NELSON MANDELA UNIVERSITY

# THE EFFECT OF THE EXCHANGE RATE ON ECONOMIC GROWTH IN SOUTH AFRICA

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In accordance with Rule G5.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

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**Abstract**

The study examines the effect of the exchange rate on South African economic growth rate, as this relationship is of paramount importance in South Africa, since the country has a highly volatile exchange rate in among emerging economies, and this has a significant impact on economic growth. The exchange rate can be explained or defined as the value of the home country or domestic currency in relation to foreign currencies, and economic growth, which is measured in terms of gross domestic product (GDP), which is the measure of currently produced final output in a country at a specific time period, usually a year or quarter.

It has been long known that an inadequately or poorly managed exchange rate can be problematic in a country's economic growth rate. Some economists point out that management of a country's foreign exchange market is of utmost importance. Furthermore, bad exchange rate management can lead to unstable international relations that detrimentally affect the international trade of a country and cause large speculative financial flows, which could cause financial markets to be disrupted and also lead inefficient allocation of funds. At the same time, competitive exchange rate promotes a suitable economic environment that is a precondition when it comes to expanding of international trade and investment, and gaining of higher economic growth in a country.

The purpose of this study is to investigate the effect of the exchange rate on economic growth in South Africa. This study employs a newly developed econometric technique known as non-linear autoregressive distributive lag (NARDL). This study employs annual data for the period of 1970 to 2017. The first variable is the real effective exchange rate of the rand, and the study compares the value of the rand against the currencies of the twenty trading partners. The second variable is economic growth, which is measured in terms of the gross domestic product (GDP). GDP is the value of output produced within the region or borders of a country during a period of time, usually a year or quarter. Investment is another variable used, and it is categorised into economic investment (capital formation) and financial investment but the study adopts economic investment. Economic investment is the quantity of capital stock in a society, simple put it is goods used in the making of other goods. Government expenditure is also used in the study, and government expenditure is

about public goods and services provided to society, and is a major component of gross domestic product. The last variable employed in the study is broad money supply as a percentage of GDP, which can be explained as the sum of the currency outside financial institutions, such as demand deposits other than the ones for government, the time, savings, and foreign currency of residents other than the government. GDP data was obtained from the electronic data bases of South African Reserve Bank, and all the remaining variables were obtained from the electronic data bases of the World Bank.

The results of the NARDL model indicate that a positive change of the real effective exchange rate has a positive and significant effect on the gross domestic product in the long-run, while a negative change of the real effective exchange rate has a negative and significant effect on the gross domestic product in the long-run. In the short-run, the results also behave in the same manner as in the long-run. The study recommends that the real effective exchange rate should not be the only area to look into when trying to improve economic growth in South Africa. Investments must be looked into as well, and South Africa needs more growth desperately.

**Keywords:** Economic growth, real effective exchange rate, ARDL, NARDL

THE EFFECT OF THE EXCHANGE RATE ON ECONOMIC GROWTH IN SOUTH AFRICA

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# CHAPTER ONE: INTRODUCTION AND BACKGROUND

## 1.1 Introduction and background

The study will explain the effect of exchange rate movements on South African economic growth. Froyen (2009) defines the exchange rate as the value of home country currency in relation to foreign currencies, and economic growth which is measured in terms of gross domestic product (GDP can be explained as the measure of all produced final output in a country, usually a quarter or year). It is critical to explain the relationship between the exchange rate and economic growth, as it is of paramount importance especially for the case of South Africa, which has a highly volatile exchange rate among emerging economies, and this also has an impact on economic growth.

Rodrik (2007) stipulates that it has been known for a long time that if exchange rates are not properly managed, they can turn out to be problematic for economic growth of a country. This point is further explained by Van de Merwe and Mollentze (2010), who point out that management of a country's foreign exchange market is of utmost importance. Mismanagement of the exchange rate can potentially lead to unconducive international trade relations that could detrimentally affect the international trade of a country and cause large speculative financial flows, furthermore this would course disruptions of financial markets and the efficient allocation of funds. At the same time competitive and properly managed exchange rate promotes a suitable economic environment that is a precondition for the expansion of international trade and investment, and it also leads to a higher economic growth (Hsing, 2016). The theory of exchange rates tells us that a higher domestic currency improves imports, but hurts exports, and decreases overseas asset values which are measured with home currency. On one other side a low home currency, however, promotes exports, but reduces imports, and increases overseas asset values which are measured in the home currency. Rodrik (2007) further states that when the exchange rate of a country is overvalued growth will be low, but it is undervalued the growth is facilitated. In some other countries, high economic growth periods are affiliated with low exchange rate, and an increase in undervaluation of the home currency promotes economic growth just as a decrease in overvaluation of a currency does.

Gumede (2017) postulates that over the years South Africa has always experienced a sluggish growth, and in September 2007 manufacturing exports and non-commodity sectors had declined despite a 40 percent depreciation in the nominal effective exchange rate. Talking about volatility of the exchange rate and its effect on the economic growth, Movee and Schimmel (2017) view the South African rand as of one of the most volatile emerging market currencies and this has been caused by the global financial crises, which resulted in foreign investors becoming more sensitive to local economic developments of the country.

Quantec (2018) has recorded the performances of South African growth with respect to its exchange volatility. In July 2014 many rich countries showed signs of more sustainable economic growth, the first evidence of this was during the global recession of 2008-2009 which started in United States. Growth in the bigger emerging economies remained soft. China's growth at more than 7 percent, remained low by their expectations, as the State was limiting credit expansion due to concerns over their financial system.

At the same time South Africa's real GDP in 2013 went up only by 1.9 percent on the year before. During this period the rand was valued at R9.05 per US dollar, and according to Big Mac Index (2016), in 2014 the economic growth recorded an annual rate of 1.5 percent which is quite smaller than the 1.9 percent of 2013. The value of the rand against the US dollar was R10.88. In 2015 the economic growth recorded a disappointing rate of 1.2 percent, and this time the value of the rand in terms of the US dollar was R11.48.

Stats SA (2017) compiled quarterly data for the 2013 to 2016 period for the performance of the South African gross domestic product. In 2013 the GDP showed a growth rate of 1.8 percent during the first quarter, the second quarter recorded a 4.3 percent growth rate, while the third quarter recorded a 1.8 percent growth rate and the fourth quarter recorded 5.2 percent. For the year 2014, during the first quarter,a -1.6 percent growth rate was recorded, in the second quarter a growth rate of 0.7 percent was recorded, the third quarter recorded a growth rate of 2.2 percent and the fourth quarter recorded a growth rate of 4.1 percent. The year 2015 first quarter recorded a 1.9 percent growth rate, the second quarter recorded a growth rate of -1.8 percent, and the third quarter recorded a growth rate of 0.4 percent, while

the last quarter recorded a 0.5 percent growth rate. In 2016, the first quarter growth rate was -1.5 percent, the second quarter rate was 3.1percent, while the third quarter growth rate was 0.4 percent, and finally the fourth quarter recorded a growth rate of -0.3 percent.

Quantec (2018) noted that, compared with the major trading partners, the South African rand became stronger when compared against most major developed and emerging market currencies during the period of November 2014. The unweighted increase in the rand against 12 currencies was 2.6 percent m/m. and measured on the previous year, the unweighted average change in the value of the rand amounted to 0.7 percent. But having said that, the rand was mostly undervalued against the GBP (around 19 percent) during the three months ending in October 2014, while it was overvalued against the yen (5.5 percent). In January 2015, reports showed that the rand weakened against major developed and some emerging markets currencies, and the rand was mostly undervalued against the GBP (around 20 percent) during the three months which ended in November 2014, while it was overvalued against the yen (6.8 percent). In the February 2015 report, the rand generally strengthened against most developed and emerging market currencies. The rand was mostly undervalued against the GBP (14.3 percent) during the three months ending in December 2014, while it was overvalued against the yen (12.6 percent). In the March 2015 report, the rand had a generally mixed performance against most developed and emerging market currencies. The rand was most undervalued against GBP (13.5 percent) in the three month period, ending in January 2015, while it was overvalued against the yen (12.1 percent). Against the USD, the rand was overvalued (10.4).

In the April report, in comparison with the past month, the rand weakened against most currencies of high income countries as well as the currencies from emerging markets. The rand was mostly undervalued against the GBP (14 percent) during the three months ending in February 2015, while it was overvalued against the yen (10.4 percent) and against the USD, the rand was undervalued (11.3 percent). In the May report the rand displayed mixed performances against developed and emerging markets. On a month-on-month basis, the rand gained most against the Indian rupee (4.9 percent m/m) and lost most against the Russian rouble (-8.7 percent m/m). The rand was mostly undervalued against the GBP (13.4 percent) during the three month

period ending March 2015, while it was overvalued against the yen (9.6 percent) and was overvalued by 12.4 percent against the USD, while also overvalued by 5.2 percent against the Euro.

In the June report, the rand had again showed mixed performances when compared to currencies of high income countries and emerging market currencies in May. On a month-on-month basis, the rand gained most against the New Zealand dollar (3.8 percent m/m) and lost against the Chinese yuan (-2.8). The rand was mostly undervalued against GBP (14 percent) during the three month period ending April 2015, overvalued against the yen (10.4) and undervalued by 13.5 percent against the USD, while it was overvalued by 5.7 percent against the Euro.

Nassif (2010), in examining the performance of the developing economies during and after the global financial crisis, took two countries into consideration with regard to economic growth and exchange rates volatility. By comparing the exchange rate depreciation between September 2008 and December 2008, the conclusion could be drawn that India became more effective than Brazil in stabilising its foreign exchange market. Hence, in 2009 the first quarter, the Indian economy showed a remarkable capacity for recovery and growth. This was in contrast to the Brazilian economy, where there was a huge decrease in real GDP growth for the last quarter of 2008.

Osakwe (2010) looked at global financial crises regarding exchange rates and growth in Africa. It was noted in the financial sector that several African countries experienced huge volatility in stock markets and exchange rates. During the third quarter of 2008 and first quarter of 2009, African currencies depreciated against the US dollar by more than 30 percent. Whilst Seychellois rupee was badly affected, with a depreciation of 108 percent, furthermore Zambian Kwacha depreciated by 54 percent during that period. These rapidly and unanticipated movements in exchange rates they present costs as they have negative results to investment, output and economic growth.

Kang (2016) looked into a number of developing and developed economies on the role of the exchange rate on international trade, particularly after global financial crisis of 2008-09, and during this period, the exchange rate volatility grew significantly. Countries with appreciating currencies showed rising import intensity and significant export growth. On the other hand, the impact of currency depreciation

on trade became smaller, more especially after the world financial crisis. All of this suggests that competitive devaluations may not spur exports as much as earlier expected.

### 1.2 Problem statement

Van de Merwe and Mollentze (2010), in accordance with the elasticity approach theory, claim that devaluation or a depreciation of the currency of country will trigger an increase in import prices because these prices are usually denominated in foreign currencies, while revaluation or appreciation of the currency causes import prices to decline. At the same time, devaluation or depreciation of a domestic currency can lower export prices to become more competitive in foreign markets. Similarly a revaluation or appreciation of the domestic currency could drive an increase in export prices. According to Khondker, Bidisha and Razzaque (2012), devaluations of a country's currency will trigger what they refer to as an "expenditure switching" mechanism, which leads domestic demand away from imports to locally produced competing goods. It also improves international competitiveness, thereby boosting exports, which is why Rodrik (2007) states that an overvaluation hurts growth, but undervaluation facilitates it.

In contrast, however, is the case of South Africa, where its currency has been undervalued, but regardless of the undervaluation the country has been experiencing sluggish growth. The Big Mac Index (2017) indicates that the South African currency remains as the one which is mostly undervalued globally, as at that time, the rand was trading at R13.55 to the dollar, when it was supposed to be less than half of that (Van de Merwe, 1996). The theory of purchasing power parity postulates that identical products must be sold at the same price after conversion into a common currency as a result of the arbitrage. This is known as the law of one price, the theory states that an equilibrium exchange rate between two currencies is equal to the ratio of the price levels in the two countries. The Big Mac index (2017) indicated that South Africa was mostly undervalued by 62.7 percent in the world. In the US a big Mac sold for $5.04 on average in 2016, while in South Africa the price was $1.89. Simply put, in the United States a South African is expected to pay a lot more for the same product which would be less than half the price in their home country.

Despite such actions of undervaluing the domestic currency, these do not appear to have worked for South Africa. It is, as Gumede (2017) puts it, that ever since 2007 the country has been experiencing sluggish growth despite the 40 percent depreciation in the nominal effective exchange rate. Stats SA (2017) indicates that in the first quarter of 2014 the GDP declined by -1.6 percent, in the second quarter of 2015 it further declined by -1.8 percent again in during the first quarter of 2016 GDP declined by -1.5 percent, and in the same year, the fourth quarter of 2016, the GDP declined by -0.3 percent.

If we are to look at the annual growth rate, we could see that South Africa last had a growth rate of more than 2 percent in 2013, which was 2.5 percent. In 2014 the country recorded an annual growth rate of 1.7 percent, the year 2015 recorded a growth rate of 1.3 percent and in 2016 the growth rate was 0.3 percent, keeping in mind that the South African rand was undervalued by more than 60 percent in 2016. During this period the South African economy had been growing at a declining rate. This is a problem, because Gumede (2017) points out that the population is increasing at an annual rate of 1.6 percent per year, which leads to an increase in the unemployment rate. There is thus a problem in South Africa, because our economy in terms of GDP is not growing, and the attempts to undervalue the domestic currency are not helping to increase our GDP. Growth is needed in South Africa.

### 1.3 Objective of the study

Primary objective of this study is to investigate the effect of exchange rate on economic growth. To empirical examine the effect of exchange rate on the economic growth in South Africa. The secondary objectives are outlined as follows:

- To provide an overview of relevant literature.
- To empirically examine the effect of exchange rate volatility on South Africa economic growth rate.
- To provide conclusions and policy recommendations with reference to growth rate and the exchange rate regime in South African economy.

The study also looks at the short-run and long-run effects of the secondary objectives.

## 1.4 Hypothesis

H0: exchange rates do not have an influence on economic growth.

H1: exchange rates do have an influence on economic growth.

## 1.5 Significance of the study

This study differs from others, in that it investigates the effect of exchange rate on the South African economic growth rate, using a newly developed econometric technique called non-linear autoregressive distributive lag (NARDL).

The primary significance of the study is to contribute towards knowledge and information for the government to grow the economy of South Africa, to assist the policymakers in terms of planning in their respective institutions or to contribute to the body of knowledge that is already existing. The study will assist the Treasury Department, and the financial sector as a whole, which deal directly with exchange rates. This study will also assist government agencies, and the Treasury Department in providing information on the effect of exchange rates regimes on economic growth. The study will also inform government, SMMEs, communities and agencies about how exchange rates operate and the influence they have on their daily lives.

## 1.6 Outline of the study

The rest of this paper is organised as follows: chapter one begins with the background, problem statement, objectives of the study as well as significance of the study. Chapter two will present the overview of exchange rates as well overview on economic growth in South Africa. Then chapter three present the literature review of the study, and chapter four provides the research methodology of the study. Chapter five presents the empirical results, and finally, chapter six presents the conclusion and policy recommendations based on the results.

## 1.7 Chapter Summary

This chapter introduced the study and gave relevant background. Chapter 2 presents an overview of exchange rates and economic growth in South Africa.

# CHAPTER TWO: OVERVIEW OF EXCHANGE RATES AND ECONOMIC GROWTH IN SOUTH AFRICA

## 2.1 Introduction

In chapter two the study provides historic events of the exchange rates and growth rate in South African economy. It starts with exchange rate systems or regimes that have been operating in the gold standard era, using the Bretton Woods' system. The chapter goes further to explain financial liberalisation when the whole world broke out of the Bretton Woods' system and the adoption of flexible/floating exchange rates between the 1979 and 1980 period. The relaxation of the exchange controls is outlined as the trends that indicate the performance of an exchange rate for a given period. The next section gives an overview of South Africa economic growth rate, starting from the period of the new administration of Nelson Mandela. The trends also show how the country has been performing for all these years. At the end, a connection is made between exchange rates and economic growth in South Africa.

### 2.1.1 Exchange rate regimes in South Africa

It was in 1925 when the gold standard was introduced, which was also called the gold exchange standard. Then fixed exchange rates were established, and in this exchange rate system when countries viewed the shortage of gold, part of their reserves were kept in the form of bills and other liquid investments payable in a foreign currency that could be converted into gold (Van de Merwe & Mollentze, 2010). When the gold standard was still in place, the home currency value fluctuated in the market within a narrow band around parity (Van de Merwe, 1996).

The currency blocks were established by the international monetary system in 1931. The largest of them was the sterling block which comprised the United Kingdom, then a second block was informally grouped around the United States and the third block was grouped around France. South Africa became an active participant of the sterling area and, together with other participants, pegged their currencies to sterling. However this system had its own shortfalls in that it would lead to the more expansion of the short term liabilities of a country that were held as part of the foreign reserves of another country (Van de Merwe & Mollentze, 2010).

According to Fedderke and Simkins (2009), in 1912 South Africa was characterised as an economy that was open to the globe. The quantity of South African exports

produced were valued at £ 23.2 million, without counting ship stores and gold. At the same time the value gold exports amounted to £ 38.3 million. The domestic income during this period was valued at £ 132.9 million. Furthermore the level of domestic income was reached by substantial imports which comprised of investment (capital), directly in the mining of gold industry and indirectly through loans to colonial states as their revenues increased. The export of gold and diamonds would have taken place in any global monetary market and trade system, but agricultural exports had very low levels of protection elsewhere. Manufacturing was a very small portion of domestic income (which was less than 7 percent) and an even smaller portion of exports.

South African History Online (SAHO, 2018) points out that it was 27 December 1932 when South Africa as a country decided to abandon the system of gold standard. This move restored South African fortunes; as gold prices increased and that resulted in a booming of South African economy, where there was an increase in economic expansion. An assessment is further given by Fedderke and Simkins (2009) that during the period of 1914 to 1932, South Africa and its economy was buffeted by adverse shocks which were coming from the international economic system, and from 1933 to 1945, the rise in the gold price and increased the role of protectionism which caused or facilitated by the Second World War, which allowed a sustained, rapid rate of economic growth.

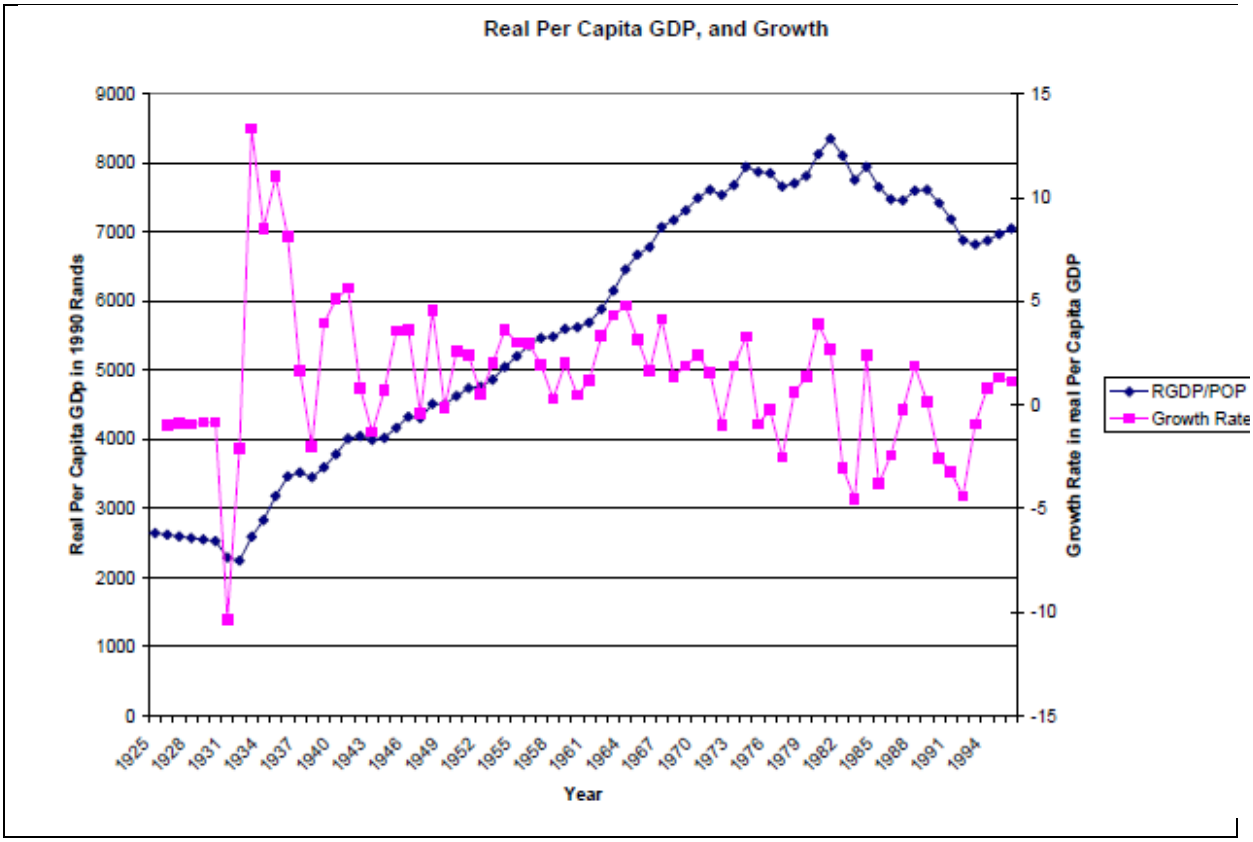
Van de Merwe (1996) explains that for the period of 1945 to 1971 as a key member of the Bretton Woods Monetary Agreement, South Africa, with other founder members, in 1945 during December became party to the system of stable but adjustable par values from the time of its inception. According to Froyen (2009:286), what was central to the Bretton Woods system was the set of fixed exchange rates and the key currency of the dollar. Par values set for currencies were not assumed to be fixed all the time; the system of Bretton Woods was set to be made up of the adjustable pegs. A country was then able to make changes to its exchange rates if it discovered a “fundamental disequilibrium” in its balance of payments. However, those changes were to be made in consultation with International Monetary Fund (IMF). Countries with chronic deficits were allowed devalue their exchanges rates, which was to decrease the par value of the exchange rate in terms of the US dollar, and also because the US dollar’s value in terms of gold was fixed, to also lower the

currency's value in terms of gold. Countries with persistent surpluses would revalue their exchange rates at higher par values in terms of the US dollar.

According to Fedderke and Simkins (2009), in the system of Bretton Woods the constraints of the balance of payments was stressed as the issue of paramount importance. The gold standard automatic adjustments were phased out, and two new mechanisms in dealing with deficits came into place for the balance of payments: and those were the changes in monetary policy and fiscal policy, in the first case, and in the second case which is the adjustment of the exchange rate. In looking at the growth rate in the Bretton Woods system as a whole, the growth rate during 1945 and 1969 was relatively higher than the period of 1920 and 1945, even though the period of 1934-39 had a remarkable improvement in terms of the economic growth rate. Furthermore, the period of 1920-1945 was characterised by a diversity set of growth drivers across industries, and industries in different sub-periods.

The capital accumulation is what some industries relied on, whilst some were more on increasing the employment, and some on the efficiency gains of Total Factor Productivity (TFP) growth. Equally so, some other industries placed greater importance on the accumulation of capital in certain periods, and on effective gains. During the period of 1945-1969 growth was predominantly characterised by higher capital accumulation. Figure 2.1 below summarises the growth rate and GDP per capita between 1925 and 1994 in South Africa.

**Figure 2.1: Real GDP per capita and Growth rate**




Source: Fedderke and Simkins (2009)

According to Van de Merwe (1996), to be in line with Bretton Woods' system, member countries were mandated to stick their currencies to 1 percent on either side of stated parity rates. When it was fundamentally disequilibrium in the balance of payments it was only then that member country was allowed, in that to consult with the the International Monetary Fund, in terms of adjusting its exchange rate by more than the fixed margin (Van de Merwe & Mollentze, 2010). However, it was only the United States that had to maintain the price of gold at $35 per fine ounce and it also had to exchange US dollars on demand for gold at that price without restrictions or limitations (Van der Merwe, 1996).

