ANALYSING THE IMPACT OF THE EXTERNAL DEBT ON REAL EXCHANGE RATE IN NAMIBIA

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN DEVELOPMENT FINANCE

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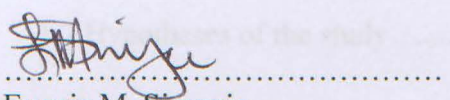
ABSTRACT

The relationship between external debt and real exchange rate is multifaceted. Namibia is not excluded from this spectacle as concerns are escalating about the fast-increasing of external debt and its implication on the real exchange rate in the long run. However, counter arguments accentuate that if foreign borrowing is for stimulating economic growth via increased economic earnings, then external debt growth might not pose a problem to the economy.

This study examined the impact of external debt on real exchange rate in Namibia using annual time series for the period 1990 to 2019. The study employed a time series econometric model to examine the nature of the relationship that exists between external debt and real exchange rate. The augmented Dickey-Fuller (ADF) test was utilized in testing the unit root characteristics of the series and to determine the order of integration. All variables with the exception of debt service payment were found to be non-stationary in levels but became stationary at their first differences. The autoregressive distributed lag (ARDL) cointegration framework was also employed to determine whether there is a long run relationship among the variables. The ARDL bounds test results confirm the presence of a long run relationship among the variables. The empirical evidence show that an increase in external debt appreciates the real exchange rate while real money supply, lagged debt service payment, foreign reserves and real income depreciates the real exchange rate. However, real income, and foreign reserves only depreciates the real exchange rate in a short run. External debt and real money supply are the only variables that significantly impact the real exchange rate both in a long run and short run. This indicates that both external debt and real money supply partially drives the real exchange rate in Namibia. Thus, the implication of these results for the Namibian Government is that, since borrowing secures much-needed funds to aid development, a hefty external debt load can also impact real exchange rate which will ultimately dampen economic growth.

DECLARATION

I, Evonia Mola Simunja, hereby declare that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree in any other institution of higher learning.



Evonia M. Simunja

16.03.2023

Date

Table of Contents

LIST OF TABLES

LIST OF FIGURES

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Exceptional thanks goes to my parents, Florencia Mufani Simasiku and my late Dad, Albert Mushiba Simunja, thank you for instilling discipline in me, and the appreciation for the value of education. This work is for you.

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DEDICATION

I dedicate this thesis to my Kids, Ethan Mulisa Siyata and Anna-Laila Mabuku Silume for their patience and understanding during the times of my absence from home, while mired in research work. I still saw it inevitable to dedicate this work to my late Dad Albert Mushiba Simunja and my Mother Florencia Mufani Simasiku for her unconditional love.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

In the prevailing global setting, the subject of external debt and real exchange rate would remain a matter of discussion because of its substantial role towards the economy of the country. External debt is an important source of finance used to supplement the domestic sources of funds for supporting development and other needs of a country (Odera, 2015). In the words of Kouladoum (2018), external debt can greatly contribute to the economic growth of a nation when used to finance investment expected to yield an adequate return. In addition, Masaku, (2014) states that, external debt may also bridge the gap between domestic saving, investment and between export and imports of goods and services. However, these external debts as Alam and Taib (2014) affirmed are contracted in foreign currencies which may lead to the appreciation or depreciation of the real exchange rate. According to Conrad and Jagessar (2018) the appreciation or depreciation of the real exchange rate when poorly managed may powerfully affect cross-border economic transactions which may result in economic instability, distortion of investment decisions, resulting in welfare and efficiency costs.

Since independence, the Namibian government has resorted to borrowing externally to fund the capital projects and fill the budget deficit that is caused by the continuous increase in public expenditure (Schlettwein, 2019). These public projects are attempted for strengthening the Namibian economy and improve domestic infrastructure, the projects are frequently supported through donations and external financing in the form of concessional loans (Zaruaka, 2007). Schlettwein (2019) stated that, Namibia borrows externally with the assumption that, GDP growth rate would increase over time and commensurate increase in export production thus meet the country's debt service obligation. However, Davis (2015) argued that, the size of external debt of the borrowing country has an impact on the real exchange rate while Galstyan and Velic (2016) indicated that the real exchange rate is significantly more persistent during

times of low debt (either public or external). Meanwhile, Alam and Anwar (2018) disputed that there is no relationship between external debt and real effective exchange rate. In Namibia for instance, external borrowing has reached considerable proportions, in 2015 external debt as a percentage of GDP increased to 19.0% from 8.1% of the preceding year. This surpassed the 5% benchmark that is stated in the country's Sovereign Debt Management Strategy (SDMS) (BON, 2015). During the same period, real effective exchange rate appreciated from 105.2 in 2014 to 89.3 in 2015 (BON, 2015). In 2019, external debt stood at 18% as a percentage to GDP while real effective exchange rate appreciated by 1.1% to 103.8 in 2018 and depreciated by 0.9% to 104.7 in 2019 (BON 2019).

1.2 Namibia's Economic Performance

Like many other sub-Saharan African countries, Namibia has been confronted with the challenges of a prolonged period of sluggish economic growth during the pre-independence period (the period before 1990) and early years of independence (BON, 2000). During 1990-1999, the Real GDP grew at an average of 3.8% and average inflation rate stood at 12.2% while the balance of payment position was low, recording USD 131.797 Million in 1992 with fixed exchange rate (Allum, Dwight & Chen, 2008). During 2003-08 there was a remarkable growth and structural change in real GDP growth rate averaging 6.0% with a relatively low inflation of 6.9% (Kaberuka, Gurria, Clark & Janneh 2012).Still in the same period, Namibia continued to enjoy a positive balances and surpluses in both the overall fiscal position and the current account due to surpluses in net current transfer, primarily in Southern Africa Customs Union (SACU) receipts (Zaaruka, 2007). The growth was also caused by buoyant diamond production and sustained strengthening of the non-mining sectors such as manufacturing and services, hence the debt servicing ratio to GDP was negligible to cause concern (BON, 2008). However, real GDP growth declined to 2.9% in 2008 and it fell further to 1.0% in 2009. The decline in

diamond prices and the global economic crisis reduced the expectations for growth (Kaberuka et al 2012).

Annual economic growth rate slowed to 3.8% in 2011, from 6.6% in 2010 following a contraction of 0.4% in 2009 (Kaberuka et al 2012). This was as a result of modest performance in mining and agricultural activities due to severe flooding in the northern part of the country as well as weak demand for mineral products arising from weaker global economy (Kaberuka et al 2012).The launch of Namibia's Eurobond in the same period saw the external debt to GDP rising to 7.3% thus exceeding the acceptable threshold of 5% stated in the Sovereign Debt Management Strategy of Namibia (BON, 2012). Moreover, the ratio of external debt to GDP rose further in 2012 to 8.3% as Namibia launched a ZAR-denominated offering on the Johannesburg Stock Exchange (JSE) (BON, 2012). These two international offering made up 57% of total external debt and it dragged the average external debt to GDP ratio to 5.9% over the 2008 to 2012 period (BON, 2013). In addition, the offering especially the Eurobond was seen to cause depreciation of the domestic currency against the USD dollars (BON, 2013).

Furthermore, the ratio of external debt to exports spiked to 18.9% in 2011 on the back of the Eurobond issue-almost double the 10% benchmark published in the SDMS- and this figure rose to 19.2% in 2012 (BON,2013). The external debt to export ratio was already in excess of this threshold prior to the Eurobond being launched, standing at 10.1% in 2010, which actually represented a decline from 11.4% in 2009 (BON,2013). With external debt to export also coming in at 11.4% in 2009, the average of this metric stood at 13.1% over the 2008 to 2012 period (BON, 2013).

During 2013-2014, a robust construction and mining activities kept the domestic economic recovery on course with gross domestic product (GDP) growing by 5.3% in 2014, up from

5.1% in 2013. Export earnings slightly improved which subsequently saw the debt servicing to revenue falling slightly from 4.1% of 2013 to 3.8% in 2014 (BON, 2015). However, the external debt stock to GDP increased from 38.4% to 40.4% between 2013 and 2014 respectively, the increase was mainly due to the depreciation of the local currency and the JSE listed bond (BON, 2016). During the same period there was expansion of domestic credit to the private sector, high growth rates on real money supply and appreciation of real exchange rate (BON, 2016).

The real GDP growth was impressive in 2015-16 at 5.3% on average. However, the improvement was short lived as Namibia's economy entered a recession in 2016 and has since struggled to grow (NPC, 2018). It recorded the slowest growth of 1.1% due to weak performance activities in mining, agriculture, manufacturing and construction sectors, while inflation rose over the same period (NPC, 2018). The growth in money supply contracted to 0.1 %. However, government's budget deficit to GDP improved to 3.6% from 8.3% of the previous year due to the Government's fiscal consolidation efforts (NPC, 2018). The stock of external debt rose to N$26.3 billion in 2016 compared to N$15.4 billion of 2015. The increase was mainly due to accumulation of new external debt and the depreciation of the local currency against major currencies (BON, 2017). During the same period government began with fiscal consolidation to correct growing imbalances from high public spending and failing revenues from the Southern African Custom Union (NPC, 2018).

In 2018 the Namibian real GDP contracted by 0.2 percent from a deeper contraction of 0.9 percent in 2017. This was mainly caused by the temporary stimulus from constructions in the mining sector that dissipated, raw material prices that dropped and agriculture sector that was hit by drought (BON, 2018). In 2019 the President had to declare a state of emergency due to

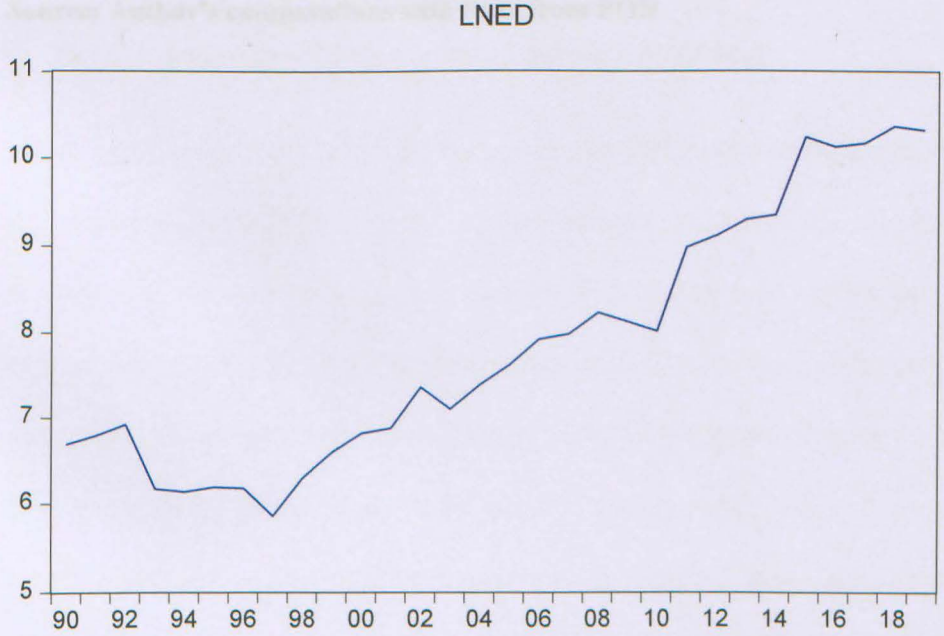
the severity of the drought and its consequences. The Namibian economy remained weak in 2019 with the contraction of 1.9 percent (BON, 2019).

1.3 Structure and the Size of Namibia's External Debt

Total external debt is the sum of publicly and publicly guaranteed long- term debt, private non-guaranteed long-term debt, use of IMF credit and short- term debt (World Bank). Long-term debt consists of publicly guaranteed and private non-guaranteed debt and has the highest proportions of total external debt stock of 75% in Namibia (BON, 2019). Concerns have been expressed about the growth pace of the Namibian's external debt and some analysts such as Shipala (2019) are of the opinion that Namibia is approaching a debt trap.

