EXCHANGE RATE BEHAVIOR IN THE CASES OF THE ZAMBIAN KWACHA AND MALAWIAN KWACHA: IS THERE MISALIGNMENT?

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DECLARATION

I declare that the thesis hereby submitted by me for the Masters degree at Rhodes University is my own independent work and has not been previously submitted by me to another university/faculty.

ABSTRACT

The exchange rate is the price of one currency against another currency or currencies of a group of countries. Real exchange rates are important because they show the external competitiveness of a country's economy. Thus, when the exchange rate of a country is misaligned, this will affect its trade, production and the welfare of people. This study analysed macroeconomic determinants of the real exchange rate and dynamic adjustment of the real exchange rate as a result of shocks to these determinants. The study also determined the extent of misalignment of the real exchange rate in Malawi and Zambia and identified variables that contributed to it. Such information is important to policy makers. Quarterly data were used for both countries from 1980:1-2008:4. The literature review identified those variables that determine the exchange rate and these include government consumption, foreign aid, net foreign assets, commodity prices, terms of trade, domestic credit, openness and the Balassa Samuelson effect (technological progress). To determine the long-run relationship between the exchange rate and its determinants, we employed the Johansen approach and the Vector Error Correction Model (VECM). For robustness check on the long-run and short-run effects of determinants on the exchange rate, variance decomposition and impulse response analyses were used.

Results in the study show that in Malawi for both models, an increase in LAID, LGCON and LTOT resulted in real exchange rate depreciation and increases in LDC, NFA and LNEER resulted in an appreciation. In Zambia, increases in LAID, LGCON, LOPEN and LTOT caused the real exchange rate to depreciate while increases in LDC, NFA and LCOPPER led to an appreciation. Lagged LREER and LNEER were found to have short run effects on the equilibrium exchange rate for Malawi and lagged LCOPPER and LDC for Zambia. Periods of exchange rate misalignment were found in both countries. It was also found that the coefficient of speed of adjustment in Malawi in models 1 and 2 indicate that 11% and 27% of the variation in the real exchange rate from its equilibrium adjust each quarter respectively. The speed of adjustment for Zambia in both models was 45% and 47% respectively, higher than that of Malawi. Foreign aid has proven to be important in exchange rate misalignment in both countries, though this was not really expected in the case of Zambia. Given these results, it may be of interest to policy makers to understand which variables impact most on the exchange rate and how misalignment due to these determinants can be minimised.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX TABLE

LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criteria
BRER	Bilateral Real Exchange Rate
BEER	Behavioural Equilibirum Exchange Rate
CPI	Consumer Price Index
DF	Dickey-Fuller
EREER	Equilibrium Real Effective Exchange Rate
FEER	Fundamental Equilibrium Real Exchange Rate
GDP	Gross Domestic Product
GLS	Generalised Least Squares
GCC	Gulf Cooperation Council
HQIC	Hannan-Quinn Information Criteria
IMF	International Monetary Fund
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
LM	Lagrange Multiplier
LRM	Linear Regression Model
LRMH	Linear Regression Model with Heteroskedasticity
NER	Nominal Exchange Rate
NEER	Nominal Effective Exchange Rate
NFA	Net Foreign Assets
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PEER	Permanent Equilibrium Exchange Rate
PPP	Purchasing Power Parity

RER	Real Exchange Rate
REER	Real Effective Exchange Rate
SDR	Special Drawing Rights
SIC	Schwarz Information Criteria
TOT	Terms of Trade
QMA	Quadratic match average
QMS	Quadratic match sum
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
US	United states
WPI	World Price Index

CHAPTER 1

INTRODUCTION

1.1 CONTEXT OF THE RESEARCH

Maintaining a stable and competitive real effective exchange rate (REER)[1] has been one of the main aims for policy makers within different exchange rate regimes. An appropriate value of a country's real exchange rate is crucial because it determines the external competitiveness of a country's economy (Bova, 2008:1). According to Edwards (1989:3) the issue whether a country's real exchange rate (RER) is out of line with respect to its long-run equilibrium level is an important one. Di Bella *et al.* (2007:3) define real exchange rate misalignment as when the RER is out of line with its fundamentals for a sustained period of time. Exchange rate misalignment has welfare costs, therefore it is important that it adjusts to, or that policy directs it to adjust to, its equilibrium level.

Since RER is a link between the internal economy and external economy of a country, an appropriately valued RER becomes important in determining macroeconomic stability and the inducement for a country to take part in international trade (Williamson, 2008:2). Policy makers have an important task in setting policies that drive the economy in the right direction. Inappropriate exchange rate policies followed by some countries in the late 1970s contributed to the international debt crisis in the early 1980s. In the affected countries, exchange rates were highly uncompetitive and overvalued and large current account deficits were allowed to develop which were funded with excessive amounts of foreign debt (Williamson, 2008:1). Thus, in order to have a stable economy that benefits from trade and can foster economic growth, appropriate exchange rate levels and policies should be maintained.

Looking further into exchange rate misalignment, Edwards (1989: 11) distinguishes between two types of real exchange rate misalignment which are important for policy and analytical purposes. The first one is a macroeconomic induced misalignment which happens when there are inconsistencies between macroeconomic (especially monetary) policies and the official exchange rate system. If a country is implementing an expansionary policy and has an exchange rate which is not appropriately valued, domestic prices may rise rapidly compared to world prices. As a result, this upward price pressure on domestic non-tradable goods will cause the RER to

[1] In some cases REER is used interchangeably with RER

appreciate, thus undermining the international competitiveness of a country and negatively impacting on exports. The second is a structural misalignment which occurs when changes in the real determinants/fundamentals of the equilibrium RER are not translated in the short run into actual changes of the RER. The RER may therefore become under or overvalued.

Important to note is the difference between nominal exchange rate (NER) and real exchange rate (RER). Nominal exchange rate is the monetary measurement of the relative price of two currencies (one currency to another) for example, Kwacha per US Dollar or US Dollar per Euro. Real exchange rate, on the other hand, measures relative prices of goods between the two countries (tradables to non-tradables) (Edwards, 1989:3). In simple terms RER seeks to determine the value of a country's goods against those of another country, a group of countries, or the rest of the world, to nominal exchange rate over time. For this, it is necessary to measure not only the nominal exchange rate but also changes in the prices of goods of other countries.

In terms of the currency, in which prices are measured, it is important also to recognise that the exchange rates of the countries with which the country trades are also changing over time. Accordingly, it may be appropriate to consider a basket of currencies with which the target country trades (the real effective exchange rate--REER). REER is a trade-weighted multilateral exchange rate which provides an overall indicator of the competitiveness of a country's currency. This study uses REER where REER for Malawi and Zambia is weighted to their respective trading partners.

From the literature there are several approaches of estimating the equilibrium exchange rate. These include relative PPP (Purchasing Power Parity)-based approach, trade–equation approach, structural general-equilibrium approach, reduced–form general-equilibrium approach, behavioural equilibrium exchange rate (BEER), fundamental equilibrium real exchange rate (FEER), permanent equilibrium exchange rate (PEER) (Montiel and Hinkle, 1999). According to Kamar and Naceur (2007:7) the two main model based approaches used are the BEER and the FEER. According to Clark and MacDonald (1999) BEER connects the observed real exchange rate with its long-run fundamental determinants, such as the terms of trade, the relative price of traded to nontraded goods, and net foreign assets. This link is then assumed to be identical to the empirically estimated long-term relationship.

On the other hand, FEER is defined as the exchange rate consistent with internal and external balance. In terms of application, BEER is more feasible to estimate. According to Jongwanich (2009:4) FEER is a normative measure of equilibrium RER, as it involves some notion of 'ideal'

economic circumstances of internal and external balances. Defining external balances, for example, sustainable current account balance sometimes tends to be controversial. This makes the BEER more practical to use because it is consistent with the prevailing level of economic fundamentals. This study used the BEER because it has been widely used in the literature for developing countries because of its simplicity. According to Zhang (2001:84) because of data limitations this method is suitable for developing countries where large and complex models are often not feasible.

There are five key fundamental variables that are generally used in estimating the long-run RER under the BEER approach (Jongwanich, 2009:9). These include net foreign assets (NFA), productivity differentials (TECHNO) which is also known as the Balassa-Samuelson effect, terms of trade (TOT), government consumption spending (GCON) and trade policy openness (OPEN). The Balassa-Samuelson effect results from faster productivity growth in the traded goods sector than in the non-traded goods sector (Hinkle and Montiel, 1999:12). If there is a productivity shock in the traded goods sector, labour demand is likely to increase, increasing the equilibrium wage rate. This will result in the non-traded goods sector losing labour to the traded sector. The traded goods sector will expand while the non-traded sector shrinks, increasing prices in the non-traded goods sector and causing the exchange rate to appreciate. For this study, the model also includes foreign aid in the case of Malawi, and commodity price fluctuations (testing for signs of the 'Dutch disease') in the case of Zambia. Including these variables will assist in determining causes of exchange rate misalignment if any such misalignment is found to exist. Furthermore the resultant implications for policy making, should any misalignment be found, will be more clearly revealed.

Several authors (Li and Rowe, 2007; Iimi, 2006; MacDonald and Ricci, 2004; Mathisen, 2003 ;) estimated the equilibrium exchange rate and determined RER misalignment in developing countries. The phenomenon still needs further research as a number of variables that affect the exchange rate have changed in recent years. For example, foreign aid to Malawi increased substantially in the 1980s and became volatile thereafter until it began to increase again in recent years where there are, therefore, possibilities of a bigger impact on the exchange rate. Likewise, the rise in the copper prices in recent years, and the possibility that this may be sustained due to continued strong demand from China and India, has implications for Zambia's exchange rate. These factors increase the possibility that the value of the currency today will not truly reflect other economic fundamentals.

A study by Mathisen (2003:7) on Malawi included variables such as investment, terms of trade, government consumption and capital flows. Capitals flows incorporated private transfers but this study proposes to separate transfers from capital flows; treating them as an individual variable. This will give a clearer picture of the impact of foreign aid on the exchange rate and assist in identifying proper economic policy responses to possible exchange rate misalignment. In Mathisen's (2003:7) results the proxy for capital flows, net foreign assets, was found to be insignificant and one of the possible reasons was that balance of payments assistance became a substantial part of net foreign assets only during the 1990s (Mathisen, 2003:16). In recent years, Malawi's economic performance has been improving and foreign aid donors have increased funding. In addition, other changes in the global economy may have a significant impact on the Malawian economy which may impact on the exchange rate.

Cerra *et al,* (2008:4) investigated the theoretical effects of foreign aid on the real exchange rate. They showed that there is a difference between the impacts of untied (pure) and tied (productive) aid. Pure transfers are said to have no long-run effects in the real exchange rate as long as aid capital can freely move between sectors. However, permanent relative price effects are generated by tied transfers. Li and Rowe (2007:15) in a study on Tanzania included aid inflows as one of the variables; they found an inverse relationship between aid inflows and the REER. Different conclusions were drawn by White and Wignaraja (1992:1478) on the impact of aid on REER. They found that as aid inflows increased the currency of Sri Lanka appreciated. The different results depend on where aid inflows are directed in the economy. If foreign aid is spent on consumption of non-traded goods, the prices of these goods increases relative to the prices of traded goods and the real exchange rate appreciates. The opposite is also true. This study is not ruling out the impact of other variables in determining possible misalignment in the RER in Malawi.

In the case for Zambia, Bova (2009: 12) concluded that the Zambian Kwacha is a commodity currency since there was found to be a long-run relationship between the Kwacha exchange rate and the price of copper, with both displaying similar volatility. The results showed that as the price of copper increased by one percent the currency would appreciate by 0.5 percent. This study takes Bova's study (2009) a step further and attempts to determine whether the Zambian Kwacha is misaligned from its real equilibrium rate and the extent to which any over or undervaluation is a result of changes in the copper price.

1.2 GOALS OF THE RESEARCH

The main purpose of the research is to determine whether the real effective exchange rates of Malawi and Zambia are misaligned and to identify possible causes of misalignment and applicable solutions for each country. In order to achieve this, the following specific objectives are addressed.

1. To determine the long run relationship between the real effective exchange rate for each country and macroeconomic variables.
2. To determine the extent, if any, of exchange rate misalignment for Malawi and Zambia from the equilibrium REER.
3. To determine and compare the extent to which any exchange rate misalignment may be the result of commodity prices or foreign aid.

1.3 MOTIVATION FOR THE STUDY

This study is important because it adds to the body of literature especially with the two countries in question. To our knowledge there have been very few individual studies on determining possible exchange rate misalignment in Zambia or Malawi. Although there is a plethora of literature on determinants of equilibrium exchange rate and misalignment for developed countries, developing countries face data challenges and this has possibly contributed to fewer studies done on them. Establishing the appropriate level of the exchange rate is crucial for any country's economy thus more studies on developing countries need to be done.

This study extends the study period for Zambia and Malawi beyond what was previously done, making it relevant and useful to current policy makers. Some previous literature (although some disagree)[2] has concluded that Zambia is a commodity currency as copper is its main source of foreign revenue and is therefore expected to play an important role in determining the level of real exchange rate in the country. Copper production has decreased over the years therefore it is of interest to analyse whether the copper price still plays an important role in exchange rate determination in Zambia. To this end, we have included copper prices in our model of the Zambian Kwacha.

For Malawi it is important to include foreign aid in the model as aid significantly increased in the

[2] Cashin *et al,* 2004

1980s and then decreased and was volatile on an annual basis in the 1990s (Fagernäs and Schurich, 2004). This variable was not individually included in previous studies of the Malawian Kwacha. It is thus important to determine whether these changes have impacted on the equilibrium exchange rate.

1.4 PROPOSED METHODS, PROCEDURES AND TECHNIQUES

The Johansen (1988) and Johansen, (1995), co-integration method and vector error correction model (VECM) is employed to determine the long run, co-integrating relationship which determines the equilibrium exchange rate. A possible method of generating the permanent values of all fundamentals is the Hodrick-Prescott filter. This makes it possible to calculate the misalignment between the long run equilibrium RER and the actual RER (Jongwanich, 2009:17). ADF (Augmented Dickey-Fuller) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin) are used to test for unit root and stationarity of the series respectively. Variables included in the models include foreign aid, government consumption, net foreign assets, technological progress, domestic credit, nominal effective exchange rate, openness, terms of trade and copper prices. Real effective exchange rate is the dependant variable.

The study period is from 1980-2008 for both countries. For most variables, data had to be interpolated from a low to a high frequency so as to increase the number of observations. It is important to note that for Malawi the government adopted a floating exchange rate regime only in 1994 (Reserve Bank of Malawi, 2000). In Zambia, a freely floating exchange rate regime was implemented only in 1994 as part of the completion of more general liberalisation reforms (Mkenda, 2001:12). Data were accessed from Thompson DataStream, the website of the Malawian and Zambian Reserve Banks, the IMF database, and the OECD website (for foreign aid data) and the World Bank.

1.5 OUTLINE OF THE STUDY

The research is divided into six chapters as follows: Chapter 1 covers an introduction to what equilibrium real exchange rate and misalignment is and why it is important. The contexts, objectives of the study, as well as the motivation for the research are discussed and an outline of the study provided. Chapter 2 contains the literature review and includes both theoretical and empirical reviews. Chapter 3 presents overviews of the Zambian and Malawian economies and the relationship with the relevant adopted exchange rate regimes. The structure of the economy and developments that have occurred in both countries that may have impacted on their

exchange rates are discussed. The expected relationships between REER and macroeconomic variables are also presented. Chapter 4 focuses on the methodology of the study. Variables and data used in the research are explained, including data sources and modifications to the data such as interpolation. The econometric techniques employed are also described. Results are presented and analysed in Chapter 5. Chapter 6 covers a summary of results, and relevant policy recommendations where the exchange rates were found to be misaligned. Limitations of the research and the agenda for future research are presented.

CHAPTER 2

CONCEPTUAL, THEORETICAL FRAMEWORK AND LITERATURE STUDY

2.1 INTRODUCTION

This chapter discusses the theory and empirical evidence on exchange rate determination, equilibrium RER and the concepts around it. The study also explains what it means when a currency is said to be over- or under-valued. Exchange rate misalignment is a crucial issue that requires analysis since a country's exchange rate is one of the principal indicators of that country's economic performance and global competitiveness. Key issues that are discussed are how to measure exchange rate misalignment, beginning with the different definitions and how to calculate real exchange rate (RER). Models of equilibrium real exchange rate determination are discussed, as are the determinants identified from theory. This chapter also reviews empirical evidence on the subject. This chapter is divided into three broad sections: the first section being the conceptual framework. It is built on the definitions of exchange rate. This is followed by a theoretical section which discusses how exchange rate is measured and models derived that identify fundamental variables important in explaining the equilibrium exchange rate. The third section presents empirical evidence on other countries..

2.2 CONCEPTUAL FRAMEWORK

2.2.1 Nominal exchange rate

Nominal exchange rate (NER) is the price of one currency in terms of another currency, for example, US Dollar per EURO, Rand per US Dollar. NER is determined in currency trading markets known as foreign exchange (Forex) markets. Forex markets are markets where economic agents trade currencies. The global Forex market is the largest and most liquid of all markets in the world. The values of NER traded at any moment of time are referred to as the spot rate. The spot rate is the rate at which foreign exchange can be bought and sold for immediate delivery. There is also a forward rate, which is the rate agreed today at (time *t*) at which foreign exchange can be bought or sold in the future (MacDonald, 2007). Both spot and forward exchange rates are determined daily in the foreign exchange markets.

2.2.2 Real exchange rate

Real exchange rate measures changes in the value of a country's goods against those of another country, a group of countries, or the rest of the world at the prevailing nominal exchange rate (Catao, 2007). Several definitions of RER are found in literature and as Li and Rowe (2007:3) state the definition used depends on the issue being investigated and data availability. Real exchange rate can be defined internally: internal real exchange rate is the relative price of traded goods to non-traded goods produced in domestic economy (Hinkle and Nsengiyumva, 1999:41). According to Kemme and Roy (2006), for small open economies especially developing countries, economists tend to use theoretical models that measure internal real exchange rate (IRER) in exchange rate determination. IRER is presented in the following equation:

$$RER = \left(\frac{PT}{PN} \right) \tag{2.1}$$

PT is the domestic currency price index of traded goods while PN is the domestic currency price index of non-traded goods. This definition expresses the internal relative price of producing and consuming traded goods at the cost of non-traded goods. This ratio represents the two-good model and a decline in the real exchange rate signifies an appreciation while an increase in RER is depreciation. Due to data problems, external real exchange is usually used as a proxy for internal real exchange rate. External real exchange rate is the nominal exchange rate adjusted for differences in price levels between countries (Hinkle and Nsengiyumva, 1999:41). This is shown in the equation below:

$$RER = \frac{E\, P_T^*}{P_N} \tag{2.2}$$

In Equation 2.2, domestic real exchange rate is given by the relationship of the nominal exchange rate E, P_T^* is the world price of tradables and P_N is the domestic price of non-tradables. The World Price Index (WPI) multiplied by nominal exchange rate and domestic Consumer Price Index (CPI), are used as proxies for home country's tradable goods prices and non-tradable goods prices respectively.

2.2.3 Bilateral and multilateral exchange rate

According to Hinkle and Nsengiyumva (1999:45), bilateral RER has been widely used because of its simplicity and is useful when a country has one dominant trading partner or if it belongs to a currency block, such as, the dollar or franc zones. It compares the price of a representative consumption or production basket in the home country measured in the same currency either domestic or foreign, and shows the relative value of the domestic and foreign currencies. On the other hand, the multilateral exchange rate is the currency of the domestic country compared to its main trading partners or competitor countries. It is also known as a nominal/real effective exchange rate.

2.2.4 Nominal effective exchange rate

In order to obtain the overall external competitiveness of a county, and when relating exchange rates to international trade balances, it is best to determine the effective exchange rate. Nominal effective exchange rate (NEER) is a country's bilateral exchange rates summed up and weighted according to the importance of trade with the individual countries. The value of NEER is expressed as an index, being an average of bilateral exchange rates. Swings in this index are an indication of either appreciation or depreciation of the domestic currency against a set of other currencies (Mathisen, 2003).

2.2.5 Real effective exchange rate

Real effective exchange rate (REER) adjusts NEER by the appropriate composite foreign price levels and deflates by domestic prices. It is applied when a country has multiple trading partners. REER in terms of the domestic-currency is shown in the following equation:

$$REER_{dc} = \prod_{i=1}^{m} \left[E_{dc_i} P_{Gi} \right]^{w_{id}} \cdot \frac{1}{P_{Gd}} \qquad (2.3)$$

where m is the number of trading partners or competitors of the home country and Π denotes the product of the bracketed terms over the m countries.

REER can be calculated in two ways, the first method calculates REER as a geometric weighted average of the bilateral RERs of the home country with each of its main trading partners or competitors. In the following equation, BRER is the bilateral real exchange rate in domestic currency.

$$RER_{dc} = \prod_{i=1}^{m} BRER_{dc_1}^{w_{id}} \quad (2.4)$$

The second method, calculates REER as the product of the nominal effective exchange rate and the effective relative price index,

$$REER_{dc} = \frac{NEER_{dc} * EP_{gf}}{P_{Gd}} \quad (2.5)$$

where,

$$NEER_{dc} = \prod_{i=1}^{m} E_{dc_1}^{w_{id}} \quad (2.6)$$

$$EP_{Df} = \prod_{i=1}^{m} P_{dc_1}^{w_{id}} \quad (2.7)$$

NEER is the nominal effective exchange rate in domestic currency terms between the home country and its trading partners or competitors. P_{gf} is the geometric weighted average or effective foreign aggregate price index for the home country's trading partners. These two methods are similar, although they produce different statistical information as by-products. In this study, the real and nominal effective exchange rate is measured in foreign currency terms, thus an increase in this variable indicates an appreciation, while a decrease means depreciation. Next, is a review of the various definitions of equilibrium RER.

2.2.6 Equilibrium real exchange rate

A rate that is consistent with the simultaneous achievement of internal and external balance is said to be an equilibrium exchange rate (Williamson, 1994). According to Edwards (1989:8) equilibrium real exchange rate is "that relative price of tradables to non-tradables that, for given sustainable (equilibrium) values of other relevant variables such as taxes, international prices, and technology results in the simultaneous attainment of internal and external equilibrium". These variables are known as the real exchange rate fundamentals. In other words, that level of RER allows a country to accumulate assets at the most 'desired' rate and the demand for domestic goods matches its supply. It should be noted because the fundamentals change over time, there is not one particular equilibrium RER level but a series of equilibrium RERs levels over time (Edwards, 1989:24).

According to Montiel (1999) long-run equilibrium real exchange rate (LRER) is "the value of the real exchange rate that emerges from the economy's macroeconomic equilibrium when

policy and exogenous variables are at sustainable 'permanent' levels and when the operationally relevant subset of the economy's predetermined variables have settled into their steady-state configurations". In other words, real exchange rate is in equilibrium if it has no tendencies to change and this is expected only when there are no shocks/disturbances. When there are shocks in the economy, it is expected that there will be change to the equilibrium RER. Montiel (2003:316) notes that when the exchange rate is said to be in equilibrium and is sustainable then the economy's endogenous variable is determined by the following variables:

- Predetermined variables: variables that change slowly over time e.g. capital stock, technology, net international creditor position.
- Exogenous policy variables: fiscal and monetary policy, trade policies and other variables under the control of domestic authorities. Other exogenous variables are classified into three groups as observable variables (terms of trade), unobservable (shocks) and 'bubble variables' those that influence the economy through their influence on expectations (Montiel, 2003:316).

A problem now arises when the equilibrium RER is not at its desired level and this is explained below.