During the period of 1971 to 1979, when the system of Bretton Woods became disintegration of fixed exchange rates, it actually made the authorities to adjust their country's exchange rate regime. In realignment of exchange rates in 1971 December, the South African rand was devaluated by 12.3 percent. During 1972 June 1972 the British pound began to decline against other major currencies and in order to stay at the momentum of its balance of payments recovery, then South African rand was linked British pound. When the South African rand floated with

British pound for four months, then in 1972 during October the rand was pegged to the US dollar, and that resulted to an extent whereby the rand value appreciated against the major currencies, at the rate of 3 percent. But, when the dollar was devaluated by 10 percent on 13th February 1973, the government of South Africa made decision of choosing not to follow this change because of the issue of balance of payments position and a general economic situation which was not suitable for economic growth. At the time the relatively fixed dollar pegging was undeveloped in the foreign exchange market, thus it was not suitable in attaining the optimum combination of economic growth, internal economic stability and balance of payments equilibrium and internal. Furthermore, it was pointed out by the De Kock Commission that the South African currency was moving with US dollar for too long without considering the local economic conditions. It was then that financial liberalisation was initiated in South Africa during 1979/80.

### 2.1.2 Financial liberalisation in South Africa

According to Mpofu (2016), financial liberalisation was initiated when the system of the Bretton Woods collapsed during the 1970s, which led to exchange rates volatilities in developing and developed nations. According to Van de Merwe (1996) it was then that the state president at the time the commission of enquiry which was appointed to the monetary policy and monetary system in South Africa (the De Kock Commission) and the commission requested was to give priority of research on the exchange rate regime because of the new conditions.

The deficiencies that were identified by the De Kock commission in the exchange rate regime include the following: firstly, the South African rand was moving with the US dollar for too long without even looking at South African conditions because the rand-dollar peg was adjusted only infrequently. Secondly, there was a mandatory in buying and selling of foreign exchange and these were quite large spreads, and they were result of the unavailability of the highly active and more competitive foreign spot exchange market. Thirdly, South Africa had the forward exchange market was more administered and undeveloped, and even more tightly restricted by exchange control regulations and rulings than the spot market, leading to rigid forward rates that bore no relation to demand and supply factors. Lastly, more resilience that was put on the control of exchange rate, but economically this was not an efficient manner in terms

of rationing the availability of foreign exchange among the various domestic uses and deferred the inflow of foreign capital.

According to Van de Merwe and Mollentze (2010,) the proposals were sent to the South African government, and the government accepted and at the initial of 1979 a programme was set into motion in order develop the foreign exchange market that was going to be relatively free from the interference of authorities. After so many reforms the country now had a unitary exchange rate system whereby the spot exchange rates and forward exchange rates were basically determined by the market forces of demand and supply. Hence the Reserve Bank announced in August 1998 that it would allow the rand to float more freely. Van de Merwe (1996) cited different measures which were initially introduced during the period of 1979 and 1980 to establish a commercial exchange rate was freely floating. However, as a result of financial sanctions imposed on South Africa these measures were reintroduced in 1985. These measures include the dual exchange rate system was reestablished; the SARB terminated its involvement in the international sales of gold; authorized dealers were allowed to cover their forward positions on a swap basis; the SARB gradually withdraw from the forward market. Lastly there were administrative changes which made, such as development of a well-functioning communication system and information services.

The first set of reforms was undertaken at the beginning of 27 February 1979, when the Reserve Bank ceased to announce at period zero (before the initial date) it's predetermined buying and selling rates for dollars. However, because of difficulties and some other challenges in coming up with a very good network of communication with other banks in the foreign exchange market, South African Reserve Bank proceeded to deal in dollars at purchasing and selling rates which were, in fact, revealed to the other financial institutions at all times and which were never altered during the course of the day and at times other times not even for the days on the end. The next step was given by the then Finance Minister in the National Assembly on 4 May 1979, the Minister stated that market forces in future are to determine the exchange rate of the rand. However, South African Reserve Bank would still continue to be actively involved continuously in the market as a seller and buyer of US dollars. Thereby it would not only get rid of exchange rate fluctuations which were unnecessary but to also enforce a large measure of control over the rand-dollar

rate movements. However, the rates at which the South African Reserve Bank dealt in dollars would be freely varied in response to the forces of supply and demand, even during the course of the day, with due regard to policy considerations and all other relevant facts.

### 2.1.3 Growth rate during and after financial liberalisation

The annual growth rate provided by World Bank (2018), and the real effective exchange rate of the rand for 20 trading partners is provided by the South African Reserve Bank (2018), which indicates the performance of the South African GDP in response to exchange rate movements after financial liberalisation. In 1980 the growth rate showed a remarkable improvement of 6.6 percent after 3.7 percent in 1979, while the real effective exchange rates during these periods were 105.16 in the year 1979 and 117.61 in 1980. However things started to change in 1981 as the growth rate started to decline to 5.4 percent and the real effective exchange rate of the rand was sitting at 127.25. In 1982 it was -0.4 percent, and the real effective exchange rate was 122.32. 1983 brought further bad news, as growth was -1.8 percent and the real effective exchange rate during this year was 136.78.

However, in 1984 growth improved to 5.1 percent and the real exchange rate of the rand was 118.79. It then declined again in 1985 to -1.2 percent and the real exchange rate was 92.84, then following year growth was 0.01 percent and the exchange rate was 89.37. In 1987 the growth started to improve again by hitting 2.1 percent with an exchange rate of 100.15 and even further improved to 4.2 percent in 1988 with an exchange rate of 96.16. During 1989 growth declined to 2.4 percent with a real exchange rate of 98.16, then the growth rate further performed poorly for the period of 1990 to 1992, as growth was below a zero percentage and the real effective exchange rate of the rand during these years was 103.65 in year 1990, 107.98 in 1991 and 109.9 in 1992. In a nutshell this information indicates that during the period of financial liberalisation when the real effective exchange rate was higher, growth declined, indicating a negative relationship between the real exchange rate of the rand and economic growth during this period.

According to Bhoola (2016), these days South Africa uses a flexible exchange rate system, whereby the value of the rand is merely explained or determined by the market forces of supply and demand. This means that demand for a currency

relative to the supply will determine its value in relation to currency of another country. The theory postulates that based on the multitude of factors the demand for a floating currency continue to change. Froyen (2009) further believes that a completely flexible or floating exchange rate system is a particularly simple set of rules for the central banks to follow, as they do nothing to directly affect the level of their exchange rate. According to Bhoola (2016), for the rand, its present weaknesses can be attributed to structural problems engulfing the domestic economy.

### 2.1.4 Liberalisation of exchange controls in South Africa

Post 1994 the South Africa Reserve Bank and Government decided on an approach which aimed at abolishing as well as liberalisation of exchange controls rather than what is known as a “big-bang” (the removal of all exchange-control regulations) approach (SARB, 2007). This approach gave the government more time to put into place other policy adjustment in order to achieve the preconditions which were considered necessary for a successful liberalisation of exchange controls. According to Van de Merwe and Mollentze (2010), having decided on this approach, the authorities indicated that the sequencing of the removal of controls would be done in an orderly manner. The exchange controls were accordingly relaxed in the following manner:

SARB (2007) introduced the removal of exchange rate controls on all current account transactions (which were made up of exports and imports of goods and services). Van de Merwe and Mollentze (2010) maintain that limits continued to be applied to certain items on the current account that could be used to circumvent capital restrictions. However the controls of non-residents were removed as well. In 1993 the debt standstill arrangements of the year 1985 were rescheduled, and the financial rand system was abolished in the beginning of 1995. From that date, non-residents were able to introduce funds for any purpose into the country as they were able to do so, to repatriate such funds and transfer any earnings on their investments out of South Africa.

SARB (2007) gradually became very lenient in approving applications for direct foreign investment by South African Companies. Clarity is given by Van de Merwe and Mollentze (2010) that South African resident corporates often were allowed to

make direct investments in foreign subsidiaries, joint ventures or branches, and to raise funds abroad through equity and loan issues. A number of companies were also given permission to remove their primary listings from the JSE Ltd.

SARB (2007) further states that it allowed diversification of portfolio investments in foreign assets to be acquired by its institutional investors. Van de Merwe and Mollentze (2010) further clarify by saying that institutional investors from South Africa were granted opportunity from June 1995 to make their total assets more diversified into investments denominated in foreign currency. The limits placed on these investments were increased in subsequent years and eventually replaced in February 2008 by prudential requirements. From this date fund managers, pension funds and long-term insurers could invest 30 percent of their total retail assets under management in countries outside the Common Monetary Area. During 1997 in June individuals were allowed to make limited investments in their own name outside South Africa. In 2009 this limit was increased to R4 million per individual, provided such persons obtained a tax clearance certificate from the South African Revenue Services.

SARB (2007) then removed the last control, which is to let go of the blocked funds of immigrants, and these are assets or funds of an immigrant that are not transferable from outside South Africa and are physically controlled and monitored by an Authorised Dealer. According to Van der Merwe and Mollentze (2010), the amount that emigrants are allowed to transfer outside South Africa was also progressively increased, until 2009 it reached R8 million per family unit plus a discretionary allowance of R750000 and households and motor vehicles and personal effects that fall within the overall insured value amount of R1 million. Since 2003 emigrants have, in addition, been allowed to apply to transfer abroad the remaining part of their assets that were blocked, at an exit charge of 10 percent of the amount remitted. In February 2003 the government declared a foreign exchange-control amnesty with an accommodating tax dispensation. Individuals applying for this amnesty were released from all civil penalties and criminal liabilities stemming from the illegal transfer of funds abroad and from not declaring the income earned on such funds to the tax authorities before 28 February 2002. The filing for exchange-control amnesty was made subject to a 5 percent charge on funds repatriated to the country which is South Africa in this case and 10 percent charge on any assets kept offshore.

### 2.1.5 Volatility of South African rand

SARB (2007) states that factors that influence the exchange rate include the position of the balance of payments of South Africa as a country, and expected adjustment or changes of transactions with the rest of the world. Burgen (2010 cited in Twala & Mchunu, 2014) lists major factors that influence the exchange rates and they include terms of trade, political stability, differentials in interest rates, and differentials in inflation rates, public debt and economic performance of the country. Van de Merwe and Mollentze (2010) point to factors such as increases in the domestic product of South Africa, an increase in the demand for products that are not produced locally, an improvement in the quality of foreign goods that cannot be matched by domestically produced goods, perceived political threats, increased interest differentials, and expected downturn in domestic economic activity.

According to Movee and Schimmel (2017), many economists view the South African rand as one which is more volatile among the currencies of emerging markets and it was hit hard by the global financial crises which has resulted in investors from abroad to become more cautious and sensitive when it comes to the local economic developments of South Africa. One example in terms of recent developments in politics, which affected the rand, was the news that the then Minister of Finance, Mr. Gordhan, was summoned to testify in court for his former role in a South African Revenue Services (SARS) for the early retirement with benefits in the year of 2010.

The other effect which also took place is that of 2015 during December when South African rand depreciated by 3.3 percent overnight from R14.90/$ to R15.38/$ this was after the news that Minister of Finance, Nhlanhla Nene was dismissed which was very shocking and unexpected, and also the shocking appointment of new and unknown Minister of Finance Des van Rooyen nicknamed “the weekend special minister” (he held the post of Finance Minister for three days). The depreciation of South African rand quickly reversed when Jacob Zuma reappointed the former minister of finance, Pravin Gordhan to the job, and rand showed some strength by returning to R14.84/$. In contrast, during 2016 in earlier June, the South Africa rand strengthened by 5 percent in overnight on after positive news from the so called rating agencies, after many months of negative speculation for a possible downgrade in South Africa.

Having talked about the volatility of the South African currency, Hsing (2016) believes that the theory tells us that when a home currency is stronger it actually boost imports, but lowers exports, and decreases overseas asset values which are measured with home currency. But a low home currency boost exports, reduces imports, and actually leads to an increase of overseas asset values which measured in the local or home currency.

### 2.1.6 Real effective exchange rates in South Africa for the period of 1995-2017

It was in 1994 when the government of national unity prepared to take over in South Africa, and the exchange rate at that time was -2 percent, but it slightly improved in 1995 to -1.5 percent and the growth rate was 3.1 percent. In the following year, 1996, the exchange rate depreciated even further to -6.2 percent in that period and the growth rate was 4.3 percent. However things changed in 1997 when the exchange rate appreciated to 6.6 percent and the growth rate was 2.6 percent, but it depreciated to -9.4 percent when South Africa was hit hard by the Asian financial crisis and growth rate was only 0.5 percent that year. In 1999 the exchange rate was -6.6, which nevertheless, showed signs of improvement after that tragic event with a growth rate of 2.4 percent.

In the year of 2000, the new century full of promises, the exchange rate again showed remarkable improvement, as it was sitting at -0.9 percent while the growth rate was 4.2 percent. In 2001, the stock prices took a sharp downturn in stock markets across the United States, Canada and Europe, and as a result the local exchange rate depreciated to -8.6 percent while the growth rate was sitting at 2.7 percent. Even the following year 2002, was affected by what happened in the previous year and the exchange rate further depreciated further to -9.7 percent with a growth rate of 3.7 percent. In 2003, the things changed as the country hosted a major sporting event, the ICC Cricket World Cup, and as a result, the exchange rate appreciated to 25.1 percent in that year, but the growth rate declined to 2.9 percent.

In the following year, which was 2004, the exchange rate was 6.7 percent and the growth rate was 4.6 percent, while in 2005 the exchange rate was 2.2 percent with growth rate of 5.3 percent. However, in the year 2006 it depreciated to -3.2 percent while the economic growth rate was 5.6, and these indices decreased further to -3.5

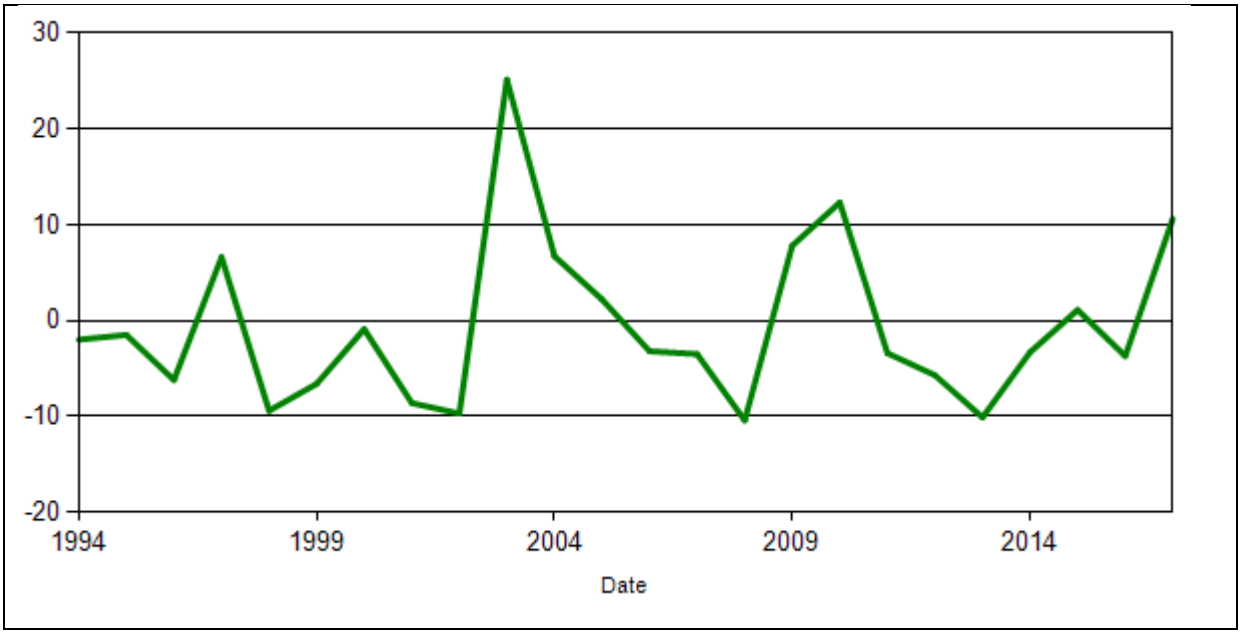
percent accompanied by an economic growth rate of 5.4 percent when we were approaching the world financial crises in 2008.

Almost the whole world was affected by the world financial crisis which began in the United States in the year 2008, and the SA exchange rate depreciated to -10.4 percent at that time, while the growth rate was sitting at 3.2 percent. However in the following year, 2009, the exchange rate showed remarkable improvement by appreciating to 7.8 percent, but the growth rate declined even further to -1.5 percent. In 2010 the country hosted another major sporting event, the FIFA World Cup, and as a result the local exchange rate appreciated even further to 12.3 percent at that time and the growth rate was 3 percent.

However, in the year of 2011, the exchange rate depreciated to -3.4 percent and the growth rate increased to 3.3 percent, and even in 2012 the exchange rate declined further by depreciating to -5,7 percent and the growth rate was down to 2.2 percent. The year 2013 was no exception the exchange rate declined sharply, depreciating to -10.1 percent and the growth rate was 2.5 percent.

In 2014 the exchange rate was -3.3 percent with a growth rate of 1.8 percent, in 2015 it was 1.1 percent and the growth rate of 1.3 percent. In 2016 the exchange rate was -3.7 percent with a growth rate of 0.6 percent, and in the year 2017, the exchange rate appreciated to 10.6 percent and the growth rate was 1.3 percent. The graph in figure 2.2 depicts what has been explained in the above trends (SARB, 2018).

**Figure 2.2: Effective exchange rate**




Source: SARB (2018)

## 2.2 Overview of economic growth in South Africa

Leke *et al*, (2015) maintain that it has been just more than two decades ever since South Africa as a country transitioned from apartheid regime into democracy and captured the world's imagination by bringing Nelson Mandela as a president. Ever since then, South African GDP has in real terms almost doubled, and millions of people have emerged from poverty. The developmental programme of infrastructure improved the quality of life by giving access to water, electricity, sanitation, and means of transport to the previously disadvantaged individuals. However there is still a lot that needs to be done and South African promises still remain unfulfilled, as the government of the country and business leaders acknowledge it. The South African economy over the years has performed poor and quite recently job opportunities have been very low in those years. Ever since the year of 2008, South African economy had an average annual GDP growth rate of about 1.8 percent, which is lower than half of the growth rate experienced from the period of 2004 to 2007. In what follows is a discussion of gross domestic product at market prices.

### 2.2.1 South Africa's key economic policies and changes 1994-2013

According to SAHO (2017), since 1994, South Africa has embarked on a number of policies which aimed at reconstructing and transforming the economy of the country after so many years of economic isolation and sanctions by world countries. The Reconstruction and Development Programme (RDP) was chosen by the government of the leading party, the African National Congress (ANC) as a primary socio-economic programme which aimed at improving the lives of the South Africans as a whole. The RDP programme had some success in certain areas such as social security, whereby the government established an extensive welfare programme; however, this policy had its own shortfalls which included the inability to deliver as it was thought, more special in terms of low economic growth which impacted negatively on the policy itself.

There was an indication that the new government had some challenges in the implementation of the RDP, such as fiscal constraints because of the inadequate of poor fiscal and economic legacy it inherited over fifty years of Apartheid and twenty years of planning and strategy. Secondly, there was an issue of organisational limitations which result from the poor public service and a distressful inability of the state to construct the necessary state capacity. Thirdly, the new government had no ability to prioritise the RDP and help integrate and transform principle guiding principle that is socio-economic policies of the country. For these reasons it was then decided that a new policy, which was known as GEAR, had to be pursued in 1996.

The new government came up with a new policy framework which was referred to as Growth, Employment and Redistribution (GEAR) in 1996 in an attempt to improve, and fasten the level of growth in South Africa, of which it was a requirement in order to provide resources and meet social investment needs. This policy, however, while it also included social objectives which were stressed out in the RDP, also aimed at lowering fiscal policy, lowering inflation, and ensuring that exchange rate stability is maintained, reducing trade barriers and also liberalising capital flows. In GEAR progamme, government consumption and inflation targets and the fiscal deficits were all partially met, but despite those improvements, investment, job opportunities and GDP growth indicators were not convincing. The levels of economic growth and private investments were not sufficient enough in order to reduce unemployment,

and furthermore there is very little success that is achieved by the policy in terms of wealth redistribution. In the year 2005 the GEAR policy was phased out, and a new policy came into effect, which was Accelerated and Shared Growth Initiative for South Africa (SAHO, 2017).

In 2004 the government of South Africa (ASGISA SAgov, 2006) had a mandate which was to reduce poverty and unemployment by half in 2014, and at the time these objectives were feasible, thus it was hoped to surpass them because of steady improvements in the performance of the economy and its capacity to create jobs. According to SAHO (2017), after 1994 the ASGISA strategy was adopted as a developmental strategy. In ASGISA there was some small level of success. However, the level of future planning and implementation of the programme remained uncertain as there was no official word came from the South African government regarding the fate of ASGISA. After Thabo Mbeki was recalled as president of the country, ASGISA was phased out and the new policy referred to as New Growth Path (NGP) came in, and this was announced by President Jacob Zuma in year 2010. The GNP was envisioned as the policy for promoting growth in the South African economy, and to do so in such a way that would reduce poverty, inequality and unemployment rate. But the government under the new administration decided to follow a new strategy known as the National Development Plan (NDP), which was based on Vision 2030.

According to the National Planning Commission (2010), NDP is a South African plan, where it aims at providing a strategic framework that guides key choices and actions to be followed. The success of this plan depends on the actions and responsibility taken by all South Africans regarding its implementations. SAHO (2018) contends that this plan was adopted as a cornerstone for the economic future and socio-economic development strategy for the country as of 2012/13. For this plan to succeed, in an attempt to redress the country's socio-economic imbalances, among other things the NDP identifies, are the key constraints to faster growth, and it also presents the roadmap into a more inclusive economy.

The objectives and goals of the NDP include the following; the provision of goals and about what South Africa as a country wants to achieve by 2030; ensuring that there is an agreement on the key challenges to achieving these goals; and what must be

done to ensure that these challenges are stressed out and resolved. The NDP provides a detailed long-term framework which is useful in terms of planning and advancing and advancement of the long-term goals of the NDP, as well as creating basis for making sound choices when it comes to the use of limited resources.

### 2.2.2 Gross Domestic Product at market prices for the period 1995-2017

When the new the administration came into power as part of the regime change in South Africa, there was a transition from apartheid to democracy. In 1995 the growth rate in South Africa was 3.1 percent annually with a real effective exchange rate of -1.5 percent, in 1996 the growth rate increased to 4.3 percent while the real exchange rate declined even further to -6.2 percent. But in 1997 the growth rate declined to 2.6 percent but the real exchange rate improved to 6.6 percent, which further declined 0.5 percent in 1998 and the real exchange rate was -9.4 percent, as the Asian financial crises definitely had an effect on South African economic growth during this period.

