and implement policies in an informed manner as well as selecting appropriate deficit financing options to foster economic growth that will be translated into job creation, poverty alleviation and the reduction of income inequality. On the other hand, financial analysts would derive a better knowledge of the extent of **the** behavioural patterns of the three selected macroeconomic variables so as to analyse their impact on the financial market.

1.2.1 Definition of variables

(i) *Exchange rate* is the price of one country's currency (e.g. the South African rand) in terms of another country's currency (e.g. the US dollar). Exchange rates can be expressed directly or indirectly. With the direct method, the exchange rate shows how much of the local currency (rand in the case of South Africa) has to be exchanged for one unit of a foreign currency (e.g. the US dollar).The direct method indicates the domestic price of the foreign currency, while the indirect method expresses the exchange rate as the amount of foreign currency that is required to purchase one unit of the domestic currency. It indicates the foreign price of the domestic currency (Mohr 2016:143).

It is worth noting that South Africa adopted a flexible exchange rate policy. Salvatore (2007) noted that the nation need not concern itself with its external balance and is free to utilise all policies at its disposal to achieve its purely domestic goals. Particularly, domestic goals include full employment, price stability, growth and equitable distribution of income and stable balance of payments. According to Spratt (2009) financial liberalisation requires a stable macroeconomic environment with appropriate and sustainable exchange rate regimes.

(ii) *Inflation* is defined as a persistently rising price level (Parkin 2012). Moreover, Mohr and Associates (2015) put emphasis on the effects of inflation that affects the distribution of income and wealth among the various participants in the economy. It has various economic effects which may result in lower economic growth and higher unemployment than would otherwise occur. In addition, it reduces the value of existing savings and hence discourages traditional forms such as fixed deposits and pension fund contributions. In an open economy, it can produce balance of payment problems. It increases the costs of export industries and import-competing industries. Due to the interdependence of countries, if inflation in South Africa is higher than in the economies of its major trading partners and international competitors, the result will be a loss of international competitiveness. Consequently, the domestic currency will certainly depreciate.

0Bakare, Adesanya and Bolarinwa (2014) stated inflation is one of the numerous problems facing developing nations, and as a result it needs to be regulated; hence, inflation targeting in the case of South Africa. Bakare *et al.* (2014) further argued that the rate of inflation has been on the increase with its damaging effects on the economy through the movement of prices of consumer goods and services.

(iii) *M3 Money supply* comprises M2 money and all long term deposits of South Arica's domestic private sector with monetary institutions. In essence M2 is equivalent to M1 combined with all other short term and medium term deposits of South Africa's private sector with monetary institutions. M1 is made up of notes and coins circulating outside South Africa's monetary sector plus demand deposits which include cheques and transmission deposits belonging to South Africa's private sector with monetary institutions (Mohr 2013).

In view of the above distinction, it is clear that M3 is a broader and more comprehensive measure of money supply. The monetary authorities regard M3 as the most reliable indicator of development in the financial sector of the economy. Consequently, Bakare *et al.* (2014) asserted that central banks, as well as private and public analysts show interest in the growth of money supply because of the impact it is believed to have on real economic activities and the general price level.

(iv) *Fiscal deficit* is defined as the difference between total government revenue and total government expenditure; the variable that generally receives the most attention. It indicates the government's borrowing requirements, which adds to the public debt. The fiscal deficit is expressed as a percentage of GDP, as well as an important policy target. For example, one of the main targets of the Growth, Employment and Redistribution strategy (GEAR) launched in 1996, was to reduce the fiscal deficit to three per cent of GDP by the year 2000 (Mohr 2016).

1.2.2 Government expenditure and government revenue in the context of fiscal deficit

An understanding of the relationship between government expenditure and government revenue is of paramount importance as a strong base for the realisation of the aim of this study. Moreover an understanding of this relationship can contribute toward a better interpretation of results of large fiscal deficits and policy implications - more especially in the field of public finance.

Since the inception of democracy in 1994, the main economic objectives of the South African government have been job creation, the elimination of poverty and the reduction of inequality with the focus being sustainable and diversified economic growth. The Ready to Govern, and Reconstruction and Development Programme documents reflect the quest of the South African government to improve the living standards of the population. These objectives have been echoed in succeeding policy documents since the Growth, Employment and Redistribution (GEAR) strategy of the late 1990s, throughout the Accelerated and Shared Growth Initiative for South Africa (Asgi-SA) of 2006, the New Growth Path of 2010 and the National Development Plan (NDP) of 2012.

The government adopted fiscal and monetary policies aimed at maintaining economic stability. Fedderke and Giannaros (2016) argued that the sustainable and long-term oriented economic policy framework did not engage in extreme redistributive interventions, despite the fact that South Africa is facing the world's highest level of inequality. It bears mentioning that since democracy, South Africa's national budgeting has been and still is guided by the development priorities and fiscal targets that the country has set for it.

Ram (1988) applied Granger-Causality tests to examine the relationship between government expenditure and taxes at the federal, state and local levels of government. The study used annual and quarterly data for 1929-83 and 1947-83 respectively. The results of the study showed that taxes Granger-caused expenditures at the federal level, but in the opposite direction at the state and local government. Owoye (1995) elaborated that the causal relation that indicates one-

way causality from tax revenues to expenditures would imply that higher taxes lead to higher government expenditure.

Ogujiuba and Abraham (2012) examined the revenue-spending hypothesis for Nigeria. The study employed correlation analysis, Granger causality tests, regression analysis, the lag regression model, the vector error correction model (VECM) and impulse response analysis. The study used macro data covering the period from 1970 to 2011. The results of their study revealed that revenue and expenditure were highly correlated and that causality moved from revenue to expenditure in Nigeria. As for the VECM, the results showed a significant long-run relationship between revenue and expenditure. On the other hand, the lagged regression model output indicated that the positive relationship between revenue expenditure relapsed to negative at lag five, thereby justifying the need for the utilisation of medium term expenditure framework to monitor expenditure patterns in the short to medium term.

At the centre of developed and developing countries' debt problems has been the relationship between government expenditure and government revenue, which triggered a fiscal sustainability analysis to determine fiscal policy; fiscal sustainability is affected by the revenue side of the budget as well as by the expenditure side. As for the revenue side, countries ensnared in large fiscal deficits or public debt, finance the deficits by imposing higher taxes or obtain other public sector revenues to offset the debt increase. Consequently, such fiscal actions tend to trigger growth in the shadow economy, thereby eroding the tax base through tax evasion, which reduces the tax receipts and thus further increases the fiscal deficit.

1.3 The research problem

Macroeconomic policies are planned and implemented in order to foster economic growth, full employment, price stability, equitable income distribution and a stable balance of payment. The research question therefore, is: "What is the relationship between fiscal deficit, inflation, M3 money supply and exchange rate?" The fiscal deficit is regarded as the explained variable due to its impact on the economy.

Fiscal deficit reduction is pivotal to stimulating economic performance, driving robust growth in output, consumption, and to encourage savings, as well as enhanced productivity and purchasing power in an economy.

If the fiscal deficit is extremely large and persistent, it cannot comply with the fiscal deficit benchmarked by the country as its policy target, for example, one of the main targets of the Growth, employment and redistribution strategy (GEAR) launched in 1996, was to reduce the fiscal deficit to three per cent of GDP by 2000 (Mohr 2016). It is worth mentioning that South Africa's fiscal deficit was four per cent of GDP for the 2013/14 fiscal year, and for the 2015/16 period it was 3.9 per cent of GDP. Large and persistent deficits accompanied by rising debt commitments narrow a fiscal position of the country and consequently undermine the country's creditworthiness.

If the budget deficit is not dealt with it will bring about negative effects such as economic imbalances, exacerbated unemployment situations, an increased external debt burden, and macroeconomic instability, which will have adverse effects on output growth, economic depression, reduction in bank loans and advances and hence, a decline in the economy.

Using policy recommendations based on the findings by Brima and Mansara-Pearce (2015) fiscal deficits should be diverted to industrial investments like infrastructural developments that would serve as incentives to productivity via the attraction of foreign direct investment.

The country stands to benefit substantially from the adoption of fiscal deficit targeting and fiscal consolidation. For instance the estimated fiscal deficit of the 2015/16 period can be diverted to savings so as to expand investment. In addition South Africa stands to gain considerable recognition as a preferred investment destination brought about by fiscal stability and business confidence.

1.4 Research aim and objectives

1.4.1 The research aim

This current study empirically investigates the relationship between fiscal deficit, inflation, M3 money supply and the exchange rate in South Africa. The achievement

of this aim would help to guide a more systematic prioritisation and sequencing of intervention strategies in order to foster economic growth, reduce unemployment, equitable income distribution, price stability and a stable balance of payments.

1.4.2 Objectives of the study

The study was undertaken to achieve the following objectives:

- To examine the effects of fiscal deficit on inflation in South Africa;
- To analyse the relationship between fiscal deficit and M3 money supply in South Africa;
- To evaluate the effect of fiscal deficit on exchange rates in South Africa; and
- To determine the long-run relationship between fiscal deficit, inflation, M3 money supply and the exchange rate.

1.4.3 Research questions

The following research questions are derived from the above:

- Does inflation have any effect on fiscal deficit in South Africa?
- Does money supply have any effect on fiscal deficit in South Africa?
- Does the exchange rate have any effect on fiscal deficit in South Africa?
- Is there a long-run relationship between the three selected macro-economic variables and fiscal deficit in South Africa?

1.4.4 Hypotheses of the study

From the research problem, what is the relationship between fiscal deficit, inflation, money supply and exchange rate, the following hypotheses were formuated:

$H0_1$: Inflation does not have any significant relationship on fiscal deficit

$H0_2$: M3 Money supply does not have any significant relationship on fiscal deficit

$H0_3$: Exchange rate does not have any significant relationship on fiscal deficit

$H0_4$: There is no long-run relationship between inflation, M3 money supply, exchange rate and fiscal deficit

1.5 Scope and scale of the research

The purpose of this study is to empirically investigate the relationship between fiscal deficit, inflation, M3 money supply and the exchange rate in South Africa from 1994Q1 to 2015Q1. To realise the stated objectives the study used secondary quarterly data for South Africa. The data focused on the following variables: fiscal deficit, inflation, M3 money supply and the exchange rate obtained from the World Bank database, South African Reserve Bank (SARB) and Statistics South Africa (Stats SA).

1.6 Literature review

Macroeconomic theory postulates that persistent fiscal deficits are inflationary, due to the fact that governments finance deficits with money creation “seigniorage”, thus producing inflation. Presented in this two pronged literature review is firstly a theoretical framework of factors affecting the relationship between fiscal deficit, inflation, money supply and exchange rate, and secondly relative empirical literature pertaining to the relationship between fiscal deficit, inflation, money supply and exchange rate. The empirical literature presents different research opinions and views on the short and long-run relationship between fiscal deficit, inflation, money supply and exchange rate.

1.6.1 Theoretical Framework

The grounded theoretical approaches to the relationship between budget deficit and other macroeconomic variables are categorised into *traditional* and *new* approaches. The traditional approach is the reflection of the quantity theory of money; the monetarist approach. The fiscal theory of price, also known as the quantity theory of public debt links the fiscal and monetary policy. On the other hand, the neoclassical school suggests a negative relationship between macroeconomic variables and budget deficits. However, the Keynesian school suggested a positive relationship between macroeconomic variables and budget deficits. The Ricardian School posited that government budget deficits do not affect the total level of demand in an economy and is therefore immaterial.

(i) The monetarist approach

In this approach the pattern of real economic activity requires a certain level of real money balances, and the price level is controlled by the nominal money supply. The nominal money supply is exogenously determined by monetary authority, whilst the price level is determined as the unique level of prices that will make the purchasing power of money supply equal to the desired level of real balances. If the nominal money supply differs from the desired real balances at a given price level, it will translate into changes in that price level. Thus, the price level has to be fully flexible and determined exclusively by the exogenous nominal money supply.

(ii) The fiscal theory of the price level

As for the fiscal theory of the price level, the integration of fiscal and monetary policies is of importance. This is done through the government inter-temporal budget constraint (GBC) which is understood to be a long-term solvency condition for public sector finances. The GBC is satisfied when the discounted value of the government's future primary surplus is larger than or equal to the current nominal value of public debt. The GBC is assumed to be in equilibrium and the future path revenues and expenditure is decided exogenously by the fiscal authority. Hence, at a given discount rate, if the discounted value of primary surplus is lower than a predetermined level of nominal debt as a percentage of GDP, the price level has to be adjusted to equalise the GBC condition. The price level therefore, becomes the exclusive adjustment variable to maintain the equilibrium condition.

(iii) The neoclassical school

The neoclassical school advocated a negative relationship between macroeconomic variables and the budget deficits. This school argues that the budget deficits lead to higher interest rates, discourages the issue of private bonds, private investments and private spending, increases inflation levels and cause a similar increase in the current account deficits, and finally slows down the growth rate of the economy through resources crowding out. This school further asserts that the government's expansion crowds out the private sector. It is therefore, worth noting that resource crowding out is an important issue to take into account especially in developing countries, where resources are scarce so that any excess demand for the resources from government will severely impinge on private sector productivity.

(iv) The conventional Keynesian proposition

The Keynesian school argues for a positive relationship between macroeconomic variables and budget deficits. This school asserts that changes in budget deficits usually result in an increase in aggregate demand, savings and private investment at a particular interest rate level. The Keynesian absorptive theory postulates that an increase in budget deficits would bring about domestic absorption and import expansion, more so leading to a current account deficit. This will in turn, cause the budget deficit to increase, causing an upward pressure on interest rates, capital inflows and an appreciation of the exchange rate and lastly increase the current account balance.

(v) The Ricardian school

The opposing approach advanced by Barro-Ricardo (1989) suggests that government budget deficits do not affect the total level of demand in an economy and does not matter because an increase in government's budget deficit is effectively equivalent to a future increase in tax liabilities. Taking into account that lower taxation in the present is offset by higher taxation in the future, means that budget deficits do not influence macroeconomic variables. Governments may either finance spending by taxing current taxpayers or may borrow money. However, governments must eventually repay this borrowing by raising taxes above what would otherwise have been in future.

1.6.2 Empirical literature

The interaction that may exist between fiscal, international trade and monetary policy through the relationship between fiscal deficit, inflation, M3 money supply and exchange rate triggered different views among economists and researchers. Different opinions have continued to emerge on how fiscal deficit affects other macroeconomic variables in different economies. Nguyen (2015) investigated the effects of fiscal deficit and broad M2 money supply on inflation in Asian countries, namely Bangladesh, Cambodia, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam. The study covered the period from 1985 to 2012. The Pooled Mean Group (PMG) estimation-based error correction model and the panel differenced General Method of Moment (GMM) were used. The results showed that broad M2 money supply had a significantly positive impact on inflation only in the

PMG estimation. Fiscal deficit, government expenditure and interest rates were statistically significant determinants of inflation in both methods of estimation.

Brima and Mansaray-Pearce (2015) utilised Johansen's test of co-integration, Vector Error Correction Model (VECM) and the Granger causality test in exploring the long run and short run relationship between budget deficit, gross domestic product, interest rate, inflation and money supply in Sierra Leone. Time series data was used for a period of 34 years from 1980 to 2014. The study adopted the budget deficit as an explained variable and exchange rate, gross domestic product, interest rate and money supply and inflation as explanatory variables. The results indicated that the long-run relationship between the exchange rate, gross domestic product and money supply was negative and significant with a budget deficit. However, interest rate and inflation had a positive one with budget deficit, though interest rate was insignificant in the long-run. The Granger-causality test confirmed the causal link between exchange rate, gross domestic product, inflation, money supply and budget deficit.

Kadria and Aissa's (2016) study focused on the evaluation of the time varying treatment effect of inflation targeting adoption by emerging countries on their budgetary discipline in terms of reducing or mastering the public deficit.

The study employed the propensity score approach requiring the grouping of countries into two categories, those that have adopted an inflation targeting framework and those that did not. The study investigated 41 countries divided into 20 countries and 21 countries, over the period from 1990 to 2010. The findings revealed that the lag in the effect of inflation targeting on deficit performance proved to be shorter and gradual for emerging countries that have adopted this monetary policy framework. Accordingly, the low performance was during the early years following the adoption of inflation targeting.

Abu and Karim (2015) explored the non-linear association between inflation and fiscal deficits in Africa. The study results showed that the deficit/inflation relationship was non-linear for the whole sample of 51 African countries, whereas for the subsamples the results yielded different relationships. The study utilised the fixed-effects and GMM estimators, from 1999 to 2011 in these 51 countries, which were

further grouped into high-inflation/low-income countries and moderate-inflation/middle-income countries. Quantitatively, the study results revealed that for the 51 countries a percentage point increase in deficit resulted in a 0.25 percentage point increase in the inflation rate, the relationship widened once deficit reached 23 per cent of GDP.

Ahmad and Aworinde's (2015) study aimed at examining structural breaks and twin deficits hypothesis in African countries, the results from ARDL showed that the fiscal deficit, the real GDP, the current account, the real interest rates and real exchange rates in twelve African countries under consideration had long-run relationship as indicated by the presence of co-integration. However, short-run dynamics of the model estimated for all the countries showed that the systems adjust back to equilibrium fairly quickly and they were statistically significant. On the other hand, results for the long-run coefficients obtained from the bound test illustrated a positive relationship between the fiscal deficits and the current account deficits in Botswana, Cameroon, Egypt, Ghana, Morocco, Nigeria, Tanzania and Tunisia. The results for these afore-mentioned countries concurred with the twin deficit hypothesis that a strong relationship between the budget deficit and current account exists. A negative relationship between fiscal deficit and the current account deficits was revealed for Ethiopia, Kenya, South Africa and Uganda.

Kelikume (2016) studied government deficit and interest rate, with the help of Panel Vector Auto regression, Impulse response function, variance decomposition and VAR causality on data sets collected from 18 countries across Sub-Saharan Africa over the period 2000 to 2014. The results of the study suggested the response of interest rate to rising government deficit was slow initially. The findings contradicted the standard Keynesian proposition that rising government deficit reduces the stock of loanable funds and subsequently crowds out private sector investment. In the same vein, interest rates responded positively to the exchange rate, inflation and money supply.

Solomon and de Wet (2004) researched the deficit-inflation relationship in the Tanzanian economy over the period from 1967 to 2001. The findings indicated the existence of a stable long-run relationship between the budget deficits, exchange

rate, GDP and inflation using co-integrating vectors. The simulation results reflected that inflation was very responsive to shocks in the budget deficits as well as GDP.

In Nigeria, Bakare, Adesanya and Bolarinwa (2014) investigated the long term relationship between budget deficit, money supply and inflation. The study used annual data from 1975 to 2012, with the aid of Augmented Dickey-Fuller (ADF), Johansen co-integration test and the Error Correction Model (ECM). The study found that about 132 per cent of the errors in the short-run were corrected in the long-run. The results further revealed a causal relationship that existed between budget deficit and inflation. Subsequently, inflation indicated high dependence on performance of growth of money supply and the budget deficit.

1.7 Methodology, research design, and research methods

The research question: “What is the relationship between fiscal deficit, inflation, money supply M3 and exchange rate?” The theory applied in this study is important and of a deductive nature. Empirical epistemological orientation was revealed in the use of regression analysis, as well as stationarity tests. This study centres around the deductive approach in which the direction of causality with the aid of the Granger-causality test is determined with the view to provide help that guides a more systematic prioritisation and sequencing of intervention strategies, so as to foster economic growth, reduce unemployment, equitable income distribution, price stability and stable balance of payments.

More specifically, the aim of this research is to empirically investigate the relationship between fiscal deficit, inflation, M3 money supply and exchange rate in South Africa. In order to realise the above aim econometric methodology was employed. The methodology involved regressing fiscal deficit on its explanatory variables, inflation, money supply and exchange rate through the following procedures: Testing for stationarity of the variables using the Augmented Dickey Fuller unit root test, followed by Johansen’s co-integration test to check for the existence of co-integration and long-run relationships. Subsequently, the Vector Error Correction Model (VECM) and Granger-causality was executed to estimate the error correction term and causal relationship. Lastly, stability and diagnostic tests were conducted to determine the robustness of the model adopted. The rigorous utilisation of

econometric techniques created an enabling opportunity to make general statements about the results of the study in the sense that, the researcher was not part testing hypotheses, but truth was tested.

1.7.1 Data collection

Data was sourced from the South African Reserve Bank and Quantec database. Quarterly data was collected on fiscal deficit, inflation, money supply and exchange rate for the period 1994Q1 to 2015Q1.

1.7.2 Model specification

The study applied four variables using quarterly data for the period 1994Q1-2015Q1. The variables of interest are fiscal deficit, inflation, M3 money supply and exchange rate. In this study fiscal deficit was regarded as the dependent variable with inflation, money supply and exchange rate as the independent variables. The mathematical form of the model is stated as follows:

$$FD = f(IF, MS \text{ and } ER) \quad (1.1)$$

Where

FD = Fiscal Deficit

IF = Inflation

MS = Money supply

EX = Exchange rate

The empirical model of the study will be:

$$FD_t = \beta_0 + \beta_1 IF_t + \beta_2 MS_t + \beta_3 ER_t + \epsilon_t \quad (1.2)$$

Where β_0 is the constant and β_1, β_2 and β_3 are parameters to be estimated and ϵ is the error term. Sweeney, Williams and Anderson (2006:158) stated that the error accounts for the variability in the dependent variable that cannot be explained by the linear effect of all the independent variables in the model.

The log model was employed to estimate the elasticity (degree of responsiveness) of fiscal deficit (FD) with respect to inflation (IF), money supply (MS) and exchange rate (ER).

$$\text{Log } FD_t = \beta_0 + \beta_1 \text{Log} IF_t + \beta_2 \text{Log} MS_t + \beta_3 \text{Log} ER_t + \epsilon_t \quad (1.3)$$

1.7.3 Econometric model estimation

It is standard practice for effective research that requires the use of econometric technique, to highlight the significance of investigating the data generating process that are fundamental to the variables, before estimating the parameters and carry out various hypotheses. The procedures are meant to address validity and reliability so as to avoid spurious statistical results that can be misleading.

1.7.4 Unit root test

As the model contains economic variables, of a time series nature, the empirical analysis starts by examining the statistical properties of these variables. The essence of analysing these properties is to detect whether the variables in the model are stationary. Brown (1991) and Thomas (1997) argued that a series is stationary if the covariance, mean and variance between terms depend on the time interval between the terms, not on time itself. Thomas (1997) further stated that these properties would remain the same whether observations for the time series were, for example from 1975 to 1985 or from 1985 to 1995.

The study utilised the Augmented Dickey-Fuller (ADF) test for stationarity of variables. The golden rule states that the data becomes stationary if the probability value is lower than the five per cent level of significance. When running the ADF test, the main focus will be on the probability values, critical values and the t-statistics values. If the critical values are lower than the values of the t-statistics at different levels of significance, the null hypothesis is not rejected. Implying that there is a unit root or the time series data is not stationary. However, if the critical values are greater than the t-statistics at different levels of significance, the null hypothesis is rejected. The implication will then be that there is no unit root (Semosa & Mongale 2016). The equation for ADF is given by:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{n} + \alpha \Delta Y_i + \epsilon_t \quad (1.4)$$

Where Δ is the difference operator, t is a time trend, Y_t is the variable under consideration, n is the number of lags, ϵ_t is the stochastic error term.

