CHAPTER 1. INTRODUCTION

1.1 Introduction

One of the most challenging macroeconomic policy issues is exchange rate management. It is generally agreed that the main objectives of the exchange rate policy should be to correct real exchange rate misalignment. Real exchange rate misalignment is a serious problem in many developing countries. In order to correct real exchange rate misalignment it is important to identify the equilibrium real exchange rate. The identification of the equilibrium real exchange rate is not observable directly and this poses a fundamental difficulty in real exchange rate economics.

A large number of empirical studies estimated the equilibrium real exchange rate using the theory which states that the equilibrium real exchange rate depends on the fundamental variables, and that the actual real exchange rate converges to the equilibrium over time. It is important for monetary policy makers to understand what drives developments in the real exchange rate. That is because the investigation of macroeconomic impact of the real exchange rate depends on the source of the variables that drive them (developments in the real exchange rate). Although it is not easy, it is important to investigate the extent to which developments in the real exchange rate are driven by various fundamentals.

Like other economies, a study of the behaviour of the real exchange rate and its determining factors is very important for Namibia. Empirical studies of the real exchange rate for Namibia are limited. It is in light of this background that the general objective of this study is to develop and estimate the equilibrium real exchange rate and the resulting real exchange rate misalignment for Namibia.

This chapter starts by introducing the real exchange rate theory, an overview of Namibia's exchange rate policy and outlines the research objectives as well as hypotheses

to be tested. The chapter also discusses the research methodology and outline of the thesis. This chapter is organised as follows. Section 1.2 introduces the real exchange rate theory. Section 1.3 presents an overview of exchange rate policy in Namibia. Section 1.4 defines the research problem while Section 1.5 discusses the research objectives. The methodology and outline of the thesis are presented in Sections 1.6 and 1.7.

1.2 Introduction to Real Exchange Rate Theory

The exchange rate is important because it affects many variables in the economy. Changes in the country's exchange rate affect the local currency equivalent of prices which domestic producers of given goods and services receive and their incentives to supply those products. The exchange rate affects resource allocation between tradable goods and non-tradable goods. The exchange rate movement may also affect foreign demand, depending on the type of product and the country's position in the world market for that product. In a small open economy, the prices of a country's exports and imports are determined in the world market, and in this context the exchange rate affects the output of goods and services and demand for foreign products, but does not affect the foreign demand for the country's products.

The exchange rate affects the decision to invest and save. Changes in the exchange rate may have direct effects on the distribution of income and wealth. This is especially applicable between urban consumers and rural producers of exports. The exchange rate is the main variable that determines movements in the balance of payments and is regarded as a nominal anchor for the level of prices. This means that changes in exchange rates because of shocks to the balance of payments affect output and stability of prices.

Edwards (1988a) pointed out that the exchange rate is expected to provide signals to economic agents in the economy. Information on the extent to which the real exchange rate diverges from its equilibrium level, serves as a guide to policy makers to ensure that the real exchange rate does not send wrong signals to economic agents. Wrong signals

can result in inefficient resource allocation and lead to reduction of the country's welfare. Misalignment of the real exchange rate could rise economic instability and distort investment decisions.

Studies on the real exchange rate have taken and still are taking centre stage in both academic and policy research. That is because almost all structural adjustment programmes target the exchange rate as a key instrument to achieve the necessary reforms. Duesenberry *et al*. (1994) maintained that because of the variety of influences exerted by the exchange rate, disagreements over the choice of the exchange rate target and whether and how government should intervene to attain a certain target is inevitable. Concern often centres on steering the right mix of policies which aim at avoiding real exchange misalignments.

Analysts of the real exchange rate often encounter problems of determining by how much the real exchange rate diverge from its equilibrium value. Measuring the real exchange rate misalignment requires information about the real exchange rate and equilibrium real exchange rate. These are not observable directly like the nominal exchange rates. Real exchange rate misalignment is defined by Edwards (1988a; 1988b) as a sustained departure of the actual real exchange rate from its equilibrium value. To obtain the values of the real exchange rate misalignment, the equilibrium real exchange rate must be estimated, and the real exchange rate must also be computed. The literature does not provide clear cut guidance on the measurement and conceptual definitions and interpretations of the real exchange rate, although the World Bank has prepared manuals on the computation of external and internal real exchange rate.

1.3 Overview of the Exchange Rate Policy in Namibia

1.3.1 Monetary and Exchange Rate Arrangements

Developments in exchange rate and monetary policy in Namibia must be viewed in the context of the country's colonial relationship with South Africa. Namibia was a German colony between 1884 and 1919 and used the German Reichsmark. The League of Nations abolished Germany's colonisation of the then South West Africa after the First World War (which ended in 1919) and placed the country under the mandate of South Africa. This resulted in the inclusion of Namibia into the South African monetary and exchange rate system. South African banking institutions were extended to Namibia with the main purpose of financing commerce and trade. The South African Reserve Bank opened its branch in Windhoek in 1961 (Kalenga, 2001: 3; Ikhide and Fitchat, 2002: 42). The role of the South African Reserve Bank branch in Windhoek was the distribution of notes and coins, administration of exchange controls and acting as banker to commercial banks.

At independence from South Africa in 1990 Namibia faced a choice on whether to remain in the Common Monetary Area (CMA) or whether to have an independent monetary system by leaving the CMA and explore some alternative exchange rate regimes (Namibia was regarded as *de facto* member of the CMA before independence by being a South African colony). Namibia formally joined the CMA on 6 February 1992 (Van Der Merwe, 1996: 14). This membership was formalised 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. The obligations of Namibia are spelled out in the Multilateral Monetary Agreement (MMA) of 1992 and the Bilateral Monetary Agreement (BMA) with South Africa in 1993. As Kalenga (2001: 3) and Dwight (2006: 52) point out, the dominant features of the MMA arrangement are:

- Each CMA member country may issue its own national currency after consulting with South Africa;

- Current or capital account transactions in the CMA may not be restricted, but members (of the CMA) may impose domestic investment requirements.
- The agreement makes provision for governments and financial institutions of Lesotho, Namibia and Swaziland to have access to South African capital and money market;
- Each CMA member country has a Central Bank and foreign exchange responsibility within its territory;
- Since the rand is circulating within the territories of Lesotho, Namibia and Swaziland, South Africa compensates these countries for loss of seigniorage.

The mechanics of Namibia's peg to the rand and access to South Africa's financial markets are provided in the BMA of 1993 (Dwight, 2006: 52):

- The bilateral agreement provides that either of the contracting parties has the right to issues its own currency, and either party may introduce measures for domestic resource mobilisation in the interest of the development of their respective economies.
- A commitment by the Bank of Namibia to exchange the domestic currency for a specified amount of the reserve currency, the rand without restrictions and this is subject to the normal handling charge at a fixed exchange rate;
- A requirement that at least a proportion of its monetary liabilities be backed by reserve currency or foreign assets. The BMA provides for 100 percent foreign exchange backing for the Namibia dollar. Namibia agrees that the South African rand is a legal tender within its territory;
- The Bank of Namibia and the South African Reserve Bank manage their own foreign exchange reserves separately;
- Lack of flexibility in changing the exchange rate and the need to fulfil backing rules.
- Namibia agrees to bring its exchange controls in conformity with those of South Africa. South Africa agrees to consult with Namibia before changing the exchange controls.

- South Africa agrees to compensate Namibia for loss of seigniorage because of rand circulation in Namibia.

From the key features of the MMA and BMA it is clear that that the CMA countries do not share a common currency and they have not committed themselves to exchange rate parities irrevocably. This means that Namibia, Lesotho and Swaziland still have the option to adjust the value of their currencies. Although Lesotho, Namibia and Swaziland are compensated to some extent by South Africa, they do not share in the seigniorage of a common currency.