2.2.7 Exchange rate misalignment

According to Montiel (2003) the nature of real exchange rate equilibrium at a certain point depends on the current and expected future values of certain macroeconomic variables (fundamentals) mentioned earlier. Real exchange rate equilibrium is not constant but changes as the macro-economic values change. Estimation of exchange rate misalignment has usually followed one of two conceptual approaches. The first defines misalignment in terms of the purchasing power of each country's currency, using overall inflation differentials across countries to assess deviations from purchasing power parity (PPP). The second defines misalignment in terms of a domestic real exchange rate (RER) between tradable and non-tradable goods within a country (Masters and Ianchovichina, 1998:465). Next is a brief analysis on the importance of equilibrium exchange rate.

2.2.8 The importance of equilibrium exchange rate

It is important for RER to be at its equilibrium level because a country's exchange rate reflects its competitiveness against other countries. An over or under-valued currency has negative implications for the economic performance of a country, especially with reference to trade and

economic growth. If a currency is overvalued it means prices of its exports may be expensive to the rest of the world thereby reducing the value of exports and hurting trading activities (Cottani *et al*, 1990). Import prices will be cheap, damaging the performance of domestic industries competing with or making use of imported products. According to Takaendesa (2006), the level of the real exchange rate relative to the equilibrium real exchange rate level and its stability has been proven to have an important influence on export growth. Real exchange rate stability and correct exchange rate alignments have been identified under policy discussions as vital for economic performance improvement in less developed countries (Cottani *et al*, 1990). This is so because there is a strong relationship between RER behaviour and economic performance.

Large swings in RER also result in uncertainty with respect to relative prices. Understanding what causes changes in the long run equilibrium helps investors to forecast and compare expected returns on stocks and bonds denominated in different currencies (Lane, 1999). This reduces uncertainty in the economy. Furthermore, exchange rate misalignment brings about macroeconomic instability**,** which may cause periods of below-average growth or above-average inflation. Smaller episodes of exchange rate misalignment also result in an increased 'noise' effect in the movements of RER that undermines the significance of RER as a relative price signal. This affects growth, resource allocation becomes inefficient, and capital accumulation may be discouraged. Thus, it is important to determine the equilibrium RER so that appropriate policies can be implemented to reduce the adverse effects of any exchange rate misalignment

2.2.9 Conclusion

The various definitions of exchange rates all point to the same concept of measuring one currency in relation to another. RER is used to measure a country's economic competitiveness against other countries. There will be disturbances/shocks in the economy and thus the RER should adjust so that it is in line with the equilibrium real exchange rate. Macro-economic fundamental variables play an important role in determining the correct equilibrium level. With disturbances an exchange rate misalignment may result; the difference between the actual and the desired equilibrium exchange rate. The next section discusses models of how equilibrium real exchange rate is derived and fundamental variables that influence the level and movements of the rate.

2.3 THEORETICAL FRAMEWORK

2.3.1 Theoretical models of the definition and measurement of the real exchange rate

As mentioned earlier the real exchange rate is defined externally or internally. According to Montiel (2003), real exchange rate is modelled according to the production structures adopted in the analytical macroeconomic model being used. This arises due to the difficulty of measuring real exchange rate. In a number of cases the definition of real exchange rate is adapted to suit different frameworks and theoretical concepts t presented. Different production structures are identified which may affect the definition of real exchange rate. Hinkle and Nsengiyumva (1999), state that in the developing country context, RER tends to be defined either as the price of traded goods relative to the price of non traded goods, known as the two- good model, or as the price of exportable and importable goods relative to non traded good referred to as three-good model internal real exchange rates. These are discussed below:

1. The one-good model

This model has the simplest production structure of the open-economy macroeconomic models. It assumes that the domestic economy produces a single good that is traded internationally and that it is similar to the good produced by the rest of the world. Montiel (2003:313) notes that such a model has been used to a large extent, mainly by studies on purely monetary phenomena, for instance inflation, or monetary approaches to the balance of payments. Such a model makes it impractical to determine real exchange rate since at least two goods are required.

2. Complete specialization (Mundell-Fleming) model

This open economy macroeconomic model is most suitably used on industrial countries. Each country is assumed to produce a single aggregate good which the country both consumes and exports. The good is unique and faces less competition from the international market. The price of each country's good is therefore determined by its cost of production. In this model, the price index that defines external RER, is an output price index or production cost index for the economy which includes exports as well as goods produced and sold within the country. Thus, RER is defined by the number of units of the foreign good that have to be given up for each unit of the domestically produced good (Montiel, 2003:313.). According to Hinkle and Nsengiyumva (1999), the Mundell-Fleming formulation does not distinguish between terms of trade and RER. This model is different from the one-good model; the good produced in the

one-good model is only for exports while in the Mundell-Fleming model it is both for domestic consumption and exports.

3. Dependent-economy (Swan-Salter Model) two-good model

In this model, real exchange rate has been defined as the relative price of tradable to non-tradable goods *e,*

$$e = \frac{P_t}{P_{nt}} \tag{2.8}$$

where P_t is the domestic price of tradables and P_{nt} is the domestic price of non-tradables. This RER is referred to as the internal exchange rate. Because there is only one type of foreign good, there is no terms of trade and the model is useful in cases where the role of exogenous change in terms of trade is not important. Of the two goods produced, one is produced and consumed at home only, known as the non-traded and the other is produced and consumed both domestically and internationally, namely traded good (Montiel, 2003:313). According to Holden (1991:2) the concept of the two-good model of real exchange rate ascertains the competitiveness of producing and consuming tradables as opposed to non-tradables in the domestic economy.

4. Three-good model (Exportable-Importable-Non-traded)

In cases where changes in terms of trade matter, the three-good model is required since it comprises exportable and importable goods, both of which may be produced and consumed at home but one of which is exported and the other imported, and the non-traded goods. In this model there are two foreign goods resulting in two real exchange rates and two different ways of defining terms of trade. The model is useful when analysing macroeconomic effects of terms of trade changes and changes in commercial policies that affect the domestic relative prices of exportable and importables (Montiel, 2003:314). Most developing countries do not have much influence on their terms of trade due to a number of prices being set in global markets thus the three-good model does not apply well in these countries.

2.3.2 Theoretical model of long run real exchange rate

After defining the long-run equilibrium real exchange rate, there is a need, to identify fundamental variables that determine the exchange rate. There are models that explain the long run real exchange rate; two of the models that are found in most literature are by Edwards and

Montiel. They basically identify the fundamental variables that have an impact on the equilibrium exchange rate. The monetary model is also discussed.

Monetary model

This model is based on the assumption that prices are completely flexible and it is important to include it in this analysis as it represents a benchmark for comparing other approaches to modelling an exchange rate. Some approaches grew from the monetary model, such as the PPP approach. Three main building blocks of this model include a vertical aggregate supply curve, a stable demand for money, and PPP. The first block of vertical aggregate supply curve presupposes perfect price flexibility in all markets and that the curve changes as productivity in the economy changes. The second is a stable demand for money which is said to be a function of a few domestic macroeconomic variables.

$$Md = kPy \tag{2.9}$$

k >0 with y = real national income, k = positive parameter

Money stock equilibrium is given by, Ms = $kPy = k$ Y and Y= nominal income

Finally the last block is PPP. PPP hypothesis states that given domestic prices P and foreign price P^*, equilibrium is achieved when the two price level are as follows,

$eP^* = P$, e is the exchange rate, P^* = foreign price, P domestic price level. Putting all these together, the model comes up with the money stock (Ms) equilibrium as shown in Equation (2.10);

$$Ms = kPy = keP^* y \tag{2.10}$$

The external equilibrium in this economy is shown in Equation (2.11) with the use of the PPP relationship

$$e = \frac{Ms}{kP^* Y} \tag{2.11}$$

In the monetary model, the exchange rate is the ratio of the money stock to the demand, measured at the foreign price level. The three variables that would cause disturbances to the

equilibrium exchange rate would be monetary expansion, rise in real income in the domestic economy and an increase in the world price level (Copeland, 1994:159).

Edwards' model

Edwards developed a general equilibrium model of a small open economy assuming that the economy is formed by optimizing consumers and producers and a government (Edwards, 1989:15). The model captures the short and long run behaviour of the exchange rate and the long run equilibrium real exchange rate is a function of real variables. If changes in the fundamentals are permanent then they impact on the long run equilibrium exchange rate, while temporary fundamentals affect the short run equilibrium exchange rate. A three-good model, exportables (X), importables (M) and non-tradables (N) was used, assuming each sector uses capital, labour and natural resources. The derivation of the model is not presented here but below is the summary of the equation with relevant fundamentals.

The following equations indicate all the exogenous variables that have an impact on the RER.

$$RER = h\left(p^*, \tilde{p}^*, \tau, \tilde{\tau}, \delta, \delta^*, V, T, \tilde{T}, G_X, \tilde{G}_X .....\right), \qquad (2.12)$$

RER = real exchange rate

P = domestic relative prices of importables

$\tilde{p}$ = world relative prices of imports

$\tau, \tilde{\tau}$ = imports tariffs in period 1 and 2,

δ = domestic discount factor, equal to $(1+r)^{-1}$. Since there is a tax on foreign borrowing, $\delta < \delta^{'*}$

$\delta^{'*}$ = world discount factor, equal to $(1+r^*)^{-1}$, where r* is real interest rate in terms of exportables,

V = vector of factors of production, excluding capital

$T, (\tilde{T})$ = lump sum tax in periods 1 and 2,

$G_x, \tilde{G}_x$ = quantities of goods X consumed by the government in periods 1 and 2

The next model is not very different from that of Edwards (1989) but it can be seen as an expansion to it. There are variables the two models define differently, but they have the same effect on the real exchange rate.

Montiel's model

Montiel's (2003) model (derived from the Montiel (1999)) investigates factors that influence the long-run changes of real exchange rate incorporating the three-good production structure mentioned earlier. It assumes that exportable goods are not consumed in the domestic country. In this model, the real exchange rate (Y) is the endogenous variable and can be expressed in the following reduced-form equation:

$$Y(t) = F\left[X1(t), X2(t), X3(t), B(t)\right] \tag{2.13}$$

where $X1$ represents the current values of a set of predetermined variables, $X2$ represents the current and expected future values of a set of real policy variables. $X3$ shows current and future values of a set of exogenous variables, both observable and unobservable, and represents any 'bubble' variables that may affect the economy. A point to note, $X1$ does not necessarily contain all policy variables. As stated before, 'bubble variables' are those that have an impact on the economy only through their influence on expectations. The long-run equilibrium exchange rate is not influenced by all the variables; it depends only on sustainable values of the exogenous and policy variables that affect real exchange rate directly and indirectly through $X1$. This is shown by the following equation:

$$Y^* = \left[X_2^*, X_3^*\right] \tag{2.14}$$

Y^* is the long run equilibrium exchange rate, X_2^* and X_3^* represent the steady state variables (long-run fundamental).

From the definition of long-run equilibrium given above, if there is internal and external balance in the RER then it is said to be at equilibrium level. The equilibrium real exchange rate is that which is consistent with external and internal balances in the long run (Montiel, 1999:278). The internal balance condition for simultaneous equilibrium in the markets for labour and non-traded goods can be presented as:

$$Y_N(e,\phi) = (1-\theta)ec + g_N \qquad (2.15)$$

where,

Y_N = level of output of non-traded goods in the economy

g_N = government's consumption of non-traded goods

e = importables real exchange rate (price of importable goods in terms of non-traded goods)

ϕ = relative price of exportable goods in terms of importable ones (terms of trade)

c = private absorption measured in terms of importable goods

θ = the share of importables in private absorption

The right hand side of the equation represents the demand for goods and the left represents the supply of nontradable goods.

The external balance condition sets the current account deficit equal to the sustainable level of capital inflows. This is show in the equation below:

$$\pi^* f^* = \phi yx\left(\underset{+}{e},\underset{+}{\phi}\right) + yz\left(\underset{+}{e},\underset{-}{\phi}\right) + (r^* + \pi^*)f^* + t - \left[\tau\left(\underset{+}{\pi^*}\right) + \phi\right]c - gz \qquad (2.14)$$

yx = level of output of exportable goods

yz = level of output of importable goods

r^* = world real interest rate

π^* = world rate of inflation

f^* = the economy's steady-state net international creditor position

t = value of international transfers received by this economy

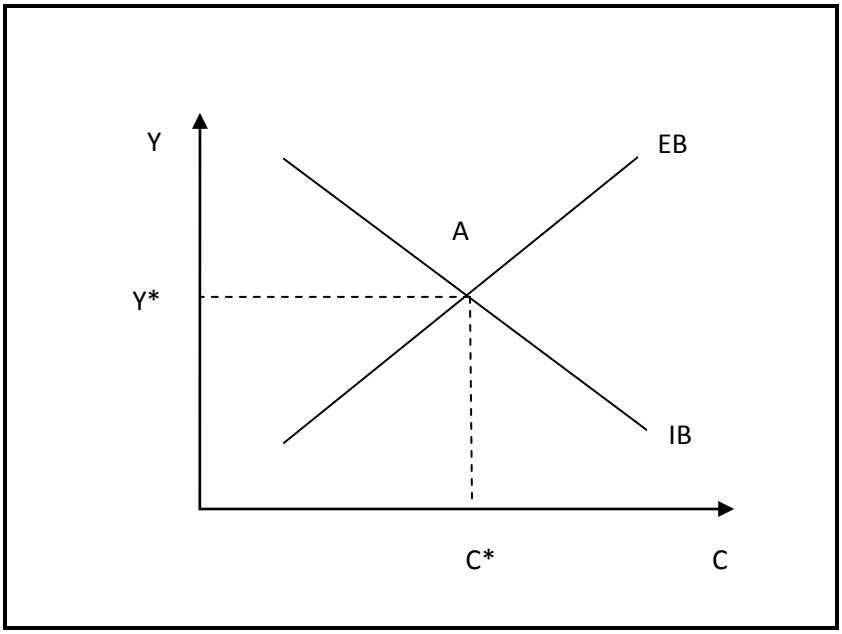
gz = government's consumption of importable goods

τ = cost, per unit of consumption, of making consumption transactions

In Montiel's model, τ, explains why people hold money, which is to reduce transaction costs. The demand for money is inversely related to the domestic inflation, (equal to the world inflation rate π^* under fixed exchange rate), transaction costs per unit of consumption are increasing in π^*. $\phi yx + yz$ (measured in units of the importable good) is the sum of the production of exportables and importables which shows the domestic output of tradable goods. Domestic spending on such goods is the sum of private spending $(\tau + \phi)c$ and the government spending gz. $\phi yx + yz - [(\tau + \phi)c - gz]$ shows the difference between production of tradable goods and the domestic demand for them which is the domestic excess supply of tradable goods. This value is the trade balance surplus. Furthermore, net interest receipts from abroad $(r^* + \pi^*) f^*$ and the receipt of net international transfers t yields the current account of the balance of payments. For external balance to hold, the current account balance must be equal to the sustainable capital inflow, which is the amount of new borrowing required to offset the inflationary erosion of the country's net international creditor position in the presence of world inflation. This is shown by the left hand side of the equation above, $\pi^* f^*$.

Figure 2.1 below illustrates the whole model for long run equilibrium real exchange rate showing the internal and external balance condition. Real private consumption C is on the horizontal axis and real exchange rate Y on the vertical axis. The negative slope of the internal balance curve shows the combinations of Y and C and an increase in consumption increases demand for non-tradable goods. An increase in the relative price (increase in Y) must offset the increase in demand so as to maintain equilibrium in the non-traded goods market. On the other hand, the EB curve must have a positive slope because an increase in consumption of such goods increases the trade deficit, which requires a real exchange rate depreciation to shift resources into the production of traded goods so as to maintain external balance. According to the definition at point A on the graph, the intersection shows the simultaneously consistent internal and external balances in the long run.

Figure 2.1: Determination of the Long-Run Equilibrium Real Exchange Rate[3]



Source: Montiel (2003:324)

Montiel (2003:318) identifies sustainable values of the exogenous and policy variables that have an influence on the real exchange rate which are referred to as the long- run fundamentals. According to Montiel (1999:294), determining long-run fundamentals precisely and concretely is an important step in estimating the long run RER because the path that it follows over time is established by the dynamic behaviour of these variables. Only real factors - the fundamentals - have an impact on the equilibrium real exchange rate and can cause changes in the IB and EB curves. The next section is an in-depth discussion of the fundamental variables and their impact on the equilibrium exchange rate.

2.3.3 Long-run fundamentals (Edwards, 1989 and Montiel , 1999)

Fiscal Policy

Changes in government spending on traded goods and non-traded goods

An increase in government spending on traded goods has no impact on the internal balance, but the external balance shifts upward. An increase in government spending is a starting point of a trade deficit thus exchange rate depreciation is required to maintain the external balance

[3] An upward movement of the curve indicates a depreciation of the real exchange rate

(Montiel, 1999:279). At that level, equilibrium real exchange rate depreciates and private consumption of traded goods falls. On the other hand, an increase in demand for non-traded goods requires an increase in their relative prices to maintain equilibrium in the non-traded goods market. The internal balance is affected and shifts down to maintain equilibrium. This results in an appreciation in the equilibrium real exchange rate. In summary, if government consumption is biased towards non-tradables, then the real exchange rate will appreciate, and when biased towards tradable goods, then it will depreciate.

A reduction in the fiscal deficit

Reduction in fiscal deficit, which is the difference between total government outlays and receipts, excluding changes in debt, is seen as a form of increase in tax. Taxes are endogenous, thus an increase in taxes is equivalent to a reduction in the rate of monetary emission by the central bank. The advantage derived from a lower fiscal deficit is revealed in the form of a reduction in the distortions associated with inflation tax. The reduced rate of depreciation lowers the domestic interest rates, increases money demand and reduces the transactions cost linked with consumption, τ^* falls and has the effect of increasing the supply of real output.

The appreciation or depreciation of the long run equilibrium exchange rate depends on whether transaction costs are on traded or non-traded goods. If the costs are borne by the traded goods, a reduction in transaction cost will increase the supply of these goods thus shifting the external balance locus downward, causing a real appreciation and an increase in consumption. On the other hand if the cost is on non-traded goods, the external balance will remain fixed with the internal balance locus shifting upwards. This causes the equilibrium exchange rate to depreciate and consumption to rise. Overall, the effects depend on whether the reduction in spending falls on traded or non-traded goods, as well as on the composition of transactions costs. In summary, a reduction in fiscal deficit causes the RER to appreciate if the deficit as due to government spending on tradeable goods but depreciation if government spending is on non tradable goods.

Changes in the value of international transfers, foreign aid

Another variable that plays an important role in determining the equilibrium RER is the changes in international transfers to the domestic country. International transfers represent an increase to households' incomes equivalent to the transfers. According to Montiel (1999:282), additional transfer income permits an expansion of consumption which, in turn, will raise the price of non-tradable goods and eventually an appreciation of the real exchange rate. International transfers

can also be seen in the form of foreign aid. Theory shows that foreign aid has an impact on the relative prices of traded and non-traded goods. If foreign aid is spent on consumption of non-traded goods then prices of these goods will increase in comparison to the prices of traded goods resulting in the exchange rate appreciating and the opposite is also true (White, 1992:218). Resources also shift from the traded to the non-traded sectors. These two effects reduce the competitiveness of a country. The distinction between the different types of aid is important to note. Pure or untied aid can freely move between sectors while productive or tied aid causes a permanent relative price effect. Levy (1987) found that the marginal propensity to consume of tied aid was 0.27 compared to 0.71 for untied aid. Untied aid has a greater impact in causing RER to appreciate because it is not controlled (White, 1992).

Changes in international financial conditions

A change in the world interest rate is an example of a change in international financial conditions. Capital inflows is an endogenous variable which can come from a number of changes in the domestic and external economic conditions. The source of the shock on capital inflow has an important role in determining the long-run equilibrium real exchange rate. When world real interest rates fall relative to the domestic interest rate, the external balance shifts downwards and the equilibrium exchange rate appreciates. In summary, an increase in real interest rate differentials increases capital inflows and that induces spending on non-traded goods causing the prices to rise and the equilibrium exchange rate to appreciate.

The Balassa-Samuelson effect *(technological progress)*

This variable relates to the differential in productivity growth in different domestic sectors, traded and non-traded. Given a productivity shock in the traded goods sector demand for labour will increase in that sector causing the equilibrium real wage to rise. Labour in the non-traded sector is released and utilised in the traded-goods market. At a given exchange rate the non-traded market tends to shrink while the traded good market expands. The productivity shock decreases production in the non-traded good market and that creates excess demand in the market thus prices increase. An appreciation (IB curve shifts down) is required to maintain internal balance. As a result of a rise in the production of traded goods this gives rise to an incipient trade surplus. A real appreciation is required to maintain external balance, the EB curve shifts downwards and as a result the equilibrium exchange rate appreciates. Differential productivity growth in the traded-goods sector creates an appreciation of the equilibrium real exchange rate (Montiel, 1999:284). In Edwards' model this variable has the same effects as in the

Montiel's model. Due to data issues GDP growth rate per capita is used as a proxy. A country's GDP growth rate per capita that is faster relative to its trading partners, may signal faster productivity in the traded goods' sector. This leads to higher prices and wages growth and real exchange rate appreciation.

Changes in terms of trade

Improvements in the terms of trade (TOT) , namely export prices divided by import prices, increase the real wage since it allows labour to be transferred from the importables and non-traded sector to the growing exportables sector. Output in the non-traded sector contracts and the excess demand of the non-traded goods markets causes the internal balance curve to shift downwards. The effect on the external balance curve depends on whether there is an increase or a decrease in the real total output value of traded goods. According to Edwards (1989:38) to understand the impact of changes in TOT on the RER, both income and substitution effects should be analysed. Kemme and Roy (2006) analysed the a *priori* expectations on changes to terms of trade. If there is an increase in terms of trade then purchasing power rises and the domestic demand for all goods increases. The prices of traded goods are expected to remain constant in the small country scenario but prices of non-traded goods rise. In such a situation the equilibrium exchange rate will rise (an appreciation) and is described as an income effect.

If it is a substitution effect, an improvement in the terms of trade means consumption will shift to importables from exportables and non-traded goods, imports increase and prices of non-traded goods fall. This will cause the equilibrium exchange rate to fall (depreciate). With the substitution effect suppliers will produce more of exportables and drop production on non-traded goods. Thus the impact of a change in terms of trade on the equilibrium exchange rate is not conclusive.

Commercial policy (openness)

Commercial policy is reflected as changes in export subsidies or import tariffs (trade liberalization). An increase in export subsidies would draw labour from the importables sector into the exportables sector. There is therefore an impact on the internal and external balance curves. A subsidy increase causes the IB curve to shift downwards by creating an excess demand for non-traded goods. The effects differ on the external balance; an increase in the subsidy rate would create an expansion in the output of traded goods and the trade balance improves. Excess demand is created in the non-traded market. In summary, such a shock causes both internal and

external curves to shift downwards. Commercial (trade) liberalisation is more related to a depreciation of the equilibrium exchange rate.

Similarly, an increase, for example, in an import tariff increases the domestic price of imports, which are part of tradable goods. This, in turn, shifts domestic demand towards non-tradables, which will lead to an increase in their price, resulting in a real appreciation of the exchange rate. The conclusion on the effect of tariff increases or reductions is similar to that of Montiel (1999). According to Edwards (1989:27), the emphasis is that tariffs should be used to change long-run resource allocation between sectors and not as a way to combat balance of payments deficits.

Capital controls

In the case of capital controls in the form of a tax on foreign borrowing, a reduction in these taxes, through liberalization of the capital account, will result in an increase in the price of non-tradables, therefore the real exchange rate appreciates. The argument is as follows: a reduction of a tax on foreign borrowing makes future consumption relatively expensive thus people will substitute inter-temporally consuming more of non-tradable goods in the current period forcing prices of non-tradables to rise (Edwards, 1989:41).

Commodity prices

Increases in commodity prices appreciate the real exchange rate of that particular commodity exporting county (MacDonald and Ricci, 2004). Such an increase is expected to encourage wages to increase thereby leading to an increase in wages in the non-tradable sector. Due to such increases there is positive wealth effect. The country will feel wealthier and that causes demand for domestic goods to increase leading to higher prices of non-tradable goods.