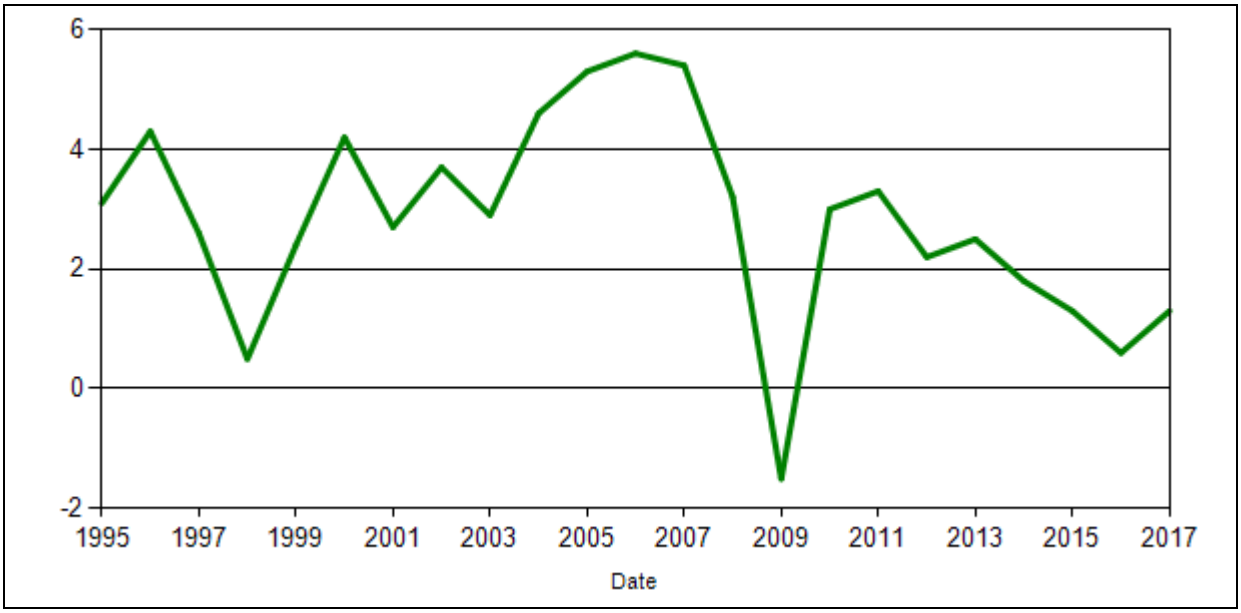
In 1999 however, things started to improve as the growth rate increased to 2.4 percent while the real exchange rate was -6.6 percent. Year 2000, the beginning of new century, and with new administration in South Africa, during this period the growth rate was 4.2 percent, which signaled great things to come for the country, accompanied by a real exchange rate of -0.9 percent. But eventually the growth rate declined to 2.7percent in 2001, while the exchange rate was -8.6 percent. A possible reason for this was the stock market crash across the United States, Canada, Asia and Europe. Nevertheless, growth increased to 3.7 percent in 2002, while the exchange rate declined to -9.7 percent.

When the country hosted a major sporting event, the ICC Cricket World Cup in 2003, the growth rate declined to the rate of 2.9 percent and the real exchange rate appreciated to 25.1 percent, but growth then improved to 4.6 percent while the exchange rate depreciated to 6.7 percent in 2004. Growth then further increased from 5.3 to 5.6 percent for the years 2005 and 2006 and the real exchange rate was 2.2 and -3.3 percent respectively for the same period. Then in 2007 the growth rate declined to 5.4 percent accompanied by a real exchange rate of -3.5 percent. Then in 2008 and 2009, as previously mentioned, almost the entire globe was affected by the world financial crisis and even South Africa was negatively affected by that crisis.

As a result, the growth rate in the country declined to 3.2 percent in 2008 and the exchange rate was -10.4 percent. The decline continued in 2009 by dropping to -1.5 percent which was too severe, and the real exchange rate increase was 7.8 percent, but then in 2010 growth started to regain its momentum, as it increased to 3 percent while the exchange rate was 12.3 percent. This positive trend went further to 3.3 percent in 2011, but the real exchange rate depreciated to -3.4 percent.

In 2012 growth decreased to 2.2 percent accompanied by a real exchange rate of -5.7 percent. Growth increased to 2.5 percent in 2013 while the real exchange rate depreciated even further to -10.1 percent. Ever since then the economic growth rate has been growing, but at a declining rate because in 2014 it was 1.8 percent with a real exchange rate of -3.3 percent, 2015 it was 1.3 percent with a real exchange rate of 1.1 percent, and it even declined further in 2016 to 0.6 percent with a real exchange rate of -3.7 percent. In 2017 growth remained at 1.3 percent annually and the real exchange rate was 10.6 percent during this time. The graph below in figure 2.3 shows what has been outlined:

**Figure 2.3: GDP at market prices**




Source: SARB (2018)

According to the IDC (2017) the South African economy expanded by only 0.3 percent in 2016, which was largely due to the sharp lower growth in the agricultural,

mining and electricity sectors, but other sectors of the economy recorded fairly modest rates of expansion. Other than the 2009 recession, when GDP contracted by 1.5 percent, this was the worst growth performance since 1994. This point is further clarified by Van der Wath (2017), who states that South Africa's economy shrank by 0.3 percent in the fourth of quarter of 2016, down from a growth of 0.4 percent in the third quarter. As was highlighted before, the mining and manufacturing sectors were largely responsible for the GDP contraction. The decline in value-added for the secondary sector eased in the fourth quarter as electricity rebounded. The value-added growth in the tertiary sector recovered in fourth quarter, driven by a much improved performance from the trade sector. In the first quarter of 2017, the headline Absa PMI remained above the neutral 50 point mark for all three months, an indication that GDP growth might improve slightly in that period.

In 2017 the prospects of South Africa in the short term remained mostly unfavourable in the shorter term. The GDP growth rate was forecasted at 1 percent for that year, with the pace of expansion it is likely to gain some momentum in subsequent years. But according to SARB (2018), the GDP at market prices was 1.3 percent for 2017. Thus, for the previous two years, things were not looking good for South Africa, as the risks of the country's downgrade were still looming. S&P Global, has expressed deep concerns about South Africa regarding its poor performance and low growth, the fiscal metrics and its performances, as well as rising guarantees of government to financially vulnerably state-owned institutions and political developments which could potentially weaken the institutions of government.

Treasury SA (2017) predicted that in the year of 2017 the South African growth rate would moderately improve the medium term period. The 1.3 percent of economic growth was projected for the year 2017, and reaching 2.2 percent by 2019. The forecast is supported by factors that include, more marginal global growth, stability of prices commodity, maximization of reliable electricity network, climatic conditions, regaining of business and consumer confidence and improved labour relations.

### 2.3 Conclusion

This chapter gave an overview of the real effective exchange rates and economic growth in South Africa, starting from the periods of the Gold standard, then Bretton Woods to financial liberalisation. When financial liberalisation began in 1979/80 the

country experienced the highest growth for the first few years, and furthermore, the connection between exchange rates movement and economic growth could be made. This was because during the period of financial liberalisation, when the real effective exchange rate was higher, growth declined. Even after the period of exchange rates liberalisation, when the growth was higher, exchange rates were low; like in 1995, the economic growth rate in South Africa was 3.1 percent annually with a real effective exchange rate of -1.5 percent, and in 1996 the growth rate increased to 4.3 percent while the real exchange rate declined even further to -6.2 percent. However the situation changes in 1997 as the growth rate declined to 2.6 percent and the real exchange rate appreciated to 6.6 percent. This supports the economic theory, as the theory tells us depreciation of the currency promotes economic growth through exports, while appreciation of the currency reduces economic growth as imports become more expensive to the trading partners. What follows next is the chapter on the literature review.

# CHAPTER THREE: LITERATURE REVIEW

## 3.1 Introduction

According to Korkmaz (2013), everywhere in the world, countries are producing and exporting goods in which they have an advantage in their production power and importing goods that they need. Money is used as a tool in this form of trade. Appleyard, Field, and Cobb (2010) thus postulate that the exchange rate alters a country's trade pattern and that affects economic growth. When there is an increase in local price of foreign currency, that will cause domestic products to be cheaper when they are measured in a foreign currency, which means in terms of exports, the competitiveness of the country will be increased and that leads to higher economic growth. Conversely, when a domestic cost of foreign currency decreases, it will make foreign goods cheaper and that will act as a stimulus to imports which also cause local economic growth to decline.

The purpose of the chapter is to explore knowledge and ideas that have been established on the effect of the exchange rate on economic growth, including the strengths and weaknesses of this relationship. Additionally, the literature will allow the researcher to discover the agreed academic opinion on the effects of exchange rates on growth, while at the same time allowing the researcher to find out the disagreements about the effects of exchange rates on growth. Furthermore a literature review enables the researcher to determine what each source contributes to the study (Randolph, 2009).

This chapter is structured and presented as follows: first the introduction on exchange rates and economic growth and how they are related on theory. The literature review can be explained as an investigation or examination of the research that has been carried out in a certain field of study, according to Hart (1998, cited in Cresswell, 2009). The purpose and the structure of the chapter is also given. The theoretical literature section describes growth theories and exchange rate theories, which are later discussed. Abend and Swanson (2008) believe that theoretical literature introduces and give description on the theory that explains why the research problem under study exists in the first place. Among the growth theories which the chapter discusses are classical growth theory, Keynesian growth model, post Keynesian model, neoclassical growth model, and Solow growth model. The exchange rate theories include the following; elasticity approach, absorption

approach, purchasing power parity theory, monetary approach and portfolio approach. The last section of the chapter is empirical literature which gives studies in developed countries, developing countries and also studies in South Africa.

### 3.1.1 Theoretical literature

The growth theories that the study covers include the classical growth theory, Keynesian growth model, post Keynesian growth model, neoclassical model, and Solow growth model. From the exchange rates models, this paper covers the elasticity approach, absorption approach, purchasing power parity, monetary approach, and portfolio approach theory.

## 3.2 Growth theories

The following section discusses the theories of economic growth, and the theories that the study looks into include the following; classical growth model, Keynesian model, post Keynesian growth model, neoclassical model, and Solow growth model.

### 3.2.1 Classical theory (Adam Smith)

According to Popa (2014), Adam Smith postulates that what determines the element of growth in production is the growth in population which affects the respective quantity of workers (Sharipov, 2015). Smith had a belief that growth in population is something that is endogenous and often depends on the availability of means of substance. Adam Smith also recognised investment as a variable that is endogenous and depends on the hard work and savings of the capitalists. By savings it meant that some of the reserves were not used for personal consumption, but rather for the purposes of industrial production. The production growth from the land was often associated to geographical discoveries and improvements in technological fertility of the existing land. According to this model, if the population increases, higher growth is going to be experienced because growth depends on the population. So again from the orthodox theory of exchange rates, it is stated that high growth triggers undervaluation of the domestic currency.

Pettinger (2007) states that Adam Smith is the one who advocated for a laissez faire free market, his point of argument was that a great division of labour and specialisation can possibly lead to more economic growth rates. Appleyard, Field and Cobb (2010) postulate that Smith saw no need for the government to intervene

and control the economy. He suggested laissez faire policy to be followed by the government, and this policy allows private individuals to pursue their own activities by adhering to the law and order and have respect for property rights, would lead to growth in a nation. From the perspective of Smith, the State role was to see the functioning of the market in an unconstrained and free manner by removing the barriers to the effective operation of the 'invisible hand' of the market. This theory is also in line with a floating exchange rate regime, according to Van de Merwe and Mollentze (2010:134), the currency value of the country is allowed to fluctuate against all major currencies and the exchange rates are largely determined by the supply or demand for the currencies.

The authorities can, however, attempt to influence their exchange rates either directly, by applying exchange controls on exchange rate transactions, or indirectly, by actually selling and buying currencies for their own accounts. Froyen (2009:287) also highlight that under a floating exchange rate, policy makers can concentrate on domestic goals, and worry less about balance of payments deficits. Kurz and Salvadori (2015) postulate that Smith saw growth process as more endogenous, he placed a special emphasis on the effect of capital accumulation on the productivity of labour. As stated the key ingredient to the growth productivity of labour is the division of duties among labourers, which further says that it depends on the market extent and that is upon the accumulation of capital.

### 3.2.2 Keynesian growth model

Sharipov (2015) believes this theory has arisen as a result of the critical processing and development of macroeconomic equilibrium in the Keynesian, and lies on the economic values which include national income, savings, consumption and investments. Popa (2014) contends that this theory considers takes two types of variables, and that is exogenous and endogenous variables. The most valuable variable for proper functioning of the market economy is the effectiveness of demand for goods, which depends on some other variables, such as final consumption, savings, global income, the volume of occupants and global investments. The exogenous variables have an influence on their mutual interdependance. These exogenous variables include rates regarding the behaviour of the economic agents; the propensity to consume which is created by consumers; and the entrepreneurs who add to marginal efficiency of capital and the interest rate. The models of

demand lie on three functions; the consumption function; the marginal propensity to consume and income; and the investment function (relies on the propensity to save which is considered to be marginal), while the liquidity function explains the formation of the interest rate which relies on the behaviour of the economic agents in relation to the proportion of income saved.

This theory tells us that economic agents, who are consumers, may after receiving an increase in their income choose to spend it rather than saving it. Blanchard and Johnson (2013) emphasise that consumption depends on the main factor which is income, or more precisely, disposable income and when it goes up, people buy more goods because of the increase in their demand. This is why Appleyard, Field and Cobb (2010) further emphasise that with this increase in demand, home industries will expand their production which leads to higher growth. Production capacity increases, as does economic growth, and when the growth is higher that will cause the domestic exchange rate to appreciate.

### 3.2.3 Post Keynesian (Harrod-Domar)

According to Popa (2014) this theory was developed in the postwar period (Sharipov 2015) by two famous economists, the first is American economist which originate from Poland, Evsey Domar and second one is the British economist, known as Roy Harrod. The results found by these two were similar to each other and subsequently these theories were referred to as Harrod-Domar theory (Nitisha, 2015). In this theory, the condition which is necessary for the growth to occur in an economy, is that the demand generated as a result of new income generated must be sufficient enough, so that the total production made by the new investment (or increase in capital) must by all means be fully absorbed. If the output is not fully absorbed, there would be an excess, or idle production capacity. That condition should be satisfied consecutively to maintain full employment levels and achieve steady economic growth in the long term. The possible assumptions of the Harrod-Domar theory are: the first constant capital-output ratio which assumes that relationship between capital and output is always the same. The second one is the constant saving-income ratio, which assumes that society saves a constant proportion of national income.

Since the capital and output ratio is the same, there is also the assumption that society saves a constant amount of income. In other words there will be no excess

demand or supply, what is produced is what is required, so there will be no appreciation or depreciation of a currency. This will produce an exchange rate equilibrium because the quantity of the currency demanded is equal to the quantity supplied, a situation which is known as market clearing, according to Van de Merwe and Mollentze (2010:123).

### 3.2.4 Neoclassical theory

According to Sharipov (2015), the neoclassical growth theory started in the period of 1950s to 1960s, whereby the focus on the associated challenges of dynamic equilibrium lessened and the challenges of obtaining potential economic growth came to the fore; were not that much because of the unused capacity, as inventing and introducing new ways of technology, then there was an improvement in productivity, as did the organisation of production. (Popa, 2014) The growth theory of neoclassical on its core analysis, has incorporation of capital accumulation, this model explains how accumulation of capital and changes in technology constitute the leading forces that are able to gain and lead to higher economic growth.

The neoclassical growth model contains a series of characteristic features, which entail: the attainment of economic growth through the ultimate use of full employment in labour; the working assumptions which refer to perfect competition, flexibility, wages and prices, the degree of substitutability of the production factors; the population growth correlates with an increase in economic rate; the saving rate determines the level of investments, the relations between the two economic categories being balanced by the interest rate; the increased economic rate is in correlation with the growth of the population; the dependence of investments on the level of saving; the economic system’s balance is obtained or reached at full employment, which is made possible by maintaining a certain level of wages; and finally, the decreasing yields are exposed by capital.

As has been stated by Sharipov (2015), the neoclassical theory employs two factors of production, which are labour and capital and further takes into account technology as an exogenous variable. Labour will depend on population growth, while on the other hand, capital will depend on savings, and technology is likely to depend on organisational changes by firms like introducing new production techniques to increase production, which will lead to higher growth. But if there is an appreciation in the real exchange rate, according to Blanchard and Johnson (2013), that will lead

to a shift in the quantity foreign goods demanded, and as a consequence, to a decrease in net exports. When net exports decreases they will decrease the demand for domestic goods. This through a multiplier effect, will lead to a decrease in output.

### 3.2.5 Solow growth model

According to Sharipov (2015), from the Solow growth model it is assumed that an economic equilibrium condition that is necessary in the economic system is the equality in aggregate supply and demand. In Robert Solow's model, the Cobb-Douglas production function determines aggregate supply, the functional form dependence is expressed between production volumes on the one hand, and the factors used and their combinations, on the other. The Solow growth model can actually show interconnections between three sources of economic growth which are: workforce, investments, and technological progress. Thus, what can be further stated about these three sources is that if they increase proportional to each other, the result will be higher economic growth in the domestic country. But it should also be noted that in terms of the exchange rates, higher growth will result in revaluation or appreciation of the domestic currency when the domestic country is to participate in international trade. This may cause locally produced goods to be less attractive as they are going to cost more to the trading partners.

The model reveals that the key factor in determining level of capital intensity is the amount of savings. It has been long known that greater stock of capital is provided by higher rate of savings rate which will lead to higher production. In the Solow growth model it is also assumed that when there is population growth model that means there is going to be a continued growth and stability condition in the economy. But if population growth is not proportional to an increase in investments, this will in turn reduce the capital stock per worker. Thus, the model of Robert Solow outlines that highly populated countries, usually have lower capital-labour ratio, and hence lower incomes. Another source of economic growth after an increase in the number of employees and investment is the technical progress. The neoclassical model is very specific in this regard, that a technological progress does not necessarily mean the replacement of humans by machines, but rather qualitative changes in production processes and techniques, like increasing the level of

education of the workers, the organisational improvement, growth of production scale and so forth (Sharipov, 2015).

### 3.3 Exchange rate theories

This section will discuss the exchange rate theories, and among the theories that are going to be discussed in the study are the following: elasticity approach, absorption approach, purchasing power parity, the monetary approach and the portfolio approach.

#### 3.3.1 Elasticity approach

According to Van Marrewijk (2005), the elasticity approach puts more emphasis on the relationship between the exchange rate and the flow of goods and services as measured by the current account balance. Van de Merwe and Mollentze (2010) elaborate that the elasticity measures indicate to what an extent the quantity of imports supplied adjust in response to a change in relative prices. The changes in relative prices are determined by the country's balance of payments and the exchange rate. In accordance with this model, a devaluation or depreciation of a currency will lead to an increase in import prices, as these prices are usually determined in foreign currencies, while a revaluation or appreciation of a currency causes the import prices to decline. It is further stated that the value of the elasticity of demand for imports is subject to the type of goods that are imported if such goods are not obtainable domestically and are regarded as essential for production or consumption, then the elasticity demand for imports would be low.

According to Bass (2018) this approach tries to predict the outcomes policy changes will have, and how they impact on the balance of payments (BOP). In actual fact this approach shows how the balance of payment position will be affected by the exchange rate. Furthermore, the approach of elasticity makes an assumption that if the balance of payments is in equilibrium, a devaluation of the exchange rate can actually improve the balance of payments. The exchange rate devaluation boosts exports and often leads to economic growth, so when a country decides to devalue a currency, it is improving the balance of payments under ideal conditions and this condition is known as the Marshall-Lerner condition.

According to Meghana (2018), the Marshall-Lerner condition functions by eliminating deficits of BOP in a devaluing country. Then devaluation of the exchange rate

decreases home prices of exports in relation to foreign currency, and when prices go down, the exports will eventually increase. The extent of their increase relies on the demand elasticity for exports. It also relies on nature of products exported and the conditions of market. It is also stated that if the country is the only supplier and also exporter of raw materials, then the demand elasticity for its exports will be low.

### 3.3.2The absorption approach

Van de Merwe and Mollentze (2010) explain that this theory was developed during the period of fixed exchange rate systems where financials flows were unimportant. The absorption approach emphasises that changes in real domestic income and expenditure are the main determinants of the current account in the balance of payments, as well as the level of exchange rates. As it assumes constant prices, the absorption approach is generally regarded as providing an explanation of exchange rate changes over the short term where financials flows do not play any significant role (Van Marrewijk, 2005). The elasticity approach exclusively focuses on the effects of the changes in relative prices on exports, imports, and the current account balance. Now the absorption approach remedies the shortcomings of the elasticity approach in a simple Keynesian framework.

According to Meghana (2018), the absorption approach to the balance of payments in nature, is general equilibrium and is based on the national income relationships of Keynesian, therefore it is the approach of the Keynesians. Unlike the elasticity approach which focuses on the price effect, the absorption approach focuses on the income effect of devaluation. The economic theory say that if a country is experiencing a deficit in balance of payments, it means that individuals are consuming more than they can actually produce. This further says that national income is less than investment and domestic expenditure on consumption. So there is a surplus in the balance of payments, then they are absorbing less.

When looking at the direct absorption of this approach, Meghana (2018) states that devaluation of the currency has a direct impact on absorption approach in various ways, for instance if the devaluing country has resources that are idling by, then an expansionary process will begin with declining imports and increasing exports. As a consequence, when income rise the absorption will rise as well. If the rise in income is greater than the rise in absorption, then the position of the balance of payments will improve. In a country where resources are idling by, the effect of a currency

devaluation in absorption is not significant. If the economy is operating at full employment and also has a balance of payments deficit, the national income cannot just be increased by currency devaluation. An improvement in the balance of payments can be brought about by reducing direct absorption. The absorption in domestic country can automatically fall because of exchange rate devaluation due to the real cash balance effect, money illusion and redistribution of income.

### 3.3.3 Purchasing power parity theory

According to Isola *et al*, (2016), purchasing power parity (PPP) shows the relationship between exchange rates and prices. The originality of the concept of PPP can be traced back to the School of Salamanca in the 16$^{th}$ century in Spain. Cassel (1918, cited in Isola *et al.*, 2016) is the one who came up with its modern use as a model of determining exchange rate. Cassel (1918) suggest that PPP should be used as means of trying to amend pre-World War I exchange rate parities for nations that resolved to return to the system of gold standard after the end in conflicts. Some modifications were a necessity because countries that left the gold standard in 1914 witnessed extensively different rates of inflation during and after the war.

The theory of the PPP lies on the international multi-good edition of the law of one price. Appleyard, Field and Cobb (2010) postulate that this law of one price is believed to operate when markets are functioning well both locally and globally. Under these conditions, arbitrage will quickly erase any price differences between different geographical locations. If goods and services do follow the law of one price, then it can be argued, that the absolute level of the exchange rate should be that level that causes traded goods and services to have the similar price in all countries when measured in one currency or the same currency, and that referred to as absolute purchasing power parity condition. For example, if a bushel of wheat costs $4.50 in America and £3 in England, then the exchange rate should be equal to $4.50 per bushel divided by £3 or $1.50/£.

The International Monetary Fund (1976) stipulates that the rationale for the PPP model is that the value of the exchange rate of a country is fundamentally determined by a number of goods and services that a unit of exchange rate can actually buy in the country of issue. This is why Pettenger (2017a) points out that a

stronger exchange rate is often viewed as a sign of economic success, and it becomes a symbol of national pride. At times politicians and civil servants may be worried if they see a “weakening” in the exchange rate, as they associate a stronger exchange rate to the economic success. However Blanchard and Johnson (2013) emphasise that an appreciation in the real exchange rates will lead to a shift in demand toward foreign goods, and as a result, to a decrease in net exports. The decrease in net exports decreases the demand for domestic goods, and through a multiplier effect, this will lead to a decrease in output which is detrimental to economic growth.

### 3.3.4 The monetary approach

Van Marrewijk (2005) postulates that the monetary approach emphasises that the exchange rate is the relative price of two monies. The money demand has an important role to play in the adjusting process and also in determining the exchange rate levels.

According to Meghana (2018), the changes in the balance of payments through the demand and supply for money are explained by this monetary approach. In this approach it is assumed that a deficit in the balance of payments is always a monetary phenomenon in everywhere and therefore it can only be rectified through the measures of money. Appleyard, Field and Cobb (2010) in examining the exchange rate changes in the context of demand and supply for money, begin their analysis with the position of the equilibrium, where $M_s$ equals $L$. In this theory it is assumed that an increase in the money supply by monetary authorities will thereby create an excess supply of money. Keeping in mind that when there is an excess supply of money, the balances of cash for individuals will exceed the balances of cash needed in connection with the existing prices, interest rates, real income, wealth and price expectations. The given results for this increase in money supply is that more expenditure by individuals will occur on the transaction of goods and services and also on financial assets so as to get rid of the excess money supply. When there is an increase in expenditure, there will be an increase in imports, and this is likely to cause a possible decrease in exports as some goods are now purchased by home country citizens, and this process is likely to lead to a decline in economic growth.

