

AN EXAMINATION OF THE DETERMINANTS OF REAL EXCHANGE RATE IN
NAMIBIA

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ABSTRACT

This study examines the determinants of the real exchange rate in Namibia using annual time series for the period 1980 to 2014. The fundamental determinants of the real exchange rate in Namibia are openness, terms of trade, ratio of government expenditure to GDP and the ratio of investment to GDP. Time series properties were tested for stationarity using the Dickey Fuller-GLS test. The variables were found to be non-stationary but became stationary at their first differences. The study employed the Autoregressive Distributed Lag (ARDL) Bounds testing approach to co-integration to test for the existence of the long run relationships among the variables. The ARDL results confirm the presence of a long run relationship among the variables. The empirical investigations show that an increase in openness appreciates the real exchange rate while terms of trade, ratio of government expenditure to GDP and the ratio of investment to GDP depreciate the real exchange rate. However, the ratio of investment to GDP appreciates the real exchange rate in the short run. Openness and terms of trade are the only variables that significantly determine the real exchange rate in the long run while in the short run, the real exchange rate is only determined by terms of trade.

DECLARATION

I, Tusnelde Namutenya Fillemon, 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.

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(x)

DEDICATION

I dedicate this thesis to my mother, Rosalia Shilongo for her unconditional love and support.

CHAPTER ONE: INTRODUCTION

1.1 Orientation to the Study

The real exchange rate is an important player in the growth of an economy as both its level and stability are important in driving up exports and private investment. The agreement in policy circles in developing nations is that the main objective of exchange rate policy should be to reduce persistence in misalignment, which is a common issue in most developing countries (Hamdu, 2013). However, in order to manage misalignments, it is relevant to identify what determines the real exchange rate. Importers, exporters, investors and the monetary authorities are all concerned with the behavior of the exchange rate, as it directly or indirectly affects them.

The real exchange rate as defined by Pilbeam (2006) is the nominal exchange rate adjusted for relative price level between the countries under consideration. It is normally expressed in index form as: $Sr = S \frac{P^*}{P}$

Where Sr is the index of the real exchange rate, S is the nominal exchange rate (foreign currency units per unit of domestic currency) in index form, P is the index of the domestic price level and P^* is the index of the foreign price level.

Bhattarai and Armah (2013) point out that the real exchange rate has been used as a tool for regulating flows of trade and capital by many developing economies, which tend to have persistent deficits in the balance of payments because of a structural gap between

the volumes of exports and imports. These economies tend to have inelastic demand for both exports and imports. In addition, the rate of growth of imports is often higher than the rate of growth of exports resulting in rising imbalances in trade. The real exchange rate is usually used as an indicator of the need for devaluation of a country's currency. An appreciation in the real exchange rate may signify that a country may experience current account difficulties in the future because it usually leads to an overvaluation of the exchange rate. Overvaluation makes imports temporarily cheaper for consumers and making exports relatively expensive for producers and foreign consumers; hence a reduction in the external competitiveness of a country.

The deviation of the real exchange rate from the equilibrium real exchange rate is referred to as misalignment (Montiel, 2003). Real exchange rate misalignment can lead to a distortion in price signals that affect the allocation of resources in the economy. In developing countries, misalignment in the real exchange rate has often taken the form of overvaluation, which adversely affects the tradable goods sector or export sector (Otieno, 2013). Overvaluation results in a real decline in the price of foreign goods relative to domestic goods. A decline in the price of foreign goods in terms of domestic goods has two primary effects on the export sector. First, on the production side, fewer resources will be allocated towards producing goods that can be exported, since these goods will be expensive for foreigners; at the same time, production of local substitutes for foreign goods will also decline, these both affect the current account. Secondly, on the consumption side, a fall in the price of foreign goods relative to domestic goods will stimulate domestic spending on foreign goods. The net effect is making exports less

competitive in foreign markets, while stimulating imports, hence a current account deficit. In addition, when the real exchange rate is perceived to have become excessively misaligned, the expectation will be created that it will adjust towards its equilibrium level in the future. Importers, exporters, investors and the monetary authorities are all concerned with the behaviour of the exchange rate, as it directly or indirectly affects them. The behaviour of the exchange rate is therefore a useful indicator of economic performance that needs to be understood.

Overview of the Exchange Rate Policies in Namibia

As in the case of many developing countries, Namibia adopted a fixed exchange rate regime, shortly after independence (1990), which dictates its monetary policy conduct. The Namibian currency, well known as the Namibia Dollar (N\$), replaced the South African Rand (R) which had been the country's currency while it was under South African rule as South-West Africa from 1920 until 1990. The Rand is still legal tender, as the Namibian Dollar is one on one pegged to the South African Rand and can be exchanged locally. However, the Namibian Dollar cannot be used in South Africa (Kalenga, 2001).

Namibia intends to remain in this arrangement due to an array of benefits such as prevention of high inflation and transaction cost payments. Inflation in Namibia is generally lower than the average inflation in Sub Saharan Africa. This benefit is attributed to the pegging of the currencies, which results in low and stable prices of Namibia imports from South Africa. Delinking the Dollar from the Rand could hence

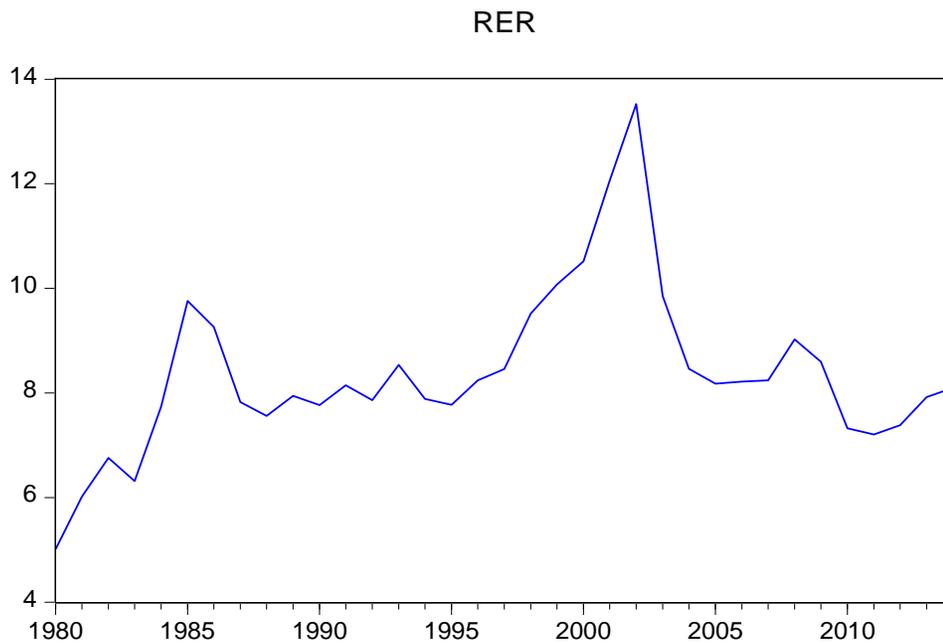
compromise this benefit and lead to high inflation. Furthermore, Namibians who import goods from South Africa are exempted from paying transaction costs, which would have been required if the Namibia Dollar was not linked to the Rand. Imports from South Africa are therefore presently less expensive than they would be if the Namibian Dollar was delinked. An exemption of transaction costs is a great advantage to Namibia since about 65% of goods consumed in Namibia are imported from South Africa (The Villager Newspaper, March 2015).

Developments in exchange rate and monetary policy in Namibia are viewed in the context of the country's colonial relationship with South Africa. South African Reserve Bank opened its branch in Windhoek in 1961. The Windhoek branch was responsible for the distribution of notes and coins, administration of exchange controls and acting as banker to commercial banks. Namibia faced a choice on whether to remain in the Common Monetary Area (CMA) or to have an independent monetary system by leaving the CMA and explore some alternative exchange rate regimes. Namibia formally joined the CMA on 6 February, 1992 (Van der Merwe, 1996). This membership was formalized by accession to both the multilateral agreement between Namibia, Lesotho, Swaziland and South Africa in 1990 and a separate agreement between each country and South Africa in 1992 (Kalenga, 2001).

The CMA is an asymmetric currency union dominated by South Africa. Namibia's currency, the Namibian Dollar, is pegged to the South African Rand on a one to one basis. Within a monetary area, exchange rates between the participating countries are

fixed and there are no payment restrictions. The CMA has many of the characteristics of a monetary union, as the exchange rates vis-à-vis other member states are fixed and capital flows are free. As a consequence, interest rates and the money supply cannot be directly influenced by an individual country (Alweendo, 1999). The following graph demonstrates the changes in real exchange rate between 1980 and 2014.

Figure 1.1: The Real Exchange Rate in Namibia



The graph above shows a rapid depreciation of the real exchange rate from 1983 to 1985 caused by an increase in the domestic prices relative to foreign prices. A sharp depreciation and appreciation of the real exchange rate from 1996 to 2004 was determined by the changes in the nominal exchange rate.

1.2 Problem Statement

The real exchange rate is believed to be a good measure for a country's international competitiveness, hence it should always be at its equilibrium level. The recent depreciation of the South African Rand caused a massive depreciation of the Namibian Dollar. These developments might result in Namibia facing real exchange rate misalignments. A study by Eita and Jordaan (2013) shows that there were periods of undervaluation and overvaluation of Namibia real exchange rate and this simply means that the real exchange rate was misaligned. Miyajima (2009) also found that the nominal depreciation in the Namibia Dollar in 2002 caused by a steep depreciation in the South African Rand created historically one of the largest deviations of the real exchange rate from its equilibrium level.

Real exchange rate misalignment has a negative impact on the economic performance and macroeconomic stability of a country. It causes an increase in economic instability and distorts investment decisions, which results in welfare and economic loss. Real exchange rate misalignment in terms of overvaluation could affect export performance, since overvaluation reflects a loss in a country's competitiveness and misallocations of resources towards the non-tradable sector (Kasie, 2015). Capital flight, which may be optimal from a private perspective but a substantial cost in terms of social welfare, may also occur due to the misalignment of the real exchange rate. Controlling of misalignments requires a thorough examination of the determinants of the real exchange

rate. It is against this background that the study examines the determinants of real exchange rate in Namibia.

1.3 Research Objective

The ultimate objective of this study is to examine which factors influence the real exchange rate in Namibia.

1.4 Hypothesis

The study will test the following research hypothesis:

H_0 : Real exchange rate is not influenced by Trade openness, Terms of Trade, ratio of Government Expenditure to GDP and the ratio of investment to GDP.

H_1 : Real exchange rate is influenced by Trade openness, Terms of Trade, ratio of Government Expenditure to GDP and the ratio of investment to GDP.

1.5 Significance of the Study

The real exchange rate has been a policy target in most exchange rate regimes whose aim is to maintain a stable and competitive real exchange rate. A number of researchers have argued that real exchange rate is crucial not only for attaining sustained general economic performance and international competitiveness, but has a strong impact on resource allocation amongst different sectors of the economy, foreign trade flows and balance of payments, employment, structure of production and consumption, and

external debt crisis (Edwards, 1989; Aron, Elbadawi, Ibrahim & Kahn, 1997; Edwards & Savastano, 1999).