The CMA is an asymmetric currency and the three smaller countries (Namibia, Lesotho and Swaziland) are dominated by South Africa. Namibia's currency, the Namibia dollar is pegged to the South African rand on a one to one basis (see Tjirongo, 1995: 2). Together with Lesotho and Swaziland, Namibia is constrained by its fixed exchange rate to follow South Africa's monetary policies and there is no joint policy making. The CMA is a hybrid of a currency board and a monetary union. It is regarded as a currency board because the issuing of domestic currency is backed by foreign assets. The domestic currency is fully convertible with the reserve currency. Monetisation of a fiscal deficit is not allowed in the CMA. However, as Ikhide and Fitchat (2002: 58) state, the monetary system in Namibia is governed by a central bank, the Bank of Namibia. The Bank of Namibia has the authority to do normal functions ordinarily done by central banks. This includes the possibility of extending loans to the government of Namibia. It regulates commercial banks and provides lender of last resort services. The CMA differs from the full monetary union in the sense that each country has its own central bank.

Since there is no institution that acts as an orthodox currency board, the central banks of Lesotho, Namibia and Swaziland have some freedom in monetary policy (Dwight, 2006: 53). Dwight notes that the Bank of Namibia maintained a varying and largely negative interest rate with South Africa's policy rate before 2004.

Following the classification of the different types of monetary integration by Cobham and Robson (1994: 287), the CMA would be regarded as an informal exchange rate union. That is because the CMA has no reserve pooling, no single central bank and no single currency.

1.3.2 The CMA and Optimum Currency Areas

Monetary arrangements under the CMA raise an important question on whether it (CMA) is an optimum currency area. An optimum currency area is defined as an area in which it is best to use a single currency. Mundell (1961) initiated the literature of optimum currency area and argued that although transaction costs associated with changing or exchanging money are lower within the currency union, fixing the exchange rate across countries by forming a currency union is costly if countries face asymmetric disturbances and when prices are sticky. These costs could be reduced if there is a high level of factor mobility (such as labour mobility) between countries, flexible wages and prices as well as fiscal transfers. Mundell viewed mobility of factors such as labour as a key factor in deciding whether to join a currency union.

McKinnon (1963) stated that openness of the economy is another important criterion for the choice of currency union. If an economy is more open to external trade, a floating exchange rate would be relatively ineffective because changes in the exchange rate would destabilise the internal price level and have few advantages on real wages and terms of trade. Kenen (1969) states that countries with a wide range of products would be able to maintain a currency union compared to those with few products. This is because countries with low product diversification are subject to larger disturbances. Mundell (1961), McKinnon (1963) and Kenen (1969) represent the core of the theory of optimum currency areas and form the basis for much of the empirical studies in this area.

Other criteria that affect the desirability of currency union or a fixed exchange rate are benefits from lower trade and investment costs, asymmetry of shocks, the ability of

authorities to resist monetising fiscal deficits and the desirability of adopting monetary policy of the anchor currency (see Dwight, 2006; Tjirongo, 1995). As Dwight (2006: 54) notes, there is no consensus on the methodology of assessing the costs and benefits identified by the theory of optimum currency areas, and many analyses focus on criteria such as labour mobility and asymmetry of shocks. Some criteria such as the cost of political considerations or the value of tying the hands of the authorities are difficult to measure, and hence different analysts place different weights on different aspects of monetary integration.

A fixed exchange rate regime can alleviate the costs of trade and cross-border investment if the intensity of trade and cross-border investment is higher. Namibia's direction of trade by region in 2003 compared with other members of the CMA is presented in Table 1. Table 1 shows that Lesotho, Namibia and Swaziland trade more with South Africa. Since the intensity of mutual trade in the CMA especially on imports is high, a fixed exchange rate could help to reduce the costs of trade.

Table 1. Direction of trade (in percentage) in 2003

Region	Lesotho	Namibia	South Africa	Swaziland
		Exports		
CMA	19.0	28.6	7.3	68.2
Rest of Africa	0.2	5.5	12.7	11.7
Europe	0.1	49.7	30.6	1.9
America	79.5	5.9	9.7	9.1
Other	0.8	10.3	39.7	9.1
		Imports		
CMA	86.0	81.5	1.3	89.0
Rest of Africa	0.1	1.3	3.0	0.6
Europe	0.1	6.2	43.4	1.2
America	0.2	0.8	9.7	0.3
Other	13.6	10.2	42.6	9.0

Source: Dwight (2006: 55)

According to the theory of optimum currency areas, countries that are subject to similar economic shocks have less need for exchange rate adjustment as an instrument to offset those shocks. Although the intensity of mutual trade in the CMA is high, Table 2 and Table 3 show that Namibia together with Lesotho and Swaziland are exposed to different economic shocks than South Africa. Namibia has lost the ability to adjust the exchange rate due to its peg of the Namibia dollar to the rand. Compared to other CMA members, Namibia's exports are concentrated on two commodities, diamonds and fish. These two commodities account for more than half of Namibia's total commodity exports. Clothing is Lesotho's major exports, accounting for 71.8 percent of the total commodity exports. Swaziland's exports are concentrated on edible concentrates which accounts for 55 percent of the total commodity exports. South Africa is the only country with diversified exports, and no single commodity accounts for more than 12 percent of its total exports.

Table 2. Main commodity exports of the CMA (percentage of total export) in 2003/2004

Lesotho	Namibia	South Africa	Swaziland
Clothing (71.8)	Diamonds (40.8)	Gold (11.8)	Edible concentrates (55.1)
Telecom equipment (8.1)	Fish (18.3)	Iron and steel (9.0)	Cotton seed and lint
Footwear (3.7)	Other minerals (14.6)	Platinum (8.2)	Wood pulp (12.9)
Beverages and tobacco (2.7)	Some manufactured (12.1)	Other metals (7.2)	Sugar (8.5)
Wool (2.3)	Live animals (6.3)	Motor vehicles (6.9)	Plastic products (2.7)

Sources: Data for Lesotho are obtained from the IMF Country Report No. 05/438 and Central Bank of Lesotho's Annual Report. Data for Namibia are obtained from the Namibia's Central Bureau of Statistics. Data for Swaziland were obtained from the IMF's Country Report No. 06/109, and data for South Africa were obtained from Statistics South Africa.

The structure of production in the CMA shows that agriculture is a significant contributor to GDP in Lesotho, Namibia and Swaziland, but it accounts for only 4 percent of the GDP in South Africa. Mining accounts for 15 percent of Namibia's GDP compared to 8 percent of South Africa's GDP. Namibia has the lowest share of manufacturing as percentage of GDP than other CMA members.

Table 3. The structure of production in the CMA: sectors' contribution to GDP in 2004

	Lesotho	Namibia	South Africa	Swaziland
Agriculture, forestry and fishing	16	11	4	13
Mining and quarrying	0	15	8	0
Manufacturing and construction	38	16	24	30
Services	46	58	64	57
Total	100	100	100	100

Sources: Data for Lesotho are obtained from Central Bank of Lesotho' Annual Reports. Data for Namibia are obtained from the Bank of Namibia's Annual Reports, while those of Swaziland are obtained from the IMF Country Report No. 06/109. South African data were sourced from South African Reserve Bank's Quarterly Bulletins.

The CMA agreements could restrict the ability of the Bank of Namibia to pursue expansionary monetary policies in order to boost growth or create money to finance the budget deficit. The CMA arrangements require that the Namibia dollar be 100 percent backed by foreign exchange. This arrangement puts an upper limit on the quantity of money which the Bank of Namibia can circulate. Despite these arrangements Dwight (2006: 56) notes that foreign exchange backing for the Namibia dollar has been about twice the currency in circulation and this implies that the 100 percent backing requirement has not been binding. The Bank of Namibia has been able to use its limited flexibility within the constraint of the fixed exchange rate in order to keep interest rates below those in South Africa for an extended period so as to promote economic growth. According to Dwight (2006: 57) this differential was eliminated in mid-2004 to help safeguard international reserves.