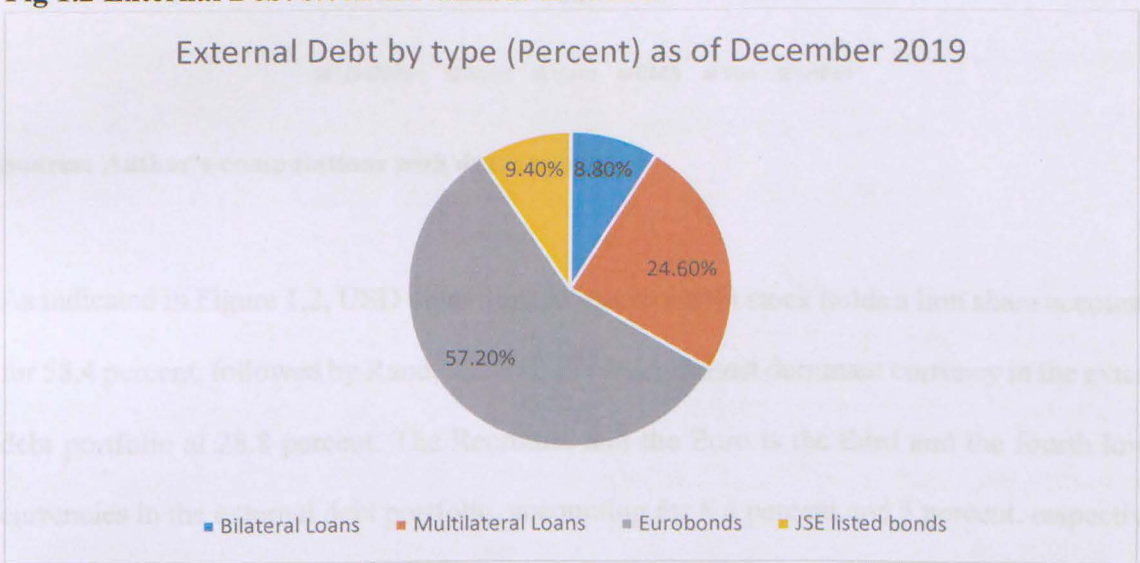
This external debt portfolio is dominated by Eurobond, official debt (Multilateral, bilateral) contracted in concessional terms as well as small proportion of JSE listed bond. In Figure1.1 as shown below, Eurobond remains the major contributor of the Namibian external debt stock during 2019. It accounted for 57.2 percent of the external debt stock, the share of both multilateral and bilateral loans to the external debt portfolio stood at 24.6 and 8.8 percent respectively. The share of the JSE-listed bonds stood at 9.4 percent during the same period.

Fig 1.1: The Evolution of Namibian External Debt



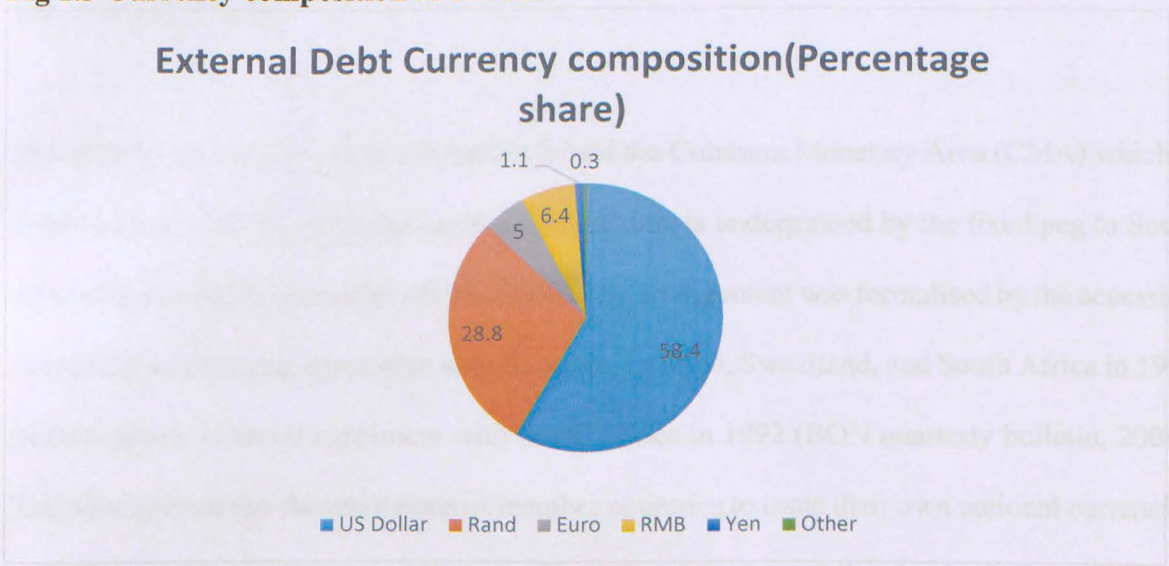
The graph above depicts evolution of the Namibian external debt from 1990 to 2019. During 1992 to 1998 period, there was a slight decline in external debt stock that may have been caused by partly government policy of borrowing locally to develop the domestic debt market and the debt forgiveness by South Africa in 1997 on the external debt contracted by the South African Apartheid regime government in Namibia. From 2000 to 2019, there has been a perpetual increase in the foreign debt stock in those periods.

Fig 1.2 External Debt stock in Namibia as of 2019



Source: Author's computations with Data from BON

Fig 1.3 Currency composition as of 2019



Source: Author's computations with data from BON

As indicated in Figure 1.2, USD denominated external debt stock holds a lion share accounting for 58.4 percent, followed by Rand, which is the second-most dominant currency in the external debt portfolio at 28.8 percent. The Renminbi and the Euro is the third and the fourth lowest currencies in the external debt portfolio, accounting for 6.4 percent and 5 percent, respectively while Yen stands at 1.1 percent.

1.4 The Genesis of the Exchange rate regimes for Namibia

The rapport between a currency and other foreign currencies is administered using an exchange rate regime. Pilbeam (2006) documents two types of exchange rate regimes: Fixed and floating exchange rates. Fixed exchange rate dictates that the domestic currency is dependent on other currency/currencies, while floating exchange rate relies on the market that deals with demand and supply of currencies (Pilbeam, 2006). Between these two, there are intermediate regimes with various deviations of currency pegs. These regimes range from single currency, to crawling currencies, to free-floating currencies. Depending on the regime, the role of the

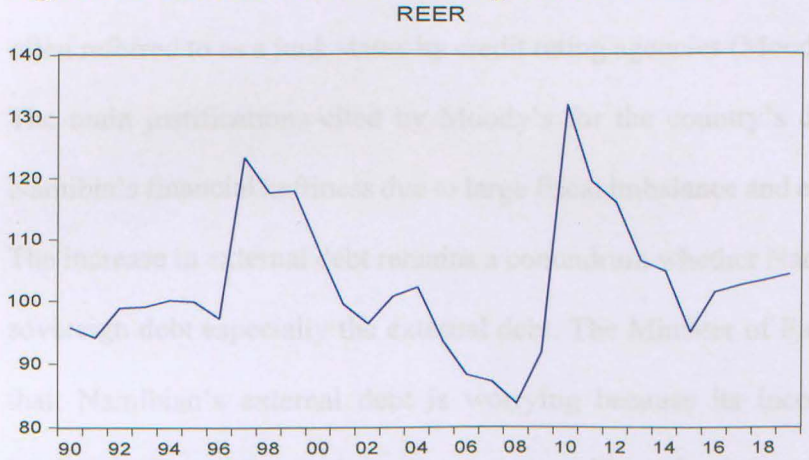
monetary authority ranges from full control, to minimal control, to no control of the exchange rate (Pilbeam, 2006).

Just after the pre-independence, Namibia joined the Common Monetary Area (CMA) which is characterised as fixed exchange regime. This regime is underpinned by the fixed peg to South African Rand (BON quarterly bulletin, 2000).The arrangement was formalised by the accession to both the multilateral agreement with Namibia, Lesotho, Swaziland, and South Africa in 1990 and a separate bilateral agreement with South Africa in 1992 (BON quarterly bulletin, 2000). The arrangement has the provisions of member countries to issue their own national currencies as well as to introduce measures for their domestic resources mobilisation in the interest of the development of their respective countries (BON quarterly bulletin, 2000).

The Namibian currency, well known as the Namibia Dollar(N$), replaced the South African Rand(R) which has been the country's currency while it was under South African regime as South-West Africa from 1920 until 1990 (Fillemon, 2017). In CMA, South Africa remains the dominant factor; hence, its exchange rate regime is flexible and it is exposed to volatility in the international markets, which may spill over to member countries including Namibia (BON quarterly bulletin, 2000). Nevertheless, Namibia anticipates to remain in this arrangement due to the several benefits such as price stability. The goal of monetary policy in Namibia is to ensure price stability in the interest of sustainable economic development of the country, this will be achieved by importing stable inflation from the anchor country (Alweendo, 1999). In Namibia, inflation is generally lower than the average inflation in Sub Saharan Africa. This is attributable to the pegging of the currencies, which results in low stable prices of Namibia imports from South African (Alweendo,1999). Another benefit is that of reduction in transaction costs, for instance, Namibian importers of goods from South Africa are exempted from paying transaction costs, which would have been obligatory to be paid have Namibian

Dollar not pegged to the Rand (Alweendo, 1999). It therefore, offer Namibia with great advantage since about 45.3 percent lion market share of Namibian imports is accounted for South Africa (Namibia Statistics Agency, 2019). Though not the least , another benefit from the CMA arrangement is the free flow of capital between the members' countries. This provides wider access to financial markets and thus helps in satisfying extraordinary financial requirement for the infrastructural projects in the country (BON quarterly bulletin, 2000).

Figure1.4: The real effective exchange rate in Namibia



The graph above shows a swift depreciation of the real effective exchange rate from 1991 to 1998 caused by an increase in the domestic prices relative to foreign prices. Albeit slightly appreciation of the real exchange rate was observed from 1997 to 2008. During 2009 to 2012 period, there was sharp depreciation of the real effective exchange rate that may have been caused by the Eurobond offering in those periods.

1.5 Statement of the problem

Despite external debt being one of the means of bridging the gap between government expenditure and revenue especially in most developing countries, Ahmad Fida, Khan and Sohail (2016) have shown that the size of the foreign currency denominated debt of a country contributes to the occurrence of appreciation or depreciation of the real exchange rate. The overvalued or undervalued of the real exchange rate can be a serious economic problem that

can reduce export earnings, pushing the current account into deficit which may culminate to balance of payment crisis (Agboola, Tchokote, & Uche, 2015).

In recent years, the increase in Namibia's external debt, has implored the question of medium to long term debt sustainability, and doubts are being enunciated about the possibility of Namibia sinking into a debt distress that has affected several developing economies. What is more perturbing is the Namibia's credit rating that has seen a consistent downgrade, often referred to as a junk status by credit rating agencies (Moody's Investor services, 2017:1). The main justifications cited by Moody's for the country's downgrade was an erosion on Namibia's financial heftiness due to large fiscal imbalance and enormous external debt burden. The increase in external debt remains a conundrum whether Namibia will be able to sustain its sovereign debt especially the external debt. The Minister of Finance shared some sentiments that, Namibian's external debt is worrying because its increasing rate may cause grave implications on the real exchange rate ultimately impacting on the current account (Schlettwein, 2019). In recent years, Namibia's current account (CA) has been deeply in deficit. In 2018 and 2019 the CA deficit stood at 9.5% and 12.5% of GDP respectively, exceeding the 5% acceptable threshold of CA deficit sustainability set by central Bank (BON, 2019), The Namibian's large CA deficits have become persistent and have reached worrisome levels, putting pressure on the country's foreign reserves (Manuel, Eita, & Naimhwaka, 2018). In 2019 the CA deficit stood at N$ 4.1 billion and the foreign reserves declined by 6.7% between 2018 and 2019. (BON, 2019). According to Osakwe and Verick (2007), countries whose CA deficit that exceeds 5% CA threshold may experience macroeconomic instability, thus low level of investment and sluggish economic growth.

Moreover, Odera (2015) indicated that the size of the external debt in Kenya contributed to the occurrence of appreciation/depreciation of the real exchange rate, sudden stop of capital flow and output drop in the domestic market. However, the study failed to Saheed, Sani and Idakwoji

(2015) focused on the impact of external debt on real exchange rate in Nigeria. This research fills a gap in which it focused on the Namibian perspective with much emphasis on the relationship and the impact of external debt on Real Effective Exchange Rate. Other studies by Kia (2012), Couharde et al (2016) and Jean-Claude, et al (2019) focused on the external debt-to-Real Exchange Rate relationship in developed economies. This study fills a gap in that it focused on Namibia, which is classified by the World Bank as an upper middle income country. It is therefore indispensable that research on the relationship of the Namibian external debt to real exchange rate is prioritised in academic, government fiscal policy and monetary framework determination. It will provide a more defined stance to the much-debated Namibian government debt sustainability status as well as help debt managers in addressing operational and reputational risks that could originate from non-sustainable debt levels. Debate on the relationship between external debt and real exchange rate in Namibia has been based on mere socio-political arguments and inferred evidence. It is therefore a challenge to determine a strong long-run relationship that exists between the two variables without a comprehensive examination.

Although the literature exists on external debt and real exchange rate for other countries, similar studies on the same phenomenon for Namibia is scant. A study conducted by Fillemon (2017) on the determinants of real exchange rate in Namibia could not address external debt as one of the determinants of real exchange rate. Though the study was conducted for Namibia, the methodology was focused on determining the relationship between real exchange rate and other variables with the exception of external debt.

Therefore, the present study seeks to provide empirical evidence that determines the relationship between external debt and real exchange rate in Namibia for the period 1990-2019.

1.6 Objectives of the study

The main objective of this study was to analyse the impact of external debt on the real exchange rate in Namibia for the period 1990 -2019.

- To investigate whether or not there is a long-run relationship between the external debt and the real exchange rate in Namibia.
- To assess whether or not external debt has any significant impact on real exchange rate in Namibia.
- To review theoretical and empirical literature on external debt and real effective rate.
- To make policy recommendations.

1.7 Hypotheses of the study

In line with the above objectives, the below hypotheses were tested over the period of 1990 to 2019 in the study:

H^1_0: There is no long-run relationship between the external debt and the real exchange rate in Namibia; **H^1_1:** there is a long-run relationship between the external debt and the real exchange rate in Namibia.