Nominal exchange rate

Changes in the nominal exchange rate have huge implications for the real exchange rate and can be seen as a powerful tool to manage the real exchange rate. As nominal exchange rate is devalued it is expected that the real exchange rate will depreciate and, the opposite is also true. The variable is included in the model to capture short term deviations of the real exchange rate (Joyce and Kamas, 2003).

Other variables: Monetary policy

Below is a discussion of these fundamental variables with the assumption that the exchange rate is allowed to float.

Money supply

Given a fixed income and output, as money supply increases and there is excess supply of money this results in increase in demand for goods as economic agents reduce their money balances. Increase in demand for goods drives up domestic prices and the domestic currency appreciates in real terms.

Income

Income changes also have an impact on the equilibrium exchange rate. Given any domestic price level, higher real income implies a greater demand for money. Other things being equal, a rise in domestic real income leads to an appreciation of the home currency. This fundamental variable gives the same results as with international transfers and foreign aid discussed above.

Foreign prices

As foreign prices increase, domestic goods become more competitive before the exchange rate adjusts, holding other things constant. Since the domestic goods are cheaper compared to the foreign goods, demand for domestic currency will increase causing the value of the domestic currency to improve and foreign exchange reserves to increase. Due to this, domestic money supply also increases resulting in domestic prices increasing. This will continue until the foreign country's competitiveness is restored and a new equilibrium will be established. Overall, as foreign price level rises, *cet par* the domestic currency tends to appreciate.

2.3.4 Conclusion

Montiel (2003:316) notes the distinction between defining and measuring actual RER; the equilibrium RER is not between disequilibrium and equilibrium but rather between different types of equilibria, namely, equilibria conditioned on different values of macroeconomic values. The theoretical section explored the different models derived from different production structures which define real exchange rate. Edwards and Montiel's models present macroeconomic variables that determine the equilibrium exchange rate. Some of the variables from the monetary model are related to Edwards and Montiel's models, such as income. These

fundamental variables influence the equilibrium exchange rate differently from country to country. It is then crucial for policy makers to take into consideration the most important influencing variables so as to have an accurate understanding of the equilibrium level. In summary, the long run determinants come from four main components: domestic supply-side factors, fiscal policy, changes in the international economic environment, and liberalization of commercial/trade policy (Zhang, 2001:84). The next section analyses the empirical evidence on the subject, for both developing and developed/transition countries.

2.4 EMPIRICAL LITERATURE

There is a large body of literature on equilibrium real exchange rate determination, how it is measured and, the importance of having the exchange rate at its equilibrium level. What is important for each country is to identify those fundamentals that play an important role in determining the equilibrium real exchange rate. Although authors arrive at different conclusions in their analyses, especially on the definition of real exchange rate, there seems to be some similarity in conclusions reached on developing and developed countries. In other words, there are similar trends amongst developing countries which are not necessarily the same with developed countries. Most authors also agree that persistent exchange rate misalignment has negative consequences on macroeconomic balance (Montiel, 2003). In this chapter we analyse previous work done on this phenomenon. We identify the econometric method and approach used and review what different studies found on the impact of fundamental variables on determining the equilibrium exchange rate. Furthermore, we identify which exchange rates were found to be misaligned. This will be important when we estimate the equilibrium exchange rate for this study. We begin with methods and approaches used in previous studies.

2.4.1 Estimation methods

There are various approaches found in the literature for estimating the equilibrium real exchange rate of a country. From the literature reviewed, a common approach, found in both developed and developing countries, is the behavioural equilibrium exchange rate (BEER) approach as found in Chen (2007), Iimi (2006), MacDonald and Ricci (2004), and Zhang (2001). Other approaches found in the literature include the reduced form approach in Li and Rowe (2007) and the general equilibrium approach in Mathisen (2003), Devarajan (1997), and White and Wignaraja (1992). For developing countries, because of low level of data availability, some approaches, such as PPP, cannot be used thus for developing countries the most suitable approach is the BEER (Zhang, 2001:84).

Recently, most studies have employed the multivariate co-integration, Johansen approach to determine the long-run relationship between fundamental variables and the real effective exchange rate. This econometric method was employed in the studies of Chen (2007), Mathisen (2003), Mkenda (2001) and Zhang (2001). One of the advantages of the Johansen approach is that it allows for more than one co-integrating vectors to be determined. Other methods used include the generalised least squares (GLS) in Adenauer and Vagassky (1998), Engle and Granger in Kemme and Roy (2006) and ordinary least squares (OLS) in Li and Rowe (2007) and White and Wignaraja (1992). Kamar and Nuceur (2007) in their study used pooled mean group (PMG) estimator[4] because it constrained only the long-run coefficients to be identical across groups. The long-run variables determine the equilibrium REER, there are also short-run variables and these impact the equilibrium level in the short term. Long-run variables coefficients are decomposed using different filtering methods[5] and from studies reviewed, the Hodrick-Prescott filter is found in studies of Chen (2007), Li and Rowe (2007), Eita *et al,* (2006) and, MacDonald and Ricci (2004).

2.4.2 Misalignment

Real exchange rate is misaligned when it is above or below the equilibrium real exchange rate. According to Mathisen (2003), Malawi's exchange rate was misaligned in 1992 and 1994 when the country experienced major drought. The study compares the equilibrium real effective exchange rate and the actual real effective exchange rate to determine misalignment. In Malawi, food prices rose and all the gains from previously reduced inflation were wiped out. The Kwacha was also overvalued when it was pegged to a basket of seven major currencies. The REER was undervalued from the time it floated and the nominal exchange rate depreciated. Only in 2001 and early 2002 was REER in equilibrium.

It was also found that in the absence of continued shocks about half of the gap between the actual value of REER and the equilibrium values could be eliminated in about 11 months in Malawi. Eita *et al,* (2006) found that for Namibia it would take 1.7 years, while in South Africa, MacDonald and Ricci (2004) estimated that the gap would close within 2 to 2.5 years. Li and Rowe (2007) found that Tanzania's actual REER was undervalued for much of the 1970s, but also sharply overvalued in 1986 due to the balance of payment crisis. The exchange rate was said to be in equilibrium around the same time as the study was being conducted. It would take just

[4] See Kamar and Nuceur (2007) for the estimation procedure
[5] Exponential smoothing and Kalman filter

less than two years for REER to return halfway to its equilibrium value. The Botswana Pula was found to have been undervalued in the 1980s and in 1990s but the misalignment was very minimal (Iimi, 2006). The Pula was overvalued by 5 to 10 percent from about 2000 to 2003.

In the study of 13 CFA Zone countries Devarajan (1997) found that in late 1993 RER was greatly misaligned. Compared to smaller countries which were slightly out of equilibrium, larger oil producing countries, namely Cameroon and Gabon, were highly overvalued and on average domestic prices had to fall by 31% to restore equilibrium. Even after the 50% devaluation of the whole CFA zone, the oil producing countries still remained overvalued while other countries' exchange rates were undervalued. Zhang (2001) found that the actual real exchange rate for China was overvalued for most of the period from 1957 to 1977 (the pre-reform period) but undervalued between 1971 and 1973. The undervaluation in this period was because the world was generally adopting a floating exchange rate. Overall, the Chinese currency was undervalued in 12 of the 20 years of the study from 1978 to 1997.

In the study by Jongwanich (2009), some of the 8 East and Southeast Asia countries had some level of misalignment. Although in Hong Kong and China, RER depreciated continually during 1998-2008 there was no significant RER misalignment as the exchange rate was consistent with economic fundamentals. On the other hand, in Singapore during 1999-2003, the real exchange rate was depreciating and this was associated with undervaluation of about 9% but overvalued by the end of 2007. RER in Thailand and Malaysia was undervalued between 2001-2008 by about 15% and 10% respectively. In Korea there was no significance of RER misalignment as the RER was appreciating and in Indonesia, from 2007-2008, the RER was overvalued. The RER in India was overvalued in 2007 by 6%.

In the case of Zambia, REER was found to be misaligned in various time periods. Mkenda (2001) estimated three different exchange rates for Zambia and found that for the real exchange rate for imports, the exchange rate was overvalued between 1978 and 1984. For the real exchange rate for exports, the exchange rate was overvalued between 1982 and 1985. Due to the poor performance of the currency, the auctioning system for foreign exchange was introduced to assist solve with the problems.

2.4.3 Developed and transition countries

Literature on developed and transition countries includes Chen (2007), and Zhang (2001) who found a positive[6] relationship between TOT and the equilibrium exchange rate, leading to an appreciation of the real exchange rate. A similar result was found in the study of Jongwanich (2009) of eight East and Southeast Asian countries: in China, Thailand and Indonesia, improvements in TOT caused exchange rate appreciation. As export prices increase relative to import prices, income in the country increases and demand for non-tradable goods increases, appreciating the currency. Kemme and Roy (2006) also found the relationship for TOT to be positive. This indicates that in Russia and Poland the substitution effects are larger than the income effect of a change in the terms of trade.

As expected in theory, studies by Chen (2007) of China, and Kemme and Roy (2006) of Poland and Russia, found that increases in net capital inflows appreciated the real exchange rate. Net foreign assets (NFA) is sometimes used as a proxy for net capital inflow. In Alberola and Lopez (2001), an increase in net inflow was also found to result in REER appreciating.

In the case for China, according to Chen (2007) there was no co-integrating relationship between the relative price of tradables to non-tradables and the real exchange rate, thus the Balassa Samuelson effect was said not to exist in China. A possible explanation for this is that in the case of China during the study period neither sufficient international capital mobility nor perfect internal labour mobility existed. Alberola and Lopez (2001), in a study on Spain, found the Balassa-Samuelson effect led to a 4.2% change in the equilibrium real exchange rate.

According to Zhang (2001), results for China indicated that government consumption is greater on non-tradable goods compared to tradable goods. Jongwanich (2009) in a group study of eight East and Southeast Asian countries found similar results for China, Korea, Singapore Malaysia and Indonesia. The results are also similar to the study by Kemme and Roy (2006) though only for Russia because in Poland the study found a negative relationship between government consumption and equilibrium real effective exchange rate, as government consumption was biased towards tradable goods.

[6] From now on a negative relationship means REER depreciation and a positive relationship means an appreciation. The difference with theoretical section is then RER instead of REER was used.

Credit creation is included in the model to represent expansionary macroeconomic policy and is expected to cause short run movements of the exchange rate. Kemme and Roy (2006) found for Poland and Russia that increases in domestic credit result in exchange rate appreciation. Expansionary macroeconomic policy generates inflationary pressures increasing the price of non-traded goods. Nominal exchange rate revaluation as expected caused an appreciation of the real exchange rate in the studies of Kemme and Roy (2006).

Next we analyse the relationship between fundamental variables and the equilibrium real exchange rate in developing countries.

2.4.4 Developing countries

Developing country literature reviewed includes Li and Rowe (2007) MacDonald and Ricci (2004), Mathisen (2003), Mkenda (2001) and Edwards (1989), and others. There have been mixed results for different countries on how the economic fundamentals impact on the equilibrium real exchange rate. This is expected as the impact of macroeconomic fundamentals differs from country to country. From a number of fundamental variables identified by Edwards (1989) and further expanded by Montiel (2003), the most common one found in the literature includes terms of trade, net capital inflow, commercial policy (openness), fiscal policy (government consumption), capital inflow and foreign aid.

One of the pledges to be achieved by the G8 countries is to increase the amount of aid to developing countries. Theory, supported by empirical studies, indicates that an increase in aid[7] causes the real exchange rate to appreciate as income increases, causing an increase in spending on non-tradable goods. As demand for non-tradable goods increases, prices of these goods also increase, appreciating the real exchange rate. It should be noted though that not all aid is channelled into consumption of non-tradable goods. An increase in aid was found to cause an appreciation on the real exchange rate in studies by Adenauer and Vagassky (1998) and White and Wignaraja (1992). The study by Adenauer and Vagassky (1998) investigated the possibility of the 'Dutch disease' in some of the CFA zone countries (Burkina Faso, Cote d'lvoire, Senegal and Togo) using the Salter-Swan two-sector model. White and Wignaraja (1992) found that aid had a positive effect on the real exchange rate in Sri Lanka. The results showed that a one unit increase in the variable caused a 0.006 percent increase in the real exchange rate in the following period.

[7] Pure (untied) aid

In the case of Zambia, flow of aid was found to impart short-run effects on the internal real exchange rate (Mkenda, 2001:49).

Contrary to expectations, but not unique, Li and Rowe (2007) found a negative impact of aid on the real exchange rate in Tanzania during the period 1970 to 2005. The results were due to the fact that before Tanzania fully liberalized its imports, aid was used to finance imported inputs and that eased constraints on domestic production and raised output. Thus aid was used on imports rather than on consumption of non-tradable goods.

Another variable found in the literature is terms of trade (TOT), which is the relative price of exportable goods in terms of importable goods. Theoretically, the expected sign of the impact on equilibrium real exchange rate is not conclusive. According to White and Wignaraja (1992), in Sri Lanka an improvement of TOT resulted in a substitution effect as the impact on the prices of imports was greater compared to those of exports and this led to depreciation of the real exchange rate. Similarly, according to Masters and Ianchovichina (1998), a negative relationship was found in the case of Zimbabwe and the same was found in Zambia (Mkenda, 2001). However, a positive relationship was found in the respective studies of Li and Rowe (2007), Iimi (2006), Mathisen (2003), and Adenauer and Vagassky (1998). This relationship indicated that for these countries, as terms of trade increased, real exchange rate appreciated, indicating an income effect.

According to Mathisen (2003) in Malawi, net foreign assets were used as a proxy for net capital inflow. Improvement in net capital inflow resulted in the real exchange rate appreciation as expected. These results were found only when TOT and the fiscal variable were omitted from the equation. The results are also similar for South Africa in MacDonald and Ricci (2004) and Aron *et al,* (2000). For Zimbabwe (Masters and Ianchovichina, 1998), and Botswana (Iimi, 2006), the relationship was negative; a depreciation in RER. These last results are not as expected. In the case of Botswana, the country accumulated foreign reserves because of very strong export performance and due to the privatization of the public pension system net foreign assets declined sharply between 2001 and 2004. REER was observed to significantly appreciate and this was attributed to the Rand's effect.

The Balassa-Samuelson effect relates to the differential productivity growth in different sectors, traded and non-traded. In developing countries, data are not available to measure productivity and growth rate of per capita is the only general indicator of long-term productivity growth and is thus used as a proxy (Hinkle and Nsengiyumva, 1999:138). According to Iimi (2006) in

Botswana, as mentioned earlier, export performance was high and, compared to trading partners, there was high productivity growth in the tradable sector. A positive relationship was found meaning that the traded sectors performed much better than the non-traded sector and, the equilibrium real exchange rate appreciated. The same was also found for Namibia (Eita *et al*, 2006), while for the Gulf Cooperation Council countries, the relationship was positive but insignificant (Kamar and Naceur, 2007). For Tanzania the case is different as a negative relationship was found (Li and Rowe, 2007). It was positive for CFA zone countries though the results were not significant (Adenauer and Vagassky, 1998). According to Devarajan (1997), within the 12 CFA Franc zone countries, real GDP growth was negatively related to the real exchange rate. In another study, with only four CFA Franc zone countries, (Adenauer and Vagassky, 1998), it found that there was a positive relationship but it was not significant.

Another variable found in most of the literature is commercial policy (openness); this is the degree of trade liberalization within a country or the level of trade controls. Of the studies analysed, the majority of results were in line with *a priori* expectations. As a country increases export subsidies or decreases import tariffs, for example, real exchange rate depreciates. Real exchange rate depreciation was found in Li and Rowe (2007) and Masters and Ianchovichina (1998). Aron *et al,* (2000) used tariff as a proxy for openness for South Africa and found a negative relationship with the real exchange rate. Kamar and Naceur (2007) removed the impact of oil as it would distort the real level of openness as oil is a major component of exports within the Gulf Cooperation Council (GCC) and thus only imports to GDP were used as the proxy of openness. Interestingly, a higher level of trade liberalization led to an exchange rate appreciation. This is due to the fact that these countries have all adopted common trade policies, thus trade openness is beneficial to all. Similar to the results for developed countries, improvement in commercial policy (increased openness) results in real exchange rate depreciation in the majority of studies.

Government consumption is also one of the main variables that plays an important role in real exchange rate determination. A real exchange rate appreciation was found in the respective studies of Li and Rowe (2007) and Mathisen (2003) when government consumption increased. These results just indicated that most of government consumption is concentrated in non-traded goods. Not only that, a positive relationship with REER is a signal that government consumption could have been used as an efficient tool to manage inflation within the GCC countries (Kamar and Nuceur, 2007). On the other hand if government consumption is high on tradable goods, real exchange rate depreciates.

Fiscal balance, domestic credit creation and nominal real effective exchange rate, are some additional fundamentals that impact the equilibrium real exchange rate although we found few studies that include them. MacDonald and Ricci (2004) found a negative relationship between equilibrium real exchange rate and improvements in fiscal balance in South Africa. A plausible explanation is that the South African government may have increased its savings, thus impacting total domestic demand especially on non-tradable goods. The latter prices drop as a result thereby causing real exchange rate to depreciate. Credit creation captures expansionary monetary policy. Masters and Ianchovichina (1998) concluded in their study on Zimbabwe that increased credit creation resulted in exchange rate depreciation. This is supported by the country's low inflation levels during the study period. These results differed from many other developing countries such as in South Africa, for example (Aron *et al*, 2000).

In the study of Joyce and Kamas (2003), nominal exchange rate was included in their model as a policy variable. In the study a change in the nominal exchange rate is used to capture the impact of nominal devaluation on the short-run movements of real exchange rate. In this study nominal exchange rate devaluation led to a depreciation of the real exchange rate. Even though the effect is temporary the impact on the exchange rate was found to be huge showing the significance of nominal devaluation as a policy on real exchange rate.

As we have discussed in the theoretical section, real interest differentials have a positive impact on the real exchange rate. Iimi (2006) and MacDonald and Ricci (2004) in studies on Botswana and South Africa respectively found that, when domestic interest is higher compared to those of major trading partners, the equilibrium exchange rate appreciated.

In commodity exporting countries - especially commodity currency countries - equilibrium exchange rate appreciates as commodity prices increase. According to Eita *et al,* (2006), Iimi (2006) and MacDonald and Ricci (2004) when commodity prices increase the real exchange rate appreciated. An example is the gold price with reference to South Africa. In our study we will consider the impact of copper prices on Zambia's equilibrium real exchange rate.

2.5 CONCLUSION

The main objective of this chapter was to define real exchange rate and discuss how it is measured. From the discussion, it has been shown that RER can be measured internally and externally. Internal real exchange rate measurements tend to be difficult because data are not available. External real exchange rate is used as a proxy for internal real exchange rate. In

addition, a country's RER can be bilateral (against one foreign currency) or multilateral (against a basket of foreign currencies such as trading partners). A crucial matter that most studies tried to analyse was whether or not the RER of a country is at the desired equilibrium level. When the actual real exchange rate is not equal to the equilibrium level, there is exchange rate misalignment. We have also seen that misalignments are bad for the economy because they cause economic instability. The country will be less competitive against other countries when the exchange rate is over-valued thus misalignments have a negative impact on economic growth. Long-run equilibrium RER is achieved when the fundamental variables are stable. The cost of long-run misalignment becomes greater as financial integration expands (Montiel, 2003:320).

Macroeconomic fundamental variables that determine the equilibrium real exchange rate level were identified in the three models discussed, namely the respective models of Edwards and Montiel, as well as the monetary model. These include terms of trade, government consumption, net foreign assets, foreign aid, domestic credit openness, nominal exchange rate and commodity prices.

The majority of results in the literature reviewed agree with a *priori* expectations on the impact of the fundamental variables on the exchange rate. Important to note is that results depended on the country or countries in the study. As trade controls (openness) were reduced, real exchange rate usually depreciated. This was the case, however, in all literature reviewed. In the case of foreign aid, the results were mixed although there were more studies that found a positive relationship with real exchange rate. An increase in foreign aid to a country is expected to cause an appreciation of the RER but this was not so in Tanzania. Also of those studies reviewed, foreign aid is found in developing studies only, showing how important this variable is in developing countries as they are usually recipients.

Most of the recent studies employed the Johansen approach to determine the relationships between variables (Jongwanich, 2009; Iimi, 2006; MacDonald and Ricci, 2004). The BEER and the general equilibrium model for long-run equilibrium real exchange rate determination were common in most studies, especially studies on developing countries. This study follows the model mostly applied to developing countries and those variables most applicable for Zambia and Malawi.

CHAPTER 3

COUNTRY OVERVIEW

3.1 INTRODUCTION

The focus of this chapter is to give a brief economic overview of the countries in this study. The chapter is divided as follows. Section 3.2 is the macroeconomic policy environment of Malawi and Zambia analysing changes over the study period in fiscal policy, monetary policy, trade policy, financial policy and finally exchange rate policy. Sections 3.3 and 3.4 analyse selected macroeconomic indicators for Malawi and Zambia and examine their trend with exchange rate movements over the study period. Section 3.5 concludes this analysis. The chapter is important because it provides a clearer picture of historic and present economic events in both Malawi and Zambia. These events will help us understand and interpret our findings and give relevant policy recommendations.

3.2 THE MACROECONOMIC POLICY ENVIRONMENT

3.2.1 Malawi

Malawi is one of the poorest countries in Africa. It is highly dependent on foreign aid which has an impact on the country's economic performance and is also likely to impact its exchange rate (Mallik, 2008:251). Although agriculture is the dominant sector in the economy, accounting for 34.1 percent of gross domestic product (GDP) in 2009 (Reserve Bank of Malawi, 2010), the country is highly dependent on foreign aid to sustain the economy. In 2005, Malawi received foreign aid amounting to 27.8 percent of its GDP (Reserve Bank of Malawi, 2006). The country needs institutional reform to maintain or improve economic growth, from 2000-2004, the average was 0.83% and 2005 -2008 rose to 7.26%.

Fiscal policy

"The country's fiscal policy aims at reducing domestic debt and hence debt service costs to lower domestic interest payments and create fiscal space for increased pro-poor expenditure" (African Economic Outlook, 2010a). Taxes in Malawi are moderate and in 2009, total tax revenue as a percentage of GDP, was 17.6% (Index of Economic Freedom, 2010a). The government intends to broaden the tax base in order to provide for a lower corporate tax rate in the medium term which would benefit all corporate businesses and make Malawi internationally competitive. In

terms of government spending, general government final consumption expenditure (% of GDP) has been fairly constant over the years at just below 20% of GDP, increasing above this level only in 1994, which could have been due to this being election time. Growth in general government final consumption expenditure (annual % growth) was positive in real terms in most of the years of the study period, with few negative annual growth rates.

Monetary policy

The monetary policy framework of any country is shaped by the kind of government, the economic and legal structure and the nature of its financial institutions. According to Sato (2001), up until the late 1980s the monetary policy in Malawi was very restrictive in terms of direct credit, interest rate ceilings and tight controls on foreign exchange and capital flows. Since 1981 to 1994 Malawi undertook a number of structural adjustment programmes driven by the International Monetary Fund (IMF). Only at the end of 1997, after the floatation of the Kwacha, did the economy enjoy low inflation, but this was partly because there were huge foreign exchange reserves and this impacted on the exchange rate and it strengthened in real terms and interest rates were high. After achieving low inflation, the monetary authorities shifted their focus towards regaining external competitiveness.

Money (M2) targeting was the monetary policy anchor in the economy. In 2000, in order to restore stability, the central bank undertook open market operations to reduce liquidity. By the end of 2000, the growth in M2 aggregates was still above target and the central bank decided to monitor growth of reserve money aggregates as an anchor of monetary policy as it had better control over these than of M2 money stock (Reserve Bank of Malawi, 2000). According to African Economic Outlook (2010a) the key monetary policy objectives of the current government of Malawi aim to achieve single digit inflation, strong foreign reserves and increased credit to the private sector. In 2008 short-term interest rates were raised to levels more consistent with medium-term inflation objectives and the declining foreign reserve situation.

