An empirical analysis of real exchange rate and economic growth in South Africa

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Dissertation accepted in fulfilment of the requirements for the Degree of *Master of Commerce in Economics* at the North-West University

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Graduation ceremony July 2018

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Acknowledgements

I wish to thank God for guiding and protecting me during my studies and for seeing me through this journey. I am sincerely grateful to the North-West University for the financial support received during my post graduate studies. I am also grateful to my supervisor, Prof. Mah, for her encouragement, support and guidance during my studies. I wish to thank my family and friends for their support.

Dedication

I dedicate this study to the following:

- My late mother, Jayaben Patel;
- My loving father, Bhupendra Hiralal Patel; and
- My brother, Kavir Patel.

Abstract

The relationship between real exchange rate and economic growth has become an ongoing debate in economics and the rest of the world. The objective of this study was to investigate the relationship between real exchange rate and economic growth in South Africa. Using time series data, the period from 1980 to 2015 was considered in the study. The explanatory variables employed in the study were: gross domestic product deflator; money supply; export and foreign direct investment. Data was collected from the South African Reserve Bank, International Monetary Fund and International Financial Statistics. The Johansen cointegration and the Vector Error Correction Model estimation techniques were used while Granger causality test was used to determine causality between the variables. Variance decomposition and impulse response function were subsequently performed to determine the response of real exchange rate to various shocks from the other variables used in this study.

Results of the long-run revealed a negative and significant relationship between real exchange rate with export and economic growth. On the other hand, money supply and foreign direct investment had a positive and significant relationship with real exchange rate. In the short-run, only export was significant and positively related to real exchange rate. Results of Granger causality revealed that only export Granger causes real exchange rate, thus an unidirectional causality exists between export and real exchange rate while other variables do not granger cause one another. Results of the variance decomposition revealed that real exchange rate is highly affected by shocks from economic growth while its response to export, money supply and foreign direct investment is so small. The impulse response functions revealed that real exchange rate responds positively to shocks from real exchange rate and money supply, while real exchange rate responds negatively to a shock from economic growth. Moreover, real exchange rate responds negatively than positively to shocks from foreign direct investment while the response of export is positive and later negative.

There is, therefore, a need for government to maintain stable growth and focus on variables that affect real exchange rate positively. For example, encourage and maintain the level of foreign direct investment, a well balance of money supply and trade between imports and exports.

Keywords: Real exchange rate, Economic growth, South Africa, VEC Granger Causality, Variance Decomposition, Impulse Response Function and VECM

JEL Classification: C32, E1, E51, F1, F2, F31

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Glossary of terms

Cointegration is one of the econometric techniques used for testing the relationship between non-stationary time series variables. Cointegration exists when two or more variables travel together at an equal wavelength.

Currency appreciation is defined as an increase in the value of one currency in relation of another or rather; it is a currency that is worth more in terms of foreign currency.

Currency depreciation is the opposite of appreciation. It is a reduction in the level of a currency in a floating exchange rate system in line with market forces. It is caused by a number of factors such as political instability, interest rate differentials and so forth.

Error correction model is a vibrant model in which the movement of the variables in any period is shared to that of the previous period's gap from long-run equilibrium.

Exchange rate volatility is defined as the risk associated with unexpected movements in the exchange rate.

Exchange rate regime is a system that a country's monetary authority, normally the central bank, agrees to establish the exchange rate of its own currency against other currencies. Each country is free to accept the exchange rate regime.

Franc Zone consists of 14 countries in sub-Saharan Africa, each affiliate with one of two monetary unions. It is an economic, monetary and cultural area that is equivalent to none other in the world.

Global financial crisis refers to an economic situation where the economies of countries all over the world are facing a liquidity crunch and taking steps forward to battle this issue.

Trade imbalance is when there is either a trade surplus or trade deficit. Trade imbalance is the difference between the monetary value of exports and imports of output in an economy over a certain period. Trade surplus is when there is a positive balance; this is when the amount of exports is more than the amount of imports. On the other hand, trade deficit or trade gap (when there is a negative balance); this is when imports are more than exports.

Monetary policy committee the South African monetary committee was constituted shortly before it adopted the inflation targeting framework. The committee consists of the Governor of

the Bank, eight members of the Bank, three deputy governors and four senior officials of the Bank.

Monetary policy is the process whereby the monetary authority of a country controls the supply of money. It often targets a rate of interest for the purpose of promoting economic growth and stability.

Repurchase rate is the interest rate at which commercial banks can borrow money from the Reserve Bank.

Vector error correction model is an econometric technique used to estimate the long and short-run equilibrium parameters in relationship with non-stationary variables.

List of abbreviations and acronyms

ADF –Augmented Dickey Fuller

AIC- Akaike Information Criterion

ARDL-Autoregressive Distributed Lag Model

ANC- African National Congress

BBC – British Broadcasting Corporation

BS-Balassa-Samuelson

BOP- Balance of payment

CBN-Central Bank of Nigeria

DOLS-Dynamic Ordinary Least Square

DTI – Department of Trade and Industry

EXPO-Export

ECM-Error Correction Model

FDI-Foreign Direct Investment

FPR-Final Prediction Error

GDP-Gross Domestic Product

GDPD-Gross Domestic Product Deflator

GMM – Generalised Method of Moments

HQ-Hanann-Quin Criterion

LR-Sequential Modified Likelihood Ratio

LNFDI-Log of foreign direct investment

LNRER- Log of real exchange rate

LNEXPO- Log of export

LNMS- Log of money supply

LNGDPD- Log of gross domestic product deflator.

IMF-International Monetary Fund

IFS-International Financial Statistics

IRF- Impulse Response Function

IDC-Industrial Development Corporation

M1-Narrow Monetary Supply

M2-Broad Money Supply

MS or M3 -Money Supply

OLS-Ordinary Least Square

PP- Phillips Perron

PPP-Purchasing Power Parity

RER-Real Exchange Rate

RMB - Renminbi

SARB- South African Reserve Bank

StatsSA-South African Department of Statistics

SC-Schward Information Criterion

US Dollar – United States Dollar

VAR-Vector Autoregressive Regression

VEC- Vector Error Correction

VECM- Vector Error Correction Model

Chapter 1
INTRODUCTION TO THE STUDY

1.1 Introduction

The term real exchange rate has become highly important, since the scope of international transactions has increased along with more economic activities that are directly or indirectly affected by activities in other nations (Chinn, 2006). It is considered to be an important element that measures the economic status of a country and also determines the amount of trade in a country (Twala & Mchunu, 2014). On the contrary, Akpan and Atan (2012) explain that variations in the exchange rate are most likely to determine the economic performance of a country. Real exchange rate can be defined as the price of one currency in terms of another. When a country's rate appreciates, it is an indication that the value of the currency has increased, thus resulting in an increase in demand for that currency in the markets. Currency depreciation, on the other hand, is when a country's rate has lost value through one or more foreign reference bills.

The relationship between exchange rate and economic growth has remained a controversial subject. Most economists believe exchange rate is an endogenous variable, whose contribution to growth may be difficult to separate (Habib, Mileva & Stracca, 2016). Thus, an exchange rate strengthens a country's economic growth rate. Rodrick (2007) argues that in some developing countries, an increase in undervaluation enhances economic growth just as much as a decrease in overvaluation.

According to Garlick and Edwards (2007), exchange rate plays a fundamental part in public deliberation around trade as well as its policies, with general requests for increase, decrease or equilibrium. Similarly, Takaendesa (2006) maintains that real exchange rate plays a vital part in managing the extensive provision of production and spending in the local economy between goods produced at home and abroad. Economic analysts believe that weakened exchange rates can be detrimental to the economy (Rodrick, 2007). Thus, functions of real exchange rates serve as a means towards shaping the effectiveness of a country. In the model of an open economy, real exchange rate plays an important role.

South Africa is considered as an open economy and participates extensively in international trade, since it focuses in commodity exports and depends more on capital goods imported

(Sibanda, 2012).Economic theory explains that if a country's exchange rate weakens, then goods imported into the country become expensive while those exported become cheaper. The devaluation of the rate of exchange raises the demand for exports, thus enhancing economic growth. Also, when imports become expensive, devaluation in a currency allows domestic expenditure to move away from goods that are being imported, thus resulting in an increase in economic growth (Jones, 2012). In addition, it also improves the balance of trade of a country. In order for South Africa to benefit from trade, it is very essential for it to maintain a very competitive exchange rate whereby it is not too weak or too strong (Sibanda, 2012).

According to the South African Reserve Bank (SARB, 2012), the South African economy grew significantly from 1994. The growth rate of average real gross domestic product was 3% and in per capita terms, 1% since 1995 up to 2004. However, as of 1994, South Africa has been experiencing great levels of inflation, decreasing output and unemployment. Financial experts opted for the implementation of inflation targeting system in order to save up inflation parity along with its main trading partners as well as to ensure price stability. Ultimately, the fixed exchange rate regime was discarded by the country for market-based, free floating exchange rate in 2000 (Van der Merwe, 1996). The economy was uncovered to the risks of exchange rate misalignment due to the implementation of the free floating exchange rate regime.

Moody's Investor Services (2008) warned that South Africa will fall into a recession due to electricity shortages, high interest rates, soaring inflation, lower business and consumer confidence indicators, thus leading to a slow economic growth of the real gross domestic product. This reflected a 0.39% decrease in Gross Domestic Product (GDP) for the first quarter of 2008.For the first time in 17 years; South Africa opted for a depression in 2008 as soon as GDP diminished by 6.4% on the back of a 1.8% turn down in GDP in the fourth quarter (Bruyn, 2009). The economy was also disturbed by the United States (US) financial disaster. In 2009, the recession continued, thus causing GDP in the first and second quarter to stand at -6.4% and -3% (Zwedala, 2013). The South African Department of Statistics (StatsSA, 2009) explained in the British Broadcasting Corporation (BBC) news that the manufacturing, mining and quarrying sectors were the primary sources for the contraction after calculating the latest figures.

In foreign exchange markets, the value of the Rand is established by forces of demand and supply. In the fourth quarter of 2009, the weighted average exchange rate of the Rand increased by 1.2% (SARB, 2009). An appreciation in the Rand exchange value was due to improvement

in the position of external trade, constant increase in the prices of international commodities and positive sentiments towards the 2010 World Cup organized in South Africa.

Hence, the South African rate of exchange plays an essential role in terms of economic development and overseas trade. The exchange rate, therefore, has to maintain its stability for the economy to gain from international trade. Since one of the objectives of South Africa's macro-economic policy is to maintain sustainability in economic growth, similarly far above the ground, economic growth will be directed to an adequate level of foreign reserves (Sibanda, 2012). This is an indication that one needs to understand how exchange rate changes and how it affects economic growth.

1.2 Problem statement

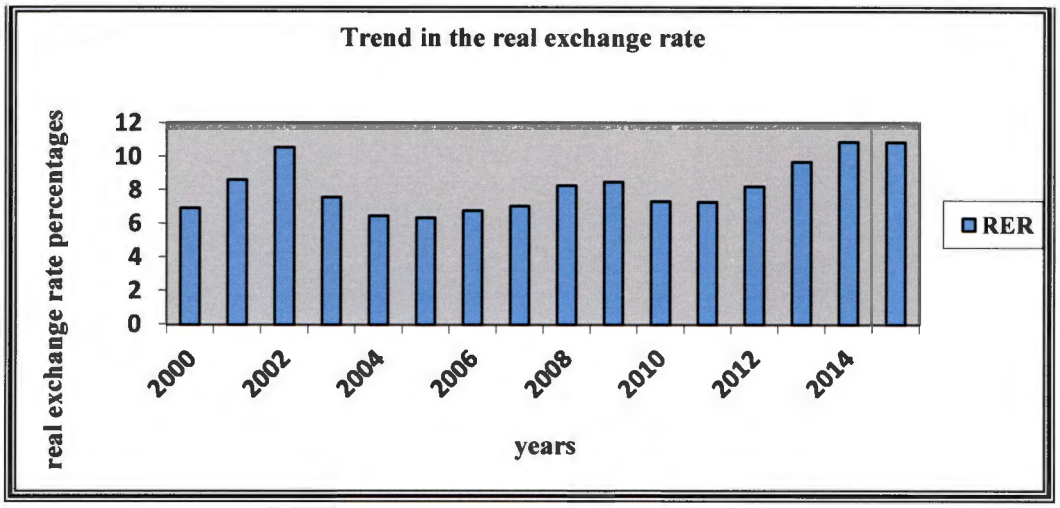
A country's level of economic wellbeing is governed by factors such as exchange rate, interest rate and inflation. In terms of a country's level of trade, exchange rate plays an essential role, thus its importance allows exchange rate to be among the most observed, evaluated and governmentally influenced economic measures. Exchange rate fluctuations have been considered to be a problem in developing countries (Frankel, 2003). Fluctuations of exchange rate started occurring when most countries adopted the free float regime, after the change from global fixed exchange rate. South Africa was one of the countries that changed after 2000 to the free floating system (Van der Merwe, 1996).

The South African exchange rate has been going through a series of fluctuation recently. The Rand began to experience depreciation against the US Dollar, at the beginning of the 2012 financial year, with the depreciating exchange rate level averaging 9 % (Census and Economic Information Centre Data, 2016). During the beginning of the 2015 financial year, between January and March, the depreciating exchange rate was recorded to be 12.45% (Trading Economics, 2015). In January 2016, it took a hard hit when it recorded its all-time high of a rate of R16.84 (Maepa, 2015). This was caused mainly by South Africa's political instability and the verdict of the replacement of the Finance Minister, Nhlanhla Nene, with the African National Congress (ANC) Member of Parliament, David Van Rooyen on the 9 December 2015.

Furthermore, global economic crises and economic slowdown in emerging markets (for example, the Chinese economy and the slowdown along with debt talks in Greece) weighted down the currencies of developing markets (Reuter's Data, 2015).Thus; a weak Rand

negatively affects South Africa's economy. The devaluation of the Rand has a number of implications. For instance, it could lead to an increase in inflation on goods such as imported goods becoming more expensive, high levels of unemployment levels, a shortage in the supply of electricity, water and gas (StatsSA, 2016).

Figure 1.1: Trend in the real exchange rate



Data source obtained from SARB

Figure 1.1 shows the trend in real rate of exchange of the South African economy. It covers the period from 2000 to 2015.Although the study covers the period from 1980-2015, the graph above covers the trend from 2000 to 2015 as the value of the Rand started fluctuating more during this period. The attack on the World Trade Centre on 11 September 2001 caused the Rand to increase to R13.84 to the Dollar (BusinessTech, 2015). In addition, the global economic crisis of 2008 and 2009 had a negative impact on most countries (which led to a global recession). South Africa is one of the countries that was hit by the global economic crisis. The Rand touched a five-year low of R 11.56 due to the international financial crisis (Maveé, Perrelli & Schimmelpfening, 2016). When South Africa exited the recession in the third quarter of 2009, it continued to battle with unemployment and economic recovery (Reuters in Fin24, 2010). The Rand experienced its worst year in 2014 against the US Dollar as it dropped by 3.5% from the beginning of the year. However, the value increased by 2.5% by the end of the first quarter of 2014 (Twala & Mchunu, 2014).The Rand further lost its value for about 9.5% from December 2013 to December 2014 (Matlasedi, Zhanje & Iiorah, 2015). Furthermore, in 2015, the Rand hit to R15.38, mostly due to political instability in the country, low levels of investment and factors such as electricity crisis and water shortages

(BusinessTech, 2016). Since then, the Rand has been experiencing fluctuations, and there are concerns that the Rand may remain weak for at least the next five years (from 2014 to 2018) (Mittner, 2014).

Local events such as growing debt, socio-political instability and energy issues led to the weakening of the Rand. Due to a weak Rand, the inflation rate went up by 6.2% year on year, which was out of the SARB target range of 3%-6% in the beginning of January 2016 (NEWS24, 2016). Equally, the Monetary Policy Committee agreed to raise the repurchase rate by 50 basis points to 6.75% per annum and the prime lending rate to 10.25% (Kganyago, 2016). Although the SARB can keep the interest rates low, it will, however, lead to higher inflation which will go a long way in devaluing the Rand further (Bhoola, 2016). High interest rates also discourage investment as businesses and consumers are not willing to take the risk of incurring a loss, it also increases debt repayments.

At the beginning of 2017, the Rand gained some momentum. However, on the 28th of March 2017, the President replaced Finance Minister Pravin Gordhan with Mr Malusi Gigaba. Prior to the replacement, the Rand was trading at R12.74 (on Thursday and Friday at R12.90) and further weakened to R13.02. During April 2017, the Rand was heading to R14/$ (trading at R13.84. In addition, rating agencies downgraded South Africa to junk status (Fin24, 2017). This brought much chaos in the economy, thus resulting to higher interest rates, high inflation, arise in the cost of goods and services and an increase in the cost of borrowing. Due to the Cabinet reshuffle and the subsequent downgraded to junk status, South African citizens called for the President (Zuma) to step down as much damage had been done (Fin24, 2017).South Africans can further expect devaluation in the Rand and this could have a huge impact on the economy. This indicates that political instability within the country affects the outlook of the economy and therefore has an impact on exchange rate.

Real exchange rate plays a crucial role in the models of an open economy as it is an important factor that determines the development of a country (Chinn, 2006).Looking at the current situation in South Africa, the aim of this study is to investigate whether there is a positive or negative relationship between the rate of exchange and the growth rate.

1.3 Aim and objectives of the study

The study aims to analyse the relationship between real exchange rate and economic growth in South Africa from 1980 to 2015.The objectives of the study were to:

1.3.1 Provide a summary of the movements of exchange rate and economic growth in South Africa;

1.3.2 Evaluate the long and short-run relationship between real exchange rate and economic growth from 1980 to 2015;

1.3.3 Examine the direction of causality between exchange rate and economic growth;

1.3.4 Estimate the response of shocks on real exchange rate from other variables in this study; and

1.3.5 Propose policy recommendations in stabilising real exchange rate in South Africa.

1.4 Hypotheses

1.4.1 Null hypothesis: There is no significant relationship between real exchange rate and economic growth.
Alternative hypothesis: There is a significant relationship between real exchange rate and economic growth.

1.4.2 Null hypothesis: Real exchange rate does not Granger cause economic growth.
Alternative hypothesis: Real exchange rate does Granger cause economic growth.

1.4.3 Null hypothesis: Real exchange rate does not respond to shocks from economic growth, foreign direct investment, money supply and export.
Alternative hypothesis: Real exchange rate responds to shocks from economic growth, foreign direct investment, money supply and export.

1.5 Significance of the study

This study examines how growth rate influences rate of exchange rate in the South African economy. It follows the study of Tang (2015) which explored the relationship between real exchange rates on economic growth from 1994 to 2012 in China. The relationship involving the rate of exchange and economic growth has become the most significant issue of debate

since neither empirical evidence nor economic theory gives a clear-cut answer to how real exchange rate influences economic growth. Looking at the current situation in South Africa, there is a need to investigate how exchange rate affects growth. This study will add value to the current discussion on rate of exchange and growth rate in the South African economy as well as assist other students and researchers in terms of information on the topic. It would also assist local policymakers to formulate suitable policies. The study will also add value to available literature on the relationship between rate of exchange and growth rate of the economy. This study is unique because of the variables used. There are many studies such as Tarawalie (2010), Alawin, Sawaie, Al-Omar and Al-Hamdi (2013), Uddin, Rahman and Quaosar (2014) and Ayodele (2014) which are based on the same topic, however, the variables chosen for this study makes it different from other studies. Furthermore, the methodology used in this study is diverse due to the inclusion of the VEC Granger causality. Most studies conducted so far have only used the Vector Error Correction Model, variance decomposition and impulse response function.

1.6 Limitations of the study

The unavailability of quarterly data for some of the variables was one of the limitations. However, variables such as export, foreign direct investment, money supply, real exchange rate and gross domestic product deflator were later considered and time series data chosen for the period ranging from 1980 to 2015. The study is also limited in terms of the study period covered (1980 to 2015) to determine the relationship between real exchange rate and economic growth.

1.7 Structure of the study

The study is divided into six chapters. Chapter1 presents the problem statement, the aim and objectives of the study, the hypotheses, the significance and limitations of the study.

Chapter 2 provides a summary of the rate of exchange in addition to the growth rate of the South African economy. A brief explanation of exchange rate in South Africa is given followed by the different types of exchange rate regimes. The types of exchange rate systems adopted by South Africa during the past and current regimes are explained followed by the policy of the rate of exchange. The trend of the rate of exchange in South Africa is also discussed to show how the fluctuation of the Rand in the past. Economic growth is seen as an essential

factor as it is linked to exchange rate. Economic growth in South Africa is also discussed in this chapter.

Chapter 3 is a review of literature on exchange rate such as the Purchasing Power theory, the Balance of Payment theory, the Asset approach, the Traditional theory, the Structuralist theory and the Balassa-Samuelson hypothesis. Various empirical findings based on the relationship between real exchange rate and growth rate of the South African economy are also discussed in this chapter.

Chapter 4 is the research methodology. Details of the regression model used in analysing the data are provided in this chapter. The sources of the data and definition of the variables are provided along with the expected signs, unit root tests, lag order selection and tests for cointegration. The vector error correction model, diagnostic test, Granger causality, variance decomposition and generalised impulse response are also discussed in this chapter.

Chapter 5 focuses on the examination and interpretation of results obtained from the different estimations. The results of different tests are interpreted in order to determine the relationship between exchange rate and economic growth in South Africa.

Chapter 6 is the summary of the study. It provides the conclusion and possible policy recommendations. It also provides areas for further research.

1.8 Summary

This chapter has provided a general overview of the study. The introduction, problem statement, aim and objectives of the study, hypotheses, significance of the study, limitations and organisation of the study were discussed. The next chapter presents a summary of the rate of exchange and growth rate of the South African economy.

Chapter 2

OVERVIEW OF REAL EXCHANGE RATE AND ECONOMIC GROWTH IN THE SOUTH AFRICAN ECONOMY

2.1 Introduction

The first part of this chapter provides a brief explanation of exchange rate in South Africa followed by the different types of exchange rate regimes. A discussion of exchange rate policies in South Africa is also provided. This section also provides the movement of the exchange rate. Apart from rate of exchange, one of the variable closely examined is economic growth since it is linked with exchange rate. The second part discusses the trend in economic growth and the influence of the rate of exchange.

2.2 Exchange rate in South Africa

Over the years, the South African Rand has been highly volatile. During a greater part of 2015, the Rand depreciated significantly compared to other developing currencies. Yet, in September 2015,it departed from its movement as concerns were raised around South Africa's growth outlook and alleged risks to the fiscal framework. The depreciation in the Rand contributed to a number of factors such as price competitiveness of exports and increase in the cost of South African goods, high inflation, lower wages, and high import costs (National Treasury, 2016). The following section discusses the types of exchange rate systems and the strategy applied in South Africa. The trend of the rate of exchange is presented graphically to show the variations from the past years up to 2015.

2.2.1 Exchange rate regimes

It is important for a country to choose an appropriate exchange rate system since it provides a basis for a country to become competitive in the world economy as well as prevents a country from entering into a currency crisis. It also assists in maintaining macroeconomic stability, including growth, especially with developing countries such as South Africa (Yagci, 2001).

According to Rodrick (2007), when exchange rates are managed poorly, it could be devastating for the economy.

Ahmad, Ali and Ahmad (2013) explain the change between real exchange rate and nominal exchange rate by stating that if the impact of inflation is included, then its nominal exchange rate is excluded from its real exchange rate. They further maintain that exchange rate regimes are categories in which different patterns of exchange rate behviour are known. In a system where exchange rate is stable, it is known as fixed exchange rate system while exchange rate that fluctuates is referred to as floating exchange rate. If it is between fix and floating exchange rate regime, then it is known as managed floating system.

As mentioned earlier, the forces of demand and supply determine the rate of exchange or through monetary policy administration. The authorities of the Monetary Policy may decide to go with a free floating exchange rate regime whereby the rate of exchange is controlled by market forces of supply and demand (Van Der Merwe, 1991). On the contrary, the monetary authorities can choose to use a fixed exchange rate system where the rate of exchange is steadily preserved at a specific level of interest rate (Van Der Merwe & Mollentze, 2012).

2.2.2 Free floating exchange rate regime

A free floating exchange rate is when the government allows the rate of exchange to be determined by market forces. In recent years, several countries have followed inflation targets as the main objective of monetary policy. Therefore, through inflation targeting, less importance is given to the exchange rate and allowed to float freely (Pettinger, 2012). The monetary authorities have no market intervention in this regime and the exchange rate is assumed to be any value between zero and infinity (De Oliveria, 2014).Zhang (2009) argues that in this system, worldwide economic performance influences exchange rate fluctuations as well as the actions of investors.

Van der Merwe and Mollentze (2012) advance a number of advantages with regard to the free-floating exchange rate system. The advantages are that the balance of payments disequilibrium is amended. In order to correct business deals in the balance of payments, only one price is needed which is a smaller amount contrary to a scheme that would need domestic prices to be corrected. Also, the efficiency of financial policy is improved as measures focus on domestic

objectives and to maintain a specific exchange rate level, a maximum cost of intervention is required to be sustained.

As much as there are advantages to this regime, there are also some drawbacks of the free-floating exchange rate regime. With such a regime, insecurity sourced by currency conjectures and forecasts put off global deals and savings, though hedging process can be utilised to be counter-productive to some extent. Exchange rates can be unstable when demand and supply of imports and exports are extremely inelastic, thus high exchange rate instability could occur. The assumption supported on expected alteration of exchange rates could be disabling. Large variations in interest rates and exchange rates can be caused by lack of financial discipline, thus resulting in costs to the country (Van der Merwe & Mollentze, 2012).

2.2.3 Fixed exchange rate regime

A fixed exchange rate is also identified as the pegged exchange rate system. It is a system under which the government or central bank links the authorised exchange rate to another country's currency or to the price of gold. The purpose of this system is to uphold the country's currency value within a very narrow band.

In order to come over the problem of exchange rate, uncertainty or rather, high currency volatility, the monetary authorities implement this system. The monetary authorities interfere in the market to also achieve the objective for the nominal exchange rate (De Oliveira, 2014). According to Maepa (2015), this system is more effective in longer periods if the monetary authorities have the understanding, talents and capabilities to sustain it by eradicating the difficulty of exchange rate uncertainty, which in turn, attracts potential new investments into a country as well as maintain existing investments.

However, Kydland and Prescott (1977) state that when using the fixed exchange rate system, the problem of credibility occurs. To transform from the fixed exchange rate regime might be expensive and can cause a huge depreciation in the domestic currency. As a result, it is significant for financial experts to keep stability when considering the rate of exchange policy, whereby they choose to embark on to solve uncertainty problems (De Oliveira, 2014).

The fixed exchange rate regime has some advantages. It encourages price solidity because of open certainty, considering the price of imported goods. It also boosts international trade due to price solidity resulting in higher economic growth and wealth. Furthermore, it implements

discipline to countries to monitor accountable monetary policies. When the rate of exchange remains steady, the confidences of operators of the foreign exchange market are high (Van der Merwe & Mollentze, 2012).

The fixed exchange rate also has a number of disadvantages. One of the key disadvantages of this system is the fact that financial experts give more importance to external balances relative to its domestic considerations. Further shortcomings include the fact that fixed exchange rates do not separate a country in contrast to any external shocks. However, they offer a certain degree of constancy when internal shocks take place. With this type of system, it becomes relatively difficult for financial experts to sustain a fixed exchange rate plus capital mobility to gather domestic goals. Financial experts cannot secure a fixed rate for ever as it could come under great speculative concerns (Van der Merwe & Mollentze, 2012).

2.2.4 Managed floating exchange rate regime

Sometimes, the management or central banks as a member, go into the foreign exchange market to try and influence the currency value at various levels (Zhang, 2009). Colander and Gamber (2002) maintain that in this system, the government, from time to time, trades its currency to manipulate the exchange rate, if not, then the market force can control its value. The monetary authorities for countries that follow this system are able to level out short-term variations while the basic amendment procedure takes effect. When the current exchange rate movement affects other economic factors such as employment, inflation and international competitiveness, then the monetary authorities are allowed to intervene by the managed floating system.

Dornbusch, Fischer and Startz (2004) further explain that this system is a guide to highlight the strengths or weaknesses as well as an instrument to correct short-term imbalances in an economy. However, this system may be different in various countries according to the different time periods. Nevertheless, the effectiveness of this system is determined by government's capability towards bringing about foreign currency assets, its capability to differentiate among adjustable short-term effects plus other important elements, including the level at which the administration is ready to use financial strategy to stimulate the rate of exchange rather than to follow local policies, for instance, the control of inflation and interest rate.