According to Bernanke (2015), the monetary easing usually results in a lower exchange rate, and that creates trade competitiveness of a country which promotes economic growth, it usually increase domestic incomes, which in turn raise the local demand for foreign goods and services.

### 3.3.5 The portfolio approach

According to Isola *et al.* (2016) the portfolio balance approach is also known as the market approach and it differs from the monetary approach because in this approach there is an assumption that domestic bonds and foreign bonds are imperfect substitutes. Furthermore, this approach outlines that the exchange rate is determined through the process of balancing or equilibrating the demand and supply stock of financial assets in each country. Therefore, it is for this reason that the portfolio balance approach can be regarded as a more satisfactory and realistic monetary approach version. In the portfolio approach, individuals and business organisations keep their financial wealth through combinations of domestic bonds, domestic money, as well as foreign bonds denominated in the foreign currency.

A further clarification from this approach is given by Khan and Abbas (2015), according to them, the exchange rate establishes an equilibrium in the investor portfolio in such a way that if there is a change in any one of these three assets (money, domestic assets and foreign assets), the investor will reestablish the desired balance in his/her portfolio account. This process of rebalancing needs has an influence on the demand for the asset and in turn, the exchange rate. Khan and Abbas further make an example that, if interest rates on foreign bonds increase, this would increase the demand for the asset, and when there is an increase in demand for foreign currency, the local currency will depreciate (Khan and Abbas, 2015). It is further stated that bonds and foreign money are substitutes for local bonds and local money. In other words, if there is a rise in demand for local currency, it means that the price of the local currency will appreciate in the same way as the depreciation worked. At the same time, an increase in demand for local bonds positively affects local currency, which means when demand for local bonds increases the local currency appreciates. This is particularly in line with the orthodox economic theory, as shown by Rodrik (2007), that an undervaluation of a currency stimulates economic growth while overvaluation of the currency hurts growth, but this

relationship only holds for developing countries. Rodrik further postulate that it has been long known that when the exchange rates are not properly managed they can potential be disastrous to the economic growth of a country.

Avoiding a significant overvaluation of the currency is one of the most robust imperatives that can be gleaned from the diverse experience with economic growth.

### 3.4 Empirical literature

The following section discusses studies in exchange rates and economic growth that have been undertaken in developed countries, developing countries as well as studies in South Africa.

#### 3.4.1 Developed countries

Di Nino, Eichengreen and Sbracia (2011) examined the relationship between real exchange rate misalignment and economic growth in Italy for the period of 1861 to 2011. They did this by building a simple analytical model, which they then used to further investigate ways through which an undervaluation may exert a positive impact on the economic growth. They verified empirically that, as it has been suggested in economic theory, that an undervaluation of the currency has a positive effect on the exports of Italy. The undervaluation played a major role, especially when it comes to increasing the exports in sectors that are considered to be highly productive such manufacturing industries.

Bhattarai (2011) investigated the effect of exchange rate and supply of money on economic growth, interest rates and inflation in United Kingdom. Economic growth rates, interest rates and inflation are determined simultaneously in United Kingdom. The results show that depreciations of sterling enhances international competitiveness which in turn contribute to economic growth.

Petersen and Scheneider (2014) explore the risks of an appreciation of the euro. To them, 2014 was not going to be a quiet year on the currency markets. They did not expect to see any pronounced shifts in the euro and dollar exchange rates in their base scenarios.

Manalo, Perera and Rees (2014) examined movements in exchange rate in the economy of Australia, they employed a structural vector autoregression model to characterize industry effects exchange rate. The results reveal temporary terms a 10

percent appreciation in real exchange rate that is not related to the interest rate differentials or terms of trade, lowers the level of real GDP over the subsequent one-to-two years by 0.3 percent. The results further show that the movements in the exchange rate over the past 10 years have had a broadly stabilising effect on the economy of Australia and can largely be explained by economic fundamentals.

Lee and Yue (2017) explored the effect of the US dollar exchange rate on growth rate and environment in the United States by employing a model structural vector autoregression for the period of 1989 to 2015. The results show that the US currency has a positive relation with net imports, petroleum consumption of the United States in the pollution intensive industries with major US trading partners, real GDP and CO2 emissions.

Papanikos (2015) made an argument that when euro currency was overvalued it has resulted in greatest ever drop of GDP in Greece ever since World War II. This study, discovered that euro currency was overvalued by 20 percent and this has resulted in lower economic growth of Greece. A claim is also made that if the exchange rate would have been undervalued by 10 percent that would have led to the increase in rate of growth of per capita GDP by an additional amount of 1.25 percent per annum.

Korkmaz (2013) investigated the effect of the exchange rate on growth by employing annual data for the period of 2002 to 2011 from randomly selected European countries. The relationship between the exchange rate and economic growth was tested by utilising the analysis of panel data. The findings of the study show that there is causality running from the exchange rate to economic growth rate for the nine countries in Europe.

One concluding remark that can made from the developed countries, is that the results are in line with the orthodox of economic theory that an exchange rate depreciation promotes growth while appreciation has a negative effect on growth. One example that can be pointed out is that of the economy of Greece, where the European Central Bank overvalued the euro which negatively affected the economy of Greece. At the same the depreciation of the currencies of the UK and Italy has had positive effects in their economies in terms of economic growth.

### 3.4.2 Developing countries

Habib, Mileva and Stracca (2016) investigated the effect of movements in the real exchange rate on economic growth using an average data of five years for a panel of 150 countries after the period of Bretton Woods. Their results reveal that real appreciation (depreciation) significantly reduces (raises) annual real GDP growth, but their findings further confirm that this effect holds for developing countries only.

Razzaque, Bidisha and Khondker (2017) examined the effect of exchange rate on growth rate of Bangladesh. They constructed a series of real exchange rate and employed the techniques of co-integration in order determine the response of output in Bangladesh currency depreciations. Their findings reveal that in the long-run, there was a 10 percent rise in aggregate output. The results further point out that in the short-run the contractionary effect is observed. The expansionary effect of real depreciations in the long-run may be appealing for considering exchange rate policy as a development strategy.

Tarawalie (2010) in Sierra Leone examined the impact of the real exchange rate on economic growth using quarterly data and econometric techniques, such as the Granger causality test to examine the causality between the two variables of interest. The findings of the study reveal that the real effective exchange rate has positive correlation with economic growth, and their coefficient is statistically significant. Furthermore, the results show that exchange rate devaluations, terms of trade, investment to GDP ratio and money supply of domestic credit were the main determinants of the real exchange rate in Sierra Leone.

Ashour and Yong (2018) examined the empirical impact of exchange rate regimes on economic growth, in a number of 16 developing countries for the period of 1974 to 2006. Their study incorporated fixed effects and pooled regression as the methodologies for data collection and the data analysis was performed through SPSS. Their findings showed that, compared to a floating exchange rate system, a 0.64 percent growth rate was obtained under the intermediate regime when compared to a floating exchange regime. The results further show that countries that have chosen to follow floating exchange rate systems are now encountering a

scarcity for the existence of an advanced financial system, which restrict them from enjoying the benefits of a floating exchange rate system.

Tang (2015) showed the relationship between the real exchange rate and economic growth in China by employing a cointegrated VAR model. In contrast to the accusations of the trading partners, the study reveals that China has not benefited from its low exchange rate of the RMB, and no direct linkages found between the Chinese real exchange rate and economic growth in the long run.

Bussiere, Lopez and Tille (2014) investigate the effect of the exchange rate appreciations, booms in productivity and capital flow surges employing an approach of propensity-score matching in order address the issues of causality. They further reveal that appreciations on higher productivity have a huge and significant effect on economic growth than appreciations on capital inflows. Furthermore, they show that appreciation on exchange rate have a negative effect on economic growth.

Oteng, David and Emmanuel (2016) investigated the effect of a real exchange rate on economic growth of Ghana for the period from 1975 to 2015, they employed quarterly time series data. The study used an analysis of co-integration with a VAR framework to examine the impacts of real exchange rate on real GDP growth in Ghana. They found that there is a long-run relationships among the variables employed in the study. Their study found that appreciation of real exchange rate has a positive impact on the economic growth of Ghana. The study also showed that there is bidirectional causality from a real exchange rate and money supply and real GDP.

Akpan and Atan (2010) examined the effects of exchange rate movements on Nigerian economic growth employing quarterly series data for the period of 1986 to 2010. The relationship is derived in two ways using a simultaneous equations model with a fully specified macroeconomic model. Their study explored the Generalised Method of Moments (GMM). Their results showed no strong direct relationship between movements in the exchange rate and output growth.

Wong (2013) examines the misalignment of exchange rate and Malaysian economic growth, whereby the approach of autoregressive distributed lag (ARDL) and generalised forecast error variance decomposition were used as methods of estimation. The results of the ARDL showed that an increase in misalignment of real exchange rate will result into a decrease in the economic growth. In other words, devaluation enhances economic growth and appreciation reduces economic growth.

Brixiova, and Ncube (2014) explore the real exchange rate and economic growth in Zimbabwe, since the country experiences external competitiveness challenges and growth issues as it has been revealed by its low trend of investment and economic growth. The approach of stock-flow to the equilibrium exchange indicates that the real exchange rate experienced periods of sizeable overvaluation, both before the 2008 economic collapse and under the multicurrency regime. Their findings reveal that overvaluation hampers growth and employment in export sectors, but they found no evidence that linked undervaluation to economic growth.

Brigitta (2016) investigates the effect of exchange rate regimes on economic growth of developing countries. The economic data used from the study is for 74 countries for the year 2012, and the study discovered found a positive and significant correlation between a pegged exchange rate and growth in GDP.

Hua (2011) examines the economic and social effects of a real exchange rate, using panel data for 29 Chinese provinces for the period of 1987 to 2008. The method of estimation used is the GMM approach, and the test results reveal that appreciation of real exchange rate had a negative effect on economic growth more in coastal than inland provinces.

Berg and Miao (2010) revisited the real exchange rate and growth, using the Washington consensus. The core finding is that the Washington consensus (WC) and the Rodrik views of the role of misalignment in growth are observationally equivalent for the main growth regression in Rodrik's report. There is a problem of identification: misalignment determinants are more likely to be independent growth drivers, and these types of growth regressions are hard pressed to disentangle the different channels. However in the end they confirm that overvaluations of exchange

rate are bad for economic growth, but on the other side undervaluations are good for growth.

Yinghua, Yan and Xiong (2015) examined the effects of the currency exchange rate on economic growth on China's national economy. They used the effect of the RMB exchange rate on import and export trade of China, they then discussed its effect on economic growth and the method of estimation was the VAR model. What they found is that the RMB exchange rate has certain effects on trade imports and exports in China, and from this it could be stated that an RMB exchange rate change has an effect on economic growth. An RMB exchange rate change has a concretionary effect on output in the short-run but it has a positive effect in the long-run.

Rodrik (2007) examined the impact of real exchange rate on economic growth for the developing economies. Evidence that undervaluation stimulates economic growth is provided, and this is particularly true for the developing countries, suggesting that tradable goods suffer disproportionately from the distortions that keep poor countries from converging.

Ihnatov and Capraru (2012) examined the effect of exchange regimes on economic growth in 16 Central and Eastern European countries. In doing so, they used OLS and GMM methods to estimate a growth model with dummy variables that isolated the impact of exchange rate regimes on economic growth. The results suggest a superior effect on economic growth of the floating and intermediate regimes compared to the fixed arrangements.

Yeyati and Sturzenegger (2003) provide evidence on the impact of exchange rate regimes on economic growth utilising a sample of 183 countries after the period of Bretton Woods, employing a new de facto classification of regimes based on the actual behaviour of the relevant macroeconomic variables. The results show that less flexible exchange rate regimes are associated with slower growth in developing countries, and there is greater volatility of output. Finally, their results also show that exchange rate regimes for industrial economies do not have a significant effect on economic growth.

Most of these results in developing countries verify what economic theory suggests, that undervaluation promotes growth, while appreciation hampers growth. However, an exception can be made for countries such as China, Nigeria and Zimbabwe. In China the results are in contrast with what economic theory suggests, secondly the Chinese have been false accused of manipulating their currency in order to benefit by lower exchange rates. However Appleyard et al, (2010) pointed out that there has been an ever increasing flow of foreign investment into China, which is adding to the tremendous productive capacity of the country. The study by Tang (2015) proves that China does not benefit from the low exchange rate, furthermore the results show that there are no direct linkages found between the Chinese real exchange rate and economic growth in the long-run. The conclusion made in the findings of the study, is that there is no link between the exchange rate and growth in the long-run. The same applies in Nigeria, where there is no evidence of a strong relationship between the exchange rate and growth. In a study undertaken in Zimbabwe the results show that overvaluation hampers growth, but there is no link that undervaluation leads to economic growth.

### 3.4.3 South Africa

Sibanda, Ncwadi and Mlambo (2013) investigated the effects of exchange rates on growth in South Africa, employing quarterly data for the period from 1994-2010. The Johansen co-integration and vector error correction models were used as methods of estimation, and their results reveal that exchange rates have a long-run effect on growth in South Africa. What they discovered is that undervaluation of the currency negatively affects economic growth in the long-run, but in the short-run it has a positive effect on growth.

Chipeta, Meyer and Muzindutsi (2017) investigated the impact of movements of exchange rate and economic growth on job creation, and South Africa, as a developing country, was selected as a case study because of its huge rate of unemployment. The period covered by the study is the first quarter of 1995 to the fourth quarter of 2015. Their study used a multivariate co-integration and model of VAR as methods of estimation. The results of the study show that in the long-run the employment responds positively to economic growth and negatively to the real

exchange rates, in the short-run the relationship is positive between employment and real economic growth, but the results display a negative relationship between real exchange rate and employment. Furthermore their results indicate that movements in the exchange rate caused a significant short- and long-run negative effect on dynamics of employment, which implies that a depreciation of the domestic currency against American dollar goes hand in hand with a decrease in overall employment. Their suggestion is that stability of exchange rate is of vital importance for economic growth and job creation of the country.

Fourie, Pretorious, Harvey, Van Niekerk and Phiri (2016) investigated the nonlinear relationship between exchange rate volatility and economic growth in the economy of South Africa. Employing data collected from the period of 1970 to 2016 and using a smooth transition regression model as the method of estimation, they were able to prove that the exchange rate-economic growth correlation is indeed nonlinear within the sampled time period. Furthermore their results show that volatility of exchange rate have a positive and significant influence on South African economic growth when growth in government expenditure is 6 percent below. But when it is above 6 percent, volatility exerts an insignificant effect on economic growth.

Patel and Mah (2018) investigated an exchange rate and economic growth relationship for South Africa, utilising a data series covering the period of 1980 to 2015. Their study used the Johansen co-integration model, Vector Error Correction model, VEC Granger causality test, variance decomposition, and impulse response function as estimation techniques. Their findings of the study in the long-run indicate a significantly negative relationship between real exchange rate with exports and economic growth. The results of Granger causality test indicate that exports Granger cause real exchange rates and there is a unidirectional relationship between exports and real exchange rates.

Matlasedi, Ilorah and Zhanje (2015) examined the effect of real effective exchange rate on the trade balance of South Africa and also to show whether a J-curve phenomenon and the Marshal-Lerner condition are satisfied in the South African economy. In their study, a bounds test and Johansen co-integration reveal that there is an equilibrium relationship discovered between real effective exchange rate, trade balance, money supply, domestic GDP, terms of trade and foreign reserves in the

long-run. Finally, the results indicate that when a rand depreciates the trade balance of South Africa improves in the long-run.

Semusa and Aphane (2017) investigate the effect of the exchange rate and exports on South African economic growth. The method of estimation used included the Johansen co-integration and vector error correction model to capture the short-run and long-run relationship between the variables. Furthermore, the Engle-Granger causality test was also employed to determine the degree of influence amongst the variables. The findings from their study indicate that there is a significantly negative relationship between the exchange rate and economic growth.

Mpofu (2016) investigated the effect of the volatility of real exchange rate on manufacturing employment growth in South Africa covering the period from 1995 to 2010. The results indicate that volatility of real exchange rate has a significant and contractionary effect on manufacturing employment growth. Furthermore, the findings of the study show that when the exchange rate depreciates it actually improves manufacturing employment growth of South Africa.

The conclusion that can be made about studies undertaken in South Africa, is that the exchange rate negatively affects economic growth in the long-run. The depreciation of the rand affects economic growth in the long-run, but there is also no strong supporting evidence that depreciation of the rand enhances economic growth in South Africa.

### 3.5 Conclusion

In summary, chapter two consists of a literature review which is basically an overview of theoretical and empirical literature. The theories of economic growth started with Adam Smith on the classical theory, advocating for a laissez fair free market, specialisation and division of labour which could lead to higher growth according to Smith. The second theory on growth is the Keynesian growth model which makes use of endogenous and exogenous variables in the market economy. Then the Harrod-Domar method was discussed, which states that a necessary condition for growth in any economy is that the demand created due to newly generated income should be sufficient enough so that output created by new increased capital be fully absorbed. The fourth theory discussed is the neoclassical theory, which encompasses capital accumulation and technological changes which

constitute the leading force for economic growth. The last model discussed is the Solow growth model which shows that the savings rate is a key factor in determining the level of capital intensity.

The exchange theories on the other hand, consist of the purchasing power parity condition, which is based on the law of one price. The second theory under exchange rate regimes is the elasticity approach which is more about the relationship between the exchange rate and flow of goods/services as measured in the current account balance. Then the absorption approach was discussed which remedies the shortcomings of the elasticity approach in the Keynesian framework. The monetary approach as the fourth theory is also discussed, which stipulates that demand for money plays an important role in the adjustment process and in determining exchange rate levels. The last theory is the portfolio approach where domestic and foreign bonds are regarded as imperfect substitutes.

The empirical literature from the developed countries seem to follow a similar trend to that of the developing countries. This suggests that appreciation of the exchange rate hampers growth, while depreciation enhances growth through exports. In South Africa, the results indicate that exchange rate misalignment negatively affects growth in the long-run, but there is no strong supporting evidence that links depreciation of the rand with higher growth.

The next chapter, chapter four, will reveal the methodology of this study.

# CHAPTER FOUR: METHODOLOGY

## 4.1 Introduction

The section below outlines the model specifications in examining the role of, or the effect of, the exchange rate on economic growth in South African economy. The study adopts a nonlinear autoregressive distributive lag (NARDL) model, which is inspired by Shin, Yu and Nimmo (2011). They describe that this model incorporates asymmetries of both long-run and short-run relationships, while at the same, it captures the asymmetries in the dynamic adjustment. This chapter is structured as follows; section one covers data description and sources, section two describes unit root testing which comprises DF-GLS, NG Perron and KSS tests. In section three the NARDL methodology is covered, section six is based on the diagnostic tests which include heteroskedasticity, serial correlation, the Ramsey reset test, and the normality test.

### 4.1.1 Data description and sources

This study employs yearly data for the period of 1970 to 2017. The variables used in the empirical analysis include: exchange rate which can be categorised as nominal exchange rates, real effective exchange rate and real exchange rate. According to Pettinger (2017b), the nominal exchange rate measures the current value of a currency against another. At the same time, the real exchange rate measures the value of currencies, taking into account the changes in the price levels (Catao, 2007). The real exchange rate seeks to measure the value of a country's goods against those of another country, a group of countries or the rest of the world at the prevailing nominal exchange rate, while the real effective exchange rate according to BNM (2012), is defined as the weighted average of a country's currency against a basket of other major currencies adjusted to the effects of inflation.

When evaluating the real effective exchange rate of the rand, we compare the value of the rand against the currencies of major trading partners which may include the Euro, US dollar, Pound and Yen. The study utilises the real effective exchange rate since it looks at the overall performance of the currency. The second variable is economic growth which is measured in terms of gross domestic product (GDP). Jordaan (2013) defines GDP as the total value of all goods and services produced within the borders of a country during a specific period of time, usually a year or

quarter. Investment is another variable used and according to MKB (2018), it is categorised into economic investment and financial investment.

Economic investment is the capital stock of society, which means these are goods used in the production of other goods. The term investment implies the formation of new and productive capital in the form of new construction and producer's durable instruments such as plant and machinery. Financial investment refers to the allocation of monetary resources to assets that are expected to yield some gain or return over a given period of time. It means an exchange of financial claims such as shares and bonds, and real estate. Government expenditure is also used in the study, as according to Trading Economics (2018), government expenditure refers to public goods and services and is a major component of the gross domestic product. (Gilani, 2017) Government expenditure relates to the objectives of a government, such as price stability, financial control and economic growth. Government spends to maintain roads, harbours and canals, defense activities, provide social security and facilitate education.

The last variable employed in the study is broad money supply as a percentage of GDP. Yodatai (2017) perceives the broad money supply as a percentage to GDP, and can be defined as the sum of the currency outside financial institutions, such as demand deposits other than the ones for government, the time, savings, and foreign currency of residents other than the government; the traveller's checks, and other securities which consist of deposits and commercial papers. GDP was retrieved from South African Reserve Bank, and all the remaining variables were retrieved from the electronic data bases of the World Bank. The variables used in the model for this study are given in table 4.1 below, including their acronyms.

**Table 4.1: Variable names and descriptions**

| | |
|---|---|
| **REER** | Real effective exchange rate |
| **GDP** | Gross domestic product |
| **INVE** | Investment |
| **GVE** | Government expenditure |
| **Broad** | Broad money as percentage of GDP |

### 4.1.2 Unit root test

According to Hill, Griffiths and Lim (2008), there are a number of unit root tests available for determining whether a series is stationary or non-stationary. This study deviates from the conventional unit root tests, such as the Augmented Dickey-Fuller test and Phillips-Perron, because such tests according to Canarella, Miller and Pollard (2010), lose power dramatically against stationary alternatives with a low order moving average (Chang, 2012). However, they fail to consider information across regions and they also lead to less efficient estimations. Therefore, this study adopts the model of Kapetanios, *et al* (2003 as cited in Chang, Wu, and Gupta, 2015). (KSS), Dickey-Fuller Generalised Least Squares (DF-GLS) and Ng-Perron.

**(a)KSS test**

According to Chang, Wu and Gupta (2015), in line with Kapatanios *et al* (2003 as cited in Chang, Wu and Gupta, 2015), it is stated that the test is based on detecting the presence of non-stationarity against a nonlinear but globally stationery exponential smooth transition autoregressive (ESTAR) process. The main idea is that time series data may revert to mean only when they are sufficiently far away from it. When they are close to their mean, they may behave as non-stationary processes. The equation is:

$$\Delta y_t = \gamma y_{t-1}\{1 - \exp(-\theta y_{t-1}^2)\} + v_t \quad \text{.....4.1}$$

Where $y_t$ is the variable of interest, $v_t$ is an error term with zero mean and constant variance, and $\theta \geq 0$ is the transition parameter of the ESTAR model and governs the speed of transition. Under the null hypothesis, $y_t$ follows a linear unit root process, but $y_t$ follows a nonlinear stationery ESTAR process under the alternative. One of the shortcoming of this framework is that the parameter $\gamma$ is not identified under the null hypothesis. Furthermore, Kapetanios *et al*, (as cited in Chang, Wu and Gupta, 2015) used a first-order Taylor series approximation for $\{1 - \exp(-\theta y_{t-1}^2)\}$ under the null hypothesis $\theta = 0$ and have then approximated equation (4.1) by using the following auxiliary regression:

$$\Delta y_t \vartheta + \delta y_{t-1}^3 + \sum_{i-1}^{k} \theta \, \Delta y_{t-1} + v_t \qquad t = 1,2 \ldots \ldots T \quad \text{.....4.2}$$

In this framework, the null hypothesis and alternative hypotheses are expressed as $\delta = 0$ (non-stationarity) against $\delta < 0$ (non-linear ESTAR stationarity). The system of KSS equations with a Fourier function that the study estimates is here:

$$\Delta y_{i,t} = \vartheta + \delta y_{i,,t-1}^{3} + \sum_{j-1}^{k1} \theta_{i,t-j} + a_{i,1} \sin\left(\frac{2\pi kt}{T}\right) + b_{i,1} \cos\left(\frac{2\pi kt}{T}\right) + \varepsilon_{i,t} \quad \text{.....4.3}$$

Where $t = 1,2 \ldots \ldots T$. The rationale for selecting $[\sin\left(\frac{2\pi kt}{T}\right), \cos\left(\frac{2\pi kt}{T}\right)]$ is based on the fact that a Fourier expression is capable of approximating absolutely integrated functions to any desired degree of accuracy. Meanwhile $k$ represents the frequency selected for the approximation, and $[a_{i,1}, b_{j,1}]$ measures the amplitude and displacement of the frequency component.