With regard to fiscal policy the authorities' policies have been prudent and the government has relied on the issuance of debt and has not financed the deficit through money creation. Since the CMA arrangements imply that the hands of the authorities are tied, the value of tying the hands of the authorities may be less.

Labour mobility that was cited by Mundell (1961) as an important criterion for currency or monetary union to be successful appears to be more important for Lesotho and Swaziland, but has less impact for Namibia and South Africa. The mobility of labour between countries can help to compensate for lack of exchange rate flexibility. According to De Grauwe (1992: 8), if there are two countries, one with trade surplus and the other one with a trade deficit, labour can move from a country with high unemployment and trade deficit to the one with low unemployment and trade surplus. This can smooth income by preventing employment losses in countries with trade deficit.

Dwight (2006: 57) states that a significant number of workers from Lesotho and Swaziland work in South Africa. Approximately 2 percent of Swaziland's workforce is employed in South African mines and remittances from expatriates accounted for 5

percent of GDP in 2004. Lesotho has about 15 percent of its workforce employed in South Africa and remittances have accounted for 22 percent of GDP in recent years. According to Dwight (2006: 58) labour mobility with regard to Namibia appears lower because the government limits immigration in order to promote Namibianisation. With regard to South Africa, labour mobility to and from CMA has less impact because South Africa accounts for more than 90 percent of the CMA population. Tjirongo (1995: 9) notes that labour mobility between South Africa and its neighbouring countries has been extensive, and more so in mining. Labour movement between Namibia and South Africa has been very small and this could be attributed to the fact that mining itself is the dominant activity in the Namibian economy. It appears that the mobility of labour in the CMA is a significant instrument of adjustment for Lesotho and Swaziland, but not for Namibia.

1.3.3 Implications for Monetary and Exchange Rate Policies

The full convertibility requirement implies that 100 percent of the Namibian currency, the Namibia dollar, is fully backed by foreign exchange assets. Budget deficit cannot be accommodated by printing money. As Tjirongo (1995: 3) states, the free flow of capital between Namibia and the rest of the CMA ensures that interest rates in Namibia are determined in the larger money and capital market of South Africa. CMA membership also implies that Namibia loses the nominal exchange rate as a policy instrument. The exchange rate system of the South African rand is applicable in the CMA.

Under these conditions, the equilibrium real exchange rate will not only be influenced by Namibian fundamentals, but South Africa's as well. Pegged currencies are also vulnerable to speculative attacks, and this suggests that the focus on the causes of exchange rate tensions and the extent to which exchange rates are in line with economic fundamentals, are important. It is necessary to examine trends over time in the indicators of a country's external competitiveness and balance of payments to asses whether its real exchange rate is likely to be consistent with a sustainable external account. Devarajan

(1999) showed that real exchange rate misalignment in the CFA Franc Zone, was disproportionally distributed. Countries whose exports are dominated by primary products experienced the largest real exchange rate misalignments. This shows that the costs of real exchange rate misalignments for countries participating in a currency union may be unevenly distributed.

Estimation of the real exchange rate misalignments is necessary for Namibia. Namibia has a higher share of primary exports to overall exports in comparison to other members of the CMA. It is likely that Namibia experienced some real exchange rate misalignments in response to shocks that affected primary products.

1.4 Statement of the Research Problem

The preceding sections provided a basis on which to conceptualise the research problem. It was pointed out firstly that the real exchange rate is important because it affects many variables in the economy. It affects foreign demand for domestic goods depending, on the country's position in the world market. It affects decisions to save and invest and is expected to provide signals to economic agents in the economy. Information on the extent to which the real exchange rate diverges from its equilibrium rate serves as a guide to policy makers to ensure that it does not send wrong signals to economic agents. Wrong signals can result in inefficient allocation of resources and could cause a reduction in the country's welfare.

Secondly, a review of monetary and exchange rate arrangements showed that the CMA is an informal exchange rate union. Namibia's membership of the CMA implies that the country loses the exchange rate as an instrument of adjustment. Although there is a significant amount of trade between Namibia and South Africa, the two countries are subjected to different shocks. The composition of Namibia's trade as well as that of its GDP differs from South Africa's. It is to be expected that Namibia's terms of trade differs from that of South Africa.

Thirdly, labour mobility which was cited as a key criterion for the success of currency union is not important to Namibia. There is very low labour mobility between Namibia and South Africa. Labour mobility is not a significant instrument of adjustment for Namibia.

Fourthly, Namibia's export is dominated by few primary commodities, and it is argued that countries with a high percentage of primary commodities in their total export, experience the largest real exchange rate misalignments. Since Namibia has more primary commodities in its total exports compared to other members of the CMA it is likely that the country experienced real exchange rate misalignment in response to shocks that affect commodity export prices. Since Namibia cannot use the exchange rate as an instrument of adjustment, it is likely that there were some misalignments because under that arrangement real exchange rate cannot be immediately or easily realigned.

Although the real exchange rate is an important variable in the economy, empirical research on the determination of the equilibrium real exchange rate in Namibia is limited. This could be because estimating the equilibrium real exchange rate is a challenging task. It requires the determination of the equilibrium real exchange rate in the first place and then measurement of the degree of deviation of the actual real exchange rate from this equilibrium value. Methods of estimating the equilibrium real exchange rate and the resulting real exchange rate misalignments have been advanced by new time series econometrics such as unit roots, cointegration and vector autoregression. It is against this background that this thesis focuses on the determinants of the real exchange rate and resulting real exchange rate misalignments in Namibia. It also assesses the impact of real exchange rate misalignment on economic performance. The research is divided into the following questions:

- What are the determinants of the equilibrium real exchange rate in Namibia?
- Was the real exchange rate in Namibia misaligned?
- If there were misalignments, what is the impact of those real exchange rate misalignments on economic performance of Namibia?

1. 5 Objective of the Study

The objective of the study is to:

- Estimate the determinants of the real exchange rate and equilibrium real exchange rate for Namibia and policy implications;
- Measure the resulting real exchange rate misalignment;
- Test the impact of real exchange rate misalignment on measures of economic performance (investment, per capita, agricultural sector and export sector).

The study covers the period 1970 to 2004. The analysis of how changes in the fundamental determinants affect the equilibrium real exchange rate can provide some additional guidance to the prevailing exchange rate policy. This could help to draw inferences about the type of exchange rate regime for Namibia.

The study will test the following main hypotheses:

- Pegged currencies are vulnerable to speculative attacks, and countries whose exports are dominated by primary exports experience the largest real exchange rate misalignment.
- The following two sub-hypotheses will also be tested:
    - Namibia's export is dominated by primary export and is likely to have experienced real exchange rate misalignment in response to external shocks that affected primary products.
    - Real exchange rate misalignment affects economic growth, investment, export and competitiveness of the country's economy. It also increases capital flight and could undermine the performance of the agricultural sector.

1.6 Methodology

The methodology of this study comprises the following:

- A review of exchange rate and monetary policies in Namibia.
- Extensive review of the literature on the determinants of the real exchange rate and the resulting real exchange rate misalignment. An investigation of the theories and empirical studies regarding the hypothesis and signs of coefficients of the determinants of the real exchange rate.
- The application of time series techniques to estimate the equilibrium real exchange rate and resulting real exchange rate misalignment. The technique applied to estimate the equilibrium real exchange rate is Johansen (1988, 1995) full information maximum likelihood.
- An investigation of the impact of real exchange rate misalignment on economic performance using vector autoregression technique.

1.7 Outline of the Study

The rest of the thesis is organised as follows. Chapter 2 deals with the fundamental literature on the real exchange rate with special emphasis on concepts, definitions, analytical framework, the theoretical model, fundamental determinants and empirical studies.

Chapter 3 deals with real exchange rate and commodity prices. It examines the theory and empirical studies on the relationship between real exchange rate and commodity prices for a commodity exporting country such as Namibia. The model is discussed and empirical studies are reviewed.

Chapter 4 discusses the real exchange rate misalignment. The emphasis is on theory, models and empirical studies of the impact of real exchange rate misalignment on economic performance.