1.7.5 Johansen co-integration test

Thomas (1997) argued that co-integration is the statistical equivalent to the existence of a long-run economic relationship between I (1) variables. It is assumed that the variables are stationary-integrated of the same order. The theory postulates that non-stationary time series are co-integrated if their linear combination is stationary. The co-integration test involves testing for the presence of long-run equilibrium relationship between the variables of the same order of integration through the formulation of co-integration equations. It requires the error term in the long-run relation to be stationary. Given that Y_t is a vector of *n* number of stochastic variables, it follows that there exists K lag vector auto regression. Johansen's method takes a starting point from the vector auto regression (VAR) of order K specified by:

$$Y_t = \delta + \beta_1 Y_{t-1} + \ldots \alpha_k Y_{t-k} + W_t \qquad (1.5)$$

Where Y_t denotes an (nx1) column vector of K-variables that are integrated of order one and W_t denotes a vector of white noise residual. In representing the vector error correction model (VECM) equation (5) can be re-written as follows:

$$\Delta Y_t = \delta + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-1} + \epsilon_t$$

$$\Pi = \sum_{i=1}^{k} \Gamma_i - 1 \text{ and } \Gamma_i = - \sum_{j=i+1}^{k} {}^*\alpha j \qquad \textbf{(1.}6\text{)}$$

Where Δ is the difference operator, Y_t is an (nx1) column vector of K-variables, δ is a constant, ϵ_t is an error term, Γ_i denotes the long-run coefficient matrix and Π denotes the short-run coefficient matrix. They both show an impact in the long-run and short-run respectively.

Johansen's method builds co-integrated variables directly on maximum likelihood estimation instead of relying on OLS estimation (Gujarati *et al.* 2009). This procedure

relies heavily on the relationship between the rank of a matrix and its characteristic roots. Johansen derived the maximum likelihood estimation using sequential tests for determining the number of co-integrating vectors. Consequently, the method proposes two different likelihood ratio tests, namely trace test and maximum eigenvalue test. The two tests can be illustrated by the following equations:

$$\lambda trace = -T \sum\_(i = r + 1)\hat{}n \blacksquare \ln(1 - \phi i) \quad (1.7)$$

$$\lambda max = -T\ (1 - \phi_{r+1}) \quad (1.8)$$

The trace test, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors. The test statistic is given by the maximum eigenvalue test, on the other hand, λmax tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of (r + 1) co-integrating vectors. Its test statistic is given by $\boldsymbol{\phi}$ where T is the sample size (Gujarati *et al.* 2009:424).

1.7.6 The Engle-Granger Approach (The two-step procedure)

The study utilised the Engle-Granger approach, which is residual based and seeks to examine whether the residuals have an equilibrium relationship or are stationary. Engle and Granger developed this method in 1987 to test for the existence of co-integrating relationships between variables.

1.7.7 Vector error correction model (VECM)

Most empirical studies use econometric techniques in order to investigate the validity of either the Keynesian or classical approach; both concerning the direction of VAR modelling. Therefore, according to Johansen and Juselius (1990) a VAR model is a technique that could be used by macroeconomists to characterise the joint dynamic behaviour of a collection of variables without requiring strong restrictions of the kind needed to identify underlying structural parameters. This model provides a multivariate framework where changes in a particular variable are related to changes in its own lags and to changes in other variables. All variables are treated as endogenous and do not impose *a priori* restrictions on the structural relationships Aktham (2004).

Bakare, Adesanya and Bolarinwa (2014) stated that the VECM is a restrictive VAR that can be used to estimate non-stationary time series that were identified to be co-integrated. It is designed in such a way that it restricts the long-run behaviour of the independent variable to meet the co-integrating relationship and at the same time allow for short-run correction. This can be illustrated by the following equation:

$$\Delta X_t = \gamma_0 + \gamma_1 + \Delta Y_t + \Delta V_{t-1} + \epsilon_t \quad (1.9)$$

Substituting equation (1.3) into equation (1.9) to incorporate the error correction term to reflect the short-run dynamics yields the following equation:

$$\Delta \text{Log } FD_t = \alpha_0 + \sum_{i=1}^{q} \alpha_1 \Delta \text{Log } FD_{t-j} + \sum_{i-1}^{q} \alpha_2 \Delta \text{LogMS}_{t-j} \sum_{i-1}^{q} \alpha_3 \Delta \text{LogIF}_{t-j}$$

$$+ \sum_{i-1}^{q} \alpha_4 \Delta \text{LogER}_{t-j} + \lambda \text{ECM}_{t-1} + \epsilon_t \quad (1.10)$$

Where Δ is the first difference operator, q is the lag length, λ is the speed of adjustment and ECM_{t-1} is the lagged error term.

1.7.9 Granger-causality test

The Granger-causality test was conducted in order to detect causal relationships between the variables under investigation and to establish whether the current lagged values of one variable affects another. Granger (1969) asserted that given two variables X and Y, X is caused by Y if X can be predicted well from previous values of X and Y instead of from previous values of X alone. The causal relationship can best be presented with the aid of the following equations:

$$X_t = b_0 + \sum_{i-1}^{p} b_1 Y_{t-l} + \sum_{j=1}^{q} d_i X_{t-j} + e_t \quad (1.11)$$

$$Y_t = C_0 + \sum_{i=1}^{p} C_1 X_{t-l} + \sum_{j=1}^{q} r_i Y_{t-j} + w_t \quad (1.12)$$

The above equations are based on the assumption that $\mathbf{e_t}$ and w_t are uncorrelated white noise error terms.

1.7.9 Diagnostic and stability test

To determine the robustness of the model used, standard practice calls for stability and diagnostic tests. The intention of the test is to investigate the adequacy of the coefficient estimates of the model. Diagnostic tests help to ascertain that the findings are efficient and reliable. The study conducted autocorrelation, heteroscedasticity and residual normality tests.

1.8 Ethical considerations

This current study relied on secondary numerical data from the South African Reserve Bank (SARB) and Statistics South Africa (Stats SA). The researcher is fully aware of the Nelson Mandela University's (NMU) policy on plagiarism and has taken every precaution to comply with the regulations. In all the phases of the study the researcher acknowledged the sources of information to avoid plagiarism.

In respect of research ethics, the researcher is fully aware of the NMU's policy and has therefore, taken every precaution to comply with the regulations, by obtaining an ethical clearance certificate from the NMU Research Ethics Committee. (The reference number is not applicable).

1.9 Time line of the study

The department scheduled the study for ten months; therefore, the researcher satisfied the time lines predetermined by the department.

1.10 Structure of the study

The study is organised into five chapters: Chapter One comprises the introduction, in which, the background, statement of the problem, and the aim and objectives of the study were presented. Furthermore, a brief description of the relationship between government expenditure and government revenue was given so as to contextualise fiscal deficit as the dependent variable.

Chapter Two discusses the theoretical and empirical literature on fiscal deficit, money supply, inflation and exchange rate.

Chapter Three presents the methodology and research methods employed in the empirical investigation of the relationship between fiscal deficit, inflation, M3 money supply and exchange rate in South Africa. The presentation revolves around the use of the VECM model.

Chapter Four estimates and analyses the results generated from VECM model in relation to the variables of the study. The analysis concerns the rejection or acceptance of the stated hypotheses of the study.

Finally, Chapter Five provides conclusions drawn and the findings of the study. It proposes a set of policy recommendations and policy implications as well as suggestions for future research.

1.11 Chapter summary

This introductory chapter has provided the rational and background to the study and a short description of the relationship between government revenues and government expenditures with a view to contextualise fiscal deficit. It further described the objectives, statement of the problem, hypotheses of the study, together with the presentation of the structure of the dissertation. The study has been motivated by fiscal consolidation and fiscal deficit targeting in South Africa.

Fiscal deficit adversely affects the economy, highlights the need to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate. In overseeing the economy, the government uses both fiscal and monetary policy. Fiscal policy is the most important macroeconomic policy; it is used to maintain economic growth and employment rates. Keynesian economists noted that expansionary fiscal policy is effective during economic depression following the Great Depression from 1929 to 1939.

The relationship between fiscal deficit, inflation, money supply and exchange rate, was investigated to serve as a guide for policy makers to design and implement

effective policies. Additionally, an understanding of macroeconomic variables that impact on price levels is of significance. Policy makers, therefore, select deficit financing options that do not hinder economic growth. This in turn, provides a hedge to the government's fiscal position against financial and macroeconomic shocks.

The following chapter comprises a more rigorous literature search that will assist in achieving the objectives of the study and the interpretation of the results. The chapter specifically evaluates theoretical and empirical literature on fiscal deficit, inflation, money supply and exchange rate relationships.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Chapter One presented an introduction to the study conducted and provided the outline of the research process followed. This chapter provides a literature review on the relationship between fiscal deficit, inflation, money supply and exchange rate. The chapter essentially comprises five sections. Following this introduction is Section Two, which provides an analysis of relevant literature on the variables of the study and an overview of some fiscal policy aspects in South Africa. Section Three reviews the theoretical framework with the aim of revealing theoretical underpinning of the relationship between fiscal deficit, inflation, money supply and exchange rate. Examination of the empirical literature under the subheadings: fiscal deficit and inflation, fiscal deficit and growth, fiscal deficit and money supply, fiscal deficit and exchange rate and lastly, fiscal deficit, inflation, money supply and exchange rate is contained in Section four. Section five comprises the chapter summary.

Calitz, Du Plessis and Siebrits (2013) argued that there are ever-increasing signs of the harmful effects of too much fiscal deficits on macroeconomic performance. Meanwhile, Mehrara and Rezaei (2014) contended that sometimes governments, to decrease the unemployment of their citizens, utilise the budget deficit policy. Through having the budget deficit in the long-run, not only is the policy an issue but also a problem for citizens that it needs to solve. Makanza and Dunne (2015) explained this point further, by stating that deficits are exemplified by low investments, low savings rates and exchange rate depreciation.

As stated in Chapter One, fiscal policy occupies an important status in achieving its macroeconomic goals for economic growth, employment and price stability. Raising revenue through taxation and then spend on provision of public goods justifies the existence and operations of all governments. Accordingly, there is no government that can last without efficient public finance management based on financial management capacity. A pre-requisite for efficient financial management is to start up with fiscal discipline. Kumar and Ter-Minassian (2007) postulated that fiscal discipline is essential to improve and sustain economic performance, macro-economic stability and reduce vulnerability.

2.2 An overview of some fiscal policy aspects in South Africa

Every government purchases goods and services and raises taxes and borrows funds to finance its expenditures. However, the size and composition of government spending and the way in which it is financed is relevant due to its significant effects on important macroeconomic variables such as aggregate production, income and employment and the price level as well as the distribution of income (Mohr & Associates 2015). Parkin (2013) contended that the purpose of fiscal policy is to achieve macroeconomic objectives such as full employment, sustained economic growth and price level stability.

It bears highlighting that total spending on South African goods and services consists of spending by four sectors (Mohr & Associates 2015):

- Spending by households on consumer goods and services(C)
- Spending by firms on capital goods (I)
- Spending by government on goods and services (G)
- Spending by foreigners on South African goods and services (X) minus spending by South Africans on imported goods and services.

Total expenditure can therefore be written as follows: C + I+ G+ X-Z

Government spending therefore is a crucial component of total spending in the economy and it is often measured by government's share in total spending in the economy - Gross Domestic Expenditure (GDE). Government spending can be classified into two categories: (i) functional classification, expenditure according to the function of government for which it is intended such as education, defence and safety and housing among others, and (ii) State debt cost, which is also included as a separate item in this classification (Mohr & Associates 2015, Parkin 2013).

As for economic classification, it includes expenditure according to its nature as either current payments such as salaries for government employees, transfers and subsidies e.g. grants to households or subsidies to educational institutions. Additionally, payments for capital assets such as government purchases of buildings, machinery and equipment are yet another component of government spending.

Table 2.1: Government spending in South Africa as a percentage of gross domestic expenditure 1960-2015

Year	Final consumption expenditure by general government (% of GDE)	Total spending by general government (% of GDE)
1960	9.8	12.7
1970	11.7	15.8
1980	14.5	17.6
1990	20.3	22.6
2000	19.3	21.6
2010	21.5	24.5
2013	21.6	24.7
2015	19.9	36.3

Source: Mohr & Associates (2015) computed using data from www.resbank.co.za

Table 2.1 indicates two ways by which government spending can be measured in South Africa, final consumption by general government and total expenditure including investment, both expressed as a percentage of GDE. Since 1960, there has been a constant rise in the role of the South African government's activities resulting in a sharp surge in the share of domestic resources utilised by the public sector to meet the needs of the people.

As a percentage of GDE total spending by general government increased from 12.7 per cent of GDE in 1960 to 36.3 per cent of GDE in 2015. This indicates that over a third of all domestic expenditure was a burden of government in 2015. In the 1980s, a drastic rise in total general government spending was attributed to political and other shocks such as South Africa's involvement in wars in Namibia, Angola and Mozambique, as well as domestic political unrest. Notably in 2010 final consumption was 24.5 per cent of GDE; contributing factors were partly the requirements for the 2010 FIFA World Cup tournament.

Table 2.2: Budget deficit, public debt and interest on public debt in South Africa (1994-2015)

Year ended 31 March	Budget deficit as % GDP	Public debt (at end of year) as % GDP	Interest on public debt as % of total expenditure of national government
1994	6.5	52.5	16.9
1995	6.0	52.5	17.3
1996	5.1	55.6	18.7
1997	5.0	48.6	18.7
1998	3.7	48.7	20.4
1999	2.8	46.3	20.9
2000	2.2	43.4	20.3
2001	1.9	43.6	19.8
2002	1.4	37.0	18.0
2003	1.1	37.0	16.0
2004	2.3	35.9	14.0
2005	1.5	34.7	13.2
2006	0.4	32.6	12.2
2007	-0.7	28.3	11.1
2008	-0.9	27.8	9.8
2009	0.7	31.3	8.7
2010	5.4	35.6	8.0
2011	4.2	39.4	8.4
2012	4.9	42.5	8.6
2013	5.4	46.1	9.2
2014	4.3	44.8	9.6
2015	4.1	45.4	10.1

Source: Mohr & Associates (2015), Budget review 1994 and 1995 and researchers' own calculations

The difference between government spending and current revenue is referred to as the budget deficit. In most cases, this deficit is financed by borrowing. Government borrowing increases the public debt. In the early 1990s South African budget deficits were very high and large amounts had to be borrowed, resulting into large amounts

of public debt. Like any other borrower, government has to pay interest on all borrowed funds, hence, substantial increases in the interest payable on public debt.

An increase in the interest burden means that a smaller proportion of government spending is available for social development and other priorities. Interest charges as a percentage of GDP as shown in column four of Table 2.2 have increased significantly. Furthermore, in one way or another, interest charges to GDP indicate the level of taxation on average that is required to service the public debt. Black, Calitz and Steenkamp (2012), emphasised that public debt or government debt is the sum of all the outstanding financial liabilities of the public sector in respect of which there is a primary legal responsibility to repay the principal amount and interest. In addition, the cost of servicing government debt is influenced by the volume of debt, new borrowing and market variables such as interest, exchange and inflation rates (National Treasury 2015). Debt service costs are summarised in Table 2.3 below.

Table 2.3: Debt service costs (2014/15)

R billion	Budget	Revised budget	Preliminary outcomes
Domestic loans	106.2	106.8	106.5
Short-term	14.8	14.6	14.7
Long-term	91.4	92.2	91.8
Foreign loans	8.7	8.2	8.3
Total	**114.9**	**115.0**	**114.8**
As % of GDP	3.0	3.0	3.0
Expenditure	10.1	10.1	10.1
Revenue	11.9	12.1	12.0

Source: National Treasury (2015)

In the 2014/15 financial year, debt-service cost was 3.0 per cent of GDP, lower than the budgeted amount. However, in the 2015/16 financial year debt service cost was 3.2 percent of GDP, higher than initially budgeted - partly because of a sharp depreciation of the rand against currencies in which foreign debt is denominated.

Budget deficits were at the edge of macroeconomic adjustment policies in the 1980s and 1990s in both developing and industrial countries (Jacobs, Schoeman & van Heerden 2000). Easterly, Rodriguez and Schmidt-Hebbel (1994) argued that budget deficits were pivotal in the massive reform programs initiated in many developing countries on all continents; hence, fiscal consolidations and budget deficit targeting are indicators of financial discipline in the South African case.

2.2.1 Fiscal consolidation

The great international economic and financial crisis which resulted in severe international recessions put enormous strain on public finance around the globe. McConnell and Brue (1996) stated that the idea that government fiscal actions can exert a stabilising influence on the economy began in the depression of the 1930. Hence, Mohr and Associates (2015) contended that fiscal policy is often regarded as an effective means of influencing total spending in the economy. Moreover, fiscal policy is classified as an instrument of demand management in the sense that it can be used to manage or regulate the total demand for goods and services in the economy.

It is against this background that government's deficits and debt ratios swelled on the back of collapsing revenues in the aftermath of international economic recessions. Government actions aimed at preventing the meltdown of financial systems and stifling the sharp contraction of economic activities, sparked immense fiscal consolidation. Thus, the South African Government committed itself to a fiscal consolidation plan in the 2014 Medium Term Budget Policy Statement (National Treasury 2014). Furthermore, the 2015 national budget outlined the details of the consolidation plan, in which fiscal authorities predicted a decline in the budget deficit to 2.5 per cent of GDP by the end of the 2017/18 fiscal year. The medium term estimates are summarised in Table 2.4.

Table 2.4: National Treasury's predicted medium-term consolidation of the fiscal framework for South Africa

	2014/15	2015/16	2016/17	2017/18
Percentage of GDP	Revised Estimates	Medium Term Estimates		
Revenue	28.1	28.4	29.3	29.2
Expenditure	32.0	32.2	31.9	31.7
Non-Interest	28.9	29.1	28.7	28.5
Interest	3.1	3.2	3.2	3.2
Budget balance	-3.9	-3.9	-2.6	-2.5

Source: National Treasury (2015)

Troupin, Steen and Stroobants (2015) provided an economic explanation of fiscal consolidation as a situation within which state budgets are expected to adjust at a term to the macroeconomic context. Macroeconomic context can be assessed by a country's GDP growth rate, the evolution of government's deficits and gross debt and unemployment rate. However, poor economic performance weighs on budget deficit and state debt.

In essence fiscal consolidation is designed to reduce government deficit and debt accumulation. Meanwhile, high unemployment levels, lead to decreased revenues from income and to increased expenditure on unemployment allowances. On the other hand, governments are expected to engage in fiscal consolidation under such circumstances in order to consolidate public finances. Burger, Siebrits and Calitz (2016) contended that fiscal deficit/GDP ratios can be decreased by reducing government expenditure and or increasing government revenue as a percentage of GDP.

To reinforce the above, Lopes and do Amaral (2017) posited that a sharp reduction in public expenditure, coupled with an increase in taxes, will ultimately reduce the budget deficit. Accordingly, this will increase the confidence of private investors, leading to a significant flow of private capital; the economy will expand and compensate for the short-term negative impacts of the fiscal consolidation.

Fiscal consolidation finds application through the adoption of one or more rules, including an expenditure rule (ER), a revenue rule (RR), a structural budget rule (SBR) and a debt rule (DR) (Warren 2013). In the case of the European Union (EU) countries, economic stability was essential for the formation of the European Monetary Union (EMU) as well as the smooth functioning of the single currency. As such, the 1998 Stability Growth Pact (SGP) was agreed upon by member states prior to the introduction of the Euro in 1999. SGP included a fiscal rule requiring member countries to avoid excessive budget deficits by setting a threshold of budget deficit to GDP ratio at 3 percent and public debt to GDP ratio at 60%.

As stated earlier, the South African Government committed itself to a fiscal consolidation plan in the 2014 Medium Term Budget Policy Statement (National Treasury 2014). In the same vein, the government proposed a series of measures to reduce the budget deficit and stabilise public debt. Debt service payments consume a growing share of the national budget, resulting in a narrowing of the space to expand public services and investment. Furthermore, sustaining deficits, while the economy is unresponsive can exacerbate the current account deficit; this is supportive of the twin deficit hypothesis. In addition, current account deterioration has detrimental effects on the economy such as pushing up inflation and interest rates as well as reducing the competitiveness of the currency - undermining growth and employment.

2.2.2 Fiscal sustainability

Developed and developing countries have witnessed mounting public debt in recent years, which sparked the need to promote fiscal sustainability. High levels of public debt are perceived to trigger downgrading of the sovereign debt ratings of several developed and developing countries. Sluggish economic growth, inequality and unemployment pose challenges to the reduction of public debt. Sustainable public finance and smaller public debt burdens are important elements that ensure sufficient fiscal policy space to cope with adverse and unforeseen macroeconomic developments. Sustainable application of fiscal policy should therefore, and importantly, ensure that buffers are built in good times to safeguard the country from being vulnerable.

The European Commission (2015) defined fiscal sustainability as generally referring to solvency of the public sector. A public entity is considered as solvent if the present discounted value of its current and future budget balance is smaller than or equal to the present discounted value of its current and future path of income, net of any initial debt levels.

In essence, fiscal sustainability can thus be perceived as a situation where fiscal policy can be maintained without changes in public spending, or taxation, without causing the public debt to rise continuously as a share of GDP. The crux of this definition points to public debt as the central element of fiscal sustainability. It is worth mentioning that fiscal sustainability excludes Ponzi game conditions, which imply government keeps on indefinitely accumulating debt faster than the increase in its capacity to service it.

Fiscal sustainability is defined in terms of government inter-temporal budget constraints, which look at the long-run relationship between government revenue and expenditure. The government faces a budget constraint as indicated by the following equation:

$$G_t + (1+r_1)\, B_{t-1} = R_t + B_t$$

Where G is government expenditure, r is the one-period real rate of interest, R is government revenue and B is the stock of debt.

Burger, Siebrits and Calitz (2016) argued that during the 2000s, the South African government did not attain adequate primary surplus to alleviate the public debt and it also raised the primary surplus to the extent that the public debt declined from about 48% of GDP in the late 1990s to 27 per cent of GDP in 2008. This substantial reduction in government's debt burden guaranteed sustainability of fiscal policy at that time.

On the other hand, Makanza and Dunne (2015) regarded South Africa's fiscal position as weaker than other Emerging Market Economies (EME), with high readings of government debt averaging about 42 per cent of GDP in 2012.

Accordingly, the accumulation of public debt reflects the position of fiscal policy. The fiscal deficit in South Africa is reflective of a country living beyond its means.

2.3 Theoretical framework

The impact of fiscal deficit on the economy is a concern that is highly questioned in economics literature. There are two broad contesting viewpoints, on the one hand there are those who argue that fiscal deficit has a positive impact on macroeconomic variables, thus fiscal deficit is effective in accelerating growth via investment. On the other hand, some economists argue against the effectiveness of fiscal deficit in accelerating economic growth. This section reviews the theoretical literature and empirical studies relating to the relationship between fiscal deficit, inflation, money supply and exchange rate. The first part of this section covers the theoretical framework of perspectives on the monetarist approach, fiscal theory of the price level, neoclassical school, the conventional Keynesian proposition and Ricardian School, followed by a review of empirical work in the second part.

2.3.1 The Monetarist approach

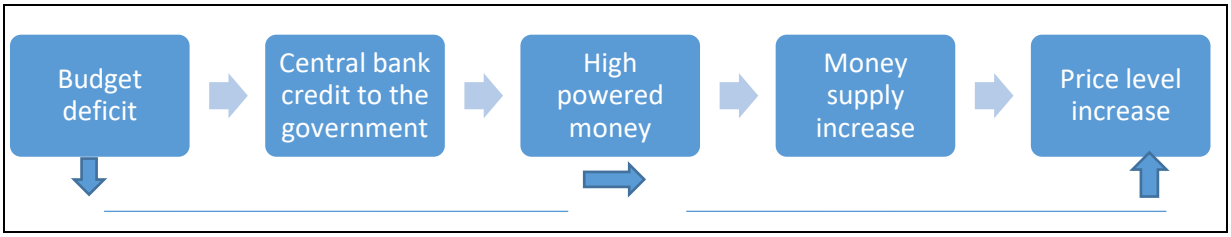
The monetarist view has its origins in economist Irving Fisher's Quantity Theory of Money which was developed in the early 1900s. The quantity theory of money explains long-run adjustment of the price level. The theory postulates, in the long-run an increase in the quantity of money brings an equal percentage increase in the price level. Moreover, this theory has its roots in the equation of exchange, which links aggregate spending in an economy and the stock of money. The equation states that inflation is driven primarily by money supply growth.