2.2.5 Exchange rate policy in South Africa

Mtonga (2011) states that the exchange rate management in South Africa is characterised by a number of regime changes. The South African exchange rate regime began from being fixed exchange rate, moved to managed floating exchange rate and finally to free floating from 2000.

Table 2.1: Exchange rate regimes adopted by South Africa

Phase	Duration	System
1	1961 February – 1971 July	Fixed exchange rate regime: Rand pegged to the British pound
2	1971 August – 1971 November	Fixed exchange rate regime: Rand pegged to the US Dollar
3	1971 December- 1972 September	Fixed exchange rate: Rand pegged to the British pound
4	1972 October- 1974 May	Fixed exchange rate regime: Rand pegged to the US Dollar
5	1974 June - 1975 May	Crawling peg Rand: Rand pegged to a basket of currencies
6	1975 June - 1979 May	Fixed exchange rate regime: Rand pegged to the US Dollar
7	1979 June - 1983 January	Dual exchange rate regime: Crawling peg commercial Rand and free floating Rand
8	1983 February- 1985 August	Unitary exchange managed float Rand
9	1985 September - 1995 February	Dual exchange rate regime: managed float commercial and free float financial Rand

10	1995 March- 2000 January	Unitary exchange rate: managed float Rand
11	2000 February– present	Unitary exchange rate: free floating Rand, with inflation targeting monetary policy

Source adopted from: Mtonga (2011)

The table above shows the following rate of exchanges regimes adopted by South Africa from February 1961 till present. Since 1994, South Africa has implemented the three regimes: dual exchange rate regime under a managed float commercial and free float financial Rand. From February 2000 to present, the country adopted a free floating Rand, with inflation targeting framework of monetary policy (Sibanda, 2012).

Aron, Elbadawi and Kahn (2000) state that socio-political events were the main influence of the choice of an exchange rate system from the late 1984 to 1994,thus delaying improvement in the South African foreign exchange market. Such problems compelled authorities to go for other direct control procedures to manage the rates of exchange. Van der Merwe (1996) explains that because of the monetary authorisations imposed on the state, the South African Reserve Bank was forced to re-enter the foreign exchange market like an active participant below circumstances of direct control measures to regulate the effect of capital flows on financial assets. Additionally, he maintains that South Africa's international financial relations stabilised throughout the first two years of the new Government of National Unity (1994-1995) and measures were taken in the improvement of a forward market with fewer SARB involvements and progressive reduction of exchange control.

In March 1995, the country implemented the managed float exchange rate system, after the financial Rand was withdrawn (Mtonga, 2011). Aron *et al.* (2000) argue that transforming to this system was a huge step towards the gradual liberalisation of financial markets as well as repositioning the South African economy globally. Financial liberalisation caused the removal of exchange control regulations. Eliminating the financial Rand, the exchange control was abolished on transactions of non-residents (Mtonga, 2011).

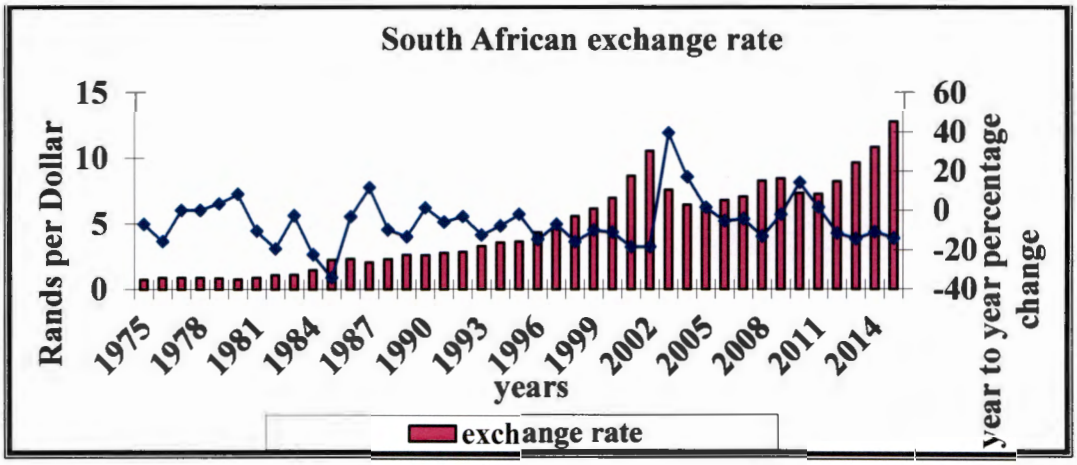
In 2000, South Africa brought changes in the monetary policy. The country implemented inflation targeting as part of the financial policy framework. In this framework, the monetary policy paid attention to the inflation rate to be done at a particular period, open inflation estimate by means of transitional variables and the rate of interest as a strategy mechanism (Mtonga, 2011). This change was followed by the execution of the free floating exchange rate system which complements the fundamentals of inflation targeting regime (Sibanda, 2012).

The implementation of the free floating exchange rate system along with the inflation-targeting framework monetary policy, led to significant ups and downs in the Rand exchange rate. During the period 2000 and 2001, the depreciation of the Rand exchange rate generally revealed the low levels of foreign exchange reserves of the country as well as investors' concerns regarding developments of other emerging market economies rather than weaknesses in fundamental economic factors in South Africa. In 2002 and the first four months of 2003, the Rand appreciated substantially. The recovery in the Rand was possibly due to sound macroeconomic policies practiced constantly by authorities, relatively high interest rates in South Africa, uncertainties about economic conditions and general flow of funds to emerging-market economies (Van der Merwe, 2003).

The present exchange rate policy of the central bank in South Africa is to stay out of the market and allow market forces of demand and supply to control the exchange rate. Although the bank stopped direct control on foreign exchange, it still influences the exchange rate by participating in the market (by buying and selling other currencies) (SARB, 2012).

2.2.6 The trend in the South African exchange rate

Figure 2.1: Trend in the South African exchange rate



Source: Data obtained from SARB

The graph above shows fluctuations of the Rand to the Dollar from 1975 towards 2015 in the columns and the change of rate in percentage year-on-year is indicated by the blue dotted line. In 1982, the Rand value was 1.40 US Dollars due to increased political pressure which was positioned against the country because of apartheid and began to corrode its worth. The depreciation of the exchange rate gained momentum when the currency broke above parity in March 1982 for the first time with the Dollar. It traded between R1 to R1.30 to the Dollar until June 1984.In February 1985; it went beyond by trading R2 per Dollar. During the same year (three days in July) all foreign exchange trading were suspended in order to stop the depreciation.

When the State President, PW Botha made his Rubicon communication, which took place on 15 August 1985, the Rand had weakened to R2.40 per Dollar. However, from1986 till 1988, the currency recovered since most of the time it traded at R 2 and breaking below now and then. The recovery of the currency was not long yet, at the end of 1989, it traded at a level of more than R2.50 per Dollar.

During the early 1990s, further improvements were declared and insecurity concerning the future of the country which accelerated the devaluation of the currency until the level of R 3 to the Dollar was cracked in November 1992. The currency was influenced by local and international events, especially by the 1994 democratic election which weakened to over R3.60

to the Dollar. The inauguration of President Thabo Mbeki in 1999 and at the same time, the election of a new governor, Tito Mboweni of the South African South African Reserve Bank, led the Rand to slide over R6 to the Dollar. In addition, the controversial land reform programme that kicked off in Zimbabwe, forced the Rand to its weakest historical level of R13.84 to the Dollar in December 2001.

Due to the unexpected devaluation in 2001, an official inquiry was called, which resulted in an intense recovery. Again, the currency was trading under R9 end of 2002 and under R5.70 to the Dollar end of 2004. Towards the end of 2005, the currency softened and traded around R6.35 to the Dollar. In the preceding year, the currency continued its rally and by 19 January 2006, it was trading under R6 to the Dollar. However, the Rand had deteriorated considerably during the second and third quarter of 2006.

Thereafter, it weakened dramatically and lost 25% of its international trade-weight rate in just six months. In late 2007, it gained some ground trading much firmer just over R8 to the pound and a similar occurrence during 2008.

A number of factors contributed to the downward slide of the currency such as the deterioration of the current account shortfall, high inflation rate and increasing international threat aversion due to investors' fear over the spreading impact of the sub-prime crisis produced. The fall of the Rand worsened as a result of the Eskom electricity crisis; this was due to the inability of the utility to gather the country's fast increasing power demands.

The Rand weakened to R15.05 per Dollar by the end of 2014.This was mostly caused by South Africa's steady trade account deficit with the rest of the globe.

Over a four-day period (from 9 December 2015 to 13 December 2015), the Rand went down by 10 percent. This was caused by the surprise announcement by President Zuma to replace the Finance Minister, Nhlanhla Nene with David van Rooyen. The quick drop in rate ended as soon as the President changed his decision and reinstated former Minister of Finance, Pravin Gordhan. The dismissal of Nene broke international confidence in the Rand, thus resulting in major exchange instability right through January 2016, reaching a low record of R17.9169 to the US Dollar on 9 January 2016 (prior to returning to R16.57 afterwards). Similarly, during that month, the Japanese retail shareholders reduced their losses in the value to come across for higher-yield reserves somewhere else as well as fears over the impact of the economic slowdown in China which resulted in a plummet in the value. In the middle of January, economists were looking ahead to the volatility of the Rand for the whole year. On 29thApril,

the Rand was trading at a rate of R14.16 to the US Dollar, reaching its highest performance above the 5 months.

According to the Brenthurst Wealth Management (2016), out of fear, the situation resulted in large capital outflows, which knocked the Rand 10% weaker to a record low against the US Dollar and raised the cost of government borrowing. The monetary policy committee (MPC) in their first meeting of 2016 came to a decision to hike rates by 50 basis point to 6.75% while some of the committee members preferred a 25 basis point hike. Members of the MPC found it essential to increase rates due to the decline in the inflation outlook.

Economists believe that the exchange rate worsens every year due the SARB's interest rate policy which does not go in line with growth prospects. The Economist's Big Mac Index 2016 maintains the Rand has become weaker and the currency remains one of the most undervalued currencies in the world.

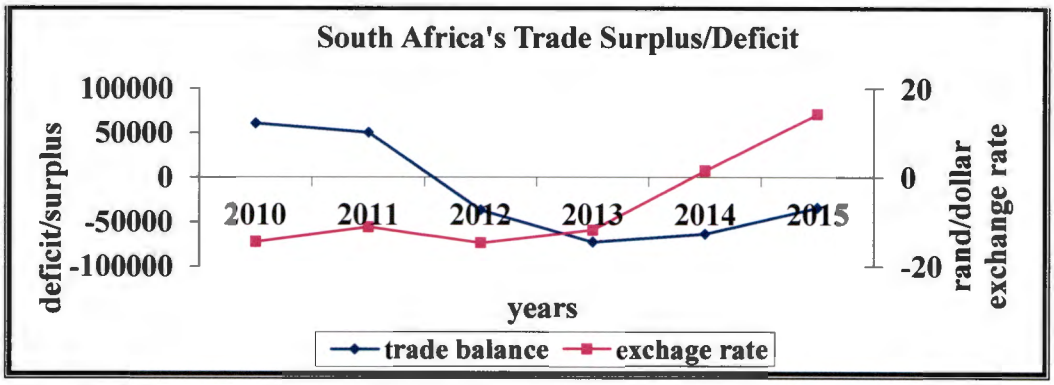
One of the contributing factors to the Rand and for an economy entering into a recession is the worst drought which still continues to destroy crops in South Africa. According to the Crop Estimates Committee, in 2016, South Africa was expected to harvest 7.44 million tons of maize. This figure is lower compared to the previous year. It was declared the smallest crop since 2007. Most economists maintained that during the course of the year, South Africa would plunge into a recession due to the downward risk of the impact of drought, the outlook of the mining sector and concerns that the monetary policy would will increase interest rates in a low growth environment.

Furthermore, South Africa is experiencing its worst drought in decades and this has increased pressure in the expansion of mines and factories in KwaZulu-Natal. The shortage of water affects big industrial players such as Tongaat Hulett, Mondi, Broken Hill Proprietary Company limited (BHP) Billiton, Foskor, Richards Bay Minerals, Tronox Fairbreeze mine, amongst others. Since industries are currently spending more on water, especially in drought-stricken areas, it also adds to the cost of production and thus becomes one of the most important issues for both the industrial and agricultural sectors.

In addition to the terms of trade, a depreciated currency increases the demand for export, thus stimulating growth while imports become expensive; this in turn, improves the trade balance of a country. However, this is not the case with South Africa. This can be explained by Figure 2.2 below. The Figure shows South Africa's trade balance per month from the beginning of

2010 to 2015. Since most of the world's trade takes place in US Dollars, the diagram below indicates the Rand and Dollar exchange rate.

Figure 2.2: South Africa's trade surplus/deficit

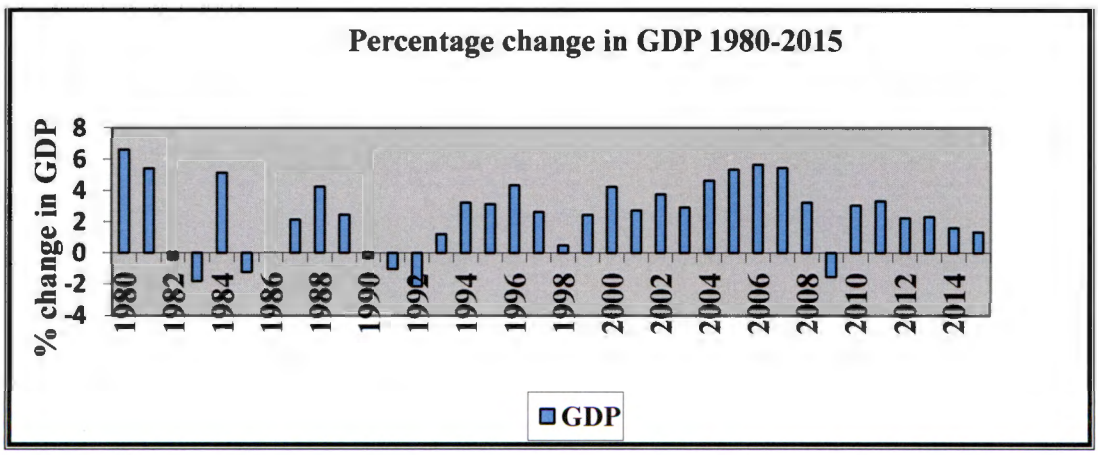


Source: Data obtained from SARB

From the above graph, a positive trend of trade balance shows a surplus. This is an indication that exports outnumbered imports during the period. The negative trend of trade balance shows a deficit, an indication that South Africa's imports outnumbered exports. This is an indication that a weak Rand does not develop the trade balance of South Africa. It can, therefore, be concluded that an exchange rate is really an important element towards stimulating growth.

2.3 Economic growth in South Africa

Figure 2.3: Percentage change in GDP 1980-2015



Source: Data obtained from SARB

During the past three decades (from the 1980s up to 2000s), South Africa's economic growth has been highly volatile. After the first democratic elections (which took place in 1994), there was a major transformation in the economy, such as sanctions and political unrest which led to economic instability (Mohammed & Finoff, 2004; Bhorat & Oosthuzien, 2005; Arora & Bhundia, 2003). On the other hand, Sibanda (2012) argues that there were a number of improvements in growth after 1994. Factors such as improved macro-economic performance due to better policies and elimination of financial authorities in 1994, along with a peaceful political atmosphere, together with high foreign direct investment, ensured that there was development in the economy.

From 1994 to 2012, the economy developed at 3.2% a year on average, resulting in the transformation from a GDP of Dollar 136 billion US Dollars in 1994 to a GDP of Dollar 384 billion US Dollars in 2012(World Bank, 2014). During this period, there was negative growth for the four quarters, which is an extreme lower rate compared to the years before democracy. The economy shrank in 36 quarters from 1965 to the first quarter of 1994. In contrast, the South African economy benefited from long periods of growth compared to the years before 1994. In the fourth quarter of 1998, together with the third quarter of 2008, the economy grew for 40 quarters and developed steadily as of the third quarter of 2009 to the third quarter of 2013. On the contrary, from 1965 to 1993, the economy never developed, apart from the 14 uninterrupted quarters. Through rapid international developments, GDP chopped down after 1994 in those quarters (StatSA, 2013).

Sibanda (2012) further argues that in 1997, GDP growth decreased sharply from 4.3 % to 2.6% in 1996. The East Asian financial crisis led to a major delay in the world economy in 1998. In 1999, there was an improvement of 2.4% growth rate from 0.5% recorded in 1998. To obtain high growth rate, the country registered a 4.2% growth rate in 2000. However, in 2001, it dropped to 2.7%. As from 2002, when South Africa implemented the inflation targeting framework, positive and sustained growth rates were obtained (during 2006, the growth rate stood at 5.6%, the highest since 1981).

Nevertheless, the international financial crisis initiated in 2007, directed to a global recession which caused a decrease of 3.6% in 2007. From there onwards, growth rate of GDP decreased to 1.8% in 2008 and turned negative (-6.4%) in the first quarter of 2009 and -3.2 % in the second quarter. This was the first time South Africa experienced such a situation after

independence as the country recorded a negative growth rate of 1.5% (Sibanda, 2012) and SARB, 2007-2009). At the end of the first quarter of 2009, the country went into a technical recession (SARB, 2007-2009).

From 2009 to 2012, the economy grew by 3.1% a year. In 2010, the South African economy saw an improvement in the economy as growth rate was 2.9%. This could be attributed to the Soccer World Cup tournament that was hosted by the country. In the fourth quarter of 2011, growth rate grew to 3.2% up from a revised 1.7% in the third quarter (Zwedala, 2013). Yet, growth dropped by 1.5% due to shortage of electricity supply, increased costs from late 2007 onwards and a rise in other administered costs.

In 2015, the GDP growth was 1.3%, an indication that economic performance remained a challenging aspect. This was supported by the saddened commodity demand from China, low global commodity prices, low investment, erratic capital flows, low consumer and business confidence. Kevin Lings, chief economist at Stanlib, argues that South Africa will experienced an outright economic recession in the coming quarters. Moreover, he blames the manufacturing and mining sectors for the slow growth rate as manufacturing output decreased by 6.3% during the quarter and mining by 6.8%. By August 2015, the Rand dropped nearly 15% against the Dollar challenged by South Africa's current deficit and slow growth.

Reuters maintains that the Minister of Finance, Pravin Gordhan, indicated in February 2016 that the country was in a crisis and sliced the growth forecast for 2016 to 0.9% from 1.7%. 25% of unemployment and widespread poverty caused the country's economy to struggle with shrinking growth. South Africa was at risk of falling into a recession. However, in September 2016, South Africa missed getting into a recession.

With an estimated rate of 0.7%, the real GDP was forecasted to continue it's down swing in 2016. For the past two decades, droughts and water shortage has continued to destroy the agricultural sector whose real proportion of GDP declined by 16.2%. Furthermore, the continuous shortage of electricity has had a negative effect on the economy (Kumo, Chulu & Minsat, 2016). This is an indication that economic growth in South Africa is very challenging.

The key trends in the South African economy released by the Industrial Development Corporation (IDC, 2016) for the year 2016 revealed that the country was experiencing serious challenges; an indication that it was, indeed, a difficult year for the country. Furthermore, IDC indicated that demand conditions will remain weak domestically and in key exports market which will lead to spare production capacity in many manufacturing industries. The

Corporation also revealed that the financial standing of the public sector will affect government spending negatively, including the effect of drought to be felt for some time until the return of rains to normalise the situation. The mining sector remains at the mercy of developments in commodity prices and a weaker Rand improving the impact of adverse forces.

Nevertheless, in 2017, the outlook was expected to improve significantly and more in 2018. Challenges faced by the infrastructure sector are currently being addressed and demand conditions are expected to recover locally and abroad on the back of improving business and consumer sentiment (IDC, 2016).

Reuters (2017) states that South Africa's economy will grow a bit through perkier commodity prices, a benign inflation outlook and good rains for the agricultural sector. Some economists have suggested that the economy will grow to 1.1% in 2017 and 1.6% in 2018.

Habib, Mileva and Stracca (2016) posit that to most economists, the real exchange rate is an endogenous variable as its contribution to growth may be tough to disentangle, and thus, can have an influence on economic growth. If for instance, it is assumed that both exchange rate and economic growth are endogenous, it is an indication that both are controlled internally, thus both having a huge influence on one another. When a country fails to implement proper polices in order to govern its institutions, investors look elsewhere and capital inflows decrease. Therefore, if capital inflow determines economic growth and development has an influence on the rate of exchange, it is an indication that strategies put in place by the administration have an impact on the rate of exchange (Berg & Miao, 2010).

2.4 Summary

In this chapter, a summary of the rate of exchange and economic growth from 1980 to 2015 in the South African economy has been presented. It was revealed that the South African exchange rate has been fluctuating in recent years compared to the years shortly after 1994, thus causing major concerns towards growth and financial stability. Many exchange rate regimes were adopted and changed over time until the adoption of the free floating exchange rate regime along with inflation targeting framework in 2000 in order to keep inflation rate between 3 and 6% and also to maintain a stable exchange rate. Economic growth in South Africa is very low although it improved after 1994 apart from 2009 when growth was negative due to the global financial crises and other factors. South Africa faces many challenges such

as: attaining high economic growth; low levels of inflation; decrease in unemployment levels; poverty; inequality; and most importantly; to keep the exchange rate stable. The next chapter presents the theoretical and empirical frameworks of the study.

Chapter 3

LITERATURE REVIEW

3.1 Introduction

The relationship between the rate of exchange and economic growth seems to be an important aspect of research and has motivated several researchers to investigate the link between the two. However, there are different conclusions from the theories and empirical evidence presented based on the relationship between the rates of exchange and economic growth. The first section of this chapter is a discussion of the various theories on exchange rate and economic growth while the second part focuses on the empirical framework with particular emphasis on the literature, methods of estimation and their results.

3.2 Theoretical framework

This section deals with theories based on exchange rate. There are a number of theories that explain the linkage between real exchange rate and economic growth of a country. For the purpose of this study the following theories are found to be relevant namely; balance of payment theory, purchasing power parity, Balassa-Samuelson hypothesis, asset approach, portfolio balance approach, monetary approach, traditional approach and structuralist approach.

3.2.1 Balance of payment (BOP) theory

The balance of payment theory is also known as the demand and supply theory of exchange rate. This implies that in a foreign market, the demand and supply of currency determines the rate of exchange. Solnik (2000) states that the balance of payment method was the original method designed for economic modeling of the exchange rate. It tracks all of the financial flows across a country's boundaries throughout a certain phase and all financial transactions are taken care of as a credit and the last balance should be zero. The theory specifies that below free exchange rates, a country's currency exchange rate depends upon its balance of payment. The theory states that if the price of a country's exports increases by a better rate than its imports, then its terms of trade have recovered favourably. The rise in terms of trade is an

indication that there is a huge demand for the country's exports, thus resulting in growth in revenues from export along with demand for the country's currency. Yet, if the price of exports increases by means of a lesser rate, then its imports will experience a reduction in the currency's value in relation to its trading partners.

Therefore, an outcome of a favourable balance of payment is an appreciation in the external price of the currency of the country, while an unfavourable balance of payment causes a depreciation of the external price (Jhingan, 2004).

If the demand and supply of a country's currency are equal, the equilibrium rate of exchange is determined. An internal and external equilibrium exists to determine the exchange rate. Internal equilibrium is an indication that there is full employment and that there is a natural rate of unemployment. On the other hand, external equilibrium refers to equilibrium in the balance of payments, which explains permanent deviations of Purchase Power Parity (Udoye, 2009).

There are a number of limitations with the balance of payment theory. It is not easy to find out what is the exact natural rate of unemployment or the currency that is reliable with equilibrium of external accounts. The model determines where the rate of exchange has to join to yet, it gives very small amounts of direction to the short-term variations (Hoontrakul, 1999).

3.2.2 Purchasing power parity (PPP) theory

The Purchasing power parity theory postulates that spot exchange rate between currencies will vary to the differential in inflation rate between countries. The changes in spot exchange rate are encouraged by the acts of importers and exporters caused by cross country price disparity. PPP implies that on foreign markets, operations on a country's current account influence the value of the rate of exchange.

The PPP theory is broadly defined as either being absolute or relative in nature. The absolute PPP theory holds that the equilibrium exchange rate between two currencies is equal to the ratio of the price levels in the two countries. This simply means that it adheres to the 'law of one price', whereby goods are identically priced between countries across efficient market (Sandler, 2010) or in other words after two currencies are transformed into a common currency, and then the same products should be sold at the same price (Van der Merwe & Mollentze, 2012). This is due to the arbitrage process whereby the demand for a good at a lower cost rises

as the demand for a similar good at a greater value declines in anticipation that the values of the goods are precisely identical (Dornbusch, 1985).

However, this theory can be misleading as it appears to give the exchange rate that equilibrates trade in goods and services while completely disregarding the capital account. Therefore, a country experiencing capital outflows would incur a deficit in its BOP while those receiving capital inflows would incur a surplus if the exchange rate were the one that equilibrated international trade in goods and services. Furthermore, the theory does not give the exchange rate that equilibrates trade in goods and services due to the existence of many nontrade goods and services. Since the general price level in each nation includes both traded and nontrade commodities and prices of the latter are not equalized by international trade, the absolute PPP theory does not lead to the exchange rate that equilibrates trade. Lastly, it does not take into account transportation costs or other obstructions to free flow of international trade.

On the other hand, relative PPP theory postulates that the change in the exchange rate over a period of time should be proportional to the relative change in the price levels in the two countries over the same time period. This means that exchange rates between countries will adjust accordingly to changes in prices of goods and services within them (Sonlik, 2000). The parity of the purchasing power determines the equilibrium currency exchange rate between two inconvertible paper currencies. That is, their relative price level establishes the exchange rate between two countries (Obadan, 2006). In addition, when a country's domestic price level increases (meaning that when inflation occurs), that country's exchange rate must devalue and return to PPP.

It is important to note that if absolute PPP held, the relative PPP would also hold. However, when the relative PPP holds, the absolute PPP not hold. For instance, while the very existence of capital flows, transportation costs, other obstruction to the free flow of international trade and government intervention policies leads to the rejection of the absolute PPP, only a change in these would lead the relative PPP theory off track.

Therefore, absolute PPP posits that the exchange rate is the adjustment mechanism between countries while relative PPP posits that the exchange rate is the adjustment mechanism between domestic markets (Sandler, 2010).

3.2.3 The Balassa-Samuelson (BS) hypothesis

Balassa and Samuelson (1964) developed a hypothesis that rich countries had higher absolute productivity and were more productive in internationally traded- goods. The theory analyses the relationship between real exchange rate appreciation and increase in productivity in the traded goods sector. The Balassa-Samuelson effect states that countries with higher income per capita, have a higher real exchange rate. When these relative differences in productivity continued over time, they would mean that PPP no longer applied and long-run PPP would need to be adjusted accordingly. According to BS, a country that has relatively high productivity growth experiences exchange rates that are overvalued relative to PPP. The overvaluation of the currency increases with productivity gap between the domestic country and foreign countries (Majaya, 2017).

Solanes and Flores (2009) found a positive relationship between relative economic growth with real exchange rate, an indication that depreciation stimulates economic growth. This approach generally suits fast growing countries than slow growing countries (Sibanda, 2012).

While Chong, Jorda and Taylor (2012) investigated the BS effect for the period 1973-2008 for 21 OECD countries. The results support the BS hypothesis moreover; it was found that equilibrium adjustment in the long-run took between .5 to 2 years much shorter than findings of earlier studies.

However, the BS hypothesis is associated with its key assumptions. The law of one price under which only domestic prices determine the real exchange rate cannot be observed in the real world (Tyers & Zang, 2014). This is due to factors such as "sticky prices, trade costs", the difference in product specifications and prices and "pricing to market" (Engel & Rogers, 1996). Therefore, factors that affect price levels for good that can be traded internationally for a country, as well as the relative prices of goods that can only be sold within the domestic economy will affect the exchange rate (Majaya, 2017).