It is therefore significant to analyze the determinants of the real exchange rate in a developing country like Namibia because of the following reasons: Firstly, the recent depreciation of the South African Rand has caused a massive depreciation in the Namibian Dollar and this greatly affects Namibia's economic performance. As a result, the economy is hit with high inflation and interest rates. The cost of imported goods for consumers has also risen, making it more expensive for consumers to purchase items such as imported electronics or other durable and semi-durable items. Secondly, the real exchange rate is an instrumental tool in determining an economy's international competitiveness. Its movement may either overstate or understate changes in a country's international competitiveness position. In other words, a depreciation of real exchange rate has a positive influence on the export sector while the real appreciation of the local currency tends to reduce the external competitiveness of a country. A more competitive exchange rate improves competitiveness, and in turn, exports performance. The study will help policy makers to make informed decisions in prescribing effective economic policies to avoid the misalignment of the real exchange rate. Lastly, this study will also serve as literature to researchers who may wish to research further within this area of study in the future.

1.6 Outline of the Study

The study is divided into five chapters. Chapter One presents the introduction and the background of the study. Chapter Two reviews both the theoretical and empirical literature on the determinants of real exchange rates. Chapter Three presents the methodology of the study. This includes the model specification, estimation techniques and data descriptions. The model estimation, discussion and presentation of results as well as diagnostic tests are also reported and analyzed in Chapter Four. Chapter Five ends the study with conclusions and policy recommendations.

1.7 Limitations

The study was limited due to the unavailability of data on some of the variables intended for this study. The study was also limited to the use of the Namibian nominal exchange rate, since the Namibian currency does not trade on the international market. Therefore, the South African nominal exchange rate was used in the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Review

There is abundant literature and theories about the determination of exchange rates. These theories view the exchange rate as a purely financial phenomenon for the most part. The different theories behind exchange rate determination are discussed below.

2.1.1 Purchasing Power Parity (PPP)

While the origins of the PPP concept can be traced back to the Salamanca School in 16th-century Spain, its modern use as a theory of exchange rate determination began with the work of Gustav 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: $PPP = S = \frac{P}{P^*}$, where, 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 under valuations 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. If not, arbitrage will occur. The purchasing power parity is classified in two versions: the Absolute purchasing power parity and the Relative purchasing power parity. 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 $PPP = S = \frac{P}{P^*}$, 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.

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 nor 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).

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 $\Delta \ln P^*$ 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 as cited in Hamdu, 2013).

2.1.2 Interest Rate Parity (IRP)

The theory of interest rate parity can be traced back to 1923 and was developed by Keynes, who links the exchange rate, interest rate and inflation. This theory has two variations: covered interest rate parity (CIRP) and uncovered rate interest parity (UIRP). The covered interest rate parity states that when measures have been taken to avoid foreign exchange risk, the rates of return on investment and the cost of borrowing will be equal irrespective of the currency denomination of the investment or the currency borrowed. If the condition of risk-free arbitrage exists, then the spot exchange rate should be equal to the difference in interest between assets (Rusydi & Islam, 2007). The uncovered interest rate parity predicts that high yield currencies should be expected to depreciate. It also predicts that, *ceteris paribus*, a real interest rate increase should appreciate the currency. UIRP is one of the cornerstones of international finance, constituting an important building block of most important exchange rate determination theories such as the monetary exchange rate model (Bekaert, Wei & Xing, 2007).

2.1.3 The Balassa-Samuelson Approach or Effect

Balassa and Samuelson (1964) considered an economy to split into two sectors: tradables and non-tradables. They assumed that demand and supply are at work in both sectors; wages are linked to the level of productivity in the open sector; tradable prices are equal in each country; therefore, PPP holds in the open sector, while the increase in

labour productivity is higher in the tradable sector than in the non-tradable sector; and wages tend to equalize between sectors. They also considered the developing countries having lower productivity level in the open sector than the developed countries. Considering the above-mentioned hypothesis, if the home country is in a catching-up process with the developed economy, productivity tends to increase in the open sector, so there is a possibility of wage increase in tradable sector without any inflationary effect. However, due to the wage equalization assumption between sectors, the productivity gain in the open sector will create inflationary pressures in the non-market based sector. In this way, the overall price level will rise faster in the home country (creating a positive inflation differential vis-à-vis the foreign country) than in the foreign country because of the positive productivity differential between sectors in the home country, which in turn will result in a real appreciation of the home country's real exchange rate. This phenomenon is known in literature as the Balassa-Sameulson effect to which the trend appreciation of the real exchange rate in the developing countries can be attributed (Hamdu, 2013).

2.1.4 Monetary Approach to Exchange Rate Determination

There are three monetary models of exchange rate determination, namely the flexible-price, the Frankel sticky-price and Dornbusch real interest differentials models. The flexible-price monetary model was developed by Frenkel (1976), Mussa (1976) and Bilson (1978). The model assumes that goods prices are flexible and that the purchasing power parity holds continuously. The flexible-price monetary model is based upon the premise that all prices in an economy are fully flexible; bonds are perfect substitutes 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 PPP. Despite the shortcomings and reliance of the monetarist model on PPP, the flexible-price monetarist model is an important 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 Dornbusch sticky-price monetarist model was developed by Rudiger Dornbusch (1976). The basis underlying this 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 slowly over time in response to various shocks from such money supply. Prices and wages are resistant 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 matched by corresponding price movements and there can be persistent and prolonged departures from PPP.

In the Dornbusch model the UIP 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 important 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.

Jeffrey 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 ‘sticky-price’ 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.

2.1.5 Portfolio Balance Approach to Exchange Rate Determination

The Portfolio Balance Approach determines the exchange rate as the relative price of money in the short run. It takes into consideration the diversification of investors' portfolio assets. Diversification is a technique that attempts to reduce risk by investing both among various financial instruments and across national borders. The asset substitution effects and the nature of expectations formation place more emphasis on short run capital flows rather than the Trade balance. In general, the short run impact of policies can be quite different from the long run impact, depending on the nature of the expectations. Exchange rates should implicitly behave the same as asset prices in speculative markets. The portfolio balance is an important contribution to the exchange rate literature as it plays a role for changes in perceived risk or risk-aversion in the determination of the exchange rate (Pilbeam, 2006).

2.2 Empirical Review

Faruqee (1995) used postwar data for the United States and Japan, examined the long-term determinants of the real exchange rate from a stock-flow perspective using data from 1950 to 1990. Applying recent co-integration techniques, co-integration analysis supports the finding that the structural factors underlying each country's net trade and net foreign asset positions determine the long-term path for the real value of the Dollar and the Yen. The empirical analysis also provides estimates for the underlying stochastic trend in each real exchange rate series.

Aron et al. (1997) used a co-integration framework to investigate the short-run and long run equilibrium determinants of the real exchange rate in South Africa from 1970 to 1995. The results showed that the real exchange rate was not constant over time, but responded to changes in a range of fundamentals and shocks to the economy. The difference between South Africa's inflation rate of around 7 percent and the OECD (Organization for Economic Cooperation and Development) average of around 2 percent, a fall in competitiveness of 5 percent per annum was taking place if the nominal exchange rate was assumed to be held fixed.

Antonopoulos (1999) tested the “Shaikh hypothesis” which explains that the real exchange rate is determined by the ratio of relative real unit labor costs as a proxy for productivity differentials of tradable goods between two countries. The author used co-integration methodology on Greece's data for the period of 1960 to 1990. The study provides evidence that there is a less significant role of net capital inflows and also

movements of the real exchange rate (RER) cannot be clarified by the PPP hypothesis. However, it suggests that improvement in the export sector can appreciate the country's real exchange rate.

Chowdhury (1999) examined the determinants of real exchange rate in Papua New Guinea by employing annual data for the period 1970 to 1994. The theoretical analysis of this study was based on the two-goods tradables and non-tradables. The study used the Dickey Fuller procedure as well as the Augmented Dickey Fuller approach to co-integration. The findings are consistent with the predictions of the model. The researcher suggests that nominal devaluation plays a major role in determining real exchange rate behavior, whereas an improvement in external terms of trade seems to have no long run effect on the trade-weighted real exchange rate. Net capital inflow, foreign aid, trade restrictions and expansionary macroeconomic policies tend to cause the real exchange rate of Papua New Guinea to appreciate.

Mkenda (2001) analyzed the main determinants of the real exchange rate in Zambia and estimated the degree of misalignment in the real exchange rate. The study used the Dickey Fuller procedure as well as the Augmented Dickey Fuller approach to co-integration. Johansen co-integration analysis was employed in identifying and estimating the long-run determinants of the real exchange rates in Zambia. Terms of trade, investment share, and government consumption, were found to influence the real exchange rate for imports in the long run, while terms of trade, central bank reserves and trade taxes were found to be the long-run determinants of the real exchange rate for

exports. The internal real exchange rate is influenced by terms of trade, investment share, and the rate of growth of real *GDP* in the long run. Besides the difference of the fundamentals mentioned above, aid and openness are found to impart short-run effects on the real exchange rate indices. The coefficients of adjustment are found to be, respectively, -0.38, -0.79 and -0.80 for the real exchange rates for imports and exports, and for the internal real exchange rate.

Fernandez, Osbat and Schnatz (2001) did an empirical analysis of the medium-term determinants of the euro effective exchange rate. The empirical analysis built on synthetic quarterly data from 1975 to 1998, and derived a Behavioural Equilibrium Exchange Rate (BEER) and a Permanent Equilibrium Exchange Rate (PEER). The econometric methodology employed in the paper was the Johansen's co-integration analysis to identify the long-run relationships among the variables as well as the Augmented Dickey Fuller (ADF) unit root test. The main determinants used in the study were productivity differentials, real interest rate differentials, government expenditures, time preferences, net foreign assets evolution and the terms of trade. The Euro appears to be mainly affected by productivity developments, real interest rate differentials, and external shocks due to the oil dependence of the Eurozone. The Behavioural Effective Exchange Rates (BEER) obtained from the co-integrating vectors were compared with the Permanent Effective Exchange Rates (PEER) obtained using the Gonzalo-Granger decomposition. The two measures indicated that in the seventies, the Euro was close to its fundamental value (or slightly overvalued) and in the first half of the nineties. Equally, they detected a sizeable undervaluation in the first half of the eighties. During

the first year after its launch, the Euro experienced a strong depreciation in effective terms. While the estimated models account for some of that depreciation, they also unanimously indicated undervaluation by the end of 1999. All four models in the course of 2000 suggested that the Euro deviated further from equilibrium, which supports the judgment that the Euro was undervalued in effective terms towards the end of 2000.

Bagchi, Chortareas and Miller (2003) examined the effects of the terms of trade and the expected real interest rate differential on the real exchange rate in a sample of small open developed economies from 1975 to 1995. They considered the terms of trade and the long-term expected real interest rate differential as exogenous fundamental determinants of the long-run real exchange rate in small open developed economies, This suggests that the terms of trade and the expected real interest rate differential proved important in explaining the long-run real exchange rate of small open developed economies in the post-Bretton-Woods era. For the small open developed economies in our sample, a long-run equilibrium relationship exists among the real exchange rate, the terms of trade, and the long-term expected real interest rate differential. The terms of trade prove an important and non-excludable element in each co-integrating relationship, while the expected real interest rate differentials prove excludable in two countries.