Trade policy

In Malawi "Import and export restrictions, some services market access restrictions, import and export licensing requirements, import taxes, some discriminatory regulations, inadequate infrastructure, subsidies, and inefficient and corrupt customs administration add to the cost of trade" (Index of Economic Freedom, 2010a). This indicates that there are still restrictions that hinder free trade, though these restrictions have decreased over the years. The applied, weighted

mean, tariff rate for all products (%) was 22.31% in 1994 and had decreased to about 6 percent in 2008, indicating a considerable decline in tariff protection over the period.

Financial policy

Malawi has a small financial sector which is stable relative to others in the region. Business environment and an active private sector require a well built regulatory framework and the country has taken steps to improve this, though progress has been slow.

Exchange rate policy

According to the Reserve Bank of Malawi (2000) the management of the exchange rate in Malawi has been driven by three major policy objectives:

i. attainment of growth in real income,
ii. maintenance of a viable balance of payments position, and
iii. attainment of stable domestic prices

Like the currencies in most developing countries, the Malawian Kwacha has been under a number of different exchange rate regimes in recent decades. Table 3.1 below summarises these exchange rate regimes.

Table 3.1 Malawi exchange rate regimes

Period	Exchange rate regime
1965-1973	Pegged to the British Pound Sterling
1973-1975	Pegged to the weighted basket of British pound and the US dollar
Jun 1975-1984	Pegged to the IMF SDR
Jan 1984-Feb1994	Pegged to the weighted-basket of seven currencies
1994-1998	Managed Floatation of the Malawian kwacha
1998-2006	Market determination of the Malawian Kwacha
2006-2009	Fixed pegged to the US dollar
2009-current	Floatation of the Malawian kwacha

Source: Sato (2001)

As the study period starts, the Malawian Kwacha was stable because it was pegged to the SDR, but was later devalued because the SDR began appreciating as the US Dollar appreciated. The authorities then pegged the Kwacha to a weighted-basket of seven currencies. There were signs of improved stability, but there were also numerous devaluations of the currency as transportation costs were adversely affecting terms of trade. With these devaluations, the private sector could speculate regarding future exchange rate movements, leading to weak confidence in the then exchange rate system. The cutting of non-humanitarian assistance (for political reasons) made the exchange rate situation even worse.

From 1994 Malawi adopted a managed float exchange rate then later a market determined exchange rate aimed at ending the foreign exchange crisis and assisting recovery from the 1992/93 drought. A foreign exchange market was established which was administered by the central bank where foreign currency prices were bid between buyers and sellers. According to Simwaka (2007:9)

> The free-float system, is perhaps remembered by the first ever appreciation of the Kwacha in 2001. Receipt of some donor inflows at the beginning of 2001 coupled with relatively higher average tobacco prices at the auction floor meant a favourable healthy foreign exchange position and this helped to dampen any speculative attacks on the kwacha.

In May 2006, "the government of Malawi pursued a fixed pegged exchange rate policy, holding the nominal value of the Malawi Kwacha steady at MWK 141:1 USD up to October 2009" (African Economic Outlook, 2010a). This policy resulted in the central bank failing to clear the foreign exchange market at the prevailing rate. Both the real and nominal real effective exchange rates appreciated as the US Dollar was itself strengthening. This caused import demand backlogs as they became cheaper in domestic currency and there were foreign currency shortages. The exchange rate spreads between the official and the parallel market widened, suggesting that the exchange rate was overvalued. Foreign reserves fell and at the end of 2009 authorities liberalized the exchange rate to improve foreign reserves.

3.2.2 Zambia

Zambia is a mineral-exporting country with copper being the most important export. Mineral tax as a percentage of government revenue was 58% in 1970 though it has decreased over the years. The mining sector also employed 10% of total employment in 1996 (Mkenda, 2001). Since most commodity producers are price takers, this would mean that when the market prices for copper are low, copper export revenues will be low thereby having a great impact on total export

revenues. Zambia also produces other minerals such as gold, silver, tin, zinc and cobalt but copper is the dominant export. It is therefore expected that changes in copper prices and its production play an important role in determining the external value of the Zambian currency. As the price of copper increases, copper export revenues increase and the exchange rate of Zambia is expected to appreciate. It is claimed that the poor performance of the Zambian economy was due to the heavy dependence on the production and export of copper and that the macroeconomic response to the decline in world copper prices in the 1970s was flawed (Adam, 1999). Having stated that, we will now analyse the Zambian economy in terms of its fiscal policy, monetary policy, trade policy, financial policies and the exchange rate policy.

Fiscal policy

In recent years the Zambian economy has been growing rapidly. The economic policy environment has generally been good and expectations met. With the difficult external environment of rising world food and oil prices, inflation started to rise in 2005-2008. Tax revenues as a percentage of GDP have been consistently between the ranges of 15-20% from 1990 to 2007 (see Table 3.2).

Table 3.2: Tax revenues as a percentage of GDP

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
19.5	17.5	18.7	15	18.8	17.2	17.7	17.7	17.7	18.4
2000	2001	2002	2003	2004	2005	2006	2007		
N/A	18.6	17.4	16.7	17.6	17.2	16.4	17.1		

Data source: World Bank, 2010

Due to fiscal policies that encouraged macroeconomic stability, economic growth has been about 6% on average over the past five years. The government has managed to control public finance well even though fiscal deficit has been on the rise. General government final consumption expenditure has fallen as a % of GDP even though it has increased annually in real terms, reversing the sharp 21% decline in 2000.

Monetary policy

The ultimate goal for most central banks is to promote financial stability. In the current year the Bank of Zambia, through its monetary policies, managed to reduce inflation and created

channels for economic growth (IMF, 2010). Real interest rates have been volatile, with high negative rates in the late 1980s and early 1990s (-42% in 1991) but rates have been positive since 1994. Real interest rate remained high for a long period after 1994 and that increased cost of borrowing. High borrowing costs hindered development of starting up businesses and existing ones. In recent years the rate has been below 10%.

Trade policy

In the late 1980s, Zambian trade policies were strictly protectionist but over the years there has been liberalization of these policies. The weighted mean tariff barrier for all products was 18% in 1993 and decreased to just 5% in 2008 (World Bank, 2010). In addition to tariffs, according to the Index of Economic Freedom (2010b),

> …some import and export restrictions, services market access barriers, import taxes and fees, import and export permit and certification requirements, non-transparent standards, improving but still cumbersome customs implementation, and corruption add to the cost of trade.

Trade flows have nonetheless improved and we see that both export price index and imports price index have increased reducing terms of trade (Appendix B).

Financial policy

In the early 1980s, financial market structures were distorted to assist in allocating credit to the government sectors at non-market rates (Muhanga and Soteli, 2008). Government funded high public sector deficits even though they did not perform well leading to high inflation and the partial collapse of the economic system. According to the Index of Economic Freedom (2010b), the financial sector of Zambia has performed relatively well in recent years even though change has been slow. It has benefited from reforms, such as, the implementation of the Financial Sector Development Plan. The financial policy of Zambia is now relatively liberal and the banking system has been advancing. The financial system is mainly dominated by the banking sector, as in most developing countries.

In Zambia capital markets are still in their infancy and bank supervision and regulation have been improving. The stock exchange does not have restrictions on foreign investments in order to boost participation in the market. Developments in the financial sector include amendments to policies and financial laws such as the Banking and Financial Services Act in 2005. The number of banks and non-bank financial institutions has also increased. According to Muhanga

and Soteli (2008), foreign holdings of Zambian government securities rose from 0.5% in 2005 to 17% in 2008, showing an increase in investor exposure as a result of the growth of foreign capital inflows into the country.

Exchange rate policy

Exchange rate policy in Zambia has been characterised by two distinct exchange rate regimes namely fixed and flexible rates. Table 3.3 below takes us through the different exchange rate regimes the country has adopted over the years. Currently the country is under a managed float exchange rate regime but according to Mali (2010) the exchange rate is volatile, which is not good for investment as the market is unpredictable. Since 1994 the exchange rate has been allowed to float because authorities aimed at reducing the negative impact to the country due to donor support that was withdrawn and the 1992/1993 drought effects. It was also to try and improve export competitiveness.

Table 3.3: Zambia exchange rate regimes

Period	Exchange rate regime
1964-1971	Fixed exchange to the British pound
1971-1976	Fixed exchange to the US dollar
1976-1983	Pegged to the Special Drawing Right
1983-1985	Pegged to a weighted average of a basket of currencies
1985Oct-1987 Jan	Dual exchange rate system- auction and below auction rate
1987Jan- 1987 Mar	Fixed rate to the US dollar; then to a basket of currencies
1987 Mar-1987 May	Dual exchange rate system – official rate and auction rate
1987 May-1990 Feb	Fixed rate, with occasional devaluations
1990 Feb-1991 Apr	Dual exchange rate system – retail and official windows
1991Nov-1992Feb	Retail and official windows unified, Crawling peg
1992 Feb-1992Oct	Fixed rate to the US dollar
1992 Oct-1992Dec	Bureau de Change system introduced
1992 Dec-1993	Flexible exchange rate system
1994- to date	Free market exchange rate and Exchange Control Act suspended

Source: Chipili (2009), Mungule (2004) and Mkenda (2001)

The next section is a discussion of selected macroeconomic variables and exchange rate movements. The size and trend over the year may help explain the movement of the exchange rate and any misalignment.

3.3 SELECTED MACROECONOMIC VARIABLES EXCHANGE RATE MOVEMENTS

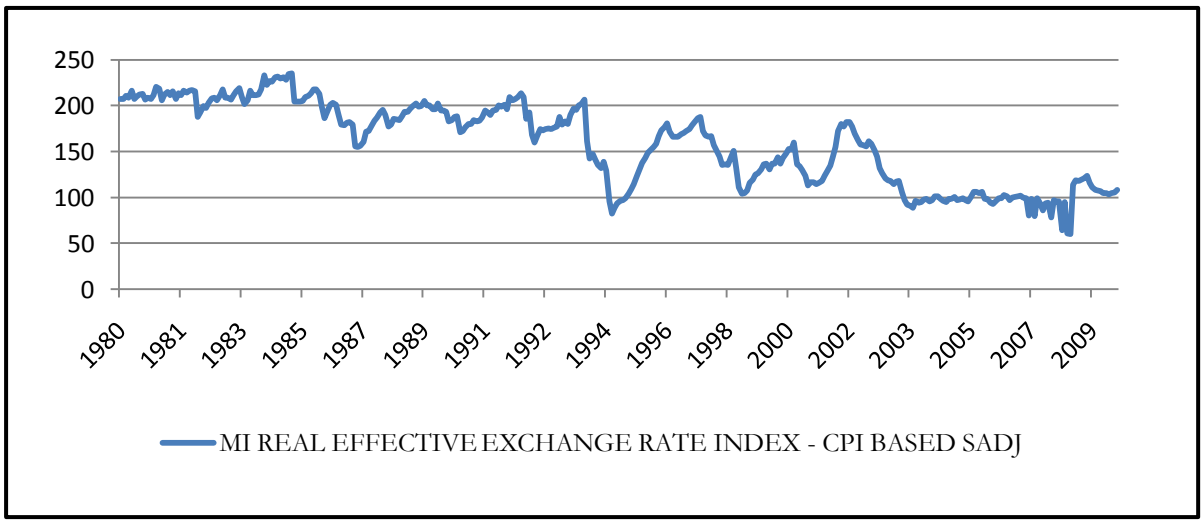
3.3.1 Malawi

Table 3.4: Five year averages of selected macroeconomic variables

Years	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2008
Terms of trade (%GDP)	128	98	87	75	92	102
Foreign aid (% GDP)	11.2	20.4	29.6	23.2	20.8	21
Exports + Imports (% GDP)	55	53	63	66	74	67
Government consumption (% GDP)	17.4	17.8	17.2	16.2	13.2	11.5
Domestic credit (%GDP)	37	29	22	8	11	15
Net foreign asset (%GDP)	-24	-9	-6	7	6	4
GDP growth rate	1.34	2.10	1.31	6.96	0.83	7.26

Data Source: World Bank (2010): Authors' estimations

Figure 3.1: REER of Malawi (Monthly), 1980-2010

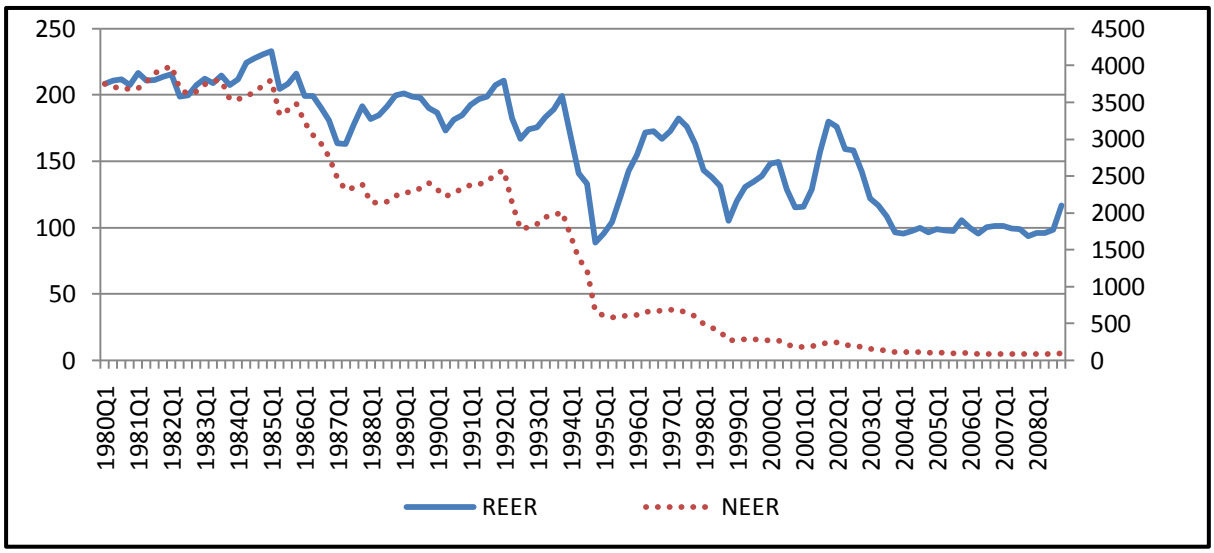


Note: Index 2005 = 100 (For all figures)

Data Source: Thompson DataStream (2010)

Figure 3.1 indicates a long term downward trend in the REER rate of Malawi since 1980. As discussed above REER is the best indicator when comparing a country's competitiveness relative to its competitors and is also useful in analysing exchange rate movements. Despite brief periods of appreciation the REER depreciated from an index level of more than 200 in 1980 to a lowest point just above 50 in 2008. The fall in 2008 is possibly due to the global financial crisis which adversely affected the terms of trade. The rapid depreciation in the Kwacha from 1993 to 1994 may be explained by the fact that it was allowed to float, being determined by market forces. In addition, trade controls were liberalised adding pressure on the currency as imports increased.

Figure 3.2: REER and NEER of Malawi, 1980-2009



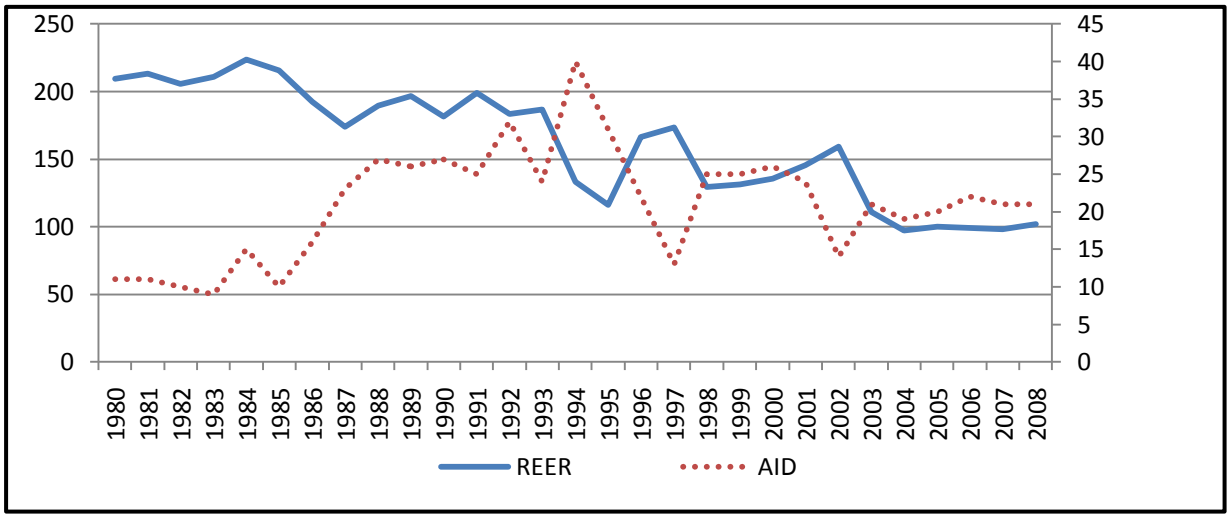
Note: REER is plotted on the left axis and is consistent on all figures that include the variable.
Data Source: Thompson DataStream (2010)

In Figure 3.2 REER is plotted against NEER and a downward sloping trend can be observed with the NEER below the REER. The nominal effective exchange rate has been on a continuous decline since it was floated in 1985 and this has risen concerned to policy makers as the (nominal) exchange rate is an important indication of the performance of the economy, especially Malawi's excessively high rate of inflation over much of the period.

Looking more closely at the fundamental variables and considering the objective of this paper of investigating whether foreign aid (official development assistance as a percentage of GDP or ODA) has any effect on Malawi's exchange rate, it should be noted that at the period of the most rapid depreciation of the REER, foreign aid increased. This can be seen in Figure 3.3, for example during 1993 to 1995 and throughout much of the period of analysis, where a negative

relationship between the two variables appears to be illustrated. At this moment the direction of causality cannot be easily identified. Whether changes in foreign aid have any impact on REER will be determined in the following chapters.

Figure 3.3: REER of Malawi and Net ODA (AID) as a percentage of GDP



Data Source: Thompson DataStream (2010) and World Bank (2010)

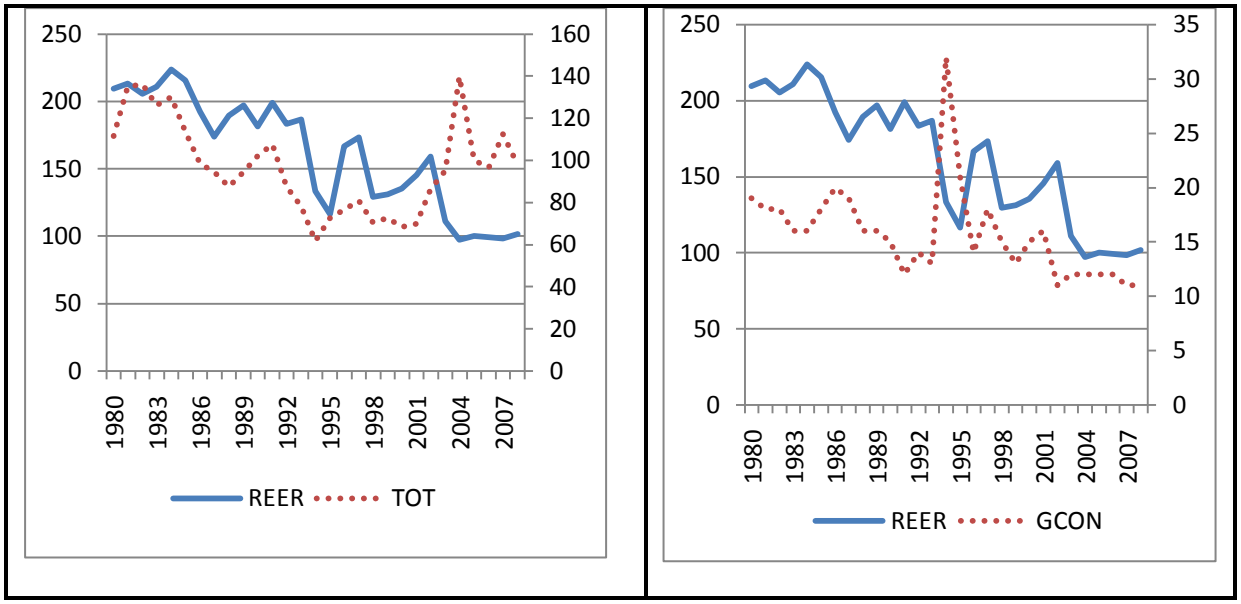
Table 3.5 below shows the proportion of foreign aid to Malawi's GDP in five year averages. Foreign aid increased in significance from the 1980s until early 1990s and slightly decreased in importance in the following years. Importantly, during the period of rising foreign aid from 1985-1995, the REER weakened rapidly. In 1992 non-humanitarian assistance was cut together with the suspension of balance of payments support yet the REER strengthened for part of this period. This does not automatically mean that foreign aid could not have resulted in an overvalued exchange rate. But it does cast a question mark against the *a priori* expectation that foreign aid may be responsible for overvalued exchange rates in recipient countries.

Table 3.5: Five year averages of the net ODA to Malawi as a percentage of GDP

Net ODA from all donors (% of Malawi's GDP)						
Years	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2008
	11.2	20.4	29.6	23.2	20.8	21

Data Source: World Bank (2010): Authors' estimations

Figures 3.4 & 3.5: Terms of trade and government consumption versus REER

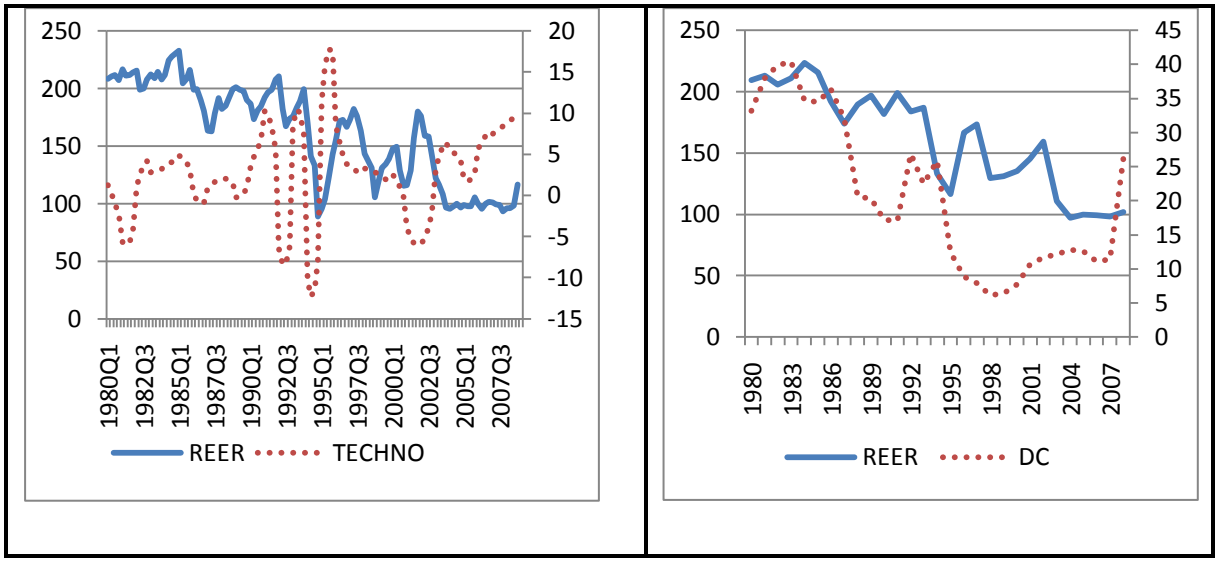


Data Source: Thompson DataStream (2010) and World Bank (2010)

Figures 3.4 and 3.5 above indicate the movements of some of the fundamental variables against REER so as to visually determine whether the expected relationship is observed or not. Terms of trade (TOT) and REER graphs moved closely together as expected from 1980 until 2003. In 2002 both export and import prices increased but export prices rose more than import prices so TOT improved. In the following year both prices fell but export prices fell more than import prices and both the TOT and the REER fell (see Appendix A). As expected increases in terms of trade appear to result in an appreciation of the exchange rate due to the income effect.