3.2.4 The asset approach

The asset approach posit that financial markets determine the exchange rate in the short- run while trade and fundamentals play the dominant role in the medium to long-run (De Jong, 1997). The theory argues that the rate of exchange is established in the course of equilibrating or balancing the demand and supply of financial assets in each country (Salvatore,

2012).Therefore the asset approach is divided into two. It consists of the portfolio balance approach and the monetary approach.

3.2.4.1 The portfolio balance approach

The portfolio balance theory does not only focus on the view that a currency is controlled by market forces of demand and supply but also looks into the supply and demand for fiscal assets in every individual nation (Van der Merwe & Mollentze, 2012). The model contains fours assets, namely; home money, foreign money, home currency securities and foreign currency securities. The model assumes "that there is imperfect substitutability between domestic and foreign asset" (Sandler, 2010)

Macdonal and Taylor (1992) are of the opinion that supply and demand determines the exchange rate at any rate in the short-run for a wide range of financial assets. Thus, it is an asset pricing outlook of the rate of exchange. The basic thought of this approach is that there is a portfolio option among domestic and foreign assets. These tools can be cash or bonds whereby an estimated return could be arbitraged. Hence, the arbitrage prospect is what regulates the development of the rate of exchange (Dornbusch, 1988).

According to this approach, the link between the rate of interest and assets (identified as investments) are major links between exchange rate and investment. This theory differs from other exchange rate theories as it takes into account, adjustments within financial flows that add to variations in the rates of exchange (Van der Merwe & Mollentze, 2012).

According to the study of (Black, 2015) though the portfolio balance model is attractive it failed together with other empirical models to provide convincing results. Over the years, extension to the portfolio balance concept includes a general equilibrium setting and a modification to include central bank intervention and non-rational expectations. The more recent use of order flows in the micro structural approach appears to show potential as an empirical explanation of exchange rate behaviuor (Sandler, 2010)

3.2.4.2 The monetary approach

Robert Mundell and Harry Gordon Johnson improved the monetary approach from 1960 to 1970 (Van der Merwe & Mollentze, 2012). This concept was developed due to the shortfall of

the portfolio balance theory (Udoye, 2009). This theory illustrates that the rate of exchange is regulated by the supply and demand of currency among two states. The monetary exchange rate model assumes that through the fundamentals of money supply and demands it is possible to stabiles or direct the exchange rate through the PPP relationship (Cushman, 2000).

This theory is an extension to PPP and theoretically describes the nominal exchange rate and connects it to monetary fundamentals. Fluctuations in the exchange rate are due to the movements of monetary variables. The key overarching assumption in the monetary approach is the preservation of PPP between countries (Civcir, 2004).

It diverges from the portfolio approach to the rates of exchange as the monetary approach to the rates of exchange and affirms that domestic and foreign bonds are completely substitutable to each other (Husted & Melvin, 2007). With this model, equilibrium is obtained when existing stocks of money in two countries are willingly held (Frankel, 1978). Frankel (1984) states that there are two versions in which the exchange rate can be determined through the monetary approach. That is, it assumes that in the market, there are perfectly flexible goods prices and other versions in the market. This is an indication that there are sticky goods prices.

In addition, this theory believes there is a link between the demand for money and level of national income. Hence, it is believed that the relationship is positive and stable in the long-run (Maepa, 2015).

The theory tries to address the limitations of PPP. Although the monetary approach appears to be acceptable, empirical work on the model has not been convincing. Moreover, it does not cover the full set of fundamental determinants of real exchange rate. This gap has led to a number of additional theoretical frameworks which includes portfolio balance and those that are based on fundamentals (Majaya, 2017).

3.2.5 The traditional approach

The traditional approach holds that devaluation has expansionary effects on economic growth. This is an indication that the depreciation of a currency causes local goods to be expensive overseas, which in turn, raises their demand, thus resulting in a growth in exports (Salvatore, 2005). The two main channels through which exchange rate affects economic growth are: the total factor productivity growth channel; and the capital accumulation channel.

3.2.5.1 The total productivity channel

The total productivity channel states that rate of exchange devaluation moves the invention of traded products from non-traded products in an output composition of a nation. The connection from output composition to development is all the way through economy-wide productivity improvements created by the production of a few kinds of traded goods (Montiel & Serven, 2008). This shifts the production of traded goods and improvement in technology, leading to a rise in local investments locally, an increase in exports and a rise in economic growth. However, due to lack of empirical support, there is no empirical investigation on the effects of total factor productivity channel of real exchange rate undervaluation on the growth rate of economy (Mbaye, 2012).

3.2.5.2 The capital accumulation channel

The capital accumulation channel holds that exchange rate affects the growth rate of the economy throughout the outcome on savings. The real exchange rate undervaluation stimulates economic development through a rise in capital stock of the economy as a whole (Mbaye, 2012). According to the background of this channel, a devalued real exchange rate has a trend to boost the domestic saving rate. An increase in savings rate, encouraged by depreciation, enhances the growth rate of the economy through raising the rate of capital accumulation.

Montiel and Serven (2008) further explained that in order to understand the capital accumulation channel, it is essential to note that there are two theoretical links in the casual chain that underlies the capital accumulation channel. The first being the real exchange rate to the saving rate and the second from saving rate to growth. Moreover, he argued that if real exchange rate is implemented as a policy target, an expansion in a nations current account balance due to depreciation which therefore increases the nations saving rate relative to its investment rate.

Nevertheless, the traditional approach exposes challenges with regard to low economically developed countries as they generally depend on imported capital goods and infrastructure. Although a depreciation in a country's currency results in exports being cheaper for external buyers, imports become dearer for local buyers. Therefore local firms that rely on imported capital goods pass the extra cost to customers through high prices resulting in inflation.

3.2.6 The structuralist approach

Contrary to the traditional approach, the structuralist approach maintains that currency devaluation may contain a contractionary outcome on output and employment. It shows that currency devaluation might cause a decrease in output. In order for the structuralist approach to hold, it has a number of channels in which it functions. These channels the rate of exchange devaluation causes a decrease in aggregate demand and eventually, national output. Furthermore, the contractionary effect mainly due to a rise in price levels and a policy to devalue the currency can end up contradicting macro polices that seek to stabilise the macro-economy through a decrease in inflation (Sibanda, 2012).

3.3 Empirical framework

In this section, a review of studies conducted by other researchers on the link between exchange rates and economic growth is presented. The various methods of estimation employed depending on their type of country and period of study are also examined. From the empirical evidence provided, it is clear that the results obtained differ from one study to another.

Tang (2015) examined the long-run equilibrium and short-run dynamics between real exchange rate and economic growth in China. The period of study was from January 1994 to December 2012 using a cointegrated vector autoregression (CVAR) model. The study consisted of variables such as nominal exchange rate, nominal gross domestic product, the consumer price index of the US and China, foreign exchange reserves, foreign direct investment and imports and exports. From the results of cointergration, it is clear that China's growth has not benefitted from the devaluation of Renminbi (RMB).From the empirical evidence, the economy was stimulated by the expansion of exports and inflow of foreign capital. In the long-run, foreign direct investment and exports show a positive impact on real exchange rate and economic growth while a negative impact of imports and foreign exchange reserves are found on real exchange rate and economic growth. Yet, in the long-run, there is no direct link between real exchange rate and economic growth while in the short-run, the RMB policy reform in 2005 contributed to growth but not to real exchange rate. The determinants of the Chinese currency are foreign trade, foreign exchange reserves and foreign direct investment. It is also concluded that the Chinese authorities may insist on the managed floating exchange rate system in order

to make adjustments of the daily floating range if the RMB exchanges rates. Furthermore, in the long-run, it should concentrate on the improvement of capital and technical intensive products as well as upgrade the existing export structure since it will not only contribute to growth but maintain the stability of the Chinese currency. This study differs from the current study in terms of the chosen country, the period of investigation (from 1980 to 2015), the methodology used in conducting the study (VECM estimation technique) as well as the variables used in the study.

Papanikos (2015) examined real exchange rate of the Euro and growth rate of the Greek economy. In the study, the researcher disputes the fact that since World War II, an overvalued Euro caused Greece's GDP growth to drop. It is claimed that a decrease in GDP growth would have been avoided if the European Central Bank's monetary and exchange rate policy was different to countries that incurred the most from the world economic crisis in 2007. It was established in the study that there is a negative impact on the Greek economic growth due to the Euro-Dollar misalignment. Also, 20% of the real effective exchange rate of the Euro was undervalued, which negatively affected the Greek economic growth. Further research is needed, considering the bilateral economic relations with its neighbouring countries since the results of the present study are indicative of the impact of the European exchange rate policy on the duration and severity of the recession in Greece. The results of this study are comparable to the current study since a negative relationship between exchange rate and the growth rate of the economy was established.

Owoundi (2016) studied the growth effects of currency misalignments in sub-Saharan African countries and the Franc Zone in particular. A sample group of 16 sub-Saharan African countries were examined (6 of the countries are part of the Franc Zone and the period of study covered is from 1980 to 2011 on an annual basis). This study is different from the present one as since an investigation of the relationship between exchange rate and economic growth in South Africa from 1980 to 2015 was done. The study followed three stages as follows: the behavioural approach of the equilibrium exchange rate was first employed in order to establish real exchange rate misalignments; the second stage relied on the latest Bayesian inference technique which assesses the probability of whether or not to include two variables together by determining the probability of inclusion for each variable as well as to control any jointness relationships between all pairs of selected determinants; while the third stage (through several specifications of the final growth equation) was estimated to prove consistency of results for membership in a fixed exchange system. It was concluded that deviations of REER from its

equilibrium level do not exercise a favorable effect on growth irrespective of the currency is overvalued or undervalued. Moreover, the decomposition of misalignments indicators illustrated negative effect of overvaluation and a statistically nil effect of undervaluation contrary to the experience of Asian countries.

Ihnatov and Căpraru (2012) assessed the effect of exchange rate regimes on economic growth from 1999 to 2010 for 16 Central and East European countries. The study employed the Ordinary Least Square (OLS) and Generalised Method of Moments (GMM) estimation technique to estimate a growth model with dummy variables in order to separate the effect of exchange rate regimes on economic growth. Data was collected from the World Bank, the United Nations, the International Monetary Fund (IMF) and the web pages of the Heritage Foundation. This study is also different from the current study in terms of the period covered and the methodology used. The results obtained revealed that only certain control variables have significant coefficients in the regression model and their signs are in line with economic growth theory. The results obtained are similar as all variables were also significant in the present study. For the regime dummy variables, the results are statistically significant. This might be due to the floating regimes during the sample period that presented the best results. However, the results implied for macroeconomic stabilisation of the currency boards may be suitable for short periods of time than in the long run. It was also found that in less developed countries, flexible rates favour economic growth. In conclusion, based on the *de jure* classification, it was discovered that exchange rate stability does not have an impact on economic growth if obtained through enormous authorised interventions to the exchange rate. One of the shortcomings of the study was the application of *de jure* classification exchange rate regime classification. Further research could be done using different classifications in order to determine the effect of exchange rate on economic growth.

Kandil (2004) studied the outcomes of exchange rate fluctuations on real output growth along with price inflation for 22 developing countries. The author argues that the depreciation of a domestic currency all the way through an initial rise in the price of foreign goods relative to home goods, could stimulate economic activity. A theoretical model was employed which decomposes the movements of the exchange rate into anticipated and unanticipated components. The impact of anticipated exchange rate shifts in the long run is assessed through a significant decrease in output growth and a significant rise in price inflation. On the other hand, unanticipated exchange rate shifts during the short-run. Through the demand and supply channels, in the face of unanticipated currency depreciation, there is proof of a significant

contraction of output growth as well as price inflation determined by demand expansion and supply contraction. In conclusion, the study revealed that in a range of developing countries, the exchange rate of fluctuations generates unfavourable consequences on economic performance. These outcomes are clear by means of output contraction and price inflation during a phase of currency devaluation. It is recommended in this study that exchange rate policies should aim at minimising unanticipated currency fluctuations in order to insulate economic performance from unfavourable outcomes of inconsistency in developing countries. Moreover, evidence from empirical studies suggests that the exchange rate should be stabilised at a level that is reliable with difference in macroeconomic fundamentals over time.

Tarawalie (2010) investigated the impact of real effective rate of exchange on economic growth in Sierra Leona. The author used quarterly data from 1990Q1 to 2006Q4.Data was obtained from International Financial Statistics (2007) published by the IMF and the Bank of Sierra Leone Bulletin. The Johansen cointegration technique was used along with a bivariate Granger causality test which examined the relationship between real exchange rate and economic growth. Quarterly data was used in the study while annual data was used in the current study. However, the method of estimation used is the same (the Johansen cointegration technique). The government of Sierra Leone considers exchange rate to be an important macroeconomic tool to ensure low inflation rate, a stable financial system along with promoting exports, controlling imports and enhancing economic growth. The empirical results obtained indicate that there is a positive relationship between real effective exchange rate and economic growth supported by statistically significant coefficients. The results are different from the current study as a negative relationship was found between exchange rate and the growth rate of the South African economy. The results also showed that in the long-run, the monetary policy is somewhat, more efficient than the fiscal policy (which is in line with the basic Mundell-Fleming model). Equally, the determinants of real exchange rate were found to be exchange rate devaluation, investment to GDP ratio, terms of trade and excessive supply of domestic credit. For policymakers, it is recommended in this study that in order to obtain macroeconomic solidity, the monetary policy and fiscal policy should be in consonance. Importantly, it is necessary to maintain a stable exchange rate by letting the exchange rate to depreciate within a given band as well as maintain a stable political environment to recover investment.

The study of Kabundi and Schaling (2014) focuses more on the positive of real depreciation rather than the pass-through from the period 1994 to 2011 in South Africa. The Johansen cointegration technique was used in the study followed by the vector error correction model.

The results showed that in the long run, net exports are increased by a weaker real effective exchange rate yet, it does not sustain in the short-run. There is evidence of the existence of the J-curve effect.

Alawin, Sawaie, Al-Omar and Al-Hamdi (2013) examined the impact of real effective exchange rate on the Jordon economy through the aggregate demand-supply theoretical framework. The method used was the fully modified Ordinary Least Square (OLS) to determine the relationship between real effective exchange rate and economic activity. The study employed financial variables such as narrow monetary supply (M1) and broad money supply (M2) and GDP, and data was obtained from the Central Bank of Jordon and the Department of Statistics. The theories are based on aggregate demand and aggregate supply to test the relationship. This study is different from the current study as it employed the OLS method while in the present study, the Johansen cointegration with VECM and Granger causality test were employed. The variables chosen are also different from those used in the current study. As the traditional theory implies, the results revealed that the appreciation of real effective exchange rate does not reflect international competitiveness of the Jordanian goods, an indication that the government of Jordan should maintain stability in real exchange rate in the economy. The empirical results showed that the impact of real exchange rate works through aggregate supply and a rise in real effective exchange rate enhances economic growth. In contrast, it was found that narrow money supply was more effective and because the total price elasticity of exports and imports were found to be less than 1, the Marshall-Lerner condition was not obtained. The two polices recommended in the study were as follows: to use the policy of real rate of exchange as one of the macroeconomic policies and maintain a fixed rate of exchange; and as an active variable, focus on the narrow money supply in the Jordanian monetary policy.

Rodrik (2008) maintains that a high real exchange rate, which is an undervaluation of the currency, encourages economic growth, particularly with developing countries. The study covered seven developing countries from 1950 to 2004. Data was obtained from Penn World Table and the method used was the PPP-based index of real exchange rate undervaluation in a fixed effect model. This study is related to the current one in terms of its conception. However, it differs in many ways as it covers seven developing countries while in the current study; focus is only on one country. The period of the study covered also differs. The present study covers the period from 1980 to 2015. Rodrik (2008) confirmed in his study that the impact of growth undervaluation is closely dependent on a country's level of development. He argues that a

sustained real depreciation increases the relative profitability of investing in tradable and acts in second-best fashion to alleviate the economic cost of these distortions. It also promotes economic growth by speeding up structural change hence, episodes of undervaluation are strongly associated with more rapid economic growth.

Similarly, Rapetti, Skott and Razmi (2011) found a positive relationship between real exchange rate undervaluation and economic growth. Rodrik (2008) maintains that the impact of real exchange rate growth is more rampant in developing countries. Rapetti *et al.* conducted a study by dividing the sample between developed and developing countries and used various methods and classification criteria. Data was obtained from the Penn World Table. The results obtained indicated a strong positive link between real exchange rate undervaluation and the growth rate of the economy. It was found that in developing countries, the effect of currency undervaluation on growth is huge and more robust.

Uddin, Rahman and Quaosar (2014) examined the relationship between exchange rate and economic growth in Bangladesh. The time period of the study covered was from 1973 to 2013and employed times series econometric technique such as the Augmented Dickey-Fuller test (ADF), Granger causality test and the Johansen cointegration model. Data was collected from the Bangladesh Bank, the Bangladesh Bureau of Statistics, the Asian Development Bank, the International Financial Statistics and World Development Indicators. The empirical results showed that there was a significant positive relationship between exchange rate and economic growth. The Granger's causality test proved that a bi-directional causality runs through exchange rate to economic growth and vice-versa which was indicated by the existence of a long-run equilibrium relationship between exchange rate and economic growth.

Bibi, Ahmad and Rashid (2014) conducted an empirical study on the role of exchange rate, trade openness, inflation, imports, exports, real exchange and foreign direct investment, which improve economic growth in Pakistan. The period of study was from 1980 to 2011 using times series data. The methods used to determine stationarity were: ADF; Philips Peron (PP) and Dickey-Fuller Generalised Least Square (DF-GLS); and cointegration and Dynamic Ordinary Least Square (DOLS) estimation techniques. The results of the cointegration showed that a long-run relationship existed between the variables. On the contrary, inflation and trade openness imposed a negative impact on economic growth, which is supported by results of the DOLS (that trade openness is negatively related to economic growth due to depreciation in the exchange rate along with huge volumes of importing resulting in trade deficit and foreign direct

investment, imports, exports and exchange rate influenced positively by economic growth). Although a positive relationship was shown between exchange rate and economic growth, there is no significant relationship as the local economic performance of economic growth is much sensitive to the variation in the exchange rate in the long period. It is recommended that policymakers should take the presence and amount of exchange rate instability into account as well as the influence of changes in exchange rate on each macroeconomic factor of trade policy and foreign direct investment.

Ayodele (2014) studied the impact of exchange rate on the Nigerian economy from 2000 to 2012. Inflation rate and exchange rate are factors measured in change in Gross Domestic Product. Secondary data was collected from Annual Reports of the Central Bank of Nigeria, the Nigerian Stock Exchange and the Nigerian Securities and Exchange Commission. Multiple regression models were used in the study. It was found that as exchange rate increased, it negatively affected economic growth. This is an indication that exchange rate had a negative impact on GDP while inflation rate exerted a positive impact on economic growth, thus showing that firms were willing to produce more when the rate of inflation was higher. The negative effect of the rate of exchange did not allow the economy to boost as anticipated, although the economic growth rate increased every year in Nigeria. The author suggested that in order to accelerate economic growth, through a favourable exchange rate, and to decrease the pressure of the Dollar, the government should be informed to make the investment climate friendly in the Nigerian economy by reinstating safety of lives and property, infrastructural growth and development in the local production.

Hua (2011) analysed the impact of real exchange rate on economic growth by examining the precise transmission channels of how exchange rate acts on growth. He also stated that real exchange rate has various economic and social effects. In his study, he argues that if real exchange rate can bring positive effects on economic growth, such as putting pressure on efficiency improvement, technological progress through worker's motivation, education and capital intensity, then it can bring along negative effects as well by deteriorating the international competitiveness in the trade sector and destroying employment. In order to understand the economic and social effects of real exchange rate, an econometric model was employed in the study (the GMM system approach for panel data of 29 Chinese provinces from 1987 to 2008). The Levin-Lin-Chu panel unit root test was applied to all the variables. The results of study indicated that in coastal areas, the real exchange rate appreciation had a

negative effect on economic growth. In addition, a negative effect of real exchange rate on employment, exports, industrial production share, FDI and state-owned enterprise prevailed over the positive impact of an overvaluation of real exchange rate by capital intensity, level of education and efficiency.

Wong (2013) examined the real exchange rate misalignment and economic growth in Malaysia. The study used annual data from 1971 to 2008. An Autoregressive Distributed Lag Model (ARDL) and generalised forecast error variance decomposition approach were used. The results revealed that in the long-run, an increase in real interest rate differential, productivity differential and the real oil price or reserve differential, will lead to an appreciation of the real exchange rate. It also showed that a rise in real exchange rate misalignment would lead to a reduction in economic growth. Particularly, devaluation will promote economic growth while appreciation will hurt economic growth. The results of the generalised forecast error variance decomposition showed that real interest rate differential, productivity differential, real oil price and reserve differential are important in determining the real exchange rate. According to the fundamentals, real exchange rate misalignment should be evaded in order to facilitate the allocation of resources in the economy. It was recommended in the study that government intervention is necessary during the short-run to minimise real exchange rate misalignment and to smooth down the fluctuations of the exchange rate while in the long-run, markets and financial organisations should be strengthened.

Basirat, Nasirpour and Jorjorzadeh (2014) studied the effects of the rate of exchange instability on economic growth, taking into account the speed of growth of financial markets in developing countries. The authors analysed panel data of 18countries from 1986 to 2010.The 5-year mean was used for each of the variables in order to eliminate the effects of short-term cycles as well as to avoid fluctuating annual data from denting the results. The World Development Indicator from the website of the World Bank was used to obtain statistics for all the variables. The results revealed that there is a negative and significant effect of financial development and exchange rate fluctuation on economic growth. Whereas, a positive effect was obtained from the mutual effect of exchange rate fluctuations and financial development on economic growth although it is not statistically significant as the effect in the countries studied is small.

Harberger (2003) considered the real rate of exchange and the growth rate of the economy by adopting the Balassa-Samuelson effect. However, the results of the study were too complex as

they did not have a strong tendency for the real exchange rate (whether it increases or decreases).

Aman, Ullah, Khan and Khan (2013) examined the link between the rate of exchange and the growth rate of the Pakistan economy. The study covered the period 1976 to 2010 and data was collected from the World Bank database and the Pakistan Economic Surveys. This study is an indirect approach as theoretical literature is inadequate to clarify the exact link since most of the academic literature emphasises an indirect relationship because exchange rate encourages growth through export, investment and internal trade. Hence, it employed the simultaneous equation model with two and three stage least square techniques. It was found that there is a positive relationship between exchange rate and economic growth all the way through the channel of export promotion incentives, expanding the volume of investment, improving FDI inflow and encouraging import substitute industry. Although a positive relationship was found, exchange rate cannot be used as a policy tool to increase growth with regard to Pakistan.

Akpan and Atan (2012) explored the effects of the rate of exchange actions on real output growth in Nigeria. The authors used quarterly data from 1986 to 2010 obtained from the International Monetary Fund, Financial Statistics (FS) and the Central Bank of Nigeria (CBN) statistical Bulletins. The authors also examined the possible direct and indirect relationship between exchange rates and GDP growth. Two methods of investigation were used in the study as follows: First, was the simultaneous equation model within a fully specified macroeconomic model and GMM. Based on the results, there is a statistically significant direct relationship between the two variables. The exchange rate and income may flow separately in the long-run. However, in the short-run, their relationship is direct and strong. The results of the vector auto regression showed that real exchange rate and real income are significantly cointegrated. Nevertheless, there was no strong evidence of a direct relationship between changes in the rate of exchange and growth output. Instead the monetary variables affected economic growth in Nigeria. In conclusion, the authors suggested that an improvement in exchange rate management framework is important; however, not sufficient to restart the Nigerian economy. Abroad programme of economic reform was thus recommended in order to complement the exchange rate policy adopted.

Likewise, McPherson and Rakovski (2000) examined the link between exchange rate and economic growth in Kenya from 1970 to 1996. Data was obtained from the IMF, International Financial Statistics, World Tables and the World Bank. The authors explored the probable

direct and indirect relationship between real and nominal exchange rate and GDP growth as well as emphasised the significance of other economic aspects that influenced their interaction. The authors used various methods such as the single equation regression, a system of simulations equations and a Vector Autoregressive Regression (VAR) model test. The results indicated that there is no significant direct relationship between the two variables but, rather, are indirectly related by some channels such as money, imports, agricultural production and foreign aid. Real exchange rate and real income were found to be significantly not co-integrated as shown by the results of the vector auto regression test. Furthermore, their relationship was found to be weak and indirect in the short-run.

Ndhlela (2012) evaluated an empirical analysis of the relationship between real GDP and real exchange rate misalignment for Zimbabwe. The period of the study was from 1985 to 1994 based on monthly data from the Reserve Bank of Zimbabwe. The method used in the study was the ARDL estimation technique. In this study, the author explored the hypothesis that real exchange rate overvaluation was caused by inconsistent macroeconomic policies as well as distorted resource allocation away from productive activities resulting in a decrease in real GDP growth. The results revealed that a negative and highly statistically significant impact of exchange rate misalignment exercised growth. In addition, a decrease in Zimbabwe's growth was due to real exchange rate misalignment caused by a combination of excessively expansionary monetary and fiscal policies. A decrease in real GDP growth is highly elastic to a rise in real exchange rate overvaluation. During periods of real exchange rate overvaluation, empirical evidence from Zimbabwe revealed that it is linked with negative growth effects. In conclusion, both theory and empirical evidence revealed that keeping the real exchange rate at level or close to, or below equilibrium by evading periods of protracted real exchange rate, overvaluation economic growth could be achieved.

Sibanda (2012) studied the impact of real exchange rates on the South African economy. The author used quarterly time series data from 1994 to 2010. Data was obtained from DTI, SARB and StatsSA. The author used Johansen cointegration and vector error correction models. Explanatory variables such as real exchange rate, real interest rate, money supply, trade openness and gross fixed capital formation were used in the study. In the long-run, the results showed that real exchange rates, gross fixed capital formation and real interest rate imposed a positive impact on economic growth while money supply and trade openness imposed a negative impact on economic growth. Furthermore, the results of regression revealed that in the long-run, undervaluation of the rate of exchange drastically slows down the growth of the

economy while in the short-run, it stimulates economic growth. The researcher recommended that exchange rate misalignment should be avoided at all cost and that the present financial strategy in South Africa be maintained since interest rates also impose a major impact on the growth rate of the economy.

Khondker, Bidisha and Razzaque (2012) assessed the effects of changes in the rate of exchange on economic growth in Bangladesh. The period considered in this study was from 1980 to 2012 and data was obtained from different government documents such as the Bangladesh Economic Survey and the Bangladesh Bank of Publications. A Keynesian analytical framework was used in order to obtain an empirical specification. Areal exchange rate series as well as cointegration techniques were used to determine the output response for depreciation. The results presented several major findings such as movements in the real exchange rate does affect the overall output and the effect is borne out even after controlling other variables. Moreover, the long-run effects of real devaluations are found to be positive; however, in the short-run, it is likely to be contractionary.

Ali *et al.* (2013) examined the impact of inflation, nominal exchange rate, Foreign Direct Investment (FDI) and capital stock on economic growth in Pakistan. The authors used times series data from 1975 to 2011.Data was obtained from economic surveys of Pakistan and World Development Indicators. Theoretically, the authors stated that there is a positive relationship between high rate of exchange and economic growth, an indication that depreciation or rather decrease of a currency, stimulates economic growth. The ADF test was employed to check stationarity while the OLS technique was used to determine the impact of exchange rate, FDI and capital stock on GDP. The results of the OLS showed that inflation and the rate of exchange impose a negative and major effect on the growth rate of the economy. FDI imposes a positive and significant effect on economic growth while capital stock does not significantly affect economic growth. The authors suggested that government should come up with measures to increase the standard of exporting goods to make smooth balance of trade. Pakistan is a country that seems to be facing severe crises and threats as one of its major problems is balance of trade. Measures should thus be taken to reduce trade deficits. The authors also suggest that Pakistan should export finished goods instead of raw materials, followed by encouraging industrial-based production.

Aron, Elbadawi and Kahn (1997) argue that real exchange rate is a key policy variable in South Africa's open economy. The study covered the period from 1970:1 to 1995:1 and was based

on quarterly data. The authors examined the determinants of real exchange rate in the short-run and long-run equilibrium through the use of a cointegration framework with single equation equilibrium correction models. The macroeconomic balance approach (which focuses on the simultaneous achievement of internal and external balance for given sustainable values of variables) was used in the study.