Sorsa and Chobanov (2004) empirically analyzed the medium and long-term determinants of the real (effective) exchange rate (RER) of the Bulgarian lev using elements from the natural real exchange rate (NATREX) and the behavioral equilibrium exchange rate (BEER) approaches. Using quarterly data from 1998 to 2003, the authors

constructed an econometric model to analyze the medium-term and long-term dynamics of the real exchange rate. The findings show that appreciation of the real exchange rate in Bulgaria reflects changes in fundamentals, such as productivity, terms of trade, gross savings, world interest rates, and foreign direct investment.

Macdonald (2004) used the BEER approach to identify a long-run equilibrium exchange rate for the real effective exchange rate of Singapore. Using quarterly data from 1983-2003, the multivariate co-integration methods of Johansen demonstrated that there is a statistically significant co-integrating vector.

Korsu and Braima (2005) investigated the determinants of the real exchange rate for Sierra Leone using annual aggregate data from 1970 to 2005. These authors observed that previous studies on the determinants of real exchange rate in developing countries only captured the effects of nominal exchange rate on the real exchange rate without capturing the effects of price changes; thus, their study considered the effects of price changes. The study employed the Dickey Fuller class of tests and the Phillips-Peron Unit root test for stationarity and the Engle-Granger test for co-integration. The equilibrium real exchange rate model shows that improvement in the terms-of-trade and an increase in capital inflow depreciates the equilibrium real exchange rate. Capital accumulation, increase in output, increase in government expenditure and trade restrictions appreciate the equilibrium real exchange rate.

Eita and Sichei (2006) estimated the equilibrium real exchange rate and the resulting real exchange rate misalignment in Namibia using annual data for the period 1970 to 2004. The study employed the Johansen's Full Information Maximum Likelihood (FIML) to investigate the existence of a long-run co-integrating relationship. The study used real effective exchange rate, terms of trade, openness of the economy and ratio of investment to GDP as variables. An increase in openness and ratio of investment to GDP caused the real exchange rate to appreciate. The real exchange rate was overvalued for almost the entire estimation period. It reached its equilibrium value in 1998 and this leaves suggestions to policy makers to monitor the real exchange rate regularly and correct misalignments. It is important to note that, while Eita and Sichei used the real effective exchange rate, terms of trade, openness of the economy and ratio of investment to GDP as their variables, this study has included the ratio of government expenditure to GDP as one of the variables.

In South Africa, Takaendesa (2006) analyzed the main determinants of the real exchange rate and the dynamic adjustment of the real exchange rate, using quarterly South African data covering the period 1975 to 2005. In the study, co-integration and vector autoregression (VAR) analysis are augmented with impulse response and variance decomposition analysis to provide robust long-run effects and short-run effects on the real exchange rate. The estimate of the speed of adjustment coefficient found in this study indicates that about a third of the variation in the real exchange rate from its equilibrium level is corrected within a quarter. The author established that terms of trade, the real interest rate differential, domestic credit, the degree of openness of the

economy and technological progress have a long-run impact on the real exchange rate. Terms of trade, domestic credit and degree of openness of the economy have significant influence on the real exchange rate in the short run. Shocks to the terms of trade and domestic credit have persistent effects on the real exchange rate. The most interesting result of this study which is supported by previous research is that among other determinants, the terms of trade explain the largest proportion of the variation in the real exchange rate. This evidence shows that real exchange rate fluctuations are predominantly equilibrium responses to real and monetary shocks rather than fiscal policy shocks.

Grigoryan and Dallakyan (2007) modeled the equilibrium real exchange rate (ERER) of Armenia. Since Armenia has a short-run time series problem which does not allow estimating the Vector Error Correction (VEC) model, the authors used co-integrating equations in the form of a restricted single-equation model. The long-run equilibrium real exchange rate appreciated by 23.75 percent, where 6.3 percentage point of appreciation (26.4% of total appreciation) was due to acceleration of capital inflow, 3.9 percentage point (16.4% of total appreciation) was due to an increase in share of government investments in GDP, and 13.6 percentage point appreciation (57.2% of total appreciation) was due to increase in the share of transfers in GDP. The real exchange rate till 2002 was overvalued because of crisis in the Russian Federation and the periodic selling of foreign currency by the CBA for neutralization of the expectations of depreciation.

Daboh (2007) investigated the determinants of both the actual and equilibrium real exchange rate (ERER). In order to address the objectives of the study, annual aggregate data from 1970 to 2006 were used to estimate a small macroeconomic model. The Ordinary Least Squares (OLS) was used to estimate the short-run dynamics, with error correction consideration. The results for the four countries’ models confirmed the significance of variables such as the terms of trade, openness, government expenditure, investment as a share of GDP, GDP growth rate, capital flows, domestic credits, nominal and real exchange rate (lagged) in line with Edwards’ (1989) model, but not in one single country model. The speed of adjustment of the real exchange rate to equilibrium ranges from one year in the Gambia to four years in Nigeria. What stands clear is that all the countries’ real exchange rate was found to be misaligned, and the incidence was very high in the fixed exchange rate regime than the managed float regime.

Zwanzger (2008) analyzed the relationship between the exchange rate movements of two countries, Chile and the United States, by studying the underlying fundamentals given by the modern exchange rate theory. The author used monthly data from January 1990 to March 2008. A simple linear regression analysis was used to analyze the data. Monetary policy interest rate, money supply and inflation rates were used in the regression analysis for both countries under consideration. The author also included a fourth variable: Copper price. Copper was considered because of its increasing importance in the Chilean economy. Chile is the biggest producer and exporter of copper worldwide and Exchange rate movements seemed to move in concordance with variations in international copper prices. The results obtained show that the determinants

of the exchange rate may vary over time. The independent variables that have an effect on the exchange rate may lose their explanatory power when economic conditions change or when there is a switch in the foreign exchange rate policy dictated by central banks.

Su (2009) estimated the time varying values of the equilibrium real effective exchange rate and associated exchange rate misalignments for China. The study employed the Johansen-Juselius (1990) co-integration procedure on the quarterly data for the period 1990 to 2007. The study focused on the reduced-form equilibrium real exchange rate model for developing countries presented by Elbadawi (1994) and followed Edwards' (1989, 1994) work on models of exchange rate determination. Using the terms of trade, openness, government expenditure, productivity, and money supply as important explanatory variables, the results show that there is a co-integrating relationship between the real effective exchange rate and its economic fundamentals. The RMB was undervalued by an average of 6.7 percent during the period 2005-2007. Furthermore, the short-run empirical error correction model indicates that, on average, the real exchange rate took over one quarter to reach its long-run equilibrium level.

Eslamloueyan and Kia (2009) developed and estimated a model of the real exchange rate for oil-producing countries in the Middle East and North Africa (MENA) for the period of 1985-2009. Using the Engle-Granger co-integration method, the model takes into account external crises, debt and deficits for the period 1985 to 2009 using a panel-data of eleven MENA oil-producing countries, i.e., Algeria, Bahrain, Egypt, Iran, Kuwait,

Libya, Oman, Qatar, Saudi Arabia, Syria, and United Arab Emirates. The study found that the main determinants of the real exchange rate over the long run in these countries are: money supply, domestic real GDP, government expenditure, oil price and the USA externally financed debt per GDP. However, neither the domestic and USA interest rates nor the USA debt per GDP have any impact on the real exchange rate over the long run in these countries. In the short run, however, the changes of the domestic and USA interest rates as well as the USA debt per GDP influence the growth of the real exchange rate in these oil-producing countries. The USA stock market crisis of 1987 and the economic crisis of 2008 had a short-term negative impact on the real exchange rate for oil producing and exporting countries.

Grenade and Riley (2009) employed the standard behavioural exchange rate approach to modeling exchange rate equilibrium. The study exploited panel co-integration techniques to estimate the equilibrium REER for each of the ECCU member countries for the period 1990 to 2007. The most important explanatory variables were found to be the terms of trade, government consumption and capital inflows. Specifically, increases in government consumption and capital inflows are associated with an appreciation of the REER, while decreases in the terms of trade are associated with a depreciation of the REER on average.

Martínez-Hernández (2010) presented an alternative approach to the real exchange rate determination based upon a classical approach to the theory of competition developed by Shaikh (1980, 1991, 1998 and 1999b). The empirical analysis covered the period 1970 to

2004. The fundamental outcome of this alternative theory is that the long-run real exchange rate can be pinned down by the vertically integrated real unit labor cost ratios of the tradable sectors of the transacting countries, when adjusted for differences in the price levels of a common standard wage-bundle of goods. The result implies two things: firstly, that neither the absolute nor relative versions of the PPP will generally hold; secondly, that devaluations will not have a lasting effect on trade balances, unless they are accompanied by fundamental changes in real production costs of nations. In addition, the empirical results of the alternative model showed that, in contrast to the PPP hypothesis, the real unit labor cost of the manufacturing sector between the USA and Mexican economies is a perfect approximation to estimate the real exchange rate.

Bergvall (2010) used quarterly data for the period 1975 to 2001 to examine the long-term forces driving the real exchange rate for the Nordic Countries (Denmark, Finland, Norway and Sweden). The study employed the Johansen maximum likelihood method of co-integration. The author found that most of these variables are important determinants of long-run movements in the real exchange rate. Exogenous terms-of-trade shocks are found to be the most important determinants of long-run movements in the real exchange rate for Denmark and Norway. For Finland, most of the long-run variance in the real exchange rate is due to demand shocks. Finally, for Sweden, most of the long run variance is due to demand shocks, although supply and exogenous terms-of-trade shocks also have a substantial influence on the long-run variance in the real exchange rate.

Alomoom (2010) empirically investigated the determinants of the real exchange rate and the role of the fundamental factors in New Zealand's economy. The study used quarterly data covering the period 1974 to 2009. The author applied Multivariate co-integration, Granger causality and unit root techniques to identify the relationship between the real exchange rate and its economic determinants. The thesis also checked the validity of the model and the relative importance of different variables which may have an impact on the real exchange rate policy of New Zealand's economy. The empirical findings obtained show that terms of trade, relative productivity, capital inflows and government consumption are insignificant, whilst the domestic credit, the growth in the official nominal exchange rate and openness are significant indicators in the long run. In the short-run period, relative productivity, the growth in the official nominal exchange rate and openness are the variables which may have an impact on the real exchange rate of New Zealand's economy.

Ndjoku-Ivoke (2011) analyzed the determinants of the real exchange rate and the dynamic adjustment of the real exchange rate in Nigeria. The author used annual data covering the period 1975 to 2010. The Dickey Fuller test of unit root was used to test for stationarity and the Johansen co-integration and vector auto-regression with impulse response and variance decomposition analyses to provide the long-run and short-run effects on the real exchange rate. The findings obtained reveal that an increase in real interest rate differential appreciates the real exchange rate in the long run, while a more open economy depreciates the real exchange rate.