Parkin (2013) explained this theory by calling the quantity of money M , the velocity of circulation V, price level P and output Y. Velocity of circulation is the number of times an average unit of money is used annually to buy the goods and services to make up GDP. The velocity of circulation V is determined by the equation: $V = PY/M$.

From the definition of the velocity of circulation, the equation of exchange indicates how M, V, P and Y are connected and this equation is expressed as: $MV = PY$.

The quantity theory of money assumes that velocity is held constant and output is given. The equation of exchange thus states that inflation is determined by the supply of money in an economy. Ashra, Chattopadhyay and Chaudhuri (2004) contended that budget deficits can influence the rate of inflation as it leads to an expansion of aggregate demand. A higher budget deficit through an increase in deficit financing increases the Reserve Bank credit to the government. The overall volume of money supply (M) is supposed to be closely related to the base money through the money multiplier (m) process (exogenous money view). A rise in fiscal deficit (FD) expands the potential money supply, which, according to this view, would lead to the eventual build-up of inflationary tendencies (an increase in price P) in the economy. Figure 2.1 explains this process in a much simpler way.

Figure 2.1: Monetarist view on the relationship between budget deficits and inflation



Source: Ashra e*t al.* (2004)

However, Meltzer (1998) emphasised that the monetarists explain inflation as the result of excessive money growth. Furthermore, money growth is perceived to be excessive when it exceeds the growth of real output with adjustment for improvements in the efficiency of monetary exchange, innovations in intermediation or other sustained changes in monetary velocity.

Van Hoang (2014) argued that theoretically, budget deficit could be a source of inflation depending on how long it lasts and how it is financed. Mishkin (2004) postulated that if budget deficits are permanent and are financed by money creation, inflation will be evident.

2.3.2 Fiscal theory of the price level (FTPL)

The discontent with the quantity theory of money gave rise to the fiscal theory of price level (FTPL), where fiscal policy affects the price level. The advocates of FTPL are bound by the view that for the price level to be stable as one macroeconomic policy, government finances must be sustainable. This school of thought points out that, to achieve price stability government must run a balanced budget over the course of the business cycle. For the theory to hold, government must not run a structural deficit. The FTPL follows its roots from simple relations of velocity equation and government's inter-temporal budget constraints. The FTPL was developed by Leeper (1991) followed by contributions by Sims (1994) and by Woodford (1994, 1995 and 2001).

Bassetto (2000) maintained that FTPL describes policy rules as the price level determined by government debt and the present and future tax and spending plans, with no direct reference to monetary policy. In its simplest form the FTPL models the government's inter-temporal budget constraints in its present value form, given by: B/P = Present value of future surpluses, where B, is the outstanding nominal debt of the government and P, the price level.

Afonso (2002) expounded that the price level adjusts in order to reassure that the value of nominal government debt divided by price level equals the present value of future surpluses; that is, the price level equals the ratio of the nominal government liabilities to the present value of future budget surpluses in real terms. As for the government's inter-temporal budget equation, the conventional view holds that the equation is a constraint on the government's tax and expenditure. FTPL proponents refute this view and argue that there is no inherent requirement that government's treat the equation as a constraint on policy. Inter-temporal budget constraint is an equilibrium condition (Lawrence & Fitzgerald 2000).

2.3.3 Neoclassical theory

The standard neoclassical theory is guided by the assumptions that the consumption of each individual is determined as the solution to an inter-temporal optimisation problem; Consumers have access to capital markets where borrowing and lending are permitted at the market rate of interest and consumers have finite lifespans

(Eigbiremolen, Ezema & Orji 2016). Bernheim (1989) stated that budget deficits raise total lifetime consumption by shifting taxes to subsequent generations. Under conditions of full utilisation of resources, increased consumption implies decreased savings. To maintain the state of balance in the capital market, interest rates must increase. Accordingly, persistent deficits crowd out private capital accumulation in the form of investment.

Furthermore, in the standard IS-LM analysis of monetary economics, increasing the budget deficit causes output to expand; this expansion of output raises the demand for money. If the money supply is fixed, interest rates must rise and private investment falls, thus dampening the effect of the Keynesian multiplier. Carrasco (1998) argued that crowding out effect reduces economic growth. It brings about less capital stock than it would have grown, had private investment been higher.

Moreover, lower capital stock translates into a lower growth path for both output and marginal productivity of labour. In a profit maximising environment, the marginal productivity of labour equals real wages, a decline in private investment, and therefore has a negative impact on the level of real wages. Consequently, it adversely affects the living standard of workers.

Ramu and Gayithri (2016) noted that government dis-saving caused by a deficit in the budget will have a detrimental effect on economic growth. Higher external borrowing to fill the investment gap have an adverse effect on the exchange rate and trade account, which in turn affects the growth rate negatively.

The neoclassical theory is aligned to the Mundell-Fleming framework, which holds that an increase in the budget deficit would induce an upward pressure on interest rates. Consequently, creating an attractive environment for capital inflows in the domestic economy will have an effect on domestic exchange rate appreciation; thus competitiveness of the domestic economy will be affected in international markets, worsening the current account balance.

2.3.4 The conventional Keynesian Proposition

The Keynesian school of thought is basically challenging the effectiveness of expansionary monetary policy at recession-fighting. The Great Depression of 1929-1939, a decade characterised by stagnant production and high levels of unemployment throughout the world economy motivated John Maynard Keynes' theory. The effect of the Great Depression was significant, since the decline in world demand caused the core of the South African economy at that time agriculture and mining to decline significantly (Parkin 2013).

It was in this climate of economic depression that The General Theory of Employment Interest, and Money was written by John Maynard Keynes in 1936. This famous theory was the first to provide a theoretical framework for fiscal policy. Keynesian theory states that during a recession, governments should increase their government expenditure and cut taxes, thus shifting the budget towards a deficit. Keynesians make reference to the expansionary effects of the budget deficit.

Ramu (2016) and Eigbiremolen *et al,* (2016) noted that from the Keynesian viewpoint, government expenditure will have a multiplier effect on output and employment. Keynesians argue that budget deficits result in an increase in domestic production, increase aggregate demand, and thus improve the profitability of private investment. Profitability of private investments will provide an incentive for investors to increase their investments.

Mujuba (2013) asserted that fiscal deficit boosts capacity utilisation and smoothes the business cycle. From the Keynes perspective, expansionary monetary policy is powerless to boost the economy out of depression, because it depends on reducing interest rates. During economic depression interest rates are already close to zero; an economic phenomenon that is widely known as the liquidity trap (Dornbusch & Fischer 1996).

2.3.5 The Ricardian School

The Ricardian school of thought postulates that interest rate, current economic activity and economic growth would be unaffected by the way the government finance its expenditure (Hyman 2008). Ricardo, a classical economist of the 1800s

theorised that deficit spending is offset by an equal spending in private savings, thus keeping the level of interest rate fixed (McConnell & Brue 1996). According to Ricardo, forward looking taxpayers know that the government will have to raise taxes in the future to pay back what it borrowed and the interest on those funds. Consequently, as a response to government deficits, individuals increase their current savings in order to meet their future tax liabilities. In essence, a budget deficit leads to an increase in private savings; a theory known as the Ricardian Equivalence theorem.

McConnell and Brue (1996) pointed out that financing a deficit by borrowing has the same effect on GDP as financing it through a present tax increase. Basically, for Ricardian Equivalence theorem to hold, a rise in government borrowing will be exactly counterbalanced by an equal reduction in aggregate consumption as households pursue saving to finance anticipated higher taxes. Consequently, there will be no increase in aggregate current spending, no effect on the interest rate and crowding out of private investment. Furthermore, there will be no reduction in future economic growth. In 1989, Barro advanced the controversial idea of Ricardian Equivalence and it became knoen as Barro-Ricardo Equivalence.

2.4 Empirical literature

Taking the theoretical framework presented in section 2.3 into consideration, the precise relationship between fiscal deficit, inflation, money supply and exchange rate can only be confirmed through empirical substantiation. Therefore, this study reviews empirical literature according to the main contribution made by this current study aligned with the objectives of the study.

2.4.1 Fiscal deficit and inflation

In view of macroeconomic policy objectives such as price stability, income distribution, full employment, balance of payment stability and economic growth, maintaining fiscal stability is an imperative. Due to the adverse effects of inflation on the economy, controlling it is one of the main objectives of policy makers, in both developing and developed countries. It is believed that governments running budget deficits continuously have to finance those deficits with money creation “seigniorage” the mechanism through which inflation can be stimulated.

Wakeel and Ullah (2013) carried out a study in Pakistan, aimed at analysing the impacts of budget deficits on macroeconomic aspects. The study used annual data for the period 1970 to 2010. With the help of ADF, 3-stage least square method, the study provided evidence of a positive relationship between output, commercial banks' credit provided to the public sector (BCP) and government expenditure, but negatively related with interest rate. While money supply on the other hand was positively related to government borrowing from the banking system (GBD), BCP and foreign reserves. Wakeel and Ullah (2013) concluded that money supply did in fact increase when they tried to finance budget deficit through government; private and external borrowing resulted into inflation.

In Nigeria, Oladipo and Akinbobola (2011) provided empirical evidence on the direction of causality among budget deficit and inflation. The study was aligned to the Neo-classical school of thought. Secondary data for the period 1970 to 2005, was employed, utilising pair wise Granger-causality. The results revealed that there was no causal relationship from inflation to budget deficit, though the causal relationship from budget deficit to inflation was evident. Awe and Shina (2012) concluded that budget deficits affect inflation directly and indirectly through an increase in money supply in the Nigerian economy. The study covered the period 1980 to 2009 using time series data and employed vector error correction mechanism (VECM). The research results demonstrated a significant causal relationship from budget to inflation whereas causal relationship from inflation to budget deficit was insignificant.

2.4.2 Fiscal deficit and economic growth

A country's rate of economic growth and the expansion of its potential to produce goods and services depend on investment. Scarcity of resources is one of the central elements of economics, thus investment requires a sacrifice of current consumption so that the resources used to produce goods for today can be reallocated to the production of capital goods. Hyman (2008) argued that when we save more, we can allocate more resources to the development of new technology, production of new machinery and investment in people through education. National saving therefore is the summation of personal saving by households, business saving and saving by the government sector. The government sector participates in an increase in national saving when it spends less than it receives. In simple terms,

for the government sector to support an increase in national saving, it would have to produce a budget surplus.

Economic growth is one of the macroeconomic policy objectives. McConnell and Brue (1996) contended that a growth of total output relative to population means a higher standard of living. Nayab (2015) investigated the impact of a budget deficit on the economic growth of Pakistan during the period 1976 to 2007. Co-integration, VAR, Granger-causality and the vector error correction model were used for the data analysis. The empirical results demonstrated a positive impact of budget deficit on the economic growth of Pakistan. The results pointed out that GDP causes investment and investment causes deficit; In addition, budget deficit does not cause GDP growth.

In the same vein, Fatima, Ahmed and Rehman (2011) drew attention to the impact of government fiscal deficit on investment and economic growth of Pakistan. The study employed time series data from 1980 to 2009. The two-stage least squares method provided an opportunity to estimate two model equations. The results indicated a direct impact of fiscal deficit on real GDP per capita whereas, investment showed an indirect impact on real GDP per capita. Eminer (2015) utilised annual time series data covering the period 1983 to 2010. Through ADF, Granger-causality tests, and Autoregressive Distributed Lag (ARDL), the empirical results showed that a relationship exists between budget deficit, productive government expenditure and economic growth; the relationship was in both directions. Moreover, bivariate causality as well as long-run relationships were evident between budget deficit and economic growth in North Cyprus.

Checherita and Rother (2010) investigated the impact of high and growing debt on economic growth for 12 Euro countries, Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. The study used data covering the period 1970 to 2011. The study employed a quadratic equation in debt to control for country specific characteristics. The equation also contained country-fixed-effects. Furthermore, year dummies were included to control for common shocks. The estimated results indicated a highly statistically significant non-linear relationship between the government debt and the per capita GDP growth

for the sampled countries. Additionally, the debt-to-GDP turning point of concave relationship was roughly between 90 and 100 per cent on average for the sample. By implication, the results pointed out that government debt-to-GDP ratio above such a threshold would have a negative effect on economic growth.

2.4.3 Fiscal deficit and real exchange rate: The twin deficits hypothesis

The real exchange rate is another important macroeconomic variable which cannot be disregarded when investigating the interaction between macroeconomic policies. Theoretically, fiscal deficits lead to appreciation of the domestic currency (McConnell & Brue 1996). Supporting this view is the neoclassical school of thought that postulates that fiscal deficit will impact the trade balance negatively via increased interest rates and subsequent appreciation of the domestic currency. It is worth mentioning that domestic currency appreciation will be experienced in a flexible exchange rate regime.

The relationship between fiscal deficit and real exchange rate terminates in the twin deficit hypothesis. It is therefore, imperative to provide an overview of the applicability of the twin deficits hypothesis. Ogbonna (2014) examined the empirical relationship between fiscal deficit and current account imbalances of South Africa. Estimation results showed no evidence of the twin deficits hypothesis for South Africa. This, by implication, suggested that the Ricardian Equivalence proposition was applicable to South Africa during that period of time. Furthermore, the results pointed to the existence of a current account targeting state of affairs for South Africa in the short-run. In the same manner, Mandishekwa, Tambudzai and Marufu (2014) contributed to the twin deficits hypothesis debate, by testing its applicability to Zimbabwe. The study results suggested that the twin deficits hypothesis holds in Zimbabwe.

Alam and Taib (2013) empirically investigated the relationship of external public debt to budget deficit, current account deficit and exchange rate depreciation in debt trapped countries and non-debt trapped countries. Theis dichotomous study comprised an empirical analysis of six debt trapped countries, namely India, Indonesia, Nepal, Pakistan, Sri Lanka and Thailand as well as eight non-debt

trapped countries: Bangladesh, Fiji, Korea, Malaysia, Myanmar, Papua New Guinea, Philippines and Singapore.

Evidence deduced from the estimation results indicated a positive relationship between external public debt and budget deficit, current account deficit and exchange rate depreciation. However, the variable strength of relationship varies in debt trapped countries and non-debt countries. The study concluded that a stronger coefficient of external public debt, budget deficit and exchange rate indicated explosive borrowing, a higher demand of external public debt and intensive utilisation of foreign exchange. Whereas, a lower current account deficit indicated the diversion of borrowed funds towards adjustment in the current account, particularly in debt-strapped countries.

2.4.4 Fiscal deficits, inflation, money supply and exchange rate

Over the past few years, several studies tried to understand, model and predict the relationship among the important macroeconomic variables such as economic growth, money supply, inflation, unemployment, interest rate, fiscal deficits and exchange rate. The relationship between these variables has been one of the main provocative concerns for economists, researchers and policy makers. In the context of economic stabilisation in both developed and developing economies, a clear understanding of the linkage between the mentioned variables is imperative. For policy makers in particularly, such an understanding will ensure that effective macroeconomic stabilisation policies can be designed and implemented effectively so as to achieve price stability, economic growth, balance of payment stability, full employment and equitable distribution of income. Subsequently, the improved standard of living for citizens will be realised.

It bears mentioning that there has been little empirical research on the long-run relationship between fiscal deficit, inflation, money supply and exchange rate in the context of South Africa. A study by Egwaikhide, Chete and Falokun (1994) explored quantitative effects of exchange rate depreciation on budget deficit and inflation in Nigeria. Evidence from the estimation results indicated that exchange rate depreciation can be inflationary through its impact on inflation and budgetary and monetary effects. The empirical results also showed that on average, the

depreciation of the naira by about 76 per cent seemed to raise the growth of total expenditure more than total revenue for the period between 1973 and 1989. Furthermore, the study assumed a floating exchange rate and used the ordinary least squares method to estimate annual data.

Chaudhary and Ahmed (1995) undertook a study aimed at identifying the relationship among fiscal deficit, money supply and inflation in Pakistan. The model was estimated using annual data for the periods 1973 to 1992, 1973 to 1982, and 1982 to 1992. The findings revealed that domestic financing of budget deficit was inflationary in the long-run. In addition, estimation results also indicated that money supply was not exogenous; it depended on the state of international reserves, as well as fiscal deficit, which as a result emerged as an endogenous variable.

Gerezgiher and Rao (2016) established that domestic sources of budget deficit financing were long-term determinants of inflation. The study employed time series annual data for the period 1974/75 to 2013/14. Co-integration and vector error correction models were used to model estimated parameters.

2.5 Chapter summary

This chapter reviewed relevant literature on the relationship between fiscal deficit, inflation, money supply and exchange rate. The chapter began with an overview of fiscal policy aspects in South Africa, with a view to create a framework for the literature review. Fiscal policy aspects showed that government expenditure exceeds government revenue such that the country is experiencing fiscal deficits year on year. An important conclusion is to promote fiscal discipline so as to sustain the fiscal position of South Africa.

Empirical literature showed that, inflation is influenced by money supply, the inflation rate is used to measure price stability, which makes it imperative for monetary policy authorities and policy makers to understand and determine the key fiscal and monetary policy factors that have a significant impact on domestic price levels. The potential impact of exchange rate cannot be underestimated as within the context of globalisation, it causes the need to investigate how best to finance fiscal deficits.

This investigation would enable policy makers to design and implement optimal deficit financing options that will strengthen the country's fiscal position.

Despite the importance of the linkage between fiscal deficit, inflation, money supply and exchange rate, studies on these variables have been scanty. In this regard South Africa presents an ideal case for the investigation of these macroeconomic variables.

Based on the literature reviewed in this chapter, the following chapter provides the research methodology. The research methodology presented in Chapter Three also draws from the theoretical and empirical perspectives discussed in this chapter.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter reviewed the literature on various theories and empirical literature on the relationship between fiscal deficit, inflation, money supply and exchange rate. This was combined with some fiscal policy aspects in South Africa, which shed some light on the fiscal position of the country. This chapter provides a detailed discussion of the research methodology applied as well as the research design followed to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate in South Africa.

In research methodology according to Kothari (2004) “we study the various steps that are generally adopted by a researcher in studying his research problem along with the research problem”. The investigation of the relationship between fiscal deficit, inflation, money supply and exchange rate, required an assessment of co-integration, causality and long-run relationships. Doing so served as a basis for the research design of this study.

In the empirical analysis the study used quarterly data and the vector error correction model (VECM) to estimate parameters. The application of the VECM method in fiscal policy has been the basis of many studies undertaken to investigate the economic impact of fiscal policy on macroeconomic variables.

The discussion of the research methodology is divided into the following sections: Section 3.2 presents the research paradigm, followed by section 3.3 which outlines the research design. Section 3.4 presents data collection and data source. Thereafter, section 3.5 provides model specification, followed by section 3.6 which details estimation techniques. Section 3.7 contains a summary of the chapter.

3.2 Research paradigm

The philosophical assumption motivating this study is derived from the positivism paradigm. The positivist paradigm sometimes is called scientific approach. This implies relying on systematic observations, measuring and drawing conclusions in order to test a particular hypothesis (Bertram & Christiansen 2014). It is also

perceived as reductionist, in that the focus is to reduce the knowledge into small, discrete sets of variables that comprise hypotheses and research questions. Hence, the aim of this study is to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate. Fiscal deficit is regarded as the dependent variable, while inflation, money supply and exchange rate re regarded as independent variables. In order to realise the aim of the study, and verify the study hypotheses the study used quantifiable data and econometric techniques to estimate parameters.

Aliyu, Bello, Kasim and Martin (2014) argued that positivism could be interpreted as research strategy and approach that is entrenched in the ontological principle and doctrine that truth and reality is free and independent of the viewer and observer. Moreover, positivists assume that reality is objectively given and is measurable using properties which are independent of the researcher and instruments. Consequently, knowledge is objective and quantifiable; therefore, the results of this study are based on the available numerical data.

3.3 Research design

Prathapan (2014) stated that “the purpose of research design is to ensure that the data collected through various methods must lead us to a solution of a problem”. Bertram and Christiansen (2014) asserted that research design is a plan of how the researcher will systematically collect and analyse the data that is needed to answer the research question. The focus of this current study is to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate; hence the question posed is “What is the relationship between fiscal deficit, money supply and exchange rate?” The study selected a quantitative research approach to respond to the research question requiring the use of numerical data.

There are three common approaches to conducting research namely, quantitative, qualitative and the mixed method. The quantitative research approach creates meaning through objectivity uncovered in the collected data. Additionally, quantitative researchers seek explanations and predictions that will generate to other and places. The objective therefore, is to validate relationships and develop generalisations. Creswell (2014) stated that quantitative research is an approach for

testing objective theories by examining relationships among variables. These variables in turn can be measured typically on instruments, so that numbered data can be analysed using statistical procedures.

Furthermore, researchers who engage in quantitative research have assumptions about theories deductively, building in protections against bias, controlling for alternative explanations and being able to generalise and replicate the findings.

There are three broad classifications of quantitative research: descriptive, experimental and causal comparative (Williams 2007). The emphasis of this study is on measuring variables and testing hypotheses with a view to predict and link to causal explanation. Accordingly, the study employed the causal comparative design in investigating the relationship between fiscal deficit, inflation, money supply and exchange rate in South Africa. Hence, co-integration and Granger-causality were utilised.

In causal comparative design, the researcher examined how the independent variables affect the dependent variables and involve the cause and effect relationship between variables. It provided the researcher with an opportunity to examine the interaction between independent variables and their influence on dependent the variable. It therefore, builds its premises on deductive reasoning (Williams 2007).

3.4 Data collection and data sources

The study made use of quarterly macroeconomic time series data sets comprising 84 observations, covering the period from 1994Q1 to 2015Q4. The data sets were prepared in a way that the first quarter refers to the first three months of the Gregorian calendar, (that is January to March) and so forth. Quarterly data as opposed to annual data have many advantages as highlighted by Martins (2010) that fiscal decisions are taken throughout the year, and often based on monthly or quarterly information. For example, the government may need to increase domestic borrowing unexpectedly. The quarterly data therefore, will be better suited to depict the rich dynamic pattern of the decision-making process than the aggregate yearly-data.

Yearly-data often contains large contemporaneous effects that complicate the analysis and the interpretation of results, and that it is not suitable for producing precise estimates (Ilzetzki, Mendoza & Vegh 2010). In addition, quarterly data increases the sample size, hence attempts to alleviate the problem of disappearing degrees of freedom during model estimation (Martins 2010). De Castro and Garrote (2015) argued that quarterly data avoids the need of making too stringent identifications and allow for within-year feedback response among all variables in the system. The data was obtained from Quantec data base.

3.5 Model specification

The aim of this study is to investigate the relationship between fiscal deficit, inflation, money supply and exchange rates in South Africa. The traditional approach to economic modelling is to begin by formulating the equation. This study estimated the following equation:

FD = f (IF, MS and ER) (3.1)

Where

FD = Fiscal Deficit

IF = Inflation

MS = Money supply

ER =Real Exchange rate

The empirical model of the study is:

$FD_t = \beta_0 + \beta_1 IF_t + \beta_2 MS_t + \beta_3 ER_t + \epsilon_t$ (3.2)

This study applied a vector autoregressive (VAR) methodology; the VAR has its roots in the works of Sims (1980). In the Sims approach the division between endogenous and exogenous variables is deserted (Thomas 1997) and hence, according to Brown (1991) VAR models do not even attempt to capture the underlying structure of the economy. Consequently, all variables are treated as endogenous and that each equation has exactly the same set of regressors.