Adeniran, Yusuf and Adeyemi (2014) conducted a study on the impact of exchange rate on economic growth in Nigeria from 1986 to 2013. The authors used secondary data obtained from various sources such as the Central Bank of Nigeria Statistical Bulletin. The OLS estimation technique was employed to determine the relation between exchange rate and economic growth. The results showed an insignificant but positive impact of exchange rate on economic growth while interest rate and inflation were also found to be insignificant but negative on economic growth. The authors suggested that government should support export promotion strategies to assist in maintaining a surplus balance of trade as well as a favourable environment along with adequate security and infrastructural facilities. In order to attract investors, effective fiscal and monetary policy should be provided.

Akpan (2008) studied foreign exchange markets and economic growth in an emerging economy (such as the case of Nigeria). The study focused more on the implications of exchange rate movements on economic growth from 1970 to 2003. The method used was the OLS based on times series data obtained from the Central Bank of Nigeria Statistical Bulletin. A positive relationship between exchange rate, volatility and economic growth was maintained. The results showed that exchange rate movement affects economic growth positively and a rise in volatility of exchange rate boosts economic growth. Therefore, the authors advised that exchange rate policy should be planned to link the savings investment gap to stimulate government revenue along with a reduction in fiscal gap by limiting deficits aimed at improvements in economic growth.

Zwedala (2013) investigated the effects of real exchange rate misalignment on economic growth in South Africa. The author also determined the level of real exchange equilibrium, misalignment in the real value of the Rand and how misalignment affected economic growth. The period considered was from 1985 to 2011 and a vector error correction model was adopted to estimate the real exchange rate equilibrium. To determine the effect of real exchange rate misalignment on the economy, a least square method was employed. The results obtained indicated a positive coefficient of real exchange rate; an indication that misalignment in the

Rand value did not affect economic growth negatively. From the results, it could be concluded that in South Africa, misalignment usually enhances economic growth, especially when the currency is undervalued. In order to increase economic growth, real exchange rate should be kept at competitive levels.

Mohieldin and Elsherif (2008) study focused on real exchange rate misalignments and economic growth for Arab countries using panel data covering from 2000 to 2016. The econometric estimation technique employed was the GMM approach. The results obtained revealed that exchange rate misalignment had a negative and significant impact on growth in the Arab countries.

Jager (2012) presented a model of South Africa's equilibrium real effective exchange rate using a VECM approach. The author investigated various factors that could have an impact on the level of the exchange rate, thus a suitable model is estimated to measure the level of equilibrium real effective exchange rate. The results obtained from the model revealed that equilibrium level may be determined by the effects of key economic fundamentals such as interest rate differential, a suitable productivity measure, commodity prices, fiscal balance and capital flows. The author also pointed out that the model only indicated a possible equilibrium level based on the given economic fundamentals. A clear indication is given that exchange rate is inconsistent with its fundamental's however; it does not state that the equilibrium level can be viewed as the correct value without a doubt.

From the literature examined; it is found that the relationship between real exchange rate and economic growth have various results such as; Tang (2015) who did a study on the Chinese economy employed a cointegrated vector autoregression (CVAR) model and found that growth has not benefitted from the devaluation of RMB as no direct link was found between exchange rate and growth in China, Tarawalie (2010) investigated the impact of real effective rate of exchange on economic growth in Sierra Leona. The Johansen cointegration technique was used along with a bivariate Granger causality test which examined the relationship between real exchange rate and economic growth. The empirical results obtained indicate that there is a positive relationship between real effective exchange rate and economic growth supported by statistically significant coefficients. Alawin, Sawaie, Al-Omar and Al-Hamdi (2013) examined the impact of real effective exchange rate on the Jordon economy through the aggregate demand-supply theoretical framework and used the fully modified Odinary Least Square (OLS). The results from the study revealed that appreciation of real effective exchange rate

does not reflect international competitiveness of Jordan goods meaning the government should maintain the stability of the currency. On the other hand, a study by McPherson and Rakovski (2000) examined the link between exchange rate and economic growth in Kenya, the authors used various methods such as the single equation regression, a system of simulations equations and a Vector Autoregressive Regression (VAR) model test. The authors found that no direct significant relationship exists between the two variables but rather are indirectly related.

Meanwhile, Wong (2013) examined the real exchange rate misalignment and economic growth in Malaysia using an Autoregressive Distributed Lag Model (ARDL) and generalised forecast error variance decomposition approach found the increase in real exchange rate misalignment would lead to a reduction in economic growth. Similarly, Ndhlela (2012) who used the ARDL estimation technique for Zimbabwe and; Mohieldin and Elsherif (2008) who used panel data covering from 2000 to 2016 along with GMM approach for Arab countries, found a negative significant impact of real exchange rate misalignment on growth.

Alternatively, Papanikos (2015) examined real exchange rate of the Euro and growth rate of the Greek economy. The researcher disputes the fact that since World War II, an overvalued Euro caused Greece's GDP growth to drop. It was established in the study that there is a negative impact on the Greek economic growth due to the Euro-Dollar misalignment. Also, 20% of the real effective exchange rate of the Euro was undervalued, which negatively affected the Greek economic growth.

Moreover, Uddin, Rahman and Quaosar (2014) examined the relationship between exchange rate and economic growth in Bangladesh and employed times series econometric technique such as the Augmented Dickey-Fuller test (ADF), Granger causality test and the Johansen cointegration model while Khondker, Bidisha and Razzaque (2012) assessed the effects of changes in the rate of exchange on economic growth using a Keynesian analytical framework to obtain an empirical specification as well as cointegration techniques for the same country. The results of the two studies found that real exchange rate and growth do influence one another thus a positive relationship exists.

Other authors focused their study on the Nigerian economy such as Ayodele (2014) who used multiple regression model, Akpan and Atan (2012) used two methods; the simultaneous equation model within a fully specified macroeconomic model and GMM, Adeniran *et al.* (2014) and Akpan (2008) both used OLS estimation technique to determine the impact of exchange rate on growth. The results obtained from these studies differ from one another;

Ayodele (2014) who found a negative relationship while Akpan (2008) found a positive relationship; Akpan and Atan (2012) found a direct relationship between the two variables and Adeniran *et al.* (2014) found a positive but insignificant relationship.

Similarly, Ali *et al.* (2013) who employed OLS technique, Bibi *et al.* (2014) used Dickey-Fuller Generalised Least Square (DF-GLS); and cointegration and Dynamic Ordinary Least Square (DOLS) while and Aman *et al.* (2013) employed the simultaneous equation model with two and three stage least square techniques focused their study in Pakistan. Ali *et al.* (2013) found a negative relationship between real exchange rate and growth while Bibi *et al.* (2014) and Aman *et al.* (2013) found a positive relationship. However, Aman *et al.* (2013) stated though a positive relationship was found exchange rate cannot be used as a policy tool to increase growth with regard to Pakistan.

On the other hand, other studies were focused on a larger sample such as Owoundi (2016) who studied on sub-Saharan African countries and the Franc Zone in particular followed three stages: the behavioural approach of the equilibrium exchange rate; the second stage relied on the latest Bayesian inference technique; while the third stage was estimated to prove consistency of results for membership in a fixed exchange system. It was concluded that deviations of REER from its equilibrium level do not exercise a favorable effect on growth irrespective of the currency is overvalued or undervalued. Moreover, the decomposition of misalignments indicators illustrated negative effect of overvaluation and a statistically nil effect of undervaluation contrary to the experience of Asian countries. Ihnatov and Căpraru (2012) examined 16 Central and East European countries using OLS and GMM, based on the *de jure* classification, it was discovered that exchange rate stability does not have an impact on economic growth if obtained through enormous authorised interventions to the exchange rate. Kandil (2004) studied the outcomes of exchange rate fluctuations on real output growth along with price inflation for 22 developing countries for 22 developing countries. A theoretical model was employed which decomposes the movements of the exchange rate into anticipated and unanticipated components, the study revealed that in a range of developing countries, the exchange rate of fluctuations generates unfavorable consequences on economic performance and suggested that exchange rate policies should aim at minimising unanticipated currency fluctuations in order to insulate economic performance from unfavourable outcomes of inconsistency in developing countries. Basirat, Nasirpour and Jorjorzadeh (2014) in developing countries using panel data of 18countries, the results revealed that there is a negative and significant effect of financial development and exchange rate fluctuation on economic growth.

Whereas, a positive effect was obtained from the mutual effect of exchange rate fluctuations and financial development on economic growth although it is not statistically significant as the effect in the countries studied is small. Rodrik (2008) maintains that a high real exchange rate, which is an undervaluation of the currency, encourages economic growth, particularly with developing countries, the method used was the PPP-based index of real exchange rate undervaluation in a fixed effect model. He confirmed in his study that the impact of growth undervaluation is closely dependent on a country's level of development. Similarly, Rapetti *et al.* (2011), found a positive relationship between real exchange rate undervaluation and economic growth. Rapetti *et al.* conducted a study by dividing the sample between developed and developing countries and used various methods and classification criteria. It was found that in developing countries, the effect of currency undervaluation on growth is huge and more robust. Hua (2011) analysed the impact of real exchange rate on economic growth by examining the precise transmission channels of how exchange rate acts on growth using the GMM system approach for panel data of 29 Chinese provinces. The results of study indicated that in coastal areas, the real exchange rate appreciation had a negative effect on economic growth.

Sibanda (2012), Aron *et al.* (1997), Zwedala (2013), Schaling and Kabundi (2014) and Jager (2012) studied the impact of real exchange rate on the South African economy using Johansen cointegration and VECM. Sibanda (2012) found a positive relationship however, in the long-run, undervaluation of the rate of exchange drastically slows down the growth of the economy while in the short-run, and it stimulates economic growth. Similarly, Zwedala (2013) obtained a positive coefficient of real exchange rate an indication that misalignment in the Rand value did not affect economic growth negatively. It further concluded that in South Africa, misalignment usually enhances economic growth, especially when the currency is undervalued. In order to increase economic growth, real exchange rate should be kept at competitive levels. According to Jager (2012) the model suggested that equilibrium level may be determined by the effects of key economic fundamentals, including an interest rate differential, a suitable productivity measure, commodity prices, the fiscal balance and capital flows. The study of Kabundi and Schaling (2014) showed that in the long run, net exports are increased by a weaker real effective exchange rate yet, it does not sustain in the short-run. There is evidence of the existence of the J-curve effect.

Therefore three conclusions can be made, one there is a positive relationship between growth and real exchange rate which is found in studies like Alawin, Sawai, Al-Omar and Ali-Hamdi

(2013), Uddin, Rahman and Quasar (2014), Aman, Ullah, Khan and Khan (2013), Tarawalie (2010). Two there is negative relationship between growth and real exchange rate Ayodele (2014), Ndhela (2012), Kandil (2004), and three there is no relationship between growth and real exchange rate such as studies by Tang (2015), Ihnatov and Căpraru (2012).

3.4 Summary

The theoretical literature on exchange rate has been discussed in this chapter. Theories discussed included the balance of payment theory, purchasing power parity theory, the Balassa-Samuelson Hypothesis, the asset approach (which consists of the portfolio balance approach and the monetary approach), the traditional approach and the structuralist approach. The views of each theory were presented. For instance, the traditional theory maintains that depreciation of a country's exchange rate is expansionary on the economy while the structuralists argue that depreciation is contractionary. The Balassa-Samuelson hypothesis maintains there is a positive link between the rate of exchange and the growth rate of the economy.

In the second section of the chapter, empirical studies done by previous researchers on the relationship between exchange rate and economic growth in developing and developed countries, including South Africa were reviewed. Several results were found in determining the link between exchange rate and economic growth. However; a good number studies such as Bibi, Ahmad and Rashid (2014), Tarawalie (2010), Uddin, Rahman & Quaosar (2014) and Aman, Ullah, Khan & Khan (2013) found a positive relationship between the rate of exchange and economic growth while Zwedala (2013), Wong (2013) and Ndhela (2012) found no relationship between the rate of exchange and economic growth. In this study, a negative relationship is expected between the rate of exchange and economic growth for the South African economy (1980-2015). However most studies that are mentioned above determine whether real exchange rate influences economic growth or not. This study fills the gap as only few studies such as Tang (2015), Udoye (2009), and Mohieldin and Elsherif (2008) examined the influence of growth on real exchange rate. The next chapter presents the research methodology used in conducting the study.

Chapter 4

RESEARCH METHODOLOGY

4.1 Introduction

In this chapter, the techniques used in conducting the study are discussed. The variables used in the analysis were as follows: real exchange rate; real gross domestic product; interest rate; foreign direct investment; and trade openness. The theoretical framework, model specifications, source of data and definition of variables are also provided in this chapter. The last section explains the estimation techniques used to analyse the data (stationarity test under stationarity, visual inspection and Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root test and the lag order criteria) are also discussed. The Johansen cointegration test was performed in the study followed by the vector error correction model (VECM), VEC Granger causality test, the stability and diagnostics test as well as the variance decomposition and impulse response function.

4.2 Theoretical framework and Model specification

The main objective of this study was to investigate the relationship between real exchange rate and economic growth in South Africa. The dependent variable was real exchange rate (RER) and the explanatory variables were gross domestic product deflator (GDPD), foreign direct investment (FDI), export (EXP) and money supply (MS). Based on empirical literature such as Udoye (2009) and Tang (2015) the following equation was formed in order to determine the influence of economic growth on real exchange rate:

$$RER = F\ (GDPD,\ FDI,\ MS,\ EXP) \quad (4.1)$$

It was further modified and estimated as follows:

$$RER_t = \beta_0 + \beta_1 GDP_t + \beta_2 FDI_t + \beta_3 MS_t + \beta_4 EXP_t + \varepsilon_t \quad (4.2)$$

Whereby, *RER* is the dependent variable, β_0 is the intercept or slope, β_1 are the coefficients of the explanatory variables and ε_t is the error term. It is important to include the error term as it signifies other variables that can have an impact on RER but are not taken into account in the model.

It is important to change the regression equation into natural logarithm since it brings a stable trend and avoids heteroskedasticity throughout the period of study as well as eliminates the tendency of fluctuations over time (Mah, 2012). Therefore, the regression equation now becomes:

$$lnRER_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnFDI_t + \beta_3 lnMS_t + \beta_4 lnEXP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots \quad (4.3)$$

4.3 Source of data

Annual data from 1980 to 2015 using times series was used in the study. Data for the variables chosen was obtained from the South African Reserve Bank (SARB), the International Monetary Fund (IMF) and International Financial Statistics (IFS). Variables such as FDI, MS and EXP are measured in million Rands while GDPD and RER are measured in percentages. All variables are logarised to explain the variables in terms of elasticity.

4.4 Definition of variables and expected signs

Real exchange rate outlines the purchasing power of a currency in relation to another at current exchange rates and prices. Gross domestic product deflator is also known as implicit price deflator that accounts for inflation. It shows how much a change in the base year's GDP relies upon changes in the price level. Furthermore, it calculates the impact of inflation on finished goods and products by converting an economy's output into current prices. It also measures the difference between real GDP and nominal GDP. If the economy is booming meaning there is growth than it results in an appreciation in the value of the exchange rate. Therefore a positive sign is expected.

Foreign direct investment is a type of investment made by a company or individual in one country in business interests in another country which could be in the form of establishing business operations or acquiring business assets in the other country. An improvement in the foreign direct investment or increase in FDI results in an appreciation, therefore a positive sign is expected.

Money supply (M3) is one of the broadest measures of an economy's money supply since it is the total sum of money in circulation or in existence in a country. M3 is used to estimate the entire money supply within an economy for the government to direct policy and control

inflation over medium and long-term periods. If money supply increases, real exchange rate depreciates while a decrease in money supply causes the currency to appreciate. Therefore a negative sign is expected

Export is known to be a function of international trade whereby, a country produces goods and distributes to another country for trade or sale. If goods are being sold, it increases to producing a country's gross production and if utilised for trade, then exports are interchanged for other products or services in other nations. If export increase it means that a country's currency depreciates while decrease in exports results in a currency appreciation therefore a positive sign is expected.

4.5 Estimating the model

The Johansen (1995) cointegration technique was used in this study as it identifies the long-run relationship between variables. The econometric technique employed in this study to examine the relationship between real exchange rate and economic growth in South Africa is known as the Vector Error Correction Model. This estimation determines the long-run and short-run relationship between variables. Before applying the VECM, it is essential to note the integrated order of variables. In order to do this, the unit root test is conducted whereby variables are tested for stationarity.

4.6 Stationarity test

To test if cointegration exists between the variables and to avoid the generation of spurious results of regression, it is important to test for stationarity. Stationarity tests include both visual inspection and the unit root test. A non- stationary regressor cancels many practical results that may lead to spurious regression results, therefore, it is significant to conduct a unit root test for stationarity of time series data (Gujarati & Porter, 2010).

4.6.1 Visual inspection

One of the ways in which one can determine if variables are stationary is through graphical analysis or the correlogram test. For the purpose of this study, the graphical analysis approach was used as it provides a plot of time series of variables. The graphical analysis shows if the

log variables are decreasing, increasing or constant over time. If it is found that the log variables are increasing or decreasing, it means it is non-stationary and if it is constant, it is an indication that it fluctuates around the trend line and that it is stationary (Gujarati & Porter, 2010).

4.6.2 Unit root tests

According to Gujarati and Porter (2010), a series is said to be stationary when its mean and variance are constant over time. Unit root tests are conducted to avoid spurious results. The ADF and PP are the two types of unit root tests.

4.6.2.1 ADF unit root

The ADF unit root test was performed in accordance with Dickey and Fuller (1979) and the ADF. An ADF test is a form of the Dickey-Fuller test for greater sets of time series models. A negative number is used in the ADF statistic. The more negative the number, the stronger the rejection of the hypothesis than there is a unit root at some level of confidence. The Augmented Dickey-Fuller test is represented as follows:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{t=1}^{n} \lambda_t \Delta Y_{t-1} + \varepsilon_t \quad \text{..... (4.4)}$$

In the above equation, Y is the variable under consideration, Δ is the first difference operator, t is a time trend, n is the number of lags and ε_t is a white noise Random error term. For example, if the number null hypothesis is said to be $\delta = 0$, this implies that it is not rejected and the variable series contains a unit root or rather, it is non-stationary. The order of integration is a process of differencing a series Y_t a certain number of times before it becomes stationary. When a series is found to be stationary at level form, it is integrated of order zero, denoted as I (0). If it is non-stationary, it will be differenced n-times until it becomes stationary denoted as I (n).

4.6.2.2 PP unit root

The Phillips Perron test (Phillips, 1987; Phillips & Perron 1988) is likewise, one of the methods used to test stationarity. To deal with any relationship in the error terms and t-statistics, this test practices non-parametric correction. The PP test corrects any serial relationship and

heteroskedasticity in the errors of regression by directly transforming the test statistics. The Phillips Perron unit root is represented as:

$\Delta Y_t = \beta_0 X_t + \alpha Y_{t-1} + U_t$ ..... (4.5)

For the purpose of this study, the PP test was considered as it is the most advantageous than the ADF test. Nevertheless, the ADF unit root was also conducted to compare it with the PP test. The null hypothesis for both ADF and PP test states as follows:

Null hypothesis: there is unit root

Alternative hypothesis: there is no unit root

Decision rule: when the test statistics of the PP and ADF are more than the critical values at 5 % level of significance, the null hypothesis is not accepted and it is concluded that there is unit root since the variables are non-stationary. If variables are found to be non-stationary at level form, it is then differenced once. If it is still non-stationary at first difference, then it is conducted at second difference.

4.7 Lag order selection criteria

It is necessary to select a lag for the variables chosen; this is done by means of an unrestricted VAR. Asterious and Hall (2007) maintain that choosing a lag length is worthy as it will provide a lag whereby the error terms will reveal normality, no autocorrelation and no heteroskedasticity. It is important to have a good lag since variables that are omitted, affect the lag length which, in turn, affects the behaviour of the model in the short-run. There are several criteria for selecting the appropriate lag length namely; Aikaike's Information Criteria (AIC), Schward Information Criterion (SC), Hanann-Quin Criterion (HQ), sequential modified Likelihood Ratio (LR) and Final Prediction Error (FPE). The following calculations are presented below; the source is adopted from Eviews.

AIC = $-2^{l}/_{T} + 2\,^{k}/_{T}$..... (4.6)

SC = $-2\,^{l}/_{T} + {}^{(k \log T)}/_{T}$..... (4.7)

HQ = $-2\,(\,^{l}/_{T}\,) + 2K \log\, {}^{(\log(T))}/_{T}$..... (4.8)

LR = $(T - m)\,\{\log|\Omega_{n-1}| - \log|\Omega_{n}|\} - X^2\,(k^2)$..... (4.9)

For the purpose of this study, focus was on the FPE lag length as stipulated by Liew (2004) (that it is good for a small sample of 60 and below).

4.8 Cointegration test

This test is an econometric method which tests the relationship between non-stationary and time series variables. Gujarati and Porter (2010) state that two or more variables are said to be cointegrated when they move together at the same wavelength. The advantage of cointegration analysis is that it observes the dynamic co-movement among variables and the adjustment process in the direction of long-term equilibrium through building an error correction model (ECM). In order to test for cointegration, two well-known methods are the Engle-Granger approach or the Johansen approach. For the purpose of this study, the Johansen test was employed as introduced by SØren Johansen. The Johansen cointegration tests the whole system of equations in one step and without requiring a specific variable to be normalised, which allows one not to carry the error of the first step into the second.

Johansen cointegration test

This cointegration estimation technique is a method for analyzing cointegration of a number of I (1) time series. It authorises more than one cointegration relationship. The Johansen technique applies maximum likelihood estimation to a vector error correction model at the same time in the model. It also determines the long and short-run determinants of the dependent variable. In order to implement the Johansen cointegration test, the following steps are taken:

The first step is test for the order of integration of variables under examination. In some situations, the order of integration can differ which can be very crucial, however, the positive thing is that it is common to have I (1) variable. The second step entails setting the appropriate lag length of the model. This step is very essential as it is important to have Gaussian error terms (Asteriou & Hall, 2006). This step also includes the evaluation of the model and determination of rank of $\prod$ (Sibanda, 2012). In the third step, the deterministic component in the multivariate system of selecting the appropriate model is done. A study based on normalised cointergatring vector and speed of adjustment coefficients is made. The fourth step consists of determining the number of cointegrating vectors or rather, the determination of the rank of II.

There are two methods that determine the number of cointegrating vectors: the Maximum Eigenvalue and the Trace tests (Asteriou & Hall, 2006).

In the Maximum Eigenvalue test, the null hypothesis states that there are *r* cointegrating vectors or relations and the alternative hypothesis states that there are r + 1 cointegrating vectors or relations.

$$J_{\max Egen} = -T\ln(1-\lambda_{r+1}) \quad (4.10)$$

The trace test regards the null hypothesis as r cointegrating vectors and the alternative hypothesis as n cointegrating vectors.

$$J_{trace} = -T\sum_{i-t+1}^{n}\ln(1-\lambda_i) \quad (4.11)$$

Lukephol (1993) suggested that neither of the two tests is superior, yet, the Trace test performs better than the Max-Eigen value.

There are number of cointegrating relationships in the Johansen hypotheses such as:

1. There are no cointegrating relationship which means the regression is spurious.
2. There is, at most, one cointegrating relationship.
3. There are at most two cointegrating relationships and so on.

The number of such hypotheses tested gives the number of cointegrating variables. If none of the hypotheses is rejected, it could mean that the regression is spurious. If only the first hypothesis is rejected, then it is assumed that there is only one cointegrating relationship. Moreover, if the first and second hypotheses are rejected, then it is accepted that there are two cointegrating relationships. If all the hypotheses are rejected, then it means that not any of the variables contain a stochastic trend after all, resulting in a lot of cointegrating relationships as variables.

Once the existences of cointegrating relationships are determined, the VECM can be applied. This is done by the vector autoregression (VAR) of order P (Sibanda, 2012):

$$Y_t = A_1Y_{t-1} + BX_t \ldots A_pY_{t-p} + \varepsilon_t \quad (4.12)$$

Whereby, Y_t is a k- vector of I (1) variables, X_t is a d-vector deterministic variable and ε_t a vector of innovations. The equation above is rewritten into a VECM specification to employ the Johansen technique (Brooks, 2008). Thus, the VAR is rewritten as:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i-1}^{p-1}\Gamma_i\Delta Y_{t-1} + BX_t + \varepsilon_t \quad (4.13)$$

Where: $\prod = \sum_{i-1}^{p} Ai$- Iand $\Gamma_i = -\sum_{j=i+1}^{p} Aj$ ..... (4.14)

When the coefficient matrix $\prod$ has reduced rank, then m x r matrices α and β exists. Moreover, $\prod = \alpha\beta'$ and β' Y_t are stationary and r is the number of cointegration, each column of β is the number of cointegrating vector and α adjustment parameters in the VECM (Sibanda, 2012).Johansen's procedure is to estimate the $\prod$ matrix from an unrestricted VAR and to further test if the restrictions implied by the reduced rank of $\prod$ can be rejected (Greene, 2007).

4.9 Vector Error Correction Model

In order to conduct a VECM, the variables should cointegrate of the same order. Once the regression detects that there is cointegration between the variables, the next step is to apply the VECM to assess the short-run properties of the cointegrated series (Asari, Baharuddin, Jusoh, Mohamad, Shamsudin & Jusoff, 2011).

The VECM is the combination of the long-run information with short-run adjustment mechanism. To determine the short-run adjustment, the VECM overcomes the problem of spurious regression by applying correct differenced variables in the model. A VECM is a restricted VAR intended to be used with non-stationary series that are identified to be cointegrated. In addition, a VEC model restricts such variables in a manner that they tend to return to equilibrium, which is specified by the cointegrating vector Engle and Granger (1998).

Similarly, Brooks (2008) explains that the VECM has cointegration relations built into the measurement so that it limits the long-run behaviour of the endogenous variable to join to their cointegrating relationships at the same time as allowing for short-run adjustment dynamics. Furthermore, the cointegration term (also known as the correction term because of the deviation from the long-run equilibrium) is slowly corrected throughout a series of partial short-run adjustments. Therefore, the existence of cointegration vectors or relations forms the foundation of the VECM specification.

The VECM is simply an idea of a proportion of the disequilibrium from one period to the next period as corrected. This entails assessing the first differenced form (in equation 4.2) model by adding an error correction term as an explanatory variable. Thus, the error correction model estimated was as follows:

$$\Delta \ln (RER_t) = \beta_0 + \sum_{i-n-1}^{n} \beta_1 \ln (GDPD_{t-1}) + \sum_{i-n-1}^{n} \beta_2 \Delta \ln (FDI_{t-1}) + \sum_{i-n-1}^{n} \beta_3 \Delta \ln (MS_{t-1}) + \sum_{i-n-1}^{n} \beta_4 \ln (EXP_{t-1}) + \beta_5 EC_{t-1} + v \quad (4.15)$$

Where n is the value selected using the AIC and SC. EC represents the error correction term and V represents the Random error term. The error correction term is defined as the lagged values of the error term developed from the regression mode. When the coefficient of the EC is negative and statistically significant, then it reveals the proportion of the disequilibrium in RER and is accurate in the next period. A VECM illustrates how the system is changing in every period towards its long-run equilibrium (Hassan, 2003).

4.10 Diagnostics and Stability tests

The diagnostic test helps in electing whether or not a model has been correctly identified. The diagnostic test consists of Heteroskedasticity. For a serial relationship, Autocorrelation Lagrange Multiplier (LM) test is employed and Normality tests are employed. Under the stability test, the autoregressive (AR) root graph is employed since it determines if the model is stable or not. Both the diagnostic and stability tests are important as they can be used for economic decisions and predictions.

4.10.1 Heteroskedasticity test

This test occurs when the variance and standard deviation are not constant over time. The White (1980) test is used as it is a common test for heteroskedasticity in error distribution by regressing the squad residuals on all distinct regressors, cross-products and squares of regressors (Sibanda, 2012). The null hypothesis states that there is no heteroskedasticity, in other words, the errors are homoscedastic whereas, the alternative hypothesis states that there is heteroskedasticity. When the p-value is less than the level of significance ($p < 0.05$), the null hypothesis is rejected and it is concluded that there is significant evidence of heteroskedasticity.

4.10.2 Autocorrelation LM

Gujarati and Porter (2010) state that autocorrelation is generally related with time series data and that there should be no relationship between error terms. The Durbin-Watson statistics is used to detect the existence of first order serial relationship in the residuals. The LM test is

used for autocorrelation. The null hypothesis states that there is no serial relationship and the alternative hypothesis states that there is serial relationship. If the p-value is less than 0.05 level of significance, then the null hypotheses is rejected and it is concluded that there is serial relationship.