Hangsasuta and Jiravanichsakul (2011) used quarterly data from 1993 to 2010 to examine the explanatory variables that can affect the real exchange rate. The study aimed at investigating the way in which real exchange rate misalignment relates to the Thai economy regarding the financial crisis, capital control policy imposed by the Central Bank of Thailand (BOT), and import/export. The result revealed real exchange rate misalignment, i.e., overvaluation in the period before the 1997 Asian financial crisis and before USA subprime crisis in 2008. These misalignments of real exchange rate correspond to the intervention from BOT.

Saeed, Awan, Sial and Sher (2012) have undertaken an econometric analysis of determinants of exchange rate for the American Dollar in terms of the Pakistani Rupee within the framework of monetary approach. Monthly data from January 1982 to April 2010 for Pakistan to USA have been used to examine the long run and short run behavior of PKR/USD exchange rate and relationship of exchange rate behavior with relative monetary variables. The study applied the ARDL approach to co-integration and the error correction model. The stock of money, foreign exchange reserves and total debt of Pakistan relative to United the States along with political instability in Pakistan as a dummy variable were found to be the determinants of PKR/USD exchange rate during the managed floating regime in Pakistan. Empirical results however confirm that stock of money, debt and foreign exchange reserve balance all in relative terms are significant determinants of exchange rate between the Pakistani Rupee and the USA Dollar. Moreover, political instability has a significant negative effect on the value of domestic currency.

Oriavwote and Oyovwi (2012) investigated the determinants of the real exchange rate in Nigeria using data covering 1970-2010. They used real effective exchange rate as a function of the ratio of capital flow to Gross Domestic Product (GDP), terms of trade, an indicator of the degree of openness, the ratio of government spending (fiscal policy) to GDP, measure of technological progress (Balassa-Samuelson effect), nominal effective exchange rate, Real Gross Domestic Product and rate of inflation. The variables were tested for unit root as well as co-integration and their short run dynamic relationship using Hendry's general-to-specific model. The long run equilibrium real exchange rate was analyzed using the Johansen maximum likelihood technique. Their findings from the error correction model show that, an increase in the price level, capital inflow, capital accumulation and trade openness appreciates the real effective exchange rate and an increase in the nominal effective exchange rate and output depreciate the real effective exchange rate in Nigeria.

In Nigeria, Udousung, John and Umoh (2012) analyzed the exchange rate determinates in Nigeria using six variables, namely: balance of payment, fiscal deficit, import tax, openness of the economy, trends and exports tax. Data used covered the period 1971 to 2000. The purpose of the study was mainly for analysis and policy-making. Multiple regression analysis was used to evaluate the relationship between the dependent variable and the explanatory variables. The economic relationship of the coefficients was estimated using the Ordinary Least Squares (OLS) because of a single-equation model used in the study. The findings show that the coefficient of import tax, export tax, openness and trend all show a positive relationship with the real exchange rate. This

implies that an increase in these variables would raise the real exchange rate and thus trigger its real depreciation and improve its competitiveness. The coefficient of fiscal deficit and balance of payment show a negative relationship with the real exchange rate. An increase in these variables will bring about a depreciation of the real exchange rate.

Jager (2012) investigated the various factors that may have an impact on the level of the exchange rate, and estimated a suitable model to measure the level of the equilibrium of real effective exchange rate. Employing quarterly data from 1982 to 2012, the study estimated a vector error correlation model to generate a long-run equilibrium level of the real effective exchange rate by separating the long-run co-integrating equation from its short-run VAR dynamics. The results from the model suggest that the equilibrium level may be determined by the effects of key economic fundamentals, including an interest rate differential, a suitable productivity measure, commodity prices, the fiscal balance and capital flows. The estimated results of the study suggest that the real effective exchange can deviate from its equilibrium during protracted periods of time. In fact, the equilibrium level of the real effective exchange rate was roughly 20 percent less depreciated when compared to the actual level of the exchange rate during the late 2001 and early 2002 period, which suggests that it was not the fundamentals that were driving the severe depreciation of the Rand, but that it was rather the result (or consequence) of various other external factors, including the speculation against the currency.

Musyoki, Pokhariyal and Pundo (2012) examined the real exchange rates misalignment in Kenya using the Johansen co-integration and error correction technique which are

based on a single equation and Vector Autoregressive (VAR) specification. The results show that during the study period, the actual real exchange rate was more often than not above its equilibrium value in the period between June 1993 and December 2009, implying that the real exchange rate was generally overvalued. Kenya's real exchange rate exhibited an appreciating trend, which implies that the country's international competitiveness deteriorated over the study period. Real exchange rate misalignment continued to hamper the country's economic growth due to the failure of the adopted floating exchange rate regime.

Uddin, Quaosar and Nandi (2013) examined the factors affecting the fluctuation in exchange rate of Bangladesh using the co-integration approach. The study adopted an econometric analysis of determinants of exchange rate for US Dollar in terms of the Bangladeshi currency (BDT) within the framework of monetary approach. Monthly time series data from January 1984 to April 2012 for Bangladesh relative to USA have been used to examine the long run and short run behavior of BDT/USD exchange rate. The variables used are the stock of money, foreign exchange reserves and total debt of Bangladesh relative to United States. A dummy variable representing Political Instability in Bangladesh as the determinant of nominal exchange rate of Bangladeshi Taka against the US Dollar has also been incorporated. The Augmented Dickey Fuller (ADF) test was used to test for stationarity of variables. The autoregressive distributive lag (ARDL) approach to co-integration has also been applied to estimate the long run relationship between the nominal BDT/USD exchange rate and explanatory variables. The results obtained show that real exchange rate and the macroeconomic variables affecting real

exchange rate forms a co-integrating vector. An increase in stock of money and debt service result in a real depreciation of the currency, while increasing foreign exchange reserve results in a real appreciation of currency. Moreover, political instability has a significant negative effect on the value of domestic currency.

Eita and Jordaan (2013) estimated the real exchange rate misalignment and investigated its impact on economic performance and competitiveness of Namibia using annual data covering the period 1970 to 2011. They applied the model of Edwards (1988b). The variables used in the study are real effective exchange rate, government expenditure, terms of trade, openness of the economy, ratio of investment to GDP and resource balance. Johansen’s FIML was employed in order to investigate the existence of a long-run co-integrating relationship between the real exchange rate and the fundamental variables. The study also employed the VAR methodology to test the impact of real exchange rate misalignment on economic performance and competitiveness. Their findings show that there were periods of overvaluation and undervaluation of the real exchange rate. The analysis revealed that the misalignment has a negative impact on the competitiveness and performance of the economy. They suggested that policy makers should monitor the real exchange rate regularly and make the exchange rate policy part of trade promotion strategy.

Ranadive and Burange (2013) examined the factors affecting the real exchange rate in India using quarterly data from 1993 to 2011. The fundamental determinants used are productivity differences, government expenditure, foreign institutional investment,

openness of the economy, interest rate differentials, inflation differentials, terms of trade, foreign exchange reserves and net foreign assets. The ARDL bound test approach confirmed the co-integration relationship between the real exchange rate and its determinants, implying a long run relationship among the variables in India. Foreign institutional investment and the long run interest rate difference explain the largest portion of variation in the real exchange rate in India. The real exchange was thus affected by an array of internal and external economic fundamentals and success of the economy depends on them.

Otieno (2013), using annual time series data for Kenya over the sample period 1960 to 2010, examined the factors that influence the real exchange rate and the export sector performance in Kenya. The study adopted the Error Correction Model because of its ability to induce flexibility by combining the short-run dynamic and long-run equilibrium model in a unified system. The findings show that foreign aid inflow led to real exchange rate appreciation in Kenya. This was depicted by the significance of aid in the long run co-integrated equilibrium results. Foreign aid inflows also had a positive impact on export volumes as shown by the significance of aid in the export performance model estimation. The results of the short-run parsimonious real exchange rate model revealed that real exchange rate is influenced by domestic factors such as government expenditure, technological progress and commercial policy stance. External factors proxied by terms of trade also played a critical role as they led to real exchange rate depreciation; this was shown by the positive co-efficient of terms of trade in the long run co-integrated equilibrium results.

Eita and Sichei (2014) estimated the equilibrium real exchange rate for Namibia for the post-independence period (1998 to 2012) using quarterly data. The variables used to determine Namibia's real exchange rate were: terms of trade, trade and exchange restrictions, government expenditure, capital control and technology. The Johansen co-integration and the Vector Error Correction model (VECM) were employed in order to investigate the existence of a long-run co-integrating relationship between the real exchange rate and the explanatory variables. The Augmented Dickey Fuller (ADF) was used to test for unit root of the variables. The results show that an increase in the ratio of investment to GDP and resource balance causes the real exchange rate to appreciate. The terms of trade variable is associated with a depreciation of the real exchange rate. This is not in line with the results of previous studies on Namibia. While previous studies on Namibia concluded that the income effect dominates, Eita and Sichei's (2014) study found evidence which suggests that the substitution effect dominated during the period 1998 to 2012. Some periods of real exchange rate misalignments were observed and this indicates that it is important for policy makers to monitor the real exchange rate regularly and re-align the real exchange rate to its equilibrium value.

Saradhi and Goel (2014) analyzed the relationship between the net capital flows (NCFs) and other fundamentals and the real exchange rate (RER) in India following the liberalization of the capital account in the 1990s for the period 1996/97 to 2012/13 using the Autoregressive Distributed Lag (ARDL) approach to co-integration. The most significant finding of this research was that the net capital flows in India were positively associated with the RER appreciation, and the association was statistically significant.

Government consumption expenditure was not found to be significantly associated with real appreciation, thereby limiting the role of fiscal policy in managing capital flows. Current account balance had a positive and statistically significant association with RERs indicating that the outflows on account of current account deficits have been associated with depreciation of RER or a prevention of the appreciation on account of capital flows. The change in foreign exchange reserves had a negative and statistically significant association with RERs, indicating that the accumulation of reserves by the Reserve Bank of India has prevented the appreciation of RERs and mitigated their adverse consequences on the competitiveness of the Indian economy.

Kakkar and Yan (2014) did an empirical study on the determinants of real exchange rates for the 15 OECD countries including China. They focused on two strands, the first one being the real economic shocks such as sectoral technology shocks suggested by the celebrated Balassa-Samuelson model, whereas the second strand emphasized monetary shocks which create persistent effects on both the real interest rate and the real exchange rate. They also hypothesized a third factor which may affect real exchange rates – shocks to the global financial system – which we proxy by the real price of gold. The data used was collected from 1970-2006 for all the OECD countries as well as China. The findings show that the three factors: sectoral total factor productivity differentials; real interest rate differentials; and the real price of gold in conjunction can successfully explain the medium to long run movements in 14 bilateral U.S. dollar real exchange rates.

Afzal and Hamid (2014) employed fixed effects panel data regression and the Pooled Mean Group estimator to examine the drivers of real exchange rate movements for 15 countries from Asia, Europe and USA. GDP per capita, interest rate differential, reserves, trade balance, foreign direct investment, external debt and stock prices were the independent variables used for the study. The fixed effects model results show that GDP per capita and external debts are the significant and common drivers of real exchange rate movements across three groups. Interest rate differential is a significant force that impacts real exchange rate in developing economies.