Chapter 5 presents an econometric analysis of real exchange rate in Namibia. It discusses the estimation technique and data to be used in the estimation. It then presents the results for both the three-good model and the Cashin *et al*. model.

Chapter 6 discusses the impact of real exchange rate misalignment on economic performance. It applies the technique for assessing the impact of real exchange rate misalignment on economic performance and presents the results. The conclusion and policy implications are provided in Chapter 7.

CHAPTER 2. FUNDAMENTAL LITERATURE ON REAL EXCHANGE RATE

2.1 Introduction

This chapter discusses the fundamental literature on the real exchange rate. It starts with the conceptual definition of the real exchange rate, the analytical framework and theoretical model. The chapter also reviews the literature on the fundamental factors that influence the real exchange rate as well as the empirical studies on the real exchange rate.

The chapter is organised as follows. Section 2.2 discusses briefly the theoretical foundations of real exchange rate. Section 2.3 provided concepts and definitions. Section 2.4 deals with analytical framework. Section 2.5 presents the theoretical model. Section 2.6 reviews the literature on fundamentals and empirical studies. The conclusion is provided in Section 2.7.

2.2 Theoretical Foundations of Real Exchange Rate

Frequent movements in the real exchange rate had been and still are regarded as temporary divergence of the real exchange rate from its sustainable equilibrium value. The purchasing power parity (PPP) hypothesis remains a prevailing pattern in the discussion of the real exchange rate and other topics of international finance. The PPP hypothesis was pioneered by Cassel (1922) and states that the nominal exchange rate should reflect the purchasing power of one currency against another. According to Cassel (1922: 140-162) the purchasing power exchange rate is measured by the reciprocal of one country's price level, $1/P$ against another, $1/P^*$, where $1/P$ and $1/P^*$ are domestic and foreign countries' internal purchasing power parity. The purchasing power parity rate is a rate at which the nominal exchange rate e would tend. This is when trade imbalances, speculation, central bank intervention and other barriers to trade do not exist. It is

expressed as: *e =(1/P*)/(1/P)=P/P*=n,* where *n* is purchasing power exchange rate. The real exchange rate, *rer* is defined as $(e \cdot P^*)/P$. If absolute PPP holds *rer =1.* The relative version of the PPP which uses price indexes allows *rer* to be some constant scalar Φ (see Breuer, 1994: 247). The PPP hypothesis is tested empirically as $\ln e_t = \alpha + \beta \ln(p_t - p_t^*) + \varepsilon_t$, where p_t and p_t^* are domestic and foreign prices and ε_t is the error term. If there is absolute PPP $\alpha = 0$ and $\beta = 1$. Evidence of relative PPP requires that α will not be zero. The PPP equation has been tested empirically, and Officer (1976), Isard (1976) and Frenkel (1978; 1981), were some of the first notable studies. Isard (1976) and Officer (1976) did not find evidence in support of the PPP hypothesis. However, Frenkel (1978, 1981) found evidence in favour of the PPP hypothesis.

Breuer (1994: 263-274) summarised some empirical studies on the PPP hypothesis and showed that many studies did not find evidence in support of the PPP hypothesis. There were few studies that supported the PPP hypothesis before the late 1980s, but after that period most studies rejected the PPP hypothesis. Although the PPP had served as and still regarded as a benchmark for the value of currencies it is not an appropriate representation of the equilibrium real exchange rate especially when fundamental disturbances exist (Allen, 1995: 1). It only relates the exchange rate to the relative foreign and domestic prices. Allen argues that the natural real exchange rate offers an alternative pattern or paradigm for the equilibrium real exchange rate. The natural real exchange rate refers to medium term and inter-cyclical equilibrium real exchange rate. It is the equilibrium real exchange rate that clears the balance of payments when cyclical factors, speculative capital flows and movements in international reserves do not exist (Allen, 1995: 6). This equilibrium real exchange rate changes when there is a movement in the fundamentals.

The natural equilibrium real exchange rate approach identifies the fundamental determinants and models for estimation (of the equilibrium real exchange rate). This approach is mainly empirical and it aims at explaining long-term movement of the real exchange rate. Fundamental disturbances (which will be explained later in this study) occur regularly and move the natural equilibrium real exchange rate to a new long-run value, and does not (the natural equilibrium real exchange rate) reach a steady state.

According to Allen (1995: 9) since the fundamental disturbances are not constant around the mean, the real exchange rate will also not be moving around the mean. If that was the case, then the real exchange rate will also converge to a given mean or trend. The main criticism of the PPP hypothesis is that it does not take into account of movements in the fundamentals. It postulates that the real exchange rate is stationary around a given mean and fluctuations in the nominal exchange rate are solely attributed changes in relative prices.

The natural real exchange rate is also supported by Stein (1994: 137) who argues that the PPP hypothesis is not correct and must be replaced by the natural real exchange rate generated by the fundamentals. Stein provided empirical evidence using USA data that the real exchange rate has not been stationary.

Williamson (1983, 1994) also rejected the PPP postulation that the equilibrium real exchange rate is an immutable number. He argued that the real exchange rate changes over time and this can be caused by factors such as productivity. If a country is growing faster than others the real exchange rate will appreciate. Other fundamentals such as accumulation of foreign liabilities by a country in order to finance its deficit, and changes in the terms of trade also cause the real exchange rate to fluctuate. Williamson proposed a fundamental equilibrium real exchange rate. The fundamental equilibrium real exchange rate is a rate which is in line with macroeconomic balance. This means that internal and external balances are achieved.

The fundamental equilibrium real exchange rate differs from the natural equilibrium real exchange rate in the sense that it is a rate that will guide policy. It is a measure that makes the current account to be consistent with sustainable capital flows. According to Allen (1995: 10) and Williamson (1994: 180) the fundamental equilibrium real exchange rate is normative and this is the main difference with the natural equilibrium real exchange rate. The natural equilibrium real exchange rate takes the fundamentals such as trade and commercial policies as given, and has no judgement as to whether the fundamentals are

in line with the welfare of the country. This analysis illustrate that there is a criticism of the PPP hypothesis and the natural real exchange rate which is a function of fundamentals has gained popularity in real exchange rate discussions.

2.3 Concepts and definitions

There is no single definition of the real exchange rate that is accepted generally by economists as well as analysts. Montiel (2003: 312) defines in broad terms the real exchange rate as the relative price of foreign goods in terms of domestic goods. Montiel notes that what constitutes domestic and foreign goods depends on the particular analytical framework and the specific macroeconomic model being used. Economists use different types of models for different purposes and this cause a variety of analytical real exchange rate definitions.

Hinkle and Nsengiyuma (1999: 41) define the real exchange rate in two ways. The first is in external terms where real exchange rate is defined as the nominal exchange rate adjusted for differences in price level between economies and these are measured in a common currency. The second way defines real exchange rate in internal terms as the ratio of local price of tradable to nontradables within a country. The first way of defining real exchange rate derives originally from the purchasing power parity (PPP) theory and it compares the relative value of currencies by measuring the relative prices of foreign and domestic consumption baskets. The second way of real exchange rate definition captures the internal relative price incentive in a particular economy for the production or consumption of tradable as opposed to nontradables goods. In this latter definition, the real exchange rate is an indicator of resource allocation and incentives in the local economy.

Edwards (1988a) also defines the real exchange rate as the ratio of the prices of tradables to nontradables (*RER*= price of tradable goods/price of nontradable goods), where *RER* is real exchange rate. In practical terms it is not easy or straightforward to calculate the ratio

of prices of tradables to nontradables, and a more operational definition of the real exchange rate is computed as: $RER = EP_T/P_N$, where E is the nominal exchange rate defined as units of domestic currency per unit of foreign currency, P_T is the world price of tradable goods, P_N is the domestic price of nontradable goods. Empirically, P_T and P_N are proxied by foreign price level such as wholesale price index and the local consumer price index. Using this definition, an increase in RER is described as appreciation and a decrease is described as depreciation.