4.10.3 Normality test

Under the normality test, there is a histogram graph of the residuals or the jarque-bera test. The jarque-bera test was employed in this study because it compares the sample versions of the coefficient of excess skewness and coefficient of kurtosis. The JB follows a chi-sqaure distribution (x^2). The null hypothesis states that residuals are normally distributed and the alternative hypothesis states that residuals are not normally distributed. If the value of JB is significant, the null hypothesis is rejected and it is concluded that residuals are normally distributed.

4.10.4 AR autoregressive root graph

The AR autoregressive consists of the AR root table and graph to test whether the model used in this study is stable or not. However, for the purpose of this study, it only focuses on the AR root graph. When all the roots are inside the unit circle, then the model is considered to be steady. Nevertheless, if some of the roots are found outside the unit circle, then it is concluded that the model is not stable and cannot be used for further.

4.11 VEC Granger Causality test

Awe (2012) defines causality as the relationship between cause and effect in two sets of variables. Since the introduction of the concept of Granger (also is referred to as non-causality) by Granger (1969), it has become a popular concept in econometrics. The Granger causality test is done to determine whether one variable can be useful in predicting another variable in a time series data.

Gujarati and Porter (2010) explain that Granger causality is based on the assumption that the variables are stationary and the error terms are uncorrelated. Furthermore, the existence of a relationship between variables does not mean causation and does not prove the direction of

causation. It tests whether the past values of Y together with past values of X explain the current change in X better than the past values of X alone. If the null hypothesis is accepted, it implies that Y granger causes X. Moreover, Granger causality between two variables cannot be deduced as a real causal relationship yet, it shows that one variable can help to predict the other one better (Awe, 2012). When testing for Granger causality, the following four possible results are analysed:

Unidirectional Granger causality from variable X_t to variableY_t;

Unidirectional Granger causality from variable Y_t toX_t;

Bi-directional causality; and

No causality.

In this study, a multivariate granger causality test was employed based on VECM. The probability values were used to evaluate the casual relationship amongst the variables. The results were evaluated at 5% or 0.05 level of significance. If the probability value was more than 5 %, then the null hypothesis was not rejected and it was concluded that X does not Granger cause Y. If the probability value was less than 5% then the null hypothesis was rejected and it was concluded that X does Granger cause Y.

4.12 Variance Decomposition

The variance decomposition analysis gives the proportion of movements in the dependent variables that are due to its own shocks, against shocks to other variables (Brooks, 2008). In addition, Enders (2009) states that when the total forecast error variance is explained by shocks in the variable itself, then that variable can be considered exogenous. Thus, in applied research, it is distinctive for a variable to explain almost all its forecast error variance for short horizons and smaller proportions at longer horizons. Assuming the matrix coefficients ofA_0 and Π_1 are identified and one wants to forecast the various values of z_{t+i} conditional on the observed value of z_t,taking that and adding one period ahead and taking the conditional expectation of z_{t+1} gives:

$E_t z_{t+1} = A_0 + \Pi_1 z_t$ ..... (4.16)

(Oni, 2013).

Then, the equivalent forecast error can be defined as:

$e_{t+1} = z_{t+1} - E_t z_{t+1}$ ..... (4.17)

In a general step, the n step ahead forecast is defined as:

$E_t z_{t+1} = (I + \Pi_1 + \Pi_1^2 + \ldots + \Pi_1^{n-1}) A_0 + \Pi_1^n z_t$ ..... (4.18)

Thus, the associated forecast is defined as:

$e_{t+n} + \Pi_1 e_{t+n-1} + \Pi_1^2 e_{t+n-2} + \ldots + \ldots \Pi_1^{n-1} e_{t+1}$ ..... (4.19)

The forecast error terms can be written as ε_{xt} and ε_{yt} shocks. It can be concluded that x_t is exogenous when ε_{yt} shocks explain none of the forecast error variance of x_t at all forecast horizons. Therefore, x_t would progress independently of the ε_{yt} shocks plus the y_t. Alternatively, when ε_{yt} shocks explain all the forecast error variance in the x_t at all forecast horizons, then x_t is endogenous (Oni, 2013). In this study, VECM variance decomposition was employed.

4.13 Impulse Response Analysis

The impulse response analysis traces out the responsiveness of the dependent variable to shocks in each of the other variables in a study. The impulse response analysis is normally related to the vector error correction model given that the shocks associated with the vector error correction model slowly deters away over time (Brooks, 2014). Lu and Xin (2010) further emphasize that impulse response is when a reaction of any dynamic system is in response to some external change. A VAR is written in vector MA (∞) in the form of:

$Y_t = \mu + \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \ldots\ldots\ldots\ldots$ (4.20)

Therefore, the matrix Ψ_s can be interpreted as $\frac{\partial Y_{t+s}}{\partial \varepsilon'_t} = \Psi_s$ whereby row i and column j are the elements of Ψ_s in which they recognize the cost of a unit increase in the jth variables innovation at date t (ε_{jt}) for the value of the ith variable at time t+s (y_{it+s}) holding all other innovations at all dates stable.

Thus, the impulse response function is an s function denoted as $\frac{\partial Y_{t+s}}{\partial \varepsilon'_t}$ in which it illustrates the response of y_{it+s} to one time impulse in y_{jt} with all other variables dated t or kept stable early. The VECM impulse response function was used in this study.

4.14 Summary

The estimation technique employed in conducting this study has been outlined in this chapter. The dependent variable is real exchange rate and the explanatory variables are economic growth, money supply, foreign direct investment and export. The study focused on the period from 1980 to 2015 and data was obtained from different sources. In order to perform estimation, it is important to make sure that the variables are stationary. In order to do this, the visual inspection and ADF and PP unit root tests were employed. The Johansen technique and vector error correction model was applied in order to determine the long and short-run determinants of the dependant variable in the model. In order to determine whether the variables do cointegrate, the Max-Eigen value and trace test were employed. Once cointegration was observed, VECM was then applied. A VECM is the combination of the long-run information with short- run adjustment mechanisms. Moreover, the cointegration term (also known as the correction term because of its deviation from the long run equilibrium) is slowly corrected throughout a series of partial short-run adjustments. The error correction term value should be negative and statistically significant. Furthermore, the model goes through a diagnostic and stability test to examine whether the model is stable, free from serial correlation or heteroskedasticity and whether the residuals are normally distributed. VEC granger causality was also employed to determine if the variables in the model do cause one another. Variables can have a unidirectional causality whereby one variable causes the other, bidirectional in which both of them cause one another or no causality in which none of them cause the other. Variance decomposition was used to determine the breakdown of the forecast error variance for a specific time horizon. This technique measures the contribution of each type of shocks to the forecast error variance (Meniago, 2012). In addition, the impulse response function is also examined to identify each shock or innovation associated to a specific variable. The next chapter presents the outcomes obtained from the estimation.

Chapter 5

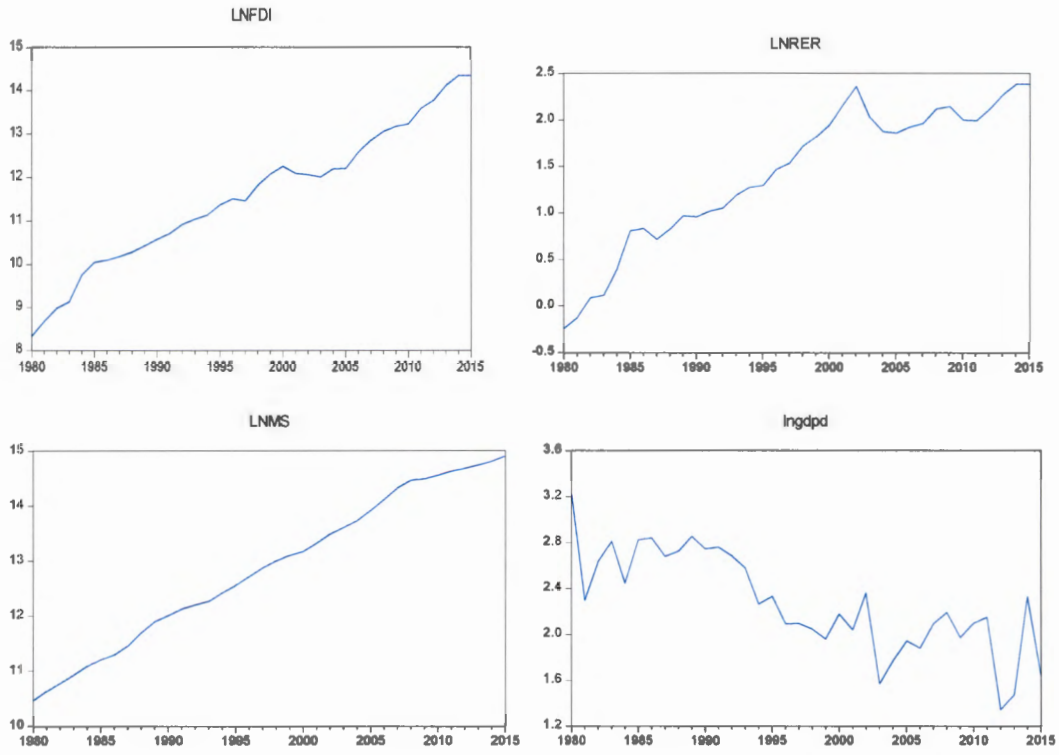
RESULTS AND INTERPRETATION

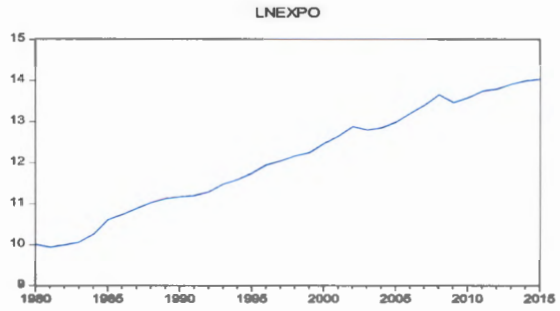
5.1 Introduction

The aim of this chapter is to provide responses to the questions raised in chapter one of this study. Various tests were performed to determine the relationship between real exchange rate and the growth rate of the South African economy from 1980 to 2015. The tests and results are presented and interpreted as follows: unit root visual inspections, unit root stationary test, lag order selection criteria, cointegration, VECM estimation, diagnostic tests, VEC Granger causality and variance decomposition as well as impulse response analysis.

5.2 Visual inspection

Figure 5.1: Variables at level form

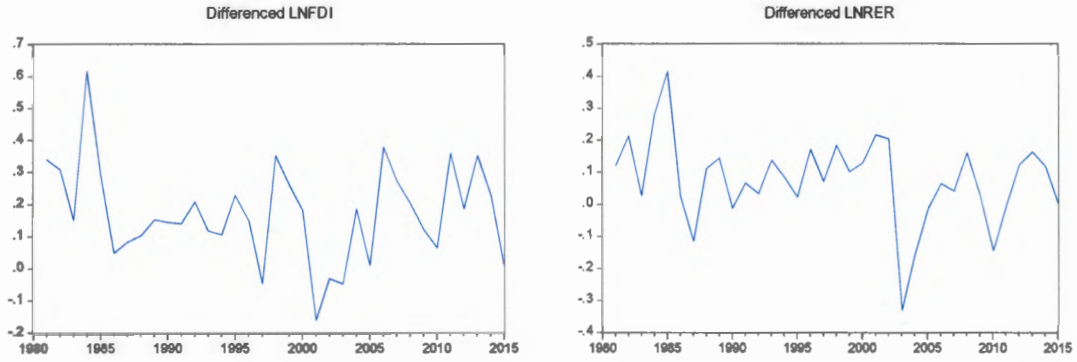


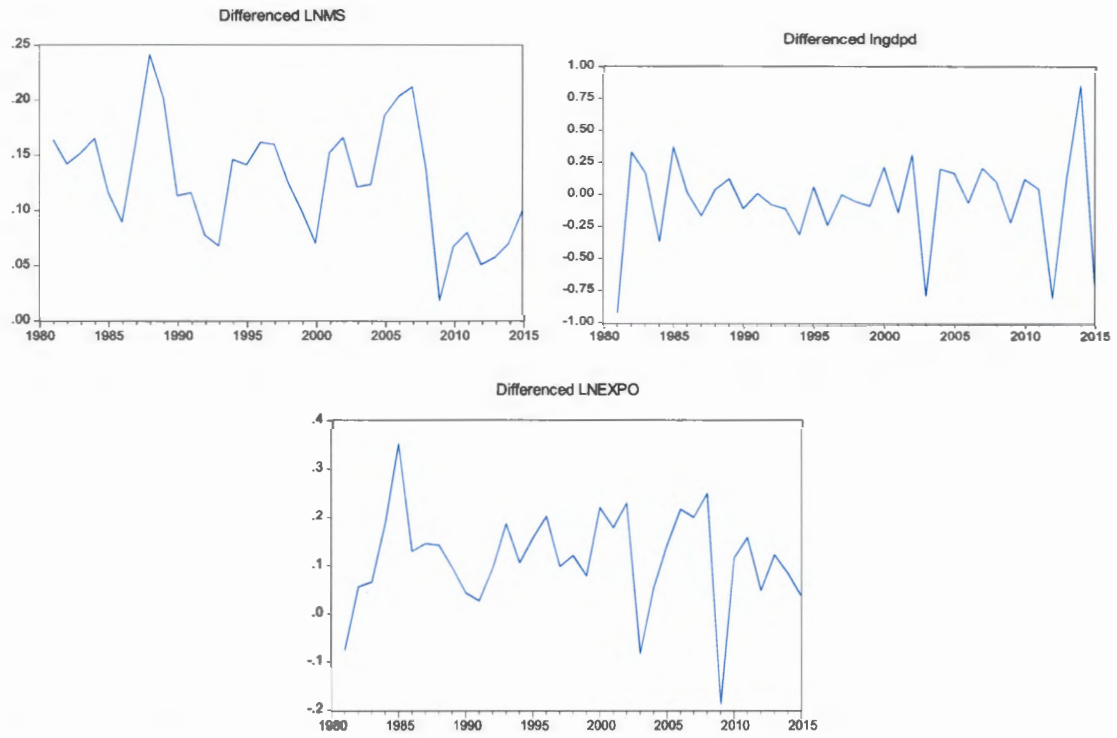


Source of data: Author's own creation

It is also important to undertake a visual inspection of the nature of variables. Figure 5.1 shows the graphical representations of all the variables used in this study. The results show that foreign direct investment, real exchange rate, export and money supply are increasing or rather, have an upward trend while gross domestic product deflator has an increasing trend that slightly has a decreasing trend towards the end, which is an indication that it is inconsistent bout the mean. It is, therefore, concluded that none of the variables are stationary at level form as they have an increasing or decreasing trend. Therefore, the next step is to test visual inspection at first difference.

Figure 5.2: Variables at differenced form





Source of data: Author's own creation

Figure 5.2 shows that the mean and variance for the variables foreign direct investment, money supply, real exchange rate, gross domestic product deflator and export are constant over time. This is an indication that stationarity has been achieved at first difference. Thus, it can be concluded that stationarity is obtained at integrated order one, as it is important to avoid results of spurious regression. A formal method to present results of the unit root for ADF and PP unit root tests were conducted in order to support the results presented in the graphs.

5.3 Results of unit root test

When variables are found to be non-stationery, it leads to nonsensical and meaningless results whereby, further tests cannot be conducted. Therefore, if variables are found to be non-stationary at level form, it is further tested at order of integration 1 and order of integration 2 if still found to be non-stationary. The null hypothesis for unit root at level, 1st and 2nd difference states that there is unit root (non-stationary) and the alternative hypothesis states that there is no unit root (stationary). For the purpose of this study, the ADF unit root tests were considered, however, the PP tests were performed to compare the results.

Table 5.1 shows the unit root tests for all the variables at level form with levels starting from intercept, trend and intercept and none. Only gross domestic product deflator was found to be stationary at 5%, 1% and 10% with PP unit root test and at 1% with ADF unit root test. Thus, the null hypothesis was not rejected in the study and it is concluded that there is unit root. Hence, all the variables were further tested at first difference.

Table 5.1: Stationarity test at level form

		ADF TEST			PP TEST		
Variables	Model specification	Lags	ADF critical value	ADF probability value	Band width	PP critical value	PP Probability value
LNGDPD	Intercept	2	-0.779792	0.8117	4	-3.013862	0.0433**
	Trend and intercept	0	-5.336358	0.0006***	3	-5.412926	0.0005***
	None	2	-1.377818	0.1531	2	-1.591726	0.1038
LNRER	Intercept	0	-2.260840	0.1898	9	-2.878229	0.0581*
	Trend and intercept	1	-2.601019	0.2822	6	-2.044735	0.5573
	None	0	1.746945	0.9784	2	1.364217	0.9539
LNFDI	Intercept	0	-1.279685	0.6280	0	-1.279685	0.6280
	Trend and intercept	0	-2.762094	0.2199	1	-2.814028	0.2020
	None	0	6.182465	1.0000	1	5.627510	1.0000
LNMS	Intercept	2	-1.820108	0.3646	1	-2.009694	0.2815
	Trend and intercept	1	-2.333866	0.4056	0	-0.335668	0.9862
	None	1	2.195885	0.9919	3	8.491978	1.0000
LNEXP	Intercept	0	-0.530060	0.8733	10	-0.649510	0.8464
	Trend and intercept	0	-2.528016	0.3136	2	-2.834946	0.1951
	None	0	6.508728	1.0000	5	7.641470	1.0000

Source of data: Author's own creation ***stationary at 1%, **stationary at 5%,*stationary at 10%

5.3.1 Unit root stationarity test at first difference

Table 5.2 shows that all the variables are stationary at first difference except for gross domestic product deflator at level none of the PP unit root and money supply were found to be non-stationary.

Table 5.2: Stationarity at 1st difference

		ADF TEST			PP TEST		
Variables	Model specification	Lags	ADF critical value	ADF probability value	Band width	PP critical value	PP Probability value
LNGDPD	Intercept	1	-8.295750	0.0000***	4	-3.013862	0.0433**
	Trend and intercept	1	-8.150655	0.0000***	3	-5.412926	0.0005***
	None	1	-8.122473	0.0000***	2	-1.591726	0.1038
LNRER	Intercept	0	-4.370257	0.0015***	7	-4.193546	0.0024***
	Trend and intercept	0	-4.570843	0.0046***	12	-5.097112	0.0012***
	None	0	-3.680718	0.0006***	2	-3.603800	0.0007***
LNFDI	Intercept	0	-4.732186	0.0006***	5	-4.632778	0.0007***
	Trend and intercept	0	-4.697891	0.0033***	4	-4.619780	0.0040***
	None	0	-2.919246	0.0048***	2	-2.798407	0.0066***
LNMS	Intercept	0	-2.914880	0.0541**	7	-2.637531	0.0956*

	Trend and intercept	0	-3.133193	0.1151	8	-2.649844	0.2623
	None	0	-1.218942	0.1999	19	-1.050425	0.2590
LNEXP	Intercept	0	-5.602897	0.0000***	12	-6.344248	0.0000***
	Trend and intercept	0	-5.610369	0.0003***	33	-11.46005	0.0000***
	None	0	-2.804708	0.0065***	2	-2.695859	0.0086***

Source of data: Author's own creation ***stationary at 1%, **stationary at 5%, *stationary at 10%

It could be concluded that the null hypothesis was rejected for foreign direct investment, real exchange rate, export and gross domestic product deflator at 1st difference since stationary was achieved (ADF unit root) at all levels (intercept, trend and intercept and none). Therefore, they are integrated of order I (1). Money supply is only stationary at the level of intercept at first difference thus; it is also further tested for stationarity at 2nd difference in order to avoid spurious results. On the other hand, using the PP test, gross domestic deflator is stationary at intercept and trend and intercept only. Therefore, gross domestic product and money supply are tested at integrated order of I (2).

5.3.2 Results of unit root stationarity test at 2nd difference

Table 5.3: Stationarity at 2nd difference

		ADF TEST			PP TEST		
Variables	Model specification	Lags	ADF critical value	ADF Probability value	Band width	PP critical value	PP Probability value
LNGDPD	Intercept	2	-6.448962	0.0000***	1	-10.80961	0.0000***
	Trend and intercept	2	-6.336827	0.0000***	1	-10.58997	0.0000***

	None	2	-6.563474	0.0000***	1	-11.09269	0.0000***
LNMS	Intercept	0	-5.007102	0.0003***	32	-9.438967	0.0000***
	Trend and intercept	0	-4.925659	0.0019***	32	-9.200620	0.0000***
	None	0	-5.088169	0.0000***	32	-8.972477	0.0000***

Source of data: Author's own creation ***stationary at 1%, **stationary at 5%, *stationary at 10%

Table 5.3 shows that both gross domestic product deflator and money supply were both found to be stationary at 2nd difference. Thus, the null hypothesis is rejected and it is concluded that there is stationarity. Therefore, it could be concluded that real exchange rate, export, foreign direct investment and gross domestic deflator are integrated of order I (1) and money supply is integrated of order I (2). The use of different order of integration such as I (1) and I (2) is also justified by a study done by Ziramba (2017), in which various econometric approach such as VAR and VECM were used. The next step was to select the lag order criteria.

5.4 Lag order selection criteria

Table 5.4: Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ	Conclusion
0	-15.13711	NA	2.25e-06	1.184536	1.409001	1.261085	Not good
1	169.4424	304.0133*	1.92e-10*	-8.202495	-6.855707*	-7.743202*	Good
2	194.8813	34.41726	2.07e-10	-8.228310*	-5.759197	-7.386272	Not good

Source of data: Author's own creation

Table 5.4 presents the selection criteria for lag length. The lag order selection criteria suggested to include two lags which indicate the lag length of the model. Liew (2004) found that AIC and

FPE are more superior criteria than any other for a small sample which is 60 and below. Hence, lag one was found to be the best lag for the data with regard to South Africa as indicated by FPE. Furthermore, majority of the criteria also suggest lag 1. This is indicated by an asterisk by LR, FPE, SC, and HQ while AIC indicated lag 2. Therefore, lag one was found to be appropriate for this study and further used to conduct other tests.

5.5 Results of Johansen Cointegration test

Table 5.5: results of Trace test

Hypothesised no.of CE(s)	Egienvalue	Trace statistics	0.05 critical value	Prob.**	Conclusion
None*	0.682195	82.08856	69.81889	0.0038	Reject H_0
At most 1	0.466338	43.11375	47.85613	0.1298	Do not reject H_0
At most 2	0.307589	21.76203	29.79707	0.3119	Do not reject H_0
At most 3	0.172086	9.264483	15.49471	0.3415	Do not reject H_0
At most 4	0.080237	2.843736	3.841466	0.0917	Do not reject H_0

Source of data: Author's own creation

Table 5.6: Results of Max-Eigen test

Hypothesised no. of CE(s)	Eigenvalue	Max-Eigen statistics	0.05 critical value	Prob**	Conclusion
None*	0.682195	38.97481	33.87687	0.0113	Reject H_0
At most 1	0.466338	21.35172	27.58434	0.2555	Do not reject H_0
At most 2	0.307589	12.49755	21.13162	0.4994	Do not reject H_0
At most 3	0.172086	6.420746	14.26460	0.5598	Do not reject H_0

At most 4	0.080237	2.843736	3.841466	0.0917	Do not reject H_0

Source of data: Author's own creation

Table 5.5 shows the results of the Trace test while Table 5.6presents the results of the Max-Eigen test. With regard to the Trace test, one cointegration exists at none. The Trace statistics at none is 82.089 which is more than the 5% critical value of 69.819. The null hypothesis of no cointegrating vectors is, therefore, rejected at none and it is suggested that there is cointegration at none. Furthermore, the null hypothesis is at most 1 and the trace statistics is 43.114, which is less than the 5% critical value of 47.856. This implies that there is no cointegration at most 1 and, therefore, the null hypothesis is not rejected In other words, it is accepted. At most 2, the trace statistics is 21.762 which is also less than the 5% critical value of 29.797.Thus, the null hypothesis of no cointegrating vectors is not rejected again. Therefore, under the trace statistics, it can be concluded that there is cointegration at none as it is only significant at none.

The Max-Eigen test reveals that at none, the Max-Eigen value is 38.975, which is more than the 5% critical value of 33. 877. This implies that there is cointegration and, therefore, the null hypothesis is rejected. However, at most 1, 2, 3 and 4 the Max-Eigen value is lower than the 5% critical value and thus, the null hypothesis of no cointegrating vectors is accepted. Therefore, it can be concluded that it is only at none that there is cointegration as the probability value of the Max-Eigen is only significant at one. Both Trace and Max-Eigen indicate 1 cointegration equation at none.

The above results are similar to those of Sibanda (2012) who found one cointegrating vector at none with the trace test and maximum eigenvalue test. Also, Maepa (2015) found one cointegrating equation in his study on the effects of exchange rate volatility on South Africa's investment, while Bibi (2014) found three cointegrating equations with the Trace and Maximum eigenvalue tests at 0.05 level of significance. For this reason, it could be concluded that a unique long-run equilibrium relationship exists among the variables. After this stage, a VECM was performed in order see the short or long-run effects of the variables.

5.6 Vector Error Correction Model results

The results of the cointegration test presented in section 5.5 revealed that there is cointegration, therefore, a VECM could be employed in order to determine the long and short-run effects.

The VECM estimation method provides a reliable test of cointegration together with an unbiased estimate of the long-run relations. The idea behind estimating the error correction term is to measure any movement away from the long-run equilibrium. The error correction mechanism is when a proportion of the disequilibrium of one period is corrected in the next period. Thus, the size of the error correction term specifies the speed of adjustment of any equilibrium towards the long-run equilibrium state (Mpofu, 2014). Table 5.7shows the results of VECM after being estimated. The coefficients are interpreted in terms of elasticity due to the use of natural logarithms.

Table 5.7 Results of long-run relationship

Variables	Coefficient	t- statistics	Standard error	Conclusion
Constant	-1.537751	-	-	
LNRER	1.000000	-	-	
LNGDPD	0.878341	5.52263	0.15904	Negative and significant
LNFDI	-0.518386	-3.03220	0.518386	Positive and significant
LNMS	-0.867919	-2.32636	0.37308	Positive and significant
LNEXPO	1.266199	2.90872	0.43531	Negative and significant

Source of data: Author's own creation

The long-run equation is presented as follows:

$$LNRER = 1.537751 - 0.878341\ LNGDPD + 0.518386\ LNFDI + 0.867919\ LNMS - 1.266199\ LNEXPO \quad (4.13)$$

The VECM results of the long-run relationship indicate that if all the independent variables are held constant, real exchange rate will rise by 1.54%. There is a negative and significant relationship between real exchange rate and gross domestic deflator in the long-run. A 1% increase in gross domestic deflator will cause real exchange rate to decrease by 0.88 %. These results are in line with Ayodele (2014) who found a negative relationship between real exchange rate and economic growth. Therefore, it could be concluded that if gross domestic

deflator increases, then it leads to the depreciation of the Rand. This result is not consistent because if gross domestic deflator increases, then the Rand should appreciate.

Foreign direct investment shows a positive and significant relationship on real exchange rate in the long-run. A 1% increase in foreign direct investment will cause real exchange rate to increase by 0.52%. This implies that if foreign direct investment increases, then the Rand will appreciate. An increase in foreign direct investment attracts more investors to invest in the country and boosts business confidence in the market. It also has a positive impact on economic growth and on the Rand. These results are similar to those of Tang (2015) who found that foreign direct investment is positively related to real exchange rate.

A positive and significant relationship was also found between money supply and real exchange rate. A 1% increase in money supply will cause real exchange rate to increase by 0.87%. On the other hand, Sibanda (2012) found a negative relationship between money supply and economic growth.

Finally, a negative and significant relationship exists between export and real exchange rate. A 1% increase in export will cause real exchange rate to decrease by 1.23%. If exports increase it means that the value of a country's currency depreciated which results in exports being cheaper. These results are similar to those of Tang (2015). On the contrary, Bibi (2014) found a positive relationship between real imports, real exports and economic growth. Table 5.8 presents results of the error correction term.