The relationship between REER and government consumption (GCON) in Figure 3.5 is unclear since before 1994 there seems to be a negative relationship. A spike in GCON is seen around 1994 which is due to the increased government spending during the presidential election. From 1996 onwards there is a mixed relationship (negative and positive). Further analysis to determine the impact of these variables to the exchange rate is undertaken in the following chapters.

Figures 3.6 & 3.7: Balassa Samuelson measure (TECHNO) and domestic credit (% GDP) versus REER

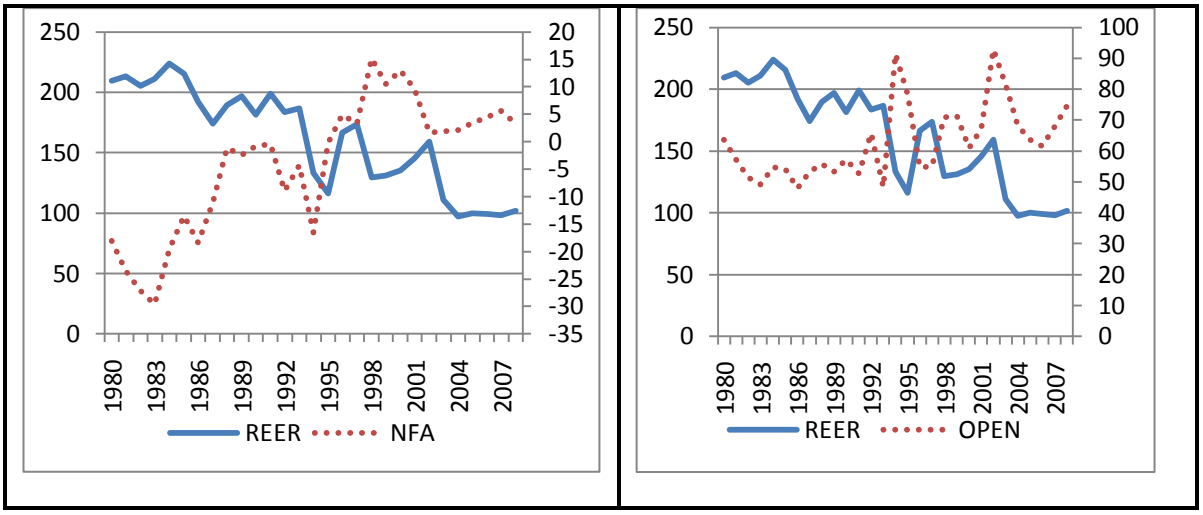


Data Source: Thompson DataStream (2010) and World Bank (2010)

The Balassa Samuelson measure as discussed in Chapter 2 relates to the differential in productivity growth in different domestic sectors, traded and non-traded. In this case, the variable compares tradable sector productivity growth to that of its trading partners. An appreciation is expected when the traded sector is performing better than of trading its trading partners. Figure 3.6 shows a positive relationship until the early 1990s but thereafter the relationship is negative. The fact that TECHNO rises and then falls may be due to trade liberalization that made trading partners perform better than the domestic market.

In Figure 3.7 domestic credit, as a percentage of GDP, shows a negative relationship: as DC decreases as a percent of GDP the exchange rate appreciates. The *a priori* expectation is that as DC increases then the exchange rate appreciates. This does not appear to be the case in Malawi (or in Zambia discussed in the next section). This can be due to a minimal impact of this variable on the exchange rate.

Figures 3.8 & 3.9: Net foreign assets (% GDP) and openness (exports plus imports as % GDP) versus REER.



Data Source: Thompson DataStream (2010) and World Bank (2010)

Net foreign assets (NFA) show an upward trend rising from negative values to positive values as a percentage of GDP. The relationship is contrary to the expected positive relationship. Openness (OPEN) and REER seem to indicate a negative relationship although OPEN is less volatile until the early 1990s. Thereafter, there are large ups and downs. The *a priori* expectation is that as OPEN increases REER depreciates. This negative relationship is expected since increases in OPEN related to increases in trade liberalisation and therefore imports increase and non-traded goods prices fall and this impact on the REER via a deterioration of the current account of the balance of payments.

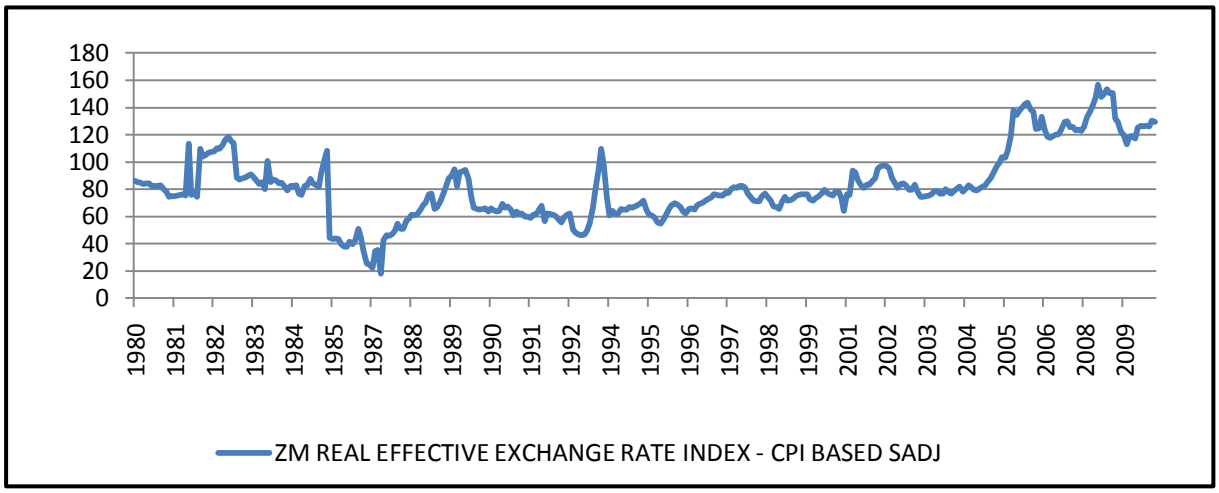
3.3.2 Zambia

Table 3.6: Five year averages of selected macroeconomic variables

Years	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2008
Terms of trade (%GDP)	72	98	66	106	87	110
Foreign aid	7.4	16.4	23.8	24.8	19.8	11.5
Exports + Imports (% GDP)	71	71	75	67	72	72
Government consumption (% GDP)	26	20	19	16	13	10
Domestic credit (%GDP)	71	55	61	59	48	19
Net foreign asset (%GDP)	-35	-55	-38	-33	-18	8
GDP growth rate	0.82	2.05	-0.82	1.56	4.46	5.85

Data Source: World Bank (2010)

Figure 3.10: REER of Zambia (Monthly) 1980-2010.

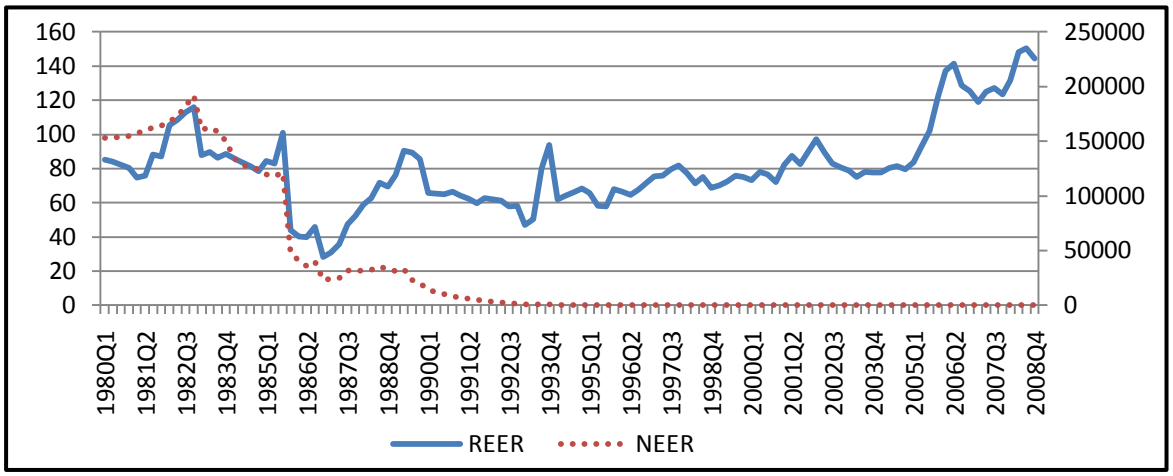


Data Source: Thompson Data Stream (2010)

Figure 3.10 shows the appreciation and depreciation experienced by the Zambian REER since 1980. From 1980 to 1985 the REER remained fairly stable with slight variations. This was followed by a sharp downward movement that ended in 1987 and occurred while the exchange rate was under the auctioning system. The REER began to appreciate until 1989 and was then fairly stable until 2004. The REER then appreciated very strongly until 2008 when, in light of the global financial crisis (and possibly its impact on the copper price), it fell and then later started to appreciate again.

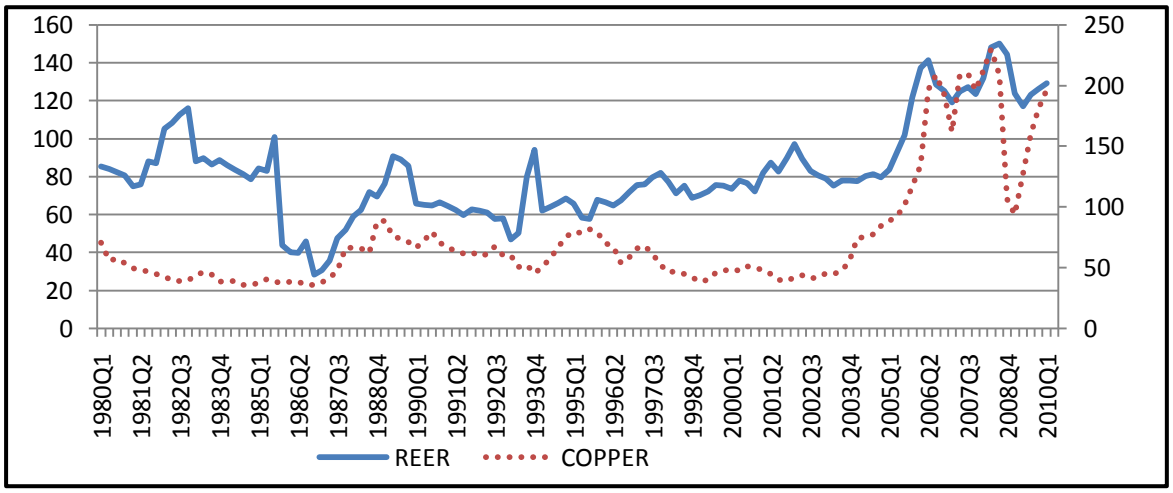
Figure 3.11 below shows the REER plotted against the NEER and the REER. Both the REER and NEER indicate depreciation around 1986 to 1987 as the economic situation in the country got worse. The dramatic fall of the NEER is the results of extremely high inflation in Zambia until about 1993.

Figure 3.11: REER and NEER of Zambia (quarterly), 1980-2008.



Data Source: Thompson Data Stream (2010)

Figure 3.12: REER for Zambia and international market copper prices.



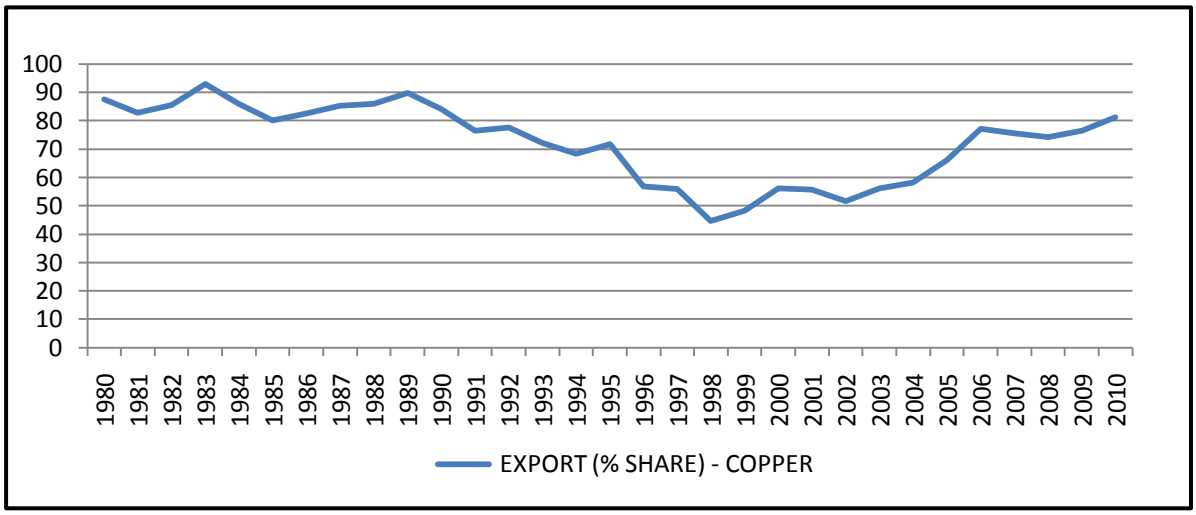
Data Source: Thompson Data Stream (2010)

Figure 3.12 shows the movements of copper prices and REER for Zambia and as expected, copper price movements correlate well with movements in the level of the exchange rate. As the copper price increases, the REER appreciates which suggests that the copper price does have an influence on Zambia's exchange rate. The exchange rate strengthened between 1987 to 1989 and in 1993 along with a stronger copper price. The decrease in copper production over the years was reversed by privatisation of mines in 2000 and with higher international copper prices this increased the significance of copper to Zambia's overall export earnings (Figure 3.13). The

exchange rate strengthened strongly around about 2003 when the copper price rose. Stronger copper price and exchange rate can also be seen in 2007 and 2009.

Weaker exchange rate along with weaker copper price in early 1990s and around 2008 can also be seen in the above figure but the correlation is not always exact. For example, the exchange rate strengthened steadily in real terms from 1995 to 2002 even when the copper price was weak. This could be attributed to other macroeconomic factors including very high domestic inflation which meant that while the exchange rate weakened in nominal terms it strengthened in real terms. According to The African Report (2010) the Zambian Kwacha lost five (5) percent in value due to decline in copper prices in 2009. Due to increased copper prices and positive sentiments on a global economic recovery, foreign exchange earnings from copper increased from the end of 2009 to early this year. This again reflects how changes in copper prices seem to have an impact on the exchange rate.

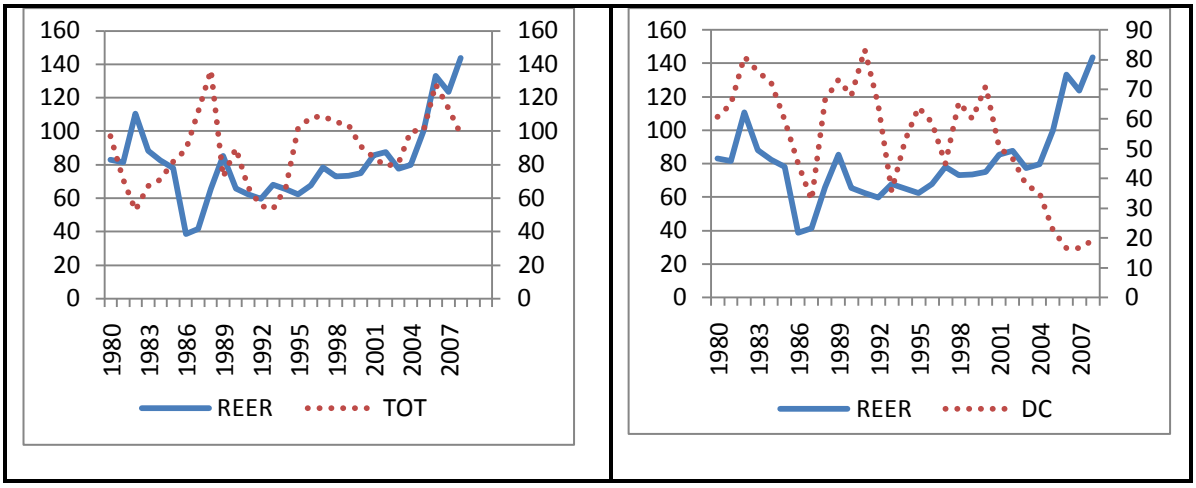
Figure 3.13: Percentage share of copper to total exports in Zambia.



Data Source: Thompson Data Stream (2010)

The next section discusses other economic fundamentals that play a role in determining exchange rate movements.

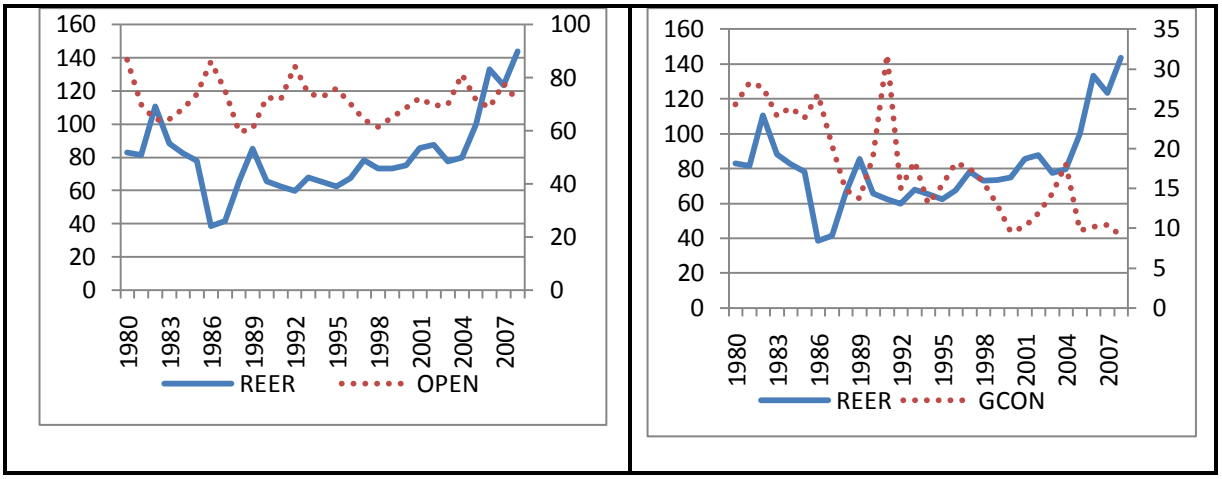
Figures 3.14 & 3.15: Terms of trade and domestic credit (% GDP) versus REER.



Data Source: Thompson DataStream (2010) and World Bank (2010)

Figures 3.14 and 3.15 indicate movements of two of the fundamental variables and the REER, namely terms of trade (TOT – export prices divided by import prices) and domestic credit extension (DC). In contrast to what was found for Malawi there seems to be a negative relationship between TOT for Zambia and the REER up until about 1990; from 2003 there seems to be a positive relationship. One can conclude that this is as a result of the substitution effect as opposed to the income effect. Appendix B indicates movements of the Zambia's exports, imports and REER. The relationship between DC and REER begins with a positive relationship before 1993 and thereafter the relationship seems to be negative. A clear picture is from 2003 where DC is decreasing and the exchange rate is appreciating. The *a priori* expectation is that as DC decreases the exchange rate depreciates. This clearly does not hold after 2003 when other factors (possibly the copper price) had a more powerful impact on the REER.

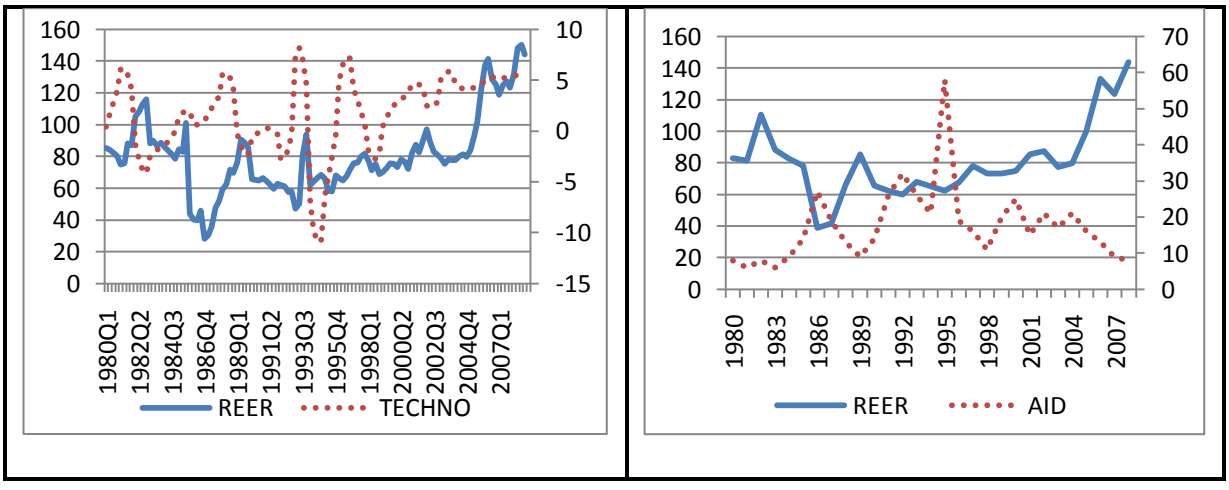
Figures 3.16 & 3.17: Exports plus imports (% GDP) and government consumption versus REER.



Data Source: Thompson DataStream (2010) and World Bank (2010)

A negative relationship is also seen between openness and REER similar to Malawi. Movements in openness becomes less volatile in the early 1990s when there was a new government that eliminated foreign exchange controls and that had an impact on trade flows. Government consumption and REER (Figure 3.17) appear to show a slight negative relationship, but the relationship is not obvious. Government consumption has a downward sloping trend and REER is upward sloping.

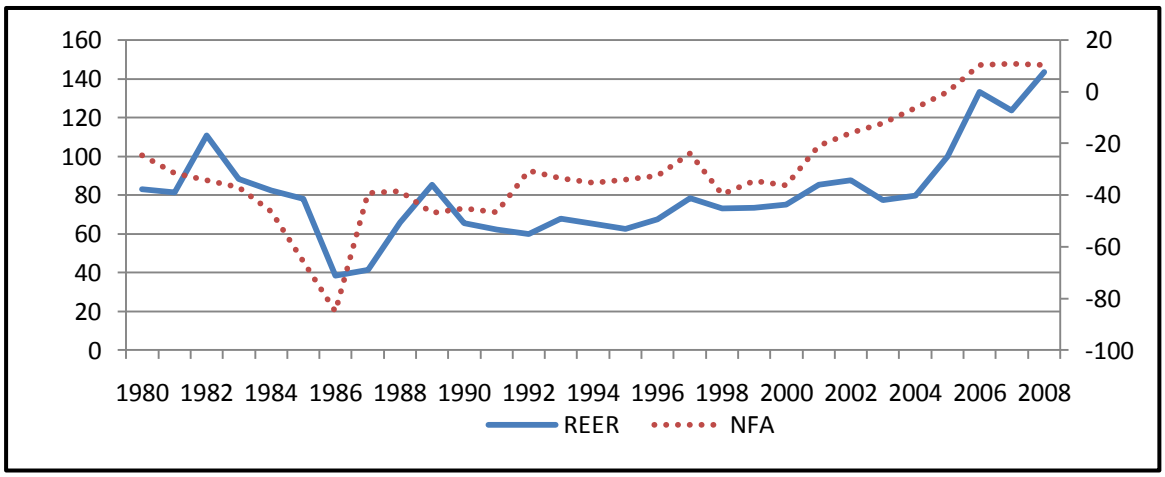
Figure 3.18 & 3.19 Balassa Samuelson measure (TECHNO) and Net ODA (AID) as a percentage of GDP versus REER. Data Source: Thompson DataStream (2010) and World Bank (2010)



Data Source: Thompson DataStream (2010) and World Bank (2010)

The productivity of the Zambian economy relative to its trading partners is compared to exchange rate movements in Figure 3.18. The relationship appears to be a negative one and this may suggest that the traded sector of the trading partners performs better compared to the traded sector of Zambia. Figure 3.19 shows a negative relationship between foreign aid and REER. As expected, an increase in foreign aid results in exchange rate depreciation, meaning demand for traded good increases as aid increases. The extent of aid received fell from the period 2005 onwards and this could be attributed to the debt relief that Zambia received from the IMF and World Bank and also from the G8 countries as it qualified for the relief awarded to the Heavily Indebted Poor Countries (HIPC) (African Economic Outlook, 2010b).