Equilibrium real exchange rate is defined as the value of the real exchange rate where internal and external equilibrium are attained at the same time. The economy is in internal equilibrium when there is a clearing in the nontradable goods market. External equilibrium is attained when the current account is sustainable. This is a situation in which the country's current account deficit is equal to the value of sustainable capital inflows that it can expect to receive (Edwards, 1988a: 4; Montiel, 2003: 316).

The definition of the equilibrium real exchange rate raises an important question on what it takes for macroeconomic equilibrium to be sustainable. Montiel (2003) suggests that this question can be answered by formalising the dynamic structure of the economy. The exchange is determined at any moment in time by predetermined variables, exogenous policy variables and other exogenous variables (see also Edwards, 1988a). Predetermined variables are endogenous that change slowly over time, for example the capital stock of the economy, technology and the country's international net creditor position. Exogenous policy variables are variables which are under the control of the domestic authorities. These include fiscal, monetary and trade policies. Other exogenous variables are variables that can be regarded as random shocks and bubble variables because they affect the economy through their influence on expectation. These include variables such as weather, terms of trade and world interest rates.

The economy determines the values of endogenous variables such as the real exchange rate and the rate of change of predetermined variables. Montiel (2003) and Edwards (1988a) noted that the actual real exchange rate observed at any time may be influenced

by speculative bubble factors, by actual values of predetermined variables and transitory variables of policy and exogenous variables. If the variables on which the actual real exchange rate depends become unsustainable the actual real exchange rate will tend to change over time. Speculative factors are generally short-lived and transitory and in this case, short-run equilibrium real exchange rate can be derived. The equilibrium real exchange rate in the short run is conditioned on the short-run fundamentals.

Montiel (2003: 317) states that the short-run equilibrium real exchange rate will not be sustainable because the policy and exogenous variables that affect it can deviate from their sustainable values. The short-run equilibrium real exchange rate can be expected to change when policy and exogenous variables change. In addition to that, even if the policy and exogenous variables are at their sustainable levels, predetermined variables may not have completed their adjustment to permanent positions. Changes in predetermined variables would result in the short-run real exchange rate to change even if there are no adjustments in the policy and predetermined variables. According to Montiel predetermined variables will stop changing when they reach a steady state. Hence, the long-run equilibrium real exchange rate depends only on the sustainable values of the exogenous and policy variables which affect the real exchange rate directly. Edwards (1998a; 1998b; 1989) calls these variables long-run fundamentals.

Despite the fact that the equilibrium real exchange rate depends on permanent variables, the actual real exchange rate responds to both short and permanent variables. The existence of equilibrium does not mean that the actual real exchange rate is always similar to the equilibrium real exchange rate. The actual real exchange rate often moves away from its equilibrium in the short-run. According to Edwards (1988a: 9) short-run and medium-run deviations which are not very large and result from temporary changes in real variables can be quite common. Other types of deviations can generate a large and persistent difference between the actual and equilibrium real exchange rates. The gap between actual and equilibrium real exchange rates is called real exchange rate misalignment. Real exchange rate misalignment is a continuous movement away of the exchange rate from its long-run equilibrium level (see also Williamson, 1983: 13).

2.4 Analytical Framework

The previous section dealt with concepts and definitions with regard to the real exchange rate. As stated above, the sustainable values of the predetermined, policy and exogenous variables constitute the long-run fundamentals which determine the equilibrium real exchange rate in the long run. The most important step in estimating the long-run equilibrium real exchange rate is identification of these fundamentals. That is because the dynamic behaviour of these fundamental variables determines the path followed by the real exchange rate over time. The use of specific analytical models that can explain the time path followed by the real exchange rate in response to macroeconomic shocks is required to make this identification.

The production structure of the model is the key factor in the definition of the real exchange rate in analytical models. The most widely used modelling frameworks of the real exchange rate are as follows (Montiel, 2003: 312):

2.4.1 One-Good Model

The one-good model framework contains a single good which is assumed to be traded internationally and elsewhere arbitrage is assumed to equalise prices. The one-good model framework is useful for the analysis of phenomena that are purely monetary, such as inflation. As Montiel (2003: 313) states, there can be no real exchange rate in the one-good modelling framework because with only a single good there is no difference to be made between domestic and foreign goods.

2.4.2 Complete Specialisation Model

The complete specialisation model is an alternative framework which assumes that the local economy and the rest of the world are each specialised in the production of a single

good. These goods are traded internationally and are imperfect substitutes for each other. According to Montiel (2003: 313) this model is applicable to countries whose trade consists largely of manufactured products, because these goods tend to be imperfect substitutes for goods produced by the rest of the world. Real exchange rate in this context is defined as the number of units of the domestically produced good that have to be given up for each unit of the foreign good. In this framework real exchange rate is the main determinant of the composition of both domestic and foreign absorption between goods produced locally and those that are produced abroad. This means that the real exchange rate determines the aggregate demand for goods produced domestically and is also an important determinant of the country's balance of trade.

In the complete specialisation model, the real exchange rate coincides with the country's terms of trade (Ahler and Hinkle, 1999: 315). Although this is the artefact of the assumption of complete specialisation in production, Montiel (2003: 313) acknowledges that the two concepts are generally different from each other in analytical frameworks which do not make this assumption.

2.4.3 Dependent Economy Model

The dependent economy model has a production structure that contains two goods. One good, nontraded is produced locally and consumed only locally, and the other is produced and consumed locally and abroad. The good which can be bought and sold across international boundaries is called traded or foreign good (see also Montiel, 1999). The real exchange rate in this case is defined as the number of nontraded goods required to purchase one unit of the traded good. It is expressed as:

$$RER = \frac{P_T}{P_N} \qquad (1)$$

where P_T is the domestic currency price of the traded good, and P_N is the domestic currency price of the nontraded good. According to Montiel (2003: 313) this is sometimes called internal real exchange rate. This modelling framework contains only one type of foreign good and does not have terms of trade. This framework is useful when analysing issues where the role of terms of trade is not important. This is mainly in economies whose terms of trade are exogenous, and is primarily used to analyse the effects of macroeconomic policies in small economies (Montiel, 2003: 314).

2.4.4 The Three-Good Model

The three-good (exportable-importable-nontraded) model is required when terms of trade do matter. The exportable and importable goods can be produced and consumed at home. There are two foreign goods in this model and therefore two real exchange rates and separate as well as distinct definition of the terms of trade (Montiel, 2003: 314). If P_X is the domestic currency price of the exportable good and P_Z is the domestic currency price of the importable good, the exportable real exchange rate is $E_X = \frac{P_X}{P_N}$ and the importable real exchange rate is $E_Z = \frac{P_Z}{P_N}$. The terms of trade (TOT) is defined as $TOT = \frac{P_X}{P_Z}$. According to Ahlers and Hinkle (1999) the three-good model is useful when analysing the macroeconomic effects of movements in the terms of trade. It is also useful for analysing the macroeconomic effects of terms of trade changes and also changes in commercial policies that affect the domestic relative prices of exportables and importables.

2.5 Theoretical Model

The growth of the traded goods in relation to nontraded goods is important for the development of developing countries' economies, and analytical framework such as the

dependent economy model can be important in indicating the incentives of reallocating local resources. It is an important method to capture the Balassa-Samuelson effects clearly. The dependent economy model has been adopted for the economies which are in transition. These are economies that are opening up to the global economy and are characterised by a large increase in traded goods relative to nontraded goods. Hence in the dependent economy model, the equilibrium real exchange rate is the prices of tradable goods relative to the prices of nontradable goods for which a given sustainable value of other important factors result in the achievement of internal and external equilibrium at the same time.