Table 5.8: Results of the short-run error correction model

Variables	Coefficient	T-statistics	Standard error	Conclusion
CointEq1	-0.304986	-4.05053	0.07530	Negative and significant
D(LNRER (-1))	0.100677	0.63417	0.15876	Positive and insignificant

D(LNGDPD(-1))	0.007415	0.11527	0.06433	Positive and insignificant
D(LNFDI(-1))	-0.119518	-0.69922	0.17093	Negative and insignificant
D(LNMS(-1))	0.307460	0.86099	0.35710	Positive and insignificant
D(LNEXPO(-1))	0.591345	2.40437	0.24595	Positive and significant
C	-0.021106	-0.39997	0.05277	Negative and insignificant
R-square	0.557084			
Adj R-square	0.458658			

Source of data: Author's own creation

The results of the short-run presented in Table 5.8 shows the differenced form which ensures stationarity of the variables. At the same time, the inclusion of the lagged values of both dependent and independent variables ensures the lagged effect of real exchange rate and its determinants are captured. The results of the short-run are discussed below as follows:

The results of the error correction term is negative (-0.305) with an absolute t-statistics of 4.051. This proves that only 30% equilibrium is corrected in the next period as it moves towards restoring equilibrium. The results of the error correction term confirm that in the long-run equilibrium, there is a problem between the dependent and independent variables. The speed of adjustment is not very high. However, Sibanda (2012) and Chipote & Makhetha-Kosi (2014) mentioned that the slow pace of correction of growth rate of the economy could indicate the existence of some other factors which affect the growth rate of the South African economy(which are not precise in the model).

The results indicate that when the variables are auto-regressed at lag one in the short-run, foreign direct investment has a negative relationship and is statistically insignificant in determining real exchange rate. Furthermore, gross domestic product deflator and money supply have a positive relationship and are statistically insignificant while export has a positive relationship and statistically significant in determining real exchange rate. This means that an increase in export, results in an increase in real exchange rate or vice-versa. Thus, it could be concluded that all the variables are statistically insignificant except for export which is statistically significant in determining real exchange rate in the short-run.

The R-square value is 0.56 which suggests that only 56% of the variation in real exchange rate is explained by the independent variables. Also, the Adjusted R-square is 0.46 which provides evidence that 46% of the independent variables explain the variation of the dependent variable. The next section focuses on the diagnostics and stability tests of the model.

5.7 Diagnostics and stability tests

This section explains the results of the diagnostics and stability tests conducted for the model. It is important to go through this process as it determines whether the model is correctly specified and whether the model is good enough. The model goes through the following tests: heteroskedasticity; autocorrelation; normality; and stability tests which are the AR root graph. The probability value of 0.05 or 5% level of significance is used to decide whether the null hypothesis should be accepted or rejected.

5.7.1 White Heteroskedasticity test

Table 5. 9: VEC residual heteroskedasticity test: with no cross terms

Null hypothesis	Component	Chi-square	Probability	Conclusion
No heteroskedasticity	Joint	169.4495	0.7026	There is no evidence of heteroskedasticity.

Source of data: Author's own creation

The null hypothesis states that there is no heteroskedasticity and the alternative hypothesis states that there is heteroskedasticity. The probability value is 0.703with more than 0.05 level

of significance. Therefore, the null hypothesis is not rejected and it is concluded that there is no evidence of heteroskedasticity in the model.

5.7.2 Autocorrelation LM test

Table 5.10: VEC Serial correlation LM test

Null hypothesis	Lags	LM-stat	Probability	Conclusion
There is no serial relationship	1	21.03871	0.6904	No evidence of serial relationship

Source of data: Author's own creation

In the autocorrelation test, serial correlation is tested between the variables. The null hypothesis states that there is no serial correlation and the alternative hypothesis states that there is serial correlation. From the results, it is clear that at lag 1, the probability value is 0.690, an indication that the probability value is more than 0.05 level of significance. Thus, the null hypothesis is not rejected. In other words, it is accepted and it is concluded that there is no evidence of serial correlation in the model.

5.7.3 Normality test

Table 5.11: VEC Residuals normality test

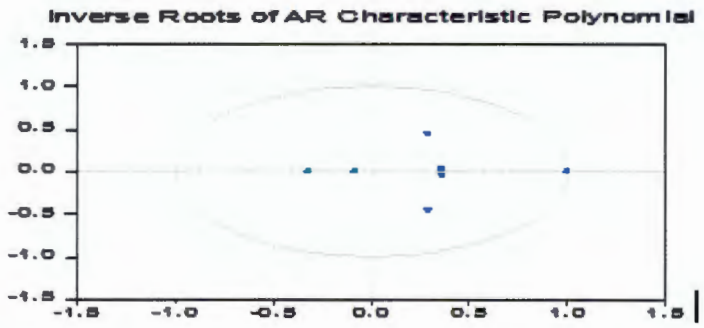
Null hypothesis	Component	Type	Chi-square	Probability	Conclusion
Residuals are normally distributed	Joint	Skewness	4.289208	0.5086	Normally distributed
Residuals are normally distributed	Joint	Kurtosis	3.405566	0.6377	Normally distributed
Residuals are normally distributed	Joint	Jarque-Bera	7.694773	0.6586	Normally distributed

Source of data: Author's own creation

The normality test is performed to test whether residuals are normally distributed in the model. The null hypothesis states that residuals are normally distributed and the alternative states that residuals are not normally distributed. The probability value of the Skewness (0.509), Kurtosis (0.638) and Jarque-Bera (0.659) are greater than 0.05 level of significance. Therefore, the null hypothesis is not rejected and it is concluded that residuals are normally distributed in the model.

5.7.4 Stability test

Figure 5.3: AR autoregressive root graph



The AR root graph in Figure 5.3 is used to detect whether the model is stable for South Africa. All the unit root points lie inside the unit circle which is an indication that the model is stable. The next section explains the Granger Causality test.

5.8 Results of VEC Granger causality test

This test is performed in order to determine whether current and lagged values of one variable affect one another. Granger (1969) explained that a variable (X) is said to Granger cause another variable (Y) if past and present values of X help to predict Y.

The chi-square and probability values are used to evaluate the casual relationship amongst the variables. The results are evaluated at 5% or 0.05 level of significance. If the probability value is more than 5%, then than the null hypothesis is not rejected and if it is less than 5%, then the

null hypothesis is rejected and the alternative hypothesis is accepted. The results are presented in Table 5.12 below.

Table 5.12: VEC Granger Causality test

Dependent variable: D(LNRER)				
Excluded	Chi-square	Df	Probability	Conclusion
D(LNGDPD)	0.013287	1	0.9082	Do not reject H_0
D(LNFDI)	0.488902	1	0.4844	Do not reject H_0
D(LNMS)	0.741309	1	0.3892	Do not reject H_0
D(LNEXPO)	5.780995	1	0.0162	Reject H_0
ALL	8.719164	4	0.0685	Do not reject H_0
Dependent variable: D(LNGDPD)				
Excluded	Chi-square	Df	Probability	
D(LNRER)	0.479045	1	0.4889	Do not reject H_0
D(LNFDI)	0.395148	1	0.5296	Do not reject H_0
D(LNMS)	0.575880	1	0.4479	Do not reject H_0
D(LNEXPO)	0.000286	1	0.9865	Do not reject H_0
ALL	1.420799	4	0.8406	Do not reject H_0
Dependent variable: D(LNFDI)				
Excluded	Chi-square	Df	Probability	
D(LNRER)	0.773285	1	0.3792	Do not reject H_0
D(LNGDPD)	0.606565	1	0.4361	Do not reject H_0
D(LNMS)	2.950218	1	0.0859	Do not reject H_0
D(LNEXPO)	0.113845	1	0.7358	Do not reject H_0
ALL	4.614046	4	0.3292	Do not reject H_0
Dependent variable: D(LNMS)				
Excluded	Chi-square	Df	Probability	
D(LNRER)	2.073036	1	0.1499	Do not reject H_0
D(LNGDPD)	0.853247	1	0.3556	Do not reject H_0
D(LNFDI)	3.083858	1	0.0791	Do not reject H_0
D(LNEXPO)	1.100630	1	0.2941	Do not reject H_0

ALL	7.379806	4	0.1171	Do not reject H_0
Dependent variable: D(LNEXPO)				
Excluded	Chi-square	Df	Probability	
D(LNRER)	0.437218	1	0.5085	Do not reject H_0
D(LNGDPD)	0.159203	1	0.6899	Do not reject H_0
D(LNFDI)	0.573549	1	0.4489	Do not reject H_0
D(LNMS)	0.170206	1	0.6799	Do not reject H_0
ALL	1.667001	4	0.7967	Do not reject H_0

The null hypothesis of real exchange rate does not granger cause gross domestic deflator and is insignificant at 5%.Since the probability value is more than 0.05, therefore, the null hypothesis is not rejected and it is concluded that gross domestic deflator does not granger cause real exchange rate. Also, the null hypothesis of real exchange rate does not granger cause foreign direct investment and money supply is insignificant at 5% as the probability value is more than 0.05, an indication that foreign direct investment and money supply do not granger cause real exchange rate. Thus, the null hypothesis is not rejected, including for the overall variables. On the other hand, export individually does granger cause real exchange rate because the probability value is less than 0.05. This means that changes in export do affect real exchange rate. Therefore, the null hypothesis is rejected and it is concluded that export does granger cause real exchange rate.

Moving on, the null hypothesis of foreign direct investment does not granger cause real exchange rate and it is not rejected since the probability value is more than 0.05 level of significance, which is insignificant. In addition, from the Table, it could be observed that all the variables do not granger cause gross domestic product deflator as their probability values are more than 0.05 level of significance. Therefore, the null hypothesis is not rejected and it is concluded that real exchange rate, foreign direct investment, money supply and export do not granger cause gross domestic product.

Furthermore, real exchange rate does not granger cause foreign direct investment since the probability value is more than 0.05 level of significance, thus it is insignificant. Hence, the null hypothesis cannot be rejected and it could be concluded that real exchange rate does not granger cause foreign direct investment. The same thing could be said with regard to other variables (gross domestic product deflator, money supply and export) as their probability values is also

more than 0.05, which is insignificant, thus gross domestic product, money supply and export do not granger cause foreign direct investment.

The null hypothesis of real exchange rate does not granger cause money supply and is not rejected since the probability value is more than 0.05 level of significance. The same can be applied for all the variables (gross domestic product deflator, foreign direct investment and export) as their probability values are also greater than 0.05 level of significance, an indication that changes in gross domestic product deflator, foreign direct investment and export do not affect money supply. Thus, the null hypothesis cannot be rejected.

Similarly, the results of real exchange rate do not granger cause export and are insignificant as the probability value is greater than 0.05 level of significance. Also, gross domestic product, foreign direct investment and money supply do not granger cause export since their probability values are more than 0.05 level of significance thus, the null hypothesis is not rejected.

From the results obtained from the VEC Granger causality, only export granger causes real exchange rate since the probability value is less than 5%, an indication that changes in export do affect real exchange rate. Thus, a unidirectional causality exists between export and real exchange rate. The next section is a discussion of the results of variance decomposition presented in Table 5.13.

5.9 Results of variance decomposition

The significance of variance decomposition is that it offers a way of defining the comparative significance of shocks in enlightening differences in the variable of interest (Andren, 2007). Henceforth, the variance decomposition gives ways of defining comparative significance of shocks to real exchange rates in order to explain variations in the growth rate of the South African economy from 1980 to 2015. The Table below shows the error variance in the real rate of exchange as explained by itself through its individual moderniszations and modernisations in real exchange rates over a period of 15 years.

Table 5.13: Variance Decomposition of LNRER

Period	S.E.	LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1	0.100089	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.156450	76.17266	19.43570	0.152111	3.320176	0.919350
3	0.198426	53.16208	41.77584	0.096914	4.372805	0.592360
4	0.237104	38.10058	56.21852	0.191887	3.753936	1.735067
5	0.260419	30.01597	63.19554	0.334948	3.127754	3.325781
6	0.296303	25.51569	66.96281	0.410983	2.745964	4.364558
7	0.319995	22.68897	69.44107	0.437347	2.534958	4.897652
8	0.341985	20.61450	71.33628	0.444775	2.411058	5.193388
9	0.362802	18.95213	72.86879	0.448918	2.320881	5.409274
10	0.382583	17.59036	74.11487	0.453687	2.244512	5.596575
11	0.401398	16.47167	75.13047	0.458640	2.178701	5.760522
12	0.419349	15.54498	75.96971	0.462924	2.123218	5.899174
13	0.4365446	14.76536	76.67660	0.466362	2.076781	6.014894
14	0.45308	14.09856	77.28217	0.469162	2.037444	6.112660
15	0.469051	13.52062	77.80736	0.471552	2.003500	6.196969

Source of data: Author's own creation

From the Table, the forecast error variance for real exchange rate is 100%, an indication that in the first period, to explicate its own shocks, 100% of real exchange rate variance is explicated through its own innovations. As it moves on to the 5th period, it decreases to 30.02 % and 17.59% in the 10thperiod. It further decreased to 13.52% in the 15th period. Therefore, one can detect that real exchange rate increased during the 5th period, an indication that it is forecasted through its own innovations. After the 5th period onwards, changes in the real exchange rate is more influenced by the gross domestic product deflator and accounts for 77.81% in the changes contrary to 13.52% in real exchange rate itself.

In the 2nd period, apart from gross domestic product being the highest variation in real exchange rate with 19.42%, money supply also explains the variation in real exchange rate by 3.32%. However, as one moves further to the 5th period, one notices some changes between money supply and export. Money supply decreased from the 5th period till the last period with 2.00%. From the 5th period with 3.32% until the last period with 6.70%, one sees variations in real

exchange rate influenced by export followed by money supply. Despite the fact that it decreased, it is regarded as the third highest variable in explicating changes in real exchange rate and lastly, foreign direct investment. Hence, it implies that gross domestic product deflator is the highest variable in explaining variations in real exchange rate for the South African economy. Therefore it is evident that any shock in gross domestic product deflator will significantly affect the level of real exchange rate over the period. The next section explains impulse response in Figure 5.4.

5.10 Impulse response analysis

Figure 5.4 shows the response of real exchange rate to real exchange rate. It has an increasing positive effect to a decreasing positive effect on itself. This suggests that a shock to real exchange rate will cause an increase in real exchange rate in the South African economy.

The response of real exchange rate to gross domestic product deflator has an increasing negative effect while the response of real exchange rate to export slightly increases positively then decreases and has a negative effect. This implies that shocks to export and gross domestic product deflator will cause real exchange rate to decline.

Response of real exchange rate to foreign direct investment starts with a slight negative effect then has a small positive and increasing effect; therefore, a shock from foreign direct investment causes real exchange rate to increase. The response of real exchange rate to money supply has an increasing positive effect. This implies that a shock to money supply causes real exchange rate to increase.

The responses of gross domestic product deflator to real exchange rate and gross domestic product deflator to export have a negative increasing effect. This shows that a shock to real exchange rate and export causes a decline in gross domestic product deflator. Yet, the response of gross domestic product deflator to gross domestic product deflator has a positive an increasing effect, an indication that shocks to gross domestic product deflator will cause gross domestic product deflator to increase. The response of gross domestic product deflator to foreign direct investment is zero at the beginning of the period. It then increases negatively and has a negative effect. The response of gross domestic product deflator to money supply is also zero at the beginning then increases positively, indicating a positive effect. This means that a

shock to foreign direct investment will cause gross domestic product deflator to decrease while a shock to money supply will cause gross domestic product deflator to increase.

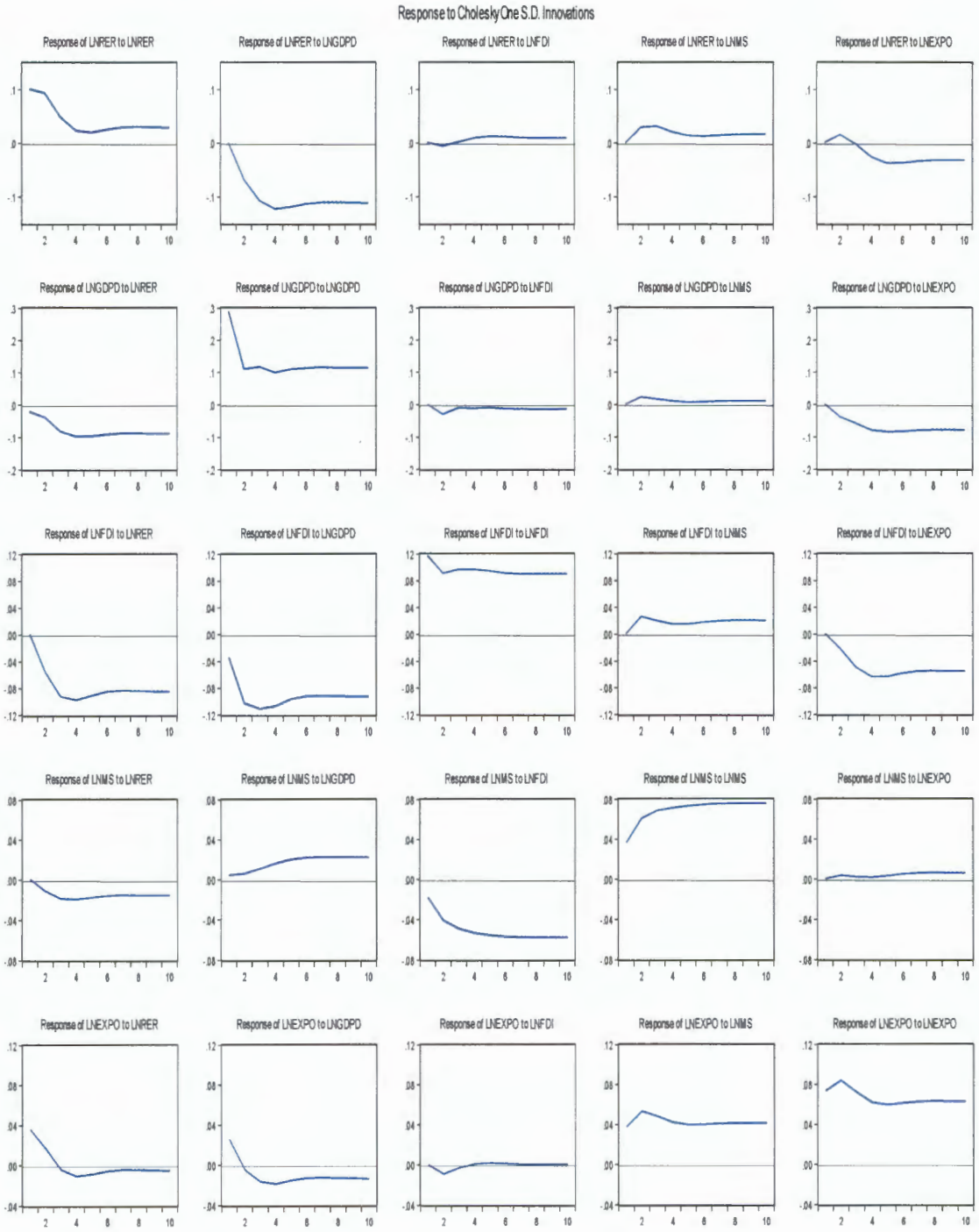
The responses of foreign direct investment to real exchange rate, foreign direct investment to gross domestic product deflator and foreign direct investment to export have an increasing negative effect, an indication that shocks to real exchange rate, gross domestic product deflator and export will cause a decline in foreign direct investment. The responses of foreign direct investment to foreign direct investment and foreign direct investment to money supply have an increasing positive effect. Hence, a shock from foreign direct investment and money supply will cause an increase in foreign direct investment.

The responses of money supply to real exchange rate and money supply to foreign direct investment are negatively increased. This means that a shock from real exchange rate and foreign direct investment will cause money supply to decrease. On the other hand, the responses from money supply to gross domestic product deflator and money supply to money supply have a positive and increasing effect, an indication that a shock from gross domestic product deflator and money supply causes a rise in money supply. The response of money supply to export is zero at the beginning, and slightly shows an increasing and positive effect along the line, an indication that a shock from export will cause an increase in money supply.

The responses from export to real exchange rate and export to gross domestic product deflator both have a positive decreasing effect than a gradually increasing negative effect. This is an indication that a shock from gross domestic product deflator and real exchange rate will cause export to decrease. Moreover, the response from export to foreign direct investment has a slight negative increasing effect and gradually becomes zero along the line. This means that a shock from foreign direct investment causes a decrease in export than becoming zero. Lastly, the responses from export to money supply and export to export have a positive increasing effect. This implies that a shock in money supply and export will cause an increase in export.

Thus, it could be concluded that a shock from real exchange rate responds negatively to gross domestic product deflator, foreign direct investment and money supply. The responses from these variables are positive than slow and negative to export. This means a shock from real exchange rate causes gross domestic product deflator, foreign direct investment and money supply to decrease. While a shock from real exchange rate, money supply and foreign direct investment later on responds positively to real exchange rate. Also, a shock from gross domestic product deflator and export responds negatively to export.

Figure 5.4: Impulse response analysis graph



5.11 Summary

This chapter was divided into nine sections. The first section presented the visual inspection, ADF and PP unit root tests used to test for stationarity. The results of the visual inspection revealed that data at level form is not stationary. When further differenced graphically, it is stationary. The ADF and PP unit root tests revealed that data is non-stationary at level form hence; it is differenced at 1st level. All variables were found to be stationary at 1st difference except for money supply and economic growth which were further tested for stationary at 2nd difference. At 2nd difference, they were found to be stationary. Once the variables were found to be stationary, the next step was to select a lag length criterion and lag one was found to be a suitable lag length for this study. Cointegration analysis was conducted thereafter. The Johansen cointegration analysis was employed in the study. It consists of two tests: Trace test and Maxi-Eigen test. Both tests were performed and the results revealed that cointegration exists at none for both. The results were significant at 5% level. Thus, it proved that a unique relationship exists between the variables. The third section was the VECM estimation technique. The results of VECM revealed that in the long-run, export and economic growth have a negative effect on exchange rate, while foreign direct investment and money supply have a positive effect on exchange rate. All variables were statistically significant. The error correction term was negative and statistically significant.

After this stage, the next section presented the diagnostics and stability tests to determine whether the model was stable and good enough. The results from the heteroskedasticity, autocorrelation and residual normality tests proved that the model was free from heteroskedasticity, autocorrelation and residuals were normally distributed. The AR root graph showed that all points were inside the circle, an indication that the model was stable.

The results of Granger causality, variance decomposition and impulse response were also presented. The results obtained from granger causality revealed that there is no causality between the variables, except for export which granger causes real exchange rate. Hence, a unidirectional causality was found between the two. The variance decomposition showed that gross domestic product deflator caused the highest variation in real exchange rate and money supply was found to be the second highest variation in real exchange rate. However, with time, export was found to be the second highest variation in real exchange rate from the 5th period followed by money supply and foreign direct investment. The impulse response showed the shock of a variable had an increasing or decreasing effect to another variable and a shock to

gross domestic product deflator responses negatively to real exchange rate. The next chapter presents the summary, conclusion of the study, policy recommendations and areas for further research.

Chapter 6

CONCLUSION

6.1 Introduction

Since the relationship between the rate of exchange and economic growth has become a significant area of research (Akpan, 2008), real exchange rate has become an important role-player in the macroeconomic performance of a country. South Africa struggles in many ways and due to fluctuations or rather volatility of the exchange rate, the growth rate has been on the declined in the past years. Moreover, shortage of water and electricity, political instability, low commodities, high interest rates have slowed down the economy. The Rand plays an important role as it determines a country's wellbeing. It also plays a role in international trade thus, has a great influence over the growth rate of South Africa's economy. The relationship between real exchange rate and economic growth in South Africa from 1980 to 2015 was explored in this study. The sections that follow, present the summary of the study, policy recommendations and areas for further research.

6.2 Summary and conclusion of the study

Chapter 1 provided the introduction to the study; the objectives, hypotheses and problem statement of the study were also stated in the chapter. Chapter 2 provided an overview of the study. The two main variables (real exchange rate and economic growth) were discussed in the Chapter. An explanation of the trend of real exchange rate and economic growth from previous years till date was provided. The two main variables (exchange rate and economic growth) were discussed in this Chapter, especially the trends and factors that affect the economy. The types of exchange rate regimes and the types of systems adopted by South Africa in the past and currently, were examined and explored. An explanation was further given as to why the Rand is not fixed by the government of South Africa but determined by the forces of demand and supply in the foreign exchange market.

Chapter focused on the literature review. The Chapter was divided into two sections: the first section provided the theoretical framework that informed the study. Various theories on real exchange rate were discussed in this section while the second section focused on the empirical framework. Studies conducted by previous researchers based on the link between exchange rate and economic growth was examined. In the literature review section, it was revealed that

researchers developed theories whereby they argued how changes in the exchange rate will affect economic growth. All the theories discussed had their own perspectives. Theories considered in this study were: the Balance of Payment theory; the Purchasing Power theory; the Balassa-Samuelson hypothesis; the Asset approach (Portfolio approach and the monetary approach); and the Traditional approach which maintains that a positive link exists between real exchange rate and economic growth. The Structuralist approach maintains that there is a negative relationship between real exchange rate and economic growth. On the other hand, the empirical studies presented various results in terms of the link between exchange rate and the growth rate of the economy in different countries using different methods of estimation. Some countries have similar results such as exchange rate affects economic growth positively while other studies found that exchange rate has a negative impact on the economy.

Chapter 4 focused on the methodology used in conducting the study. Variables considered in the study were: gross domestic product deflator, money supply, export and foreign direct investment. These variables were chosen based on the theoretical and empirical literature. Thus, the dependent variable was real exchange rate and the independent variables were gross domestic product deflator, export, money supply and foreign direct investment. The period of the study was from 1980 to 2015. The first step was to test the variables for unit root test. This was done through visual inspection and through the ADF and PP unit root tests. VECM was later performed and a lag length was selected from the optimal lag selection criteria. The Johansen cointegration test was performed to test whether the variables cointegrate at a chosen lag. The Johansen cointegration consists of two tests: Trace test and Max-Eigen value test. For the purpose of this study, the Trace test was considered. The next step was to estimate the long and short-run relationship between the variables through the vector error correction model. After the diagnostics and stability tests, the Granger causality test was conducted to determine the causality between the variables. Variance decomposition was performed to check which variables explained most of the variations in the dependent variable. Impulse response was also done to check the responsiveness of the dependent variable to shocks to each of the other variables.

Chapter 5 presented the analysis and interpretation of the findings of the study. The results of visual inspection revealed that at level form, the variables are non-stationary and at differenced form, all variables are stationary. The results of ADF and PP unit root tests revealed that at level form, most variables are non-stationary thus; they were further tested for unit root at first difference. The results of first difference revealed that all variables are statistically significant

and stationary except for money supply which was further tested at second difference to obtain stationarity. Once all variables were tested for stationarity, lag 1 was selected in order to test for Johansen cointegration. The Johansen cointegration test which consists of two tests (Trace and Max-Eigen test) were performed. The results obtained revealed that at lag 1, there is one cointegrating vector at none for both tests. The next step was to perform a VECM in order to conclude the long and short-run relationships. The results of the long-run revealed that all variables were significant in determining the relationship between real exchange rate and growth rate of the South African economy. Similarly, results of the short-run also indicated that all variables were insignificant even at lag one except for export which was significant. The adjusted R-square showed that only 46 % of the independent variables explain the variation in real exchange rate.

A negative and significant relationship exists between real exchange rate and gross domestic product deflator. Therefore according to the model, increase in growth means increase in income which means that there is an increase in import leading to a depreciation of the Rand. Money supply and foreign direct investment had a positive and significant relationship with real exchange rate. This means that there is a demand of the currency and increase in flows of funds. A negative and significant relationship was found between export and real exchange rate in the long-run. This means that export became cheaper which results in increases in international demand of goods while import decreases, resulting in an improvement in the current account, total expenditure and growth yet the exchange rate depreciates. In the short-run, export was the only variable that was significant in determining real exchange rate. In order for exports to expand in the economy, South Africa should promote more of its goods and services locally and internationally in order to increase exports. This will allow the country to be in a position to produce more and stimulate growth. The diagnostics and stability tests revealed that the model is stable and free from heteroskedasticity and serial relationship. The residuals are also normally distributed.

The results of the VEC granger causality test were evaluated at 5% level of significance. From the results obtained, only export granger causes real exchange rate since the probability values is less than 5%. This means that a unidirectional causality exists between export and real exchange rate, implying that changes in export do affect real exchange rate and vice versa. With regard to the rest of the variables, no causality was found.