**(b) DF-GLS test**

According to Canarella *et al,* (2010), DF-GLS is an essentially ADF test, except that it is transformed via a Generalised Least Squares (GLS) regression prior to performing the test. This test was developed by Elliot et al (as cited in Canarella *et al*, 2010) and it is performed in two steps. Firstly, they do this by detrending or demeaning the data using the GLS approach. In the second step, they use an ADF test for unit root. The DF-GLS test that allows for a linear time trend relies on the following regression:

$$\Delta y_t^d = \alpha y_{t-1}^d + \sum_{j-1}^{p} \beta_j \Delta y_{t-1}^d + v_t \quad \text{.....4.4}$$

Where $y_t^d$ equals the detrended or demeaned series and $v_t$ equals an error term. The DF-GLS statistic equals the t-ratio testing $H_o: \alpha = 0$ against $H_1: \alpha < 0$. In addition the DF-GLS test computes a second unit root test, the so-called point-optimal test, which derives the power to envelop and maximise the power for a given alternative hypothesis, which is a point optimal test, against the background that no uniformly most powerful unit root test exists. The test statistics that consistently asymptotically satisfy this condition are:

$$P_T = [SSR(\bar{a}) - SSR(1)]/f_o \quad \text{.....4.5}$$

The point-optimal test involves the consumption of the sum of squared residuals $SSR(\bar{a}) = \sum_{j-1}^{t} \widehat{\cap}_t^2 (\bar{a})$. The null hypothesis for the point optimal test is $\alpha = 1$ and the alternative hypothesis is $\alpha = (\bar{a})$. The test statistic equals:

$$P_T = [SSR(\bar{a}) - SSR(1)]/f_o \quad \text{.....4.6}$$

Where $f_o$ estimates the residual spectrum at frequency zero. $SSR(a)$ equals the sum of the squared residuals of a quasi-differenced OLS-regression, given the alternative hypothesis $\bar{a}$.

According to Wu (2010), the DF-GLS test is more powerful than ADF; nevertheless the test inherits the lag length selection criteria problem, as it is modified from the ADF test. Normally in the ADF regression, *k* is usually unknown, so how to choose becomes an issue, and this is known as the lag length selection criteria problem. The crux of this problem is that the performance of the ADF test relies on the selection of an appropriate lag length. On the one hand, the test would suffer from size distortion if the lag length selected is too small, which is the result of the remaining serial correlations in the error terms. At the same time, the test would experience power loss caused by inefficiency if the lag length selected is more than adequate. The DF-DLS lag length selection problems are the results of the augmented Dickey-Fuller regression, which are used in the test.

**(c) Ng-Perron test**

According to Malik and Rehman (2014), the test developed by Ng and Perron in 2001, incorporates the properties of the DF-GLS and Phillips Perron test. Ng and Perron claim that the test performs better especially in the presence of a negative moving average, but its performance depends heavily on the choice of spectral density estimators used in the construction of the test.

In what follows is the computation of the Ng-Perron test and differenced estimators of spectral density at zero frequency. Ng-Perron combine GLS detrending with SD to design a new test. The proposed test consists of a suite of four tests, namely MZa, MZt, MSB and MPT. Therefore, the four tests proposed by Ng-Perron are as follows:

$$MZ_a = \frac{((T^{-1}\bar{y})^2 - \bar{f}_{(o)})}{2k} \quad \text{.....4.7}$$

$$MZ_t = MZ_a * MSB \quad \text{.....4.8}$$

$$MSB = (\frac{k}{\bar{f}_{(o)}})^{1/2} \quad \text{.....4.9}$$

$MPT = \{\frac{\bar{c}^2 - \bar{c}T^{-1}(\bar{y}_t)2}{\bar{f}_{(o)}}$ when $d_t^0$ ……..4.10.1

$MPT = \{\frac{\bar{c}^2 k + (1-\bar{c})T^{-1}(\bar{y}_t)2}{\bar{f}_{(o)}}$ when $d_t^1$ ……..4.10.2

Where $d_t^0$ represents drift and $d_t^1$ drift and trend in DGP, and $\sum_{t=1}^{T} \frac{(\bar{y}(t-1))2}{T^2}$ while the symbol $\bar{f}_{(o)}$ indicates an estimate of spectral density at frequency zero.

**Spectral density at frequency zero:**

The spectral density at frequency zero represents the heteroskedasticity and autocorrelated corrected (HAC) standard error. There are many ways to estimate the spectral density, which can be divided into two types: (a) autoregressive spectral density, and (b) kernel based spectral density which can be further subdivided into four types: Parzen kernel, Barlett kernel, Quadratic special kernel and Turkey Hanning kernel. The two methods to estimate spectral density are discussed below:

**1Autoregressive (AR) Estimator of spectral density**

Autoregressive estimator of spectral density is based on the estimation of the parametric model, which is identical to the equation of ADF test equation. After having GLS detrending series estimate, the regression equation is given below:

$\Delta\tilde{y} = p\tilde{y}_{(t-1)} + \sum_{l=1}^{T} \Delta\tilde{y}_{(t-1)}\hat{\beta} + \varepsilon_t$ ……..4.10.3

Autoregressive estimator of spectral density is:

$\hat{f}_{(0)} = \frac{\hat{\sigma}_\varepsilon^2}{(1-\hat{\beta}(1))2}$ where,

$\hat{\beta}_{(1)} = \sum_{l=1}^{T} \hat{\beta}_1$ and $\hat{\sigma}_\varepsilon^2 = \frac{\sum_{t=1}^{(T-1)} \hat{\varepsilon}_t^2}{(T-1)}$ ……4.10.4

$\hat{\beta}_{(1)}$ is the sum of the coefficients of the lags of $\Delta\hat{y}_t$. Here $\Delta\hat{y}_t - \hat{y}_{(t-1)}$ and $\hat{\sigma}_\varepsilon^2$ is the variance of residuals $(\hat{\varepsilon}_t)$ from the equation (12).

**2 Kernel based (KB) Estimator of spectral density**

The non-parametric kernel based estimator of spectral density is the sum of auto covariance, in which weights are being decided by the kernel and bandwidth parameter. An estimation of the equation using the GLS detrended series is:

$$\Delta\hat{y}_t = p\hat{y}_{(t-1)} + \varepsilon_t \quad \text{.....4.10.5}$$

The kernel based estimator is given as:

$$\hat{f}_{(0)} = \sum_{j=-1(t-1)}^{(T-1)} \hat{Y}(j).K(\frac{j}{l})$$

$$\hat{Y} = \frac{\sum_{t=1}^{(T-1)} \hat{\varepsilon}_t * \hat{\varepsilon}_{t-j}}{T-j} \quad \text{.....4.10.6}$$

Where $l$ is bandwidth parameter, $K$ is kernel function which can be estimated in many ways. $\hat{Y}(j)$ is $j^{Th}$ is the order auto covariance of residual from equation.

### 4.1.3 Methodology

The study employs a newly developed econometric technique, Nonlinear Autoregressive Distributive Lag (NARDL) model. The empirical literature suggests that depreciation of the exchange rate improves the economic growth of the country through a trade balance, while appreciation of the exchange rate hurts economic growth which is symmetric, and this study deviates from that by using a nonlinear autoregressive distributive lag (NARDL). With this newly developed technique called the NARDL model, the study was able to test and determine whether exchange rates have symmetric or asymmetric effects on economic growth in South Africa.

Taha (2018) explains that this model makes use of the ordinary least squares method to estimate the co-integrating NARDL in which short-run and long-run nonlinearities are introduced via positive and negative partial sum decompositions of the explanatory variables. The model also provide CUSUM model stability tests.

According to Shin *et al.* (2011), before developing a full representation of the NARDL model, the study introduces the following asymmetric long-run regression which can be formulated as follows:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t$$

Where $y_t$ and $x_t$ are integrated I(1) variables and $x_t$ is decomposed as $x_t = x_0 + x_t^+ + x_t^-$, where $x_t^+$ and $x_t^-$ are partial sum processes of positive and negative changes in $x_t$.

The theoretical model which is followed by the study is formulated as follows:

$$GDP_i = \beta_0 + \beta_1 REER_i + \beta_2 Inve_i + \beta_3 GVE_i +$$

$$\beta_4 Broad_i + \varepsilon_i \quad \text{.....4.10.7}$$

Where GDP is gross domestic product, REER is the real effective exchange rate, Inve is investment (capital formation), GVE stands for government expenditure and broad stands for broad money as a percentage of GDP.

The NARDL presentation of the equation for the following variables; GDP, REER, Inv, GVE, Broad is given below:

$$\Delta GDP_t = C + pGDP_{t-1} + \theta^{+}REER^{+}_{t-1} + \theta^{-}REER^{-}_{t-1} + \theta^{+}Inv^{+}_{t-1} + \theta^{-}Inv^{-}_{t-1} + \theta^{+}GVE^{+}_{t-1} + \theta^{-}GVE^{-}_{t-1} + \theta^{+}Broad^{+}_{t-1} + \theta^{-}Broad^{-}_{t-1} + \sum_{i=1}^{p-1} \varphi i \Delta GDP_{t-i} + \sum_{i=0}^{q} \pi_i^{+} \Delta REER^{+}_{t-1} + \sum_{i=0}^{q} \pi_i^{-} \Delta REER^{-}_{t-1} + \sum_{t=0}^{r} \pi_i^{+} \Delta Inv^{+}_{t-1} + \sum_{t=0}^{r} \pi_i^{-} \Delta Inv^{-}_{t-1} + \sum_{i=0}^{s} \pi_i^{+} \Delta GVE^{+}_{t-1} + \sum_{t=0}^{s} \pi_i^{-} \Delta GVE^{-}_{t-1} + \sum_{i=0}^{t} \pi_i^{+} \Delta Broad^{+}_{t-1} + \sum_{t=0}^{t} \pi_i^{-} \Delta Broad^{-}_{t-1} + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.10.8$$

According to Shin, Yu and Nimmo (2011), the desirable features of the NARDL model include the following: firstly, the estimation of the ECM in one step is likely to improve the performance of the model in small samples, particularly in terms of the power of the cointegration test. The second one is the ability to simultaneously estimate both the long-run and short-run asymmetries in a computational and tractable manner. Thirdly, is the use of asymmetric dynamic multipliers, which provide a computational, straightforward means of assessing the traverse between short-run and log-run.

The possible shortcomings of the model according to Shin, Yu and Nimmo (2011), are as follows; firstly the presence of long-run asymmetry induces a ratchet mechanism if positive and negative regime possibilities are approximately equal, in which case no simple conclusion may be drawn. Secondly the concept of asymmetric cointegration is easily conceptualised by the use of a simple example. Thirdly, while the associated critical values can be tabulated easily using stochastic simulation, it is impractical to provide a meaningful set of critical values covering all

possible combinations. Finally, short-run restrictions may be excessively restrictive in many applications although they may be useful in providing more precise estimation results, particularly when estimating a long-run asymmetric relationship in a small sample.

### 4.1.4 Model specification

The study followed this model:

$$GDP_i = \beta_0 + \beta_1 REER_i + \beta_2 Inv_i + \beta_3 GVE_i + \beta_4 Broad_i + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots 4.10.9$$

Where GDP is gross domestic product, REER is the real effective exchange rate, Inv is investment (capital formation), GVE is government expenditure and Broad is for broad money supply as a percentage of GDP. What follows is the discussion of how these explanatory variables affect economic growth.

According to Abudalu *et al* (2014), in the flexible exchange rate regime, currency depreciation generated by the external shock could generate large increases in the value of the debt expressed in domestic currency. This could trigger bankruptcy and result in the reduction of economic growth. Furthermore, according to Bal, Dash and Subhasish (2016), economies of the world are not equally endowed with natural resources, therefore investment (capital formation) is necessary for some countries in order to maintain a higher level of economic growth. In essence capital formation has a significant effect on the gross domestic product of the country (Hosnul, 2015). Wagner's law model shows that public expenditures are endogenous to economic growth and that long-run tendencies exist for public expenditure to grow relative to some national income aggregates, such as gross domestic product. In short, Wagner's law suggests that government expenditure increases because of economic growth. On the other hand, the Keynesian model states that expansion of government expenditure accelerates economic growth, thus government expenditure is regarded as an exogenous force that changes aggregate output. From a broad money supply perspective, the theory of money argues that a change in money supply affects output in the short-run, and eventually prices in the long-run (Hussain and Zafar, 2017).

## 4.2 Diagnostic tests

The following section discusses the types of diagnostic tests which were used in the study. The tests used in the study include a normality test, multicollinearity, heteroskedasticity, serial correlation, and Ramsey reset test.

### 4.2.1 Normality test

According to Gujarati and Porter (2009), there are several normality tests which are discussed in literature, and such tests include, other than the most common histogram residuals, the normality probability plot and Jarque-Bera test. However for the purpose of this study, the Jarque-Bera test was chosen as it is formal test. (Brooks, 2014) The JB test is useful in this study because it applies property of a normal redistribution which is characterised by the first two moments, which are; the mean and the variance. (Gujarati and Porter, 2009) The histogram residuals and probability plot on the other side, make use of graphical devices in order to learn or study the shape of the probability density function of a variable, and this makes them to be inappropriate for the study.

**(a) Jarque-Bera (JB)**

The JB test for normality is an asymptotic or large sample test, and it is also based on OLS residuals. This test first computes the skewness and kurtosis measures of the OLS residuals and uses the following test statistic:

$$JB = n[\frac{S^2}{6} + \frac{(K-3)^2}{24}] \quad \text{.....4.11.1}$$

Where *n*= sample size, *S* = skewness coefficient, and *K*= kurtosis coefficient. In normal distribution, *S* = 0 and *K* = 3. Therefore, the JB test of normality is a test of the joint hypothesis that *S* and *K* are 0 and 3 respectively; in other words the value of the JB statistic is expected to be 0. Under the null hypothesis of the JB, if the p value of the JB statistic in an application is sufficiently low, so, if the value of the statistic is very different from 0, you reject the null hypothesis that the residuals are normally distributed. If the p value is reasonably high, which will happen if the value of the statistic is close to zero, you do not reject the normality assumption (Gujarati and Porter, 2009).

### 4.2.2 Heteroskedasticity

Williams (2015a), in trying to define heteroskedasticity, recalls that OLS makes the assumption that $V(\varepsilon_j) = \sigma^2$ for all *j;* that is to say, the variance of the error term is constant. If the error terms do not have a constant variance, they are said to be heteroskedastic, which means differing variance and comes from the Greek "hetero" meaning different and "skedasis" meaning dispersion. Heteroskedasticity may occur for example, when a model in which an annual family income is the IV and annual family expenditures on vacations is the DV. Families with low incomes will spend relatively little on vacations, and the variations in the expenditures across such families will be small. But for families with large incomes, the amount of discretionary income will be higher. The mean amount spent on vacations will be higher, and there will also be greater variability among such families resulting in heteroskedasticity.

**Detecting heteroskedasticity**

There are several tests which can be performed in trying to detect the problem of heteroskedasticity, and such tests include visual inspection of residuals plotted against fitted values, and the Breusch-Pagan test:

**Breusch-Pagan test**

According to Ullah (2012), the Breusch-Pagan test is named after Trevor Breusch and Adrian Pagan and it is used to test for heteroscedasticity in a linear regression model.

The regression model is $Y_i = \beta_1 + \beta_2 X_{2i} + \mu_i$ , that is there is a simple linear regression model, and $E(\mu_i^2) = \sigma_i^2$, where $\sigma_i^2 = f(\alpha_1 + \alpha_2)$.

That is, $\sigma_i^2$ is some function of the non-stochastic variable Z's. The *f()* allows for both the linear and non-linear forms of the model. The variable Z is the independent variable X or it could represent a group of independent variables other than X.

**Breusch-Pagan test steps**

The first step is to estimate the model using OLS, and obtain the residuals $\hat{\mu}_1, \hat{\mu}_2 + \cdots$.Step two involves estimating the variance of the residuals; that is $\hat{\sigma}^2 = \frac{\sum e_i^2}{(n-2)}$

In step three, run the regression $\frac{e_i^2}{\hat{\sigma}^2} = \beta_1 + \beta_2 Z_i + \mu_i$ and compute the explained sum of squares from this regression.

Step four is testing of the statistical significance of the ESS/2 by $X^2$-test, with 1 df at an appropriate level of significance$(a)$.

In step five, reject the hypothesis of homoscedasticity in favour of heteroscedasticity if $\frac{ESS}{2} > X^2_{(1)}$ at the appropriate level of $a$.

### 4.2.3 Serial correlation

According to Williams (2015b), serial correlation occurs when the error terms from different time periods are correlated, therefore we say that the error term is serially correlated. Serial correlations in most cases, occur in time-series studies when the errors associated with a given time period carry over into future time periods. There are different types of serial correlation, such as first order serial correlation. In this type of serial correlation, errors in one time period are correlated directly with errors in the ensuing time period. At the same time, errors might also be lagged; for example, if data is collected quarterly, the error of Fall of one year might be correlated with the errors of Fall in the next year. With a positive correlation, errors in one time period are positively correlated with errors in the next time period.

The consequences of serial correlation are, for instance, serial correlation will not affect the unbiasedness or consistency of OLS estimators, but it does affect their efficiency. With positive serial correlation, the OLS estimates of the standard errors will be smaller than the true standard errors. This will lead to the conclusion that the parameter estimates are more precise than they really are. There will be a tendency to reject the null hypothesis when it should not be rejected (Williams, 2015).

The test for serial correlation, one of the popular tests for serial correlation is the Durbin-Watson statistic:

$$DW = \frac{\sum_{l=2}^{T}(\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})2}{\sum_{t=1}^{T}\hat{\varepsilon}_t^2} \quad \text{.....4.11.2}$$

T = the number of time periods. It should be noted that the numerator cannot include a difference for the first observation in the sample, since no earlier observation is available. When successive values of $\hat{\varepsilon}_t$ are close to each other, the DW statistic will be low, indicating the presence of positive serial correlation. The DW statistic will lie in the 0-4 range, with a value near two indicating no first-order serial correlation.

Positive serial correlation is associated with DW values below 2 and negative serial correlation with DW values above 2.

**(a) Breusch-Godfrey test**

According to Gujarati and Porter (2009), Breusch and Godfrey developed a test of autocorrelation which is general in the sense that it allows for (1) non-stochastic regressors, such as the lagged values of the regressand; (2) higher order autoregressive schemes, such as AR (1) and AR (2).

The BG test is also known as the LM test which proceeds as follows. There is the use of a two-variable regression model to illustrate the test, although many regressors can be added to the model. At the same time, lagged values of the regressand can be added to the model. Thus:

$Y_t = \beta_1 + \beta_2 X_t + u_t$…….. ..4.11.3

Assuming that the error term $u_t$ follows the *p*th-order autoregressive, AR(p), schemes are as follows:

$u_t = p1u_{t-1} + p2u_{t-2} + \cdots + p_p u_{t-p} + \varepsilon_t$……4.11.4

Where $\varepsilon_t$ is a white noise error term and it is an extension of the AR (1) scheme. The null hypothesis $H_0$ to be tested is that:

$H_0: p1 = p2 = \cdots = p_p = 0$ ……...4.11.5

That is, there is no serial correlation of any order, and the Breusch-Godfrey test involves the following steps:

Step one, estimate the equation 4.11.3 by OLS and obtain the residuals, $\hat{u}_t$.

Step two, regress $\hat{u}_t$ on the original $X_t$ and $\hat{u}_{t-1}$, $\hat{u}_{t-2,\ldots}\hat{u}_{t-p,}$ where the latter are lagged values of the residuals to be estimated in step one. Thus, if $p = 4$, then what follows will be the introduction of four lagged values of the residuals as the additional regressors in the model. To run the regression, let $(n - p)$, then the regression is as follows:

$\hat{u}_t = \alpha_1 + \alpha_2 X_t + \hat{p}_1\hat{u}_{t-1} + \hat{p}_2\hat{u}_{t-2} + \cdots + \hat{p}_p\hat{u}_{t-p} + \varepsilon_t$……4.11.6

And obtain R-squared from the auxiliary regression.

In step three, if the sample size is large, Breusch and Pagan have shown that:

$(n-p)R^2 \sim X_p^2$ ……4.11.7

That is asymptotically, $n-p$ times the $R^2$ value obtained from the auxiliary regression, then 4.2.6 follows the chi-square distribution with *p* df. If an application $(n-p)R^2$ exceeds the critical chi-square value at the chosen level of significance, reject the null hypothesis, in which case at least one *p* in equation 4.11.4 is statistically significantly different from zero.

### 4.2.4 Ramsey's reset test

Wooldridge (2013) reveals that there are so many tests that have been proposed to detect general functional form misspecification, but Ramsey's regression specification error test (RESET) has been proven to be quite useful in this regard. The idea behind RESET is fairly simple. To illustrate, suppose that in the multiple linear regression model:

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + u$ ……4.11.8

The assumption MLR.3 (exogenous$xs$) is satisfied. This implies that no nonlinear functions of the independent variables, such as squares and cubes of $x_j s$ should be significant when added to the model. But as in the White test, adding squares, cubes and cross-products uses up many degrees of freedom. This is a drawback, so instead of this, one can add squares and cubes of the fitted values, $\hat{y}^2, \hat{y}^3$, into the model and test for the joint significance of added terms using the F or LM test.

The auxiliary regression for the RESET test statistics can be written as follows:

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_k x_k + \delta_1 \hat{y}^2 + \delta_2 \hat{y}^3 + u$ ……4.11.9

The null hypothesis of the RESET says that the model is correctly specified:

$H0: \delta_1 = 0, \delta_2 = 0$

In large samples and under the Guass-Markov assumption, the usual F restrictions test follows the $F(2, n-k-3)$ distribution. If the F statistic is greater than the critical value at a given significance level, then we reject the null hypothesis of correct specification. This indicates that there is a functional form misspecification.

### 4.3 Conclusion

This chapter gave data descriptions and sources of the variables used in the study. The variables used include gross domestic product, real effective exchange rate, investment (capital formation), government expenditure and broad money supply as a percentage of GDP. In section two, the discussions of the Ng-Perron, DG-GLS and KSS tests were given, as well as their equations and null hypotheses. Section three outlined the methodology and model specification of the study, which is the implementation of the newly developed technique known as the NARDL model and its advantages and shortfalls. Finally, section four discusses the diagnostic tests which were used in the study. These tests include a normality test, heteroskedasticity, serial correlation, and Ramsey's reset.

The next chapter, chapter five, will reveal the empirical findings of this study.

# CHAPTER FIVE: EMPIRICAL RESULTS

## 5.1 Introduction

Chapter five presents the empirical results of the relationship between economic growth and the exchange rate in South Africa. This chapter includes eight subsections. The first section presents the introduction of the chapter, the second section deals with descriptive statistics of all the macroeconomic variables which are going to be used in the study. The third section presents a correlation analysis of macroeconomic variables employed in the study. Section four on the other hand, presents the first generation of unit root tests, while section five deals with nonlinear and Flexible Fourier Function function-based unit root tests. Section six presents the results of the ARDL model, in section seven the study presents the results of the NARDL model. Lastly, section eight presents the conclusion of chapter five.