The main problem of the dependent economy model is that data are not available. The data on tradable and nontradable goods' prices for a developing economy such as Namibia are not readily available. Therefore, for empirical analysis this study uses the three-good model. The three-good model is applied to estimate the equilibrium real exchange rate. The study uses the model developed by Edwards (1988b). This model of real exchange rate determination allows nominal and real factors to play a role in the short run. Only real fundamentals influence the equilibrium real exchange rate in the long run. This model is usually adopted for small developing economies whose production structures are less flexible and whose exports are dominated by undifferentiated primary products. It attempts to capture some of the most salient macroeconomic features of the developing economy in a simple way. These include exchange control, trade barriers, and freely determined parallel exchange rates for financial transactions. This model is also referred to as the fundamental approach to real exchange rate determination.

The study follows Edwards (1988a; 1988b), Montiel (1999; 2003) and Elbadawi (1994) to specify the equilibrium real exchange rate. The relationship between the equilibrium real exchange rate and the factors influencing it or the fundamentals is specified as:

$$\ln eq_t = \beta_0 + \beta_1' PX_t \qquad (2)$$

where eq_t is the equilibrium real exchange rate, β_0 and β_1 are the vector of parameters to be estimated, PX_t is a vector of the components of fundamentals that are permanent. Equation (2) is not easily estimated empirically because the equilibrium real exchange rate cannot be observed. The β_s and PX_t are estimated by using the actual values of the real exchange rate and fundamentals in order to have an empirical model which is in line with Equation (2) as follows:

$$\ln RER_t = \beta_0 + \beta_1' X_t + \varepsilon_t \qquad (3)$$

where RER is the observed or actual real exchange rate, X_t is the vector of fundamentals and ε_t is the error term assumed to be stationary and zero mean.

The central most important part of this model is the error correction model (ECM) which captures the dynamics of the real exchange rate. Factors which cause the real exchange rate to move away from the equilibrium in the short run should bring the system back into equilibrium. This is represented in Equation (4):

$$\Delta \ln RER = \gamma(\ln RER_{t-1} - \beta' X_{t-1}) + \sum_{j=1}^{p} \mu_j \Delta \ln RER_{t-j} + \sum_{j=0}^{p} \eta'_j \Delta X_{t-j} + n_t \qquad (4)$$

where Δ denotes the first differences of the vector of variables, $(\ln RER_{t-1} - \beta' X_{t-1})$ is the error correction term, and n_t is the error term assumed to be independent and identically distributed with mean zero. Under the assumption that variables are stationary or I(1) Equation (3) is implied by Equation (4) and the value of γ represents a speed of adjustment (see Enders, 2004). The speed depends on the value of γ, and $0 < \gamma < 1$. If the values of γ is closer to 1 the speed of adjustment will be faster, and the long-run equilibrium is stable if $\gamma < 0$.

Equilibrium real exchange rate depends on the fundamental factors, and to estimate the equilibrium real exchange rate those factors must be specified. In his study of real exchange rate for developing countries, Edwards (1988a) identified a number of fundamental variables that determines the real exchange rate. Following Edwards, and Elbadawi (1994) the vector of fundamentals is specified as:

$$X_t = [\ln TOT_t, \ln GOVEX_t, \ln TARIFF_t, \ln PROD_t, \ln CAPITAL_t, \ln INVGDP_t] \quad (5)$$

where *TOT* is the terms of trade, *GOVEX* is government expenditure to GDP, *TARRIF* is import tariff, *PROD* is a measure of productivity or technology, *CAPITAL* is capital inflows and *INVGDP* is ratio of investment to GDP. This Edwards' specification has many explanatory variables and some of them are related to each other and this is one problem when applied to estimate the equilibrium real exchange rate of the Namibia dollar. The estimated equilibrium real exchange rate applied in this study does not include all the variables specified by Edwards and hence it does not coincide completely with his model. The next section explains how these fundamental variables influence the real exchange rate. As discussed in Chapter 1, the real exchange rate of Namibia can also be influenced by the fundamentals of South Africa and one would estimate the model by including some of South Africa's fundamentals. Despite this, it is important to note that not all fundamentals or South African variables are relevant to the determination of the real exchange rate in Namibia. Hence estimating the real exchange rate for Namibia with some South African variables cause difficulties, because theoretically or *a priori*, there is no methodology of determining which of the variables to include or exclude.

2.6 Real Exchange Rate Fundamentals and Empirical Studies

2.6.1 Real Exchange Rate Fundamentals

Edwards (1988a) provides a detailed explanation of the real exchange rate fundamentals. Real exchange rate fundamentals are variables that in addition to the real exchange rate

play a role in the determination of the country's internal and external equilibrium. Jointly, these variables determine the country's internal and external position. Fundamentals can be classified into two groups, external fundamentals and domestic fundamentals. The external fundamentals include international terms of trade, international transfers and world real interest rate. Domestic real exchange rate fundamentals consist of variables that can be directly affected by policy decisions and those that cannot be affected by policy decisions. Policy related real exchange rate fundamentals are trade restrictions such as import tariffs, import quotas, taxes on export, exchange and capital controls, other taxes and subsidies, and the composition of government expenditure. Domestic non-policy real exchange rate fundamental such as technological progress is another important determinant. Edwards (1988a: 7-8) considered few general cases in order to explain how the fundamental variables determine the equilibrium real exchange rate. Imposition of an import tariff will increase the domestic price of importable goods and generates intratemporal and intertemporal substitution effects, and income effects. Tariffs decrease the demand for importable goods and therefore the volume of imports. Higher demand for nontradable goods will be induced because of substitutability. The price of nontradable goods will increase in order to maintain equilibrium in that market. This will result in appreciation of the equilibrium real exchange rate. However, since the imposition of tariff results in both substitution and income effect, the real exchange rate can depreciate or appreciate. This depends on whether the income or substitution effect of import tariff dominates. Edwards notes that in most cases the substitution effect of trade restrictions dominates the income effect and thus, increasing restrictions leads to a higher relative rise in the price of nontradable goods and results in real exchange rate appreciation. Reduction of trade restrictions results in real exchange rate depreciation.

Terms of trade is one of the main factors or fundamentals that influence the real exchange rate. If the terms of trade increases it will raise the purchasing power and this results in the increase in the demand for domestic goods. Under the assumption of a small country such as Namibia the prices of traded goods remain unchanged but those of nontraded goods increases. This causes the real exchange rate to appreciate. This is called income effect (see Asfaha and Huda, 2002). On the other hand, an increase in the terms of trade

can also cause the real exchange rate to depreciate and this is called substitution effect. Consumers will change from consuming exportable and nontraded goods to consuming importable goods. When import increases the prices of nontraded goods will decrease and results in real exchange rate depreciation. The effect of terms of trade on the real exchange rate cannot be assigned *a priori*. It is ambiguous. Although the net effect of terms of trade on real exchange rate is ambiguous, Edwards (1988b) suggests that in most cases the income effect of terms of trade changes overwhelm the substitution effect.

Capital control can be defined as any restriction or control that causes impediments on free borrowing and lending to and from the rest of the world. Relaxation of capital control may cause the real exchange rate to appreciate or depreciate. According to Edwards (1988a: 8) if liberalisation of capital controls raises the inflows of capital, it leads to the expansion of the monetary base. The expansion of the monetary base results in higher expenditure for all goods including nontradables. Increase in the demand for nontradable goods results in an increase in their prices and in order to maintain internal equilibrium in the current period, the equilibrium real exchange rate appreciates. The net effect of capital control on the equilibrium real exchange rate depends on the net inflow of capital.

International transfer is another fundamental determinant of the equilibrium real exchange rate. According to Edwards (1988a) if a country has to make transfer to the rest of the world, current and future domestic real income and expenditure will fall. This generates a fall in the relative price of nontradable goods and the real exchange rate will depreciate. In cases where countries are receiving transfers from the rest of the world such as those developing countries receiving foreign aid, the equilibrium real exchange rate will appreciate.