The results of the variance decomposition revealed that real exchange rate is 100%, an indication that in the first period, to explicate its own shocks, 100% of real exchange rate variance is explicated through its own innovations. After the 5th period, up to the last period, changes in the real exchange rate are more influenced by the gross domestic product deflator and account for 77.81% in the changes contrary to 13.52% in real exchange rate itself. Thus, it could be concluded that gross domestic product is the highest variable in explaining variations in real exchange rate for the South African economy.

The results of the impulse response analysis revealed that the response from real exchange rate to real exchange rate and real exchange rate to money supply was positive, implying that shocks to money supply and real exchange rate cause an increase in real exchange rate. The response from real exchange rate to foreign direct investment was negative, then became positive, an indication that a shock from foreign direct investment causes real exchange rate to decrease and increase. The responses from gross domestic product deflator, foreign direct investment and money supply to real exchange rate were negative, suggesting shocks to real exchange rate cause gross domestic product deflator, foreign direct investment and money supply to decline. The response from real exchange rate to gross domestic product deflator was negative as well as the response from gross domestic product deflator to real exchange rate. This implies that shocks to gross domestic product deflator or real exchange rate cause one another to decrease.

It can, therefore, be concluded that the null hypothesis was rejected and the alternative hypothesis accepted as a negative and significant relationship was found between real exchange rate and economic growth. Also, the null hypothesis of real exchange rate does not granger causes economic growth and could be accepted as the results provided proof that real exchange rate does not granger cause economic growth or vice versa. Instead, export was one variable that granger causes real exchange rate. The third null hypothesis could be rejected and the alternative one accepted as significant evidence was found that real exchange rate responds to shocks from economic growth, foreign direct investment, money supply and export. Chapter 6 provided a summary of the study, the conclusion, policy recommendations and areas for further research.

6.3 Policy recommendations

The link between real exchange rate and economic growth has become a major concern for policymakers, economists and researchers. Based on the findings of this study, here are some of the recommendations that could be taken into consideration.

6.3.1 Economic growth policy

In this study, the long-run equation revealed that economic growth influences negatively on real exchange rate. Therefore, the government need to maintain stable growth and determine the factors that affect growth and come up with polices or strategies to maintain the level of growth with these factors.

6.3.2 Foreign direct investment policy

A positive relationship exists between foreign direct investments. Therefore increase in foreign direct investment results in an appreciation of the currency. This means that there is more demand of the currency. Thus, government and stakeholders should encourage, maintain and provide a conducive environment as well as maintain business confidence which will enhance foreign direct investment leading the exchange rate to appreciate.

6.3.3 Money supply policy

Money supply is found to have a positive relationship. It is recommended that government should maintain a well balance of demand and supply of money as it has an effect on the balance of payment which therefore affects the exchange rate.

6.3.4 Export policy

Exports have a negative relationship in the long-run. The negative relationship in the long-run, suggested that increase in exports results in a depreciation of the exchange rate. South Africa should maintain a well balance trade between their imports and exports which will keep the current account stable which will therefore maintain a stable rate of exchange.

6.4 Areas for further research

Further studies could be conducted using different variables to define the relationship between economic growth and real exchange rate. This study is not conclusive, further studies such as the effects of misalignments of real exchange rate on the South African economy or the analysis of misalignments of real exchange rate on South Africa's investment or current account deficit could be investigated. In addition, greater work and more sustained research needs to be embarked on by other researchers using various research methodologies to advance the study.

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LIST OF APPENDICES

Appendix A: Results of Johansen cointegration

Date: 02/17/17 Time: 12:40
Sample (adjusted): 1982 2015
Included observations: 34 after adjustments
Trend assumption: Linear deterministic trend
Series: LNRER LNGDPD LNFDI LNMS LNEXPO
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.682195	82.08856	69.81889	0.0038
At most 1	0.466338	43.11375	47.85613	0.1298
At most 2	0.307589	21.76203	29.79707	0.3119
At most 3	0.172086	9.264483	15.49471	0.3415
At most 4	0.080237	2.843736	3.841466	0.0917

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.682195	38.97481	33.87687	0.0113
At most 1	0.466338	21.35172	27.58434	0.2555
At most 2	0.307589	12.49755	21.13162	0.4994
At most 3	0.172086	6.420746	14.26460	0.5598
At most 4	0.080237	2.843736	3.841466	0.0917

Max-eigenvalue test indicates 1 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
4.386541	3.852878	-2.273922	-3.807160	5.554232
1.771632	1.745390	1.539194	10.44248	-12.87866
-3.956361	2.199765	-2.099864	1.074024	4.130913
-0.871255	2.707503	2.669711	-2.405763	0.116977
-2.074661	-0.000745	3.948936	-5.224437	2.700149

Unrestricted Adjustment Coefficients (alpha):

D(LNRER)	-0.069528	0.021579	-0.008832	0.021870
D(LNGDPD)	-0.101237	-0.026388	-0.075536	-0.076049
D(LNFDI)	-0.075416	0.030255	0.040113	-0.008245
D(LNMS)	-0.011333	-0.015063	-0.012068	0.004727
D(LNEXPO)	-0.038843	0.025890	-0.035362	0.003221

1 Cointegrating Equation(s): Log likelihood 173.3244

Normalized cointegrating coefficients (standard error in parentheses)

LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1.000000	0.878341	-0.518386	-0.867919	1.266199
	(0.15904)	(0.17096)	(0.37308)	(0.43531)

Adjustment coefficients (standard error in parentheses)

D(LNRER)	-0.304986
	(0.07530)
D(LNGDPD)	-0.444082
	(0.21835)
D(LNFDI)	-0.330814
	(0.09173)
D(LNMS)	-0.049711
	(0.03090)
D(LNEXPO)	-0.170388
	(0.07012)

2 Cointegrating Equation(s): Log likelihood 184.0002

Normalized cointegrating coefficients (standard error in parentheses)

LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1.000000	0.000000	-11.92182	-56.45684	71.43334
		(5.67006)	(12.3781)	(14.2624)
0.000000	1.000000	12.98292	63.28856	-79.88601
		(6.40416)	(13.9807)	(16.1090)

Adjustment coefficients (standard error in parentheses)

D(LNRER)	-0.266756	-0.230217
	(0.07879)	(0.07045)
D(LNGDPD)	-0.490832	-0.436113
	(0.23425)	(0.20945)
D(LNFDI)	-0.277214	-0.237761
	(0.09501)	(0.08495)
D(LNMS)	-0.076396	-0.069953
	(0.03038)	(0.02716)
D(LNEXPO)	-0.124521	-0.104471
	(0.07186)	(0.06425)

3 Cointegrating Equation(s): Log likelihood 190.2490

Normalized cointegrating coefficients (standard error in parentheses)

LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1.000000	0.000000	0.000000	-1.078987	0.588721
			(0.59125)	(0.62004)
0.000000	1.000000	0.000000	2.981777	-2.735838
			(0.93992)	(0.98569)
0.000000	0.000000	1.000000	4.645084	-5.942434
			(1.02475)	(1.07466)

Adjustment coefficients (standard error in parentheses)

D(LNRER)	-0.231813	-0.249646	0.209861
	(0.10218)	(0.07899)	(0.05727)
D(LNGDPD)	-0.191986	-0.602273	0.348204
	(0.29192)	(0.22568)	(0.16363)
D(LNFDI)	-0.435918	-0.149521	0.133824
	(0.11434)	(0.08840)	(0.06409)
D(LNMS)	-0.028652	-0.096499	0.027925

	(0.03692)	(0.02854)	(0.02069)	
D(LNEXPO)	0.015385	-0.182260	0.202432	
	(0.08374)	(0.06474)	(0.04694)	

4 Cointegrating Equation(s): Log likelihood 193.4594

Normalized cointegrating coefficients (standard error in parentheses)

LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1.000000	0.000000	0.000000	0.000000	-0.493969
				(0.04079)
0.000000	1.000000	0.000000	0.000000	0.256171
				(0.05769)
0.000000	0.000000	1.000000	0.000000	-1.281411
				(0.08379)
0.000000	0.000000	0.000000	1.000000	-1.003431
				(0.02306)

Adjustment coefficients (standard error in parentheses)

D(LNRER)	-0.250867	-0.190433	0.268247	0.427943
	(0.09981)	(0.08786)	(0.06999)	(0.18305)
D(LNGDPD)	-0.125728	-0.808176	0.145175	0.211699
	(0.28037)	(0.24681)	(0.19661)	(0.51421)
D(LNFDI)	-0.428734	-0.171845	0.111812	0.665973
	(0.11506)	(0.10128)	(0.08068)	(0.21101)
D(LNMS)	-0.032770	-0.083702	0.040544	-0.138480
	(0.03685)	(0.03244)	(0.02584)	(0.06759)
D(LNEXPO)	0.012579	-0.173540	0.211030	0.372509
	(0.08449)	(0.07437)	(0.05925)	(0.15495)

Appendix B: Results of vector error correction model

Vector Error Correction Estimates
Date: 02/17/17 Time: 12:41
Sample (adjusted): 1982 2015
Included observations: 34 after adjustments
Standard errors in ( ) and t-statistics in [ ]

CointegratingEq:	CointEq1
LNRER(-1)	1.000000
LNGDPD(-1)	0.878341
	(0.15904)
	[5.52263]
LNFDI(-1)	-0.518386
	(0.17096)
	[-3.03220]
LNMS(-1)	-0.867919
	(0.37308)
	[-2.32636]
LNEXPO(-1)	1.266199

	(0.43531)				
	[2.90872]				
C	-1.537751				

Error Correction:	D(LNRER)	D(LNGDPD)	D(LNFDI)	D(LNMS)	D(LNEXPO)
CointEq1	-0.304986	-0.444082	-0.330814	-0.049711	-0.170388
	(0.07530)	(0.21835)	(0.09173)	(0.03090)	(0.07012)
	[-4.05053]	[-2.03383]	[-3.60652]	[-1.60858]	[-2.42991]
D(LNRER(-1))	0.100677	0.318638	-0.170069	-0.093814	-0.097759
	(0.15876)	(0.46037)	(0.19340)	(0.06516)	(0.14785)
	[0.63417]	[0.69213]	[-0.87937]	[-1.43980]	[-0.66122]
D(LNGDPD(-1))	0.007415	-0.205682	0.061032	0.024388	0.023903
	(0.06433)	(0.18654)	(0.07836)	(0.02640)	(0.05991)
	[0.11527]	[-1.10261]	[0.77882]	[0.92371]	[0.39900]
D(LNFDI(-1))	-0.119518	-0.311590	-0.235194	-0.123199	-0.120556
	(0.17093)	(0.49568)	(0.20823)	(0.07016)	(0.15919)
	[-0.69922]	[-0.62861]	[-1.12947]	[-1.75609]	[-0.75733]
D(LNMS(-1))	0.307460	0.785845	0.747214	0.576219	0.137201
	(0.35710)	(1.03555)	(0.43503)	(0.14656)	(0.33256)
	[0.86099]	[0.75887]	[1.71762]	[3.93151]	[0.41256]
D(LNEXPO(-1))	0.591345	0.012052	0.101094	0.105901	0.352737
	(0.24595)	(0.71322)	(0.29962)	(0.10094)	(0.22905)
	[2.40437]	[0.01690]	[0.33741]	[1.04911]	[1.54003]
C	-0.021106	-0.096487	0.115787	0.069667	0.091008
	(0.05277)	(0.15303)	(0.06429)	(0.02166)	(0.04914)
	[-0.39997]	[-0.63052]	[1.80112]	[3.21664]	[1.85187]
R-squared	0.557084	0.354214	0.471859	0.484383	0.243992
Adj. R-squared	0.458658	0.210707	0.354494	0.369802	0.075990
Sum sq. resids	0.270478	2.274553	0.401412	0.045563	0.234583
S.E. equation	0.100089	0.290246	0.121931	0.041079	0.093211
F-statistic	5.659929	2.468257	4.020446	4.227410	1.452317
Log likelihood	33.93278	-2.266103	27.22127	64.21152	36.35331
Akaike AIC	-1.584281	0.545065	-1.189486	-3.365384	-1.726666
Schwarz SC	-1.270031	0.859316	-0.875236	-3.051133	-1.412415
Mean dependent	0.073963	-0.019513	0.166920	0.126146	0.120351
S.D. dependent	0.136034	0.326698	0.151762	0.051747	0.096968

Determinant resid covariance (dof adj.)	8.13E-11
Determinant resid covariance	2.57E-11
Log likelihood	173.3244
Akaike information criterion	-7.842611
Schwarz criterion	-6.046893

Appendix C: VEC Granger causality

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 04/30/17 Time: 21:14
Sample: 1980 2015
Included observations: 34

Dependent variable: D(LNRER)

Excluded	Chi-sq	df	Prob.
D(LNGDPD)	0.013287	1	0.9082
D(LNFDI)	0.488902	1	0.4844
D(LNMS)	0.741309	1	0.3892
D(LNEXPO)	5.780995	1	0.0162
All	8.719164	4	0.0685

Dependent variable: D(LNGDPD)

Excluded	Chi-sq	df	Prob.
D(LNRER)	0.479045	1	0.4889
D(LNFDI)	0.395148	1	0.5296
D(LNMS)	0.575880	1	0.4479
D(LNEXPO)	0.000286	1	0.9865
All	1.420799	4	0.8406

Dependent variable: D(LNFDI)

Excluded	Chi-sq	df	Prob.
D(LNRER)	0.773285	1	0.3792
D(LNGDPD)	0.606565	1	0.4361
D(LNMS)	2.950218	1	0.0859
D(LNEXPO)	0.113845	1	0.7358
All	4.614046	4	0.3292

Dependent variable: D(LNMS)

Excluded	Chi-sq	df	Prob.
D(LNRER)	2.073036	1	0.1499
D(LNGDPD)	0.853247	1	0.3556
D(LNFDI)	3.083858	1	0.0791
D(LNEXPO)	1.100630	1	0.2941
All	7.379806	4	0.1171

Dependent variable: D(LNEXPO)

Excluded	Chi-sq	df	Prob.
D(LNRER)	0.437218	1	0.5085
D(LNGDPD)	0.159203	1	0.6899
D(LNFDI)	0.573549	1	0.4489
D(LNMS)	0.170206	1	0.6799
All	1.667001	4	0.7967

Appendix D: White heteroskedasticity

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 02/17/17 Time: 12:42
Sample: 1980 2015
Included observations: 34

Joint test:

Chi-sq	df	Prob.
169.4495	180	0.7026

Individual components:

Dependent	R-squared	F(12,21)	Prob.	Chi-sq(12)	Prob.
res1*res1	0.461164	1.497739	0.2016	15.67956	0.2064
res2*res2	0.307487	0.777030	0.6673	10.45457	0.5761
res3*res3	0.333488	0.875608	0.5820	11.33858	0.5001
res4*res4	0.363471	0.999285	0.4818	12.35801	0.4174
res5*res5	0.267333	0.638533	0.7869	9.089312	0.6953
res2*res1	0.658428	3.373364	0.0072	22.38654	0.0334
res3*res1	0.508776	1.812533	0.1123	17.29840	0.1387
res3*res2	0.252734	0.591871	0.8248	8.592967	0.7372
res4*res1	0.206911	0.456562	0.9185	7.034975	0.8553
res4*res2	0.135890	0.275204	0.9875	4.620248	0.9695
res4*res3	0.229498	0.521247	0.8773	7.802933	0.8003
res5*res1	0.479682	1.613328	0.1628	16.30919	0.1775
res5*res2	0.375242	1.051083	0.4432	12.75822	0.3869
res5*res3	0.374844	1.049300	0.4444	12.74468	0.3879
res5*res4	0.246239	0.571691	0.8405	8.372124	0.7554

Appendix E: Autocorrelation LM test

VEC Residual Serial Relationship LM Tests
Null Hypothesis: no serial relationship at lag order h
Date: 02/17/17 Time: 12:42
Sample: 1980 2015
Included observations: 34

Lags	LM-Stat	Prob
1	21.03871	0.6904
2	25.31616	0.4448

Probs from chi-square with 25 df.

Appendix F: Normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 02/17/17 Time: 12:43
Sample: 1980 2015
Included observations: 34

Component	Skewness	Chi-sq	df	Prob.
1	0.176686	0.176901	1	0.6740
2	0.178880	0.181323	1	0.6702
3	-0.547179	1.696625	1	0.1927
4	-0.001653	1.55E-05	1	0.9969
5	-0.627930	2.234343	1	0.1350
Joint		4.289208	5	0.5086

Component	Kurtosis	Chi-sq	df	Prob.
1	2.627244	0.196841	1	0.6573
2	4.357253	2.609691	1	0.1062
3	3.505290	0.361701	1	0.5476
4	2.851782	0.031122	1	0.8600
5	3.381524	0.206210	1	0.6498
Joint		3.405566	5	0.6377

Component	Jarque-Bera	df	Prob.
1	0.373743	2	0.8296
2	2.791014	2	0.2477
3	2.058326	2	0.3573
4	0.031138	2	0.9846
5	2.440553	2	0.2951

Joint	7.694773	10	0.6586

Appendix G: Variance decomposition

Variance Decomposition of LNRER:

Period	S.E.	LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1	0.100089	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.156450	76.17266	19.43570	0.152111	3.320176	0.919350
3	0.198426	53.16208	41.77584	0.096914	4.372805	0.592360
4	0.237104	38.10058	56.21852	0.191887	3.753936	1.735067
5	0.269419	30.01597	63.19554	0.334948	3.127754	3.325781
6	0.296303	25.51569	66.96281	0.410983	2.745964	4.364558
7	0.319995	22.68897	69.44107	0.437347	2.534958	4.897652
8	0.341985	20.61450	71.33628	0.444775	2.411058	5.193388
9	0.362802	18.95213	72.86879	0.448918	2.320881	5.409274
10	0.382583	17.59036	74.11487	0.453687	2.244512	5.596575
11	0.401398	16.47167	75.13047	0.458640	2.178701	5.760522
12	0.419349	15.54498	75.96971	0.462924	2.123218	5.899174
13	0.436546	14.76536	76.67660	0.466362	2.076781	6.014894
14	0.453089	14.09856	77.28217	0.469162	2.037444	6.112660
15	0.469051	13.52062	77.80736	0.471552	2.003500	6.196969

Journal of Economics and Behavioral Studies (ISSN: 2220-6140)
Vol. 10, No. 1, pp. 146-158, February 2018

Relationship between Real Exchange Rate and Economic Growth: the case of South Africa

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Abstract: The objective of this study was to investigate the relationship between real exchange rate and economic growth in South Africa. Using time series data, the period from 1980 to 2015 was covered in the study. Data was collected from the South African Reserve Bank, the International Monetary Fund and International Financial Statistics. The Johansen cointegration and the Vector Error Correction Model estimation techniques were employed in the study, followed by VEC Granger causality test, variance decomposition and impulse response function. The long-run results revealed a negative and significant relationship between real exchange rate with export and economic growth. On the other hand, money supply and foreign direct investment have a positive and significant relationship with real exchange rate. Only export was significant and positively related to real exchange rate in the short-run. Results of granger causality showed that only export granger causes real exchange rate thus, a unidirectional causality exists between export and real exchange rate. Results of variance decomposition revealed that the real exchange rate is highly affected by shocks from economic growth. The impulse response functions showed that real exchange rate responds positively to shocks from real exchange rate and money supply. On the contrary, real exchange rate responds negatively to a shock from economic growth. There is, therefore, a need to increase exports, money supply, foreign direct investment and economic growth as these would lead to an increase in the Rand and consequently, appreciation of the Rand.

Keywords: *Real exchange rate, Economic growth, South Africa, VEC Granger Causality and VECM*

1. Introduction

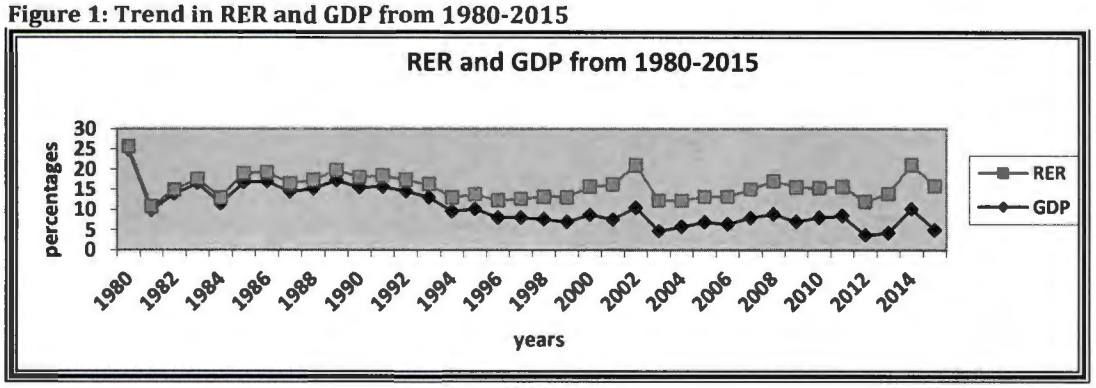
The relationship between exchange rate (ER) and economic growth (EG) has remained a controversial subject. A number of economists believe ER is an endogenous variable, whose influence on growth may be tough to separate (Habib, Mileva and Stracca, 2016). In terms of a country's level of trade, exchange rate plays an essential role. Thus, its importance allows exchange rate to be among the most observed, evaluated and governmentally influenced economic measures. Exchange rate fluctuations have been considered a problem in developing countries (Frankel, 2003). Fluctuations of exchange rate started occurring when most countries adopted the free float regime, after the change from global fixed exchange rate. South Africa is one of the countries that switched to a free floating system after 2000 (Van der Merwe, 1996). The value of the Rand has been going through a series of fluctuations recently. During the 2012 financial year, the Rand began to decrease against the United States Dollar; depreciating at 9 % average level rate of exchange (Census and Economic Information Centre Data, 2016). Moreover, in the 2015 financial year (between January and March), the decrease in the value of the currency was recorded at a rate of 12.45% (Trading Economics, 2015). In January 2016, it took a hard hit when it recorded its all-time high of R16.84 to the Dollar (Maepa,2015). This was mainly due to South Africa's political instability and the replacement of the Finance Minister, Nhlanhla Nene, with African National Congress (ANC) Member of Parliament, David Van Rooyen on 9thDecember 2015. Since South Africa is an open economy, real exchange rate (RER) is an essential factor and determines the development of a country. The exchange rate, therefore, has to maintain its stability for the economy to gain from international trade and also to increase the growth rate of the economy.

This study will add value to the current discussion on exchange and growth rates in South Africa as well as assist other students and researchers on information on the topic. It will also assist local policymakers in terms of formulating suitable policies. The study will also add value to available literature on the relationship between exchange and growth rates of the economy. This study is unique because of the chosen variables. Several studies have been conducted on the same topic; however, the variables chosen in this study are different from other studies. Furthermore, the methodology used in the study is very diverse. VEC Granger causality was employed in the study since most studies have only used the Vector Error Correction Model, variance decomposition and impulse response function.

2. Literature Review

Trend in RER and EG in the South African economy: A nation's currency value is considered to be an essential factor in determining growth (Walters and De Beer,1999). Thus, it is very important for a country to choose an appropriate exchange rate system since it offers a foundation for a nation to become competitive, especially in developing countries (Yagci, 2001).

Figure 1: Trend in RER and GDP from 1980-2015



In Figure 1 above, the graph shows the trend from 1980 to 2015, between real exchange rate and economic growth. The graph shows that from 1980 to 1995, economic growth was stable compared to the fluctuation in the real exchange rates. In 2001, the Rand was at its historical level of R13.84 to the dollar. However, in 2005, the currency softened and traded around R6.35 to the dollar. Nevertheless, South Africa, for the first time in 17 years, experienced a recession from 2008-2009, by going through three consecutive quarters of negative growth (Business live, 2017). In the fourth quarter of 2009, the weighted average exchange rate of the Rand increased by 1.2% (SA News, 2016). An appreciation in the exchange value of the Rand was due to improvement in the position of external trade, the constant increase in international commodity prices and positive sentiments towards the 2010 World Cup hosted by South Africa. However, since 2012, the Rand has been fluctuating, and lost its value for about 9.5% from December 2013 to December 2014 (Matlasedi, Zhanje and Iiorah, 2015). The Rand performed at its worst level in 2014 against the US dollar and decreased by 3.5% from the beginning of the year. However, the value increased by 2.5% by the end of the first quarter of 2014 (Twala and Mchunu, 2014). In 2015, the Rand hit to R15.38 (BusinessTech, 2016) and thenreached a level of R16.84 (Maepa, 2015), caused mainly to the political instability in the country. In 2015, GDP growth was 1.3%, an indication that economic performance remained challenging. By August 2015, the Rand dropped nearly 15% against the dollar due to South Africa's current deficit and slow growth. Since then, the Rand has been experiencing fluctuations, and concerns have been raised as the Rand may remain weak for at least the next five years (from 2014 to 2018) (Mittner, 2014).

Theoretical framework: This section is dedicated to theories on exchange rate. The Traditional approach implies that RER enhances EG, while the Structuralist approach implies that RER discourages EG. These two theories are applicable to the study as the main purpose is determine the relationship between RER and EG for South Africa.

The Traditional approach: The traditional approach holds that devaluation increases the growth rate of a country. This implies that when the exchange rate is devalued, domestic goods become inexpensive overseas, which in turn, raises their demand, thus resulting in a growth in exports (Salvatore, 2005). According to this method, aggregate demand determines output whereby, depreciation positively influences and encourages aggregate demand and output (Genye, 2011). Moreover, depreciation of a currency improves trade balance along with balance and expands output and employment (Acar, 2000). However, depreciation of a country's currency can only improve its trade balance and economic growth in the long-run when the Marshall-Lerner condition is satisfied. Thus, the traditional approach entails that real exchange rate enhances economic growth, implying a positive relationship (Sibanda, 2012).

The Structuralist approach: Contrary to the traditional approach, the structuralist approach maintains that currency devaluation may contain a contractionary outcome on output and employment. It shows that currency devaluation might cause a decrease in output. Krugman and Taylor (1978) state that devaluation encourages increase in returns share of gross domestic product thus, imposing a negative influence on aggregate demand if the saving propensity of firms and capital owners is greater than the wage of employees. In order for the structuralist approach to hold, a number of channels must be satisfied. The channels show that ER devaluation results in a decrease in aggregate demand and eventually general output. Furthermore, the contractionary effect is mainly caused by a rise in price levels. With this theory, a strategy to devalue money could result in challenging macro polices that strive to stabilize the macro-economy through a decrease in inflation (Sibanda,2012). Thus, a negative relationship exists between real exchange rate and economic growth. For the purpose of this study, the structuralist approach was considered more appropriate in terms of the situation in South Africa and thus, was adopted in the study; an indication that depreciation discourages economic growth.

Empirical literature: The purpose of this section is to examine studies conducted by other researchers with regard to exchange rates and economic growth, and to highlight the different methods of estimation employed by these researchers depending on their of country and period of study. Empirical evidence shows that results obtained differ from one study to another, thus, mixed results are found. Alawin, Sawaie, Al-Omar and Al-Hamdi (2013) examined the influence of real effective exchange rate (REER) in Jordon through the aggregate demand-supply theoretical framework. The researchers used the improved OLS method. Financial variables such as narrow monetary supply (M1) and broad money supply (M2) and GDP were employed. Data was obtained from the Central Bank of Jordon and the Department of Statistics. The theories are based on aggregate demand and aggregate supply to test the relationship. Considering the fact that the researchers used the traditional theory in their study, the results revealed that the appreciation of REER does not reflect international competitiveness of Jordanian goods, which is an indication that the Jordanian economy should maintain stability in RER. The empirical evidence showed that the impact of RER works through aggregate supply and a rise in REER enhances EG. In contrast, it was found that narrow money supply was more effective and because total price elasticity of exports and imports were found to be less than 1, the Marshall-Lerner condition was not obtained. It was recommended that real rate of exchange be used as one of the macroeconomic policies and maintain a fixed rate of exchange and as an active variable focus on narrow money supply in the Jordanian monetary policy.