Bashir and Luqman (2014) econometrically analyzed the long run determinants of real exchange rate in Pakistan. The authors used data from 1972 to 2012. The Johansen co-integration test and error correction model was utilized for examining the long run and short run elasticity. The Johansen co-integration test analyzed that real exchange rate was appreciated by trade restrictions and workers' remittances. On the other hand, terms of trade and price level were found to depreciate real exchange rate of Pakistan in the long run.

Lungaiyamu (2015) analyzed the determinants of exchange rate in Tanzania using data from 1987 to 2007. The author developed a theoretical model to capture Tanzania's unique structure of imports and exports. The model implies that the value of real exchange rate, measured as the relative price of foreign goods, should be positively related to tax, negatively related to government consumption, positively related to the expenditure on imports of oil, negatively related to the earnings from gold exports,

negatively related to foreign income and positively related to natural or long run output. The unit root and co-integration tests confirmed that the OLS regression results of a static linear specification of the theoretical model may be spurious. Therefore, co-integration tests confirm the graphical analysis results that show absence of long run relationship between real exchange rate and its structural determinants. However, Granger causality tests show past changes in gold price, government consumption and taxes have effects on real exchange rate that are consistent with the predictions of the theoretical model.

Kassie (2015) assessed the movement of the real effective exchange rate and external sector development such as export, import and trade balance of Ethiopia using descriptive analysis to incorporate the two major devaluation periods 1985/86 and 2012/13. The main finding of this study revealed that in Ethiopia the depreciation of the real effective exchange rate improved the export performance and their international competitiveness. However, it does not discourage the imports, and it was insufficient to offset the remarkable growth of imports due to trade liberalization policy. Although there was a higher growth of exports after a depreciation of the real effective exchange rate, the growth rate of imports was larger and prevented any improvement in the trade balance account. The author thus recommends promoting the import substitution strategy. This can be achieved through subsidies to the domestic industries, reducing taxes to their imported semi-finished inputs and awareness creation in favor of the home-produced substitutes.

According to Chukwuma (2015), the real exchange rate in Nigeria has been erratic, fluctuating and highly volatile over the years. The unabated problems of high unemployment, inflation and overall economic hardships have been attributed to the unstable real exchange rate. This is what necessitated him to seek and find out the determinants of real exchange rate in Nigeria. Adopting the Ballassa-Samuelson Hypothesis, the study employed the Error Correction Model (ECM) technique to perform the data analysis while using time series data ranging from 1981 to 2012. The researcher employed the Engle Granger and the Johansen co-integration approaches to establish the long-run relationship among the variables used in the study. The results revealed that the interest rate differential and oil revenues are major determinants of real exchange rate in Nigeria. Productivity differential was not a determinant in influencing real exchange rate, thus, Balassa-Samuelson technique could not be confirmed. The researcher has therefore called for the diversification of the Nigerian economy away from the oil sector in order to reduce the shocks arising from the sector.

Hassan and Gharleghi (2015) has investigated the philosophy of the Dornbusch's sticky-price model of exchange rate determination for Maldivian Rufiyaa using quarterly data obtained for a period of 14 years from 2000 to 2013. The main aim of the study was to find out if Money Supply, Interest Rate; Gross Domestic Product and Consumer Price Index have an impact on the dependent variable Exchange Rate. Person correlation analysis was applied in order to find the relationship between the frequencies of dependent and independent variables. The correlation test results indicate that there is a positive correlation between money supply, gross domestic product and consumer price

index with exchange rate, whereas interest rate shows a negative correlation with exchange rate. The correlation results also indicate that consumer price index is the most highly correlated variable among the four macroeconomic fundamentals tested. The study revealed that Dornbusch's sticky-price model cannot be validated as interest rate does not influence exchange rate at a 5 percent probability of error in the analysis. Hence they concluded that Dornbusch's philosophy of exchange rate is applicable in the context of Maldives at a 90 percent confidence interval.

The vast literature covered in this chapter shows that the main determinants of the long run real exchange rate in developing countries include changes in the terms of trade, productivity or technological progress and real interest rate differentials, fiscal policy (government spending), international transfers and capital flows, commercial policies and the extent of net foreign assets. Thus, the real exchange rate is determined by both real and nominal variables in the short run, while only real variables influence the real exchange rate in the long run. With regard to the impacts of each of these variables on the real exchange rate, increases in the terms of trade and an expansionary fiscal policy have a theoretically ambiguous impact on the real exchange rate.

CHAPTER THREE: METHODOLOGY

This chapter is divided into four sections. The first section provides 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.

3.1 Data Sources

The study used annual time series data for the period 1980 to 2014 obtained from published sources. The sources of data include the World Bank’s World Development Indicators and Bank of Namibia.

3.2 Model Specification

In order to examine the determinants of real exchange rate, this study adopts Edwards (1989) model of inter-temporal optimizing model which is used to determine real exchange rate in Namibia. Edward’s (1989) model is an inter-temporal general equilibrium model for a small open economy where both tradables and non-tradables can be exchanged. Unlike other theoretical models, this model differentiates factors that determine the equilibrium real exchange rate in the long run from those that determine the short-run dynamics of the real exchange rate. The model has been used by many other studies to estimate the real exchange rate models in many developing economies, for example, Mungule (2004) used it for Zambia and Ghura and Grennes (1993) used it for Sub-Sahara Africa.

The model is represented by the following equation:

$$\text{RER} = e^* = x(a, g\text{NT}, \text{PT and } \tau) \dots\dots\dots (1)$$

Equation (1) states that the long run real exchange rate is a function of real variables only, the value of real assets, government consumption, price of tradables and trade restrictions. The variables in this equation are normally influenced by changes in other real variables such as terms of trade (TOT) shocks, technological progress, and changes in trade and capital restrictions. In order to estimate the determinants of the real exchange rate, it is important to specify an empirical equation for the real exchange rate. Due to data availability, the variables used are not exactly as those used by Edwards in his model. A model of the real exchange rate is formulated for Namibia in the following equation:

$$\text{Sr}^* = f(\text{TOT}, \text{OPENNESS}, \text{GOV}, \text{INV}) \dots\dots\dots (2)$$

In equation (2), Sr^* is the real exchange rate; TOT is the terms of trade, defined as the price of exports to price of imports (Px^*/Pm^*); $\text{OPEN} = (\text{X} + \text{M}) / \text{Y}$ is the trade restrictions substituted by the openness of an economy; GOV is a fundamental variable which determines the equilibrium real exchange rate and Ms is domestic money supply which is a proxy for financial development.

Thus, the long run real exchange rate equation can be expressed in its linear form as:

$$\ln RER_t = \alpha + \beta_1 \ln Open_t + \beta_2 \ln TOT_t + \beta_3 \ln Gov_t + \beta_4 \ln Inv_t + \mu_t \dots\dots\dots(3)$$

Where, *t* denotes time.

3.3 Data Analysis

Testing for stationarity of variables is rooted on the fact that regression involving non-stationary variables leads to misleading inference since the estimated coefficients would be biased and inconsistent. 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 said to be integrated of order one, I (1). It is therefore for this reason that this study employs the Dickey Fuller-GLS test (GLS). The presence of unit root in the time series indicates that the variable is non-stationary, hence the degree or order of integration is one or higher. The absence of unit root however, implies that the variables are stationary and the order of integration is I (0).

The study contributes to the literature on the determinants of real exchange rate by using the co-integration test, Autoregressive Distributed Lag (ARDL), also known as the bound test. This test is proposed by Pesaran, Shin and Smith (2001) and it is used to investigate the presence of long-run relationships among variables. The chosen methodology, which is based on the estimation of the unrestricted error correction model (UECM), has certain preference over other co-integration tests. Firstly, 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). Secondly, 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). This implies that the test avoids the pre-testing problems associated with standard co-integration analysis which requires the classification of variables into I (0) and I (1) (Peresan *et al*, 2001 as cited in Ziramba 2007). Lastly, 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, Ziramba (2007), Hamdu (2013), Yildirim and Sezgin (2003), Bahmani-Oskooee and Kara (2000), Narayan (2005), Narayan and Narayan (2006), Nieh and Wang (2005), have used the ARDL approach to co-integration over other conventional co-integration approaches such as Engle-Granger (1987) and the Johansen-Juselius (1990) approach.

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

$$\begin{aligned} \Delta \ln RER_t = & \beta_0 + \sum_{i=1}^n a_i \Delta \ln RER_{t-i} + \sum_{i=0}^n b_i \Delta \ln Open_{t-i} + \sum_{i=0}^n c_i \Delta \ln TOT_{t-i} \\ & + \sum_{i=0}^n d_i \Delta \ln Gov_{t-i} + \sum_{i=0}^n e_i \Delta \ln Ms_{t-i} + \beta_1 \ln RER_{t-1} + \beta_2 \ln Open_{t-1} \\ & + \beta_3 \ln TOT_{t-1} + \beta_4 \ln Gov_{t-1} + \beta_5 \ln Ms_{t-1} \\ & + \mu_t \dots \dots \dots (4) \end{aligned}$$

Where Δ is the difference operator and \ln denotes logarithm. The bounds test methodology suggests analyzing the null hypothesis of no co-integration through a joint significant test of lagged variables $\ln RER_{t-i}$, $\ln Open_{t-i}$, $\ln TOT_{t-i}$, $\ln Gov_{t-i}$, $\ln Ms_{t-i}$, based on the Wald or F-statistic:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

$$H_1: \beta_1 \neq 0, \text{ or } \beta_2 \neq 0, \text{ or } \beta_3 \neq 0, \text{ or } \beta_4 \neq 0, \text{ or } \beta_5 \neq 0$$

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 was 35 observations, Narayan’s (2005) critical values will be used.

3.4 Long-run Model of the Real Exchange Rate

After 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:

$$\begin{aligned} \ln RER_t = & \beta_0 + \sum_{i=1}^n \partial_i \ln RER_{t-i} + \sum_{i=0}^n \partial_i \ln Open_{t-i} + \sum_{i=0}^n \partial_i \ln TOT_{t-i} \\ & + \sum_{i=0}^n \partial_i \ln Gov_{t-i} + \sum_{i=0}^n \partial_i \ln Inv_{t-i} + \mu_t \dots \dots \dots (5) \end{aligned}$$

3.5 Short-run Model of the Real Exchange Rate

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

$$\begin{aligned} \Delta \ln RER_t = & \beta_0 + \sum_{i=1}^n \alpha_i \Delta \ln RER_{t-i} + \sum_{i=1}^n \omega_i \Delta \ln Open_{t-i} + \sum_{i=1}^n \delta_i \Delta \ln TOT_{t-i} \\ & + \sum_{i=1}^n \vartheta_i \Delta \ln Gov_{t-i} + \sum_{i=1}^n \varphi_i \Delta \ln Inv_{t-i} + \phi Ecm_{t-1} + \mu_t \dots \dots \dots (6) \end{aligned}$$

Where, β_0 is a drift component, α , ω , δ , ϑ , φ are the short-term dynamic coefficients and ϕ 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, functional form, normality, and heteroscedasticity associated with the model. The stability test is important since unstable parameters can result in model misspecification (Narayan & Smith, 2004). The stability of parameters is tested using the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests.