Government expenditure is also an important fundamental variable which determines the equilibrium real exchange rate. The effect of change in government expenditure on the equilibrium real exchange rate depends on the composition of the expenditure between tradable and nontradable goods. If a greater share of the increase in government

expenditure is on nontradable goods there will be an increase in the demand for nontradable goods in the short run and that raises up the prices of nontradable goods. This results in real exchange rate appreciation. On the other hand, if a large share of the increase in government expenditure is directed towards tradable goods, the relative price of non-tradable goods will fall and the real exchange rate depreciates (Edwards, 1988b, Asfaha & Huda, 2002, and Mongardini, 1998).

The ratio of investment to GDP is another determinant of the real exchange rate. According to Mongardini (1998:14) investment is more intensive to import than to consumption. An increase in the ratio of investment to GDP will increase spending, deteriorate the current account and lead to depreciation of the real exchange rate. However, Mathisen (2003: 7) notes that the expected sign is ambiguous and an increase in the share of investment can cause the real exchange rate to appreciate or depreciate.

Technology and productivity is a domestic variable that is not related to policy and generates productivity and efficiency. This variable captures the Balassa-Samuelson effect hypothesis which states that an increase in the productivity of tradable goods versus nontradable goods of one country relative to foreign countries raises its relative wages. This leads to a rise in the price of nontradable goods and causes the real exchange rate to appreciate (Mathisen, 2003:8; Spatafora & Stavrey, 2003: 5 and Asfaha and Huda 2002).

2.6.2 Empirical Studies

The exchange rate has gained great prominence in economic discussions in developing countries. Edwards (1989) argues that inappropriate exchange rate policies pursued by some countries in the late 1970s contributed to the international debt crisis of the 1980s. Overvalued exchange rates in many African countries resulted in deterioration of the agricultural sector and external current accounts. Inappropriate exchange rate policy also caused disappointing outcomes from Argentina, Chile and Uruguay's economic reform and free market policies during the 1970s.

The issue of whether the real exchange rate is in line with its long-run equilibrium value is very important. Maintaining the real exchange rate out of its equilibrium value can result in significant welfare costs. It can send wrong signals to economic agents and this will in turn result in economic instability.

Edwards (1988b) developed a dynamic model of the real exchange rate behaviour in developing countries. This dynamic model analyses real and monetary variables in the determination of the real exchange rate in the short and long run. In the long run, only real variables or fundamentals influence the equilibrium real exchange rate. The model attempts to capture some of the salient macroeconomic features of the developing economy. These features include the existence of the exchange controls, trade barriers and freely determined parallel exchange rate for financial transaction. A three goods economy, consisting of exportable, importable and nontradable goods is considered. Residents of the country hold domestic and foreign assets and there is a dual exchange rate regime. There is a government that consumes importable goods and nontradable goods. Real exchange rate equilibrium is distinguished from real exchange rate disequilibrium. According to the Edwards' model, the most important fundamental determinants of the equilibrium real exchange rate are terms of trade, government expenditure, import tariffs, and capital flows. Other possible fundamental variables are

technological progress and the ratio of investment to GDP. The equilibrium real exchange rate was estimated as follows:

$$\ln e_t^* = \beta_0 + \beta_1 \ln(TOT)_t + \beta_2 \ln(GOVEX)_t + \beta_3 \ln(TARIFFS)_t + \beta_4 \ln(TECH)_t + \beta_5 \ln(CAPFLOW)_t + \beta_6 \ln(INV)_t + \varepsilon_t \quad (6)$$

where e^* is equilibrium real exchange rate, *TOT* is the terms of trade, *GOVEX* is the level and composition of government expenditure, *TARIFFS* is import tariffs, *TECH* is a measure of technological progress, *CAPLOW* is capital inflows, *INV* is the ratio of investment to GDP, and ε is the error term. The impact of terms of trade on the equilibrium real exchange rate is not without ambiguity. Equation (6) was estimated using pooled data for 12 developing countries (Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, Philippines, South Africa, Sri Lanka, Thailand and Yugoslavia). The dependent variable, real exchange rate was computed as ($RER=E*WPI^{US}/CPI$) where *E* is the nominal exchange rate between the domestic country and the US dollar, WPI^{US} is the wholesale price index in the US and it is a proxy for the foreign price of tradable goods, and CPI is the consumer price index and it is considered as proxy for domestic price of nontradable goods. An rise in the real exchange rate (RER) indicates a real depreciation, while a decrease reflects real appreciation.

The results showed that the coefficient of terms of trade was significant and indicate that an increase in the terms of trade will result in equilibrium real exchange rate appreciation. The coefficient of government expenditure was insignificant in all regressions and in most cases it was positive. The coefficient of the proxy for technological progress showed that an improvement in technology causes real exchange rate depreciation and this was not consistent with theoretical expectations of the model. It contradicted the Balassa-Samuelson effect prediction. The estimated coefficient for tariff was in line with the theoretical expectation, indicating that an increase in tariffs results in real exchange rate appreciation. However, this coefficient was not significant. Increase in capital flows cause real exchange rate appreciation.

The results suggest that real exchange movements have responded to both real and monetary variables. An equation for real exchange rate dynamics was postulated in order to carry out the analysis. The dynamic equation captures the most important features of the theoretical analysis in a simple but powerful way. The gap between the real exchange rate equilibrium and actual real exchange rate will tend to disappear slowly if left on their own. Although nominal devaluation is neutral in the long run, it can help to restore real exchange rate to its equilibrium value at a faster rate.

Baffes, Elbadawi & O'Connell (1997) outline an econometric methodology for analysis of both the equilibrium real exchange rate and the degree of real exchange rate misalignment. The methodology was illustrated using annual data from the Ivory Coast and Burkina Faso. The procedure involves three steps (Baffes, *et al*., 1997: 1). In the first step, time series characteristics of the real exchange rate and the fundamentals are examined. This determines the estimation technique to be used in the next step and to uncover the parameters of the long-run relationship between the real exchange rate and its fundamentals. The third step involves using the long-run parameters to calculate equilibrium real exchange rate and the level of real exchange rate misalignment. Johansen cointegration methodology was applied to estimate equilibrium real exchange rate for the Ivory Coast and Burkina Faso. Terms of trade, resource balance, openness of the economy and share of investment to GDP were included as explanatory variables in the estimation for both countries. The results for both countries indicate that an increase in resource balance shift the composition of potential output towards nontraded goods and the real exchange rate depreciates. Real exchange rate appreciates in response to improvement in the terms of trade for both countries, while an increase in openness causes the real exchange rate to depreciate. This suggests that trade liberalising reforms in Burkina Faso and the Ivory Coast caused the real exchange rate to depreciate. For Ivory Coast, an increase in investment causes real exchange rate depreciation.

The coefficient of the error correction term which measures the speed of adjustment of the real exchange rate to its equilibrium level is a crucial parameter in the estimation of the short run dynamic models (Baffes *et al*. 1997: 27). The number of years required to

eliminate disequilibrium in the real exchange rate can be derived from these estimates of the coefficient of the error correction term. The estimated adjustment speed for the Ivory Coast was between -0.3 and -0.45 and for Burkina Faso was between -0.5 and -0.61. This suggests that the speed of adjustment of Burkina was higher than that of the Ivory Coast. Baffes *et al*. (1997) used four measures (the fitted real exchange rate, its corresponding 5 year moving average, an equilibrium rate based on the Beveridge-Nelson decomposition of the fundamentals, and one based on counterfactual simulations) to estimate real exchange rate misalignment for these two countries. The computation revealed that there was overvaluation and undervaluation of the real exchange rates for the two countries.

Feyzioglu (1997) investigated the real exchange rate for Finland. The investigation was done by looking at the reduced form implied by the theoretical model in accordance with Edwards (1988; 1994). The equilibrium real exchange rate is defined as the rate that is in line with the attainment of internal and external balances simultaneously. A set of exogenous fundamentals variables which determine the internal and external equilibrium was identified. A reduced form was then constructed linking the real exchange rate to the fundamentals. The Johansen cointegration technique was used to estimate the equilibrium real exchange rate. According to Feyziouglu (1997: 10), the most important fundamental determinants of the equilibrium real exchange rate for Finland are terms of trade, real long term interest rates, difference in productivity, and price differential. The real exchange rate appreciates in the long run if the terms of trade improves or if the interest rate rises and if the productivity differential increases above the trend. The real exchange rate deviates from its equilibrium value for a long period of time, and short-run influence on the fundamentals is minimal.