Martins (2010) argued that at first VAR seems a theoretical approach; however, economic theory is often used to select the variables to include in the analysis to

hold identification of the system and to assist in interpreting the results. Moreover, the framework permits a number of hypotheses to be tested within the framework.

Stock and Watson (2001) asserted that VAR is an n-equation, n-variable linear model in which each variable is in turn explained by its own lagged value, plus current and past values of the remaining n-1 variables. Consequently, the variables capture co-movements that cannot be identified in univariate or bivariate models. Moreover, standard VAR summary statistics such as Granger-causality tests, impulse response functions and variance decomposition are widely used methods for presenting these co-movements.

3.6 Estimation Techniques

In order to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate, the model specified above was subjected to a number of econometric tests. Since the study used time series data, stationarity tests were carried out in order to avoid spurious regression. The stationarity tests were followed by the co-integration procedure to examine whether any long run relationship exists between fiscal deficit, inflation, money supply and exchange rate. Finally, there was a need to determine causality between variables of interest. Thus, a causality test between the variables was performed.

3.6.1 Testing for stationarity

According to Brooks (2008) a stationary series can be defined as one with a constant mean, constant variance and a constant auto-covariance for each given lag. These quantities will remain the same whether observations for the time series were for example, from 1975 to 1985 or from 1985 to 1995. According to Verbeek (2004) stationarity of a process requires that variance and covariance are finite and independent of time.

Supposing a set of random variables X_1, X_2, X_3,X_4, X_5 …, where the subscripts refer to successive time periods. We want to know whether the underlying stochastic process that generates the time series can be assumed stationary or nonstationary. We then refer to the above time series as X_t (t = 1, 2, 3, …). In general, each X_t will

have its own mean E (X_t) and variance Var (X_t) and non-zero covariance may exist between different series of X_t.

Thomas (1997) stated that a time series X_t is said to be stationary if it satisfies the following three requirements:

- E (X_t) = constant for all t
- Var (X_t) = constant for all t
- Cov (X_t, X_{t+k}) = constant for all t and all $k \neq 0$

However, macroeconomic time series data are generally characterised by a stochastic trend, they tend to have a unit root. In other words they fail to satisfy any part of the stationary requirements. It is important to test time series data for stationarity before determining any possible long-run relationships between the variables of interest. Brooks (2008) argued that determining whether a series is stationary or not is very important, for the stationarity or otherwise of a series can strongly influence its behaviour and properties. A problem associated with non-stationary variables is the spurious regression or spurious correlation (Thomas 1997).

Gujarati (1999) argued that regression models involving non stationary time series data give results that are of dubious value, in the sense that superficially, the results look good but on further investigation they become suspect. Consequently, high R^2 value is likely to be found, the regression residuals are likely to be auto-correlated as reflected by a very low value for the Durbin-Watson (DW) statistics and t-ratios which are very high.

To avoid the spurious regression problems associated with regression, a non-stationary time series, we have to transform non-stationary time series to make them stationary. According to Gujarati and Porter (2009) the transformation method depends on whether the time series are difference stationary (DSP) or trend stationary (TSP). A non-stationary time series might need to be differenced more than once before it becomes stationary. If a time series has a unit root, the first

differences of such time series are stationary. A stationary time series is said to be integrated of order d, written as I(d) after being differenced d times, it becomes a stationary series (Thomas, 1997).

If a time series for example, X_t becomes stationary after being differenced (d) times, X_t is said to be integrated of order d, indicated by $X_t \sim I(d)$. The order of integration refers to the number of unit roots in the series or the number of differencing operations it takes to make time series variables stationary. Some economic time series are integrated of order zero, that is they are I (0) because their time series are stationary without the need for any differencing, whilst many economic time series are integrated of order one, that is I(1) because they become stationary on first differencing.

Libanio (2005) pointed out that if a time series has no unit roots, it is characterised as stationary and therefore, displays mean reversion in that it fluctuates around a constant long-run mean. Additionally, the absence of unit roots implies that the series has a finite variance which does not depend on time and that the effects of shocks dissipate over time.

Accordingly, the VAR methodology utilised in this study required, first and foremost, that all the time series data used are stationary to avoid unauthentic and misleading results. The stationarity of a time series data can be determined by using stationarity tests. These tests consist of informal and formal tests. The informal tests are conducted by means of visual plots of data in graphs and correlograms. The informal tests check for stationarity by plotting time series data and checking for evidence of trend in mean, variance, autocorrelation and seasonality.

Brown (1991) stated that the correlogram or autocorrelation function (ACF) is a plot of the autocorrelations between the data in the series. If the correlogram declines very slowly, the terms in the series are correlated several periods in the past. This is an indication that the series is nonstationary and that it must be transformed. These graphical inspections do provide an indication about the nature of the time series, but often inconclusive and misleading, which require more objective procedures and

tests for assessing whether unit roots are present and how to tackle them (Thomas1997).

A number of formal techniques are used to detect unit roots and stationarity; this includes the Augmented Dickey-Fuller (ADF), the Phillips-Perron (PP) and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests. Formal techniques assist with determining stationarity and are based on formal statistical tests. The focus was on the identification of the existence of the unit root in the series. This study applied both informal and formal tests to ascertain stationarity in the variables. The most widely used ADF and PP tests were adopted, based on the E-Views 9.5 software package, this study mainly utilised the functions of the package to realise the statistical tests.

(i) The Augmented Dickey Fuller (ADF) test

The Augmented Dickey Fuller (ADF) test is an extension of their earlier version the Dickey Fuller (DF) test, which includes the extra lagged terms of the dependent variable in order to eliminate autocorrelation. The ADF test is the rigorous version of Dickey Fuller (DF) test. The ADF is based on random walk movements in time series and the fact that random walks have unit roots.

It assumes that the explained variable (Y) follows an auto-regressive (AR) process of order p, written as AR (p), and ads p lagged differenced terms of the Y time series to the right hand side of the regression. The null hypothesis of the ADF test states that unit roots are present in the time series, whilst the alternative hypothesis states that there are no unit roots in the time series. Elder and Kennedy (2007) argued that a crucial ingredient of the ADF test is that a testing strategy is required as opposed to mere calculation of a single test statistic. This strategy is necessary to determine if an intercept plus time trend or neither an intercept nor time trend should be included in the regression run to conduct the unit-root test.

Assume that it is possible to model an economic time series by the first–order autoregressive process AR (1) to which is added an intercept α shown in equation (3.3):

$X_t = \alpha + \emptyset X_{t-1} + u_t$ (3.3)

X_t will be nonstationary if the parameter Ø equals or exceeds unity. We then t-test the null hypothesis H_0: Ø = 1 against the alternative hypothesis H_A: Ø < 1. This unit root test is called the Dickey Fuller (DF) test.

However, the DF test does not take into account the possible autocorrelation in the error term, subsequently, it has critical values that are greater in absolute terms and may sometimes lead to a rejection of a correct null hypothesis. In order to deal with the DF deficiency, the Augmented Dickey Fuller (ADF) test corrects for higher-order serial correlation by adding a lagged difference term on the right hand side in the DF equation. The ADF consists of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_1 \Delta Y_{t-1} + \varepsilon_t \quad (3.4)$$

The null hypothesis is H_0 = δ = 0, non-stationary and the alternative hypothesis is H_A= δ < 0, stationary.

In equation (3.4) time series is denoted by Y, linear time trend is depicted by t, whereas Δ is the first difference operator, β_1 is a constant and ε_t a pure noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$. The ADF test is only valid if ε_t is white noise. The number of lagged difference terms to include is often determined empirically, so that the error term in equation (3.4) is serially uncorrelated; unable to obtain an unbiased estimate of δ, the coefficient of lagged Y_{t-1}. In general δ, the coefficient of the lagged length Y_{t-1} is expected to be negative, and the estimated t-statistic will have a negative sign. Therefore, a large negative t-value is generally an indication of stationarity. The null hypothesis is H_0: δ = 0 (i.e. there is a unit root or the time series is non-stationary or it has a stochastic trend). The alternative hypothesis is H_A: δ < 0 (i.e. the time series is stationary, possibly around a deterministic trend).

However, the test statistics do not follow the standard t-distribution, but follows the non-standard distribution; MacKinnon therefore, used Monte Carlo simulation and response surface regressions to calculate the correct critical values for the test

statistics. When the test statistics are smaller than the critical value at 5 per cent level of significance then Y_t is stationary without a unit root, $Y_t \sim I(0)$. Contrary, if the test statistics are bigger than the critical value at 5 per cent level of significance, we accept the hypothesis that Y_t is non-stationary which has a unit root. When Y_t is a non-stationary series, it must be differenced d times before it becomes stationary, then it is said to be integrated of order d, $Y_t \sim I(d)$.

On the other hand, Brooks (2008) noted that including too few lags will not remove all of the autocorrelation, and lead to biased results. However, using too many lags will increase the coefficient standard errors. The latter effect arises since an increase in the number of parameters to estimate uses up degrees of freedom. Therefore, all else being equal, the absolute values of the test statistics will be reduced. This will result in a reduction in the power of ADF. Libanio (2005) concurred by arguing that, including too many deterministic regressors lead in lost power whilst not including enough of them biases the test in favour of the unit-root null.

The ADF test can be estimated on three different scenarios that is:

- With no constant and no trend
- With constant and no trend
- With constant and trend

E-Views 9.5 statistical package automatically computes ADF statistics and gives the appropriate critical values at the 10 per cent, the 5 per cent and 1 per cent levels. Unit root test statistics for regression residuals, together with their critical values, are automatically supplied by E-views. The study tested each time series individually to ensure non-stationarity, and also ran the unit root test on the first difference to ascertain I (1).

(ii) The Phillips-Perron (PP) Test

The study further used the Phillips and Perron test to verify for stationaity in support of the ADF test. Phillips and Perron's (1988) unit root test accounts for a single structural break in the series and does not assume the normality of residuals. It is an alternative procedure that controls for serial correlation in the series while testing for

unit roots and it is based on the non-augmented Dickey Fuller test which is a simple AR(1) of the form as shown in equation (3.5):

$$Y_t = \alpha Y_{t-1} + \delta X_t + v_t \quad (3.5)$$

Unlike the ADF, the test hypotheses in PP are written by evaluating the modified t-statistic of the coefficient α in equation (3.5) so that the serial correlation does not have an impact on the asymptotic distribution of the test statistic. Nkoro and Uko (2016) pointed out that the PP test has the same null hypothesis as ADF and its asymptotic distribution is the same as the ADF test statistics. The PP test is based on estimating the following equation:

$$\Delta Y_t = \beta^1 D_t + \pi Y_{t-1} + u_t \quad (3.6)$$

Where u_t is I (0) and may be heteroscedastic.

The Phillips and Perron unit root test became popular in the analysis of financial time series. The Phillips-Perron (PP) unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroscedasticity in the errors. It corrects the statistics to conduct for heteroscedasticity and autocorrelation. Thus PP tests correct for any serial correlation and heteroscedasticity in the errors u_t of the test regression by directly transforming the test statistics $t\pi = 0$ and $T\pi$. Moreover, PP tests are vigorous to general forms of heteroscedasticity in the error term u_t.

The possible existence of heteroscedasticity is a major concern in the application of regression analysis, including the analysis of variance. The presence of heteroscedasticity can invalidate statistical tests of significance by assuming that the modelling errors are uncorrelated and normally distributed and that their variances do not vary with the effects being modelled.

The PP test is advantageous as well in that it does not require the specification of lag length for testing the regression. Moreover, the PP test is a non-parametric test, in the sense that is does not require the selection of the level of serial correlation. The

PP test is used in time series analysis to test the null hypothesis that a time series is integrated of order 1.

(iii) The Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test

ADF and PP unit root tests are for the null hypothesis that a time series Y_t is I(1), whereas stationary tests are for the null hypothesis that Y_t is I(0). However, Brooks (2008) asserted that the most important criticism that has been levelled at ADF and PP unit root test is that their power is low if the process is stationary but with a root close to the non-stationary boundary. One way to overcome this problem is to use a stationary test as well as unit root test, thus conducting confirmatory data analysis.

In order to mitigate the lower power of ADF and PP Kwiatkowski, Phillips, Schmidt and Shin (1992) proposed an alternative test where stationarity is the null hypothesis and the existence of a unit root is the alternative. This test is usually referred to as the KPSS test. Kwiatkowski, Phillips, Schmidt and Shin (1992) argued that in order to decide by classical methods whether economic data are stationary or integrated it would be possible to conduct tests of the null hypothesis of stationarity as well as tests of the null hypothesis of unit root. In essence, the underlying assumption of the KPSS test is that the variables of interest are stationary (Nkoro & Uko 2016).

Kwiatkowski, Phillips, Schmidt and Shin (1992) designed the test by commencing with the model:

$$Y_t = \beta^1 D_t + \mu_t + \hat{u_t} \qquad (3.7)$$

$$\mu_t = \mu_{t-1} + \varepsilon_t, \ \varepsilon_t \sim WN(0, \theta_\varepsilon^2)$$

where D_t includes deterministic elements (constant or constant plus time trend), u_t is I(0) and may be heteroscedastic , μ_t is a pure random walk, θ_ε^2 is innovation variance. The null hypothesis that Y_t is I(0) is therefore, formulated as H_0: $\theta_\varepsilon^2 = 0$, which implies that μ_t is a constant.

The KPSS test is the Langrange multiplier (LM) or score statistics for testing $\theta_\varepsilon^2 = 0$, against the alternative that $\theta_\varepsilon^2 > 0$, and is given by the following equation:

$$KPSS = (T^{-2} \sum_{t=1}^{T} \hat{S}_t^2) / \hat{\lambda}^2 \quad (3.8)$$

Where $S_t^2 = \sum_{j=1}^{t} u_j$, u_t is the residual of regression Y_t on D_t and λ^2 is a constant of the long-run variance of u_t using u_t.

Verbeek (2004) and Franses, van Dijk and Opschoor (2014) explained that the basic idea is that a time series is decomposed into the sum of a deterministic time trend δt, a random walk S_t and stationarity error term u_t, that is,

$$Y_t = \delta t + S_t + u_t \quad (3.9)$$

Where S_t is the random walk

$$S_t = \sum_{i=1}^{t} \varepsilon_i = S_{t-1} + \varepsilon_t \quad (3.10)$$

The null hypothesis (of trend stationarity) specifies that the variance of the random walk component is zero. Montasser (2015) emphasised that the KPSS test is used as a complement to the standard unit root tests in analysing time series properties. KPSS is similar to ADF but it includes an automatic correction for auto correlated residuals (Brooks 2002) and does not suffer from small sample problems as ADF does.

The KPSS is computed using the t-statistic, following the same process as the ADF technique. The calculated t-statistic is compared with the KPSS critical value in order to make a conclusion about the stationarity of a time series. The null hypothesis of stationarity is rejected when the calculated t-value is greater than the critical t-value using the 5 per cent level of significance. According to Nkoro and Uko (2016) the results from the ADF test differ from KPSS, because KPSS does not provide a p-value, it shows different critical values instead. Furthermore, the null hypothesis for ADF states that the series is non-stationary whilst KPSS indicates that the series is stationary.

However, the study used time series data, because of the likelihood of the existence of serial correlation and heteroscedasticity. The KPSS as stationarity test would therefore produce inconsistent results, since it is not catering for serial correlation

and heteroscedasticity. Thus, in the light of advantages associated with the PP unit root test, PP is preferred to support ADF results for robust determination of series stationarity. The PP test deals with serial correlation and heteroscedasticity in the residuals.

3.6.2 Co-integration tests

After determining that variables are stationary, it is necessary to establish whether or not there is a long-term relationship between them. Thomas (2007) argued that co-integration is the statistical equivalent of the existence of a long-run economic relationship between I (1) variables. Two variables will be co-integrated if they have a long-term or equilibrium relationship between them. It is therefore important to test for the possibility of co-integration among variables of the study. Co-integration strives to provide more reliable results.

The concept of co-integration was promoted by Robert Engle and Clive Granger in 1987. Engle and Granger's analysis was based on the argument that if two or more time series of the same order of integration, say I(1) are linearly combined and produce I(0) residuals, it means that those variables are co-integrated. Hence, the underlying assumption of co-integration is that if two or more series are I(1), then there exists a possibility of their residuals exhibiting a stationary process, that is I(0). Engle and Granger (1987) emphasised that a series with no deterministic component which has a stationary invertible, ARMA representation after differencing d times, is said to be integrated of order d, denoted by $X_t \sim I(d)$.

Verbeek (2004) asserted that the co-integration tests test the presence of a unit root in regression residuals. If a model co-integrates it confirms that the model is stationary and that the regression is not spurious. Co-integration is the verification of the long-term relationship between variables. Brooks (2008) contended that a co-integrating relationship may be seen as a long-term or equilibrium phenomenon since it is possible that co-integrating variables may deviate from their relationship in the short-run, but their association would return in the long-run. In essence, co-integrated variables will never move far apart, they will be attracted to their long-run relationship.

Nkoro and Uko (2016) stated that co-integration analysis explains how to test whether the combination of two or more variables are individually non-stationary or spurious and how to estimate the co-integration parameters. Furthermore, it shows the existence of error correction representation of the relevant variables. Consequently, co-integration establishes a stronger statistical and economic basis for empirical error correction representation.

The concept of co-integration is of particular importance in this study, since the study endeavours to ascertain and differentiate between those variables that have a long term relationship with fiscal deficit. Tests for co-integration analysis include the Engle-Ganger approach as well as the Johansen approach. The Engle-Granger approach is residual based and aims to determine whether the residuals have an equilibrium relationship. The Johansen technique is based on the maximum likelihood estimation on a VAR system, with the objective to determine the rank of the matrix.

(i) The Johansen technique

This study employed the Johansen co-integration maximum likelihood method of co-integration. The technique was developed by Johansen (1989) and applied by Johansen and Juselius (1990) to determine co-integration numbers. The Johansen technique involves the application of standard multivariate calculations in the context of a vector auto-regression (VAR) methodology. It allows for more than one co-integration relation, and the technique was designed to handle variables that are I(1) integrated.

The Johansen method of testing for the existence of co-integration allows one to explicitly test for the number of co-integrating vectors, hence revolving around an examination of the Π matrix, explained as long run coefficient matrix. The technique does not rely on arbitrary normalisation and non-pretesting of unit roots (Nkoro & Uko 2016). Furthermore, the existence of co-integration between underlying variables in VAR models means that it can be represented in a form of error correction mechanism.

This technique has two tests in determining the number of co-integrating vectors. These are the likelihood ratio test based on the maximum eigenvalues and the trace test. For both test statistics, the initial Johansen test is testing the null hypothesis of non-co-integration against the alternative of co-integration.

Moreover, the Johansen technique can be viewed as a multivariate generalisation of the augmented Dickey Fuller test. The generalisation involves the examination of linear combinations of variables for unit roots. The Johansen technique and the estimation strategy maximum likelihood make it possible to estimate all co-integrating vectors especially when there are more than two variables.

Bahmani-Oskooee and Brooks 2003) pointed out that the Johansen technique is more efficient and more powerful in that it not only permits for a feedback effect among the variables that enter into co-integrating space, but is also based on the maximum likelihood procedure for estimating the long-run co-integrating vectors

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According to Nkoro and Uko (2016) Johansen's co-integration test is applicable under the following conditions:

- When there are more than two I(d) variables in the system
- When variables are integrated of the same order or of different order
- When there are more than one (multiple) co-integration vectors (relations) among the underlying variables

In order for the Johansen co-integration test to be valid for application, the following steps outlined by Nkoro and Uko (2016) must be followed:

Step A: Testing for stationary of variables and order of integration

The unit root test is a key pre-condition in the analysis of time series models and co-integration. Conducting unit root tests is important to avoid the problems of spurious regressions. If the variables are integrated of the same order or different orders of integration, the Johansen approach is applicable, although the most desirable case is when all the variables of interest are integrated of the same order.

Step B: Optimum lag length selection process

Estimating the lag length of the auto-regressive process for time series is a crucial step in any economic study employing econometrics methodology. Most VAR models are estimated using symmetric lags, which is, the same lag length is used for all variables in the equations of the model. Symmetric lag VAR models are easily estimated since the specification of all equations of the model is the same. Consequently, estimation by ordinary least squares yields efficient parameter estimates. The chosen lag length should produce the number and form of co-integration relations that conform to all the *a priori* knowledge associated with economic theory.

Gutierrez, Souza and Guillen (2007) indicated that selecting a higher order length than the true lag length causes an increase in the mean square forecast of the VAR and that under fitting the lag length, it often generates auto-correlated errors. Additionally, impulse response functions and variance decompositions are inconsistently derived from the estimated VAR when the lag length differs from the true lag length. It is therefore, important to select the lag length optimally to avoid spurious rejection or acceptance of estimated results.

One way of choosing the lag length is to use information criteria such as the Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Hannan-Quin Criterion (HQ), Final Prediction Error (FPE) as well as Likelihood Ratio test(LR) criteria and choose the model that gives the lowest values for these criteria. Furthermore, the decision about the lag structure of a VAR model could be based on the fact that a given criteria yields white noise residuals and preserves degrees of freedom.

Including too many lagged terms waste degrees of freedom and may lead to the possibility of multicollinearity. On the other hand, too few lags will result to specification errors and omission of important lag dependence. The choice of lag length also influences the power of rejecting hypotheses. In view of the fore mentioned challenges, the study employed the information criteria approach to select the appropriate lag order for the Johansen co-integration technique.

Step C: Choosing the appropriate model regarding the deterministic components in the multivariate system

Austerious and Hall (2016) pointed out that deterministic components are an important aspect of the formulation of the dynamic model. The choice of deterministic components requires that all variables be pre-tested to assess the order of integration. The graphical analysis of the raw data and unit root tests, together with *a priori* knowledge from economic theory, should assist in selecting the deterministic trend assumption to be used in the Johansen test for co-integration (rank of Π). Selecting the deterministic components include the decision whether an intercept and or trend should enter either the short-run or the long-run model or both models.

The major concern is that co-integration tests are very sensitive to the assumptions made about the deterministic components (i.e. the intercept and the trend) of the model. Hendry and Juselius (2001) pointed out that parameter estimates; policy simulation and forecasting are much more sensitive to the specification of the deterministic components of the VAR model.

There are five baseline models describing how the trend and the intercept can enter the VAR specification as explained by Austerious and Hall (2016).

Model 1: There is no intercept or trend in the co-integrating equation (CE); implying that there are no deterministic components in the data.

Model 2: Intercept (no trend) in CE, no intercept or trend in VAR, thus there are no linear trends in the data and therefore the first differenced series have a zero mean. Additionally, the intercept is restricted to the long-run model. Ahking (2002) asserted that this is the minimum deterministic component recommended by Johansen (1995) since the constants can account for differences in measurement units.

Model 3: Intercept in CE and VAR, no trends in CE and VAR, consequently, there are no linear trends in the levels of the data, but both specifications are

allowed to drift around an intercept. It is assumed that the intercept in CE is cancelled out by the intercept in VAR, leaving just one intercept in the short-run model.

Model 4: Intercept in CE and VAR, linear trend in CE, no trend in VAR. Trend is included in the CE as a trend-stationary variable.

Model 5: Comprises an intercept and quadratic trend in the CE intercept and linear trend in the VAR. The model allows for linear trends in the short-run model and thus quadratic trend in the CE.