3.6 Measurement and Justifications of Variables

3.6.1 Real Exchange Rate

The real exchange rate is the dependent variable which is defined as the nominal exchange rate adjusted for relative price level between the countries under consideration.

It is expressed in index form as $Sr = S \frac{P^*}{P}$ where Sr is the real exchange rate, S is the nominal exchange rate, P^* being the foreign price index, while P is the domestic price index. Edwards (1989) and Obadan (2006) used it as a dependent variable in their studies.

The Namibian currency does not trade on the international market and since the Namibia Dollar is pegged one on one with the South African Rand, the South African nominal exchange rate index is used in this study. The Namibian price index is used against the United States of America's price index. It is worth noting that a decrease in the real exchange rate represents an appreciation of the country's currency. An increase thus represents depreciation.

3.6.2 Terms of Trade (TOT)

Terms of trade is defined as the ratio of export price index to import price index. TOT is believed to be the best proxy to present a country's international economic competitiveness. The impact of terms of trade on the real exchange rate depends on the income and substitution effects. According to Chowdhury (1999), the income effect occurs when an increase in export prices or a fall in import prices raises the income of an

economy and decreases the demand for non-tradables. An improvement in the terms of trade due to an increase in export prices brings about a depreciation of the real exchange rate for the given nominal exchange rate and non-tradables. However, if an improvement in terms of trade is due to a fall in the price of imports, improvement in the current account balance would increase income and the aggregate price of non-tradables and cause an appreciation of the real exchange rate. This argument is supported by Afridi (1995) and Mkenda (2001).

3.6.3 Trade Openness

Openness is a proxy for trade and exchange restriction of a country. It is computed as $(\text{EXPORT} + \text{IMPORT}) / \text{GDP}$. The degree of openness is seen through the indicators of commercial policy and trade liberalization, which have an important impact on the long-run equilibrium exchange rate. An increase in openness through lowering trade barriers will worsen the trade balance, thereby allowing foreign goods to enter the country more freely; hence a negative sign is expected.

3.6.4 Ratio of Government Expenditure to GDP

The ratio of government expenditure to GDP is a proxy for fiscal policy. The impact of government expenditure on the real exchange rate depends on whether spending is predominantly on tradable goods or non-tradable goods. An increase in government spending on tradable goods creates a current account deficit, which causes a depreciation of the real exchange rate. A depreciation of the real exchange rate induces an increase in the production of tradable goods, allowing an increase in total spending on tradable

goods. However, an increase in government spending on non-tradable goods leads to an increase in their relative price in order to maintain equilibrium in the non-tradable goods market. An increase in the relative price of non-tradable goods in turn appreciates the real exchange rate, hence the expected sign is ambiguous. Eita and Jordaan (2013) support this argument.

3.6.5 Ratio of Investment to GDP (INV)

The ratio of investment to GDP is a proxy for capital formation. The effects of the ratio of investment to GDP on real exchange rate depend on whether investment in the economy is tilted towards tradable goods or non-tradable goods. If investment is tilted towards tradable goods, it would lead to a depreciation of the real exchange rate (Baffes et al., 1999; Edwards, 1989 as cited in Hamdu, 2013). In contrast, if it is tilted towards non-tradables, it would lead to an appreciation of the real exchange rate.

CHAPTER FOUR: ANALYSIS AND DISCUSSION OF EMPIRICAL RESULTS

4.1 Analysis of the Unit Root Test

Before testing for the existence of a co-integrating relationship between the real exchange rate and its determinants, it is always important to examine the time series properties of the data in order to ensure that the variables are not integrated of order two (I (2)) as it gives spurious results. 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. According to Ouattara (2004) 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)).

Unit root test was done based on the Dickey Fuller-GLS (DF-GLS) test. The GLS test is a simple modification of the conventional augmented Dickey Fuller (ADF) t-test as it applies generalized least squares (GLS) prior to running the ADF test regression (Frimpong & Abayie, 2006). The DF-GLS test is argued to have the best overall performance in terms of sample size and power compared to the augmented Dickey Fuller (ADF). The Dickey Fuller test involves testing the null hypothesis of non-stationarity of the variables against the alternative hypothesis of stationarity. Table 4.1 below shows the results of the Dickey Fuller-GLS test.

Table 4.1: Results of the Unit Root

Levels			First Differences	
Variable	Intercept	Trend and Intercept	intercept	Trend and Intercept
Ingov	-1.537	-1.672	-2.368**	-3.918***
	(-1.611)	(-2.890)	(-1.951)	(-3.770)
Ininv	-0.338	-2.032	-5.671***	-6.793***
	(-1.611)	(-2.890)	(-2.637)	(-3.770)
Inopen	-1.076	-2.032	-5.671***	-6.793***
	(-1.611)	(-2.890)	(-2.637)	(-3.770)
Intot	-0.833	-2.032	-3.835***	-5.066***
	(-1.611)	(-2.890)	(-2.637)	(-3.770)
Inrer	-1.598	-2.127	-3.764***	-4.559***
	(-1.611)	(-2.890)	(-2.637)	(-3.770)

*** denotes the rejection of the null hypothesis at 5% level of significance and *** denote the rejection of the null hypothesis at 1%.*

Unit root test was done based on Dickey Fuller-GLS test for the variables. Table 4.1 shows that all the variables are non-stationary at levels and become stationary in their first differences. This implies that the variables are all integrated of order one (I (1)).

The results in Table 4.1 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. However, all the variables become stationary at their first differences. This means that the variables are all integrated of order one (I (1)), since none of them is stationary at the log level demonstrating the existence of unit root in the data for the variables used.

4.2 Bounds Test for Co-integration

The long run relationship and the short run dynamics of the determinants of the real exchange rate is analyzed 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 4.2 below.

Table 4.2: Co-integration Results

F - Statistics = 10.82		
Critical Values	Lower Bound I (0)	Upper Bound I (1)
1%	5.198	6.845
5%	3.615	4.913

The computed F-statistic is compared to the two critical values developed by Narayan (2005): the upper bound and lower bound. The results from Table 4.2 demonstrate that the calculated F-statistic = 10.82, is higher than the upper bound value of 6.845 at 1 percent level. Basically, this means that the null hypothesis of no co-integration is rejected, which implies the existence of a long run relationship among the variables. The results provide strong evidence of the existence of a long run relationship among the variables.

4.3 Results of the Long Run Model of the Real Exchange Rate Function

Now, having established the existence of unit root and co-integration, the next step in the ARDL procedure is the estimation of the long run relationship between the variables in the real exchange rate function. The long run model was established based on the Akaike Information Criterion (AIC). The results are presented in Table 4.3 below.

Table 4.3: Estimated Long Run Model, ARDL (3, 3, 3, 3, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNTOT	0.715	0.142	5.045	0.0001
LNOPEN	-0.442	0.222	-1.996	0.0622
LNINV	0.059	0.081	0.727	0.4773
LNGOV	0.570	0.344	1.654	0.1164
C	-7.182	1.554	-4.623	0.0002

The results above show that the coefficient of terms of trade is positive (0.72) and statistically significant at 1% level and this indicates a significant long run impact on the real exchange rate. Terms of trade plays an important role in determining the real exchange rate. A one percent increase in terms of trade depreciates the real exchange rate by 0.73 percent in the long run. The results conform to the findings of Chowdhury (1999), Deboh (2009) and Otieno (2013). The substitution effect in this case outweighs the income effect. An improvement in the terms of trade may have relaxed the foreign exchange constraints on intermediate inputs in the production of non-tradables. This in turn helped the producers to increase the supply of non-tradable goods, thus lowering the price of non-tradables. This resulted in the depreciation in the real exchange rate.

Openness carries a negative coefficient of -0.44 but is statistically significant at 10% significance level. This implies an appreciation of the real exchange rate. Thus, a one percent increase in trade openness is associated with an appreciation of the real exchange rate by 0.44 percent. Openness is reflected by import tariffs and quotas. An increase in tariffs leads to higher relative increase in the prices of non-tradable goods, which results in appreciation of RER. In addition, an increase in tariffs on imports causes an increase on import bills, a reduction in the demand for tradables and an increase in the demand and price for non-tradables, which in turn lead to an appreciation of the long run real exchange rate. Eita and Sichei, (2006) study on the equilibrium real exchange rate also found that openness appreciates the real exchange rate.

The coefficient of the ratio of government expenditure to GDP has the expected positive sign of 0.569 from the estimated long run result, but is statistically insignificant in determining real exchange rate in Namibia. An increase in government expenditure may lead to domestic inflation, which in turn depreciates the RER. When government expenditure falls more on tradables than non-tradables, it increases the demand for imports, which results in a trade deficit of the current account, thus causing the real exchange rate to depreciate. This is in line with the findings of Zakaria and Ghauri (2011).

The ratio of investment to GDP was found to be positive (0.059) but insignificant as well. The effects of the ratio of investment to GDP on real exchange rate depend on whether investment in the economy is tilted towards tradable goods or non-tradable

goods. If investment is tilted towards traded goods, then it would lead to a depreciation of the real exchange rate (Baffes et al., 1999; Edwards, 1989 as cited in Hamdu, 2013). This study therefore concludes that the depreciating effect of the ratio on investment to GDP on the real exchange rate implies that the investment shares in Namibia are concentrated more on tradable goods than non-tradables.

4.4 Results of the Short Run Model

Table 4.4: Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔLNTOT	0.919	0.175	5.269	0.0001
ΔLNOPEN	-0.191	0.231	-0.827	0.4221
ΔLNINV	-0.130	0.105	-1.241	0.2350
ΔLNGOV	0.045	0.312	0.144	0.8875
Δecm_{t-1}	-0.210	0.097	-2.172	0.0475

Table 4.4 shows the results of the short-run dynamic coefficients obtained from the Error Correction Model (ECM) equation (7). The coefficient of the error correction model measures the speed of adjustment to obtain equilibrium in the event of shocks to the system. The results shown in Table 4.4 are interesting since the coefficients of the

variables maintain their signs as in the long run equation except for the ratio of investment to GDP, whose sign changed from positive to negative.

The coefficient of terms of trade has maintained its positive sign of 0.92 and is statistically significant at 1% significance level. This indicates that an increase in terms of trade has a significant depreciation impact on the real exchange rate in the short run. Terms of trade has proved to be a significant variable that plays a great role in the determination of the real exchange rate in Namibia both in the long run and short run. The coefficient of Openness has also maintained its negative sign of -0.19; however, it is insignificant to determine the real exchange rate in the short run.

Furthermore, the ratio of government expenditure to GDP again depreciates the real exchange rate as it maintains its positive sign of 0.045. It is, however, still insignificant compared to the long run. This proves that the ratio of government expenditure to GDP does not have an important role in the determination of the Namibian exchange rate. Moreover, the ratio of investment to GDP this time has a negative sign of -0.13, but statistically insignificant.

4.5 Diagnostic Tests

In order to ensure that the results obtained meet the standard classical linear regression assumptions, it is always convenient to carry out diagnostic tests to detect any possible spurious results. The results of diagnostic tests are computed with the help of Eviews and are presented in Table 4.5 below.