H^2_0: External debt has no significant impact on the real exchange rate in Namibia;

H^2_1: External debt has a significant impact on the real exchange rate in Namibia.

1.8 Significance of the study

External borrowing is essential in any economy especially developing economies (Masaku, 2014). Developing economies opt to foreign borrowing to raise internal growth and increase resources available for investment. This is because saving in these countries is little. Most of these economies do not borrow in their own currencies in the international capital markets, but instead borrow in one of the major currencies and thus affect the exchange rate.

The Namibian external debt stock has swiftly increased over the years and its sustainability has been at the centre of much public debate. There are queries posed whether Namibia will be

able to sustain the rising external debt stock in the short to medium term given the shrinking fiscal capacity and widening of the fiscal deficit. More so, the rising of the external debt may result to the appreciation and depreciation of the real exchange rate makes it hard for policy makers to reliably foretell future exchange rate price and therefore, pricing of goods and services becomes difficult to determine. This can result to massive losses or profit for importers, exporters and foreign market participants. Therefore, understanding the long-run sustainability of the Namibian external debt requires a study into the relationship between external debt and real exchange rate which will shed light on the fiscal policy sustainability. Thus, this study will assist policymakers in crafting sustainable policy techniques that support financial stability as well as debt management to ensure stability in real exchange rate thereby spur economic growth in the country.

1.9 Limitation of the study

The study noted a limitation posed by variables using different conventions, where some were in percentages while others in monetary values. This limitation were overcame by converting all variables into natural logs for ease of interpretation of data.

1.10 Delimitation of the study

The study analysed the impact of external debt on real exchange rate for the period of 1990 to 2019. The variables that were used in the study are external debt, real effective exchange rate, debt service payment, real money supply, and real income.

1.11 Organisation of the study

Following this introductory chapter is Chapter two, which gives a detailed discussion of literature review, Chapter three discusses the Methodology, Chapter four explains the analysis and discussion of empirical results, chapter five deliberates on the conclusions and recommendations and lastly is References As well as Appendices.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter unravels the distinct viewpoint on the analysis of relevant theoretical and empirical literature on the subject matter, which is an analysis on the impact of external debt on the real exchange rate. Impact of external debt on real exchange rate is not a study where literature is in abundance. Nonetheless, this chapter presents a non-structural outlook in pinpointing theoretical models and empirical reviews for potential determinants that can be helpful in analysing the relationship between Namibian's external debts on real exchange rate. It's observed that, there is no theories that links external debt and real exchange rate, hence, the study will discuss and review the theories of this two variables on their own.

2.2 Theoretical Review

2.2.1 Threshold School of Thought (Debt-Laffer Curve)

The theory of Debt- laffer curve was developed by supply- side economist Arthur Laffer (1974). Laffer state that the burden of external debt is the concern of threshold school of thought which emphasizes the non-linear relationship between debt and growth. It links debt and growth to problem of capital flight where at high debt levels, growth falls. The fall in growth is due to the higher distortionary tax burden on capital required to service the debt. It leads to lower rate of return on capital, lower investment and hence lower growth. It maintains that low debt regimes have higher growth rate and lower strand of thought in the debt–growth nexus sees external debt as capital inflow with positive effect on domestic savings and investment and thus on growth which leads to poverty reduction via appropriate targeting of domestic savings and investment (Calvo, 1998). The theory is a link between a country's ability to service debt and the current level of public debt (Krugman, 1989). the theory shows that

when a country accumulates too much debt, in other words when payment obligations exceed its ability to pay, payment obligations act as a marginal tax rate: if the state succeed to obtain better results than those expected, benefits will return to creditors and not to the state. In these circumstances, the government may be discouraged to improve economic performances because the benefits are going rather to creditors than to the borrowing country. The accumulated debt in current period must be repaid in the next period and future investment earnings will be capital outflows to creditors, Cohen (1989) showed that the debtor country benefits are very small and this leads to more debt to repay previously debts and to finance new investments.

2.2.2 Ricardo Theory of public Debt

Ricardo's theory of public debt was developed by Ricardo Roberts back in 1942. The theory was based on an emphasis of the fact that the primary burden to the community was derived from wasteful nature of public expenditure itself rather than from the methods adopted to finance such expenditure. Regarding the question of financing public expenditure, Ricardo's view was that the requisite funds would ultimately have to be drawn from the liquid resources of the community and that in point of economy, it would make no great difference whether such funds were raised by taxes or by loans. However, where the funds were raised through the later, it would be referred as public debt. External debt involves debt servicing, which in most cases require payment in foreign currency. Whereas, the continue increase or decrease in demand for foreign currency tends to influence the real exchange rate.

2.2.3 Monetary Model of Exchange rate determination

Monetary models of exchange rate determination were developed after the collapse of the fixed exchange rate system in the early 70's. They are descendants of the Mundell-Fleming type of models. Several versions have been put forward giving rise to three main types of models.

These are the flexible price monetary model developed by Frankel (1979), the sticky price-asset monetary model of Hooper and Morton (1982) and Dornbusch real interest rate differentials models by Bilson (1978). The flexible-price monetary model is centered upon the idea that all prices in an economy are entirely flexible; bonds are perfect alternates and what matters for exchange rate determination is the demand for money in relation to the supply of money. In such circumstances, countries with high monetary growth rates will have high inflationary expectations which lead to reduction in the demand to hold real money balances, increased expenditure on goods, a rise in the domestic price level and a depreciating currency in order to maintain purchasing power parity (PPP). Despite the shortcomings and reliance of the monetarist model on PPP, the flexible-price monetarist model is a significant addition to the exchange rate theory because it introduces the role of money supplies and inflationary expectations and economic growth as determinants of exchange rate changes (Pilbeam, 2006).

The fundamental basis of Dornbusch monetary model is that the prices in the goods market and wages in the labour market are determined in sticky-price markets and they only tend to change gradually in response to several shocks from such money supply. Prices and wages are resilient to downward pressure. The exchange rate is, however, determined in a 'flex-price' market and can immediately appreciate or depreciate in response to new developments and shocks. In such circumstances, exchange rate changes are not harmonized by corresponding price movements and there can be persistent and prolonged departures from PPP.

In the Dornbusch model the Uncovered Interest rate parity condition is assumed to hold continuously; that is, if the domestic interest rate is lower than the foreign interest rate, then there needs to be an equivalent expected rate of appreciation of the domestic currency to compensate for the lower domestic interest rate. This is due to perfect arbitrage of expected returns in capital markets. By contrast, goods prices adjust only slowly over time to changes in

economic policy partly because wages are only adjusted periodically and partly because firms are slow to adjust their prices upwards or downwards, resulting in 'sticky' domestic prices. The sticky-price model is viewed to be vital as it emphasizes on capital-market rather than goods-market arbitrage being the major determinant of exchange rates in the short run. The model provides an intuitively appealing explanation of why exchange rate movements have been large relative to movements in international prices and changes in international money stocks. In addition, it explains such movements as the outcome of a rational foreign exchange market that produces an exchange rate that deviates from PPP based on economic fundamentals, not in isolation from them. Lastly, the Dornbusch model is important because it helps explain why observed exchange rates are usually even more volatile than supposed determinants such as money supply.

Frankel (1979) developed a general monetary exchange rate model that accommodates the flexible-price and sticky-price monetarist model called the Frankel real interest rate differential model. The real interest rate differentials model illustrates that if there is a disequilibrium set of real interest rates, then the exchange rate will deviate from its long run equilibrium value. If the real domestic interest rate is below the foreign interest rate, then the exchange rate of the domestic currency will be undervalued in relation to its long-run equilibrium value, so that there is expected appreciation of the real exchange rate of the domestic currency to compensate. The goods and labour market prices are assumed to slow to adjust to shocks so the speed of adjustment is finite. Thus, the rational expectations hold for the foreign exchange market but not for domestic markets. In such circumstances, an anticipated monetary expansion leads to a fall in the real domestic interest rate relative to the real foreign interest rate, while the domestic price level is initially unchanged but expected to rise. The short-run exchange rate overshoots its long-run equilibrium value, depreciating proportionately more than the increase in the

money stock so that there are expectations of a future appreciation of the currency to compensate for the lower real rate of return on domestic bonds.

A common characteristic of these models which is the supply and demand for money is the key determinant of exchange rates. The models employ the UIP condition which assumes that domestic and foreign bonds are equally risky so that their expected rates of returns are equalized (UIP condition). Beyond the similarities, there are also some significant differences between the models. The 'flexible-price' monetary model argues that all prices in the economy are perfectly flexible in both the short run and the long run. It also incorporates the role for the effect of inflationary expectations. The 'stickyprice' model is a monetary model that argues that in the short run, wages and prices tend to be sticky and only the exchange rate changes in response to changes in economic policy and economic shocks. Inflationary expectations are not explicitly dealt with in the Dornbusch model.

The model maintains that exchange rate is determined predominantly by shifts in the demand for and supply of money. Mussa in his 1976 and 1984 seminal work on "Theory of Exchange Rate Determination" applied the monetary model to show that the current exchange rate is a function of the current stocks of domestic and foreign money and the current determination of the demands for these monies, including domestic and foreign income and interest rates. Since an exchange rate is the relative price of one nation's money in terms of the money of another nation, it is natural to think of an exchange rate as determined, at least primarily, by the outstanding stocks of these monies and by the demands to hold these stocks (Mussa, 1984).

2.2.4 Monetary Approach of international capital Movement

Attempts to explain the factors that influence international capital movements resulted in three theories, namely: the flow theory, the stock theory and the monetary approach to capital movements. While the first two theories focus on the role of interest rate differential between

countries as principal factor that influences international capital movements, the monetary approach concentrates on the factors that may cause a change in foreign currency reserves, and hence the money supply. According to Sobersten and Reed (1994), the monetary approach, which was popularized through the 1976 seminal works of scholars like Frenkel, Johnson and Mussa, argues that money supply and demands are strong forces in determining a country's external position, as indicated by the change in the country's foreign currency reserves. The model concludes, that starting from an initial equilibrium position, an increase in the demand for money (or an increase in its supply) will lead to a balance-of-payments (BOP) surplus or vice versa, which will in turn affect the exchange rate either positively or negatively.

2.2.5 The Balance of Payment Theory

This theory claims that the exchange rate is determined by the forces of demand and supply for external currency as represented by the debit and credit sides of the balance of payment account respectively. Imports, unrequited outflows, and capital exports constitute debits and reasons for demanding foreign exchange, while exports unrequited inflows and capital imports constitutes the credits and supply of foreign currency. The equilibrium exchange rate is set where total debits of the balance of payments equals total credits, that is when the balance of payment is at equilibrium. Where there is a favourable balance of payment, credits exceed debits in the balance of payment, supplies of foreign exchange is more than the amount demanded, rates of exchange will be bided downwards making imports cheaper and increased, while supply of foreign exchange will be reduced until the equilibrium point is arrived at. Conversely in the case of deficit balance of payment where demands for foreign exchange is in excess of supplies, exchange rates will be bided upwards, imports will be reduced and exports encouraged until the equilibrium is arrived at again. Opponents of this theory points to the facts that the assumption of free trade, perfect competition and that the demand for imported materials is inelastic do not hold in reality, countries impose various restrictions on trade to

encourage exports while restricting imports and the demand for raw material is actually not perfectly inelastic. Again it's the changes in exchange rate that triggers correction of balance of payment problems and not the other way round and lastly the effect of domestic price levels of countries on the exchange rate is ignored in the analysis

2.2.6 The Mint- Parity Theory

In the period between late 19th century and shortly after the Second World War, Gold was either the medium used for international trade settlement or all currencies were freely convertible to gold. Each currency has a fixed exchange rate to one ounce of gold, for instance if N$100 can exchange for one ounce of gold and 200 USD exchange for one ounce of gold then the exchange rate of Namibian dollar to one USD is 0.5. The relative exchange rates between any pair of currencies of the world was determined this way. This fixed rate was allowed to fluctuate within a band determined by the cost of transporting gold between any two countries. The upper band is called the gold export point or upper specie point, and the lower band is called gold import point or lower specie point. The assumptions underlying the use of the mint parity theory are (i). The exchange price of gold to a country's currency once determined remains fixed. (ii). the country is ready to buy and sell any amount of gold at the fixed price. (iii). its supply of money consists of gold or paper currency which is backed by gold. (iv). Free movement of gold among countries is allowed. (v). There is perfect capital mobility among countries of the world. (vi). A country's price level varies directly with its money supply. (vii). the adjustment mechanism is automatic through the workings of the Fisher's Quantity Theory of money; countries with surplus must accept gold and countries with deficits must pay gold. The fisher's model equates quantity of money to its value through the equation MV=PQ where M is the money supply, V is the velocity of money circulation, P is the price and Q is quantity of goods and services. Given a constant V and Q, a country with a surplus will accept gold and increase its money supply, this will result into increased prices

and discourage exports while imports will be encouraged, the surplus will be wiped off and the equilibrium will be restored. In the case of a deficit, the country with the deficit must export gold and reduce its money supply, this will lead to reduced prices and exports will be encouraged while imports discouraged, this will ultimately cure the deficit. Critics of the Mint Parity Theory points to lack of free movement of gold, domestic prices being independent of fluctuations in the exchange rate and so forth. However, the theory has been abandoned since the 1930s.