## 5.2 Descriptive statistics

Table 5.1 presents the statistical characteristics of all the variables used in the models of ARDL and NARDL in the study. The Jarque-Bera test is employed to ascertain whether the macroeconomic variables follow the normal probability distribution.

**Table 5.1: Descriptive statistics**

| | GDP | Broad | GVE | INVE | REER |
|---|---|---|---|---|---|
| Mean | 48324.33 | 59.69 | 17.30 | 22.17 | 121.76 |
| Maximum | 56549.00 | 80.80 | 20.93 | 34.12 | 192.51 |
| Minimum | 42386.00 | 45.50 | 11.11 | 15.16 | 72.03 |
| Std. Dev. | 4248.31 | 9.61 | 2.94 | 5.10 | 33.99 |
| Skew | 0.71 | 0.73 | -0.76 | 0.72 | 0.45 |
| Kurtosis | 2.28 | 2.28 | 2.19 | 2.32 | 2.06 |
| J-B | 5.07 | 5.34 | 5.92 | 5.12 | 3.35 |
| Probability | 0.08 | 0.06 | 0.05 | 0.08 | 0.19 |
| Obs. | 48 | 48 | 48 | 48 | 48 |

Source: Researcher's own computation

From the above table, the summary statistics indicates that GDP has a mean or average value of 48324.33 per year. The gross domestic product has a maximum value of 56549.00. This figure was recorded in the year 2014, which was a turbulent year in South African politics. This was mainly caused by the cabinet reshuffling in President Zuma's administration, particularly on the position of Minister of Finance. On the other hand, the minimum value for GDP is 42386.00, which was recorded in

1993 when South Africa was heading towards a new dispensation, politically and economically. The standard deviation on the other side is sitting at 4248.31, which is low and that shows that GDP values are close to the average or mean of the GDP in South Africa. The series also indicates that GDP is 0 skewed, which suggest that data is normally distributed for GDP. Moreover, the Kurtosis on the other side is 2.28 which is less than 3 for normality. The series also shows the Jarque-Bera test and its p-values, which are 5.07 and 0.08 respectively, and this indicates that the GDP is normally distributed as the p-value is larger than 5 percent.

The broad money as a percentage of GDP, has a mean of 59.7 percent per year which is high. The highest increase of the broad money is 80.8, which is too high and undesirable for the economy. It should be noted that this occurred during the period of the global financial crisis in 2008, which suggests that the country was increasing expenditure by making credit more available (SARB, 2010). At that period South Africa was trying to boost its economy by stimulating the demand which would later help to get rid of the problem of unemployment which is engulfing the country. The figure is higher than maximum value of 72.8 in Nigeria for the period 1970 to 2008 (Solar and Peter, 2013) and this shows that South African government was determined to boost its economy, while its minimum value is 45.5 percent, which was recorded in 1993 during the political and economic transition in South Africa.

The standard deviation for the broad money is sitting at 9.6 percent, which is low and that signals that broad money supply values are closer to the average or mean of money supply. The time series also indicates that broad money is skewed to the right by 7.3, and this is high as it deviates from normality. The kurtosis at the same time is 2.3 which is lower than 3 for normal distribution. However the series further indicates that broad money is normally distributed as the p-value for the JB test is larger than 0.05, the JB and p-value are 5.3 and 0.06.

The mean for government expenditure is 17.3 percent. Moreover, the maximum value of the government expenditure is 20.9 percent which was recorded in the year 2017. This figure is lower than countries which have the highest levels of government spending, such as Zimbabwe (97.8 percent), Cuba (78 percent), and many other countries (Pettinger, 2017b). This reveals that South African government is not on embarking on government projects as it should, and that could be the

possible reason why South Africa is experiencing a higher rate of unemployment. The minimum value is 11.1 percent which was recorded in the year of 1973, during the apartheid era in South Africa. This makes sense as because at the time, the economy was more concentrated than it is today, and the government didn't spend much on certain racial groups. The standard deviation of 2.9 is very low, which signals the smoothness of government expenditure over time. It also indicates that values of government expenditure are closer to the average or mean of government expenditure. The time series also reveals that government expenditure is skewed to the left by 0.76 and this deviates from normality. The Kurtosis is 2.19 which is lower than 3 for normally distributed data. However, the results reveal that there is evidence of normality from the JB test and its probability value, as the p-value is greater than 0.05.

Investment has a mean of 22.22 percent, while at the same time investment has a maximum value recorded of 34.12 percent. This maximum value was recorded in 1981 after financial liberalisation, and this was desirable for South Africa, since investment is considered as the traditional source for economic growth (World Bank, 2018). On the other hand, the minimum value for investment is 15.16 percent, which was recorded in 1993 during the political transition in South Africa. This was a beginning of the new dispensation for South Africa, so many investors left the country as the apartheid regime was coming to an end. Since then the country has been experiencing a lower growth which is caused by low investment. The standard deviation for the investment is 5.10 percent, which is small and indicates the closeness of the investment values to the average of investment in South Africa. The skewness is 0.72 percent, which is low and that shows normality of investment over the years. However, the kurtosis is 2.32 which is lower than 3 in the case of normality. The JB and its probability values are 5.12 and 0.08 which means there is normality.

The real effective exchange rate (REER) has got a mean of 121.76. The time series also reveals that REER has a maximum value of 192.51 which was recorded in 1970 during the Bretton Woods system, when the importance was on the balance of payments constraints (Fedderke and Simkins, 2009). This shows that the South African exchange rate during this period was very strong relative to its trading partners. This can also be linked to the level of investment which was high in South

Africa during this period. On the other hand, the minimum value of the exchange rate is 72.03 which was recorded in 2016, and this suggests that the South African exchange rate is depreciating. This reveals that rand has lost so much value in comparison to its trading partners, and this is mainly because of the low rate of investment coming into the country which affects the Balance of Payments. The standard deviation is 33.99, which is high and signals that exchange rates are not smooth over time in South Africa. The skewedness of REER is 0.45, which appears to be fine, fitting in with normality. The Kurtosis is 2.06 which is less than 3 for the case of normality. The JB tests and their probability are 3.35 and 0.18 which also suggests that there is normality.

### 5.3 Correlation analysis

The following section presents the correlation analysis which measures the degree of linear association between the macroeconomic variables employed in the models of the study. Brooks (2014) stipulates that if dependent and explanatory variables are correlated, then it means that both are being treated in a completely symmetrical way. It does not imply that changes in the explanatory variable cause changes in the dependent variable or vice versa. Rather, movements in the two variables are on average related to an extent, given by the correlation coefficient.

**Table 5.2: Correlations**

| Correlation probability | GDP | REER | BROAD | GOV | INVE |
|---|---|---|---|---|---|
| GDP | 1.00 | | | | |
| REER | -0.42<br>0.00 | 1.00 | | | |
| BROAD | 0.85<br>0.00 | -0.52<br>0.00 | 1.00 | | |
| GOV | 0.30<br>0.03 | -0.89<br>0.00 | 0.32<br>0.03 | 1.00 | |
| INVE | 0.10<br>0.52 | 0.78<br>0.00 | -0.07<br>0.64 | -0.86<br>0.00 | 1.00 |

Source: Researcher's own computation

The above table shows correlation analysis between variables that are going to be used in model one. The results reveal that there is a negative correlation between real effective exchange rate (REER) and gross domestic product (GDP), and it is significant at a 5 percent level of significance. This is line with a priori expectations, as empirical literature suggests that when exchange rates appreciate, growth slows down, but when it depreciates growth improves in developing countries (Habib *et al.*, 2016). This is good for South Africa, especial as a developing country because when the exchange rate is depreciating growth improves. However if exchange rate improves, growth declines in South Africa and that is bad for the economy of the country. The broad money and GDP indices are strongly correlated, and they are significant at 1 percent, which is in line with the a priori expectations, because that means the role of the financial sector is crucial for economic growth and development (Antoni, 2015). This is good for South Africa, because when there is access to credit demand will be stimulated as well as more jobs are created in the process. At the same time the results further reveal that broad money is negatively correlated with REER and it is significant at 1 percent level of significance, which appears to suit a priori expectations of the study. It is bad for the country as there is an increase money supply distabalises the economy of South Africa. This occurs because the exchange rate depreciates on imports as a result of a growth in money supply (Levin, 1997).

Government expenditure shows a positive correlation with GDP; however, this correlation of 0.3 percent is weak, and it is significant at a 5 percent level of significance, and as expected, this is line with a priori expectations. This means that when the government increases the government expenditure in South Africa, growth improves as there are jobs created, and at the same time the demand is stimulated which is good for South Africa as it is in line with a priori expectations. These expectations arise from what is stated in Wagner's law, which suggests that an increase in growth is the result of higher government expenditure. The Keynesians also postulate that when there is an increase in government expenditure that leads to higher economic growth (Hasnul, 2015). The correlation between government expenditure and REER is negative and weak, and it is significant at 1 percent level of significance which is not in line with a priori expectations, because according to Giorgio and Nistico (2016), new open economy macroeconomics (NOEM) models

suggest that the real exchange rate appreciates as a result of an increase in public spending.

On the other hand, government expenditure and broad money have a positive correlation to each other, but the correlation is weak, and it is significant at a 5 percent level of significance. What is positive about this correlation for the case of South Africa, is that when there is an access to credit then government expenditure improves. This result is also in line with a priori expectations of the study about these two variables, because theory suggests that money supply expansion leads to the availability of credit, whilst an increase in government expenditure leads to, or promotes aggregate demand (Kandil, 2006). There is a weak but positive correlation between investment and GDP which is not significant at 5 percent level of significance; however, this is in line with a priori expectations of the study because according to Bakari (2017), investment is the most important economic variable, thus many countries attach great importance to it as a valuable component to growth, which creates a climate conducive to economic development. It is in line with the case of South Africa, because South Africa is experiencing low rate of growth because of the low inflow of investment into the country, and this is not good for South Africa as there is higher rate of unemployment.

The results further reveal that there is a strong and positive correlation between investment and REER and it significant at 1 percent level of significance, which is in line with a priori expectations of the study because exchange rates can influence the level of investment that takes place into a country (Goldberg, 2006). However it should also be noted that when investment comes into South Africa, it usually provides the foreign exchange, and that improves the balance of payments or raise the raise the value of the rand which is good for South Africa. There is a weak and negative correlation between investment and broad money which is not significant at 5 percent level of significance, but this is in line with a priori expectations of the study. The reason behind that is that most developing countries pursue growth with an intention of increasing capital formation through increasing money supply, which is coupled with high inflation (Olanipekun and Akeju, 2013). Lastly, the results reveal that there is a strong but negative correlation between investment and government expenditure, significant at 5 percent level of significance. This correlation is in line with a priori expectations of the study because according to the neoclassical theory,

an increase in government spending, especially if financed through debt, will lead to crowding out of investment.

### 5.4 First generation unit root test

The initial empirical analysis involves checking the statistical properties of the data which includes unit root tests. The study made use of first generation tests, such as DF-GLS and Ng-Perron. The findings of these tests are performed with an intercept, and also trend and intercept, as reported in Tables 5.3, 5.4, and 5.5 respectively. Table 5.3 presents the DF-GLS unit root test results which reveal that at levels in intercept, none of the variables are significant, but when the test is carried over first difference all the variables are significant at 1 percent level of significance. At trend and intercept, the results show that it is only REER (5%) that is significant in levels, the rest of the variables become significant at 1 percent when the test is carried over the first difference.

**Table 5.3: DF-GLS**

| DF-GLS TEST STATISTICS | | | | |
|---|---|---|---|---|
| Intercept | | | Trend and intercept | |
| Variables | levels | 1st difference | levels | 1st difference |
| GDP | -0.50 | -4.53*** | -1.45 | -4.65*** |
| REER | -0.44 | -5.99*** | -3.73** | -6.03*** |
| BROAD | -0.91 | -4.91*** | -1.51 | -5.24*** |
| INVE | -1.24 | -5.82*** | -2.16 | -6.62*** |
| GOV | -0.09 | -5.75*** | -1.92 | -6.76*** |

Source: Researcher's own computation, Notes: "***", "**", "*" denote 1%, 5%, and 10% critical levels.

Table 5.4 shows the Ng-Perron unit root test results with an intercept only. In levels, the MZa, MZt, MSB, and MPT show that all the variables fail to reject the null hypothesis of unit root. The rest of the variables are stationary at first difference, which mirrors the results of the DF-GLS to a large extent.

**Table 5.4: Ng-Perron**

| INTERCEPT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Levels | | | | | 1st difference | | | |
| Variable | MZa | MZt | MSB | MPT | MZa | MZt | MSB | MPT |
| GDP | -1.52 | -0.56 | 0.37 | 10.68 | -19.76*** | -3.14*** | 0.16*** | 1.27*** |
| REER | -0.28 | -0.16 | 0.58 | 21.48 | -22.76*** | -3.33*** | 0.15*** | 1.22*** |
| BROD | -2.42 | -0.95 | 0.39 | 9.29 | -20.84*** | -3.23*** | 0.15*** | 1.18*** |
| INVE | -2.99 | -1.12 | 0.37 | 7.97 | -22.34*** | -3.33*** | 0.15*** | 1.15*** |
| GOV | 0.32 | 0.22 | 0.70 | 33.32 | -22.28*** | -3.33*** | 0.15*** | 1.13*** |

Source: Researcher's own computation. Notes: "***", "**", "*" denote 1%, 5%, and 10% critical levels.

Table 5.5 below presents the Ng-Perron unit root testing with trend and intercept. The test indicates that at levels, the MZa, MZt, MSB and MPT reveal that REER (1%) is rejecting the null hypothesis of unit root. When the unit root test is carried over the first difference, MZa, MZt, MSB and MPT show that all the remaining variables are stationary at 5 percent level of significance.

**Table 5.5: Ng-Perron**

| Trend and Intercept | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Levels | | | | | 1st difference | | | |
| Variable | MZa | MZt | MSB | MPT | MZa | MZt | MSB | MPT |
| GDP | -4.68 | -1.47 | 0.31 | 19.08 | -20.06** | -3.16** | 0.16** | 4.56** |
| REER | -25.55*** | -3.54*** | 0.14*** | 3.78*** | | | | |
| BROD | -4.62 | -1.50 | 0.33 | 19.59 | -21.66** | -3.28** | 0.15** | 4.22** |
| INVE | -7.99 | -1.98 | 0.25 | 11.46 | -22.75** | -3.37** | 0.15** | 4.01** |
| GOV | -6.43 | -1.76 | 0.27 | 14.18 | -22.83** | -3.38** | 0.15** | 4.00** |

Source: Researcher's own computation. Notes: "***", "**", "*" denote 1%, 5%, and 10% critical levels.

### 5.5 Nonlinear and Flexible Fourier Function-based unit root tests

The above unit root tests presented thus far, only address symmetries when dictating the evolution of the time series. Therefore the study also aims to cater for any possible asymmetries by introducing the KSS unit root test with and without Flexible Fourier Function (FFF). The following section presents the findings of the KSS nonlinear unit root tests which are performed without an FFF and with an FFF and the empirical results are presented in Tables 5.6 and 5.7 respectively.

The results of the KSS test without FFF are shown in table 5.6. The results reveal that REER (5%), and investment (1%) reject the hysteresis hypothesis, which implies that these variables are nonlinear trend stationary, and show nonlinear characteristics. The hysteresis hypothesis does not hold for the remaining variables of GDP, Broad money, and government expenditure, which implies they are stationary series. Table 5.7 presents the results of unit root when the FFF approximation is included. The results reveal that it is only REER (1%) that rejects the hysteresis hypothesis and this implies that REER is a nonlinear trend and shows nonlinear characteristics. For the remaining variables of GDP, Broad, investment and government expenditure, the hysteresis hypothesis holds which suggests that these variables are stationary series.

**Table 5.6: KSS unit root test without FFF**

| | | KSS Stat | | Optimal lag | | AIC | SC |
|---|---|---|---|---|---|---|---|
| GDP | | 0.72 | | 1 | | 16.73 | 16.81 |
| REER | | -2.73** | | 5 | | 7.48 | 7.73 |
| BROD | | 0.16 | | 1 | | 4.75 | 4.83 |
| INVE | | -3.25*** | | 3 | | 7.63 | 7.79 |
| GOV | | 1.46 | | 2 | | 2.21 | 2.34 |

Source: Researcher's own computation. Notes: "***", "**", "*" denote 1%, 5%, and 10% critical levels.

**Table 5.7: KSS unit root test with FFF**

| | | KSS | | Optimal lag | | K* | | SSR |
|---|---|---|---|---|---|---|---|---|
| GDP | | 1.26 | | 6 | | 1 | | 348.38 |
| REER | | -3.58*** | | 6 | | 4 | | 2599.48 |
| BROD | | 0.26 | | 6 | | 1 | | 194.06 |
| INVE | | -1.68 | | 6 | | 1 | | 143.42 |
| GOV | | 2.81 | | 6 | | 1 | | 15.05 |

Source: Researcher's own computation. Notes: "***", "**", "*" denote 1%, 5%, and 10% critical levels.

### 5.6 ARDL and NARDL models

This section presents the results of the ARDL and NARDL models and it is structured as follows. The first section outlines the results of the ARDL model by starting with the ARDL bounds test, the second section presents the diagnostic tests, and thirdly the results of the long-run and short-run relationships are presented. The final section on ARDL presents the results of the CUSUMQ square. The results of the NARDL model follow the same structure, but in the end there is an added section which presents asymmetry testing results.

### 5.7 ARDL model results

What follows is the critical bounds test for gross domestic product as the dependent variable and macroeconomic variables employed as regressors in the model of ARDL.

**Table 5.8: ARDL Bounds test results**

| F-Statistic value | k | Critical values | I0 Bound | I1 Bound |
|---|---|---|---|---|
| 5.71 | 4 | 10% | 2.45 | 3.52 |
| | | 5% | 2.86 | 4.01 |
| | | 2.5% | 3.25 | 4.49 |
| | | 1% | 3.74 | 5.06 |

Source: Researcher's own computation

The results in Table 5.8 show that the calculated F-Statistic value is greater than all critical values at I1 Bound values. Hence, the study rejects the null hypothesis of no

long-run relationship between the variables employed in the model. This means that there is a long-run relationship between GDP, REER, broad money, investment and government expenditure. Having established that there is a long-run relationship, the study presents the results of the diagnostic tests.

### 5.7.1 Diagnostic tests

The following section is the representation of the diagnostic tests which are carried out in the model. These tests include normality using Jarque-Bera, while other tests used in the model include heteroskedasticity, serial correlation and Ramsey's reset test.

**Table 5.9: Diagnostic tests**

| Diagnostic tests | P-value (F-statistic) |
|---|---|
| Normality (Jarque-Bera) | 0.74 |
| Heteroskedasticity | 0.50 |
| Serial correlation | 0.40 |
| Ramsey's reset | 0.68 |

Source: Researcher's own computation

From the above results of normality, the p-value is above 5 percent level of significance and therefore the study fails to reject the null hypothesis that the residuals are normally distributed. If the null hypothesis that says residuals are normally distributed cannot be rejected, then there is normality. The results from the above table also indicate that the null hypothesis that there is heteroskedasticity, is rejected, as the p-value of the observed R-squared is greater than 5 percent level of significance. Therefore the study finds no heteroskedasticity in the ARDL model. From the serial correlation side, the results indicate that there is no serial correlation found in the model. The p-value of the observed R-squared is greater than 5 percent level of significance. The null hypothesis that says error terms are serial correlated in the model regression, is rejected. Ramsey's reset test result presented by an f-statistic value which is greater than 5 percent, indicates that the functional form of the model is right.

### 5.7.2 Long-run and Short-run results

Table 5.10 depicts the ARDL model results in the long-run. The explained variable is gross domestic product and its regressors include real effective exchange rate, broad money supply, investment, and government expenditure.

**Table 5.10: Long-run relationship results**

| Variable | Coefficient | T-statistics | Probability |
|---|---|---|---|
| REER | -0.00 | -2.36 | 0.03 |
| BROAD | 0.01 | 3.90 | 0.00 |
| INVE | 0.02 | 7.32 | 0.00 |
| GOV | 0.02 | 3.45 | 0.00 |
| C | 9.78 | 51.36 | 0.00 |

Source: Researcher's own computation

The results of the ARDL long-run results are presented in Table 5.10 above. From the above results it can be deduced that when GDP is the dependent variable, there is a negative and significant relationship between GDP and the real effective exchange rate. This implies that when the exchange rate is stronger, South African exports become less competitive and that leads to a decline in economic growth in South Africa. This is in line with a priori expectations of the study. This simple means that in South Africa, the conditions are conducive for economic growth when real effective exchange rate is depreciating. This is good, concerning the fact that South Africa is a developing country.

This result is also in line with those of Isola *et al.* (2016) in Nigeria, when they reported a negative and significant relationship between exchange rates and real GDP. The results also show that broad money has a positive and significant effect on GDP, which is in line with economic theory as it supports the financial led growth hypothesis, or supply leading hypothesis, which stipulates that the financial sector is a prerequisite for economic development. However, if financial development is influenced by economic growth, this means the demand-following hypothesis is supported (Antoni, 2015). It should be noted that, access to credit facility in South Africa will boost local demand which in return will stimulate the economy of South Africa through job creation, which is good for the country. However it should also be noted that, too much access to credit will trigger inflation in South Africa.

Furthermore, the results indicate that there is a positive and significant relationship between investment and GDP which is line with a priori expectations of the study. What this means is that if there is an inflow of investment to South Africa, the country will produce goods that have an export potential through foreign capital, which will then lead to a higher economic growth in South Africa. This result is consistent with that of Sial, Hashmi and Answar (2010) in Pakistan. Likewise, government expenditure has a positive and significant effect on the GDP in South Africa which confirms a priori expectations of the study because an increase in government expenditure leads to an increase in aggregate output. The result reveal that projects that are related to government expenditure are the ones that promote growth in South Africa, and that is beneficial for South Africans more special for job creation. This result is consistent with that of Razzaque *et al.* (2017) in Bangladesh.