Figure 3.20: Net foreign assets (% GDP) versus REER.



Data Source: Thompson DataStream (2010) and World Bank (2010)

Improvement in NFA results in exchange rate appreciation and this is shown in Figure 3.20 above. NFA has moved from negative values to positive values recently and in Table 3.6 on average as a percentage of GDP, positive values are recorded in the period 2005-2008.

3.3 CONCLUSION

The two countries have had similar exchange rate regimes. At various points both the Zambian Kwacha and the Malawian Kwacha were pegged to the British Pound, the US Dollar and SDR. In 1994 both countries adopted floating exchange rates whereby the exchange rate was determined by market forces. Interestingly, as the two currencies were market determined, and market controls were liberalised; the Zambian Kwacha strengthened in value while the Malawian currency weakened. We analysed the different policies that the two governments set and found

that they have an influence on the macroeconomic variables that ultimately affect the exchange rate movements.

In trying to achieve the set objectives of this research, macroeconomic variables that are expected to play an important role in exchange rate determination have been plotted against REER movements for the respective countries. For Malawi, the REER is plotted against foreign aid as we expect the variable to have an effect on the exchange rate given the very large inflows of foreign aid into the country. For Zambia, copper provides a large proportion of total exports thus it can be expected to influence exchange rate movements even though, as we discovered, copper production has been falling since the 1970s. A negative relationship is found graphically in the case of Malawi between REER and foreign aid, while a positive relationship is found between copper prices and REER for Zambia. The variables considered include government consumption, terms of trade, openness, copper price, foreign aid, technological progress, domestic credit, net foreign assets and nominal effective exchange rate. The impact of openness seems to be similar for both countries, namely a negative relationship. TOT for Zambia indicates a positive relationship while for Malawi there is a negative relationship. The same applies for government consumption, positive for Zambia and negative for Malawi although the relationship was not very clear for Zambia.

As the value of the currencies changed, due to changes of the economic fundamentals, economic and political situations, it is possible that the exchange rate may have been below or above the equilibrium exchange rate. In order to determine whether the currencies were over or undervalued, the equilibrium exchange rate has to be estimated. The next chapter provides the methodology used to determine the relationship between the fundamentals mentioned above, how to determine misalignment of the exchange rate and the data required to achieve the objective of this study.

CHAPTER 4

DATA AND METHODOLOGY

4.1 INTRODUCTION

In Chapter 2 we saw in the literature how fundamental variables have played a role in countries' real exchange rate movements. Chapter 3 reviewed the Malawian and Zambian economies relating them especially to the link between the exchange rate and macroeconomic determinants. This chapter continues on that knowledge to discuss the method used to estimate and analyse the long run relationship between Malawi and Zambia's exchange rate and the fundamental variables. We employed the Johansen Approach in this study, a well known method amongst studies of a similar nature that have been shown to perform better than alternative methods. The chapter provides in depth discussions of the steps performed, including testing for unit root and techniques used to determine the lag length. We also identified the sources of the data and describe how the data are interpolated from low to high frequency. One of the goals of this study is to determine if there is any exchange rate misalignment. In addition this chapter describes the method used to decompose the long run coefficients into permanent values.

Section 4.2 defines the variables, source of data and the interpolation process. Section 4.3 specifies the model used in this study taking into account the theoretical relationship of variables and REER in the previous chapters. Section 4.4 briefly discusses methods for estimating the equilibrium exchange rate. Section 4.5 discusses the Johansen approach, an estimation technique that investigates the presence of long-run co-integration between the real exchange rate and explanatory variables. Misalignment determination is discussed in section 4.6 and the chapter concludes with section 4.7.

4.2 DEFINITION OF VARIABLES AND DATA SOURCES

A number of studies acknowledge that data are a problem when conducting studies of developing countries thus proxies have to be used in the estimation. An example is TECHNO for the Balassa-Samuelson effect as there is no one variable that exactly measures technological progress. This study uses quarterly data from 1980:1 to 2008:4 for Zambia, Malawi and their trading partners. Quarterly data were not available for all the variables therefore we interpolated yearly data to quarterly data for some of the variables. We followed the study by Aziakpono (2005) which analysed how to interpolate different type of data. Some data types are flows and

some are stocks and they are treated differently. TOT was given as an index and AID was as a percentage of GDP in the original source. We interpolated these two variables using quadratic match average (QMA) to obtain quarterly data. OPEN is the ratio of exports plus imports to GDP all in current US Dollars; we interpolated the variables separately using quadratic match sum (QMS) as the series are stocks and we then computed the ratio. For GCON, DC and NFA we computed the ratio first of the original yearly data then interpolated using QMA. Only for TECHNO, (where GDP growth rate (annual %) was used as a proxy) we interpolated the yearly data using QMA similar to TOT and AID but then computed the variable by comparing the average GDP growth rate for Zambia (Malawi) and its five main trading partners.

The main trading partners for Malawi (using 2005 direction of trade statistics)[8] are South Africa (41%), Germany[9] (25%), US (17%), Zambia (11%), and India (4%). The main trading partners for Zambia are South Africa (49%), UK (18%), Switzerland (17%), Germany (12%) and France (4%). Our data were collected from Thompson Data Stream and the World Bank website unless otherwise stated. Some variables, even though they are highlighted in the literature as being important in equilibrium REER determination such as interest rate differential, are not included in the study as data were not available for some of the trading partners for both Malawi and Zambia**.** The selection of variables in this study is based on data availability, theory and indication from previous studies on developing countries and on the significance of these macroeconomic variables to the country. A variable, such as foreign aid, is seen as being important to many developing countries, especially to Malawi. Copper is an important variable to Zambia. Variables are explained below:

LREER: Natural logarithm of the real effective exchange rate indices (2005=100) of the Zambian Kwacha and the Malawian Kwacha. An increase in REER indicates an appreciation of the currencies[10] in real terms.

LNEER: Natural logarithm of the nominal effective exchange rate indices (2005=100) of the Zambian Kwacha and the Malawian Kwacha.

LTOT: The natural logarithm of terms of trade. TOT is the ratio of total exports price index to total imports price index.

[8] The study uses 2005 trade statistics because it is the base year for REER
[9] Germany represents the European Union countries
[10] LREER, LNEER is measured in foreign currency terms, thus an increase in this variable indicates an appreciation of the Kwacha, while a decrease means depreciation

LOPEN: Natural logarithm of openness, it measures the degree of openness to foreign trade. It indicates the country's trade policy. Following the study of MacDonald and Ricci (2004:287), the ratio of exports plus imports to GDP is used to proxy for openness.

LGCON: Natural logarithm of government consumption, estimated as the proportion of real government consumption to GDP. The most appropriate measure would have been government expenditure on non-tradables but data are not available.

LAID: The natural logarithm of the total official development assistance that the country received from all sovereign donors given as Net ODA from all donors (% of recipient's GDP). This data was collected from the World Bank database.

LCOPPER: The natural logarithm of market price index with base year (2005=100). The UK price index is based on the London copper market.

TECHNO: Technological progress between each of the countries (Zambia and Malawi) and their major trading partners (in proportion of their trading levels). To compute the variable, we subtracted GDP growth rate for Zambia (Malawi) from the weighted average GDP growth rate of their main trading partners.

NFA: Net foreign assets. Net foreign assets are the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities as a percentage of GDP at market prices.

DC: Domestic credit. Net domestic credit is the sum of net credit extended to the non-financial public sector, credit to the private sector, and other accounts as a percentage of GDP at market prices. This variable indicates the stance of monetary policy.

The next section specifies the model considering the above variables. *A priori* expectations for these variables will also be discussed in brief.

4.3 MODEL SPECIFICATION

The theoretical, conceptual and literature review in Chapter 2 has shown that both real and nominal fundamental variables could impact an exchange rate in the long and short term. The variables that have the potential to impact exchange rate movements in the case of Zambia and Malawi identified in Chapter 3 include nominal real exchange rate (NEER), terms of trade

(TOT), government consumption (GCON), foreign aid (AID), real commodity prices (COPPER), openness (OPEN), net foreign assets (NFA) domestic credit (DC) and a Balassa Samuelson-technological progress proxy (TECHNO). Considering the availability of data and the theoretical analysis done on the variables, this study estimates the following equation:

$$LREER_t = \beta_0 + \beta_1 LTOT_t + \beta_2 LOPEN_t + \beta_3 LGCON_t + \beta_4 LAID_t + \beta_5 TECHNO_t + \beta_6 LCOPPER_t + \beta_7 NFA_t + \beta_8 DC_t + \beta_9 LNEER_t + \mu_t \quad (4.1)$$

Where;

$LREER$ = natural log of real effective exchange rate,

$LTOT$ = natural log of terms of trade,

$LOPEN$ = natural log of degree of openness indicator,

$LGCON$ = natural log of government consumption,

$LGCON$ = natural log of total official development assistance,

$TECHNO$ = technological progress (proxy for Balassa-Samuelson effect),

$LCOPPER$ = natural log of real copper prices,

NFA = net foreign assets

LDC = natural log of domestic credit

$LNEER$ = natural log of nominal effective exchange rate, and

μ = error term.

In the case of Malawi, the regression does not include COPPER, because it is not relevant to the country's exports. For Malawi foreign aid is included because, as mentioned before, the country receives substantial amounts of foreign aid (LAID) which may therefore impact on the real exchange rate.

In Chapter 2 we analysed theoretically and from the literature how the fundamental variables behave and how they affect the real effective exchange rate. In analysing the relationship between the fundamental variables and the exchange rate, it is important to understand from which perspective it (the relationship) is being derived from. It can be expressed in terms of the domestic currency or from the foreign currency perspective. In this study the exchange rate is expressed in terms of the foreign perspective. This is because the REER as estimated by the IMF expresses countries' exchange rate in terms of the foreign currency. To give a brief summary of the *a priori* expectations:

- An increase in terms of trade (TOT) results in an appreciation of the real effective exchange rate, (income effect). Income is spent on non-tradable goods and their prices rise due to increased demand. If the income effect is stronger than the substitution effect then the real exchange rate appreciates. It should be noted that the impact of TOT on the exchange rate is ambiguous.
- The impact of changes in government consumption depends on whether the government is spending on tradables or on non-tradables. If increased government consumption is on tradables, real exchange rate will depreciate and if spending is on non-tradables, the real exchange rate appreciates.
- Increase in openness (trade liberalisation) causes the real exchange rate to depreciate as demand for imports increases and their prices rise relative to those of domestic products worsening the current account balance.
- Improvement in technological progress (productivity differential) causes an appreciation of the real exchange rate. Technological progress is related to stronger productivity in the tradable sector than in the non-tradable sector.
- The impact of foreign aid (official development assistances) on the real exchange rate depends on what the funds are spent on. Foreign aid spent on tradable goods causes depreciation of the real exchange rate and if spending is on non-tradable goods, the real exchange rate appreciates.
- Increase in copper prices improves exports revenue, induces higher wages and domestic consumption will increase and thus the real exchange rate appreciates
- Improvement in net foreign assets appreciates the real exchange rate.

- When nominal real exchange rate appreciates, the real effective exchange rate also appreciates.
- An increase in domestic credit is an indication of expansionary monetary policy. Generally, an increase in this variable pushes the price of non-tradable goods upwards and as a result the real exchange rate will appreciate.

Some of the variables explained above impact the equilibrium exchange rate in the long run and some in the short run. In the next section we discuss the different approaches for estimating equilibrium exchange rate and the level of misalignment.

4.4 APPROACHES FOR ESTIMATING MISALIGNMENT AND EQUILIBRIUM REER

These approaches are used depending on the circumstances of data availability and the characteristics of the variables. There is some consensus when it comes to the approach most suitable for developing countries although the issues of data availability are not ruled out. Below we look at the pros and cons of some of these approaches.

The Relative PPP-based approach is based on the assumption that the exchange rate between two currencies estimated at any point in time is determined by the change in the relative price levels of two countries in question (Jongwanich,2009). The PPP (Purchasing Power Parity) - based approach is still widely used and is the simplest of them. It assumes a base period at which the real exchange rate is believed to be at the equilibrium level (Chen, 2007) which is the major source of its disadvantage because the choice of the base year is subjective. Relative PPP explains differences in the rates of inflation and is reflected in the exchange rate of the two countries. Unfortunately this approach has been discredited in the literature and is not suitable in the case of developing and transition economies (Melecky and Komárek, 2007). It is said to underestimate changes in the equilibrium REER due to, for instance, terms of trade shocks (Devarajan, 1997). Using this approach may also result in inaccurate findings because it does not consider stationarity of variables.

Another approach is to measure the elasticities which suggests that imports and exports are constant-elasticity functions of the real exchange rate where the latter is defined as the price of imports or exports divided by the CPI (Devarajan, 1997). The problem with this approach is that

it neglects the response of the non-traded goods sector which is argued to be central to equilibrium RER determination.

Model based approaches presented in the literature include fundamental equilibrium exchange rate (FEER) and the Behaviour Equilibrium Exchange Rate (BEER). They both overcome the weaknesses of PPP. These approaches are part of the general equilibrium models. According to Montiel (Hinkle and Montiel, 1999) FEER is defined as the simultaneous attainment of external and internal balance. The main concept of this approach is that there is a need to determine the desirable rate of inflation (internal balance) and the desirable ratio of the current account to GDP (external balance). The equilibrium exchange rate, using this approach, considers those variables that are of medium term rather than short term importance to determine the impact on the exchange rate. To be able to use this method effectively, there needs to be consistency of the current account determined as full employment with sustainable capital inflows (Clark and Macdonald, 1998). If the internal and external positions are interrupted, it may be difficult to determine the equilibrium.

The BEER approach analyses the behaviour of fundamental variables. The difference between the FEER and BEER is that with FEER the notion of equilibrium considered relevant for assessing current exchange rates is that of macroeconomic balance. This is not found in the BEER approach where the relevant notion of equilibrium is the value given by an appropriate set of explanatory variables. In the BEER approach, the equilibrium exchange rate is determined by the prevailing level of economic fundamentals. The use of BEER has been preferred for developing countries compared to industrial countries (Clark and Macdonald, 1998).

4.5 ESTIMATION TECHNIQUES

Several techniques are available to estimate the required parameters including the classical regression method (Ordinary Least Squares) and co-integration methods (Engle and Granger, and Johansen ML). Specific to this study where we need to determine the co-integration relationship between variables, co-integration methods are applicable. Johansen ML belongs to the tests that are based on the maximum likelihood estimation on VAR system and Engle and Granger on those that are residual based. The Engle and Granger test is a two step method that tests for co-integration but has some problems. One of them is that it is possible that there may be more than one possible co-integration equation, but this method is limited to one equation (Brooks, 2008:342).

Johansen (1995) technique is an essential tool for estimating co-integration in multivariate systems. It overcomes the Engle and Granger test's weakness as more than one long–run, co-integrating vector can be estimated therefore this is the technique used in this study. A number of studies have made use of this method in determining the long run relationship between the fundamental variables to the equilibrium exchange rate using time series data (Chen, 2007; Iimi, 2006; MacDonalnd and Ricci, 2004; Mkenda, 2001; Zhang, 2001). The Johansen maximum likelihood can correct for endogeneity using a vector error-correction mechanism (VECM) specification. In addition, it has the ability to identify more than one co-integrating vector which is relevant to this study as different relationships are likely to be found. This method also provides estimates for both short and long-run changes in the exchange rate model in equation (4.1) as mentioned earlier. The method is well known and it is therefore not extensively explained.

Some of the steps the study followed in the estimation include testing for stationarity (order of integration) in all the variables in our model. For inclusion in the model the variables must be made stationary I (1). The next step is to determine whether the variables have a long-run co-integrated relationship. There must be at least one co-integrating equation. The next step is to estimate the error correction model. If there is a long-run relationship, in their short run there may be some disequilibrium, thus with error correction mechanism a proportion of disequilibrium is adjusted in the following period. It reconciles the short and long run behaviour of variables. Finally diagnostic tests are performed.

4.5.1 Testing for stationarity/unit root

The study employs one unit root test and one stationarity test as discussed below. Two examples of unit root test and one for the stationarity test are discussed below.

a) Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) Tests

The basic objective of the test is to examine the null hypothesis that $\varphi = 0$ in

$$\Delta y_t = \varphi y_{t=1} + ut \qquad 4.2$$

In Equation (4.2), y_t is the relevant time series, Δ is a first difference operator, t is a linear trend and u_t is the error term. The error term should satisfy the assumptions of normality, constant error variance and independent (uncorrelated) error terms. If the error terms are not

independent in Equation (4.2), results based on the DF test will be biased. The weakness of the DF test is that it does not take account of possible autocorrelation in the error process or term (u_t). To cater for this shortfall, the ADF can be used. The ADF test corrects for high-order serial correlation by adding a lagged differenced term on the right-hand side in the DF Equation (4.2). It then becomes

$$\Delta y_t = \varphi y_{t-1} + \sum_{i=1}^{p} a_i \Delta y_{i-1} + ut \qquad 4.3$$

For both tests the hypotheses of interest are H0: series contains a unit root versus H1: series is stationary.

b. Kwiatkowski-Phillips-Schmidt-Shin (KPSS)

The null hypothesis for KPSS is that the series is stationarity, thus reversing the null and alternatives under the Dickey–Fuller approach. An advantage of KPSS is that it does not suffer from small sample problems like the ADF test (Burger, 2008).

4.5.2 Co-integration and vector error correction modelling (VECM)

A co-integrating relationship may be seen as a long-term or equilibrium phenomenon, since it is possible that co-integrating variables may deviate from their relationship in the short run, but their association would return in the long run. Co-integration test is performed to determine if there is a long run relationship between our variables in the model. If there is co-integration we can then perform error correction using the vector error correction model (VECM). This study determined the equilibrium real effective exchange rate and short-run deviations in some of the variables together with the speed of adjustment back to equilibrium

Assume a vector: X_t

$$X_t = LREER, LTOT, LOPEN, LGCON, LAID, TECHNO, LCOPPER, NFA, LDC, LNEER$$

Given our variables, the unrestricted VAR representation is of the form:

$$X_t = z + \sum_{i-1}^{p} \prod_i X_t + \varepsilon_t \qquad 4.4$$

X_t is a $(n*1)$ vector of variables that represent variables mentioned above, z is a $(n*1)$ vector of deterministic variables, ε_t is a $(n*1)$ vector of white noise error term (zero mean and covariance) and Π_i is a$(n*n)$ matrix of coefficients. Rewriting the VAR model above into a VECM it becomes:

$$\Delta X_t = z + \sum_{i=1}^{p-1} Y_i \Delta X_{t-i} - \prod X_{t-1} + \varepsilon_t \qquad 4.5$$

Δ represent the first difference operator, Y_i is a $(n*n)$ short-run coefficient matrix. Π is a $(n*n)$ matrix whose rank determines the number of co-integrating vectors. If Π is of full rank $(r=n)$, this indicates that the variables are stationary at level terms and there is co-integration of variables. On the other hand if Π is zero rank $(r=0)$ then there is no co-integration in the long run. If there are r co-integrating vectors such that $0 \prec r \prec n$, therefore there will exist $(n*r)$ matrices α and β such that:

$$\prod = \alpha\beta' \qquad 4.6$$

α represents the speed of adjustment matrix, indicating the speed with which the system responds to last period's deviation from the equilibrium level of the exchange rate. β contains the parameters of the co-integrating vectors and the matrix.

Before we performed the tests, two things needed to be considered. Firstly, we determined the appropriate lag length. If the lag length is not appropriately selected, it would distort our results. Too few lags will not be able to remove all of autocorrelation and too many will increase the coefficient standard errors. There are various ways of choosing the lag length but Brooks (2008: 329) suggests two alternatives: observing the frequency of the data, and using information criterion. Therefore one should choose the number of lags that minimises the value of an information criterion. Three most popular information criteria are Akaike information criterion (AIC), Schwarz Bayesian information criterion, and Hannan-Quinn criterion (HQIC), E-views suggested more. In this study all three were used and only the one that gave the optimal lag length was chosen. We also performed serial correlation tests on the selected lag length.

The second issue is the choice of the deterministic assumptions that our method requires to test for co-integration. We also performed tests to determine the appropriate assumption following the study by Aziakpono and Obasa (2004) and Seddighi *et al,* (2000).Our results are discussed in

the next chapter. There are five deterministic trend assumptions that E-views provide and in most cases options 3 or 4 are chosen for data series of this study. They allow for linear deterministic trend in the data: option 3 assumes intercept but no trend in co-integration equation test VAR while option 4 has an intercept and trend in co-integrating equation and no trend in VAR. The option depends on the data we are dealing with together with *a priori* knowledge from economic theory.

The Johansen methodology has two likelihood ratio (LR) tests and the null hypothesis is that there are at most r co-integrating relationships amongst these variables. These tests are done once the lag length and the appropriate deterministic assumption have been determined. The two tests are: the trace $(\lambda_{trace})$and the maximum eigenvalu $(\lambda_{\max})$and are formulated as:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{g}\ln\left(1-\hat{\lambda}_i\right) \qquad 4.7$$

and,

$$\lambda_{\max}(r, r+1) = -T\ln\left(1-\hat{\lambda}_{r=1}\right) \qquad 4.8$$

The λ_{trace} test is a joint test where the null is that the number of co-integrating vectors is less than or equal to r against an unspecified or general alternative that there are more than r. The $\lambda_{\max}$ conducts separate tests on each eigenvalue and the null hypothesis is that there are r co-integration relations against the alternative that there are at least $r+1$ co-integration vectors.

According to Brooks (2008:352), using the critical values from Osterwald-Lenun (1992), which are non-standard, if the test statistic is greater than the critical value from Johansen's critical values, reject the null hypothesis that there are *r* co-integrating vectors in favour of the alternative that there are $r+1$ for (λ_{trace}) or more than r for $(\lambda_{\max})$ (Brooks, 2008:351-352). The two tests may give different results but of the two, the trace test is more robust than the maximum eigenvalue statistic in testing for co-integration. In our study both tests are considered.

After estimating and determining the long run model, the next step is to perform diagnostic tests. These are done to test the stochastic properties of the model such as residual autocorrelation (Takaendesa, 2006). To analyse the reaction of the exchange rate to shocks to determinants we employed impulse response and variance decomposition. The latter gives the

proportion of the movements in the real exchange rate that are due to its own shocks compared to shocks to the other variables. These tests allowed us to identify which of the fundamental variables play an important role in the equilibrium exchange rate determination. The next section describes how we determined misalignment of the exchange rate.