2.2.7 Purchasing Power Parity

Purchasing Power Party [PPP] is based on the law of one price, which emphasizes that the change in the exchange rate between any two currencies is determined by the change in the relative price levels of the countries involved. For instance, if one hundred Namibian dollar can buy a bundle of goods in Namibia then 6.51USD equivalent should buy the same identical bundle of goods in the United States of America, the purchasing Power Parity is N$15.35 to a US Dollar, this is taken to be the exchange rate of the US Dollar to the Namibian dollar. the origins of the PPP concept can be drawn back to the Salamanca School in 16th-century Spain, its modern use as a theory of exchange rate determination began with the work of Cassel (1918). Cassel (1918, 413) was the first to name the PPP theory and defined the theoretical nominal exchange rate as a report between national and foreign prices:$Sr = S\frac{P}{P*}$,where, Sr is the index of real exchange rate, S is the nominal exchange rate, P is the domestic price and $P*$ is the foreign price. However, the market value of the exchange rate could present deviations from the former value, deviations which are considered as over or undervaluation of the national currency. A real exchange rate higher than one reflects the undervaluation of the national currency and less than one is said to be a national currency overvaluation. Cassel argued that without PPP, there would be no meaningful way of discussing over- or under-valuation of exchange rates.

The PPP theory is based on the 'no arbitrage argument' or the 'law of one price'. The law of one price states that identical goods in two different economies, in the absence of transaction costs, taxes and transportation costs, sell for the same price when expressed in an equivalent currency.

Jhingan (1997) identified two ways of using the Purchasing Power parity: The Absolute purchasing power parity and the Relative purchasing power parity. The absolute determines the exchange rates of currencies of any two countries as the ratio of the price indexes of the countries; while on the other hand the relative measure takes the exchange rate as the domestic price of a foreign currency multiplied by the ratio of domestic price index to foreign price index.

The absolute PPP is the simplest and strongest form of PPP that predicts that the exchange rate should adjust to equate the prices of national baskets of goods and services between two countries because of market forces driven by arbitrage. Under absolute PPP, the exchange rate is simply equal to the ratio of domestic price to foreign price of a given aggregate bundle of commodities and this implies that the real exchange rate is constant. Absolute PPP can be mathematically expressed as $ppp = S = {}^{P}_{P*}$, where S is the exchange rate defined as the domestic currency price of a unit of foreign currency, P is the price of a bundle of goods expressed in the domestic currency, and P* is the price of an identical bundle of goods in the foreign country expressed in terms of the foreign currency. According to the absolute PPP, a rise in the home price level relative to the foreign price level will lead to a proportional depreciation of the home currency against the foreign currency. In other words, it would mean an undervalued Namibian dollar (say N$100 to1 USD) makes imports dearer relative to local products, the demand for USD will reduce and the equilibrium will be restored, the converse reflection applies in case the Namibian dollar is overvalued (say N$50 to 1 USD).

Absolute PPP does not practically hold for a number of reasons. Firstly, the existence of non-tradable goods and services in all economies, whereas the "law of one price" only applies to traded goods and services. Secondly, the PPP assumes no government intervention, but in reality there are tariffs, quotas, trade restrictions and taxes. In addition, the information on comparative prices is neither universally available for free. Even if prices were the same in two countries, differences in income levels would cause the consumer price index to change. Moreover, tradable goods are not always perfect substitutes when they are produced in different countries (Driver & Westaway, 2004).

According to Lipsey (2007), in the long term, the average exchange rates of any pair of currencies depend on their relative purchasing power. The relative PPP is the weaker and a more commonly used version of the PPP theory. The relative PPP implies that the exchange rate between two countries should eventually adjust to account for differences in their inflation rates. Thus, if most of the shocks affecting the exchange rate are monetary rather than real, then relative PPP will be able to explain a substantial portion of the exchange rate movement between two countries.

Relative PPP can be expressed mathematically as:

$\Delta \ln S = \Delta \ln P - \Delta \ln P*$

Where $\Delta \ln S$ is the percentage change in the exchange rate, $\Delta \ln P$ is the domestic inflation rate and ΔnP^* is the foreign inflation rate (Refrance & Schembri, 2002). Some researchers have argued that the PPP a might be wrong and misleading indicator for equilibrium exchange rate, especially in developing economies. First, there are significant differences between the compositions of the price basket because of the fact that consumers' preferences and the structure of the manufacture production differ from one country to another. Secondly, if the perfect competition is not working (the costs of transportation are different), the LOOP does not hold. This problem is present especially in the case of developing countries where

governments control the level of regulated prices, subsidizes certain categories of services like public transportation, telecommunication and others. Consequently, the price of non-tradable goods in developing countries will be lower than that in developed countries (Cassel, 1918).

2.3 Empirical Review

Empirical literature on the impact of external debt on real exchange rate especially in developing economies is scant (Saheed *et al* 2015). Notwithstanding, some studies that are concerned on this rubric indicated there is a relationship between external debts and the real exchange rates. In contrast, other authors argue that no strong relationship exist between the two variables, while others dispute by stating that relationship only exist in a short run.

2.3.1 Studies out of Africa

Alam and Taib (2013), used Ordinary Least Squares regression model to study the relationship of external public debt (EPD) with budget deficit (BD), current account deficit (CAD) and exchange rate depreciation (ERD) for Debt Trap Countries (DTC) and Non Debt Trap Countries (NDTC) of Asian pacific development countries. The study shows a relationship of EPD with BD, CAD and ERD. However, the strength of relationship varies in DTC and NDTC.

Galstyan and Velic (2016) used a panel cointeragration framework to investigate the empirical relevance of public external debt on real exchange rate dynamics. The study used a balanced of 10 emerging market economies over the period 1990-2011. The results showed that the exchange rate is significantly more persistent during times of low debt (either public or external). Thus, the study ascertained that, a directional move toward the fundamental equilibrium is more likely when debt levels are high. By decomposing the real exchange rate and examining the underlying sources of fluctuations of misalignments, the study provided evidence that real exchange rate misalignments tend to be more volatile during periods of high debt, with trade-weighted nominal exchange rates and inflation differentials capturing a more

significant proportion of misalignments than in states of low debt during which fundamentals exert a greater effect. Additionally, the study found threshold level at 52% for exchange rate. Likewise, the study revealed that after reaching a large debt close to default threshold, public debt is negatively associated with exchange rate as 1% increase in debt leads to exchange rate depreciation by 0.11%.

Bunescu (2014), investigated the impact of external debt on real exchange rate variation in Romania. Covering the data from 2005-2013 period. E-views was used for testing for normal distribution, stationarity, cyclical, seasonal series and autocorrelation in time. The study revealed that there is a strong link between external debt and real exchange rate variations in Romania with a high values of correlation coefficients of 0.877 on external Debt among the other four variables.

Fida, Khan and Sohail (2012) in Pakistan examined the relationship between external debt and real exchange rate fluctuations using the quarterly from the 1983: Q1 to 2004:Q4 period. Autoregressive distributive lag model (ARDL) was applied to examine the role of external debt on the fluctuation of real exchange rate. The results suggested that there is a long run cointegration relationship between external debt and real exchange rate variable.

Bhat, Hussain and Ali Shah (2017) examined the determinants of real exchange rate movement in south Asian Countries using a panel data of 15 years from 1998 to 2012. The study used variables such as real income, money supply, domestic interest rate, Budget deficit, foreign interest rate and external debt and Fully Modified Ordinary Least Square (FMOLS) was applied in the study. The study provided empirical evidence that real income with a significant level of 0.0004, has a significant positive relationship, Budget deficit with a significance level at .22, had no significant relationship to real exchange rate however direction is positive. External debt was insignificant at 0.7063, while domestic interest rate, foreign interest rate had a

significance level of 0.050, 0.01 and 0.008 respectively. This implied that there is a positive relationship between other variables and real exchange rate except external debt. M2 (broad money supply) has t-statistics -1.83 at significance level 0.07, results reveals that there is a positive and significant relationship between money supply and real exchange rate.

Faini and Gressani (1998) investigated real exchange rate management and the External debt burden, a case study of the Philippines, a study developed a simple macroeconomic model to analyze the data. The results showed that it was costly to hold real exchange rate at overvalued levels in the presence of the high external debt. Though the study provided evidence on the relationship between external debt and real exchange rate, the argument is to what extent.

Ali, Khan, Razi and Shafiq (2012) explored the reasons behind the devaluation of Pakistani currency with respect to the US dollar. They used data over a period of 11 years (2001-2011) employing the multiple regression equation as the mode of estimation. Their results showed that, inflation differential; current account deficit, external debt and interest rate differential were the most determinants which had a major impact on real exchange rate fluctuation.

Kia (2012) investigated the determinants of the real exchange rate in a small open economy, Canada. This study applied Ordinary least squares for testing cointegration. the fundamental variables such as money supply, domestic and foreign interest rate, real GDP, real government expenditure, deficit per GDP, domestic and foreign outstanding debt per GDP, domestic and foreign externally financed debt per GDP and commodity price were used in the study. The study used Canadian data from 1972Q1–2010Q3 period. The results show that all variables, except real money supply, external debt, domestic and foreign interest rate and domestic externally financed debt have a statistically significant impact on the real exchange rate in Canada. On the other hand, the domestic fiscal variables do not have any impact on the real

exchange rate. The change in interest rate, the growth of money supply, the commodity price and the US debt per GDP have a negatively significant impact on the growth of the real exchange rate over the short run.

In India, Mirchandani (2013) analyzed the macroeconomic determinants of real exchange rate volatility over the period 1991 to 2010 using Pearson's correlation analysis. The findings revealed that real exchange rate volatility is correlated with variables such as the interest rate, inflation rate and GDP growth rate and external debt.

Couharde, Cecile and Audrey (2016) examined the effect of public external debt on real effective exchange rate adjustment in 11 Euro areas countries using quarterly data during 2003: Q3 to 2012: Q3, employing NATREX model. The study proved that external debt has significant positive effect on exchange rate at a threshold level of 223% but once it reaches that threshold level, no positive effect is significant.

Wu, Liu and Yang (2017) examined the role of debt threshold level on real exchange rate using the 22 OECD countries for the period of 1994 to 2013. The study employed the panel smooth transition regression model in examining the results. The finding revealed that, up to 36.62% of threshold level of public external debt has positive effect on the real exchange rate. However, the study proved that, after crossing this threshold level, negative relationship is found between External debt ratio and real exchange rate.

Siregar and Pontines (2005) examined the External Debt and Exchange Rate Overshooting:, a case study of selected East Asian Countries applying ARDL to analysis. The results proved external debt was statistically significant in causing exchange rate overshooting.

Stein and Lim (1995) analyzed the dynamics of real exchange rate and current account in a small open economy, Australia. They introduced the model which is appropriate to a small open economy. The study showed, two detrimental effects of real exchange rates. The medium-term effect, is exchange rates and productivity and the second one is the long run effect which is capitalistic intensity and external debts. The study revealed that an increase in consumption rates on real equilibrium exchange rates with a constant value of investments will lead to a fall in national savings and an increase in interest rates. This situation attracts capital into the country which increases the real exchange rates and deteriorates the current balance of the country. Consequently, the real exchange rate disequilibrium may in the long run lead to a progressive increase in external debt.

2.3.2 Studies on Africa

Nwanne and Eze (2015) investigated the relationship between external public debt receipts, debt servicing on real exchange rate in Nigeria covering the period from 1981 to 2013. The variables that were used in the study included external public debt receipts, external public debt servicing, and exchange rate. Ordinary Least Square (OLS) multiple regression and cointegration test was used in determining the short-run and long-run relationships, the findings of the study showed that external debt receipts and external debt servicing have positive short and long-run relationships on real exchange rate. The study concluded that external public debt receipts affect real exchange rate positively while external public debt servicing affects real exchange rate negatively.

Saheed, Sani and Idakwoji (2015) in Nigeria used the linear regression model to empirically investigate the impact of external debt, debt service payment and foreign reserves on the real exchange rate, time series data covering the period from 1981 to 2013 was used. The finding of the study revealed that external debt, debt service payment and foreign reserve has a statistically significant impact on real exchange rate. Thus, explaining the reason for

depreciation and appreciation of the real exchange rate in Nigeria within the period of observation.

Jean-Claude, Dombou and Dany (2019) analyzed the effect of external debt on the real exchange rate in Chad from 1975 to 2014. The generalized method of moments (GMM) was used to estimate the effects of external debt on real exchange rate, the method was chosen as the explanatory variables we assured to be exogenous. Findings show that external debt positively and significantly affect the real exchange rate at 5% significant level. Moreover, debt servicing affects negatively and significantly the real exchange rate. Domestic investment has a negative but insignificant effect on real exchange rates, while money supply and the degree of economy openness has positive and insignificant effect on real exchange rates.