**Table 5.11: Short-run relationship results**

| Variable | coefficient | T-statistics | Probability |
|---|---|---|---|
| D(REER) | -0.00 | -0.36 | 0.72 |
| D(REER(-1)) | 0.00 | 3.06 | 0.00 |
| D(REER(-2)) | -0.00 | -1.50 | 0.15 |
| D(REER(-3)) | 0.00 | 2.50 | 0.02 |
| D(BROAD) | 0.01 | 4.29 | 0.00 |
| D(INVE) | 0.00 | 2.10 | 0.04 |
| D(INVE(-1)) | -0.00 | -0.01 | 0.99 |
| D(INVE(-2)) | -0.00 | -0.81 | 0.43 |
| D(INVE(-3)) | -0.00 | -0.86 | 0.40 |
| D(INVE(-4)) | -0.00 | -3.40 | 0.00 |
| D(GOV) | 0.00 | 0.45 | 0.66 |
| D(GOV(-1)) | -0.00 | -0.67 | 0.51 |
| D(GOV(-2)) | -0.01 | -1.53 | 0.14 |
| CointEq(-1) | -0.57 | -3.79 | 0.00 |

Source: Researcher's own computation

The short-run results presented in Table 5.11 seem to suggest that when GDP is the dependent variable, the results indicate that there is a negative and insignificant relationship between GDP and the real effective exchange rate. This shows that in

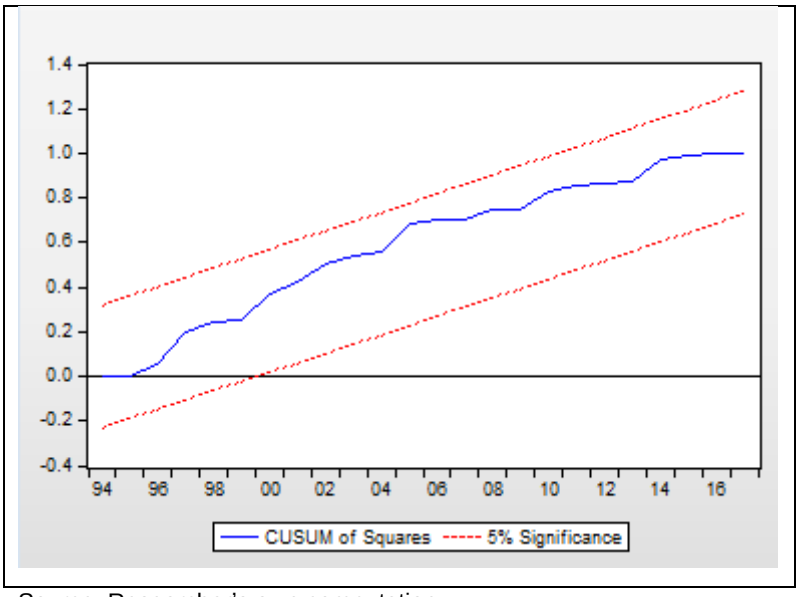
the short-run, the real effective exchange rate has got a negative impact on growth, but that impact is not significant, which conforms to a priori expectations; furthermore, result is also found by Isola *et al.* (2016). In the context of South Africa, it means that when the rand appreciates, economic growth declines. This makes more sense especial to South Africa as a developing country, because when the rand is stronger the exports are becoming expensive and that hurts firms as well as hindering growth for South Africa. At the same time most lags of real effective exchange rates show a positive and significant effect on the gross domestic product. The broad money supply has a positive and significant effect on the gross domestic product, which is not in line with a priori expectations but consistent with the result of Tarawalie (2016). This positive effect comes from the fact that, when financial institutions decide to lend money to their clients, demand is stimulated in the economy and through multiplier effect more firms and jobs are generated through this financial development. It can also be noted that investment has a positive and a significant effect on economic growth in South Africa, which is in line with a priori expectations of the study. This finding is consistent with that of Almsafir and Morzuki (2015), as the results also show that most of the lags of investment have a negative effect on economic growth in South Africa. The results further reveal that there is a positive and insignificant relationship between government expenditure and gross domestic product, whilst most of its lags show a negative and insignificant influence on gross domestic product. In South Africa, the effect of government expenditure on economic growth is not strong, it is partially because government projects are financed through loans, and these loans have to be paid back, and that puts a strain on South African economy as is still in debt. The error correction term shows the speed of adjustment from disequilibrium to equilibrium, thus, 57 percent of the disequilibrium is corrected in the long-run.

### 5.7.3 CUSUMQ square results

In testing the stability of the estimated ARDL model, and of the long-run and short-run relationships between economic growth and macroeconomic variables, the study employed the cumulative sum of Recursive Residuals (CUSUM) and Cumulative Sum of Square (CUSUMQ) graphs. The results are presented in figure 5.1 and the conclusion is that all of the coefficient of the error correction are stable and the null

hypothesis is not rejected, as not all the plots in CUSUM stay within a 5 percent range of significant.

**Figure 5.1: CUSUMQ square**




Source: Researcher's own computation

### 5.7.4 NARDL Model results

This section presents the analysis of the NARDL model and also shows that it is more superior to the linear ARDL model as it caters for the nonlinearities in the data. In this section gross domestic product is used as the explained variable, while real effective exchange rate, broad money supply, investment, and government expenditure are used as regressors.

**Table 5.12: NARDL Bounds test results**

| F-Statistic value | k | Critical values | I0 Bound | I1 Bound |
|---|---|---|---|---|
| 5.39 | 5 | 10% | 2.26 | 3.35 |
| | | 5% | 2.62 | 3.79 |
| | | 2.5% | 2.96 | 4.18 |
| | | 1% | 3.41 | 4.68 |

Source: Researcher's own computation

Based on Table 5.12 and the NARDL bounds test results, the F-statistics are greater than all the critical values at I1 Bound values. Therefore, the null hypothesis of no long-run relationship is rejected between the variables in the model. This indicates that there is a long-run relationship between GDP, REER, broad money, investment

and government expenditure. What follows next is the discussion of the diagnostic tests.

### 5.7.5 Diagnostic tests

The following section presents diagnostic tests which are carried out in the NARDL model. These tests include normality using Jarque-Bera, while other tests used include heteroskedasticity, serial correlation and Ramsey's reset test.

**Table 5.13: Diagnostic tests**

| Diagnostic tests | P-value (F-statistic) |
|---|---|
| Normality (Jarque-Bera) | 0.12 |
| Heteroskedasticity | 0.76 |
| Serial correlation | 0.72 |
| Ramsey's reset | 0.10 |

Source: Researcher's own computation

Table 5.13 present the diagnostic test results of the NARDL model from the normality Jarque-Bera test. The p-value of the JB is large than 5 percent, and therefore the study fails to reject the null hypothesis that residuals are not normally distributed, which means there is normality. The results also reveal that there is no heteroskedasticity found in the model, given the fact that the p-value of observed R-squared is higher than 5 percent. Therefore, that null hypothesis that says there is heteroskedasticity is rejected. The results also found no serial correlation in the model and this shown by the p-value of the observed R-squared, which is greater than 5 percent level of significance, and the null hypothesis that says there is serial correlation, is rejected. The study also checked Ramsey's reset test for stability, and the results indicate that the functional form of the model is right, and this is shown by the p-value of the F-statistic, which is higher than 5 percent.

### 5.7.6 Long-run and Short-run results

This section depicts the representation of the NARDL model in the long-run and short-run results, where GDP growth is the explained variable whilst real effective exchange rate, broad money, investment, and government expenditure are explanatory variables.

**Table 5.14: Long-run relationship results**

| Variables | Coefficients | T-statistics | Probability |
|---|---|---|---|
| REER_POS | 0.00 | 2.52 | 0.02 |
| REER_NEG | -0.00 | -2.24 | 0.03 |
| BROAD | 0.00 | 0.17 | 0.87 |
| INVE | 0.01 | 4.25 | 0.00 |
| GOV | -0.05 | -2.34 | 0.03 |
| C | 10.86 | 29.82 | 0.00 |

Source: Researcher's own computation

The results in table 5.14 indicate the long-run relationship between gross domestic product and explanatory variables, employing the NARDL model. The results reveal that when GDP is the dependent variable, then the real effective exchange rate has a positive and significant effect on GDP growth. This shows that an appreciation in the exchange rate causes a significant improvement in economic growth in South Africa. The results also reveal that a negative change in the real effective exchange rate has a negative and significant effect on GDP growth. These results contradict the ones found on the ARDL model, which seems to suggest that when catering for nonlinearities in the data, the results indicate that appreciation of the exchange rate may be growth-enhancing. This means that when the value of the domestic currency is stronger, imports (inputs) become cheaper and thus improve economic growth, because some imports are important for production purposes; for example, fuel. At the same time the results seem to suggest that when the value of the domestic currency is weaker, that may improve competitiveness of the exports but that drives inflation, which may not be conducive to economic growth.

These results suggest that the economic growth in South Africa is no longer facilitated by lower exchange rate, as it is the case in developing countries. This means that as a newly industrialised country, its growth is facilitated by stronger rand. This further suggest that, the devaluation of the rand in the last 10 years did not help to improve or revive the economy of the country. Because the economic growth still remain sluggish in South Africa, and there is a high rate of unemployment.

This explains the negative effect of depreciation on economic growth in South Africa. Importantly, both of these findings are not in line with a priori expectations because the empirical literature seems to suggest that depreciation promotes growth while appreciation hurts it, but they are in line with the findings of Khondker, Bidisha, and Razzaque (2012) in Bangladesh. As outlined in chapter four of the study, the time series data provided by the World Bank (2018) on real effective exchange rates and the South African Reserve Bank on growth, revealed that during the 1980s when the exchange rate was higher, there was an improvement in South African economic growth. The results show that there is a positive and insignificant relationship between broad money supply and gross domestic product. The result confirms what is normally expected and it is consisted with the findings of Akpan and Atan (2010) in Nigeria. This shows that whenever there is financial development in South Africa, such as conditions when the interest rates are lower, so as to encourage business and private individuals to borrow. That on its own, has a positive effect on the South African economy, because as a result of that demand on fixed capital formation and personal consumption. That leads to increase in production capacity, which also help to combat the high rate of unemployment in South Africa. Furthermore, investment has a positive and significant effect on the gross domestic product in South Africa. This result also reveals that South Africa benefits from increased tax revenues which are generated investment projects, subsequently as result of SARS (South African Revenue Services) the only government institution which is run effectively. These revenues mainly are mainly used for development projects, which then further attracts more foreign capital and increase in the economic growth of South Africa. On the other hand, government expenditure has a negative and significant effect on the gross domestic product. As it has been stated before, that in South Africa government expenditure does not necessarily lead to higher economic growth, the relationship between growth and government expenditure is weak. This is partially because, in South Africa a lot government projects are financed through acquisition of loans. These loans take longer to repay, and already South Africa is still financing the debts which were incurred before the administration of Nelson Mandela. This place a strain in the economy, and that subsequently inhibit growth in South Africa.

**Table 5.15: Short-run relationship results**

| Variables | Coefficients | T-statistics | Probability |
|---|---|---|---|
| DLOG(GDP(-1)) | -0.05 | -0.34 | 0.73 |
| DLOG(GDP(-2)) | -0.35 | -2.87 | 0.01 |
| D(REER_POS) | 0.00 | 2.84 | 0.01 |
| D(REER_NEG) | -0.00 | -2.41 | 0.02 |
| D(BROAD) | 0.00 | 0.17 | 0.87 |
| D(INVE) | 0.01 | 3.02 | 0.00 |
| D(GOV) | -0.01 | -1.90 | 0.07 |
| CointEq(-1) | -0.34 | -4.73 | 0.00 |

Source: Researcher's own computation

The above results in table 5.15 show the short-run relationship between gross domestic product and explanatory variables in the NARDL model. A positive change of the real effective exchange rate has a positive and significant effect on gross domestic product, which means that when the exchange rate goes up, there will be a significant effect on economic growth in South Africa. The same results also reveal that a negative change in the real effective exchange rate has a negative and significant effect on the gross domestic product in South Africa. This is not in line with a priori expectations of the study, because empirical literature seems to suggest that appreciation hurts economic growth while depreciation enhances it; however, it is consistent with the findings of Brixiova and Ncube (2014). This means that when the real effective exchange rate goes down, it has a negative and significant effect on the economic growth in South Africa.

The implication that can be drawn from this finding, is that growth in South Africa is longer enhanced through the devaluing of the rand. The evidence seems to suggest that in South Africa, when the rand the rand depreciates growth diminishes, and that contradicts with the empirical literature. This means that in this 21$^{st}$ century, South Africa as a newly industrialised country its growth is not facilitated by devaluing of its currency. What this further means, is that the authorities should direct their efforts towards floating rand and permit it to appreciate in the currency market, rather than devaluing it as they have been doing for the past decade.

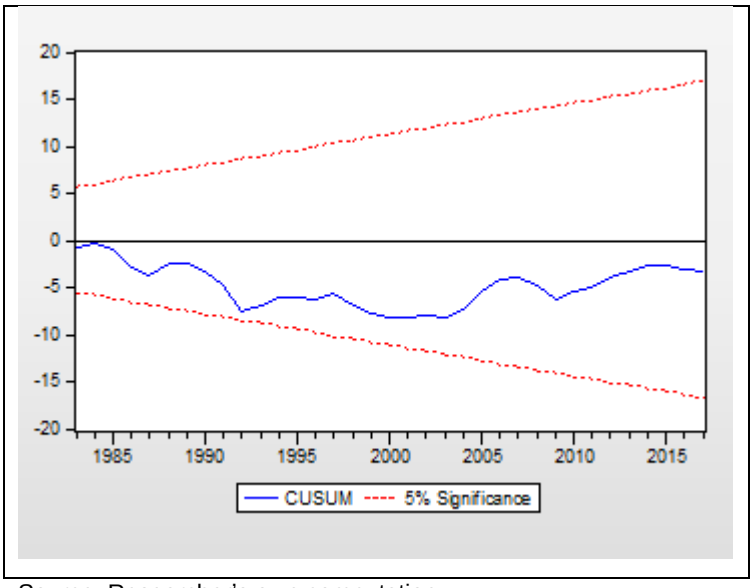
The results also reveal that broad money supply has a positive and insignificant effect on gross domestic product. This result is insignificant in the sense that, when the monetary authorities decide to influence money by increasing the amount of money in circulation in order to increase aggregate demand. The aggregate demand is what stimulates the South African economy, through increase in expenditure and subsequently increase in production capacity of the country. However, the South Africa Reserve Bank (SARB) is cautious about this, as this would lead to a demand pull inflation. Which is why the SARB has restrictive monetary policy in place to reduce demand pull inflation, and when it is applied it will lead to a decline in aggregate demand which will also cause economic growth decline. Investment on the other hand, has a positive and significant effect on gross domestic product in South Africa, and this result is in line with a priori expectations and it is also consistent with the findings of Yeyati and Sturzenegger (2003). It is inline because in South Africa, there is a lower rate of economic growth which is caused by low rate of investment. There is also a higher rate of unemployment in South Africa which result from low aggregate demand, there are no jobs because investment is low. These results suggest that, if investment increases in South Africa it will cause economic growth to increase as well. Furthermore, the results also indicate that government expenditure has a negative and significant effect on gross domestic product in South Africa. As it has been stated before that in South Africa, government expenditure does not have a strong correlation with economic growth, it does not have much effect on growth. This is partly because, government expenditure is mostly financed through the acquisition of loans from private Banks, and these loans come with conditions which may be difficult to fulfill. A phenomenon that exist in South Africa, is that of government bailout required by state owned institutions like for instance, SAA (South African Airways) which some analysts predict that it will soon operate at a loss, because of the incompetents and corruption in its management. At the same time, the South African government can only borrow up to so much, as it is already in debt. The error correction term shows the speed of adjustment from disequilibrium to equilibrium, thus 34 percent of the disequilibrium is corrected for in the long-run.

### 5.7.7 CUSUM and CUSUMQ square results

The results depicted in figures 5.2 and 5.3, show the CUSUM and CUSUMQ, which are used to test the stability of the NARDL model. The results indicate that plots in

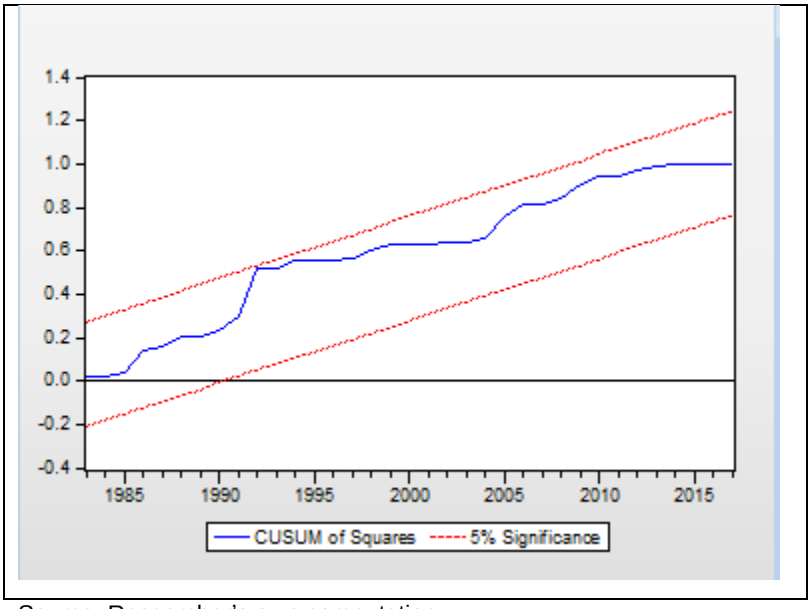
both CUSUM and CUSUMQ stay within a 5 percent range of significance. Therefore the null hypothesis is not rejected and the model is stable.

**Figure 5.2: CUSUM square**




Source: Researcher's own computation

**Figure 5.3: CUSUMQ square**




Source: Researcher's own computation

### 5.7.8 Testing Asymmetry in the long-run

The positive change of the real effective exchange rate has a long-run and positive effect on gross domestic product, whilst a negative change in the real effective exchange rate has a long-run and negative effect on gross domestic product. The study tested whether these changes are statistically different or not, thus testing the

presence of asymmetry. The asymmetry test indicates to whether the coefficients are equal or not, and if they are equal then there is no asymmetry, but if they are not there is evidence of asymmetry. Table 5.16 presents the results of the test and judging by the p-value which is less than 5 percent, that indicates the presence of asymmetry. This implies that a positive change in the real effective exchange rate is not equivalent, or equal to, the negative change in the exchange rate, and their coefficients have different effects on GDP growth in South Africa.

**Table 5.16: Asymmetry results**

| Test statistic | Value | df | Probability |
|---|---|---|---|
| t-statistic | -2.37 | 35 | 0.02 |
| F-statistic | 5.61 | (1,35) | 0.02 |
| Chi-square | 5.61 | 1 | 0.02 |

Source: Researcher's own computation

## 5.8 Conclusion

This chapter analysed the relationship between gross domestic product and real effective exchange rates in the South African economy by applying the ARDL and NARDL models. At the beginning of this chapter descriptive statistics and correlation analysis were outlined, followed by formal testing unit root using the DF-GLS and Ng-Perron, proving that all variables are integrated at I(0) and I(1). In order to address the symmetries when dictating the evolution of a time series, the study employed a nonlinear and Flexible Fourier Function-based unit root test.

The bounds test analysis was performed, and the results indicate a long-run co-integration among variables. The diagnostic tests have been performed and all the variables in the models pass the tests. The results of the ARDL model indicate that REER has a negative and significant effect on economic growth in the long-run, whilst the short-run results also display a negative and significant effect of REER towards gross domestic product. When the NARDL model was employed, results indicate that positive change of real effective exchange rate has a positive and significant effect on the gross domestic product in the long-run, while negative change of real effective exchange rate has a negative and significant effect on the gross domestic product in the long-run. In the short-run, the results also behave in the same manner as in the long-run. The CUSUM result also shows that plots are

within a 5 percent range. The last section in the NARDL model dealt with asymmetry tests and the results indicate the presence of asymmetry.

# CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

## 6.1 Introduction

This study examined the effect of exchange rate fluctuations on economic growth in South Africa during the period of 1970-2017 using yearly data, by applying the nonlinear autoregressive distributive lag (NARDL). The study tested the stationarity of the variables using DF-GLS and Ng-Perron. The study went further in testing for unit root by introducing nonlinear and Flexible Fourier Function-based unit root tests, in order to cater for any possible asymmetries. What follows is the summary of chapter one to chapter five, recommendations, limitations of the study and areas of future research.

## 6.2 Summary of previous chapters

Chapter one provided a background on the effect of exchange rates on economic growth. The problem statement was also outlined, which dealt with the issue of sluggish growth in South Africa. The objective of the study was given, which is to investigate the effect of exchange rate fluctuations on growth, followed by secondary objectives which are to provide an overview of literature, to empirically investigate the impact of exchange rate volatility on growth, and also to look at the long-run and short-run effects of the secondary objectives. The null hypothesis of the study is that the exchange rate does not have an influence on economic growth and the alternative null is the exchange rate does have an influence on economic growth. The significance of the study was then highlighted, which is to examine the effect of the exchange rate on growth using a newly developed econometric model known as NARDL. Most studies examine this relationship using a linear ARDL which is symmetry, but this study deviates from that by using NARDL which captures nonlinearities in the data.

Chapter two provided an overview on real effective exchange rates and economic growth in South Africa, starting from the period of the gold standard, Bretton Woods to financial liberalisation. When financial liberalisation began in 1979/80, the country experienced the highest growth for the first few years and the exchange rate was higher as well. But later, after the period of financial liberalisation, when the real effective exchange rate was higher, growth declined. Even after the period of exchange rates liberalisation, when the growth was higher, the currency was low in

value. In 1995 the economic growth rate in South Africa was 3.1 percent annually with a real effective exchange rate of -1.5 percent, and in 1996 the growth rate increased to 4.3 percent while the real exchange rate declined even further to -6.2 percent. However the situation changed in 1997 as the growth rate declined to 2.6 percent but the real exchange rate appreciated to 6.6 percent. This supports the economic theory, as the theory tells us depreciation of the currency promotes economic growth through exports, while appreciation of the currency reduces economic growth as imports become more expensive to the trading partners.

In chapter three, the study provided an overview of theoretical and empirical literature on the exchange rate and economic growth in both developed and developing countries and in South Africa. This chapter began with theories of economic growth, which included Adam Smith on the classical theory, advocating for a laissez fair free market by Popa (2014), specialisation and division of labour which could lead to higher growth according to Smith (Appleyard *et al.*, 2010). The second theory on growth is the Keynesian growth model (Sharipov, 2015) which makes use of endogenous and exogenous variables in the market economy. The study then went on and discussed the Harrod-Domar (Popa, 2014) which states that a necessary condition for growth in any economy is that the demand created due to newly generated income should be sufficient enough so that output by newly increased capital be fully absorbed. The fourth theory discussed is neoclassical which encompasses capital accumulation and technological changes that constitute the leading force for economic growth. The last model discussed is the Solow growth model which shows that the savings rate is a key factor in determining the level of capital intensity.

The exchange rate theories were also discussed, and these consist of purchasing power parity condition, which is based on the law of one price (Isola *et al.*, 2016). The second theory under exchange rate regimes is the elasticity approach which is more focused on the relationship between the exchange rate and flow of goods/services as measured in the current account balance (Van Marrewijk, 2005). Then the absorption approach was discussed, which remedies the shortcomings of the elasticity approach in the Keynesian framework (Van de Merwe & Mollentze, 2010). The monetary approach as the fourth theory is also discussed, which

stipulates that demand for money plays an important role in the adjustment process and in determining exchange rate levels (Meghana, 2018). The last theory is portfolio approach where domestic and foreign bonds are regarded as imperfect substitutes (Isola *et al.*, 2016).

The empirical literature discussed trends found in developed, developing, and South African studies. The majority of the studies such as those of Bussiere Lopez and Tille (2014), seem to suggest that appreciation of the exchange rate hampers growth, while depreciation enhances growth through exports (Habib, Mileva & Stracca, 2016). In South Africa, results indicate that exchange rate misalignment negatively affects growth in the long-run, but there is no strong support evidence that links depreciation of the rand with higher growth, and this is shown by Sibanda, Ncwadi and Mlambo (2013).

Data description and sources were discussed in chapter four. In section two, the study provided discussion on the Ng-Perron, DG-GLS and KSS unit root tests as well as their equations and null hypothesis. Section three outlined the methodology and model specification of the study which is about the newly developed technique known as the NARDL model and its advantages and shortfalls. According to Shin *et al.* (2011), these are the ability to simultaneously estimate both the long-run and short-run asymmetries in a computationally and tractable manner, and the use of asymmetric dynamic multipliers which provide a computational straightforward means of assessing the traverse between short-run and long-run. The last section in chapter four discussed the diagnostic tests which were used in the study. The tests include normality test, heteroskedasticity, serial correlation, and Ramsey reset.

The purpose of chapter five was to discuss empirical results of the study. Section one discussed the introduction, then section two provided descriptive statistics followed by correlation analysis in section three. The unit root test were performed using the DF-GLS and Ng-Perron, proving that all variables are integrated at I (0) and I(1). These unit root tests were followed by nonlinear and Flexible Fourier Function-based unit root tests with an attempt to address the symmetries. When dictating the evolution of time series, the KSS test without FFF shows that REER (5%) and investment (1%) reject the hysteresis hypothesis, but the hysteresis

hypothesis fails to reject the remaining variables GDP, Broad money, and government expenditure. Furthermore, when the FFF approximation is included, the results reveal that it is only REER (1%) that rejects the hysteresis hypothesis and this implies that REER is a nonlinear trend and shows nonlinear characteristics. For the remaining variables GDP, Broad, investment, government expenditure the hysteresis hypothesis holds, which suggests that these variables are a stationary series.