4.6 MISALIGNMENT DETERMINATION

Total misalignment is the difference between the actual real rate and the real rate given by the equilibrium or long-run values of the economic fundamental (Clark andMacdonald, 1998). For this study to determine the equilibrium real exchange rate, using the fundamental variables we used a smoothing technique to eliminate any short run fluctuations. The Hodrick-Prescott filter is applied to smooth the estimated coefficients. Chen (2007), Eita *et al,* (2006), McDonald and Ricci (2004) and Mkenda (2001)) used this method. It is also used in this study because of its simplicity. As noted in Chapter 2, there are other techniques used to decompose the estimated long run coefficients into permanent values. To determine the equilibrium REER, we take the determined long run coefficients of each variable, one of the long-run variables for example TOT, and then we multiply that by the filtered original values of TOT. When we repeated the same process for all the variables, we summed the entire products of all the variables including the constant term and the trend if it is present to derive equilibrium REER. The determined equilibrium real effective exchange rate is compared to the actual real effective exchange rate to determine exchange rate misalignment.

Similar results can also be derived by initially multiplying the original TOT series with the determined coefficient. The product of all the variables are then added together (this is before filtering). The result is then filtered to obtain the equilibrium REER which is then compared to the REER to determine the level of misalignment.

$$Misalignment = \frac{(EREER - REER)}{EREER} * 100 \qquad 4.9$$

where $EREER$ is the equilibrium real effective exchange rate and $REER$ is the actual real effective exchange rate.

4.7 CONCLUSION

This chapter has outlined the method used in this study. As has been mentioned, there is more than one possible method for estimating the equilibrium exchange rate but the Johansen

technique is the best available as it overcomes some of the problems faced by other methods. Data are quarterly from 1980:1 to 2008:4 and we also interpolated from yearly to quarterly for the variables that did not have available quarterly data. We note from the literature review in Chapter 2 that BEER is the most common approach employed to estimate the equilibrium exchange rate for developing countries. Our method enables us to determine which fundamental variables play an important role and, given a shock in the system, the speed at which the exchange rate can move towards the equilibrium exchange rate level. The next chapter estimates the equilibrium exchange rate with the given data and presents the results of the study.

CHAPTER 5

EMPIRICAL RESULTS

5.1 INTRODUCTION

This chapter presents and discusses the results of the study based on the methods discussed in Chapter 4. The chapter is divided into different sections. Section 5.2 presents a graphical plot of selected variables in this study in log form. Unit root test results on the series using the Augmented Dickey-Fuller and KPPS tests are also presented. This is followed by co-integration analysis in Section 5.3 using the Johansen (1988) and Johansen (1995) maximum likelihood procedure to determine the long-run relationship between the exchange rate and the identified explanatory variables. Section 5.4 presents long and short run parameter estimates. Using the long-run variables and the Hodrick-Prescott filter we determine the equilibrium exchange rate and its misalignment in Section 5.5. Section 5.6 concludes the chapter.

5.2 GRAPHICAL ANALYSIS

Graphical representation of the series is useful in order to identify data[11] properties, and can be seen as the preliminary step before testing for unit root. Figure 5.1 and 5.2 presents the graphs for Malawi and Zambia respectively. In the case of Malawi, LREER and LNEER seem to be downwardly trending while NFA and LOPEN show an upward trend. TECHNO and LGCON tend to hover around zero. Movement of LTOT and LDC is not clear though a downward trend exists up until 1995 and then an upward trend thereafter especially for LTOT. On the other hand for LAID there was an upward trend before 1995 which is followed by a steady movement. A possible explanation for the changes in the series movements is the change in exchange rate regimes, more specifically the fact that the exchange rate was allowed to float in 1994.

In the case of Zambia, LNEER and LGCON show a downward trend and NFA has an upward trend. LDC and LREER had unsteady trends and after 2000 LDC trends downwards while after 1995 LREER trends upwards. LOPEN, LTOT, LCOPPER and TECHNO tend to fluctuate over time indicating a possible stationary series. As seen also with Malawi trends of some of the variables changed direction after the currency was allowed to float or with change in exchange rate regime. LDC, for example, trended upwards before 1995 and thereafter a downward trend is

[11] The data are in log form.

seen. To further test for stationarity of the series, we performed formal tests; unit root tests using ADF and stationarity tests using KPSS, the results of which are discussed in the next section.

Figure 5.1 Plots of the real effective exchange rate and its determinants-Malawi

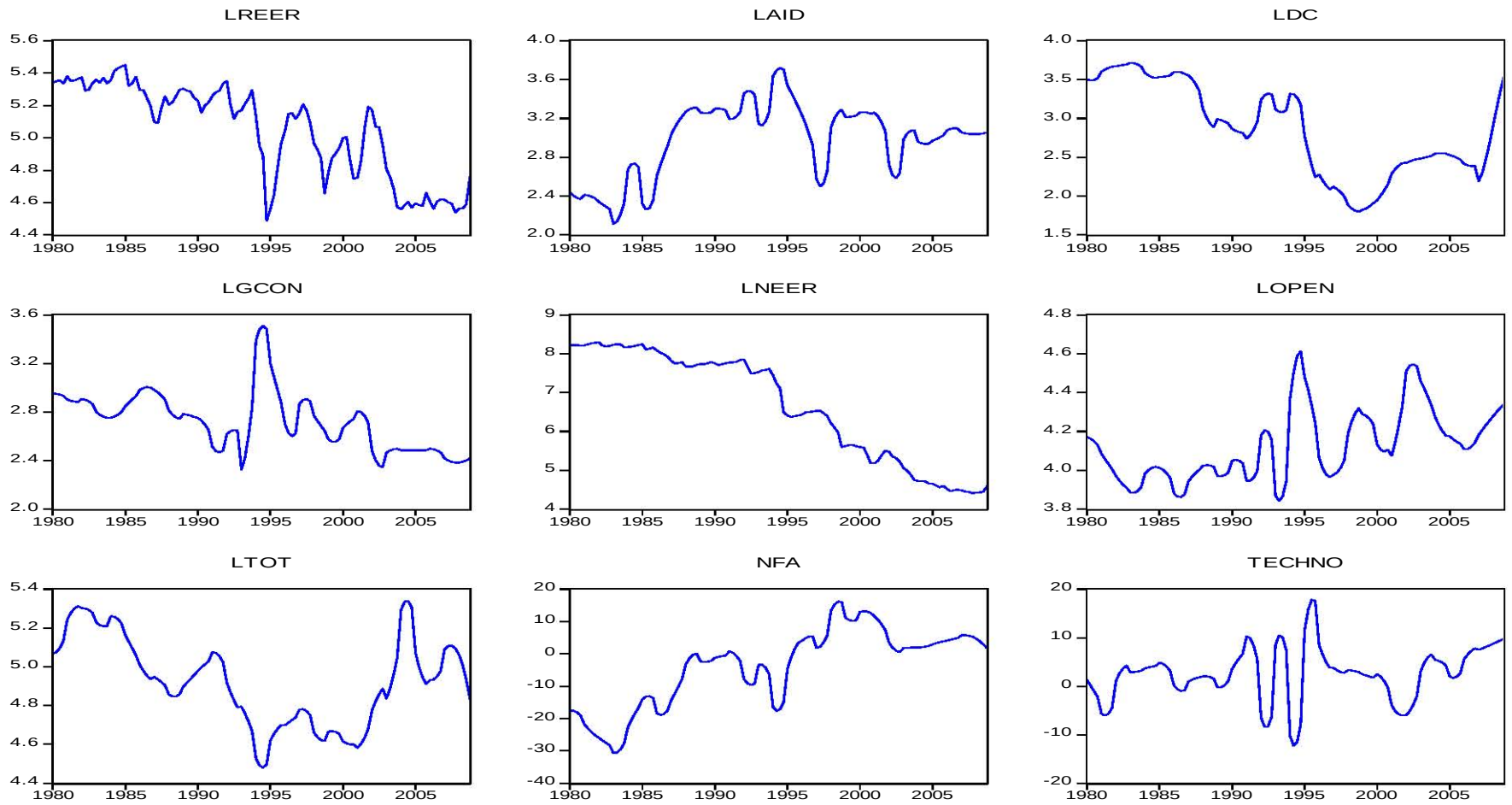
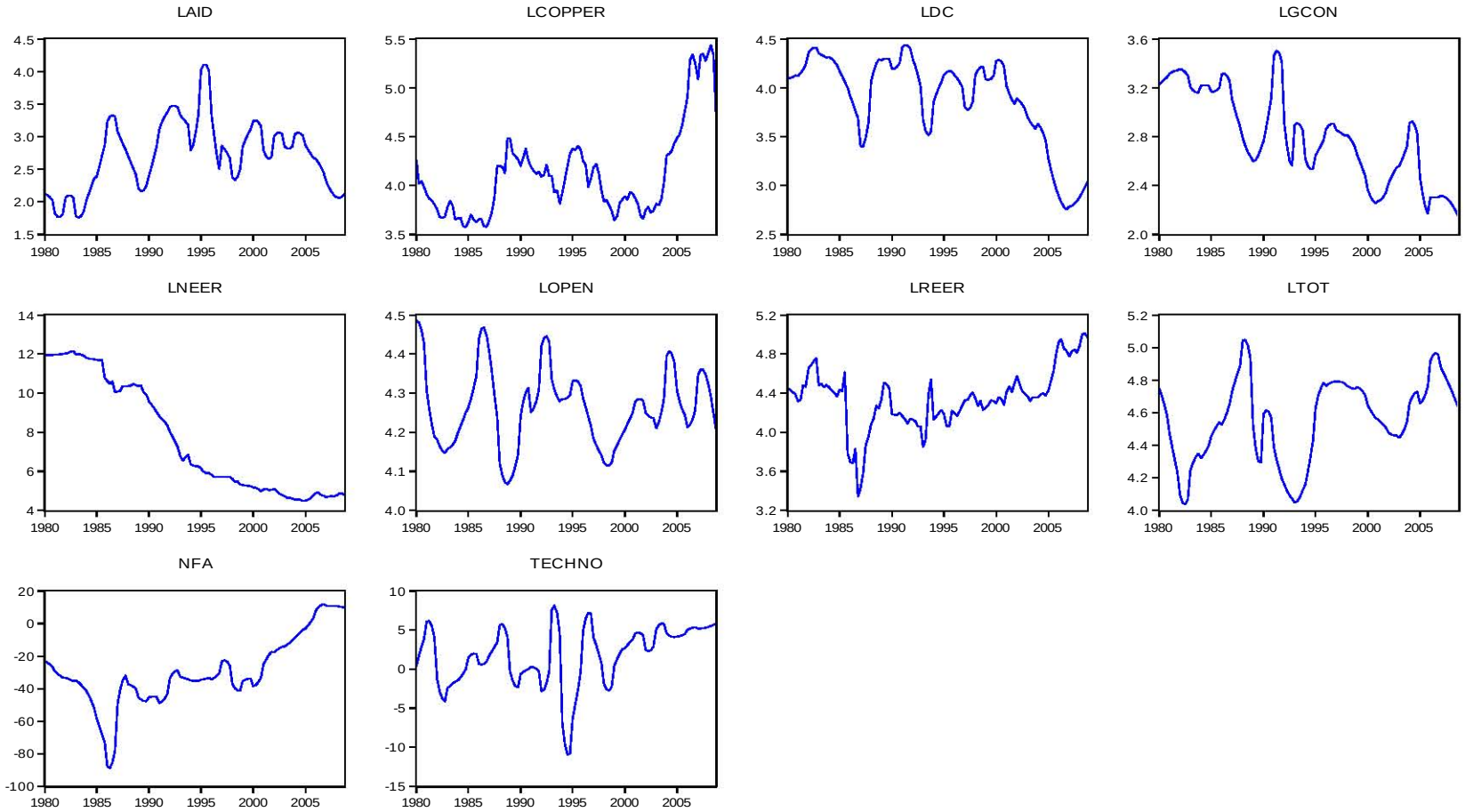


Figure 5.2 Plots of the real effective exchange rate and its determinants- Zambia



5.3 DETERMINISTIC ASSUMPTION AND UNIT ROOT TEST

Two formal tests were employed as mentioned earlier – ADF and KPSS. The null hypothesis for ADF test is that the series has a unit root (non-stationary) while the alternative hypothesis is that the series is stationary. On the other hand KPSS test is a stationarity test with the null hypothesis that the series is stationary and the alternative is that it is not stationary. As we have mentioned in the previous chapter, the tests are performed under certain assumptions, namely no intercept and no trend, with intercept only and with intercept and trend. We also determined for each variable which assumption best describes it as this is important for our estimations. To establish the deterministic assumption the study follows the procedure described in Aziakpono and Obasa (2004) and Seddighi *et al,* (2000, 267-277).

Table 5.1 presents the results of conditional hypotheses for Malawi and Zambia, determining whether each variable has a deterministic trend and/or a drift. In Table 5.1 with variables relevant to Malawi LAID, LTOT, and TECHNO indicate a stochastic trend (intercept) while LGCON, LREER, LNEER and LOPEN show that the series have both an intercept and trend. LDC and NFA both show that the series neither have a stochastic trend nor deterministic trend. alone has a deterministic trend only.

In the case for Zambia, the following variables show that there is no stochastic trend or deterministic trend in the series: LREER, LNEER, TECHNO, LDC and LCOPPER. An intercept only is found for LAID, TOT and LOPEN while NFA and LGCON have both the stochastic trend and deterministic trend. These results are important in our estimation of co-integration to determine which assumption to use.

Table 5.1: Deterministic assumption

Malawi	Variable	Stochastic trend	Deterministic trend	Intercept only	Decision rule
	LREER	4.40[a]	-3.78[a]	2.16	Trend and intercept
	LNEER	2.43	-2.53[c]	-0.30	Trend and intercept
	LAID	2.35	0.33	2.35[c]	Intercept only
	LGCON	2.87[c]	-2.23	1.77	Trend and intercept
	LTOT	2.24	-0.61	2.24[c]	Intercept only
	LOPEN	4.27[a]	3.38[b]	2.54[b]	Trend and intercept
	TECHNO	0.69	0.98	2.45[c]	Intercept only
	LDC	0.36	0.40	1.69	None
	NFA	-1.34	1.42	0.15	None
Zambia					
	LREER	2.48	1.81	2.04	None
	LNEER	-0.68	0.65	0.63	None
	LAID	2.86[c]	-0.15	2.89[b]	Intercept only
	LGCON	4.55[a]	-4.36[a]	1.19	Trend and intercept
	LTOT	4.06[a]	1.23	3.89[a]	Intercept only
	LOPEN	3.72[b]	-0.23	3.75[a]	Intercept only
	TECHNO	-0.93	1.70	1.17	None
	LDC	2.59	-2.18	1.40	None
	LCOPPER	2.36	1.40	1.95	None
	NFA	-2.92[c]	3.09[b]	-0.01	Trend and intercept

Notes: a, b, c denote the level of significance at 1%, 5%, 10% level respectively.

Source: Estimates by author

Unit root test is performed and the appropriate assumption as suggested in Table 5.1 above is considered. Most variables for Malawi are not stationary at level but first different stationary. The following variables are found to be I(1) LGCON, LOPEN, LAID, LTOT, LDC and NFA. LREER and TECHNO are 1(0). LNEER has contradicting results from the two tests. In the case of Zambia LDC, NFA, TECHNO, LREER and LCOPPER are integrated of order one, I (1) while LNEER, LAID, LTOT, and LGCON are 1(0). These results are presented in Table 5.2.

Table 5.2: Unit root/Stationarily tests

Test method			LREER	LNEER	LAID	LGCON	LTOT	LOPEN	TECHNO	LDC	NFA	LCOPPER
Malawi												
		None	-0.55	-2.27[b]	0.23	-0.73	-0.7	0.84	-1.6	-0.16	-2.53[b]	
		Intercept	-2.18	-0.19	-2.31	-1.82	-2.26	-2.53	-2.88[b]	-1.69	-2.37	
	Level	Intercept & Trend	-4.42[a]	-2.5	-2.2	-2.89	-2.3	-4.29[a]	-3.03	-0.63	-2.45	
		None	-7.62[a]	-6.70[a]	-4.47[a]	-3.94[a]	-3.79[a]	-3.89[a]	-3.89[a]	-2.65[a]	-2.60[a]	
		Intercept	-7.60[a]	-7.19[a]	-4.48[a]	-3.98[a]	-3.80[a]	-3.95[a]	-3.93[a]	-2.60[c]	-2.73[c]	
ADF	1st Diff	Intercept & Trend	-7.56[a]	-7.17[a]	-4.53[a]	-3.96[b]	-3.79[b]	-3.93[b]	-3.92[b]	-2.9	-2.92	
		Intercept	1.12[a]	1.21[a]	0.48[b]	0.72[b]	0.42[c]	0.80[a]	0.22	0.84[a]	0.93[a]	
	Level	Intercept & Trend	0.08	0.24[a]	0.25[a]	0.1	0.24[a]	0.07	0.07	0.19[b]	0.17[b]	
		Intercept	0.03	0.18	0.11	0.03	0.09	0.04	0.50[b]	0.28	0.08	
KPSS	1st Diff	Intercept & Trend	0.03	0.13[c]	0.06	0.03	0.08	0.03	0.5	0.13[c]	0.06	
Zambia												
		None	0.22	-2.16[b]	-0.33	-1.32	0.36	-0.14	-0.03	-0.82	-0.93	0.05
		Intercept	-2.02	-1.47	-2.90[b]	-1.33	-3.87[a]	-3.75[a]	-0.71	-1.48	-0.44	-1.94
	Level	Intercept & Trend	-2.58	0.22	-2.64	-4.59[a]	-3.99[b]	-3.71[b]	-1.69	-2.59	-2.76	-2.4
		None	-10.71[a]	-2.38[b]	-3.96[a]	-3.69[a]	-2.98[a]	-3.74[a]	-6.39[a]	-3.93[a]	-3.50[a]	-6.84[a]
		Intercept	-10.68[a]	-2.93[b]	-3.94[a]	-5.55[a]	-3.00[b]	-3.72[a]	-6.45[a]	-3.98[a]	-3.59[a]	-6.81[a]
ADF	1st Diff	Intercept & Trend	-10.71[a]	-3.13	-4.11[a]	-5.53[a]	-2.94	-3.65[b]	-6.46[a]	-2.69	-3.87[b]	-6.66[a]
		Intercept	0.48[b]	1.19[a]	0.33	1.14[a]	0.33	0.05	0.50[b]	0.70[b]	0.83[a]	0.48[b]
	Level	Intercept & Trend	0.21[b]	0.24[a]	0.23[a]	0.03	0.05	0.05	0.13[c]	0.19[b]	0.20[b]	0.13[c]
		Intercept	0.12	0.28	0.11	0.03	0.07	0.06	0.05	0.11	0.26	0.12
KPSS	1st Diff	Intercept & Trend	0.03	0.17[b]	0.03	0.03	0.07	0.04	0.04	0.04	0.05	0.06

Notes: a, b, c denotes the level of significance at 1%, 5%, 10% level respectively. For KPSS, critical value for 1%, 5%, 10% levels for the model with no trend are 0.739, 0.463, and 0.347 and with trend are 0.216, 0.146, and 0.119 respectively

5.4 CO-INTEGRATION ANALYSIS

In the previous section we identified that the majority of our variables are integrated of order one. In this section we determine whether the variables are co-integrated, namely whether a long run relationship exists amongst them. The study applies the Johansen maximum likelihood procedure to a vector autoregression (VAR) form of the equation. For each country two models were selected that represented the equilibrium exchange rate. Prior to identifying the appropriate models, the most important variables identified in the literature were included in the estimation as the starting point. The models did not perform well, too many co-integration vectors were found and as a consequence the results were difficult to explain. In addition to that, in the models with too many variables, the results showed that REER was not endogenous, meaning it could not be explained well by the explanatory variables.

As a result, the estimations were repeated with different combinations of variables included in the models in order to identify the best model explaining the equilibrium exchange rate for each country. When both LOPEN and LTOT were included in the same model, the constant term became large and difficult to explain the level of misalignment. As a result, two models were identified for each country in which the first includes LOPEN and excludes LTOT and the second includes LTOT and excludes LOPEN. The best two models identified for each country were chosen; REER was found to be endogenous in all four models. There was no serial correlation and economic *a priori* expectations were met. The variables entered into the equation as exogenous variables for Malawi and Zambia are:

Malawi:

Model 1: LREER, LAID, LGCON, LDC, LNEER, LOPEN and NFA.

Model 2: LREER, LAID, LGCON, LDC, LNEER, LTOT and NFA.

Zambia:

Model 1: LREER, LAID, LGCON, LDC, LCOPPER, LOPEN and NFA.

Model 2: LREER, LAID, LGCON, LDC, LCOPPER, LTOT and NFA.

Before testing for co-integration we also found the optimal lag length (k) using information criteria. Table 5.3 below shows the results of the lags chosen by different criteria. According to

Brooks (2008:235), the easiest way of choosing the model order is the one that minimises the value of information criteria and the lag length selected must be able to remove autocorrelation in the residuals.

Table 5.3 Lag length selection

		LR	FPE	AIC	SC	HQ
Malawi	Model 1	6	6	8	2	2
	Model 2	6	6	6	2	2
Zambia	Model 1	6	6	6	2	2
	Model 2	6	6	8	1	6

Source: Estimates by author

As suggested by the information criteria, we chose lag length 2 for both Malawi and Zambia as that was the minimum lag length selected by SC and HQ criteria. We also tested for serial correlation by an LM test and probability of 0.9865 for Malawi in model 1and lag 2 showed no serial correlation as the probability was insignificant. These results are reported in Table 5.4 below.

VAR was conducted with lag length 2 under assumption 4 for model 1 and assumption 3 for model 2 for Malawi. Lag length 3 in model 1, and lag length 2 in model 2, for Zambia under assumption 3 for model 1 and assumption 4 for model 2. Table 5.4 below is the summary of the number of co-integrating vectors that were generated under the different assumptions. Model 2 in Malawi, where LOPEN was replaced with LTOT, assumption 3 and 4 were tested on VAR and assumption 3 gave meaningful results.

Table 5.4 Summary of all assumptions with lag length

	Data Trend: Test Type	None No Intercept No Trend	None Intercept No Trend	Linear Intercept No Trend	Linear Intercept Trend	Quadratic Intercept Trend
Malawi						
Model 1	Trace	2	3	2	2	3
	Max-Eig	2	1	2	1	1
Model 2	Trace	1	2	2	2	3
	Max-Eig	1	2	2	2	2
Zambia						
Model 1	Trace	2	2	2	3	3
	Max-Eig	2	2	2	3	3
Model 2	Trace	0	1	1	2	2
	Max-Eig	1	1	1	2	2

Note: Critical values based on MacKinnon-Haug-Michelis (1999)

Source: Estimates by author

Table 5.5 below reports the co-integration test results for the exchange rate models that was specified based on trace $(\lambda_{trace})$and maximum eigenvalue $(\lambda_{\max})$ statistics. In the case of Malawi model 1 indicates that the null hypothesis that, none or at most 1 co-integrating vectors, is rejected. The null hypothesis that there are at most 2 co-integrating vectors could not be rejected at the 5% level. The maximum eigenvalue test concludes that there is at most 1 co-integrating vector. Though the results are contradicting in this model, the trace test is believed to produce robust results but the results with 2 co-integration vectors did not produce meaningful results as LREER was found to the exogenous. Thus we concluded that there is only one co-integrating relationship. The same analysis was done for model 2 and we found that with both the trace and maximum eigenvalue tests there are 2 co-integrating vectors. Model 1 for Zambia, both trace and eigenvalue test agree on 2 co-integrating vectors. At 5%, the null hypothesis could not be rejected.