Odera (2015) in Kenya used Ordinary least squares technique to empirically investigate the effects of external public debt on real effective exchange rate (REER) volatility under the complete float regime for period 1993 to 2013 using quarterly data. The REER volatility was measured using the standard deviation of the second order of the moving average. A linear model was developed and exchange rate volatility was regressed against inflation, interest rates, and GDP growth rate, money supply to GDP ratio and external debt to GDP ratio. The results showed that external debt to GDP ratio and interest rate had a significant effect on REER volatility with the coefficients of 0.000030 and 0.00041 while Inflation, GDP growth rate and money supply to GDP ratio were found not to have any significant effect on real effective exchange rate.

Muhammad and Fayyaz (2015) primarily investigated the impact of external debts and world oil prices for oil producing nation (Nigeria) and Non-oil producing nation (Pakistan) on real exchange rate; the study used Least Square Regression with lag variables and Granger Causality Test were used to analyse the data from 1965 to 2009. The results revealed that

external debts have a significant influence over Pakistan's real exchange rate, while no such evidence was found for the oil producing nation in Nigeria.

Mpofu (2016) investigated the determinants of real exchange rate volatility in South Africa covering the period from 1986 to 2013 using GARCH model. The study found that switching to a floating exchange rate regime had a significant positive effect on real exchange rate volatility. The results also indicated that trade openness significantly reduced real exchange rate volatility only when bilateral exchange rates are used, but was found to be opposite when multilateral exchange rates are used. The study also showed that volatility of output, commodity prices, money supply and foreign reserves significantly influence real exchange rate volatility.

Waliu (2020) investigated the determinants of real exchange rates in Nigeria covering the period from 1982 to 2018. The ordinary least square method of regression estimation was adopted for the analyses. The study used variables such as changes in reserves, domestic credit, foreign inflation, real income, domestic bond and external debt. The study provided evidence that none of the exogenous variables at 5% level of significance had significant effect on real exchange rate, their joint effect was also not significant with F statistics of 1.123. 21.2% of changes in exchange rate were accounted for by changes in the models variables. Domestic credit, foreign prices and reserves had negative coefficients at -0.126, -0.0824, -0.0826, respectively, while external debt, real gross domestic product and domestic bond had positive coefficients at 0.3364, 2.446 and 0.1900 respectively.

Chipili, (2012) in Zambia, conducted Modelling Exchange Rate Volatility using GARCH method for the period from 1964 to 2006.variable such as money supply, openness, foreign reserves are among the real factors that were used to examine exchange rate volatility in Zambia. The results showed that openness and foreign reserves has a relatively stronger positive effect on real exchange rate volatility.

Insah and Chiaraah (2013) empirically investigated the factors affecting real exchange rate volatility in Ghana for the period from 1980 to 2012. The variables of the study included; government expenditure, money supply, domestic debt and external debt. To examine the relationship, the authors employed ARDL model. Their findings revealed that, there is a positive relationship between government expenditure and exchange rate volatility, while money supply, domestic and external debts had a negative insignificant relationship on real exchange rate volatility.

Masaku (2014) examined the effect of Kenya's external debt on real exchange rate volatility using data from 1971-2010. The study concluded that Kenya's external debt significantly affects her real exchange rate fluctuations. The study applied descriptive statistics, correlation and regression analysis in determining the effect of external debt on real exchange rate fluctuations.

Njokiirungu (2017), investigated the factors that influence volatility of real exchange rate in Kenya. The study used the correlation and regression analysis to establish the effects of interest rates, inflation rates, trade flows and external debt on the volatility of real exchange rate. The study covered the period of 36 years from 1980-2016. The study provided evidence by showing that interest rate had a positive significant effect of the real exchange rate, inflation had significant negative effect on real exchange rate, while trade flow and external debt showed insignificant correlation on real exchange rate.

Devereux and Lane (2003) used an empirical model of bilateral exchange rate volatility in understanding bilateral exchange rate volatility in developing countries. The findings were that, developing countries' bilateral exchange rate volatility was strongly negatively affected by the external debt stock.

Morngardini(1998) conducted a study on the estimation of Egypt's equilibrium real exchange rate, covering the period from 1987 to 1996 and ARDL was used in the study to determine the

relationship between the variables. Variables such as external debt, debt service ratio, terms of trade, government consumption, and control over capital flows, Technological progress and the ratio of investment to GDP were used in the study. The findings concluded that the Egypt's external debt had a significant impact on the external position of the economy, which is in turn reflected in the appreciation of the real exchange rate.

Sene (2004), examined the relationship between external public debt and equilibrium real exchange rate in developing countries using an extension of Obstfield and Rogoff model. The findings show that public external debt tends to appreciate real exchange rate in the long run. In contrast, Lin (1994), investigated the steady-state effect of government external debt on the real exchange rate in united states of America within a two-country overlapping generations (OLG) model with production. The findings indicates that increase in government external debt depreciates the real exchange rate of the country.

Alam and Anwar (2018) used the panel threshold regression model to investigate the impact of external debt threshold level on real effective exchange rate, a scenario for developing countries covering the period from 2001 to 2016. The study showed that public external debt has significant negative impact on real effective exchange rate, this meant that, when Debt is smaller than or equal to 54.4860 threshold level, the coefficient value is (-0.31165) thus, a negative relationship between debt and real effective exchange rate that 1% rise in debt would result decrease in real effective exchange rate by 0.31165%. on the other hand, when debt was bigger than the 54.4860 threshold level, the coefficient value of (-0.1436), it also indicated the negative relationship between debt and real effective exchange rate that 10% increase by debt leads to real effective exchange rate depreciation by 0.1436%. Additionally, a set of other explanatory variables we used in the study including terms of trade, net export, international reserves, net foreign asset, and inflation. The study found insignificant and negative effect of

terms of trade, net export, international reserves and inflation on real effective exchange rate while net foreign assets has positive effect on real effective exchange rate.

Sekkat and Varoudaki, (1998) introduced internal equilibrium model to examine the relationship between external debts and real exchange rates in sub-Saharan countries. Their findings showed that the maladjustments of real exchange rates in sub-Saharan countries was not because of huge accumulation of external debts but rather interest rate, inflation rate and GDP growth rate.

A study conducted by Ajayi (1992) in Nigeria, used a two-stage least squares simultaneous equation model in examining the simultaneous interactions of External Debt, Real Exchange Rates, and Other Macroeconomic Variables. The study used Nigerian data covering from 1975-1986 period. The findings have showed that external debt should be included as variable in exchange rate determination.

Draz and Ahmad (2015) analysed the External Debts and real Exchange Rates of Oil-Producing and Non-Oil-Producing Nations: Evidence from Nigeria and Pakistan. Least Square Regression model with lag variables and Granger Causality Test were used to analyze the data of 1965 to 2009. The results showed that real exchange rate was significantly influenced by the external debt. Therefore, in addition to the traditional variables, the size of external debt should be included as one of the determinants of real exchange rate.

Ezirim and Muoghalu (2007) examined the foreign investment burden, real exchange rates and external debt crises, debt service payments in Nigeria using the Ordinary Least Squares method and exact maximum likelihood (EML) techniques. These methods were applied to time-series annual Nigerian data derived from 1970-2001. The results were found to associate positively and significantly with the external debt crisis variable, previous spates of foreign investment burden but negatively and significantly with exchange rates conditions.

2.4 Summary on the Literature review

From the reviewed literature, different scholars had opposing findings on the relationship between eternal debt and real exchange rate. Furthermore, the reviewed literature indicates many directions for further study in the external debt and real exchange rate within the context of Namibia or African in general. The following research gaps in external debt, study settings and methodology were identified. Previous study on external debt and real exchange rate by Saheed, Sani and Idakwoji (2015) focused on the impact of external debt on real exchange rate in Nigeria. This research fills a gap in which it focused on the Namibian perspective with much emphasis on the relationship and the impact of external debt on Real Effective Exchange Rate. Other studies by Kia (2012), Couharde et al (2016) and Jean-Claude, et al (2019) focused on the external debt-to-Real Exchange Rate relationship in developed economies. This study fills a gap in that it focused on Namibia, which is classified by the World Bank as an upper middle income country.

Outstandingly, most of the studies have been conducted in developed economies. Remarkably, there has been limited studies in developing economies especially in Namibian context concerning this rubric. To ensure the applicability of the theories, model and hypotheses in different contexts, empirical research should be extended to other developing countries such as Namibia.

In terms of methodology, Alam et al (2013), conducted a econometric analysis, focusing on relationship of external public debt(EPD) with budget deficit(BD), current account deficit(CAD) and exchange rate depreciation(ERD) for Debt Trap Countries (DTC) and Non Debt Trap Countries NDTC) of Asian pacific development countries, employing the Ordinary Least Squares regression model. Similarly, studies by Muhammad et al (2015) also employed

Least Squares Regression with lagged variables and Granger Causality test to investigate the impact of external debts and world oil prices for oil producing nation (Nigeria) and Non-oil producing nation (Pakistan) on real exchange rate. This study is different in that it employs Unit Root Test and ARDL approach in examining the relationship between external debt and Real Effective Exchange Rate in Namibia.

CHAPTER THREE: METHDOLOGY

3.1 Introduction

This chapter presents the model and provides a background evaluation of various econometric estimation techniques employed in the study to analyse the impact of external debt on real exchange rate. Therefore, the chapter is divided into four sections, the first section presents the sources of data used for the study. The second section focuses on the model specification used and the third discusses the data analysis procedure. The last section concludes the chapter with the measurement of variables.

3.2 Data Sources

The study used annual time series data covering the period from 1990 to 2019 obtained from published sources. The Data were sourced from Bank of Namibia and World Bank's World Development indicators.

3.3 Model Specification

From the reviewed literature, this study adopts and modifies Saheed, Sani and Idakwoji (2014) model in analysing the impact of external debt on real exchange rate in Namibia. Saheed, Sani and Idakwoji (2014) model is based on the set of optimal currency area (OCA) factors and financial variables. The OCA factors included in the model were trade interdependence, differences in economic shocks and country size. The financial variables included factors on internal finance capturing financial depth within the countries and external finance capturing importance of foreign currency liabilities and bilateral portfolio debt liabilities between countries. The model has been used by other studies to estimate the impact of external debt on real exchange rate in some developing countries. Jean-Claude (2018) used it for Chad and Nwanne and Eze (2015) used it for Nigeria.

Saheed, Sani and Idakwoji (2014) formed their external debt on real exchange rate model as follows:

$RER = f(ED,\quad DSP,\quad FR)$.. (1)

Equation (1) states that the Real exchange rate is a function of real variables only, the value of external debt, debt service payment, and foreign reserves. The variables in this equation are normally influenced by changes in other real variables such as real money supply and real income. In order to estimate the impact of external debt on the real exchange rate, it is important to specify an empirical model of the real exchange rate. Hence, real money supply and real income are included as they are important determinants in real exchange rate determination. Jean-Claude et al (2019) in Chad and Odera (2015) in Kenya included real money supply while Waliu (2020) in Nigeria included real income in their studies on real exchange rate determination.Therefore, the model is stated as: real effective exchange rate is the function of external debt, debt service payment, foreign reserves, real money supply and real income. Mathematically it is expressed as follows.

$REER = f(ED, DSP, FR, RMS, RI)$... (2)

In equation (2) REER is real effective exchange rate measured as the value of the Namibia Dollar against a basket of seven currencies using currency weights based on external trade patterns, ED is external debt, measured as total external debt stock values in Namibian currency, DSP is debt service payment, measured as total debt service payment values in Namibian currency, RMS is real money supply, measured as RMS= $\frac{M2}{GDP\ deflator}$ which is a proxy for financial development, RI is real income, measured as real GDP values for Namibia and FR is foreign reserves, measured as total foreign exchange reserves in Namibian currency held in the country. Studies such as Saheed *et al* (2014) also used values as the measurement of the aforesaid variables.

Thus, the variables are converted into logarithms to aid with the analysis of the estimated coefficients because it makes non-linear parameters in a model linear (Asteriou & Hall, 2007). Transferred to natural logs, the regression equations are:

$$lnREER_t = a + \beta_1 lnED_t + \beta_2 lnDSP_t + \beta_3 lnFR_t + \beta_4 lnRMS_t + \beta_5 lnRI_t + \mu_t \ldots\ldots\ldots (3)$$

Where, t denotes time

α is Constant term

β_1, β_2, β_3, β_4, and β_5 coefficients of the independent variables and they represent elasticities,

μt is an error term. The error term is included because there are a large number of independent variables that influence real effective exchange rate. If these variables are not included even one then the independent variables will not completely predict real exchange rate, hence model misspecification.

3.4 Data analysis

3.4.1 Unit root testing

Testing for stationarity of variables is premised on the basis that regression involving non-stationary variables leads to misleading interpretation. Granger and Newbold (1974) cited in Shipila (2019) postulate that when non-stationary data is encapsulated in data examination, it is probably going to yield bogus results. Granger *et al* (1974) further state that the sequences in the data will lead to fictitious ties that imply a correlation between the data when in practical use and when no correlation exists. It is along those bases that, data for this study is gauged for stationarity, using a unit root test. If the variables are found to be non-stationary at the levels and they are determined to be stationary in their first-differences, they are believed to be integrated of order one, I (1). Thus, the test of a unit root is going to be done using the augmented Dickey-Fuller (ADF) test. The *H*0: presence of unit root in the time series indicates

that the variable is non-stationary, thus the degree or order of integration is one or higher. The $H1$: absence of unit root, however, indicates that the variables are stationary and the order of integration is zero and the variable is I (0).