It is clear that for constants and or trends in Johansen's co-integration models to be meaningful they must be related to the co-integration space or excluded from it. Ahking (2002) indicated that there is a need for a much more careful treatment of the constraints and trends in co-integration models. Consequently, by avoiding the consequences of misspecification could potentially have adverse consequences for policy recommendations.

The specification of the deterministic components is based on the Pantula principle which is a way to simultaneously determining the correct co-integration rank and deterministic components of a co-integration model. It involves testing sequentially a series of joint hypotheses. Using the trace test, the null hypothesis of zero co-integrating vectors is tested for model (i) (the most restricted model). If that hypothesis is rejected, the same hypothesis is considered for model (ii), (iii), and so on. The test procedure then is to move through from the most restrictive model to less restrictive and at each stage compare the trace test statistic to its critical value. The selection process only stops at the first time where the null hypothesis is not rejected.

Step D: Determining the number of co-integrating vectors

Once the appropriate lag length and the deterministic trend assumption have been identified, the rank of the Π matrix can then be tested. This step involves determining the number of co-integrating vectors. There are two test statistics for co-integration under the Johansen approach which are the trace

statistics and the maximum Eigenvalue statistics; they are applied as benchmarks for determining the number of co-integrating relationships in the co-integration equation.

The trace test is a joint test with a null hypothesis which states that the number of co-integrating relations is less or equal to *r*. The *r* is also called the 'rank' and it determines the number of co-integrating vectors. If *r* = 0, it means there is zero co-integration relations in the model. Its alternative hypothesis, on the other hand, is a general one which states that there are more than *r* co-integrating vectors. In the maximum Eigenvalue test, separate tests on each Eigenvalue are conducted. Its null hypothesis states that there are *r* co-integrating relations. The alternative hypothesis, on the other hand, states that there are *r* + 1 co-integrating vectors (Thomas 1997).

Step E: Estimation of Error Correction Model (ECM)

After establishing the number of co-integrating vectors, the next step was to estimate the error correction model**.** The estimation of ECM is explained in section 3.6.4 below.

3.6.3 The Engle-Granger Approach (The two-step procedure)

The Engle-Granger approach is residual based and seeks to examine whether the residuals have an equilibrium relationship or are stationary. Engle and Granger developed this method in 1987 to test for the existence of co-integrating relationships between variables. According to both econometricians, the steps to be followed for examining whether residuals are stationary or not as outlined by Asteriou and Hall (2007) are:

The first step involves testing the variables for their order of integration by applying ADF unit root tests in order to infer the number of unit roots in each variable. The existence of co-integration means that the model exhibits a long-run equilibrium relationship. The ADF regression equation is presented in the following form:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \sum_{j=1}^{P} \delta_j \Delta Y_{t-j} + \varepsilon_{it} \qquad (3.11)$$

Where α is a constant, β the coefficient on a time trend series, γ the coefficient of Y_{t-1}, p is the lag order of autoregressive process, $\Delta Y_t = Y_t - Y_{t-1}$ are first difference of Y_t, Y_{t-1} are lagged values of Y_t , ΔY_{t-j} are changes in the lagged values and ε_{it} is the white noise.

One more important aspect of the Engle-Granger approach as noted by Stewart and Gill (1998) is that the distribution of the t value differs from that in the pure unit root test. Since this test is a test on residuals, the critical values are different and compared to an ADF test on a series of a raw data (Brooks 2008).

The second step requires the estimation of the long run relationship in the form of OLS regression represented by equation (3.12).

$$Y_t = \beta_0 + \beta_1 x + \varepsilon_t \quad (3.12)$$

Where β_0 is the y-intercept, β_1 is the slope and ε_t is the error term.

The estimated OLS regression can then be indicated by:

$$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 \quad (3.13)$$

Step three includes checking for the order of integration of residuals in equation (3.12) using the ADF unit root test. The residual sequence indicated by ε_t is a series of estimated residuals of the long run relationship. The residuals are estimated from:

$$\varepsilon_t = Y_t - \hat{Y}_t \quad (3.14)$$

Where: $\hat{Y}_t$ are values of estimated equation (3.13). If the residuals are stationary, the regression model of the study co-integrates and therefore, not spurious. The ADF unit root test for residuals is carried out as follows:

$$\Delta\hat{\varepsilon}_t = \alpha_i \hat{\varepsilon}_{t-1} + \varepsilon_t \quad (3.15)$$

Where $\Delta\hat{\varepsilon}_t$ are estimated first differenced residuals, $\hat{\varepsilon}_{t-1}$ the estimated lagged residuals; α_i is the slope of the line and ε_t the error terms.

After establishing that the variables are co-integrated and the residuals from the equilibrium regression are stationary, the residuals can be used to estimate the error correction model as the last step of the Engle-Granger method of testing for co-integration. The estimation of the error correction model is explained in section 3.6.4 below.

Ergun and Goksu (2013) argued that the Engle-Granger two-step procedure shows whether co-integration is present or not, but it does not provide any information about how many co-integrating relationships exist in the regression model.

3.6.4 The Error Correction Model (ECM)

The concept of an error correction model (ECM) dates back to the paper by Sargan 1964 on wages and prices in the United Kingdom. Currently, the ECM model is associated with the work of Hendry and his promotion of the general-to-specific 0approach to econometric modelling. The ease with which ECMs can be fitted into the general-to-specific approach is one of their major advantages as noted by Thomas (1997). It may be possible to estimate the long-run or co-integrating relationships between the time series. In reality, $Y_t = \beta x_t + \varepsilon_t$ are not commonly in equilibrium, as they are affected by institutional or structural changes that might be temporary or permanent. Therefore, the short-run progression of variables is important, resulting into a simple dynamic model of short-run adjustment presented by:

$$Y_t = \alpha_0 + \gamma_0 X_t + \gamma_1 X_{t-1} \alpha_1 Y_{t-1} + \varepsilon_t \qquad (3.16)$$

Where Y_t is the dependent variable, X_t is the independent variable, Y_{t-1} and X_{t-1} are lagged values of Y_t and X_t respectively, α_0, α_1, γ_0, γ_1 are parameters and ε_t is the error term assumed to be iid.

However, the short-run dynamic model is associated with problems of multicollinearity and spurious correlation as observed by Franses, van Dijk and Opschoor (2014). First differencing the equation will solve the two identified problems and lead to equation (3.17).

$$\Delta Y_t = \alpha_0 + \gamma_0 \Delta X_t + \gamma_1 \Delta X_{t-1} \alpha_1 \Delta Y_{t-1} + \varepsilon_t \quad (3.17)$$

SSekuma (2011) stated that estimating the differenced equation (3.15) introduces the problem of loss of information about the long-run equilibrium, and the possible solution is to build the error correction model estimated by:

$$\Delta Y_t = \gamma_0 \Delta X_t - (1- \alpha_1)[Y_{t-1} - \beta_0 - \beta_1 X_{t-1}] + \varepsilon_t \quad (3.18)$$

Where $-(1-\alpha_1)$ is the speed of adjustment, $\varepsilon_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1}$ as the error correction mechanism measuring the distance of the system away from equilibrium. The coefficient of ε_{t-1} should be negative in sign and it should be significant. Ergun and Goksu (2013) pointed out that ε_{t-1} is the one period lag of the residual of the model; its function is to guide the variables of the model to restore back to equilibrium. Equation (3.18) can then be written as:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + \varepsilon_t \quad (3.19)$$

The ECM equation (3.19) states that ΔY depends on ΔX_t and also on the equilibrium error term.

The empirical model of the study aimed at investigating the relationship between fiscal deficit, inflation, money supply and real exchange rate is derived from equation (3.19). The specification of the model is shown in equation (3.20) below.

$$D(FD) = \alpha + \beta_1 D(IF) + \beta_2 D(MS) + \beta_3 D(RER) + \beta_4 u_{t-1} + \varepsilon_t \quad (3.20)$$

Where D (FD) is the first difference of fiscal deficit as a percentage of GDP, D (IF) is the first difference of CPI capturing the relationship between fiscal deficit and

inflation as indicated in chapter two, Figure 2.1. Meanwhile, D (MS) is money supply M3 broader and the most comprehensive measure of money supply in South Africa. Money supply is believed to have an impact on the general price level as postulated by the neoclassical economists and the velocity of money theory. D (RER) is the first difference of the real exchange rate, accounting for the twin deficit hypothesis, which states that an increase in fiscal deficit leads to appreciation of the domestic exchange rate worsening the current account balance.

Miller (1991) pointed out that the ECM is a vector auto-regressive (VAR) system constrained by the lagged error-correction term, which captures the short-run dynamic adjustments. Thomas (1997) and Asteriou (2007) argued that ECM incorporates not only short-run effects but also long-run effects.

It bears mentioning that estimation of the ECM is the last step for both the Johansen and Engle-Granger tests for co-integration. According to Asteriou and Hall (2007), the ECM is important and popular for the following reasons:

- It is a convenient model measuring the correction from disequilibrium of the 0previous period which has good economic implications.
- In the presence of co-integration ECM models are formulated in terms of first difference, to eliminate trends from the variables involved to resolve the problem of spurious regression. Ergun and Goksu (2013) concurred by indicating that OLS estimation and t-statistics and p-values can be used for interpretation since variables are co-integrated and the equilibrium error term is stationary.
- ECM models fit easily into the general-to-specific approach to econometric modelling; this point is supported by Thomas (1997).
- The ECM disequilibrium error term is a stationary variable to ensure automatic adjustment processes which prevent the error in the long-run relationship becoming larger and larger.

The importance of an error correction model indicates the speed of adjustment from the short-run to the long-run equilibrium state (Bakare, Adesanya & Bolarinwa 2014). Consequently, the higher the co-efficient of the parameter, the higher the speed of the model from short-run to the long-run.

Ssekuma (2011) indicated that the ECM satisfies the assumptions of the classical normal regression model. These assumptions include:

- A linear regression model
- Residuals are normally distributed
- There is no serial correlation among residuals
- There is no perfect multicollinearity

3.6.5 Granger-causality

Nkoro and Uko (2016) indicated that it is essential to assess the relationship among the variables under consideration using the causality test. Causality test ascertains the ability of one variable to predict the others. The variables under consideration were found to be co-integrated; this implied that they have a long run equilibrium relationship. Therefore, it was imperative to test the existence and direction of causality between co-integrated variables. The concept of causality is attributed to Engle Granger (1969) who explained that if *X* Granger causes *Y*, then past values of *X* should contain information which helps to predict *Y*. This culminated in what is commonly known as the Granger-causality test.

The Granger-causality test is essentially a statistical measure that determines whether changes in one variable are a cause of changes in another. The theory of Granger-causality states that a variable *X* Granger-causes *Y*, if *Y* can be better predicted using the past values of both X and Y, than it can by using the past values of Y alone. Granger (1969) posited that causality can be sub-divided into long-run and short-run causality using error correction models or VECMs. The VECM models allow for the test of the direction of causality.

Long-run causality is determined by the error correction term where significance is indicative of evidence of long-run causality from the explanatory variable to the dependent variable. Short-run causality is determined by a test on the joint significance of the lagged explanatory variables, using an F-test or Wald test. It is possible to have evidence of long-run causality, but not short-run causality and vice

versa. The Granger-causality model of this study is therefore presented by the following equations:

$$FD_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} FD_{t-1} + \sum_{i=1}^{q} \beta_{1i} IFt_{-1} + \sum_{i=1}^{r} \beta_{1i} MS_{t-1} + \sum_{i=1}^{s} \beta_{1i} ER_{t-1} + \varepsilon_{1t} \quad (3.21)$$

$$IF_t = \alpha_2 + \sum_{i=1}^{q} \beta_{1i} IF_{t-1} + \sum_{i=1}^{p} \beta_{1i} FD_{t-1} + \sum_{i=1}^{r} \beta_{1i} MS_{t-1} + \sum_{i=1}^{s} \beta_{1i} ER_{t-1} + \varepsilon_{2t} \quad (3.22)$$

$$MS_t = \alpha_3 + \sum_{i=1}^{r} \beta_{1i} MS_{t-1} + \sum_{i=1}^{p} \beta_{1i} FD_{t-1} + \sum_{i=1}^{q} \beta_{1i} IF_{t-1} + \sum_{i=1}^{s} \beta_{1i} ER_{t-1} + \varepsilon_{3t} \quad (3.23)$$

$$ER_t = \alpha_4 + \sum_{i=1}^{p} \beta_{1i} FD_{t-1} + \sum_{i=1}^{q} \beta_{1i} IF_{t-1} + \sum_{i=1}^{r} \beta_{1i} MS_{t-1} \sum_{i=1}^{s} \beta_{1i} ER_{t-1} + \varepsilon_{4t} \quad (3.24)$$

Where, ε_{it} represents the serially uncorrelated random error terms.

3.6.5 Diagnostic tests

The violation of the classical normal regression model assumptions will result into estimations that are not efficient and not reliable. Diagnostic checks validate the parameter evaluation of the outcomes of the model. Accordingly, parameter estimates from such a model will be unbiased.

Tests for specification errors conducted within linear regression models are normally based upon residuals. Diagnostic checks determine the stochastic properties of the model; the distribution and characteristics of the residuals in the model. These tests are very important, for they determine the credibility of the conclusions drawn from a model. The study followed the standard practice of testing the residuals for serial correlation, normality distribution and heteroscedasticity.

(i) Autocorrelation

Gujarati (2009) posited that autocorrelation is the correlation between members of a series of observations ordered in time. Brown (1991) indicated that autocorrelation exists when error terms are correlated with each other. The classical model assumes that the disturbance term relating to any observation is not influenced by the disturbance term relating to any other observation. In the presence of autocorrelation

the coefficient estimates derived using the OLS is unbiased but inefficient, that is they are not BLUE. The standard error estimates could be wrong. Consequently, there exists the possibility that the wrong inferences could be made. Furthermore, R^2 is likely to be inflated relative to its correct value.

Chand and Kamal (2014) asserted that all dependence in terms of autocorrelations and partial autocorrelations of the data generating process should be explained by the fitted model. Accordingly, there should be no significant autocorrelation and partial autocorrelation in successive terms of the residuals. The study applied the Breusch-Godfrey Langrange multiplier test. The null hypothesis for this test states that there is no serial correlation in the model. The Breusch-Godferyy test statistic for autocorrelation of order 1 through p is:

$$BG\ (p) = T_0\ (R^2) \qquad (3.25)$$

Where T_0 is the number of observations and R^2 is the coefficient of determination. BG (p) is asymptotically chi-squared distributed under the null hypothesis.

(ii) Heteroscedasticity test

The Heteroscedasticity is a violation of the requirement that error variances be homoscedastic or constant, in other words it exists if the error terms do not have a constant variance (Brooks 2008). White (1980) and Thomas (1997) pointed out that the presence of heteroscedasticity in the disturbances of a properly specified linear model leads to consistent but inefficient parameter estimates. Brooks (2008) and Thomas (1997) indicated that the OLS estimators are no longer BLUE; they no longer have the minimum variance among the class of unbiased estimators. Consequently, faulty inferences will be drawn when testing statistical hypotheses in the presence of heteroscedasticity.

The study employed White's test, to test for heteroscedasticity. This test is valuable because it takes into account several assumptions. It assumes that the estimated regression model is a standard linear. The null hypothesis for the White test is that the error terms are both homoscedastic and independent of the regressors and that

there is no problem of misspecification. The test regression is run by the regression of each cross product of the residuals on the cross products of the regressors and testing the joint significance of the regression.

(iii) Residual normality test

The normality assumption is required in order to conduct single or joint hypothesis tests about the model parameters (Brooks 2008). Ergun and Goksu (2013) indicated that if the assumption of normality does not hold, the OLS estimator remains BLUE, since it has the minimum variance among all linear unbiased estimators. However, one cannot use the standard for the t and F distribution to perform statistical tests. The study therefore had to use this test, by employing the Bera-Jarque (BJ) normality test.

The Bera-Jarque (BJ) test uses the property of a normally distributed random variable that the entire distribution is characterised by the first two moments - the mean and the variance. The standardised third and fourth moments of distribution are known as its skewness and Kurtosis (Brooks 2008). The Bera-Jarque test stati0stic is formulated under the null hypothesis that the distribution of the series is symmetric. The reported probability is the probability that a BJ statistic exceeds (in absolute value) the observed value under the null hypothesis - a small probability value leads to the rejection of the null hypothesis of a normal distribution. A significant BJ statistic thus points to non-normality in the residuals. The null hypothesis of normality would be rejected if the residuals are either significantly skewed or leptokurtic or both.

The Bera-Jarque test statistic is expressed by equation (3.26) below:

$$W = T\left[\frac{b_1^2}{6} + \frac{(b_2 - 3)^2}{2}\right] \tag{3.26}$$

Where T is the sample size. The statistic has a Chi-squares distribution with 2 degrees of freedom under the null hypothesis of normally distributed errors. Thus, reject the null hypothesis that residuals are normally distributed if the p-value is $\leq$ level of significance or if BJ $> \chi^2$.

3.6.7 Impulse response functions (IRFs)

Stock and Watson (2001) indicated that impulse response traces out the response of current and future values of each variable to one unit increase in the current value of one of the VAR errors. This holds, if error returns to zero in subsequent periods and that all other errors are equal to zero. Furthermore, impulse response shows the sign, magnitude, and persistence of real and nominal shocks to the dependent variables. Lutkepohl (2010) observed that the relations between the variables in the VAR model are difficult to see directly from the parameter matrices. Therefore, impulse response functions have been proposed as tools for interpreting VAR models.

Brooks (2008) explained that for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted. In the context of this study impulse response shows how fiscal deficit reacts to shocks in itself and any of the variables in the equation, which shock is relatively the most important and the average period it takes for fiscal deficit to restore its equilibrium following such a shock. Accordingly, a shock to a variable in a VAR not only directly affects that variable, but is also transmitted to all other endogenous variables in the system through the dynamic structure of the VAR. The impulse response analysis is based upon VECM and is consistent, provided that the system is stable, the shock should gradually die away (Brooks 2008).

The Cholesky orthogonalisation approach to impulse response analysis, which is a multivariate model extension of the Cholesky factorisation technique, is favoured in this study. This approach is favoured because, it incorporates small sample degrees of freedom adjustment when estimating the residual covariance matrix used to derive the Cholesky factor as highlighted by Lutkepohl (2010).

3.6.8 Variance decomposition

The final step was to carry out variance decomposition analysis, which is a confirmation of the impulse response functions. Variance decomposition reveals the proportion of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables (Brooks 2008). It is a way to quantify how important each shock is, in explaining the variation in each of the variables in

the system. It indicates which variables have short-term and long-term impacts on another variable of interest.

This technique determines how much of the forecast error variance for any variable in a system, is explained by innovations (impulses) in itself and each explanatory variable, over a series of time horizons. Brooks (2008) indicated that a shock to the I th variable will directly affect that variable, but it will be transferred to all of the variables in the system through the dynamic structure of the VAR. It is also important to consider the ordering of the variables when conducting the tests, because the error terms of the equations in the VAR will be correlated, so the result will be dependent on the order in which the equations are estimated in the model. The same factorisation technique and information used in estimating impulse responses are applied in the variance decompositions.

3.9 Chapter summary

This chapter detailed the methodology used to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate in South Africa. Macr0oeconomic time series data was employed in a VAR methodology. Types of time series data appropriate for this study was explained. The empirical model relating fiscal deficit, the explained variable to inflation, money supply and exchange rate as explanatory variables was specified based on theoretical and empirical foundations.

The basic empirical investigation of the study had two objectives. The first was to examine the long-run relationship between fiscal deficit, inflation, money supply and exchange rate, whereas the second was to assess the short-run dynamic causal relationship between the different variables under consideration. The testing procedure followed three basic steps. The first step was to test whether the variables contain a unit root, so as to confirm the stationarity of each variable. This was done in order to avoid problems of spurious regression. The unit root test was conducted using the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests for a robust stationarity check.

In the second step, the study tested for the existence of a long-run co-integrating relationship between the variables. This was done using the Johansen co-integrating technique and the Engle-Granger two-step procedure.

Finally, the last step, since all variables were found to be integrated of order one I(1) and co-integrated elasticities were computed using the Vector Error Correction Model (VECM). In chapter four of this study, this methodology is applied in a more thorough and specific analysis so as to obtain research findings and interpret the data.

CHAPTER FOUR

FINDINGS AND INTERPRETATION OF DATA

4.1 Introduction

Chapter Three provided the detailed methodology used to investigate the relationship between fiscal deficit, inflation, money supply and the exchange rate. Understanding the relationship between the variables of the study is important to ensure that policy makers formulate and implement policies in a coherent manner. Consequently, select appropriate deficit financing options to foster economic growth, job creation, poverty alleviation and the reduction of income inequality in South Africa. From the empirical model derived in Chapter Three, in equation (3.2) fiscal deficit (FD) is regarded as the dependent variable, whilst inflation (IF), money supply (MS) and real exchange rate (RER) have been identified as independent variables. This chapter, therefore, presents the empirical results, showing the significance of the explanatory variables in explaining variations in fiscal deficit in South Africa.

The data set used is quarterly South African data for the period from 1994 to 2015. The decision on whether fiscal deficit is related to inflation, money supply and excha0nge rate depends on the conclusions deduced from empirical estimations. Accordingly, the results from this study are used to address the objectives outlined in Chapter One. The results include those of unit root tests, co-integration, vector error correction model, Granger-causality, diagnostic tests, impulse response function and variance decomposition.

This chapter is divided into three broad sections. The sections 4.2 to 4.8 present the empirical findings and interpretation of data. Section 4.9 comprises the chapter summary.

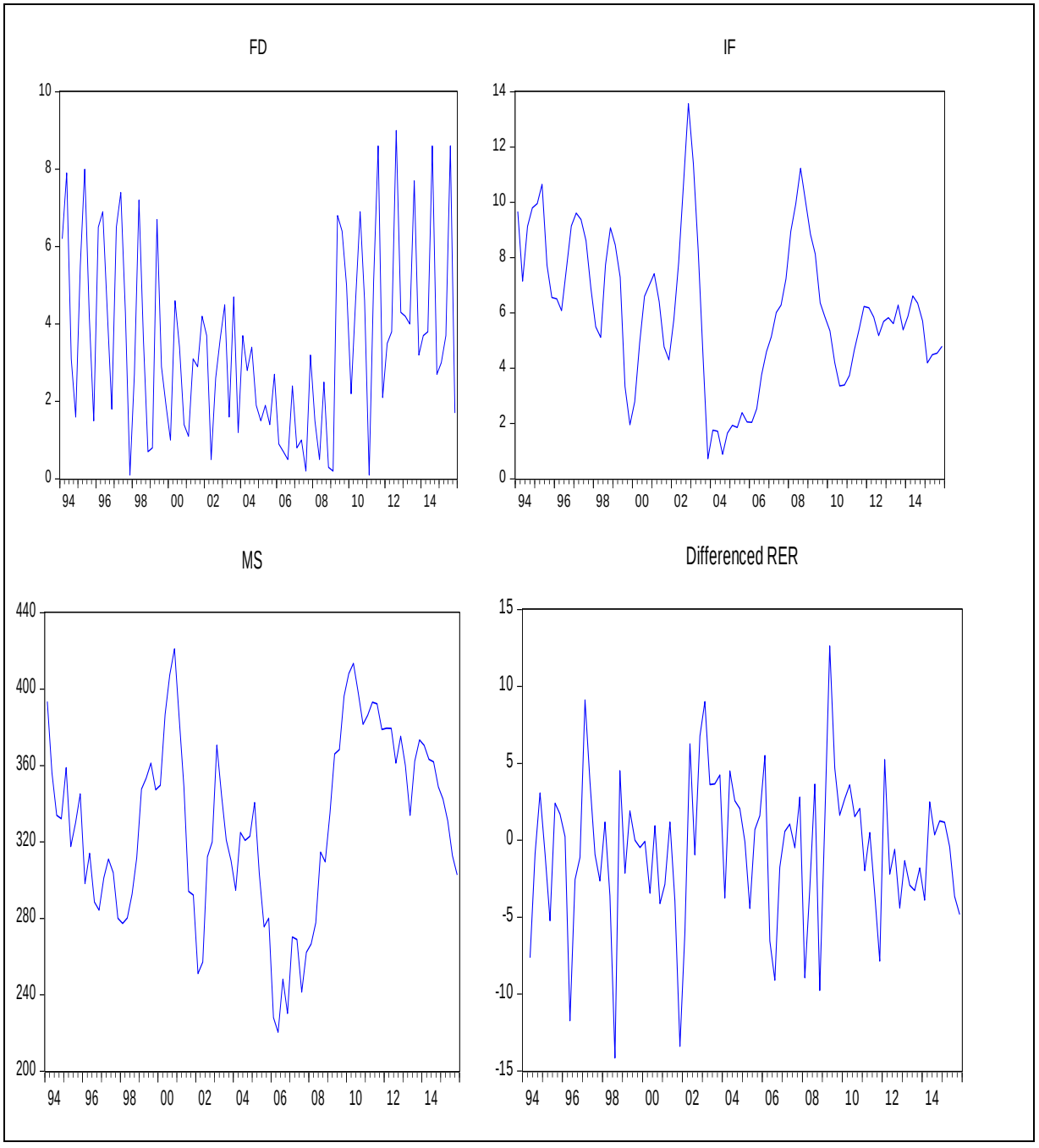
4.2 Empirical findings and interpretation of data

Section 4.2 is divided into eight sub-sections. It starts with a visual plot of the time series data by presenting the results of stationarity tests. The study subjected all four variables for unit root tests to examine the nature of variables as I (0) or I (1). It is important to test time series data for stationarity before determining any possible long-run relationships between the variables of interest. If one ignores, the stationarity test stage, and uses non-stationary data it can be misleading when by spurious regression with high R^2 value is obtained.