Table 4.5: Results of the Diagnostic Tests

Test	Test Statistic	Probability
Ramsey RESET test	2.86	0.12
Jarque Bera test	0.42	0.81
Breusch-Godfrey LM test	4.039	0.06
Breusch-Pagan-Godfrey	1.65	0.21

The diagnostic tests reflected in the table above tested for the presence of serial correlation, correct functional form, normality and heteroskedasticity. 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 implies 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 shows that the estimates are still unbiased but not efficient. The Ramsey RESET test indicates that there is no general specification error. The long run and short run models have also passed the diagnostic tests.

The stability of the coefficients in the real exchange rate regression model was also tested through the Cumulative Sum (CUSUM) and the CUSUM of squares (CUSUMSQ) of recursive residuals. The results are presented in the graphs below.

Figure 4.1: Plot of Cumulative Sum (CUSUM) of recursive residuals

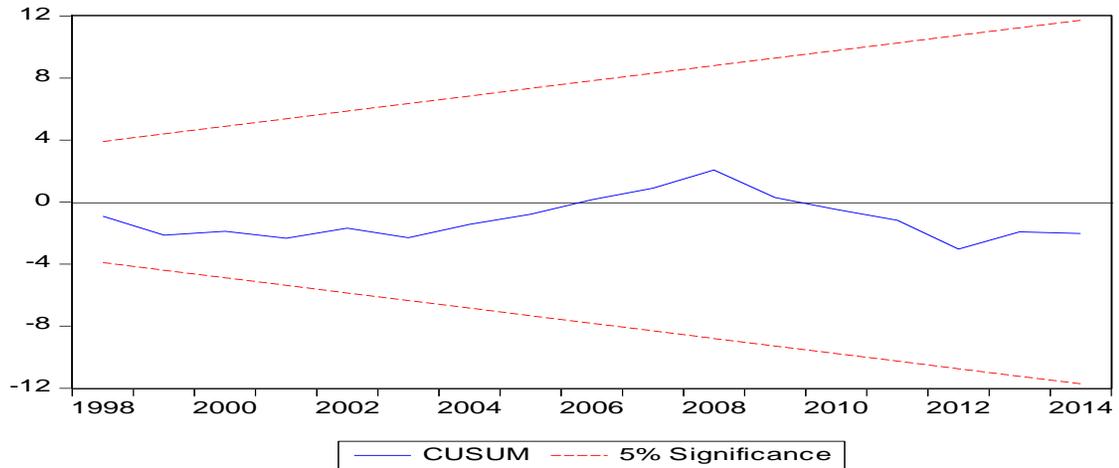
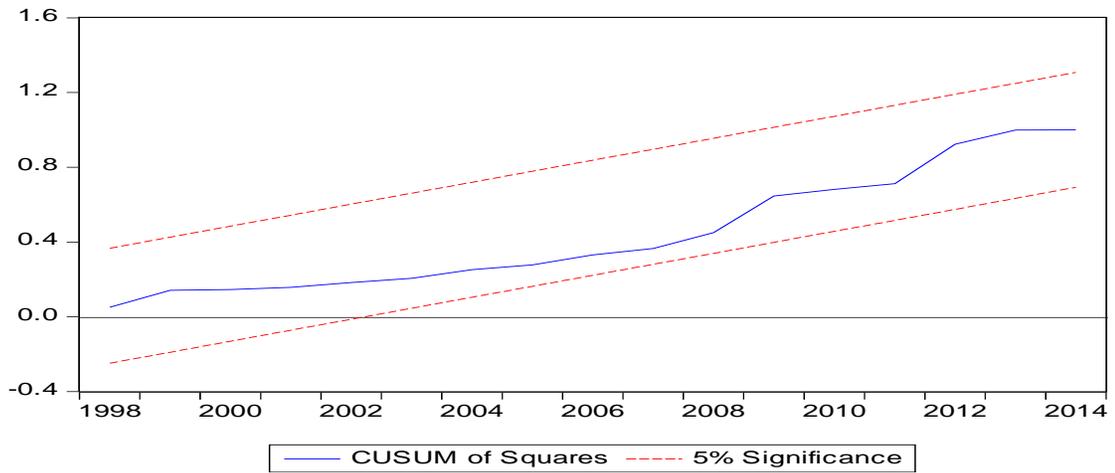


Figure 4.2: Plot of Cumulative Sum of squares (CUSUMSQ) of recursive residuals



The results from the graphs above indicate that there is stability of the coefficients because the plots of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Study and Conclusion

The main aim of this study was to examine the determinants of the real exchange rate in Namibia by using time series annual data for the period 1980 to 2014. Namibia's real exchange rate is determined by terms of trade, trade and exchange restrictions (proxied by openness), ratio of investment to GDP and the ratio of government expenditure to GDP. The study employed the Dickey Fuller-GLS test, to test for the presence of unit root among the variables. Unit root testing is an important step that should not be missed because it determines variables that are stationary and non-stationary. Non-stationary variables lead to misleading inferences, since the estimated coefficients would be biased and inconsistent. The results of the unit root test showed that the variables 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) approach was utilized. 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 its determinants, the Error Correction Model (ECM) was applied. The variables were found to be co-integrated among each other.

The empirical findings obtained from this study show that the terms of trade variable is positive and statistically significant at 5% level both in the long run and short run. This implies a depreciation of the real exchange rate. The findings also revealed that

openness has a negative impact on the RER both in the long run and short run. Regardless of the negative impact on the real exchange rate, openness is found to be significant at 5% in the long run. It is, however, statistically insignificant in determining the real exchange rate in the short run. An increase in openness leads to an appreciation of the real exchange rate according to this study. The study has also shown that the ratio of investment to GDP has a positive impact in the long run and a negative impact in the short run. The ratio of investment to GDP depreciates the real exchange rate and it is insignificant to determine the RER in the long run. In the short run, the ratio of investment to GDP appreciates the RER and still remains insignificant. The changing of the sign of the ratio of investment to GDP in the long run and short run may be due to the variation in the use of tradable and non-tradable goods towards investment. A change of signs imply that, in the long run, investment was more directed on tradable goods causing a depreciation of the real exchange rate. In the short run, the focus of investment was more on non-tradable goods, hence the appreciation of the RER. The ratio of government expenditure to GDP does not have an important role in the determination of the Namibian real exchange rate. Overall, this study found that the important long-run fundamental determinants of the real exchange rate in Namibia are the terms of trade and openness. However, terms of trade is the only important determinant in the short run.

5.2 Recommendations

The findings of this study yield some important policy implications for the policymakers in Namibia who are responsible for making exchange rate policy decisions.

Firstly, the ARDL approach to co-integration has shown that there is a long run relationship between real exchange rate and its determinants. This implies that in the long run, all these variables have the potential of affecting the movement of real exchange rate. They can lead to improvements or deterioration in the country's competitiveness, which may positively or negatively affect productivity in the tradable goods sector. Therefore, it is of importance for any policy making bodies of the real exchange rate in the Namibian economy to carefully take the impact and influence of each of these determinants into consideration.

Secondly, given the fact that openness appreciates the real exchange rate, there is need to encourage Namibia's integration with other economies in the world. Export promotion should be greatly encouraged as part of the trade liberalization policy. The value of tradable goods should also be improved in order to attract competitive prices on the world market. The study therefore suggests that the government should employ competitive trade policies that will enhance exports in the country and raise the value of exchange rate. This may include exports diversification. It is important for the country to achieve a high level of export and remain competitive in order to have a sustainable level of growth.

5.3 Further Research

This study used the following variables: terms of trade, openness, ratio of government expenditure to GDP and ratio of investment to GDP. Only terms of trade and openness are significant in determining the real exchange rate. The study invites further research to identify an expanded set of economic fundamentals such as real interest rate differential, net foreign assets, net capital flow, domestic credit and money supply in order to determine the real exchange rate of Namibia for better results. The sample size used in this study was relatively small, with only 35 observations available for analyzing the real exchange rate. The writer calls for future research to use a longer sampling time frame.

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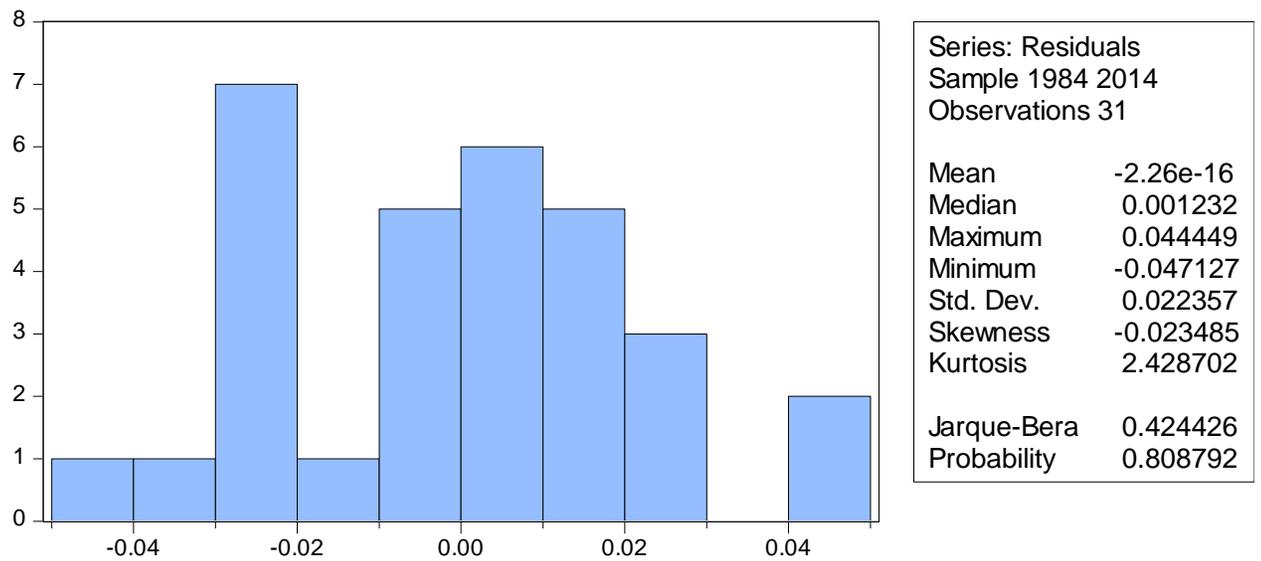
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APPENDICES

Results of the Residual Diagnostic Tests

Appendix Figure 1: Normality Test



Appendix Figure 2: Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	4.038989	Prob. F(2,8)	0.0613
Obs*R-squared	15.57518	Prob. Chi-Square(2)	0.0004

Appendix Figure 3: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.651082	Prob. F(20,10)	0.2089
Obs*R-squared	23.79432	Prob. Chi-Square(20)	0.2515
Scaled explained SS	1.768730	Prob. Chi-Square(20)	1.0000