3.4.2 Autoregressive Distributed Lag Cointergration test approach

Cointegration is an econometric concept which simulates the prevalence of a long run equilibrium among economic time series. If two or more series are nonstationary, but a linear combination of them is stationary, then they are said to be cointegrated, this is according to (Wagner & Lakiwa, 2014 cited in Shipila, 2019). Cointegration analysis is the statistical consequence of the long -run relationship between economic variables.

Therefore, this study contributes to the literature on analysing the impact of external debt on real exchange rate by using the co-integration test, Autoregressive Distributed Lag (ARDL), also known as the bound test. This test is mooted by Pesaran, Shin and Smith (2001) and it is used to investigate the presence of long-run relationships among variables. Although various cointegration tests exist such as the Engle and Granger (1987) and Watson and Johansen (1988), the chosen methodology, which is based on the estimation of the unrestricted error correction model (UECM), has a plethora of merits over these other co-integration tests. One merit is that the bound test can be applied to studies that have finite samples, unlike the Engle-Granger (1987) approach, which suffers from considerable small sample bias (Mah, 2000).

Another merit for using ARDL is that, the bound test procedure is applicable irrespective of whether the underlying explanatory variables are integrated of order zero (I (0)) or one (I (1)) (Mah, 2000). Furthermore, pre-testing is needed to ensure that the variables are not I (2). Moreover, the ARDL approach addresses the endogeneity problem and inability to test hypothesis on the estimated coefficients in the long run associated with the Engle-Granger methodology. Studies such as, among others, Odera (2015), Fillemon (2017), Shipila (2019), Morngardini (1998), Insah and Chiaraah (2013), Masaku (2014), Mirchandani (2013) and Fida,

Khan and Sohail (2012) have used the ARDL approach to co-integration over other conventional co-integration approaches such as Engle-Granger (1987) and the Watson and Johansen (1988), approach.

The bounds test approach to co-integration involves estimating the following error correction model:

$$\Delta lnREER_t = \beta_0 + \sum_{i=1}^{n} a_i \, \Delta lnREER_{t-i} + \sum_{i-0}^{n} b_i \, \Delta lnED_{t-i} + \sum_{i-0}^{n} c_i \, \Delta lnDSP_{t-i}$$

$$+ \sum_{i-0}^{n} d_i \, \Delta lnFR_{t-i} + \sum_{i-0}^{n} e_i \, \Delta lnRMS_{t-i} + \sum_{i-0}^{n} f_i \, \Delta lnRI_{t-i} + \beta_1 lnREER_{t-1}$$

$$+ \beta_2 lnED_{t-1} + \beta_3 lnDSP_{t-1} + \beta_4 lnFR_{t-1} + \beta_5 lnRMS_{t-1} + \beta_6 lnRI_{t-1} + \mu_t$$

..... (4)

Where Δ is the difference operator and ln denotes logarithm. The bounds test methodology suggests analysing the null hypothesis of no co-integration through a joint significant test of lagged variables$lnRREER_{t-i}, lnED_{t-i}, lnDSP_{t-i}, lnFR_{t-i} lnRMS_{t-i}, lnRI_{t-i}$ based on the Wald or F-statistic:

H0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

H1: $\beta_1 \neq 0$, *or* $\beta_2 \neq 0$, *or* $\beta_3 \neq 0$, *or* $\beta_4 \neq 0$, *or* $\beta_5 \neq 0$, or $\beta_6 \neq 0$

The null hypothesis says there is no co-integration and the alternative hypothesis says there is co-integration. The null hypothesis is tested by means of the F-statistic, which tests the significance of the lagged levels of the variables. The asymptotic distribution of the F-statistic is non-standard under the null hypothesis of no co-integration among the variables. Pesaran et al. (2001) developed two critical values for the co-integration test: upper bound and lower bound. The upper bound assumes that all the variables are integrated of order one (I (1)) which implies the existence of co-integration among the variables. The lower critical bound assumes

all the variables are stationary I (0) and this means that there is no co-integration relationship between the examined variables. If the computed F-statistic exceeds the upper bound, the null hypothesis of no co-integration is rejected (the variables are co-integrated). If the F-statistic is below the lower bound critical value, then the null hypothesis cannot be rejected (there is no co-integration among the variables). When the F-statistic falls between the lower and upper bound, the results are inconclusive. Pesaran et al. (2001) critical values are computed for large samples ranging from 500 to 1000 observations while Narayan (2005) estimated a new set of critical values for small samples, mostly from 30 to 80 observations. Since the sample size for this study is 30 observations, Narayan's (2005) critical values will be used.

3.4.5 Long-run model

Once establishing the co-integration by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, the long-run model of the real exchange rate is estimated by selecting the lag orders of the ARDL model, using the lag selection criterion of the Akaike Information Criterion (AIC).

The model to be estimated is:

$$lnREER_t = \beta_0 + \sum_{i=1}^{n} \partial_i \, lnREER_{t-i} + \sum_{i=0}^{n} \partial_i \, lnED_{t-i} + \sum_{i=0}^{n} \partial_i \, lnDSP_{t-i} + \sum_{i=0}^{n} \partial_i \, lnFR_{t-i} + \sum_{i=0}^{n} \partial_i \, lnRMS_{t-i} + \sum_{i=0}^{n} \partial_i \, lnRI_{t-i} + \mu_t$$

.... (5)

3.4.6 Short run model

The short run dynamic coefficients are estimated by an Error Correction Model (ECM) associated with the long-run estimates as follows.

$$\Delta lnREER_t = \beta_0 + \sum_{i=1}^{n} a_1 \Delta lnREER_{t-1} + \sum_{i=0}^{n} \omega_i \Delta lnED_{t-1} + \sum_{i=0}^{n} \delta_i \Delta lnDSP_{t-i} + \sum_{i=0}^{n} \vartheta_i \Delta lnFR_{t-i} + \sum_{i=0}^{n} \varphi_i \Delta lnRMS_{t-i} + \sum_{i=0}^{n} \rho_i \Delta lnRI_{t-i} + \emptyset Ecm_{t-1} + \mu_t \quad \ldots\ldots (6)$$

Where, β_0 is a drift component, $\alpha, \omega, \delta, \vartheta, \varphi, \rho$ are the short-term dynamic coefficients and $\emptyset$ is the speed of adjustment.

In order to ascertain the goodness of fit of the ARDL models, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, normality, and heteroscedasticity associated with the model. The stability test is important since unstable parameters can result in model misspecification (Narayan & Smith, 2004).

3.5 Measurement and justifications of Variables

3.5.1 Real exchange rate

A country's real exchange rate index can be calculated in different ways. A crude measure is simply to multiply the country's nominal exchange rate vis-à-vis a major currency (the euro or the dollar, say) by the price ratio between the countries' CPI and that of the eurozone or US. This maybe a useful rule of thumb measure but it has the obvious drawback that, it does not take into account the trading relationships an individual country has with others. Hence this study uses a more sophisticated measure- that is the real effective exchange rate (REER), which is the average value of bilateral RER's, weighted by the trade share between Namibia and each of its trade partners.

Therefore, Namibian REER is measured as the value of the Namibia Dollar against a basket of seven currencies using currency weights based on external trade patterns. These trading partners' currencies are such as Rand, Pula, Euro, Swiss franc, Zambian Kwacha, Chinese Yuan and USD. It is worth noting that a decrease in the real effective exchange rate represents an appreciation of the country's currency which imply that there was a loss in trade competitiveness. An increase thus represents depreciation. Therefore, it will imply that an increase in real effective exchange rate signifies that there is a gain in trade competitiveness, where it stimulates exports and imports become more expensive. Odera (2015) and Lin (1994) used it as the dependent variable in their study.

3.5.2 External Debt

External debt is measured as total external debt stock values in Namibian currency, Public and publicly guaranteed debt category of debt is used. The definition of external debt is based on the notion that if a resident has a current liability to a non-resident that requires payments of principal and/or interest in the future, this liability represents a claim on the resources of the economy of the resident, and so is external debt of that economy. Such foreign borrowings are meant to supplement national resources (domestic) without an immediate reduction in other uses of resources, whether for consumption or capital formation (Saheed *et al* 2015). High levels of external debt culminates to the depreciation/appreciation of real exchange rate of the country.

3.5.3 Debt service payment

Debt service payment is measured as total debt service payment values in Namibian currency. It is defined as the external debt-service payments of principal and interest on long-term and short-term debt to exports of goods and services for particular period. Debt service payment is

a possible indicator of debt sustainability because it indicates how much of a country's export revenue will be used up in servicing its debt and thus, also, how vulnerable the payment of debt service obligations is to an unexpected fall in export proceeds. External public debt servicing affects real exchange rate negatively, this repayment would cause a country's net capital inflows to shrink dramatically. This would be represented as a negative shift in the capital account, resulting in real exchange rate depreciation/appreciation.

3.5.4 Foreign Reserves

Foreign reserve also known as foreign exchange reserve is defined by IMF, as the assets, assets denominated in foreign currency, which is available at any time and controlled by the monetary authorities of the countries under consideration. It is measured as total foreign exchange reserves held in the country (Namibia) converted in domestic currency.

The impact of foreign reserve on the real exchange rate depends on any changes in foreign reserves. According to Yu and Lili (2011), any changes of foreign reserves would lead to the depreciation/appreciation of real exchange rate. Pan (2006) proved that huge accumulation of foreign exchange reserves will lead to much appreciation of local currency exchange rate. Therefore, the increase of foreign exchange reserves leads to local currency appreciation/depreciation. The foreign exchange reserves not only influence exchange rate, but also affect the choice of exchange rate regime (Agbola & Kunanopparat, 2005).

3.5.5 Real money supply

Money supply (M2) is defined as the total amount of money circulating in the economy. The circulating of money involves the currency, printed notes, money in the deposit accounts and in the form of other liquid assets. GDP deflator (implicit price deflator for GDP) is a measure of the level of prices of all new, domestic goods and services in an economy. Thus, Real Money Supply is measured as $= \frac{M2}{GDP\ deflator}$. impact of real money supply on real exchange rate is

that, an increase in a country's money supply causes its domestic currency to depreciate while a decrease in a country's money supply causes its domestic currency to appreciate provided the policy experiment in which future expected exchange rate is hold constant.

3.5.6 Real Income

Real income (RI) is defined by International monetary fund (IMF) as nominal or money national income (output) adjusted for inflation. Thus, RI is measured as real GDP values in Namibian currency. The impact of real income on real exchange rate depends on the rise or falling of the country's real GDP growth rate. This implies that slow growth or falling of the real GDP is as a result of a fall in net exports and a rise in the demand for imports which ultimately lead to real exchange rate appreciation. In contrast, a rise in real GDP will lead to the depreciation of the real exchange rate.

CHAPTER FOUR: ANALYSIS AND DISCUSSION OF EMPERICAL RESULTS

4.1 Introduction

This chapter presents analysis, discussions and empirical results of secondary data as per the method highlighted in the preceding chapter. This chapter proceeds with arguments on the discussions of the results from regression, augmented Dickey-Fuller (ADF) test and Autoregressive Distributed Lag (ARDL) tests.

4.2 Analysis of the Unit Root Test

Before testing for the existence of a co-integrating relationship between the external debt and real effective exchange rate, the study investigated the stationarity of the variables under study in order to ensure that none of series is integrated beyond order one i.e. I(1), as it gives bogus results. This is supported by Ajab and Audu (2006) who state that the outcome of working with non-stationary variables leads to spurious regression results from which further reference or result may be meaningless. One of the assumptions of the bound test is that the variables should be integrated of order zero (I (0)) or integrated of order one (I (1)) as the presence of order two (I (2)) breaks down the ARDL (Fillemon, 2017). this is because the computed F-statistics provided by Pesaran et al. (2001) are not valid in the presence of variables integrated of order two (I (2) (Fillemon,2017).

To achieve the aforesaid, unit root tests were conducted using Augmented Dickey Fuller (ADF) test. The ADF test can be used with serial correlation. The ADF test is argued to handle more complex models than the Dickey-Fuller test, and it is also more powerful (Shipila, 2019). The Dickey Fuller test involves testing the null hypothesis of non-stationarity of the variables against the alternative hypothesis of stationarity. Table 4.2 below shows the results of the Augmented Dickey Fuller test.