4.2.1 Informal Stationarity/unit root test results

The study employed one informal test for stationarity, by making use of graphical presentations of the series. Figure 4.1 depicts the graphs of all four variables of the study.

Figure 4.1: Unit root test- Graphical presentation at levels



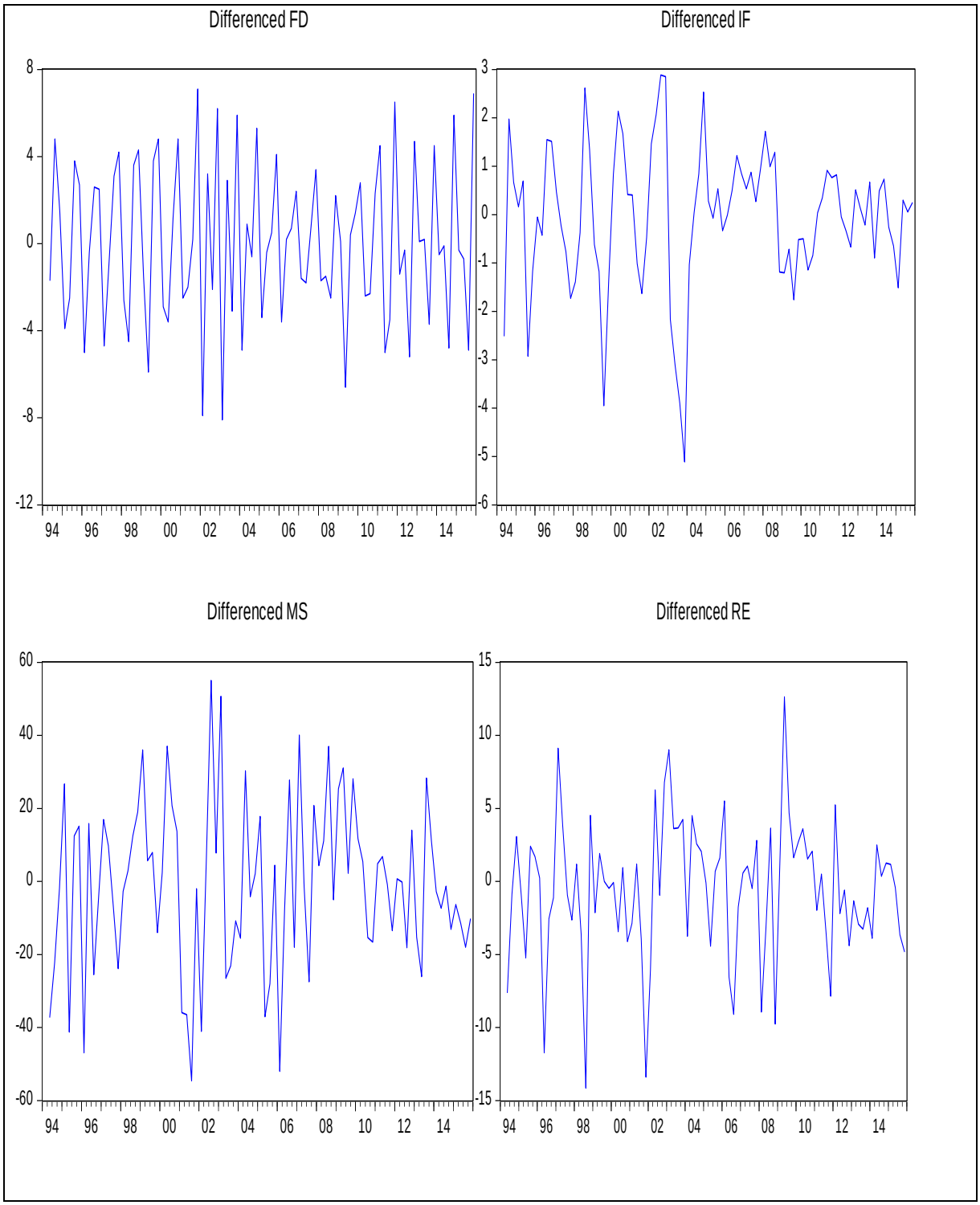
Source: Author's computation using Eviews 9.5 Econometric package

The key variable for the study is fiscal deficit (FD) and is regarded as the dependent variable. Based on Figure 4.1 the graph indicates the progression of the variable over the sample period. Fiscal deficit as a percentage of GDP is in the negative area meaning that for the most of the sample period government expenditure was more than the revenue collected. The sharpest increase in the fiscal deficit was recorded in 2000/2001.The graph reveals that FD is non-stationary, since it is showing significant fluctuations throughout the sample period. This suggests that FD is non-stationary. Fiscal deficit (FD) could be stationary or closer to the stationarity boundary since the variable appears to be moving around its mean and the variance is not constant over time. Judging from the graph, the analysis is inconclusive regarding the presence of unit root in FD.

On the other hand, variable IF does not show any trend but appears to be fairly stationary. The sharpest increase was witnessed in 2002 and 2008. However, the variance appears to be changing over time. As shown in Figure 4.1, MS displays fluctuations throughout the sample period. This graph also shows that from the beginning of the sample period money supply was decreasing up until 1998. The severe 0decline was recorded in 2006. The sharpest increase was witnessed in 2002 and 2010. MS could be stationary or closer to the stationarity boundary since the variable seems to be moving around its mean though the variance is not constant over time. Lastly, variable RER seems to be trending downwards with fluctuations. In the graph it seems that RER is non-stationary, this suggests that the mean value appears to change over time.

The analysis is inconclusive in relation to the existence of stationarity in the series. The study differenced the series once and the graphical analysis was repeated. After differencing once, all four variables became stationary at first difference (Figure 4.2). That is, they are integrated of order one.

Figure 4.2: Unit root test- Graphical presentation at first difference



Source: Author's computation using Eviews 9.5 Econometric package

Goksu and Ergun (2013) pointed out that looking at the time series plot alone is not enough to tell whether a series has unit root or not. This current study conducted formal stationarity tests to ascertain stationarity of the series.

4.2.2 Formal stationarity/unit root test results

The Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests were used to ascertain the stationarity of the series. The ADF and PP tests assumed that unit root is present in the series. As mentioned in Chapter Three that the PP test is advantageous in that it deals with serial correlation and heteroscedasticity in the residuals. The PP test supports the ADF test.

The three stationarity tests were applied to each variable of the study under no trend and intercept, trend deterministic assumption as specified in the Eviews package 9.5. The different trend deterministic assumptions are 'intercept', 'trend and intercept' and 'none'. The study conducted the two tests for both levels and first difference. The results of the two tests are depicted in Tables 4.1 and 4.2 respectively.

Table 4.1: Augmented Dickey Fuller (ADF) test results

Variable	Level	First Difference	Decision
Fiscal Deficit (DF)	-0.651831	-20.43951***	I(1)
Inflation (IF)	-1.249193	-4.163574***	I(1)
Money Supply (MS)	-0.641172	-5.947567***	I(1)
Real Exchange Rate (RER)	-1.399846	-7.893353***	I(1)

Source: Author's computation using Eviews 9.5 Econometric package

Notes:

*** (1per cent level of significance), ** (5per cent level of significance) and *(10per cent level of significance).
The ADF test is based on the null hypothesis of unit root.
The lag selection was determined by the Schwarz Information Criterion.
Critical values calculated by Dickey and Fuller are used.

Table 4.1 indicates that all the four variables are non-stationary at level and that they cannot be used in any econometrics modelling. Continuing using non-stationary series will result into spurious regression with misleading results. The objective therefore is to make the series stationary. The ADF test is based on the null hypothesis that the series under consideration has a unit root against the alternative that the series is stationary. The decision rule therefore, is to reject the null hypothesis if the ADF statistic value exceeds the critical value at a chosen level of significance (in absolute terms).

The results show that all variables are non-stationary in level form since their ADF statistic values are less than the critical values at 1 per cent, 5 per cent and 10 per cent level of significance. Hence, the null hypothesis of the existence of unit root was accepted for all four variables. The non-stationary variables all became stationary after the first difference, suggesting that they are integrated of order one.

Table 4.2: Phillips Perron (PP) test results

Variable	Level	First Difference	Decision
Fiscal Deficit (DF)	-5.266875	-22.41407***	I(1)
Inflation (IF)	-1.566779	-5.909560***	I(1)
Money Supply (MS)	-0.756587	-8.70315***	I(1)
Real Exchange Rate (RER)	-1.336576	-7.893353***	I(1)

Source: Author's computation using Eviews 9.5 Econometric package

Notes:

*** (1per cent level of significance), ** (5per cent level of significance) and *(10per cent level of significance)
The PP test is based on the null hypothesis of unit root.
The spectral estimation method is Bartlett Kernel.
MacKinnon (1996) one-sided p values are used.

Based on table 4.2, the PP test results reinforce the results of ADF. The PP test results support the existence of unit roots in the variables at level form. It is clear that the variables become stationary after first difference, indicating that they are co-integrated.

4.3 Co-integration test results

Having established that the variables are stationary, it is important to examine whether or not there is any long-run relationship between the variables. This means testing co-integration so as to ascertain that variables have converged upon some long-term values and are no longer changing. The study conducted two co-integration tests. The Engle-Granger two-step procedure was used to examine stationarity of the regression residuals. The first step required the estimation of the co-integrating regression, and secondly an ADF test based on the residuals.

4.3.1 Optimal Lag length selection criteria

It is worth emphasising that econometric modelling does not allow the regressing of a model based on variables that are non-stationary. Doing so would result into a spurious regression with misleading results. Furthermore, if the series under investigation has some variables that are non-stationary, but are able to form stationary residuals when they are regressed together, their regression will not be spurious. The desirable property is for the series to have a long-run equilibrium relationship and the variables to co-integrate.

In order to ascertain if the model forms a long-run equilibrium relationship the study employed the Johansen co-integration test. Before conducting the Johansen co-integration test, it was important to determine the optimal lag length of the model, as the test is sensitive to the number of lags used. The choice of the lag length for the study mainly depended on the information criteria provided by the Eviews 9.5 econometric package.

The information criteria in the study are Akaike Information Criteria (AIC), Schawarz Information Criteria (SIC), Hannan-Quinn Criteria(HIC), Find Prediction Error(FPE), and Likeli0000000000000000hood Ratio test (LR). Since the study series is quarterly, the selection is based on a maximum of 8 lags. Based on table 4.4, the entire five criteria indicate conflicting lag length choices.

Table 4.3: VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-1090.650	NA	9018132.	27.36625	27.48535	27.41400
1	-888.4730	379.0818	85902.70	22.71183	23.30733	22.95058
2	-852.7235	63.45540	52596.56	22.21809	23.29000*	22.64785
3	-843.0296	16.23739	62060.09	22.37574	23.92406	22.99650
4	-792.4736	79.62570	26546.04	21.51184	23.53656	22.32361*
5	-771.7034	30.63606*	24134.75*	21.39258*	23.89371	22.39536
6	-762.9721	12.00549	30010.50	21.57430	24.55184	22.76808
7	-750.9544	15.32253	34906.95	21.67386	25.12780	23.05864
8	-742.4361	10.00906	45177.50	21.86090	25.79125	23.43669

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5 per cent level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4.3 shows that for three criterion (LR, FPE and AIC), choose an optimal lag length of 5, whereas criterion (SC and HQ) selected an optimal lag length of 2 and 4 respectively. The study chose the lag length of 5, based on the results suggested by the Akaike Information Criteria (AIC). It appears as though this may be because, theoretically, there is a time lag of more than a quarter for the effects of fiscal policy to be transmitted in the economy.

4.3.2 Johansen co-integration technique

The study made a decision on the lag length choice guided by the Akaike Information Criteria (AIC), the next step was to examine whether the regression model formed a long-run relationship using the Johansen co-integration technique. As already mentioned in Chapter Three, the Johansen co-integration technique uses two tests, namely the Trace and the Maximum Eigenvalue tests.

(i) Trace test results

Table 4.4 below, indicates the results from the trace test for co-integration.

Table 4.4: Trace test: Lags interval (in first differences): 1 to 5

Unrestricted Co integration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.270870	52.23751	47.85613	0.0183
At most 1	0.192992	26.33348	29.79707	0.1190
At most 2	0.069302	8.750899	15.49471	0.3889
At most 3	0.034295	2.861585	3.841466	0.0907

Trace test indicates 1 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Based on the results from the trace test, the study rejects the null hypothesis that there is no co-integrating vector in the regression model. It It would appear that this is because, at this rank, the trace statistic value of approximately 52.24 is greater than the 5 per cent critical value of approximately 47.86. Furthermore, the null hypothesis that there is at most 1 co-integrating relationship is not rejected. This decision is based on the fact that at this rank, the trace statistic value of

approximately 26.33 is less than the 5 per cent critical value of 29.89. Thus, the trace test indicates one co-integration for the sample period of the study. Furthermore, the presence of co-integration indicates that the variables are linked together in the long-run and their deviation from the long run equilibrium path will be corrected.

(ii) Maximum Eigenvalue test results

Table 4.5 below shows the results from the maximum eigenvalue tests for co-integration.

Table 4.5: Maximum Eigenvalue test: Lags interval (in first differences): 1 to 5

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)		
Eigenvalue	**Max-Eigen Statistic**	**0.05 Critical Value**
0.270870	25.90403	27.58434
0.192992	17.58258	21.13162
0.069302	5.889314	14.26460
0.034295	2.861585	3.841466

Max-Eigenvalue test indicates no co-integration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Based on the results of the maximum Eigenvalue co-integration test, the study does not reject the null hypothesis that there is no co-integrating relation in the model. Table 4.5 indicates that at this rank the maximum Eigenvalue statistic is approximately 25.90; less than the 5 per cent critical value of about 27.58. From the two Johansen co-integration technique tests, the study obtained two conflicting results. The trace test indicated 1 co-integrating equation, whilst the maximum Eigenvalue test showed no co-integration at the 5 per cent level of significance.

Lutkepohl, Saikkonen and Trenler (2001) argued that either of the two tests can be used as a benchmark to determine the number of co-integrating vectors in the model. Furthermore, the trace test produces more robust findings than the Eigenvalue test. The study therefore, concluded that one is the number of co-integrating relations in the model. Consequently, the model produced an equilibrium relationship in the long-run.

Table 4.6: Co-integration results, the residual approach

Null Hypothesis: U has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, max-lag = 11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.673933	0.0000
Test critical values:	1 per cent level	-2.591813	
	5 per cent level	-1.944574	
	10 per cent level	-1.614315	

Source: Author's computation using E views 9.5 Econometric package

The Engle-Granger (1987) two-step procedure uses the residuals derived from the long-run equation estimated with the non-stationary variables, and then tests for the existence of unit root in the residuals using the ADF statistics. Table 4.6 indicates that the ADF statistics has a higher negative value (-8.673933) than the critical values. The test is based on the null hypothesis that there is a unit root in the co-integrating regression residuals against the alternative hypothesis that residuals are stationary.

The study strongly rejects the null hypothesis; the residuals are co-integrated. However, Engle and Granger (1987) tabulated a set of new critical values specifically for this test. Gujarati and Porter (2009) indicated that ADF critical values are not appropriate. The Engle-Granger asymptotic 5 per cent and 10 per cent critical values are about -3.34 and -3.04 respectively as indicated by Stewart (2005). The decision rule is to reject the null hypothesis if the ADF statistic value is greater than the critical values at a chosen level of significance. Based on the above table, ADF is greater than 3.34 (absolute terms) at 5 per cent level of significance, therefore, rejecting the null hypothesis of the existence of unit root in favour of the alternative hypothesis. It is therefore, evident that the residuals are stationary, validating that the regression variables have a long-run relationship.

4.4 The error correction model (ECM)

The determination of co-integration in the previous sections permits the use of the ECM. The error correction model can be defined as a dynamic model in which the movement of a variable in any period is related to the previous period gap from the long-run equilibrium. Therefore, the primary reason for estimating the ECM was to capture the dynamics in the regression model of this study. Additionally, the ECM assisted to identify the speed of adjustment as a response to the departures from the long-run equilibrium path. The outcomes from the co-integration tests and the number of lags werer used to specify the ECM.

Table 4.7: Error correction model results

Dependent Variable: D(FD)
Method: Least Squares
Sample (adjusted): 1994Q2 2015Q4
Included observations: 87 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029255	0.239368	-0.122218	0.9030
D(IF)	0.034409	0.169572	0.202916	0.8397
D(MS)	0.005192	0.010869	0.477657	0.6342
D(RER)	0.015587	0.054015	0.288569	0.7736
U(-1)	-0.920952	0.111576	-8.254056	0.0000

R-squared	0.471662	Mean dependent variable	-0.051724
Adjusted R-squared	0.445889	S.D. dependent variable	2.970861
S.E. of regression	2.211468	Akaike info criterion	4.480944
Sum squared residual	401.0285	Schwarz criterion	4.622663
Log likelihood	-189.9211	Hannan-Quinn criterion	4.538010
F-statistic	18.30090	Durbin-Watson statistic	1.941195
Probability (F-statistic)	0.000000		

Source: Author's computation using Eviews 9.5 Econometric package

It is worth noting that ECM is the last step of the Engle-Granger and Johansen tests for co-integration. The study used the residual from the co-integrating equation lagged by one period U_{t-1} as an error correction mechanism in the dynamic equation. Table 4.7 shows that the disequilibrium error term, U_{t-1} is statistically significant and negative as expected. The significance of the error term validates the existence of a long-run relationship between variables in the error correction model.

The speed of adjustment suggests that, about 92 per cent of the previous period's disequilibrium in fiscal deficit is corrected every quarter. However, the economics implication is that it will take more than one quarter for any disequilibrium in the economy caused by fiscal deficit to be corrected. The lag selection criteria Akaike Information Criterion (AIC) suggested a lag length of 5. The lag length of 5 validates the time lag of more than one quarter for the effects of fiscal policy to be transmitted in the economy. The study concludes that the dependent variable (FD) is jointly caused by all the independent variables in the long-run.

4.5 Granger causality test

The existence of co-integration between the series does not specify the direction of a causal relation if any between the variables. Asari, Baharuddin, Jusoh, Mohamad, Shamsudin and Jusoff (2011) indicated that economic theory guarantees that there is always Granger causality in at least one direction. Ahmad and Harnhirun (1996) pointed out that the standard Granger test for causality is not appropriate if time series variables included in the analysis exhibit co-integration properties. Asari *et al*. (2011) further suggested that to obtain proper statistical inferences, the causal relationship should be tested on the basis of an error correction model. Hence, the study employed the Granger-causality/Block Exogeneity Wald Tests to verify the direction of Granger-causality between FD, IF, MS and RER.

Table 4.8: Granger-Causality test results

VAR Granger-Causality/Block Exogeneity Wald Tests
Date: 09/26/17 Time: 12:51
Sample: 1994Q1 2015Q4
Included observations: 83

Dependent variable: FD			
Excluded	**Chi-sq.**	**df.**	**Probability**
IF	16.32969	5	0.0060
MS	9.141847	5	0.1035
RER	3.503759	5	0.6228
All	27.59624	15	0.0242

Dependent variable: IF			
Excluded	**Chi-sq.**	**df.**	**Probability**
FD	1.754851	5	0.8819
MS	7.641463	5	0.1771
RER	9.663468	5	0.0854
All	27.96549	15	0.0218

Dependent variable: MS			
Excluded	**Chi-sq.**	**df**	**Probability**
FD	3.584210	5	0.6107
IF	23.72414	5	0.0002
RER	9.703562	5	0.0841
All	33.29252	15	0.0043

Dependent variable: RER			
Excluded	**Chi-sq.**	**df**	**Probability**
FD	4.486709	5	0.4817
IF	1.864550	5	0.8676
MS	5.211054	5	0.3907
All	15.77258	15	0.3973

Estimation results in table 4.8 indicate that there is a strong Granger causal relationship between Inflation (IF) and Fiscal deficit (FD). The probability value is less than 5 per cent suggesting that inflation influenced fiscal deficit during the sample period of the study. Another strong causal relationship emerges between inflation and money supply. The study concluded that the dependent variable (FD) is not jointly caused by all the independent variables in the short-run.

4.6 Diagnostic tests

Diagnostic tests are analyses of residuals to assess model adequacy. These analyses validate the reliability and efficiency of the results obtained ECM model estimations. This study performed serial correlation tests, based on the Breusch-Godfrey serial correlation test, the normality test based on the Jarque-Bera test and heteroscedasticity based on the Breusch-Pagan-Godfrey test.

4.6.1 Test for autocorrelation

Correlation of a variable with itself over successive time periods is a problem faced in time series analyses. Serial correlation can lead to the underestimation of standard errors, thereby overestimating t-values. As indicated in Chapter Three in the presence of serial correlation, the coefficient estimates derived, using the OLS, are not BLUE. Moreover, the existence of serial correlation in the residuals is pointing to the fact that an important variable in the estimated model may have been omitted. Table 4.9 indicates the Breusch-Godfrey serial correlation test with the null hypothesis stating that there is no serial correlation in the model. The test shows a p-value greater than 5 per cent. Based on the results the decision rule is to accept the null hypothesis that there is no serial correlation in the residuals.

Table 4.9: Breusch-Godfrey Serial correlation LM test results

F-statistic	0.420177	Prob. F(2,77)	0.6584
Obs*R-squared	0.906853	Prob. Chi-Square(2)	0.6354

4.6.2 Heteroscedasticity test

Heteroscedasticity means that residuals do not have a constant variance. This results in a model having different probability distributions. The Breusch-Pagan-Godfrey test is used to test for heteroscedasticity. Based on the test results indicated in table 4.10, with an observed R-squared p-value of more than 5 per cent, the study accepted the null hypothesis that error terms are homoscedastic. In other words, the residuals of the estimated model are constant, and this is desirable in rendering BLUE OLS estimates.