Uddin, Rahman and Quaosar (2014) examined the relationship between ER and EG in Bangladesh. The study covered the period from 1973 to 2013 and employed a times series econometric technique, such as the Augmented Dickey-Fuller test (ADF), Granger causality test and Johansen cointegration model. Data was collected from the Bangladesh Bank, the Bangladesh Bureau of Statistics, the Asian Development Bank, the International Financial Statistics and World Development Indicators. The empirical results showed a significant positive relationship between ER and EG. The Granger's causality test proved that a bi-directional causality runs through exchange rate to economic growth and vice versa, which is an indication of the existence of a long-run equilibrium relationship between ER and EG. Aman, Ullah, Khan and Khan (2013) examined the link between exchange rate and growth rate of the Pakistan economy. The study covered the period from 1976 to 2010 and data was collected from the database of the World Bank and Pakistan economic surveys. An indirect approach was used in the study since theoretical literature is inadequate to clarify the correct link. Moreover, most academic literature emphasizes an indirect relationship since ER encourages growth through export, investment and internal trade. Hence, the simultaneous equation model with two and three stage least square techniques was employed in the study. A positive relationship between ER and EG was revealed in the study. Although a positive relationship was found, exchange rate cannot be applied as a strategy tool to boost growth with regard to Pakistan.

Tarawalie (2010) investigated the impact of REER on EG in Sierra Leona. The author used quarterly data from 1990Q1 to 2006Q4. Data was obtained from the International Financial Statistics (2007), published by the IMF and the Bank of Sierra Leone Bulletin. The Johansen cointegration technique and bivariate Granger causality were used in the study. The empirical results obtained revealed a positive relationship between REER and EG supported by statistically significant coefficients. The results also showed that in the long-run, the monetary policy was somewhat more efficient than the fiscal policy, which is in line with the basic

Mundell-Fleming model. For policymakers, it was recommended that in order to obtain macroeconomic solidity, monetary and fiscal policies should be in consonance. Importantly, it is essential to keep ER stable by letting it to depreciate within a given band as well as maintain a stable political environment in order to recover investment. Ayodele (2014) studied the impact of exchange rate on the Nigerian economy from2000 to 2012. Inflation and exchange rates are factors measured in changes in GDP. Secondary data was collected from Annual Reports of the Central Bank of Nigeria, the Nigerian Stock Exchange and Nigeria Securities and Exchange Commission. The study used multiple regression models. It was found that as exchange rate increased, it negatively affected growth while inflation rate exerted a positive impact on growth. The negative effect of the rate of exchange did not allow the economy to boost as anticipated, although the economic growth rate increased every year in Nigeria. It was suggested that to accelerate economic growth through a favorable exchange rate and to decrease the pressure of the dollar, the government should make the investment climate friendly in the Nigerian economy by reinstating safety of lives and property, infrastructural growth and development in local production.

Wong (2013) examined RER misalignment and EG in Malaysia. The study focused on the period from 1971 to 2008. An Autoregressive Distributed Lag Model (ARDL) and Generalized Forecast Error Variance Decomposition (GFEVD) approach were applied. The results obtained revealed that in the long-run, a rise in real interest rate differential, productivity differential and real oil price or reserve differential will cause an increase in RER. It also showed that an increase in RER misalignment would cause a reduction in EG. Particularly, devaluation will promote economic growth while appreciation will hurt economic growth. The GFEVD outcome showed that variables are important in determining RER. According to the fundamentals, real exchange rate misalignment should be evaded in order to facilitate the allocation of resources in the economy. It was, therefore, concluded that government intervention is necessary during the short-run to minimize real exchange rate misalignment and to smooth down fluctuations, while in the long-run, markets and financial organizations should be strengthened.

Basirat, Nasirpour and Jorjorzadeh (2014) studied the effects of instability of the rate of exchange on economic growth, taking into account, the speed of growth of financial markets in developing countries. The authors analyzed panel data of 18countries from 1986 to 2010. The 5-year mean was used for each of the variables in order to eliminate the effects of short-term cycles as well as to avoid fluctuating annual data from denting the results. The World Development Indicator from the World Bank website was used to obtain statistics for all the variables. From the results revealed a negative and significant effect of financial development and exchange rate fluctuation on economic growth. Whereas, a positive effect was obtained from the mutual effect of exchange rate fluctuations and financial development on economic growth, although it was not statistically significant as the effect in the studied countries was small.

Bibi, Ahmad and Rashid (2014) investigated the role of exchange rate, trade openness, inflation, imports, exports, real exchange and foreign direct investment which improve economic growth. The period of study was from 1980 to 2011 using times series data. The methods used to determine stationarity were: ADF; Philips Peron (PP); Dickey-Fuller Generalized Least Square (DF-GLS); and cointegration and Dynamic Ordinary Least Square (DOLS) estimation techniques. The results of cointegration showed that a long-run relationship existed between the variables. On the contrary, inflation and trade openness imposed a negative impact on economic growth, which is supported by the results of DOLS and due to depreciation in the ER along with huge volume of importing resulting in trade deficit while FDI, imports, exports and exchange rate positively influenced EG. Although a positive relationship was shown between ER and EG, there was no significant relationship as the local economic performance of economic growth is much complex to the deviation in ER in the long period. It was recommended that policymakers should take the occurrence and amount of ER instability into account as well as the effects of changes on each macroeconomic factor of trade policy and foreign direct investment.

Kandil (2004) studied the outcomes of exchange rate fluctuations on real output growth along with price inflation for a sample of 22 developing countries. The author argues that a depreciation of a domestic currency all the way through initial rise in the price of foreign goods relative to home goods could stimulate economic activity. A theoretical model was employed, which decomposes the movements of ER into expected and unexpected mechanisms. The impact of expected exchange rate shifts in the long-run is assessed through

a significant decrease in output growth and a significant rise in price inflation. On the other hand, unexpected exchange rate shifts during the short-run, affect fluctuation in output growth and price inflation. Through the demand and supply channels, in the face of unanticipated currency depreciation, there is proof of a significant contraction of output growth as well as price inflation determined by demand expansion and supply contraction. It was, therefore, concluded that in a range of developing countries, exchange rate fluctuations generate unfavorable consequences on economic performance; these outcomes are clear by means of output contraction and price inflation during a phase of currency devaluation. There is a need for exchange rate policies to aim at minimizing unanticipated currency fluctuations in order to insulate economic performance from unfavorable outcomes of inconsistencies in developing countries. Moreover, evidence from empirical data suggests that the exchange rate should be stabilized at a level that is reliable with difference in macroeconomic fundamentals over time.

3. Methodology

The Structuralist approach, the Johansen (1995) cointegration technique, the Vector Error Correction Model (VECM), VEC granger causality, variance decomposition and impulse response function were adopted in this study. Different diagnostic and stability tests such as heteroscedasticity, serial correlation, normality and AR root graph were also used in the study.

Model specification: The dependent variable was real exchange rate (RER) and the explanatory variables were gross domestic product deflator (GDPD), foreign direct investment (FDI), export (EXP) and money supply (MS). The model according to Sibanda (2012) was adopted in the study.
The model was modified and estimated as follows:

$$RER = \beta_0 + \beta_1 GDPD + \beta_2 FDI + \beta_3 MS + \beta_4 EXP + \varepsilon \quad \text{.....} \quad (1)$$

It is significant to change the regression equation into natural logarithm since it brings a stable trend and eliminates the tendency of fluctuations over time (Mah, 2012). Therefore, the regression equation now becomes:

$$\ln(RER) = \beta_0 + \beta_1 \ln(GDPD) + \beta_2 \ln(FDI) + \beta_3 \ln(MS) + \beta_4 \ln(EXP) + \varepsilon \quad \text{.....} \quad (2)$$

Stationarity test: In order to avoid the generation of spurious regression and determine whether cointegration exists among the results of the variables, it is important to test for stationarity. Stationarity tests include both visual inspection and Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests. Once the stationarity test has been done, the next step is to choose an appropriate lag length in order to see which lag fits the best.

Lag order selection criteria: It is important to have a good lag since variables that are omitted affect the lag length, which in turn, affects the behavior of the model. For the purpose of this study, FPE was chosen as the best criteria. Liew (2004) states that the FPE lag length is good for a small sample of 60 and below.

Johansen cointegration test: The Johansen technique applies the greatest likelihood evaluation towards VECM, together, they determine the short and long-run determinants of the dependent variable. There are two methods: The Maximum Eigenvalue test and the Trace test that determine the number of cointegrating vectors (Asteriou and Hall, 2006). In the Maximum Eigenvalue test, the null hypothesis (H_0) states that there are r cointegrating relations and the alternative hypothesis (H_1) states that there are $r + 1$ cointegrating relations.

$$J_{max\,Egen} = -T \ln(1 - \lambda_{r+1}) \quad \text{.....} \quad (3)$$

With regard to the trace test, theH_0isr cointegrating vectors and the$H_1$is n cointegrating vectors.

$$J_{trace} = -T \sum_{i-t+1}^{n} \ln(1 - \lambda_i) \quad \text{.....} \quad (4)$$

Lukephol (1993) suggests that the Trace test executes well than the Max-Eigen value. Once the existences of cointegrating relationships are determined, VECM could be applied. This is done by the vector auto regression (VAR) of order P (Sibanda, 2012):

$$Y_t = A_1 Y_{t-1} + BX_t \ldots A_p Y_{t-p} + \varepsilon_t \quad \text{.....} \quad (5)$$

Where by, Y_t is a k- vector of I (1) variables, X_t is a d-vector deterministic variable and ε_t a vector of innovations. The equation above is rewritten into a VECM specification to employ the Johansen technique (Brooks, 2008). Thus, the VAR is rewritten as:

$\Delta Y_t = \prod Y_{t-1} + \sum_{i-1}^{p-1} i\Delta Y_{t-1} + BX_t + \varepsilon_t$ ..... (6)
where: $\prod = \sum_{i-1}^{p} Ai$- I and i = - $\sum_{j=i+1}^{p} Aj$ ..... (7)
When the coefficient matrix $\prod$ has reduced rank, then m × r matrices α andβ exist. Moreover, $\prod = \alpha\beta'$ and β' Y_t are stationary and r is the number of cointegration, each column of β is the number of cointegrating vector and α adjustment parameters in the VECM (Sibanda,2012).

Vector Error Correction Model: VECM is simply an idea when part of the disequilibrium from one phase to the next phase is corrected. This entails assessing the first differenced form (in equation 1) model by including an error correction term (ECT) as an explanatory variable. Thus, ECM is estimated as follows:
$\Delta \ln (RER_t) = \beta_0 + \sum_{i-n-1}^{n} \beta_1 \ln (GDPD_{t-1}) + \sum_{i-n-1}^{n} \beta_2 \Delta \ln (FDI_{t-1}) + \sum_{i-n-1}^{n} \beta_3 \Delta \ln (MS_{t-1}) + \sum_{i-n-1}^{n} \beta_4 \ln (EXP_{t-1}) + \beta_5 EC_{t-1} + v$ ..... (8)
where n is the value selected using the Aikaike's Information Criteria (AIC) and Schward Information Criterion(SC). ECT represents the error correction term and V represents the Random error term. ECT is defined as the lagged values of the error term that has been developed from the regression mode. When the ECT is negative and statistically significant, it is an indication that part of the disequilibrium in RER is accurate in the next phase (Hassan, 2003).

Diagnostics and Stability tests: The diagnostic and stability tests help in electing whether or not a model has been correctly identified. The diagnostic test consists of Heteroscedasticity, Autocorrelation Lagrange Multiplier (LM) and Normality test. Under the stability test, the autoregressive (AR) root graph is employed, this test determines whether the model is stable or not.

VEC Granger causality test results: VEC granger causality is used to regulate whether present and lagged values of one variable affect one another. When X is said to Granger cause Y, then the historical and current values of X help to predict Y Granger (1969).

Variance decomposition results: Andren (2007) explained the significance of variance decomposition by maintaining that it offers a way of defining the comparative significance of shocks in enlightening differences in the variable of interest. Henceforth, it provides ways of defining comparative significant of shocks to RERs with the intention of explaining variations in economic growth.

Impulse Response Analysis: This technique traces the responsiveness of the dependent variable to shocks in each of the other variables in a study. It is normally related to VECM, given that shocks related to VECM slowly deter away after a while (Brooks, 2014).

4. Results and Interpretation

Stationarity: Figure 2 shows graphical representations of all the variables at first difference, indicating that both mean and variance are constant over time, thus stationarity has been achieved at first difference. A formal method to present results of unit root (ADF and PP unit root tests) has been conducted in order to support the graphical findings in Table 2.

Table 1: Unit root at intercept

Variables	ADF test t-statistic	Probability	PP test t-statistic	Probability	Order of integration
LNGDPD	-8.298	0.000***	-3.014	0.043**	I(1)
LNRER	-4.370	0.002***	-4.194	0.002***	I(1)
LNFDI	-4.732	0.001***	-4.633	0.001***	I(1)
LNMS	-5.007	0.000***	-9.439	0.000***	I(2)
LNEXPO	-5.603	0.000***	-6.344	0.000***	I(1)

***stationary at 1%, **stationary at 5%, *stationary at 10%

From the Table above presented reveals the unit root test for all the variables at first difference and second difference. Based on the probability values LNGDPD, LNRER, LNFDI and LNEXPO are stationary at first difference while LNMS is stationary at second difference.

Table 2: Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ	Conclusion
0	-15.14	NA	2.25e-06	1.185	1.409	1.261	Not good
1	169.4	304.0*	1.92e-10*	-8.202	-6.856*	-7.743*	Good
2	194.9	34.42	2.07e-10	-8.228*	-5.759	-7.386	Not good

Lag order selection criteria: Table 2 presents the lag length selection criteria. Lag one is found to be the best lag for the data with regard to the case of South Africa as indicated by FPE, majority of the criteria also suggest lag 1.

Table 3: Trace test and Max-Eigen test

		Trace test			Max-Eigen test			
Hypothesized no. of CE(s)	Eigen value	Trace statistics	0.05 critical value	Prob.**	Max-Eigen statistics	0.05 critical value	Prob**	Conclusion
None*	0.682	82.09	69.82	0.004	38.98	33.88	0.011	Reject H_0
At most 1	0.466	43.11	47.86	0.120	21.35	27.58	0.256	Do not reject H_0
At most 2	0.308	21.76	29.70	0.312	12.40	21.13	0.499	Do not reject H_0
At most 3	0.172	9.264	15.49	0.342	6.421	14.26	0.550	Do not reject H_0
At most 4	0.080	2.844	3.841	0.092	2.842	3.841	0.092	Do not reject H_0

Results of Johansen Cointegration test: Table 3 presents the results of the Trace and Max-Eigen tests. The trace statistics at none is 82.09; it is more than the 5% critical value of 69.82. The$H_0$of no cointegrating vectors is, therefore, not accepted at none and suggests that there is cointegration at none. The Max-Eigen test at none is 38.98, which is more than the 5% critical value of 33. 88. This implies that there is cointegration and, therefore, theH_0 is rejected. Both Trace and Max-Eigen indicate 1 cointegration equation at none.

Table 4: Results of Long-run relationship

Variables	Coefficient	t- statistics	Standard error	Conclusion
Constant	-1.538	-	-	
LNRER	1.000	-	-	
LNGDPD	0.878	5.523	0.159	Negative and significant
LNFDI	-0.518	-3.032	0.518	Positive and significant
LNMS	-0.868	-2.326	0.373	Positive and significant
LNEXPO	1.266	2.909	0.435	Negative and significant

The long run equation is presented as follows:

LNRER = 1.538 – 0.878 LNGDPD + 0.518 LNFDI + 0.868 LNMS – 1.266 LNEXPO..... (9)

Results of Vector Error Correction Model: The results of the long-run relationship of VECM show that if all the independent variables are held constant, LNRER will rise by 1.538 unit. A negative and significant relationship between LNRER and LNGDPD exists in the long-run. A 1 unit increase in LNGDPD will cause LNRER to decrease by 0.878 unit. These results are in line with those obtained by Ayodele (2014) and Wong

(2013) who also found a negative relationship between real exchange rate and economic growth. Therefore, it could be concluded that if LNGDPD increases, then it leads to a depreciation of the Rand. Also, LNFDI shows a positive and significant relationship on LNRER in the long-run. A 1 unit increase in LNFDI will cause LNRER to increase by 0.518 unit. These results are similar to those of Bibi et al. (2014) who found that foreign direct investment is positively related to economic growth. However, there is no significant evidence. This implies that if LNFDI increases, then the Rand will appreciate. An increase in foreign direct investment attracts more investors to invest in the country and boosts business confidence in the market thus, encouraging economic growth and has a positive influence on the Rand.

A positive and significant relationship was also found between LNMS and LNRER. A 1 unit increase in LNMS will cause LNRER to increase by 0.868 unit. Also, with LNMS, if increased, then the Rand will appreciate. Contrary to this, Sibanda (2012) found a negative relationship between money supply and economic growth. Finally, a negative and significant relationship exists between LNEXPO and LNRER. A 1 unit increase in LNEXPO will cause LNRER to decrease by 1.266 unit. LNEXPO is negative, an indication that a decrease depreciates the Rand. Bibi et al. (2014) found a positive relationship between real exports and economic growth. The results are contrary maybe due to effects of international financial instability.

Table 5: Results of Short-run error correction model

Variables	Coefficient	T-statistics	Standard error	Conclusion
CointEq1	-0.305	-4.051	0.075	Negative and Significant
D(LNEXPO(-1))	0.591	2.404	0.246	Positive and Significant
R-square	0.557			
Adj R-square	0.459			

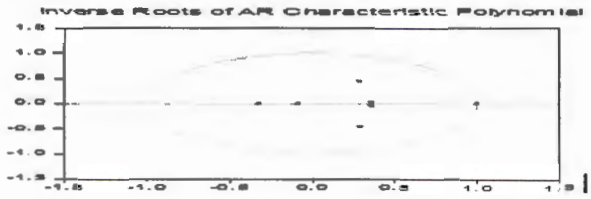
The error correction term is negative (-0.305) with an absolute t-statistics of 4.051. This proves that only 30% equilibrium is corrected in the next period as it moves towards restoring equilibrium. D (LNEXPO (-1)) has a positive relationship and is statistically significant in determining LNRER. This means that an increase in export leads to an increase in real exchange rate or vice versa. The R-square value is 0.56, which suggests that only 56% of the deviation in LNRER is explained by the independent variables. Also, the Adjusted R-square is 0.46, which provides evidence that 46% of the independent variables explain the variation of the dependent variable.

Diagnostics and stability tests: This section focuses on the results of the diagnostics and stability tests. The probability value of 0.05 or 5% level of significance was used to decide whether the null hypothesis should be accepted or rejected.

Table 6: Summary of all diagnostic tests

Test	Null hypothesis	Chi-square/ LM statistic	Probability	Conclusion
Heteroscedasticity	No heteroscedasticity	169.4	0.703	No evidence of heteroscedasticity.
Serial correlation LM	No serial correlation	21.04	0.690	No evidence of serial correlation
Normality	Residuals are normally distributed	7.695	0.659	Normally distributed

Figure 3: AR autoregressive root graph



Stability test: The AR root graph in Figure 3 is used to detect whether the model is stable for South Africa or not. All the unit root points lie inside the unit circle which implies that the model is stable.

Table 7: VEC Granger Causality test

Dependent variable: D(LNRER)				
Excluded	**Chi-square**	**Degree of freedom**	**Prob.**	**Conclusion**
D(LNGDPD)	0.013	1	0.908	Do not Reject H_0
D(LNFDI)	0.489	1	0.484	Do not Reject H_0
D(LNMS)	0.741	1	0.389	Do not Reject H_0
D(LNEXPO)	5.781	1	0.016	Reject H_0
ALL	8.719	4	0.069	Do not Reject H_0
Dependent variable: D(LNGDPD)				
Excluded	Chi-square	Degree of freedom	Prob.	Conclusion
D(LNRER)	0.479	1	0.489	Do not Reject H_0
D(LNFDI)	0.395	1	0.520	Do not Reject H_0
D(LNMS)	0.576	1	0.448	Do not Reject H_0
D(LNEXPO)	0.000	1	0.987	Do not Reject H_0
ALL	1.421	4	0.841	Do not Reject H_0
Dependent variable: D(LNFDI)				
Excluded	Chi-square	Degree of freedom	Prob.	Conclusion
D(LNRER)	0.773	1	0.379	Do not Reject H_0
D(LNGDPD)	0.607	1	0.436	Do not Reject H_0
D(LNMS)	2.950	1	0.086	Do not Reject H_0
D(LNEXPO)	0.114	1	0.736	Do not Reject H_0
ALL	4.614	4	0.329	Do not Reject H_0
Dependent variable: D(LNMS)				
Excluded	Chi-square	Degree of freedom	Prob.	Conclusion
D(LNRER)	2.073	1	0.140	Do not Reject H_0
D(LNGDPD)	0.853	1	0.356	Do not Reject H_0
D(LNFDI)	3.084	1	0.079	Do not Reject H_0
D(LNEXPO)	1.101	1	0.294	Do not Reject H_0
ALL	7.370	4	0.117	Do not Reject H_0
Dependent variable: D(LNEXPO)				
Excluded	Chi-square	Degree of freedom	Prob.	Conclusion
D(LNRER)	0.437	1	0.509	Do not Reject H_0
D(LNGDPD)	0.159	1	0.680	Do not Reject H_0
D(LNFDI)	0.573	1	0.449	Do not Reject H_0
D(LNMS)	0.170	1	0.670	Do not Reject H_0
ALL	1.667	4	0.797	Do not Reject H_0

Results of VEC Granger causality test: The probability values are used to evaluate the casual relationship among variables. The results are evaluated at 5% level of significance. When the probability value is more than 5%, then H_0 is accepted and if it is less than 5%, then H_0 is not accepted instead, H_1 is accepted. From the

results obtained, only LNEXPO granger causes LNRER since the probability value is less than 5%, an indication that changes in LNEXPO do affect LNRER. LNGDPD, LNMS and LNFDI do not granger cause LNRER. On the contrary, Tarawalie (2010) performed a bivariate granger causality test and found that REER does granger cause real GDP in the case of Sierra Leone.

Table 8: Variance Decomposition of LNRER

Period	S.E.	LNRER	LNGDPD	LNFDI	LNMS	LNEXPO
1	0.100	100.0	0.000	0.000	0.000	0.000
2	0.156	76.17	19.42	0.152	3.320	0.919
3	0.198	53.16	41.78	0.097	4.373	0.592
4	0.237	38.10	56.23	0.192	3.754	1.735
5	0.260	30.02	63.20	0.335	3.128	3.326
6	0.296	25.52	66.96	0.411	2.75	4.365
7	0.320	22.69	69.44	0.437	2.535	4.898
8	0.342	20.61	71.34	0.445	2.411	5.193
9	0.363	18.952	72.87	0.449	2.321	5.409
10	0.383	17.59	74.11	0.454	2.245	5.597
11	0.40	16.47	75.13	0.459	2.179	5.761
12	0.419	15.54	75.97	0.463	2.123	5.899
13	0.437	14.77	76.68	0.466	2.077	6.015
14	0.453	14.10	77.28	0.469	2.037	6.113
15	0.469	13.52	77.81	0.472	2.004	6.197

Results of Variance decomposition: Table8 shows the forecast error variance for LNRER is 100%, an indication that in the first period, to explicate its own shocks, 100% of RER variance is explicated through its individual innovations. While it moves on to the 5th period, it decreases to 30.02 % and 17.59% in the 10th period. After the 5th period onwards, variations in real exchange rate are more influenced by LNGDPD and accounts for 77.81% in the changes contrary to 13.52% in LNRER itself. This is an indication that LNGDPD is the highest variable in explaining variations in LNRER for the South African economy. On the contrary, Sibanda (2012) revealed that EG describes most of its variations along with real interest rates while exchange rate does not explain much variation in economic growth.

Impulse response analysis: Figure 4 shows the response of LNRER to LNRER at an increasing positive effect to a decreasing positive effect on itself. This suggests that a shock to LNRER will cause an increase in LNRER in the South African economy. Also, a positive response of LNRER to LNMS means that a shock to LNMS causes LNRER to increase. If the response of LNRER to LNGDPD is negative, it is an indication that a shock to LNGDPD causes LNRER to decrease. If the response of LNRER to LNFDI is negative than positive, this is an indication that a shock to LNFDI will cause LNRER to decrease than increase. On the contrary, if the response of LNRER to LNEXPO is positive than negative, this shows that a shock to LNEXPO will result in LNRER to increase than decrease. If the response of LNGDPD to LNRER, LNFDI to LNRER and LNMS to LNRER are negative, this implies that a shock to LNRER will cause LNGDPD, LNMS and LNFDI to decrease. If the response of LNEXPO to LNRER is positive than negative, it is an indication that a shock to LNRER will cause LNEXPO to increase than decrease. These results are different from those obtained by Sibanda (2012), who found that all variables are significant even though they are not tenacious. Since REER shock encourages growth, however, from 8 quarters, it has a negative impact.

5. Conclusion

The results obtained in this study revealed a negative and significant relationship between RER and EG. Also, RER does not granger cause EG or vice versa, instead, EXPO was one variable that granger causes RER. This is confirmed by the results of VEC granger causality test. Meanwhile, the results of variance decomposition and impulse response function showed that RER does respond to shocks from EG as well as from FDI, MS and EXPO. It is, therefore, concluded that an increase in growth will strengthen the Rand. Variance decomposition

confirmed the results, an indication that variations in real exchange rate are highly explained by shocks from economic growth. On the other hand, there is a need to attract foreign investors and increase business confidence in the markets. There is need for government and individuals to promote investment and to create a peaceful environment for investment which will enhance the Rand to appreciate. Furthermore, if money supply increases, then interest rates are likely to decline thus, increasing investment and economic growth and hence, an appreciation of the Rand. There is need for South Africa to diversify its products in order to increase international trade and to encourage export promotion. This will expand the market and economic growth will be achieved. Reducing its imports will go a long way in expanding and developing a trade balance.

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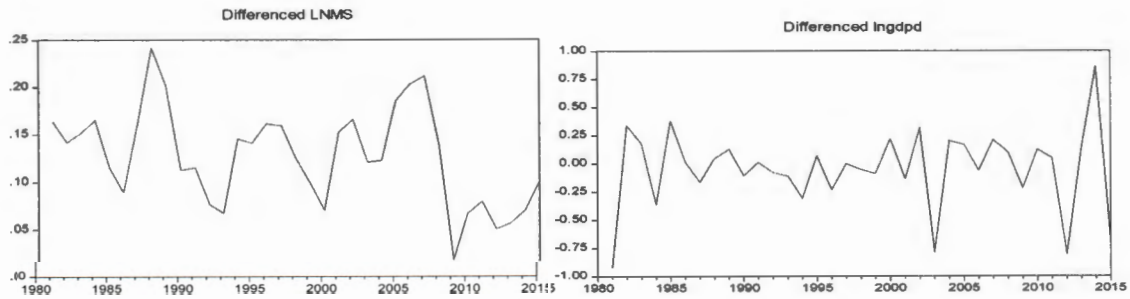
Appendices

Figure 4: Visual inspection at differenced form



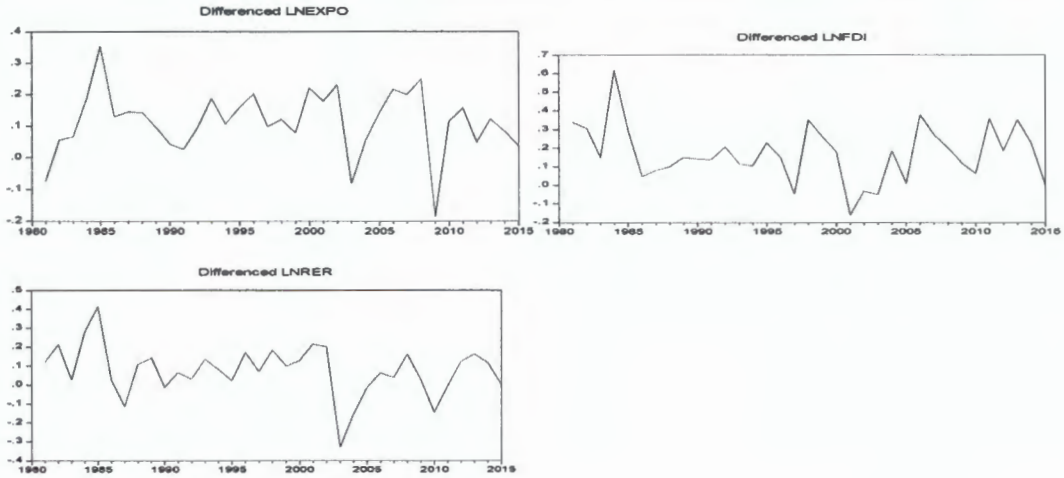


Figure 5: Impulse response graph