Mongardini (1998) estimated empirically Egypt's equilibrium real exchange rate using the Edwards model for the period 1987 to 1996 (monthly data). The real exchange rate was regressed on terms of trade, government consumption, technology and debt service ratio. The results showed that an increase in the terms of trade, government expenditure and technology improvement cause real exchange rate appreciation. A rise in capital flows and ratio of debt service cause real exchange rate depreciation. After estimation of

the coefficients of the fundamental determinants, the 12 months moving average of the fundamentals was calculated so as to smooth out temporary volatility. These averages are then used to calculate the equilibrium real exchange rate. This method reduces the sample by 12 observations. Egypt's real exchange rate was overvalued for almost the entire estimation period. Egypt experienced a high level of real exchange rate misalignment between 1989 and 1993.

Zhang (2001) estimates the behavioural equilibrium real exchange rate and the resulting misalignment in China for the period 1952 to 1997. The real exchange rate in China is determined by the ratio of investment to GDP, government expenditure, growth in exports and openness of the economy. The Johansen methodology was used to estimate the equilibrium real exchange rate and the resulting misalignment. Misalignment was estimated using a unique cointegrating vector. The results showed that an increase in investment and openness of the economy causes real exchange rate depreciation while increase in government expenditure and export is associated with real exchange rate appreciation. There was evidence of chronic overvaluation in China but economic reforms brought the real exchange rate closer to its equilibrium level. These reforms led to substantial depreciation of the real exchange rate of China after 1981. The results provided indications that China adopted proactive exchange rate policy and the nominal exchange rate is employed to attain real targets.

Buchs (2004) examines the determinants of the real effective exchange rate in Brazil from 1994 to 2003. Based on the standard theoretical model and the Johansen cointegration methodology, Brazil's long-run behaviour of the real exchange rate is determined by relative productivity differentials, real commodity prices, government expenditure on tradable and nontradable goods, trade openness and real interest differentials. Increase in government expenditure on non-tradable goods, interest rate differential, real commodity prices, and productivity differential cause real exchange rate appreciation, while increase in government expenditure on tradable goods and trade openness leads to real exchange rate depreciation. The speed of adjustment between the real exchange rate and its equilibrium values as measured by the error correction term

range from -0.14 to -0.23 and this implies that about 14 to 23 percent of disequilibrium is corrected every period. Full adjustment takes place within a maximum of one year and half.

Buchs (2004: 24) uses three alternative measures to compute equilibrium real exchange rate and the resulting real exchange rate misalignment. The first measure calculates the median real equilibrium exchange rate since the 1999 devaluation and uses the permanent value as a benchmark against which to measure potential misalignments, treating the equilibrium real effective exchange rate as constant. The second measure uses normalised cointegrating vectors to calculate the real exchange rate which is line in with the long run equilibrium values of the determining variables. This measure neutralises the temporary fluctuations in the cointegration relationship with the Hodrick-Prescott filter. Hodrick-Prescott filter is a smoothing technique which is now extensively used in the literature. The third measure computes the equilibrium real exchange rate using both the long-term cointegrating vectors and short-run deviations of the error correction model representation, thereby decomposing the real exchange rate into permanent and transitory components. This is done by using the method proposed by Gonzalo and Granger (1995). According to Buchs (2004) the main advantage of the proposed decomposition between I(1) and I(0) components is that the temporary component does not Granger cause permanent component in the long run, which itself is a linear combination of the contemporaneous observed variables. Irrespective of the measure used, the results showed that real exchange rate misalignments were moderate in the 1990s. This includes the period immediately preceding the devaluation of the Brazilian Real. This suggests that supply-side effects and demand side effects put pressure on the real exchange rate path. It also suggests that there was no inherent inevitability from a misalignment point of view in the timing of the devaluation that took place in 1999. Although the real exchange rate was slightly appreciated at the end of 2003, misalignment was relatively small.

Bjornland (2004) estimates the equilibrium real exchange rate in an oil producing country, Venezuela. The relationship between demand shocks, supply shocks and real exchange rate is examined. Four structural shocks were identified by imposing long-run

restrictions on a vector autoregression (VAR) model. These structural shocks are nominal demand, real demand, supply and oil price shocks. A positive oil shock causes real exchange rate appreciation, while a supply shock leads to real exchange rate depreciation. Positive real demand shock causes the real exchange rate to appreciate and raises prices slowly. A nominal shock causes the real exchange rate to depreciate temporarily before it appreciates back or converges to its long-run equilibrium. This is closely associated with the overshooting model of Dornbusch. The analysis provides clear evidence that the movement of the real exchange rate in Venezuela is not related to PPP. Therefore, the PPP hypothesis cannot be used to predict any over or undervaluation of the exchange rate (Bjornland, 2004: 7).

Aron, Elbadawi & Kahn (2000) presented what was probably the first formal model of the real exchange rate in South Africa. The model focused on the period of South Africa's dual exchange rate regime and the estimation was quarterly, covering the period 1970:1 to 1995:1. Cointegration and the single equation error correction models were used to investigate the short-run and long-run determinants of the real exchange rate simultaneously. In this model the real exchange was determined by terms of trade, the price of gold, tariffs, openness of the economy, capital flows, reserves and government expenditure. The estimated parameters are in line with the theoretical expectations. Policies aimed at reducing tariffs and trade restrictions and increase in openness are associated with real exchange rate depreciation. The estimated elasticity for the price of gold revealed the dominance of income over substitution effect which is as expected by the theory of real exchange rate estimation. The terms of trade also showed the dominance of income effect over substitution and this indicated that an increase in the terms of trade causes real exchange rate appreciation. Levels of government expenditure that are unsustainable lead to real exchange rate depreciation and overvaluation. The results also indicate that the declining level of sustainable capital flows causes the real exchange rate to depreciate.

MacDonald and Ricci (2003) estimated the equilibrium real exchange rate for South Africa based on the Johansen cointegration methodology. The long-run behaviour of the real exchange rate for South Africa is determined by real interest differentials, GDP per capita, real commodity prices, trade openness, the fiscal balance and the extent of foreign assets. The real exchange rate was more depreciated in 2002 compared to other years. The speed of adjustment showed that disequilibrium in the real exchange rate is corrected after two years.

2.7 Conclusion

This chapter introduced the fundamental literature on the real exchange rate. It started with the theoretical foundations, concepts and definitions with regard to the real exchange rate. It discussed the analytical and theoretical models. Fundamental determinants of the real exchange rate are also discussed. The PPP hypothesis has been used as a benchmark for exchange rate discussions, but it has weaknesses because it does not take into account of the fundamentals that influence the real exchange rate. The natural equilibrium real exchange rate and the fundamental equilibrium real exchange rate take the fundamentals into account. The analytical model distinguishes between four models, the one good model, complete specialisation model, dependent-economy and three-good model. The three-good model will be applied in this study. Hence the theoretical model is based on the three-good model. The three-good model is selected because it is more appropriate for a small open and developing economy such as Namibia.

The model defines real exchange rate as a function of fundamental variables. When the fundamentals change the real exchange rate will also change. Fundamentals are classified into two groups, external and domestic fundamental. External fundamentals are factors such as terms of trade, international transfers and world real interest rates. Domestic fundamentals consist of variables that can directly be influenced by policy decisions and those that cannot be affected by policy decisions. Fundamentals that are related to the real exchange rate are import tariffs, import quotas, export taxes, exchange and capital control, subsidies and composition of government expenditure. Technological progress is

an example of a domestic non-policy related fundamental. The impact of the fundamentals on real exchange rate is also discussed in detail.