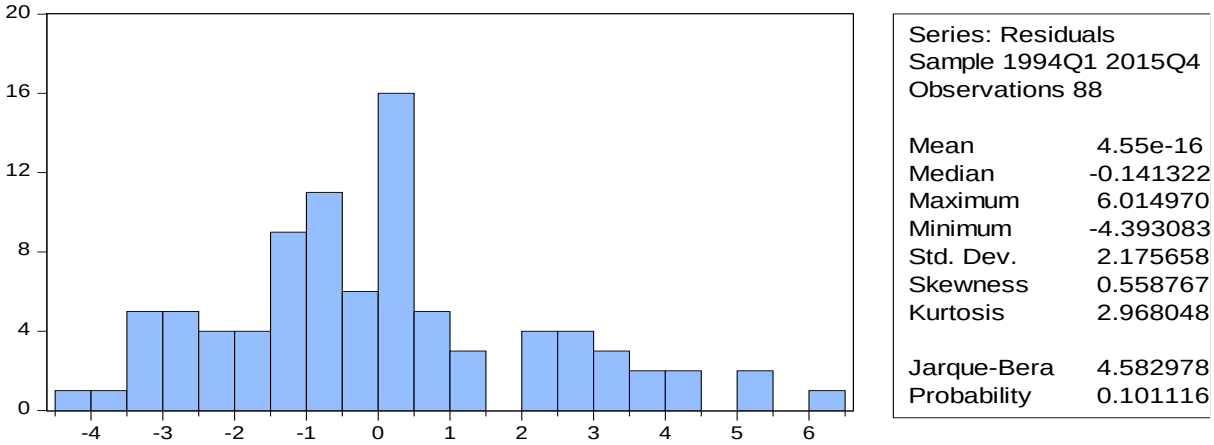
Table 4.10: Breausch-Pagan- Godfrey Heteroscedasticity test

F-statistic	0.430485	Prob. F(4,82)	0.7862
Obs*R-squared	1.789360	Prob. Chi-Square(4)	0.7744
Scaled explained SS	1.483920	Prob. Chi-Square(4)	0.8295

4.6.3 Residual normality test

The study conducted the normality test to ensure that the estimated residuals are normal. A model with residuals that are not normally distributed cannot produce efficient estimates. Figure 4.3 below shows the Jarque-Bera test for normality with a p-value greater than 5 per cent. Based on this test the null hypothesis which states that the model is normally distributed is not rejected. In other words, the residuals in the model are normally distributed, and this is desirable in making efficient and unbiased estimates.

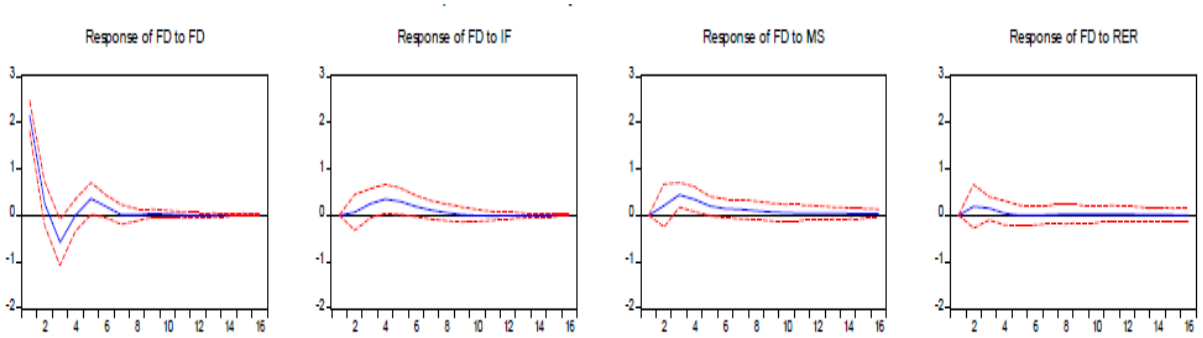
Figure 4.3: Normality test



4.7 Impulse response functions (IRFs)

The impulse response function traces the temporal and directional response of an endogenous variable to a change in one of the structural innovations. These impulse response functions show the dynamic response of the entire VAR system to a one-period standard deviation shock and also indicate the directions and persistence of the response to each of the shocks over 16 quarters (4years) into the future.

Figure 4.4: Impulse response of fiscal deficit



The variables have a different impact on fiscal deficit. Based on the above results, the response of fiscal deficit to a one unit positive standard deviation shock to itself invokes a sharp decline in the first three quarters and increases slightly in the fifth quarter and thereafter it diminishes.

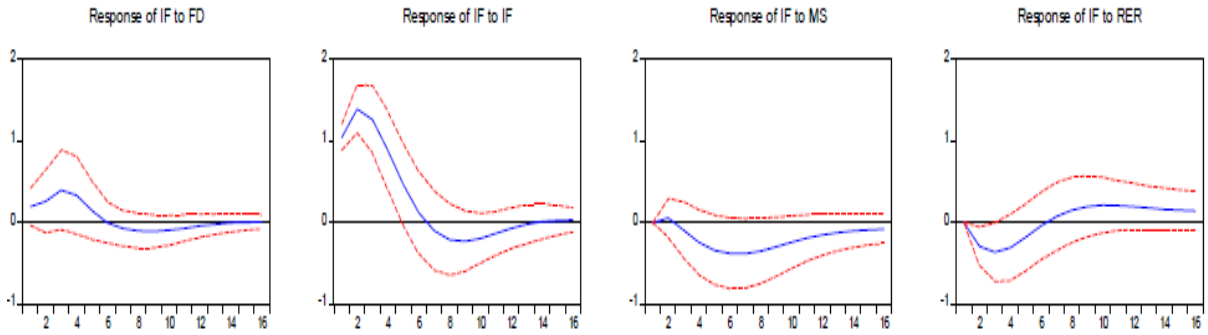
The above figure also reveals that a response of inflation to a one unit positive standard deviation shock in fiscal deficit is positive up to at least eight quarters. These results provide an answer to the first research question which once again states as follows: Does inflation have any effect on fiscal deficit in South Africa? Furthermore, the null hypothesis states that inflation does not have any significant relationship on fiscal deficit. Based on these results, the null hypothesis is rejected in favour of the alternative hypothesis that inflation has a significant relationship on fiscal deficit.

The Granger causality test also indicated that inflation is significant in explaining fiscal deficit. This conclusion concurs with the monetarist view on the relationship between budget deficit and inflation in Chapter Two. Additionally, these findings are similar to the findings of Bakare, Adesanya and Bolarinwa (2014) who applied the ECM and co-integration test for Nigeria; they found that inflation indicated a high dependence on performance of growth of money supply and the budget deficit.

An unexpected shock to real exchange rate and money produces a response which is not different from zero over the entire period. The results support the study findings that the Granger causality test indicated that the two variables are not significant in explaining fiscal deficit. Furthermore, the results do not agree with economic thought that an increase in budget deficit results into domestic exchange rate appreciation, worsening the current account balance. However, the study

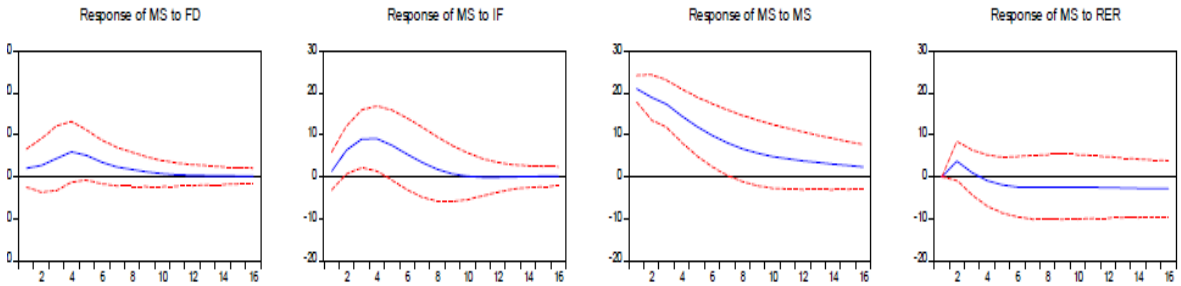
findings by Ogbonna (2014) and Ahmad and Aworinde (2015) revealed that there is no strong relationship between budget deficit and current account deficit for South Africa. The null hypothesis of this study is therefore accepted, which states that exchange rate does not have any significant relationship on fiscal deficit in South Africa for the study period.

Figure 4.5: Impulse response of inflation



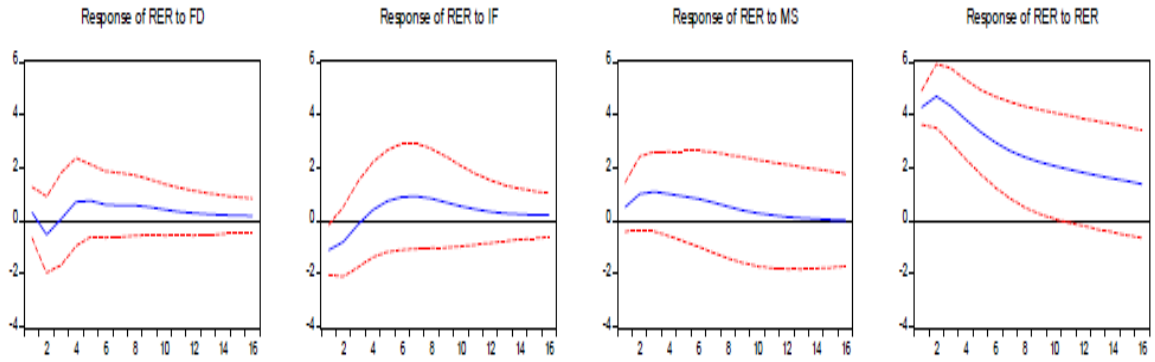
From Figure 4.5 it is clear that the response of inflation due to impulse in explanatory variables varies and is insignificant. The impulse response of IF to own shocks reveal a peak in the second quarter and thereafter, a sharp decline. The results concur with earlier results of the Granger causality test reported in the study.

Figure 4.6: Impulse response of money supply



The impulse response function in Figure 4.6 shows that the response of money supply to a one unit positive standard deviation shock in fiscal deficit is insignificant. This by implication suggests that the fiscal theory of the price level is applicable in South Africa for the period of study, whilst the impulse response of money supply to inflation is significant.

Figure 4.7: Impulse response of real exchange rate



The results in Figure 4.7 show that most shocks from explanatory variables are very weak and diminish till zero. From the figure it is clear that the response of real exchange rate due to impulse in explanatory variables is negligible. Though response of real exchange rate to fiscal deficit shows a slight increase in the sixth quarter, thereafter it disappears.

4.8 Variance decomposition Analysis

The empirical results of the variance decomposition of the four variables in the VAR model are for a 16 quarter into the future as with the impulse response function. The study take the short-run to represent a year(four quarters) from the time the innovation occurred and the long-run as period of three years (12 quarters) the time the innovation is transmitted in the economy.

Variance decomposition analysis provides for a means of determining the relative importance of innovation in explaining fluctuations in the variable of interest. In other words, it indicates the proportion of the movements in a sequence due to its ‘own’ impulse versus impulse to the other variables. It shows the fraction of the forecast error variance for each variable that is attributable to its innovations and to innovations in other variables in the system. The analysis reports the short-run and long-run relationships between the four variables of the study.

Table 4.11 below shows that the variance decomposition of FD, own innovation constitute 88.97 per cent in the short-run, with other variables contributing 6.33 per cent, 3.16 per cent and 1.52 per cent respectively**.** However, in the long-run own shock gradually decreases to 71.04per cent while IF and RER increased significantly and MS the increase is negligible. These results correspond with the results reported

using Granger causality test. It is therefore, correct to conclude that inflation in South Africa accelerate fiscal deficit.

Table 4.11: Variance decomposition of FD

Period	S.E.	FD	IF	MS	RER
1	1.472414	100.0000	0.000000	0.000000	0.000000
2	1.505723	95.69767	0.119630	2.742334	1.440362
3	1.529985	95.00364	0.898422	2.656635	1.441306
4	1.586497	88.97967	6.338347	3.163853	1.518130
5	1.873250	86.14777	6.365440	2.563811	4.922980
6	1.894367	84.25112	7.091912	3.750385	4.906581
7	1.923557	83.12288	7.938472	4.066704	4.871944
8	1.994919	79.16580	11.27935	4.052741	5.502114
9	2.138270	76.63454	11.87102	3.636791	7.857648
10	2.159403	75.14460	12.71620	4.344985	7.794213
11	2.180653	75.02768	12.78372	4.310950	7.877646
12	2.225155	73.65239	14.09818	4.237249	8.012181
13	2.293078	72.35456	14.60142	4.063301	8.980721
14	2.305049	71.60737	15.17122	4.311439	8.909962
15	2.317050	71.50451	15.29904	4.356477	8.839978
16	2.344756	71.04181	15.90217	4.323637	8.732385

Table 4.12: Variance decomposition of IF

Period	S.E.	FD	IF	MS	RER
1	0.913694	0.230979	99.76902	0.000000	0.000000
2	1.542607	0.084042	97.90346	3.23E-05	2.012469
3	1.924054	0.054124	94.58814	1.863737	3.494001
4	2.232328	0.048727	86.89635	5.136758	7.918168
5	2.424160	0.280572	76.22902	9.304814	14.18559
6	2.560166	0.695425	68.37989	14.64820	16.27649

7	2.628644	0.889576	64.86362	17.90058	16.34623
8	2.653692	0.909838	63.70183	19.32234	16.06599
9	2.686560	0.899111	63.14455	19.20942	16.74692
10	2.732902	0.896520	62.82605	18.59637	17.68106
11	2.763827	0.888419	62.42741	18.38745	18.29672
12	2.773332	0.885332	62.07575	18.53936	18.49955
13	2.784437	0.882162	62.03646	18.64235	18.43903
14	2.810121	0.903617	62.45245	18.41323	18.23070
15	2.836714	0.901705	62.69319	18.17520	18.22990

The results shown in Table 4.12, serve to clarify which variables have the greatest influence on the fluctuations of inflation both in the short- and long-run. This assessment seeks to validate the monetarists view on the relationship between budget deficit and inflation. Table 4.12 indicates that the variance decomposition of IF contributes 86.90 per cent to itself in the short-run, whilst other variables contribute 0.05 per cent, 5.13 per cent and 7.92 per cent respectively.

On the other hand, in the long-run inflation explains about 62.13 per cent of its fluctuations. The influence of FD increases significantly to about 89 per cent, while MS and RER increase to about 18 per cent.

Table 4.13: Variance decomposition of MS

Period	S.E.	FD	IF	MS	RER
1	18.22381	1.590072	0.555042	97.85489	0.000000
2	25.77059	0.807783	5.407367	90.79378	2.991069
3	32.35588	0.544465	10.03738	87.44273	1.975417
4	38.87775	0.378803	8.581140	89.32001	1.720046
5	41.60142	0.746513	8.484078	87.88077	2.888637
6	44.16421	0.980287	7.637915	84.80993	6.571864
7	45.67378	1.186338	7.152960	83.22595	8.434748
8	46.56738	1.512029	7.631977	80.75232	10.10367
9	47.63897	1.522382	9.159372	77.89596	11.42228
10	48.84359	1.494467	12.42854	74.25027	11.82672
11	50.45888	1.461721	16.30636	69.57909	12.65282
12	51.74863	1.437452	18.44945	66.16466	13.94844
13	52.74992	1.495095	19.34195	63.92551	15.23744
14	53.50716	1.589082	19.36497	62.45764	16.58831

15	53.85722	1.673390	19.25441	61.82453	17.24766
16	54.02717	1.755247	19.29267	61.55791	17.39417

As shown in table 4.13, MS explains about 89 per cent of fluctuations taking place in itself in the short-run, whereas, other variables contribute about 37 per cent, 8.6 per cent and 1.7 per cent respectively. Table 4.13 also shows that MS explains over 61 per cent of its own variation in the long-run. Real exchange rate and Inflation increases significantly to about 17 per cent and 19 per cent respectively.

Table 4.14: Variance decomposition of RER

Period	S.E.	FD	IF	MS	RER
1	4.632603	6.904088	11.33549	0.110827	81.64959
2	6.646677	4.712034	8.940219	0.163148	86.18460
3	7.796103	4.713590	8.175304	0.937219	86.17389
4	8.875490	6.526251	6.548684	2.991531	83.93353
5	9.607980	6.957238	5.752925	3.923198	83.36664
6	10.00780	6.806153	5.678905	4.058499	83.45644
7	10.21994	6.980678	5.646101	3.956812	83.41641
8	10.35157	7.484093	5.637086	4.011433	82.86739
9	10.47911	7.837564	5.552420	4.575336	82.03468
10	10.61467	7.840660	5.456412	5.702040	81.00089
11	10.79279	7.791132	5.711444	7.572297	78.92513
12	11.00604	7.996678	6.284236	9.524461	76.19463
13	11.20995	8.076414	6.778350	11.48596	73.65928
14	11.38210	7.918733	6.956308	13.55013	71.57483
15	11.52008	7.790077	6.930851	15.32582	69.95325
16	11.63254	7.778864	6.824957	16.67355	68.72263

In the short-run, as indicated in Table 4.14, real exchange rate itself explains over 83 per cent of its own fluctuations, whilst FD explains over 6 per cent, IF explains 6.55 per cent and MS explains 2.99 per cent.

However, in the long run real exchange rate explains about 68.72 per cent of its own fluctuations, whilst FD explains about 8 per cent; a slight increase compared to the short-run. Inflation explains about 7 per cent and money supply increases significantly.

This section shows that own shocks represent the dominant source of fluctuation in the forecast errors of the variables. Furthermore, this section helps to ascertain that the four variables have a long run relationship conforming to the reported ECM results.

4.9 Chapter summary

Chapter Four presented the findings from the quarterly data covering the period 1994Q1 to 2015Q4. The study results reveal a relationship between fiscal deficit, inflation, money supply and real exchange rate in the South African economy. The empirical analysis of the study followed three basic steps as indicated in Chapter Three. The first was to analyse the time series properties of the data to determine stationarity of the series. This was done by using informal tests in the form of graphical inspection, followed by formal tests.

The ADF and PP unit root tests were used as formal tests for stationarity to avoid problems of spurious regression. The stationarity test results indicated that the variables become stationary after first differencing, suggesting that they are integrated of order one.

The second step involved conducting co-integration tests; the study carried out Johansen's co-integrating technique and the Engle-Granger two-step procedure. Johansen's co-integrating technique is sensitive to the number of lags used; the study determined the optimal lag length of the model. Since the study used quarterly series the selection was based on a maximum of 8 lags. The choice of the lag length for the study mainly depended on the information criteria provided by Eviews 9.5 econometric package. Hence, the lag length of 5 based on the results suggested by the Akaike Information Criteria (AIC) was selected.

The results of the co-integration test, based on the two Johansen co-integration technique tests, obtained two conflicting results. The trace test indicates one co-integrating equation at 5 per cent level of significance whilst the maximum Eigenvalue test shows no co-integration at the 5 per cent level of significance. Lutkepohl *et al.* (2001) argued that the trace test produces more robust findings than the Eigenvalue test. The study therefore, concludes that one is the number of co-

integrating relations in the model. Additionally, results of co-integration based on the Engle-Granger two-step procedure show that the residuals are stationary, validating the existence of long-run relationships between the variables of the model.

Evidence of co-integration allowed for the estimation of the ECM model as the third step. ECM assists to identify the speed of adjustment as a response to the departures from the long-run equilibrium path. The results show that the ECM error term has the required sign and is statistically significant at the 5 per cent level of significance. The error term indicates a quick convergence to equilibrium. Furthermore, the results reveal that fiscal deficit, inflation, money supply and real exchange rate interact to re-establish the long-run equilibrium in South Africa. The study concludes that the dependent variable (FD) is jointly caused by all the independent variables in the long-run.

The existence of co-integration between the series does not specify the direction of causal relations between variables. Consequently, the study carried out a Granger causality test. The results indicate that there is a strong Granger causal relationship between (IF) and (FD). Another strong causal relationship emerges between inflation and money supply.

Further analysis was based on diagnostic tests of residuals to assess model adequacy. The results reveal that there is no autocorrelation, residuals are homoscedastic and the estimated residuals are normally distributed. The study's diagnostic test reports validate the reliability and efficiency of the results obtained from the ECM estimation.

Lastly, both the impulse response and variance decomposition produced results that are compatible with economic theory and empirical literature. The results provide more evidence on the behaviour of fiscal deficit over time. The existing evidence suggests that innovations in inflation, money supply and real exchange invoke responses in fiscal deficit that disappear over time. The next chapter, Chapter Five, will present the conclusion and recommendations.

CHAPTER FIVE
RECOMMENDATION AND CONCLUSIONS

5.1 Introduction

This study investigated the relationship between fiscal deficit, inflation, money supply and exchange rate in South Africa. The previous chapter offered the research findings based on South Africa's fiscal deficit, inflation, money supply and exchange rate. In order to realise the main objective of the study, quarterly data was used covering the period from 1994Q1 to 2015Q4. The study preferred quarterly data since it captures the rich dynamic pattern of the decision making process better.

Moreover, as indicated in Chapter Three, fiscal decisions are taken throughout the year. The study therefore, regarded fiscal deficit as the dependent variable. Fiscal deficit threatens fiscal stability; hence one of the main targets of the GEAR, alluded to in Chapter One, was to reduce the fiscal deficit to 3 per cent of GDP.

Chapter Five presents the summary of the research chapters, achievement of research objectives, research findings and recommendations. The study utilised data obtained from Quantec and the South African Reserve Bank data bases for fiscal deficit, inflation, money supply and exchange rate. Investigation of the relationship between fiscal deficit, inflation, money supply and exchange rate was based on co-integration, ECM, Granger causality, impulse response function and variance decomposition.

5.2 Summary of the research chapters

The study focused on fiscal deficit, this may be due to the fiscal stance adopted by the South African government. Since 1994 the aim of government has been to achieve fiscal policy sustainability. A study by Makanza and Dunne (2015) revealed that South Africa's fiscal position was weaker with high readings of government debt averaging about 42 per cent of GDP in 2012.

Chapter One presented the background to the study and described the relationship between government revenue and government spending. It was crucial to understand the context within which the study is conducted, hence a brief overview of the fiscal policy sustainability position of South Africa was provided. The government of South Africa adopted fiscal and monetary policies aimed at maintaining economic stability; hence the adoption of a fiscal target and fiscal consolidation. This chapter outlined the study objectives as well as hypotheses so as to assist to achieve the aim of investigating the relationship between fiscal deficit, inflation, money supply and the exchange rate.

In order to answer the research aim, a literature review was presented in Chapter Two. In this chapter, the theoretical framework was outlined as a basis for recommendations and constructing a data collection technique. Additionally, the theoretical framework assisted in the selection of independent variables as well as indicating the way in which the independent variables influence change in the dependent variable. What was clear in this chapter is that there is no concord among the different theories regarding the relationship between fiscal deficit, inflation, money supply and exchange rate.

The monetarist approach argued that there is a positive relationship between fiscal deficit and the general price level. The FTPL on the other hand is of the view that there is no direct reference between price level and budget deficit. The neoclassical theory advocated for the existence of twin deficit hypothesis, whilst the Keynesians argued for the expansionary effect of fiscal deficit. The theoretical framework differences are not evident in the empirical literature about the relationship between fiscal deficit, inflation, money supply and exchange rate. This study found that the empirical literature findings support the neoclassical view of the relationship between fiscal deficit, inflation, money supply and exchange rate.