Appendix Figure 4: Ramsey RESET Test

Ramsey RESET Test

Equation: EQ02

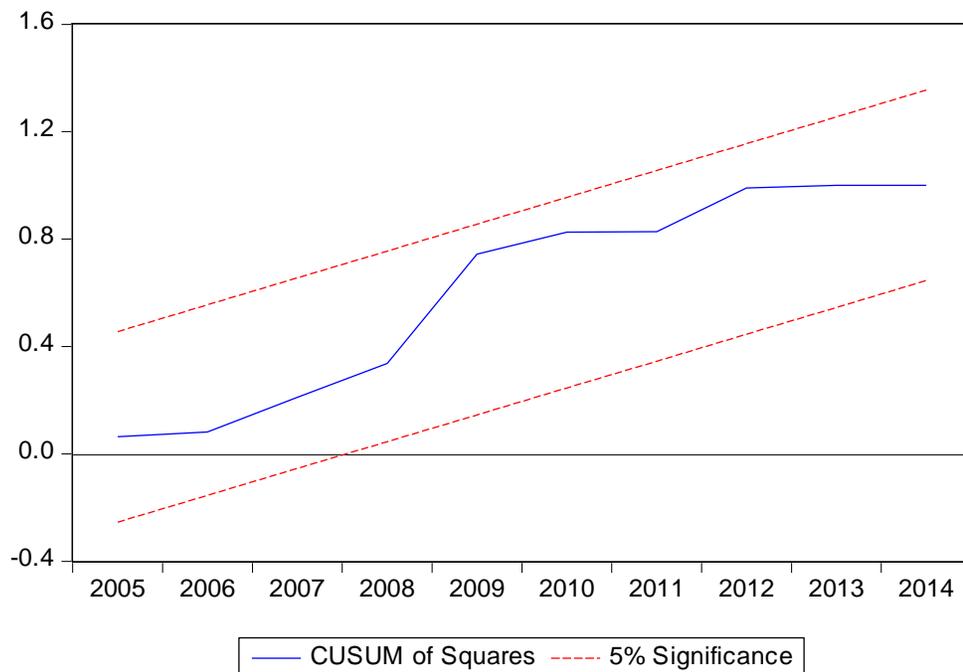
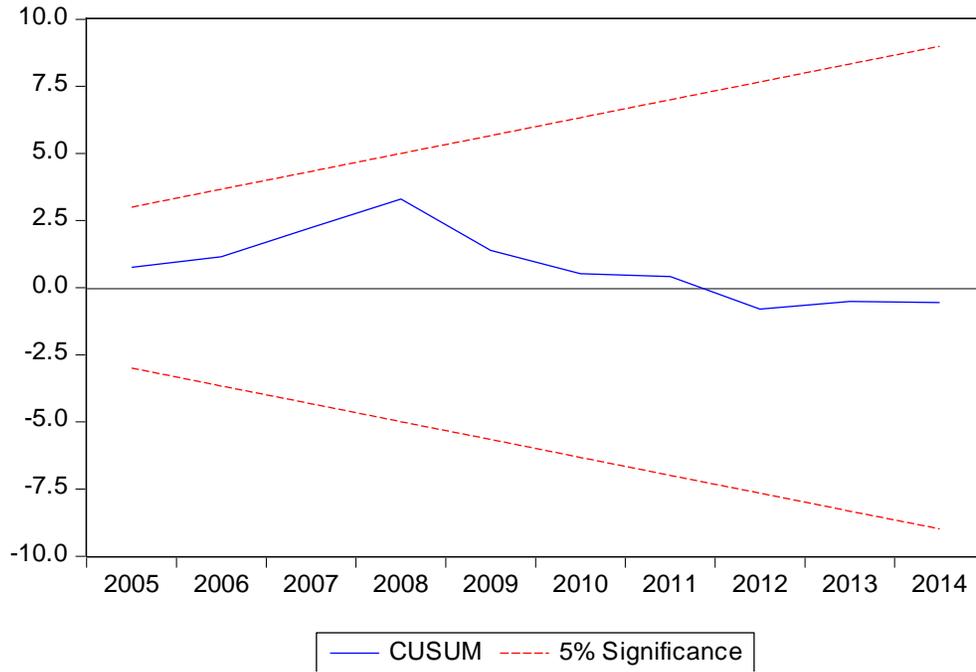
Specification: D(LNRER) LNTOT(-1) LNGOV(-1) LNINV(-1) LNOPEN(-1)

LNRRER(-1)D(LNOPEN) D(LNTOT) D(LNGOV) D(LNINV) D(LNTOT(-1)) D(LNGOV(-1)) D(LNINV(-1)) D(LNOPEN(-1)) D(LNRER(-1)) D(LNGOV(-2)) D(LNINV(-2)) D(LNRER(-2)) D(LNTOT(-3)) D(LNGOV(-3)) D(LNINV(-3)) C

Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	2.860935	(2, 8)	0.1155
Likelihood ratio	16.72603	2	0.0002

Appendix Figure 4: Results of Stability Tests



Appendix Figure 5: Unit Root Test for the ratio of government expenditure to GDP

Level: Intercept

Null Hypothesis: LNGOV has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.536507
Test critical values:	1% level	-2.634731
	5% level	-1.951000
	10% level	-1.610907

*MacKinnon (1996)

Level: Trend Intercept

Null Hypothesis: LNGOV has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.672381
Test critical values:	1% level	-3.770000
	5% level	-3.190000

10% level -2.890000

*Elliott-Rothenberg-Stock (1996, Table 1)

Warning: Test critical values calculated for 50 observations
and may not be accurate for a sample size of 33

1st Difference: Intercept

Null Hypothesis: D(LNGOV) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-2.367722
Test critical values:	
1% level	-2.636901
5% level	-1.951332
10% level	-1.610747

*MacKinnon (1996)

1st Difference - Trend & Intercept

Null Hypothesis: D(LNGOV) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
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Elliott-Rothenberg-Stock DF-GLS test statistic		-3.918244
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

*Elliott-Rothenberg-Stock (1996, Table 1)

Warning: Test critical values calculated for 50 observations
and may not be accurate for a sample size of 33

Appendix Figure 6: Unit Root Test for the ratio of investment to GDP

Level: Intercept

Null Hypothesis: LNINV has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-0.338336
Test critical values:	1% level	-2.634731
	5% level	-1.951000
	10% level	-1.610907

*MacKinnon (1996)

Level: Trend & Intercept

Null Hypothesis: LNINV has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-2.031803
Test critical values: 1% level	-3.770000
5% level	-3.190000
10% level	-2.890000

*Elliott-Rothenberg-Stock (1996, Table 1)

Warning: Test critical values calculated for 50 observations
and may not be accurate for a sample size of 34

1st Difference: Intercept

Null Hypothesis: D(LNINV) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-5.670557
Test critical values: 1% level	-2.636901
5% level	-1.951332

10% level -1.610747

*MacKinnon (1996)

1st Difference: Trend & Intercept

Null Hypothesis: D(LNINV) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-6.792513
Test critical values:	
1% level	-3.770000
5% level	-3.190000
10% level	-2.890000

Appendix Figure 7: Unit Root Test for the openness

Level: intercept

Null Hypothesis: LNOPEN has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic

Elliott-Rothenberg-Stock DF-GLS test statistic		-1.076489
Test critical values:	1% level	-2.634731
	5% level	-1.951000
	10% level	-1.610907

*MacKinnon (1996)

Level: Trend & Intercept

Null Hypothesis: LNINV has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-2.031803
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

1st Difference: Intercept

Null Hypothesis: D(LNINV) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
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“90”

Elliott-Rothenberg-Stock DF-GLS test statistic	-5.670557
Test critical values:	
1% level	-2.636901
5% level	-1.951332
10% level	-1.610747

1st Difference: Trend & Intercept

Null Hypothesis: D(LNINV) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-6.792513
Test critical values:	
1% level	-3.770000
5% level	-3.190000
10% level	-2.890000

Appendix Figure 8: Unit Root Test for the real exchange rate variable

Level: Intercept

Null Hypothesis: LNRER has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-1.597537
Test critical values: 1% level	-2.634731
5% level	-1.951000
10% level	-1.610907

Level: Trend & Intercept

Null Hypothesis: LNRER has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-2.126930
Test critical values: 1% level	-3.770000
5% level	-3.190000
10% level	-2.890000

1st Difference: Intercept

Null Hypothesis: D(LNRER) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.764401
Test critical values:	1% level	-2.636901
	5% level	-1.951332
	10% level	-1.610747

1st Difference: Trend & Intercept

Null Hypothesis: D(LNRER) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.559746
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Appendix Figure 9: Unit Root Test for terms of trade variable

Level: intercept

Null Hypothesis: LNTOT has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-0.832833
Test critical values: 1% level	-2.634731
5% level	-1.951000
10% level	-1.610907

Level: Trend & Intercept

Null Hypothesis: LNINV has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic	-2.031803
Test critical values: 1% level	-3.770000
5% level	-3.190000
10% level	-2.890000

1st Difference: intercept

Null Hypothesis: D(LNTOT) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.835416
Test critical values:	1% level	-2.636901
	5% level	-1.951332
	10% level	-1.610747

1st Difference: Trend & intercept

Null Hypothesis: D(LNTOT) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.065958
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Appendix Figure 10: Parsimonious Results

Dependent Variable: D(LNRER)

Method: Least Squares

Date: 05/13/16 Time: 12:14

Sample (adjusted): 1984 2014

Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNTOT(-1)	0.387546	0.124951	3.101577	0.0112
LNGOV(-1)	-0.455080	0.419244	-1.085477	0.3032
LNINV(-1)	0.007518	0.105930	0.070976	0.9448
LNOPEN(-1)	-0.798055	0.339129	-2.353247	0.0404
LNRER(-1)	-0.506515	0.097975	-5.169853	0.0004
D(LNOPEN)	-0.233577	0.194197	-1.202780	0.2568
D(LNTOT)	1.632190	0.279438	5.840978	0.0002
D(LNGOV)	-1.079154	0.487034	-2.215768	0.0511
D(LNINV)	-0.260708	0.142382	-1.831041	0.0970
D(LNTOT(-1))	-0.261453	0.178134	-1.467732	0.1729
D(LNGOV(-1))	0.477333	0.275918	1.729984	0.1143
D(LNINV(-1))	0.274782	0.106382	2.582965	0.0273
D(LNOPEN(-1))	-0.490779	0.290022	-1.692213	0.1215
D(LNRER(-1))	0.754038	0.254706	2.960421	0.0143
D(LNGOV(-2))	0.306266	0.245827	1.245861	0.2412
D(LNINV(-2))	0.101577	0.109121	0.930865	0.3738
D(LNRER(-2))	0.734657	0.165462	4.440039	0.0013
D(LNTOT(-3))	-0.243946	0.206387	-1.181979	0.2646

D(LNGOV(-3))	-0.720429	0.217124	-3.318049	0.0078
D(LNINV(-3))	0.583539	0.193272	3.019268	0.0129
C	0.739291	1.797000	0.411403	0.6895
<hr/>				
R-squared	0.959241	Mean dependent var	0.008035	
Adjusted R-squared	0.877724	S.D. dependent var	0.110741	
S.E. of regression	0.038724	Akaike info criterion	-3.441278	
Sum squared resid	0.014995	Schwarz criterion	-2.469868	
Log likelihood	74.33981	Hannan-Quinn criter.	-3.124623	
F-statistic	11.76730	Durbin-Watson stat	2.854971	
Prob(F-statistic)	0.000165			
<hr/>				