Table 4.2: Results of the Unit Root

	Levels		First Difference	
Variable	**Intercept**	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
lndsp	-2.524 (-2.623)	-4.354*** (-4.301)	-9.045 (-3.689)	-4.812 (-4.356)
lned	0.721 (-2.625)	-2.586 (-3.222)	-5.924*** (-3.689)	-6.416*** (4.324)
lnfr	-1.151 (-2.623)	-3.461 (-3.225)	-4.285*** (-3.689)	-4.366*** (-4.324)
lnrms	-2.243 -(2.621)	-2.831 (-3.222)	-5.159*** (-3.689)	-5.366*** (-4.324)
lnri	-1.269 (-2.623)	-0.874 (-3.222)	-4.040*** (-3.689)	-4.0351** (-3.581)
lnreer	-2.713 (-2.623)	-2.658 (-3.222)	-5.262*** -3.689)	-5.169*** (-4.324)

*** denotes the rejection of the null hypothesis at 5% level of significance, ***denote the rejection of the null hypothesis at 1% and figures in parentheses represent the critical values at 10%.*

Unit root test was done based on Augmented Dickey Fuller test for the variables. Table 4.2 shows that all the variables except debt service payment (DSP) variable, are non-stationary at levels and become stationary in their first differences. This implies that the variables are integrated of order one (I (1)) while DSP variable is integrated of order zero (I (0)). The results in Table 4.2 show that the test for the log-levels included cases of intercept and trend as well as an intercept with no trend for the first differences of the variables. The results indicate that the null hypothesis of non-stationarity for both an intercept and no trend cannot be rejected for all the variables at their levels except DSP. However, the variables become stationary at their first differences. This means that the variables are integrated of order one, (I (1)) while DSP

variable is integrated of order zero (I (0)), since none of them is stationary at the log level demonstrating the existence of unit root in the data for the variables used.

4.3 Bounds Test for Co-integration

The long run and the short run relationship of External debt and real effective exchange rate is analysed using the Autoregressive Distributed Lag (ARDL) co-integration method. The ARDL co-integration method was chosen over the most commonly used techniques such as the residual based Engle-Granger (1987) test, the maximum likelihood based Johansen (1991; 1995) and Johansen-Juselius (1990) tests. This is because of its low power and the fewer problems experienced compared to other tests. Most importantly, the ARDL can be used irrespective of whether the underlying explanatory variables are integrated of order zero (I (0)) or one (I (1)).

The presence of a long-run relationship among the variables is tested by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The result of the bound test approach to co-integration is presented in Table 4.3 below

Table 4.3: Co-integration Result

	F-Statistics=3.572	
Critical Values	**Lower Bound I (0)**	**Upper Bound I (1)**
5%	**2.62**	**3.79**
10%	**2.26**	**3.35***

** denotes the presence of co intergration at 10% level of significance.*

The null hypothesis in ARDL bounds calculation tests assert that no long-run relationship exists between the variables. Critical values at each level were tested for the hypothesis using the F-statistic and the value of the F-statistic obtained was 3.572. Narayan (2005) expound on the critical values of the F-statistic for numerous variables. Two sets of critical values, one assuming that all the variables in the ARDL model are integrated at the level I (0), range from 2.62 at 5%% and 2.26 at 10% marking the lower critical bound, which means that there is no cointegration amongst the variables. If the variables are integrated at first order I (1), as observed in Table 4.3, the 3.35 at 10% noting the upper critical bound, means that there is cointegration among the variables. This demonstrate that the calculated F-statistic = 3.572, is higher than the upper bound value of 3.35 at 10 percent level suggesting a strong evidence of a existence of a cointegration relationship among the variables. The study thus rejects the null hypothesis of no long-run relationship between the independent variables and real effective exchange rate.

4.4 ARDL Long Run Regression results

After establishing the presence of unit root and a long run relationship between variables, the ARDL co-integration method can now be applied to estimate the individual long run relationship between the variables. Table 4.4 presents the long-run estimates.

Table 4.4: Estimated long run Model, ARDL (2, 0, 1, 10, 1)

Variable	Coefficient	Std.Error	t-Statistics	Prob
LNED	-0.151	0.058	-2.763	0.013
LNED(-1)	0.179	0.063	2.854	0.011
LNDSP	0.001	0.018	0.526	0.606
LNDSP(-1)	0.038	0.017	2.255	0.038
LNFR	-0.028	0.053	-0.535	0.601
LNRMS	0.402	0.163	2.470	0.024
LNRI	0.618	0.713	0.866	0.398
LNRI(-1)	-1.321	0.857	-1.541	0.142
C	8.211	3.534	2.326	0.033

The results above show that the coefficient of external debt is negative (-0.151) and statistically significant at 5% level and this indicates a significant long run relationship on real effective exchange rate. External debt plays a pivotal role in influencing the real exchange rate. This indicates that an increase in external debt leads to a decrease in exchange real effective exchange rate. This implies an appreciation of the real effective exchange rate. A one percentage increase in external debt is associated with an appreciation of real effective exchange rate by 0.151 percent. This finding concurs with those by Odera (2015) who found that external debt had a negative coefficient and significant relationship on REER in Kenya. The findings also resonate well with those by Saheed et al (2015) who found a significant relationship between external debt and Real exchange rate in Nigeria. However, the findings contradict those by Bhat et al (2017) who found insignificant relationship between external debt and real exchange rate in south Asian Countries in the long run. Their study also established a nonlinear relationship between external debt and real exchange rate. (Sekkat &

Varoudaki, 1998, Lane & Milesi-Ferreti, 2000) also oppose by showing in their findings that the maladjustments of real exchange rates in sub-Saharan countries was not because of huge accumulation of external debts but rather interest rate, inflation rate and GDP growth rate.

A decrease in real effective exchange rate signifies an appreciation which reduces the aggregate demand because the exports would fall and import increases. The study by Bunescu (2014), on the impact of external debt on real exchange rate variation in Romania found external debt appreciates real exchange rate. Notwithstanding, with this result, external debt is statistically significant source of real exchange rate appreciation in Namibia from 1990 to 2019.

The lagged External debt is positively associated with real effective exchange rate (i.e.0.179) and statistically significant at 5 percent level of significance. This indicates that an increase in in real effective exchange rate in the current period was influenced by the external debt values of the previous period. For instance, a one percentage change in previous period on external debt lead to about 0.179 percentage changes in the current period on real effective exchange rate. This indicates a depreciation of real effective exchange rate. The depreciation means that Namibia's external competitiveness improved during the period.

The coefficient of the debt service payment has the positive sign of 0.001 from the estimated long run result and statistically insignificant impact on real effective exchange rate in Namibia. This is in line with the findings of Ajayi (1992), Ezirim and Muoghalu (2006). However, the results is contrary with those by Cavallo et al. (2005), Draz and Ahmad (2015) and Siregar and Pontines (2005) who showed it is significant. , Jean-Claude, et al (2019) is also in agreement by indicating debt servicing affects negatively and is statistically significant on real exchange rate in Chad.

Furthermore, the lagged debt service payment displays a positive coefficient (0.038) and statistically significant at 5 percent level. This indicates that an increase of the previous period's debt service payment lead to an increase in real effective exchange rate of the current period.

For instance, a 5 percentage change in the previous period's debt service payment lead to about 0.038 percentage change in the current period's real effective exchange rate. An increase in real effective rate indicates a depreciation, this could suggest that Namibian products become more competitive on the international market during the period.

Moreover, the ARDL result shows, foreign reserves is negative and statistically insignificant on real effective exchange rate (i.e.-0.028). Implying that there is an inverse relationship between foreign reserves and real effective exchange rate. In addition, it indicates that an increase in foreign reserves leads to decrease in real effective exchange rate. Notwithstanding this result, foreign reserves is not a statistically significant source of real effective exchange rate in Namibia. This results resonate with Alam et al (2018) who found foreign reserves insignificant and with negative effect on real exchange rate in the developing countries. However, other scholars such as Saheed,et al (2015) from Nigeria, Chipili (2012) from Zambia and Mpofu (2016) from South Africa contradicts the results by proving foreign reserves was positive and statistically significant in explaining the influence on real exchange rate in all those different African countries.

Real money supply is positively associated with real effective exchange rate (i.e. 0.402) and statistically significant at 5.0 percent level of significance. This implies a depreciation of the real effective exchange rate. Thus, a one percent increase in real money supply is associated with a depreciation of the real effective exchange rate by 0.402 percent. Bhat, Hussain and Ali Shah (2017) examined the determinants of real exchange rate movement in south Asian Countries also found that real money supply depreciates the real effective exchange rate which is a positive and significant relationship between real money supply and real exchange rate. However, Odera (2015) negates the results by indicating that real money supply to GDP ratio were found not to have any significant relationship on real exchange rate in Kenya. Jean-Claude, Dombou and Dany (2019) also concurs with Odera (2015) in showing that real money

supply and the degree of economy openness had a negative and insignificant effect on real exchange rates in Chad.

Real income has a positive and statistically insignificant impact on real effective exchange rate. From the result, a 1 percentage change in real income leads to about 0.618 percentage change in real exchange rate. The result however reveals that real income is not statistically significant on real effective exchange rate in Namibia. These results are in line with the study by Waliu (2020) who provided evidence that none of the exogenous variables including real income at 5% level of significance had significant relationship on real exchange rate, their joint effect was also not significant with F statistics of 1.123 in Nigeria.in contrast, Bhat (2017) results reveals that there is a significant positive relationship between real income and real exchange rate in south Asian Countries. Finally, lagged real income value has negative coefficient of -1.321 and statistically insignificant impact on real exchange rate in Namibia.

4.5 Results on Short Run Model

Table 4.5: Short run Error Correction terms

Variable	Coefficient	Std. Error	t-Statistic	Prob
ΔLNED	-0.187	0.046	-4.099	0.002
ΔLNED(-1)	0.177	0.051	3.444	0.006
ΔLNDSP	0.059	0.015	3.811	0.003
ΔLNDSP(-1)	0.065	0.011	3.346	0.007
ΔLNDSP(-2)	0.0347	0.018	1.888	0.088
ΔLNFR	-0.035	0.048	-0.724	0.486
ΔLNFR(-1)	0.040	0.034	1.184	0.264
ΔLNFR(-2)	0.040	0.038	1.076	0.307
ΔLNRMS	-0.054	0.138	-0.388	0.706
ΔLNRMS(-1)	-0.083	0.157	-0.532	0.606
ΔLNRMS(-2)	-0.527	0.153	-3.448	0.006
ΔLNRI	0.562	0.447	1.257	0.237
ΔLNRI(-1)	-1.807	0.569	-3.173	0.009
ΔLNRI(-2)	1.989	0.549	3.627	0.004
Δecm_{t-1}	-1.692	0.319	-5.304	0.001

Since the long run relationship was determined, the next step is to estimate the short-run dynamics within the framework of the ARDL model. Table 4.5 presents the results of the short-run dynamic coefficients obtained from the Error Correction Model (ECM) equation (6). The error correction coefficient is -1.692 and statistically significant at 1% level going by the p-value of 0.001.This shows the speed of adjustment to obtain equilibrium level in case of any distortion in the economy. The high coefficient for the error correction terms means that any disequilibrium will be adjusted within one year period. The results shown in Table 4.5 are

fascinating since the coefficient signs of the variables are concomitant to that of long run equation, except real money supply whose sign switched from positive to negative and has lagged up to (-2). Though the variables such as debt service payment, foreign reserves, real income maintained their sign they become lagged up to (-2) as opposed to long run results.

The coefficient of external debt has kept its negative sign at -0.187 and is statistically significant at 1% significance level. This indicates that an increase in external debt has a significant appreciation relationship on the real exchange rate in the short run. External debt has proved to be a significant variable that plays a pivotal role in the influence of the real exchange rate in Namibia both in the long run and short run. Similarly, legged external debt also upheld its positive coefficient of 0.177 and statistically significant at 1% significance level. This indicates that an increase on external debt values in the previous period leads to the depreciation of real exchange rate in the next period. This suggest that Namibia become competitive in the international market.

The coefficient of debt service payment has also maintained its positive sign of 0.059 and it became statistically significant at 1% level of significant in influencing the real exchange rate in the short run contrary to the long run results. Likewise, debt service payment (-1) retained a positive coefficient sign of 0.065 and became statistically significant at 1% level of significance in the short run. In addition, debt service payment (-2) also has the positive coefficient of 0.0347 and statistically significant at 5% level of significance. This indicates the debt service payment influence real exchange rate with two lags. It further indicates that when debt service payment increased in the previous period, it caused a depreciation in the current real exchange rate. This shows a strong evidence that debt service payment has a vital role on the real exchange in a short run compared to long run results.

Moreover, foreign reserves again appreciates the real exchange rate as it maintains its negative sign of -0.035. It is, however, still insignificant when compared to the long run results. Both lags, (-1) and (-2) of foreign reserve depreciates the real exchange rate as they have the positive sign of 0.040 and 0.040 respectively. However, they are both still insignificant in the short run. This proves that foreign reserves does not have an important role on Namibian's real effective exchange rate.

Furthermore, as stated above the coefficient of real money supply changed from positive to a negative sign of -0.054 and a coefficient of -0.083 in lag(-1). This imply that real money supply and its lag (-1) appreciates the real exchange rate. However, they are both statistically insignificant. Real money supply (-2) shows the positive coefficient of 0.527 and it is statistically significant at 1% level of significance. This indicates that real money supply depreciates the real exchange only with two lags. Thus, real money supply is proved to be slightly influencing the real effective exchange rate in Namibia in the short run.