The literature reviewed in Chapter Two clarified the relationship between fiscal deficit, inflation, money supply and exchange rate. Chapter Three, the methodology detailed an empirical framework followed in the study. Theoretical and empirical literature reviews formed the basis for the specification of the model in this chapter. Fiscal deficit was regarded as the dependent variable; inflation, money supply and exchange rate were regarded as independent variables. The methodology chapter also provided a detailed explanation for the selection of the VAR technique. In order to avoid spurious regression ADF and PP unit root test procedures were explained. Johansen's co-integration technique and Engle-Granger two-step procedure were discussed as tools to validate the reliability of the series.

In Chapter Four, findings and interpretation of data, the study applied econometric tools to ensure that the time series were conforming for use in VAR methodology. The study was obliged to ensure that the study series were stationary, and the selection of optimal lag length using information criteria. The estimated regression model passed the three residual diagnostic tests, making the model reliable and efficient. The study confirmed the Granger causality test results by conducting impulse response and variance decomposition analyses. The results showed that there is no significant relationship between fiscal deficit and exchange rate. In light of these revelations, the study concludes that there is no evidence of the existence of twin deficit in South Africa.

5.3 Achievement of research objectives

The South African economy is under economic pressure as indicated by the rate of unemployment, poverty and inequality. The fiscal position of South Africa is weak as shown in Table 2.2, by public debt being 45.4 percentage of GDP in 2015. This implies a high burden of debt servicing obligations with adverse effects on economic growth. The fiscal deficit as a percentage of GDP, reflected in Table 2.2 points to the fact that government is experiencing a revenue collection shortfall. It seems as though, this may be because of the narrow tax base relative to a growing economically active but unemployed population. It is against this background that the study aimed to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate.

In an attempt to answer the research questions outlined in Chapter One, the study was design to achieve the following objectives:

(i) *To examine the effect of fiscal deficit on inflation in South Africa*

The results show little evidence that fiscal deficit is a contributing factor to inflation in South Africa throughout the period studied. The Granger causality test and impulse response function results show an insignificant effect of fiscal deficit on inflation. On the other hand, it show unidirectional causality between fiscal deficit and inflation. The results indicate that the causality runs from inflation to fiscal deficit. This implies that inflation causes fiscal deficit in South Africa. Whilst, variance decomposition results indicate that the variance decomposition of FD contributes around 5 per cent in the fluctuations of inflation in the short-run and in the long-run the influence of FD rise significantly to 89 per cent. These results support the hypothesis that fiscal deficit is a contributing factor to inflation.

(ii) *To analyse the relationship between fiscal deficit and money supply M3 in South Africa*

The Granger causality test, impulse response function and variance decomposition results show no evidence that fiscal deficit is related to money supply. The results do not support the hypothesis that fiscal deficit influences money supply. It seems as though this is because the government of South Africa set fiscal deficit targets and money supply independent of one another.

(iii) *To evaluate the effect of fiscal deficit on exchange rate in South Africa*

Based on Granger causality and impulse response analyses, the results indicate that there is no significant evidence that fiscal deficit is related to exchange rate in South Africa. Whereas, variance decomposition results indicate that FD explains 6 per cent of exchange rate fluctuations in the short-run, and about 8 per cent in the long-run. The results do not provide strong support for the existence of twin deficit hypothesis in South Africa for the sampled period. Additionally, the findings support the Ricardian Equivalence theorem, stating that the fiscal deficit and the current account balance are independent.

(iv) *To determine the long-run relationship between fiscal deficit, inflation, money supplyM3 and exchange rate*

The evidence of existing co-integration between fiscal deficit, inflation, money supply and the exchange rate validates the presence of a long-run relation. Based on the results of Johansen's co-integration technique, the Trace and Eigenvalue tests show conflicting results, the Trace test indicates one co-integrating equation, whereas the Maximum Eigenvalue test result indicates no co-integration. Meanwhile, results of the Engle-Granger two-step procedure based on residuals, reveal that residuals are stationary, confirming the existence of a long-run relationship between the variables of the study. These results strongly support the monetarist approach as well as the fiscal theory of the price level. Furthermore, the error correction term is statistically significant, with a negative sign as required, this concurs with the validity of a long-run relationship between the variables of the estimated model.

5.4 Research findings and recommendations

The research results discussed in the preceding sections indicate an existence of a long-run relationship between fiscal deficit, inflation, money supply and exchange rate. Furthermore, the existence of co-integration suggests the effectiveness of targeting one of the variables in influencing the long-run reaction of the other variables. Moreover, the estimated model passed the important diagnostic tests indicating that the results of this study are reliable for policy making. Hence, the findings of this study have policy implications for the South African government.

Table 2.2 shows the budget deficit as a percentage of GDP, it is evident that throughout the study period the South African government has been experiencing fiscal deficit. The study regarded fiscal deficit as the dependent variable, it seems as though this may be because fiscal deficit affects macroeconomic variables such as inflation, money supply and exchange rate. These variables serve as transmission mechanisms through which fiscal deficit affects economic growth. This suggests that fiscal deficit must be managed in a manner that will ensure long-term fiscal sustainability and yield sustained economic growth.

The persistence of fiscal deficit indicates a revenue collection shortfall. On the other hand, it could be argued that for a country like South Africa, reducing public

expenditure is not a viable option, considering the backlogs in social service provisions, poverty, inequality and unemployment. The South African government set a fiscal deficit target of 3 per cent of GDP in 2000, as a desired threshold. This suggests that a country is sustainable from a solvency point of view. This concern ignores the liquidity point of view that may pose a risk to long term fiscal sustainability.

The study findings suggest a combination of a speedy fiscal adjustment and economic growth in order to raise government revenue. The reaction speed of the South African government can lead to creating an enabling environment to attract investment so as to grow the economy. This in turn will improve collection of revenues as a primary source of government income and reduce the potential of fiscal deficit.

The study results pose a challenging responsibility for policy makers in ensuring that any policy aimed at reducing fiscal deficit should take into consideration the reaction of other macroeconomic variables such as inflation, money supply and exchange rate. This requires comprehensive and coordinated macroeconomic policies aimed at promoting sustainable economic growth.

Fiscal deficit reduction requires a combination of efforts aimed at strengthening economic growth and long-term fiscal sustainability. The results suggest that expenditure priorities have to be carefully considered, fiscal authorities should priorities those expenditures that result in capacity building and employment. In the context of a narrow tax base, policies aimed at identifying and addressing other possible leakages that worsen the tax base should be adopted.

The results are also critical from a policy point of view in the selection of appropriate fiscal deficit financing options that will strengthen economic growth.

5.5 Summary

In this study fiscal deficit is the explained variable; this may be due to the fact that it is an indicator of government’s borrowing requirements, leading to accumulation of public debt. The study defined fiscal deficit as the difference between total

government revenue to total government expenditure. The aim of this study was to investigate the relationship between fiscal deficit, inflation, money supply and exchange rate in South Africa.

The study employed the Johansen co-integration technique, which is based on Trace tests and maximum Eigenvalues to determine the existence of a long-run relationship among fiscal deficit, inflation, money supply and inflation. The test showed the presence of co-integration. The Engle-Granger two-step procedure was applied to verify the results of the Johansen co-integration technique. The Engle-Granger is a residual base test, its objective is determine stationarity of the residuals. The results revealed that the residuals are stationary, implying that there is co-integration between the four variables of the study. Thus the two co-integration techniques are consistent; they lead to the same results. The study therefore, concludes that fiscal deficit, inflation, money supply and exchange rate are related in the long-run in South Africa.

The presence of a long-run relationship between the four variables is consistent with the monetarist approach on the relationship between fiscal deficit, inflation, money supply and exchange rate as illustrated in Figure 2.1 and by the Neo-classical theory.

The results of the study are critical from a policy point of view, since they suggest the effectiveness of targeting one of the variables in influencing the long-run behaviour of the other variables. This requires the fiscal adjustment speed of the South African government to reduce fiscal deficit. If the revenue collection shortfall can be dealt with, the South African government may be able to maintain fiscal sustainability that is resilient to shocks.

However, the study is limited to South Africa in respect of its economic structure, policies and stage of development. Therefore, the results obtained, though significant, may not be applicable to other economies,. There would be a need to conduct a cross country study for the relationship between fiscal deficit, inflation and money supply for developing countries to provide cross-country evidence. The study has not included other variables such as interest rate, investment and consumption.

Further research could consider including these variables to provide a comprehensive analysis and alternative policy priorities. Further research could also analyse individual aspects of public debt.

REFERENCES

Abu, A. & Karim. M.Z.A. 2015. The Non-linear relationship between fiscal deficits and inflation: Evidence from Africa. *South East European Journal of Economics and Business,* 10(2):102-112.

Afonso, A. 2002. Disturbing the fiscal theory of the price level: Can it fit the EU-15? *ISEG-UTL, Economic Department working paper.*

Ahking, F.W. 2002. Model misspecification and Johansen's co-integration analysis: An application to the US money demand. *Journal of macroeconomics*, 24:51-66.

Ahmad, A.H. & Aworinde, O.B. 2015. Structural breaks and the twin deficits hypothesis in African countries. *Econ Change Restruct*, 48:1-35

Aktham. M. 2004. Oil price shocks and emerging stock markets: A generalized VAR approach. *Interapplied Economtrics and Quantitative Studies*, 27(1):14.

Alam, N. & Taib, F.M. 2013. An investigation of the relationship of external public debt with budget deficit, current account deficit and exchange rate depreciation in debt trap and non-debt trap countries. *European Scientific Journal*, 9(22):144-158.

Aliyu, A.A., Bello, M.U., Kasim, R. & Martin, D. 2014. Positivist and Non-positivist paradigm in Social Science research: Conflicting paradigms or perfect partners? *Journal of Management and sustainability*, 4(3):79-95.

Al-Khulaifi, A.S. 2012. The relationship between government revenue and expenditure in Qatar: A co-integration and causality investigation. *International Journal of Economics and Finance*, 4(9):142-148.

Ashra, S., Chattopadhyay, S. & Chaudhuri, K. 2004. Deficit, Money and Price: the Indian experience. *Journal of Policy Modeling*, 26:289-299.

Austeriuos, D. & Hall, S.G. 2016. *Applied econometrics*. Third Edition. Palgrave. MacMillan Education.

Awe, A.A. & Shina. O.S. 2012. The nexus between budget deficit and inflation in the Nigerian economy. *Research Journal of Finance and Accounting*, 3(10):78-92.

Bahmani-Oskooee, B. & Brooks, T.J. 2003. A new criteria for selecting the optimum lags in Johansen co-integration technique. *Applied Economics*, 35:875-880.

Bakare, I.A.O., Adesanya, O.A. & Bolarinwa, S.A. 2014. Empirical investigation between budget deficit, inflation and money supply in Nigeria. *European Journal of Business and Social Sciences*, 2(12)120-134.

Bassetto, M. 2000. *Fiscal theory of the price level*. Federal Reserve of Chicago, University of Minnesota.

Bernheim, B.D. 1989. A neoclassical perspective on budget deficit. *Journal of Economics Perspective*, 3(2):55-72.

Bertram, C. & Christiansen, I. 2014. *Understanding research: An introduction to reading research*. Cape Town, SA: Van Schaik.

Black, P., Calitz, E. & Steenekamp, T. 2013. *Public Economics*. Fifth Edition. Cape Town, SA: Oxford University Press.

Brima, S. & Mansaray-Pearce, E.A. 2015. Budget deficit and Macroeconomic variables in Sierra Leone: An econometric Approach. *Journal of Economics and Sustainable Development,* 6(4):38-51.

Brooks, C. 2008. *Introductory econometrics for finance*. Second Edition. Cambridge University Press.

Brown, W.S. 1991. *Introducing Econometrics*. San Francisco: West Publishing Company.

Burger, P., Siebrits, K. & Calitz, E. 2016. Fiscal consolidation and the public sector balance sheet in South Africa. *South African Journal of Economics*, 84(4):501-519.

Calitz, E., Du Plessis, S. & Siebrits, S. 2013. Fiscal sustainability in South Africa: Will history repeat itself? Stellenbosch Economic Working Papers 07/13, *Bureau for Economic Research, University of Stellenbosch,* pp.1-34.

Carrasco, M. 1998. Crowding out and government spending. *University Avenue Undergraduate Journal of Economics*, 2(1):1-10.

Chand, S. & Kamal, S. 2014. Mixed Portmanteau test for diagnostic checking of time series models. *Journal of Applied Mathematics*, pp.1-9.

Chaudhary, M.A. & Ahmad, N. 1995. Money supply, deficit and inflation in Pakistan, *The Pakistan Development Review.*

Checherita, C. & Rother, P. 2010. The impact of high and growing government debt on economic growth: An empirical investigation for the Euro area. European Central Bank, *Working Paper series*, No. 1237.

Creswell, J.W. 2014. *Research design, Qualitative, Quantitative and mixed methods approaches*. SAGE Publications Ltd.

De Castro, F. & Garrote, D. 2015. The effects of fiscal shocks on the exchange rate in the EMU and differences with the USA. Empir Econ, 49, pp. 1341-1365

Dornbusch R & Fischer S 1996. *Macroeconomics, South African adaptation*. Third Edition. Lexicon Publishers.

Easterly, W.R, Rodriguez, C.A. & Schmidt-Hebbel, K. 1994. Public Sector Deficits and Macroeconomic Performance. Washington, D.C.: Oxford University Press.

Egwaikhide, F.O., Chete, L.N. & Faloku, G.O. 1994.The exchange rate depreciation, budget deficit and inflation-The Nigerian experience. *African Economic Research Consortium (AER), Research paper, p.26.*

Elder, J. & Kennedy, P.E. 2007. Testing for unit roots: What should students be taught? *Journal of Economic Education*, pp.137-146.

Eminer, F. 2015. *The impact of budget deficit on economic growth in North Cyprus*. The 2015 West East Institute (WEI). International Academic Conference proceedings, Viena, Austria

Engle, R.F. & Granger, C.W.J. 1987. Co-integration and error correction: Representation, estimation and testing. *Econometrica*, 55(2):251-276.

Eigbiremolen, G.O., Ezema, N.T. & Orji, A. 2016. Dynamics of budget deficit and macroeconomic fundamentals: Further evidence from Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 5(5):31-42.

Ergun, U. & Goksu, A. 2013. *Applied econometrics with Eviews applications*. Intarnational Burch University Publications.

European Commission 2015. Fiscal Sustainability, Report 2015. *European Economy Institutional Paper,* 018.

Fatima, G., Ahmed, A.M. & Rehman, W.U. 2015. Fiscal deficit and economic growth: An analysis of Pakistan's economy. *International Journal of Trade, Economics and Finance*, 2(6):501-504.

Fedderke, J.W. & Giannaros, M. 2016. Postliberation Politics: Evidence from Demographic determinants of South African voting behaviour in the 2009 National Election. *Economic Research Southern Africa (ERSA), Working paper,* 660.

Gerezgiher, T.M. & Rao, P. 2016. Deficit financing, money supply and inflation in Ethiopia. *International Journal of Science and Research (IJS*R), 5(9):939-944.

Gujarati, D.N. 1999. *Essentials of Econometrics*. Second Edition. Boston: Mcgraw Hill International Edition.

Gujarati, D.N. & Porter, D.C. 2009. *Basic Econometrics*. Boston: Mcgraw Hill International Edition.

Gutierrez, C.E.C., Souza, C.R. & Guillen, O.T. 2007. Selection of optimal lag length in co-integration VAR models with weak form of cyclical features. *The Banco Central do Brasil, Working paper,* 139.

Griffiths, W.E., Hill, R.C. & Lim, G.C. 2008. *Using EViews for Principles of Econometrics*. New York: John Wiley & Sons, Inc.

Hendry, D.F. & Juselius, K. 2001. Explaining co-integration analysis: Part II. The Energy Journal, 22(2):75-120.

Hyman, D. 2008. *Public finance a contemporary application of theory and policy*. Ninth Edition. South-Western Cengage Learning.

Jacobs, D., Schoeman, N. & Van Heerden, J. 2000. Alternative Definitions of the Budget Deficit and its Impact on the Sustainability of Fiscal Policy in South Africa. University of Pretoria, Pretoria.

Johansen, S. & Juselius, K. 1990. Maximum likelihood estimation and inference on co-integration: With applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52:169-210.

Kadria, M. & Ben Aissa, M.S. 2015. Inflation targeting and public deficit in emerging countries: A time varying treatment effect approach. *Economic Modelling.* Elsevier. (52):108-114.

Kelikume, I. 2016. The effect of budget deficit on interest rates in the countries of Sub-Saharan Africa: A panel VAR approach. *The journal of developing areas*, 50(6):105-120.

Kothari, C.R. 2004. *Research Methodology, methods and techniques*. New Dehli: New Age International (P) Ltd.

Kumar. M.S. & Ter-Minassian, T. 2007. Promoting Fiscal discipline. *International Monetary Fund.*

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. & Shin, Y. 1991. Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics,* 54:159-178.

Libanio, G.A. 2005. Unit roots in macroeconomic time series: theory, implications and evidence. *Nova Economia*, 15(3):145-176.

Lawrence, J.C. & Fitzgerald, T.J. 2000. Understanding the fiscal theory of the price level. *Federal Reserve of Cleveland, Economic Review*, Quarter 2, 36(2):1-39.

Ilzetzki, E., Mendoza, E.G. & Vegh, C.A. 2010. How big (small?) are fiscal multipliers? *NBER Working paper,* No.16479.

Lopes, J.C. & do Amaral, J.F. 2017. Self-defeating austerity? Assessing the impact of fiscal consolidation on unemployment. *The Economic and Labour Relations Review,* 28(1):77-90.

Lutkepohl, H. 2010. *Macro econometrics and Time series analysis*. Part of the series the new Palgrave Economics Collection, pp.146-150.

Makanza, C.S. & Dunne, P.J. 2015. Fiscal consolidation, fiscal policy and current account dynamics in South Africa. *Economic Research Southern Africa (ERSA), Working paper* 565, pp 1-34.

Mandishekwa, R., Tambudzai, Z. & Marufu, A. 2014. Testing applicability of the twin deficits hypothesis in Zimbabwe. *Journal of Economics and Sustainable Development,* 5(28):209-217.

Martins, P.M.G. 2010. Fiscal dynamics in Ethiopia: The co-integrated VAR model with quarterly data. *CREDIT Research paper,* No. 10/05.

Mehrara, M. & Rezaei, A. 2014. The relationship between government revenue and government expenditure in Iran. *International Journal of Academic Research in Business and Social Sciences,* 4(3):171-182.

Meltzer, A.H. 1998. Monetarism: The issues and outcome. *Atlantic Economic Journal,* 26(1):8-31.

McConnell, C.R. & Brue, S.L. 1996. *Economics Principles, Problems and Policies.* Thirteenth Edition. Toronto: Mc Graw-Hill.

Mishkin, F.S. 2004. *The economics of money banking and financial markets*. Seventh Edition. Pearson-Addition, Wesley.

Mohr, P. 2013. *Understanding macroeconomics*. Pretoria South Africa: Van Schaick Publishers.

Mohr, P. & Associates. 2015. *Economics for South African students*. Fifth Edition. Pretoria South Africa: Van Schaick Publishers.

Montasser, G.E. 2015.The seasonal KPSS test: Examining possible applications with monthly data and additional deterministic terms. *Journal of Econometrics,* 3:339-354.

Mujuba, S.C. 2013. *The effectiveness of fiscal deficits in stimulating economic growth*. University of the Western Cape, South Africa.

National Treasury 2014. Medium Term Budget Policy Statement 2014, Pretoria, *National Treasury.*

National Treasury 2015. Debt Management Report 2014/15, Pretoria, *National Treasury*.

National Treasury 2015. Budget review 2015, Pretoria, *National Treasury.*

Nayab, H. 2015. The relationship between budget deficit and economic growth of Pakistan. Journal of Economics and sustainable Development, 6(11):85-91.

Nguyen, V.B. 2015. Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia. *Journal of Economic Finance and Administrative Science,* (20):49-53.

Nkoro. E. & Uko, A.K. 2016. The Johansen-Juselius Multivariate co-integration technique: Application and interpretation. *Advances in Social Sciences Research Journal,* 3(4):248-267.

Ogbonna, B.C. 2014. Investigating for twin deficits hypothesis in South Africa, *Developing Country Studies*, 4(10):142-162.

Ogujiuba, K. & Abraham, T.W. 2012. Testing the relationship between government revenue and expenditure: Evidence from Nigeria. *International Journal of Economics and Finance,* 4(11):172-182.

Oladipo, S.O. & Akinbobola, T,O, 2011. Budget deficit and Inflation in Nigeria: A causal relationship. *Journal of Emerging Trends in Economics and Management (JETEM)*, 2(1):1-8.

Oludele, A.A. 2004. The relationship between budget deficit and interest rate in South Africa: Some econometric results. *Development Southern Africa*, 21(2): 289-302.

Owoye, O. 1995. The causal relationship between taxes and expenditure in the G7 countries: Co-integration and error-correction model. *Applied Economics Letters*, (2):19-22.

Parkin, M. 2013. *Economics, Global and Southern African perspective*. Second Edition. Pearson Education South Africa.

Prathapan, K. 2014. *Research methodology for scientific research*. I K International Publishing House, Pvt. Ltd.

Ram, R. 1988. Additional evidence on causality between government revenue and government expenditure. *Southern Economic Journal*, 54(3):763-769.

Ramu, A. & Gayithri, K. 2016. Relationship between fiscal deficit composition and Economic growth in India: A time series econometric analysis. *Institute for Social and Economic Change, Working Pap*er No. 367.

Salvatore, D. 2007. *International Economics*. Ninth Edition. United States of America: John Wiley & Sons Inc.

Semosa, P.D. & Mongale, I.P. 2016. *The effect of macroeconomic variables on inflation: A case for South Africa*. Conference Proceedings of the International Conference on Public Aministration and Development Alternatives.

Solomon, M. & de Wet, W.A. 2004. The effect of a budget deficit on inflation: The case of Tanzania. *SAJEMS,* 7(1):100-116 .

Spratt, S. 2009. Development finance, debates, dogmas and new directions. London and New York: Routledge, Taylor & Francis Group.

Stock. J.H. & Watson, M.W. 2001. Vector Autoregressions. *Journal of Economic* Perspectives, 15(4):101-115.

Sweeney, D.L., Williams, T. A. & Anderson, D.R. 2006. **Fundamentals of Business Statistics.** International Student Edition. Tax laws in Nigeria: Thomson South-Western.

Thomas, R.L. 1997. *Modern Econometrics, an introduction.* England: Addison Wesley Longman.

Troupin, S., Steen, T. & Stroobants, J. 2015. Fiscal consolidation in Federal Belgium, *International Review of Administrative Sciences*, 81(3):457-478.

Van Hoang, K. 2014. *Budget deficit, money supply and inflation: Empirical evidence from Vietnam.* Macroeconomic Policy Program, National Graduate Institute for Policy Studies, *MPRA paper,* No. 54488.

Verbeek, M. 2004. *A guide to modern econometrics*. Second Edition. England: John Wiley & Sons Ltd.

Wakeel, I. & Ullah, K. 2013. Impacts of budget deficit on output, Inflation and Balance of trade: A simultaneous equation model approach. *Journal of Global and Scientific Issues*, 1(1):40-52.

Warren, N. 2013. National Fiscal consolidation and the challenge to Australian federalism. *The Economic and Labour Relations Review*, 24(3):161-180.

White, H. 1980. A heteroscedasticity-consistent covariance matrix estimator and direct test for heteroscedasticity. *Econometrica*, 48(4):817-838.

Williams, C. 2007. Research methods. *Journal of Business & Economic Research*, 5(3):65-72.