The diagnostic tests have been performed and all the variables in the models pass the tests. These began with linear ARDL in order to demonstrate the superiority of the NARDL, and the results of the NARDL model indicate that a positive change of the real effective exchange rate has a positive and significant effect on the gross domestic product in the long-run, while a negative change of the real effective exchange rate has a negative and significant effect on the gross domestic product in the long-run. In the short-run, the results also behave in the same manner as in the long-run. The results in the long-run reveal that Broad money supply has a positive effect on growth but not significantly, whilst investment has a positive and significant effect on growth. But the results show that government expenditure has a negative and significant effect on growth in the long-run. The analysis is also the same in the short-run.

### 6.3 Recommendations

The empirical literature suggests that when the exchange rate depreciates, growth improves in developing countries. However, the study found that when the exchange rate depreciates economic growth declines in South Africa, and this contradicts empirical literature, as in the case of developing countries. This explains why the South African economic growth rate has remained sluggish, even though the rand has been devalued more in the past years.

The conclusion can be drawn from the fact that when the real effective exchange rate appreciates, growth improves in South Africa. The trend even seems to suggest that during the 1970s, the South African real effective exchange rate was stronger and so was economic growth during that period. Even during 2006/7 when South Africa experienced higher growth, the real effective exchange rate was performing better than today when compared to major trading partners. Therefore, the study suggests that policymakers should direct their efforts at trying to improve the value of

the South African currency rather than trying to devalue it, because the results reveal that when the exchange rate is stronger, growth improves. However, one point that should not be forgotten is that of investment (capital formation), as during the periods when South Africa experienced higher growth; the investment rate was higher as well. So higher growth should always be attributed to higher investment rates, not only in the appreciation of the real effective exchange. The results also show that investment has a positive and significant effect on growth. Investment is the possible source for higher economic growth in the country, and even President Ramaphosa has stressed this issue. The president has appointed task team which includes Trevor Manuel. The duty of the task team is to market South Africa to potential investors. The study suggests that the real effective exchange rate should not be the only area to look into when trying to improve economic growth in South Africa. The level of investment as well must be looked into, and South Africa needs growth badly in order to get rid of the problem of unemployment, which is alarming.

### 6.4 Limitations of the study

The primary limitation of the study is the limited availability of studies that employed the NARDL model, as those studies would have contributed a lot in terms of comparisons of results. Most studies found are those that employed ARDL, which promotes symmetry. The issue of time restricted the study from performing model two, where the trade balance would have been used as a dependent variable, while the real effective exchange rate and world GDP would have been used as explanatory variables. That regression would have improved the study in terms of conclusions and policy recommendations.

### 6.5 Areas of future research

The area of future research should be on the revaluation of the exchange rate since the results of the study indicate that growth improves when the exchange rate appreciates. Another area is that of investment and economic growth, given the fact that these variables are of key importance today in South Africa, and everyone seems to talk about them. Some other variables which could be considered for future research given enough time, is that of trade balances, real effective exchange rate, and world GDP. Another point which would require research is that of trade balance and exchange rates in South Africa employing the same NARDL model.

**References**

Abend G. Swanson R.A. (2008).The Meaning of Theory: Sociological Theory 26. *Theory Building in Applied Disciplines*. Berrett-Koehler Publishers. San Fransisco

Abudalu A. Ahmed E.M. Ahmaid S.W. & Elgazodi A. (2014). The real effective exchange rate impact on Asian-5 economic growth. *International journal of economics and management sciences*, 3:2

Accelerated and Shared Growth Initiative South Africa (ASGISA) (2006). Available from: [www.Info.gov.za/asgisa] Online. [Accessed April 2018]

Akpan E.O. & Atan J.A. (2010). Effects of exchange rate movements on economic growth in Nigeria. *CBN journal of applied statistics,* 2(2)

Almsafir M.K. & Morzuki Z.M. (2015). The relationship between investment and economic growth in Malaysia. *Journal of empirical economics*. 4(2): 116-126

Antoni Y. (2015). The dynamic relationship between money supply and economic growth. *Economic journal of emerging markets*. 7(2): 78-92

Appleyard DR. Field AJ. Cobb SL (2010) *International economics*, 7th edition, McGraw-Hill, New York

Ashour M. & Yong C.C. (2018). The impact of exchange rate regimes on economic growth: Empirical study of a set of developing countries during the period of 1974-2006. *The journal of international trade & economic development*, 27(1): 74-90

Bakari S. (2017). The impact of domestic investment on economic growth: new evidence from Malaysia

Bal D.P., Dash D.P. & Subhasish B. (2016). The effects of capital formation on economic growth in India: evidence from ARDL-bound testing approach. *Global business review*, 17(6): 1388-400.

Bass B. (2018). *The elasticity approach to the balance of payments*. Available from: [I:\pics study\dev\literature info\The Elasticity Approach to Balance of Payments _ Chron.com.html Brian Bass 2018] [Accessed online, June 2018].

Berg A. & Miao Y. (2010). The real exchange rate and growth revisited: The Washington consensus strikes back? *International Monetary Fund WP/10/58, Place*

Bernanke S. (2015). Federal Reserve policy in an international context. *16th Jacques Polak annual research conference*

Bhattarai K. (2011) Impact of exchange rate and money supply on growth, inflation and interest rates in the UK. *International journal monetary economics and finance*, 4(4): 355-371

Bhoola F. (2016). Explainer: how currency markets work and why the South African rand is falling. Available from: [https://theconversation.com/explainer-how-currency-markets-work-and-why-the-south-african-rand-is-falling-53125] Online. [Accessed on June 2018]

Big Mac Index (2017). The rand is massively undervalued according to the Big Mac Index. Available form: [https://businesstech.co.za/news/finance/151711/the-rand-is-massively-undervalued-according-to-the-big-mac-index/] Online. [Accessed on June 2018]

Blanchard O. & Johnson D.R. (2013) *Macroeconomics*. 6th edition. United States: Pearson education Inc.

BNM (2012). Nominal effective exchange rate and real effective exchange rate. [https://www.bnm.md/en/content/nominal-effective-exchange-rate-neer-and-real-effective-exchange-rate-reer-0] Accessed online on August 2018

Bohman M. Fariditavana H. (2015). Nonlinear ARDL, asymmetric effects and the J-curve.

Brigitta J. (2016) Impact of exchange rate regimes on economic growth. *Undergraduate economic review*, 12(1): pages?

Brixiova Z. & Ncube M. (2014). The real exchange rate and growth in Zimbabwe: Does currency regime matter? *Working paper 210.* African Development Bank Group.

Brooks C. (2014). *Introductory econometrics for finance*. 3rd edition. Cambridge University press. United Kingdom.

Bussiere M. Lopez C. Tille C. (2014). Do real exchange rate appreciations matter for economic growth? Graduate institute of international and developmental studies. Working papers 6

Canarella G., Miller S.M. & Pollard S.K. (2010). Unit roots and structural change: An application to US house-price indices. *Working paper 2010-04R.*

Catao L.A.V. (2007). Why real exchange rate? *International Monetary Fund*. Available from: [http://www.imf.org/external/pubs/ft/fandd/2007/09/basics.htm] [Accessed online August 2018].

Chang C. (2012). Mean reversion of real interest rates in G-20: Panel KSS test by SPSM with Fourier a function

Chang T., Wu T. & Gupta R. (2015). Are house prices in South Africa really non-stationary? *Evidence from SPSM-Based panel KSS test with Fourier function,*

Chipeta C., Meyer D.F. & Muzindutsi P. (2017). The effect of exchange rate movements and economic growth on job creation. *DeGruyter,* 62(2): 20-41.

Creswell, W. J. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*: 3rd Ed. University of Nebraska, Lincoln

Di Nino V. Eichengreen B. and Sbracia M. (2011) Real exchange rates, trade and growth in Italy 1861-2011. Economic history working papers

Fedderki J. and Simkins C. (2009). Economic growth in South Africa since the late nineteenth century. *Working paper 138*.

Fourie J., Pretorious T., Harvey R., Van Niekerk H. & Phiri A. (2017). Nonlinear relationship between exchange rate volatility and economic growth: A South African perspective.

Froyen R.T. (2009). *Macroeconomic theories and policies*. 9th edition. USA: Pearson Education International.

Gabriel A. Swanson R.A. (2008).The Meaning of Theory: Sociological Theory 26. *Theory Building in Applied Disciplines*. Berrett-Koehler Publishers. San Fransisco

Gilani N. (2017). What is government expenditure? [https://south-africa/government-spending] Online [Accessed on August 2018]

Giorgio G.D. & Nistico S. (2016). Government spending and exchange rate. *Working paper series.*

Goldberg L.S. (2006). Exchange rates and foreign direct investment.

Gujarati D.N. & Porter D.C. (2009), *Basic econometrics international edition*. 5th edition. New York: McGraw-Hill.

Gumede A. (2017). 90 days or bust: SA in last chance saloon with Moody's but S&P junks rand debt Available from: [https://www.biznews.com/global-citizen/2017/11/25/moodys-gives-90-day-ultimatum-sp-junks-rand-debt-south-africa/] Online. [Accessed February 2018]

Habib M.M. Mileva E. & Stracca C. (2016). The real exchange rate and economic growth: revisiting the case using external instruments. *Working paper series*.

Hasnul A.G. (2015). The effects of government expenditure on economic growth: the case of Malaysia. *Munich personal repec archive*. Global University of Islamic finance.

Hill RC. Griffiths WE. Lim GC (2008). *Principles of econometrics*, 3rd edition, John Wiley and Sons, United states

Hsing Y. (2016). Determinants of the ZAR/USD exchange rate and policy implications: A simultaneous equation model. *Cogent economics & finance,* 4:1151131

Hua P. (2011). The economic and social effects of real exchange rate: evidence from the Chinese provinces.

Hussain M.I. & Zafar T. (2017). The interrelationship between money supply, inflation, public expenditure and economic growth. *European online journal of natural and social sciences*, 7(1): 1-24

IDC (2017) Economic trends: key trends in the South African economy. Department of research and information

Ihnatov I. & Capraru B. (2012). Exchange rate regimes and economic growth in Central and Eastern European countries. *Procedia economics and finance, 3*: 18-23

International Monetary Fund (IMF). (1976). The purchasing power parity theory of exchange rates: A review article. *Palgrave Macmillan journal*. 23(1): 272-278

Isola L.A. Oluwafunke A.I. Victor A. Asoleye A. (2016). Exchange rate fluctuation and the Nigerian economic growth. *Euroeconomica*, 2(35): pages??

Jordaan A. (2013). *What is GDP and its impact*? Available from: [http://www.statssa.gov.za/?p=1143] online source, [Accessed 6 July 2018].

Kandil M. (2006). The growth of government spending and the money supply: evidence and implications within and across industrial countries. *Journal of economic studies*, 33(6): 406-436

Kang J.W. (2016). International trade and exchange rates. *ADB working paper series*, No.498

Khan A. & Abbas Z. (2015). Portfolio balance approach: An empirical testing. *Journal of economics and international finance*. 7(6): 137-143

Khondker B.H., Bidisha S.H. & Razzaque M.A. (2012). The exchange rate and economic growth: an empirical assessment on Bangladeshi. *Working paper*.

Korkmaz S. (2013). The effect of exchange rate on economic growth. *Researchgate*

Kurz H.D. Salvadori N (2017). Theories of economic growth-*Old and New*

Lee J. & Yue C. (2017) Impacts of the US dollar exchange rate on economic growth and the environment in the United States. *Energy economics,* 64: 170-176

Leke A., Fine D., Dobbs R., Magwentshu N., Lund S., Wu C. & Jacobson P. (2015). Africa's Big Bold priorities for inclusive growth. *McKinsey Global Institute*

Levin J.H. (1997). Money supply and exchange rate dynamics. *Journal of economic integration*, 12(3): 344-358

Malik M.I. & Rehman A. (2014). Choice of spectral density estimator in Ng-Perron test: comperative framework analysis

Manalo J. Perera D. & Rees D. (2014). Exchange rate movements and the Australian economy. *Research discussion paper.* Reserve Bank of Australia

Matlasedi T., Ilorah R. & Zhanje S. (2015). The impact of the real effective exchange rate on South Africa's trade balance. *Paper presented at the biennial conference of the economic society of South Africa*,

MBA Knowledge Base [MKB] (2018), Financial and economic meaning of investment [https://www.mbaknol.com/investment-management/financial-and-economic-meaning-of-investment/] online source, [accessed July 2018]

Meghana S. (2018). *Top 3 approaches of balance of payments*. Available from: [I:\pics study\dev\literature info\Top 3 Approaches of Balance of Payments.html] [Accessed online, June 2018].

Mofu R. (2013). Real exchange rate volatility and employment growth in South Africa: The case of manufacturing

Movee N. & Schimmel A. (2017). What makes the rand so volatile: global or home-made factors? Available from: [http://www.polity.org.za/article/what-makes-the-rand-so-volatile-global-or-home-made-factors-2017-03-30 ] *Econ 3by3*. Online. [Accessed April 2018]

Mpofu T. (2016). The determinants of exchange rate volatility in South Africa. *Economic research Southern Africa*

Nassif A. (2010). Brazil and India in the global economic crisis: Immediate impacts and economic policy responses

National Planning Commission (NPC). (2010). *National Development Plan*. Department of the Presidency, Pretoria.

Nitisha (2015) Theories of economic growth-discussed [http://www.economicsdiscussion.net/economic-growth/theories-of-economic-growth-discussed/4203] Online [Accessed May 2018]

Olanipekun D.B. & Akeju K.F. (2013). Money supply, inflation and capital accumulation in Nigeria. *Journal of economics and sustainable development*, 4(4): 173-181.

Osakwe P.N. (2010). Africa and the global financial and economic crisis: Impacts, responses and opportunities

Oteng E., David B. & Emmanuel A.K. (2016).The effect of real exchange rate on economic growth in Ghana. *International journal of current research* 8(12): 44448-44454

Papanikos G.T. (2015). The real exchange rate of the euro and Greek economic growth. *The journal of economic asymmetries*, 12: 100-109

Patel D. & Mah G. (2018). Relationship between real exchange rate and economic growth: the case of South Africa. *Journal of economics and behavioral studies*, 10(1): 146-158.

Petersen A.K. & Scheneider R. (2014). The risk of an appreciation of the euro. *Working paper 170,*

Pettinger T. (2007) Explaining theories of economic growth [http://www.economicshelp.org/blog/57/growth/explaining-theories-of-economic-growth/] Online [Accessed on July 2018]

Pettinger T. (2017a). *Exchange rates and economic growth*. Available from: [I:\pics study\dev\literature notes\Exchange Rate and Economic Growth _ Economics Help.html] –[Accessed online, June 2018].

Pettinger T. (2017b). *Real effective exchange rate. Available from:* [https://www.economicshelp.org/blog/11422/economics/real-effective-exchange-rate/] online source, [Accessed 6 July 2018].

Popa F. (2014). Economic growth theories, conceptual elements, characteristics. Strategic management and entrepreneurship.

Quantec. (2018). South African foreign exchange market. Available from: [https://www.quantec.co.za/post/2007/20141201-sa-foreign-exchange-market-monthly/] Online. [Accessed on April 2018]

Randolph J.J. (2009). How to write a literature review: Purpose of a literature review. [URL**:** http://libguides.unisa.ac.za/literature_review] Accessed online, June 2018

Razzaque M.A., Bidisha S.H. & Khondker B.H. (2017). Exchange rate and economic growth: an empirical assessment for Bangladesh. *Journal of South Asian development*.

Rodrik D. (2007). The real exchange rate and economic growth: Theory and evidence.

SAHO (2017). South Africa's Key economic policies changes (1994 - 2013) [https://www.sahistory.org.za/article/south-africa%E2%80%99s-key-economic-policies-changes-1994-2013] Online [Accessed May 2018]

SAHO (2018). South Africa abandons the Gold Standard, sparking a period of economic expansion [https://www.sahistory.org.za/dated-event/south-africa-abandons-gold-standard-sparking-period-economic-expansion] Online [Accessed on May 2018]

SARB. (2007). *Exchange rates and exchange control.* Available from: [http://www.reservebank.co.za] Online. [Accessed May 2018].

Semusa P.D. & Aphane M.I. (2017). The impact of exchange rate and exports on economic growth of South Africa. *The 2nd annual international conference on public administration and development alternatives*,

Sharipov I. (2015). Contemporary economic growth models and theories: A literature review. 7(3): 759-773

Shin Y., Yu B. & Nimmo M. (2011), Modelling asymmetric co-integration and dynamic multipliers in Nonlinear ARDL framework.

Sial M.H., Hashmi M.H. & Answar S. (2010). Role of investment in the course of economic growth in Pakistan.

Sibanda K., Ncwadi R. & Mlambo C. (2013). Investigating the impacts of real exchange rates on economic growth: the case of South Africa. *Mediterranean journal of Social Sciences*, 4(13): 261-274.

Sola O. and Peter A. (2013). Money supply and inflation in Nigeria: Implications for National development. *Modern economy*. 4: 161-170

South African Reserve Bank database (2018) [http://www.resbank.co.za/Research/Statistics/Pages/OnlineDownloadFacility.aspx] Online.

Stats SA. (2017). *Gross Domestic Product, 4th quarter 2016*. Pretoria: Government Printers.

Svigir M. (2017). Relationship between inflation and economic growth: comparative experience of Italy and Austria.

Taha Z. (2018) NARDL: Nonlinear cointergrating autoregressive distributed lag model

Tang B. (2015). Real exchange rate and economic and economic growth in China: A co-integrated VAR approach. *China economic review,* 34: 293-310

Tarawalie A.B. (2010) Real exchange rate behavior and economic growth: Evidence from Sierra Leone. *SAJEMS NS* 13 (1)

Trading Economics. (2018). *South African government spending*. Available from: [https://tradingeconomics.com/south-africa/government-spending] [Accessed online August 2018].

Treasury SA (2017) Budget review: economic overview of SA

Twala J. & Mchunu M. (2014). *Exchange rate and currency depreciation*

Ullah I. (2012). *Breusch-Pagan for heteroscedasticity*. Available from: http://itfeature.com/correlation-and-regression-analysis/ols-assumptions/breusch-pagan-test] [Accessed online August 2018].

URL**:** http://libguides.unisa.ac.za/literature_review] Accessed online, June 2018

Van de Merwe E. & Mollentze S. (2010). *Monetary economics in South Africa*. Southern Africa: Oxford University press.

Van de Merwe E.J. (1996). *Exchange rate management policies in South Africa: Recent experience and prospects*. South African Reserve Bank, Johannesburg.

Van der Wath N. (2017). Trends: reference source of economic statistics. *Bureau for economic research*

Van Marrewijk C. (2005). Basic exchange rate theories. *International macroeconomics and finance programme*

Williams R. (2015a). *Heteroscedasticity.* Available from: [https://www3.nd.edu/~rwilliam/] online source, [Accessed July 2018].

Williams R. (2015b). *Serial correlation*. Available from: [https://www3.nd.edu/~rwilliam/] online source, [Accessed July 2018].

Wong H.T (2013) Real exchange rate misalignment and economic growth in Malaysia. *Journal of economic studies*, 40(3): 298-313

Wooldridge J. (2013) *introductory econometrics: A modern approach*, 5th edition.

World Bank database (2018) [https://data.worldbank.org/indicator/ST.INT.RCPT.CD] Online.

Wu S. (2010). Lag length selection in DF-GLS unit root test, communications in statistics-simulation and computation, 39:8, 1590-1604.

Yeyati E.L. & Sturzenegger F. (2003). To float or to fix: evidence on the impact of exchange rate regimes on growth. *The American economic review*, 1173-1193.

Yinghua R., Yan Y. & Xiong Z. (2015). Effects of currency exchange rate on economic growth. *2nd International conference on education, management and information technology,* China

Yodatai. (2017). *Broad money as percentage of GDP*. Available from: [https://knoema.com/atlas/topics/Economy/Financial-Sector-Monetary-holdings-liabilities/Broad-money-percent-of-GDP] Online source. [Accessed on 11 November 2018].

## Appendix

ARDL long-run results

Long Run Coefficients

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| REEF | -0.001757 | 0.000744 | -2.361749 | 0.0266 |
| BROAD | 0.005368 | 0.001376 | 3.902756 | 0.0007 |
| INVE | 0.024631 | 0.003365 | 7.320363 | 0.0000 |
| GOV | 0.021468 | 0.006217 | 3.452959 | 0.0021 |
| C | 9.767713 | 0.190183 | 51.359544 | 0.0000 |

Source: Researcher's own computation

ARDL short-run results

ARDL Cointegrating And Long Run Form
Dependent Variable: LOG(GDP)
Selected Model: ARDL(1, 4, 1, 5, 3)
Date: 09/24/18 Time: 03:44
Sample: 1970 2017
Included observations: 43

Cointegrating Form

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(REEF) | -0.000113 | 0.000316 | -0.356685 | 0.7244 |
| D(REEF(-1)) | 0.001132 | 0.000370 | 3.056253 | 0.0054 |
| D(REEF(-2)) | -0.000522 | 0.000347 | -1.504138 | 0.1456 |
| D(REEF(-3)) | 0.000706 | 0.000282 | 2.502223 | 0.0196 |
| D(BROAD) | 0.005537 | 0.001290 | 4.291982 | 0.0003 |
| D(INVE) | 0.004667 | 0.002223 | 2.099872 | 0.0464 |
| D(INVE(-1)) | -0.000021 | 0.001877 | -0.011166 | 0.9912 |
| D(INVE(-2)) | -0.001426 | 0.001758 | -0.811228 | 0.4252 |
| D(INVE(-3)) | -0.001400 | 0.001628 | -0.860004 | 0.3983 |
| D(INVE(-4)) | -0.004745 | 0.001397 | -3.396348 | 0.0024 |
| D(GOV) | 0.002401 | 0.005367 | 0.447409 | 0.6586 |
| D(GOV(-1)) | -0.003620 | 0.005440 | -0.665472 | 0.5121 |
| D(GOV(-2)) | -0.007019 | 0.004600 | -1.525922 | 0.1401 |
| CointEq(-1) | -0.570636 | 0.150709 | -3.786339 | 0.0009 |

Cointeq = LOG(GDP) - (-0.0018*REEF + 0.0054*BROAD + 0.0246*INVE + 0.0215*GOV + 9.7677 )

Source: Researcher's own computation

NARDL long-run results

Long Run Coefficients

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| REEF_POS | 0.002637 | 0.001045 | 2.523748 | 0.0163 |
| REEF_NEG | -0.001688 | 0.000751 | -2.248971 | 0.0309 |
| BROAD | 0.000362 | 0.002130 | 0.169892 | 0.8661 |
| INVE | 0.014896 | 0.003506 | 4.249328 | 0.0002 |
| GOV | -0.050181 | 0.021464 | -2.337984 | 0.0252 |
| C | 10.855075 | 0.363985 | 29.822866 | 0.0000 |

Source: Researcher's own computation

NARDL short-run results

ARDL Cointegrating And Long Run Form
Dependent Variable: LOG(GDP)
Selected Model: ARDL(3, 0, 0, 0, 0, 1)
Date: 09/24/18 Time: 04:10
Sample: 1970 2017
Included observations: 45

Cointegrating Form

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DLOG(GDP(-1)) | -0.046784 | 0.135834 | -0.344419 | 0.7326 |
| DLOG(GDP(-2)) | -0.354952 | 0.123798 | -2.867190 | 0.0070 |
| D(REEF_POS) | 0.000909 | 0.000320 | 2.842034 | 0.0074 |
| D(REEF_NEG) | -0.000582 | 0.000241 | -2.413197 | 0.0212 |
| D(BROAD) | 0.000125 | 0.000744 | 0.167570 | 0.8679 |
| D(INVE) | 0.005135 | 0.001703 | 3.015320 | 0.0048 |
| D(GOV) | -0.008885 | 0.004672 | -1.901636 | 0.0655 |
| CointEq(-1) | -0.344711 | 0.072940 | -4.725977 | 0.0000 |

Cointeq = LOG(GDP) - (0.0026*REEF_POS -0.0017*REEF_NEG + 0.0004 *BROAD + 0.0149*INVE -0.0502*GOV + 10.8551 )

Source: Researcher's own computation