Finally, real income depreciates the real exchange rate as it has also retained its positive sign (0.562). It is, however, still insignificant in the short run. Notwithstanding, real income (-1) and (-2) has the coefficient of -1.807 and 1. 989 respectively and are both statistically significant at 1% significance level. This indicates that an increase in real income (-1) has a significant appreciation impact on the real exchange rate in a short run compared to the insignificant result in the long run. Meanwhile, real income (-2) has a significant depreciation effect on the real exchange rate in a short run. Real Income has proved to be a significant variable that plays a crucial role in the influencing the real effective exchange rate in Namibia in the short run but not in the long run.

4.6 Diagnostic Tests

The ARDL model was tested for stability and ensure that the results attained meet the standard classical linear regression assumptions. Diagnostic tests is carried out in order to detect any possible bogus results. The results of diagnostic tests are computed with the use of Eviews and are presented in Table 4.6 below.

Table 4.6: Results of the Diagnostic Tests

Test	Test Statistic	Probability
Ramsey RESET test	**0.94**	**0.36**
Jarque Bera test	**0.97**	**0.62**
Breusch-Godfrey LM test	**0.36**	**0.70**
Breusch Pan-Godfrey	**2.07**	**0.09**

The diagnostic tests presented in the table above tested for the presence of serial correlation, normality and heteroscedasticity tests. The Jarque Bera statistic confirms that the residuals are normally distributed. The Breusch-Godfrey LM test fails to reject the absence of serial correlation at 5% level of significance. The presence of serial correlation denotes that the errors associated with one observation are not correlated with the errors of any other observation. The Breusch-Pagan-Godfrey test fails to reject the presence of heteroskedasticity in the residuals. The presence of heteroskedasticity indicates that the estimates are still unbiased but not efficient. The Ramsey RESET test indicates that there is no general specification error. Thus, models have passed the diagnostic tests.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the study

The main aim of this study was to analyse the impact of the external debt on real exchange rate in Namibia by using time series annual data for the period 1990 to 2019. The study utilized Dickey Fuller-GLS test, to test for the presence of unit root among the variables. Unit root testing is a vital step that should not be overlooked because it indicates variables that are stationary and non-stationary. Non-stationary variables lead to misleading interpretations that may culminate to biased and inconsistent estimated coefficients. The results of the unit root test showed that all variables expect debt service payment, were non stationary in levels but became stationary in their first differences. In order to achieve the objective of the study, the Autoregressive Distributed Lag (ARDL) method was applied. Co-integration analysis was employed to identify the presence of a long-run relationship among the variables. For the short-run relation between the real exchange rate and other variables, the Error Correction Model (ECM) was applied. The variables were found to be co-integrated among each other.

5.2 Conclusions

The real effective exchange rate is one of the vital macroeconomic variables that have an impact on exports, imports and economic activities in both developed and developing countries. The capability to manage the real exchange rate by monetary authority can significantly benefit an economy. However, when not well managed, the depreciation/ appreciation of real exchange rate may have an impact on economic growth, by increasing uncertainty, risks and thus discourage trade and investment. This study empirically analysed the relationship between external debt and real effective exchange rate given that foreign borrowing can incalculably contribute to economic growth if the funds are used efficiently. The findings showed external debt has a negative and significant relationship on real effective

exchange rate both in long and short run and it is suggesting to partly be responsible in aggravating the real effective exchange rate in Namibia.

Therefore, the implication of these results for the Government of Namibia and the lawmakers is that, since borrowing secures much-needed funds to aid development, a hefty external debt load can also impact real exchange rate which will ultimately dampen economic growth and development via numerous means such as crowding out of private investment and public investment spending because of high-interest rate and debt servicing. Lawmakers need to strike a balance between excess external debt levels that could threaten development and sufficient debt levels that are plausible to stimulate economic growth.

5.3 Recommendations

From a policy perceptive, the findings of this study could help in formulating debt-oriented policies on the management of external debt. Lack of prudent debt management strategies as evidenced in this study, will partly lead to appreciation/ depreciation of real exchange rate. Policy makers need to ensure that both the level and rate of the growth of external debt are sustainable, that is, the debt sustainability indicator external debt to GDP ratio is at low levels and pursues strategies that will reduce excessive accumulation of external debt. Debt management needs to be linked to a clear macroeconomic framework, under which the Namibian Government will seek to ensure external public debt is sustainable. Prudent debt management strategy will greatly benefit Namibia by contributing to economic growth which one of the main objectives of economic policy and decision making.

In addition, policy makers urgently needs to ensure that external debt funds are only used for development in projects/ investments that could yield clear economic benefit because

repayment and debt servicing of external debt depletes foreign reserves that is much needed to pay for import of essential goods and services that the country currently has no capacity to produce.

Finally, the Namibian State should negotiate and contract foreign loans with concessionary low interest rates and long maturity periods.in addition, external loans should be serviced promptly and regularly to avoid the burdensome effect of accumulated compound interests.

5.4 Areas of further study

This study only analysed the relationship between external debt and real exchange rate. However, what still need to be explored on this study is to examine the relationship between the Namibian overall debt, (both domestic and external debt) and other determinants of real exchange rate such as interest rate differential, net capital flow, and domestic credit. This will add value for policymakers as it could unravel valuable evidence that can be used in determining the optimal mix of government debt and other determinants to warrant that the economy is performing at its optimal level.

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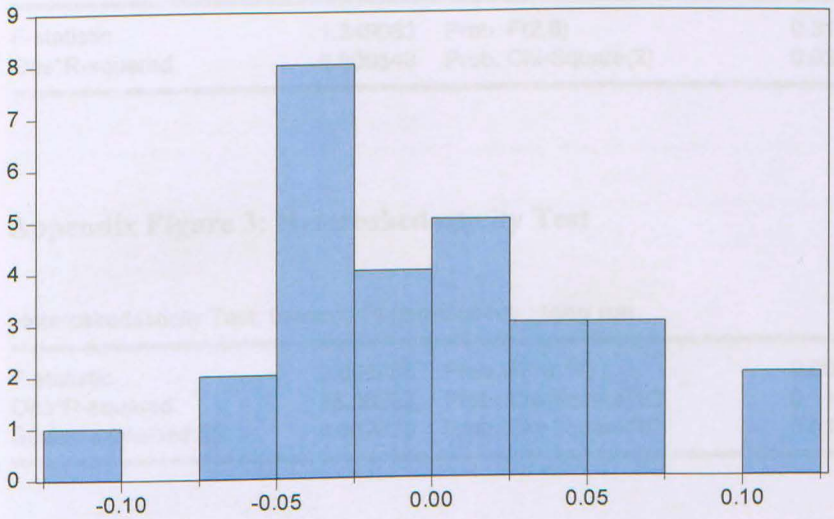
APPENDICES

Results of the Residual Diagnostic Tests

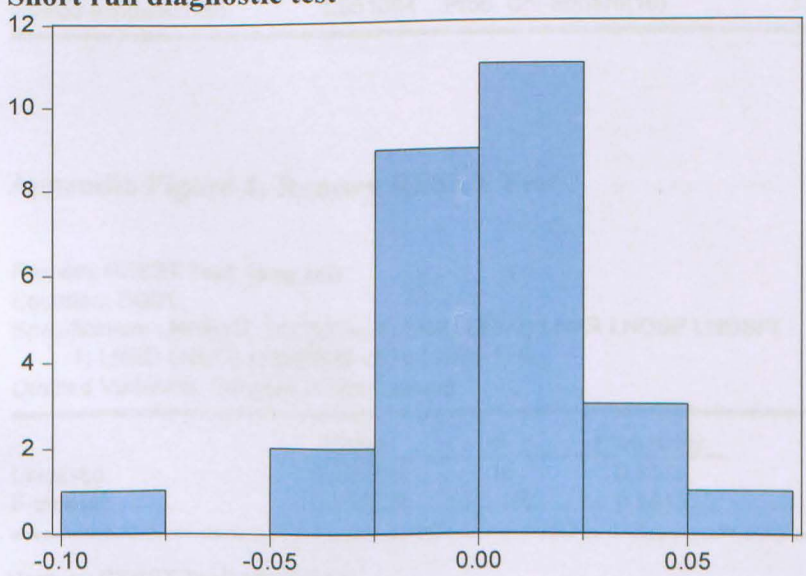
Appendix Figure 1: Normality test

Long run diagnostic test



Series: Residuals	
Sample 1992 2019	
Observations 28	
Mean	-3.49e-15
Median	-0.008600
Maximum	0.103968
Minimum	-0.101350
Std. Dev.	0.050666
Skewness	0.389725
Kurtosis	2.530261
Jarque-Bera	0.966230
Probability	0.616859

Short run diagnostic test



Series: Residuals	
Sample 1993 2019	
Observations 27	
Mean	-2.83e-18
Median	0.003445
Maximum	0.050379
Minimum	-0.093467
Std. Dev.	0.027084
Skewness	-1.287685
Kurtosis	6.598978
Jarque-Bera	22.03332
Probability	0.000016

Appendix Figure 1: Serial Correlation

Breusch-Godfrey Serial Correlation LM Test: **long run**

F-statistic	0.363931	Prob. F(2,15)	0.7009
Obs*R-squared	1.295799	Prob. Chi-Square(2)	0.5231

Breusch-Godfrey Serial Correlation LM Test: **short run**

F-statistic	1.349063	Prob. F(2,8)	0.3127
Obs*R-squared	6.809548	Prob. Chi-Square(2)	0.0332

Appendix Figure 3: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey : **long run**

F-statistic	2.066488	Prob. F(10,17)	0.0902
Obs*R-squared	15.36223	Prob. Chi-Square(10)	0.1194
Scaled explained SS	4.332830	Prob. Chi-Square(10)	0.9311

Heteroskedasticity Test: Breusch-Pagan-Godfrey: **short run**

F-statistic	0.144871	Prob. F(16,10)	0.9996
Obs*R-squared	5.080739	Prob. Chi-Square(16)	0.9953
Scaled explained SS	1.951094	Prob. Chi-Square(16)	1.0000

Appendix Figure 4: Ramsey RESET Test

Ramsey RESET Test: **long run**
Equation: EQ01
Specification: LNREER LNREER(-1) LNREER(-2) LNFR LNDSP LNDSP(-1) LNED LNED(-1) LNRMS LNRI LNRI(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.939329	16	0.3615
F-statistic	0.882338	(1, 16)	0.3615

Ramsey RESET Test: **short run**
Equation: EQ03
Specification: D(LNREER) D(LNREER(-1)) D(LNRI) D(LNRI(-1)) D(LNRI(-2)) D(LNRMS) D(LNRMS(-1)) D(LNRMS(-2)) D(LNFR) D(LNFR(-1)) D(LNFR(-2)) D(LNED) D(LNED(-1)) D(LNDSP) D(LNDSP(-1)) D(LNDSP(-2)) ECM(-1) C
Omitted Variables: Squares of fitted values

Value	df	Probability

t-statistic	4.211282	9	0.0023
F-statistic	17.73489	(1, 9)	0.0023

Appendix Figure 5: Unit Root Test for the External Debt

Level: Intercept

Null Hypothesis: LNED has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.721251	0.9905
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

Level: Trend Intercept

Null Hypothesis: LNED has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.586052	0.2887
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996)

1st Difference: Intercept

l Hypothesis: D(LNED) has a unit root
ogenous: Constant
g Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
gmented Dickey-Fuller test statistic		-5.924059	0.0000
t critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

cKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNED) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.415858	0.0001
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996)

Appendix Figure 6: Unit Root Test for Debt Service Payment

Level: Intercept

Null Hypothesis: LNDSP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.524151	0.1204
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996).

Level : Trend and Intercept

Null Hypothesis: LNDSP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.353591	0.0090
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996)

1st Difference: Intercept

Null Hypothesis: D(LNDSP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

	t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-9.045323	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNDSP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.811995	0.0036
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996)

Appendix Figure 7: Unit Root Test for Foreign Reserves

Level: Intercept

Null Hypothesis: LNFR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.159554	0.6778
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996)

Level : Trend and Intercept

Null Hypothesis: LNFR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.462867	0.0633
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996)

1st Difference: Intercept

Null Hypothesis: D(LNFR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.284988	0.0023
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNFR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.365830	0.0091
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996)

Appendix Figure 8: Unit Root Test for Real Money Supply

Level: Intercept

Null Hypothesis: LNRMS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.243227	0.1963
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996)

Level : Trend and Intercept

Null Hypothesis: LNRMS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.831033	0.1983
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996)

1st Difference: Intercept

Null Hypothesis: D(LNRMS) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.158571	0.0003
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNRMS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.365625	0.0009
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996)

Appendix Figure 9: Unit Root Test for Real Income

Level: Intercept

Null Hypothesis: LNRI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.268564	0.6302
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996)

Level : Trend and Intercept

Null Hypothesis: LNRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.873554	0.9458
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996)

1st Difference: Intercept

Null Hypothesis: D(LNRI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.040254	0.0043
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNRI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.035968	0.0191
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996)

Appendix Figure 10: Unit Root Test for Real Effective exchange rate

Level: Intercept

Null Hypothesis: LNREER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.712629	0.0841
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996)

Level : Trend and Intercept

Null Hypothesis: LNREER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.658327	0.2596
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996)

1st Difference: Intercept

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.261936	0.0002
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNREER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.169256	0.0014
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	