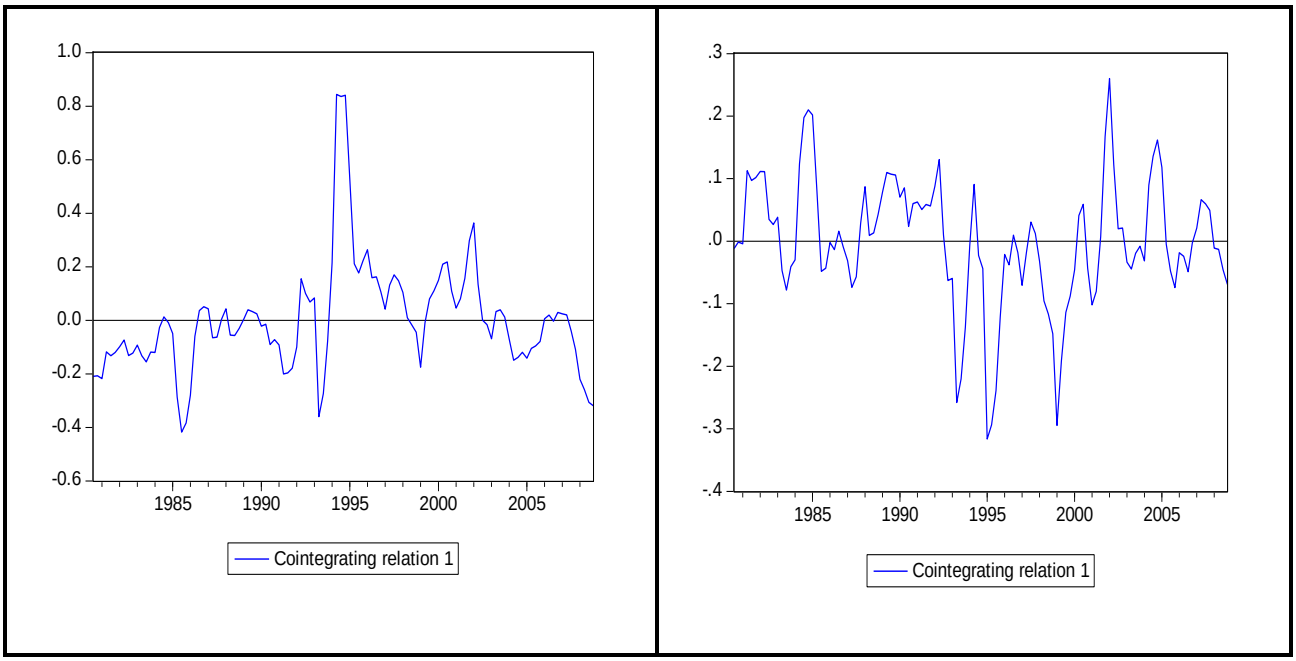
Table 5.5: Johansen co-integration test results

			Unrestricted Co-integration Rank Test (Trace and Maximum Eigenvalue)								
Malawi	k	A	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
Model 1	2	4	None *	0.44	194.19	150.56	0	0.44	65.62	50.6	0
			At most 1 *	0.3	128.57	117.71	0.01	0.3	40.57	44.5	0.13
			At most 2	0.24	88	88.8	0.06				
Model 2	2	3	None *	0.45	185.19	125.62	0	0.45	68.56	46.23	0
			At most 1 *	0.36	116.63	95.75	0	0.36	50.9	40.08	0
			At most 2	0.26	65.74	69.82	0.1	0.26	33.58	33.88	0.05
Zambia											
Model 1	3	3	None *	0.42	172.93	125.62	0.00	0.42	60.16	46.23	0.00
			At most 1 *	0.36	112.77	95.75	0.00	0.36	49.60	40.08	0.00
			At most 2	0.20	63.17	69.82	0.15	0.20	25.11	33.88	0.38
Model 2	2	4	None *	0.39	178.83	150.56	0	0.39	56.68	50.6	0.01
			At most 1 *	0.34	122.15	117.71	0.03	0.34	47.17	44.5	0.03
			At most 2	0.20	74.99	88.80	0.32	0.2	24.83	38.33	0.68

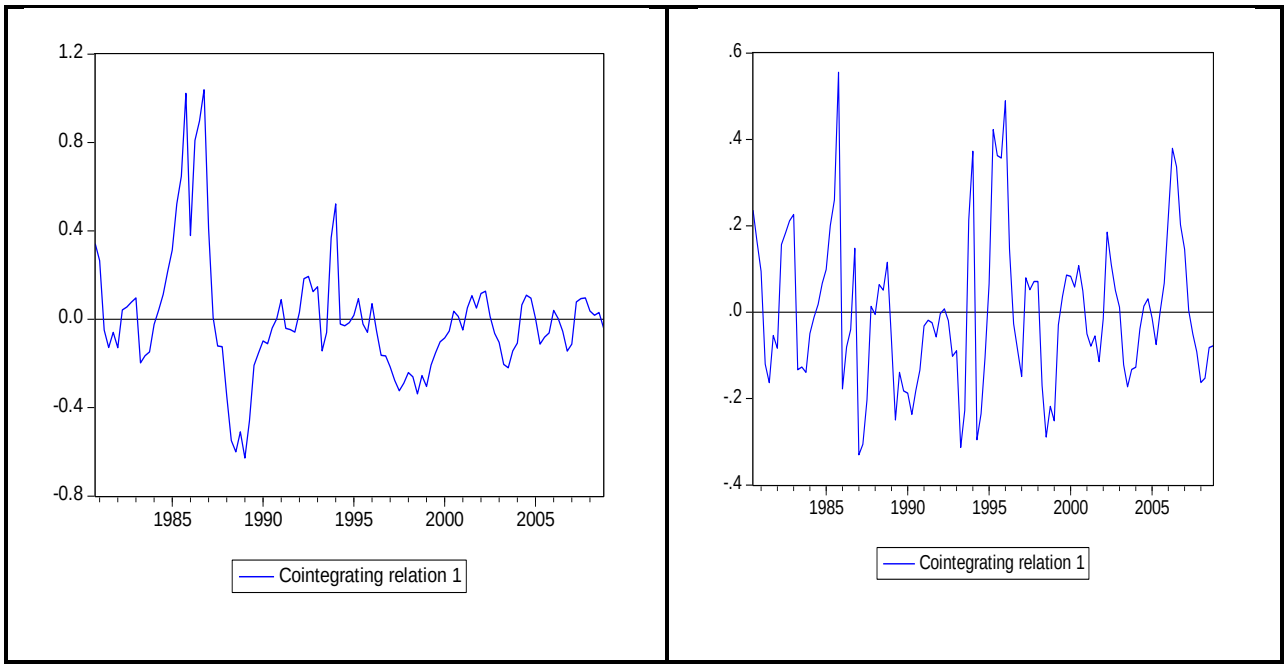
Notes: * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values
k is the VAR order that produces a white noise residual, A is the deterministic trend assumption
Source: Estimates by author

Figure 5.3: Plot of co-integration graph

Model 1 **Malawi** **Model 2**



Model 1 **Zambia** **Model 2**



Source: Estimates by author

Having identified the number of co-integrating vectors that give us the best economical meaning results, we estimated our long run relationship for all the selected models. We analysed the weak exogeneity of the variables. This section is important because we specify a model of the REER that captures the short-run dynamic and explains the movements around the long-run equilibrium REER. According to Zhang (2001, 89) "if variables are weakly exogenous to the system, there will be no loss of information from not modelling the short-run behaviour of these variables and so estimation of the multivariate model can be conditioned on such variables". To determine weak exogeneity, we placed a zero restriction on each variable in the entire α row. It is important in our study for LREER not to be weakly exogenous as this means that the exchange rate is explained by its determinants. The results are presented in Table 5.6 below.

Table 5.6: Weak exogeneity test

		Model 1		Model 2	
Malawi	Variable	Chi-Squire	Probability	Chi-Squire	Probability
	LREER	7.13	0.03	9.77	0.01
	LAID	3.38	0.18	8.49	0.01
	LGCON	3.56	0.17	7.79	0.02
	LDC	7.70	0.02	3.26	0.20
	LNEER	12.93	0.00	5.11	0.08
	LOPEN	0.56	0.75		
	NFA	8.43	0.01	4.34	0.11
	LTOT			1.60	0.45
Zambia	Variable				
	LREER	10.60	0.00	15.40	0.00
	LAID	4.12	0.13	7.30	0.03
	LGCON	4.11	0.13	1.31	0.52
	LDC	0.14	0.93	0.42	0.81
	LOPEN	3.30	0.19		
	NFA	1.41	0.49	0.08	0.96
	LCOPPER	0.11	0.94	0.07	0.96
	LTOT			0.19	0.91

Source: Estimates by author

We also normalised on LREER to obtain the long run and short run parameters. The long run coefficients of the equilibrium exchange rate are presented in the Table 5.7 below.

Table 5.7: Long and short run co-integration results

	Malawi		Zambia	
Variable	Model 1	Model 2	Model 1	Model 2
Long-run:				
LAID	-0.60(-4.88)[a]	-0.28(-6.67)[a]	-0.11(-2.33)[b]	-0.49(-9.84)[a]
LGCON	-0.79(-4.27)[a]	-0.39(-4.63)[a]		-0.04(-0.39)
LDC	0.49(3.44)[a]		0.30(3.75)[a]	0.15(1.89)[c]
LNEER	0.22(2.25)[b]	0.22(14.92)[a]		
OPEN			-2.34(-5.26)[a]	
NFA	0.04(4.75)[a]	-0.00(-0.15)	0.02(6.17)[a]	
LCOPPER			0.21(1.91)[c]	0.16(2.16)[b]
LTOT		-0.67(-6.82)[a]		-0.40(-3.70)[a]
Trend	-0.00(-1.02)			0.01(4.85)[a]
Constant	6.55	8.77	13.04	6
Short-run :				
LREER(-1)	-0.89(-4.21)[a]	-0.78(-3.57)[a]		
LNEER(-1)	0.68(3.59)[a]	0.48(2.27)[b]		
LCOPPER(-1)			-0.22(-1.93)[c]	
LDC(-2)			0.48(2.75)[a]	

Note: The ( ) represent t-values; a, b and c represent 1%, 5% and 10% significance levels respectively. The results were obtained using Eviews 6 and based on the procedure the results are interpreted in the opposite direction as presented in Eviews.

Source: Estimates by author

Overall, all the variables that have a long run relationship with REER have the signs for both Zambia and Malawi expected from both the theory and the empirical literature. Increase in foreign aid into the country results in depreciation of the exchange rate in both countries. This result is the same as that of Li and Rowe(2007) in the case of Tanzania. Mkenda's (2001) study of Zambia also found that an increase in foreign aid resulted in the depreciation of the internal real exchange rate, though it was in the short run. The relationship is also supported by the graphical relationship in Chapter 3. These results contradict the findings of Adenauer and Vagassky (1998) and White and Wignaraja (1992) and suggest firstly that aid in Malawi and Zambia is tied and is unable to flow freely between sectors. Secondly, foreign aid is directed at the traded sector, specifically imported goods, and as a results the exchange rate in both countries depreciated.

A negative effect of government consumption on REER was found for both countries. Government consumption can result in either an increase or decrease in the real exchange rate. If it is biased towards non-tradables then the exchange rate will appreciate and when it is biased towards tradable goods the exchange rate will depreciate. The results in this study contradicts Mathisen's (2003) findings for Malawi as well as those of Jongwanich (2009), Li and Rowe (2007), Kemme and Roy (2006) for Russia and Zhang (2001). They are supported by Kemme and Roy's (2006) findings for Poland and suggest that increased government consumption in Malawi and Zambia over the study period was more inclined to tradable goods than non-tradable goods.

TECHNO was found to be insignificant in all the models for both countries. Adenauer and Vagassky (1998) similarly found that the results for TECHNO were not significant for the CFA zone countries and Kamar and Naceur's (2007) results for the Gulf Cooperation Council countries were also insignificant. In contrast, Li and Rowe (2007), Iimi (2006) and Eita *et al,* (2006) found significant relationships though the signs differed. A reason for the insignificant results in our study could be due to the estimation of the variables since the data were interpolated. A further problem is that the convention of using real GDP per capita growth differences as a proxy for TECHNO is more appropriate in countries with full employment than in developing economies where increased employment maybe an important contributor to real per capita growth.

Net foreign assets in model 1 for both countries was found to be in line with a *priori* expectations and model 2 of Malawi had contradicting results. Increase in NFA resulted in exchange rate appreciation in model 1 for both countries and the results are similar to those of MacDonald and Ricci (2004), Mathisen (2003) and Aron *et al,* (2000). Mathisen's (2003) study acknowledged that increase in NFA resulted in exchange rate appreciation only when TOT was excluded. This may thus explain the negative and insignificant results on model 2.

In Zambia, NEER was found to be insignificant. On the other hand in Malawi it was found to be positive and significant. With a 1% increase in the NEER resulting in a 0.22% increase both models. The lagged NEER has been found to impact the REER in the short run (Joyce and Kamas, 2003). The finding in this study that the lagged NEER impacts on the REER also in the long run suggest that the pass-through of NEER changes to prices in Malawi is only partial.

TOT was found to be negative and significant in both countries but only when OPEN was excluded. This may be because these variables are closely related. Mkenda (2001) found a

negative relationship for Zambia, supporting the findings of this study, but Mathisen (2003) found a positive relationship in Malawi.. Theoretically the expected sign is not conclusive as it is dependent upon the relative impact of the income and substitution effects. Masters and Ianchovichina (1998) also found a negative relationship in the case of Zimbabwe and White and Wignaraja (1992) similarly found a negative relationship for Sri Lanka. However a positive relationship was found by Adenauer and Li and Rowe (2007), Iimi (2006) and Vagassky (1998).

LDC was found to be significant and positive in both models for Zambia and model 1 for Malawi. An increase in credit creation increases domestic prices and therefore the real exchange rate appreciates. The finding in this study of a positive relationship is in line with expectation but is contrary to the findings of Masters and Ianchovichina (1998) who found that increased credit creation resulted in exchange rate depreciation in Zimbabwe.

OPEN had a negative and significant effect on the exchange rate in the case of Zambia on model 1 when TOT was excluded and insignificant in Malawi. In the case of Zambia, the impact is large with a 1% increase in OPEN resulting in as 2.34% depreciation of the REER. The negative is expected as an increase in OPEN results in an increase in imports worsening the current account balance. The results are in line with findings of Li and Rowe (2007), Aron *et al,* (2000) and Masters and Ianchovichina (1998).

LCOPPER was found to be positive and significant in both models for Zambia. This variable was not included in Malawi as copper is not an important export. A positive relationship is expected for a commodity exporting country like Zambia. Such a relationship was confirmed for a number of commodity exporters by Eita *et al,* (2006), Iimi (2006) and MacDonald and Ricci (2004).

Table 5.7 also reports short run parameters for all those variables found to be statistically significant. The lagged first difference of LREER, and LNEER was found to have a significant short term impact on the exchange rate in Malawi for both models. The importance of LNEER in the short run is supported by Joyce and Kamas (2003) and that of LREER is similar to the finding by Takaendesa (2006). For Zambia, the lagged first difference of LCOPPER and lagged second difference LDC has a significant short run effect but only in model 1. The short-run importance of LCOPPER is supported in the variance decomposition of both models (Tables 5.11 and 5.12) where the impact of the copper price is much greater in the short run and diminishes over time. The importance of LDC in the short run is also supported by Joyce and Kamas (2003).

An important parameter in the estimation of VECM is the coefficient of adjustment which measures the speed of adjustment in the real exchange rate if there is a shock in the system. In this study it indicates the speed at which the real exchange rate adjusts back to the equilibrium level. The results are reported in Table 5.8 and these are -0.11and -0.27 for Malawi models 1 and 2 respectively, while for Zambia the results are -0.45 and -0.47 for models 1 and 2 respectively. This means that in the absence of further shocks it would take about two years three months in Malawi model 1 and just above eleven months in model 2 for the gap between the actual real exchange rate and its equilibrium value to be eliminated. For Zambia, the time is shorter: in model 1, it would take about seven months and model 2 about six months for the gap to be eliminated.

The speed of adjustment for Malawi in model 2 is the same as that found in Mathisen (2003:15) for Malawi, despite the different variables included in this model. The fact that the speed of adjustment in model 1 for Malawi is smaller compared to model 2 is not unique when compared to findings from other developing country studies. The speed of adjustment coefficient is larger for both models in the case of Zambia. Hence, with no presence of shocks in the system, the results show that Zambia's exchange rate moves back to equilibrium much faster than in Malawi. Though the study of Mkenda (2001) estimates three different equilibrium exchange rates, one of the coefficients is -0.38, which is slightly lower than what we found for Zambia. MacDonald and Ricci (2004) in a study of South Africa found the speed of adjustment to be 8%.

Table 5.8: Error correction term (α) results

	Malawi		Zambia	
Variable	Model 1	Model 2	Model 1	Model 2
LREER	-0.11(-3.09)[a]	-0.27(-3.14)[a]	-0.45(-5.38)[a]	-0.47(-5.62)[a]
LAID	-0.11(-2.12)[b]	-0.35(-2.82)[a]	-0.25(-2.29)[b]	-0.29(-3.12)[a]
LGCON	-0.07(-1.91)[c]	-0.30(-3.34)[a]	-0.17(-2.71)[a]	-0.09(-1.47)
LDC	-0.09(-2.88)[a]	-0.12(-1.43)	-0.02(-0.41)	-0.04(-0.69)
LNEER	-0.15(-4.00)[a]	-0.20(-2.00)[b]		
OPEN	0.01(0.36)		0.04(2.02)[b]	
NFA	2.81(3.01)[a]	4.25(1.80)	3.26(1.18)	-0.79(-0.31)
LCOPPER			0.03(0.37)	-0.03(-0.31)
LTOT		0.00(0.04)		0.02(0.53)

Notes: The ( ) represent t-values; a, b and c represent 1%, 5% and 10% significance levels respectively.
Source: Estimates by author

5.5 IMPULSE RESPONSE AND VARIANCE DECOMPOSITION

This section presents results of the variance decomposition and impulse response analyses. As the study is modelling exchange rates; these tests indicate to us what happens when there is a shock to determinants and the movement of the exchange rate. Responses of real exchange rate to shocks in the determinants are reported in Figures 5.4 and 5.5 below for both Malawi and Zambia. The results are not all as expected. The impulse response functions show the dynamic response of the real exchange rate to a one period (one quarter) standard deviation shock to changes in the system.

In model 1 for Malawi, three of the variables are not significantly different from zero. A shock in LAID, LGCON LNEER and OPEN depreciates the exchange rate but the impact of OPEN dies quickly. The results for LNEER are not as expected, as we found earlier that an improvement in LNEER causes an appreciation the exchange rate. A shock to LDC and NFA appreciates the real exchange rate as expected, although the impact is felt only in period four for LDC. The results are fairly similar for model 2 with LTOT included in the model. DC now shows a negative impact but it dies off in period eight. NFA is the only variable with a positive effect. These results may suggest that model 1 for Malawi is better.

Variance decomposition analysis indicates the relative importance of shocks to each of the determinants of the real exchange rate in its movements. Tables 5.9 and 5.10 show the results of models 1 and 2 for Malawi. In the 10th period, LREER is explained by 47% of its shocks and that indicates that it is endogenous. Of the rest of the variables, those that contribute the most to real exchange rate movement include LGCON (23%), LNEER (14%) and LAID (10%). As one of the goals for this study is to analyse the impact on foreign aid on the exchange rate, it is thus proven that it is indeed important in exchange rate movements. Model 2 shows the same results and in the same order of importance.

Figure 5.4: Model 1 Malawi: Impulse response

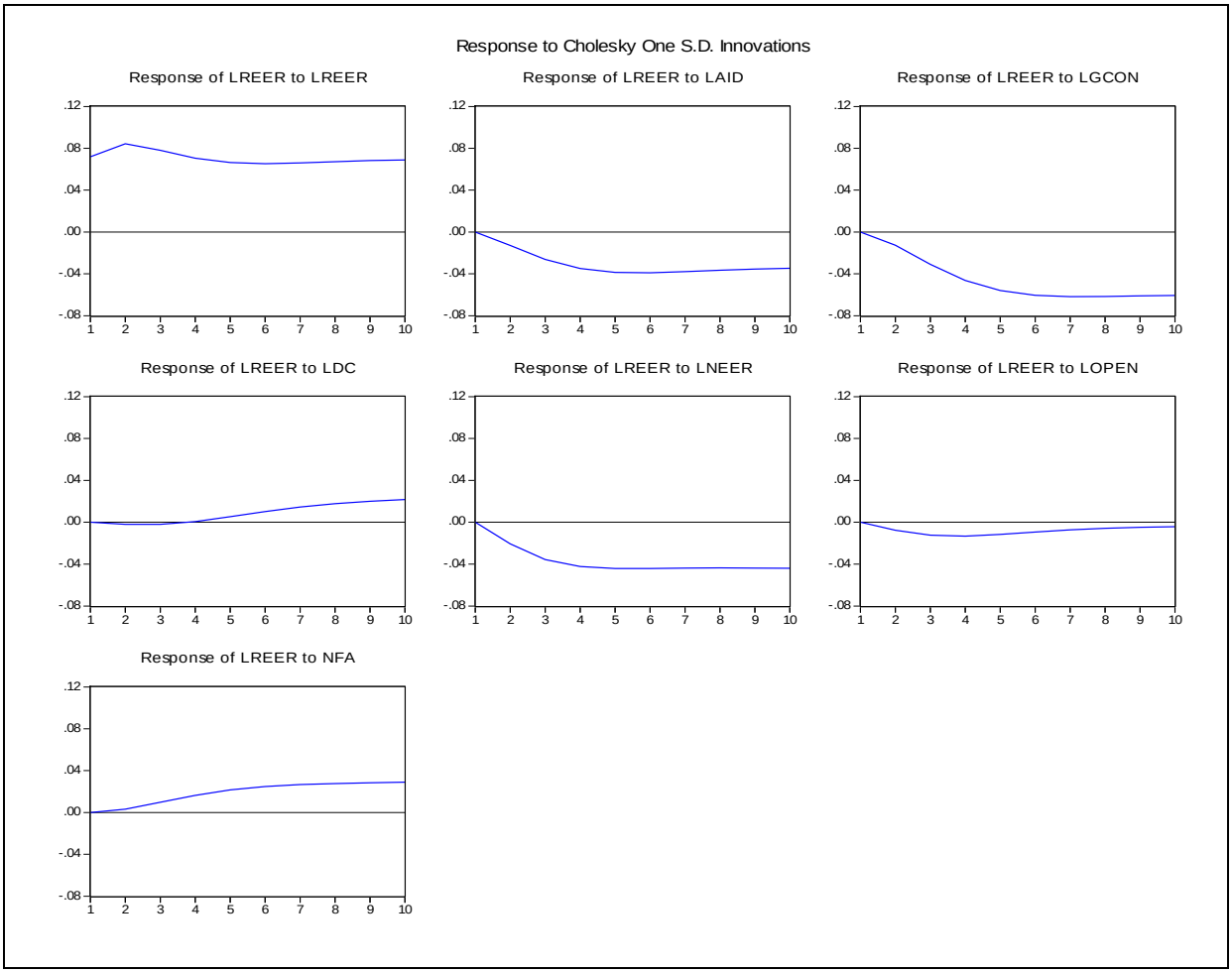


Table 5.9: Model 1 Malawi: Variance decomposition

Variance Decomposition of LREER:								
Period	S.E.	LREER	LAID	LGCON	LDC	LNEER	LOPEN	NFA
1	0.071885	100	0	0	0	0	0	0
2	0.114392	93.69270	1.265026	1.237409	0.030221	3.259123	0.442421	0.073099
3	0.149501	82.14814	3.826716	4.992817	0.037283	7.584154	0.949643	0.461246
4	0.181488	70.85129	6.313707	9.903083	0.026694	10.59529	1.178394	1.131542
5	0.211078	62.25712	8.033501	14.35869	0.081639	12.21578	1.177494	1.875775
6	0.238253	56.37984	9.002201	17.72325	0.246500	13.01941	1.078032	2.550761
7	0.263195	52.48893	9.460608	20.03987	0.504309	13.43618	0.959091	3.111009
8	0.286252	49.88451	9.628774	21.57700	0.811362	13.68433	0.850957	3.563066
9	0.307772	48.07009	9.652759	22.60212	1.127726	13.85712	0.760566	3.929616
10	0.328036	46.73336	9.615981	23.31302	1.428534	13.98944	0.686770	4.232897

Figure 5.5: Model 2 Malawi: Impulse response

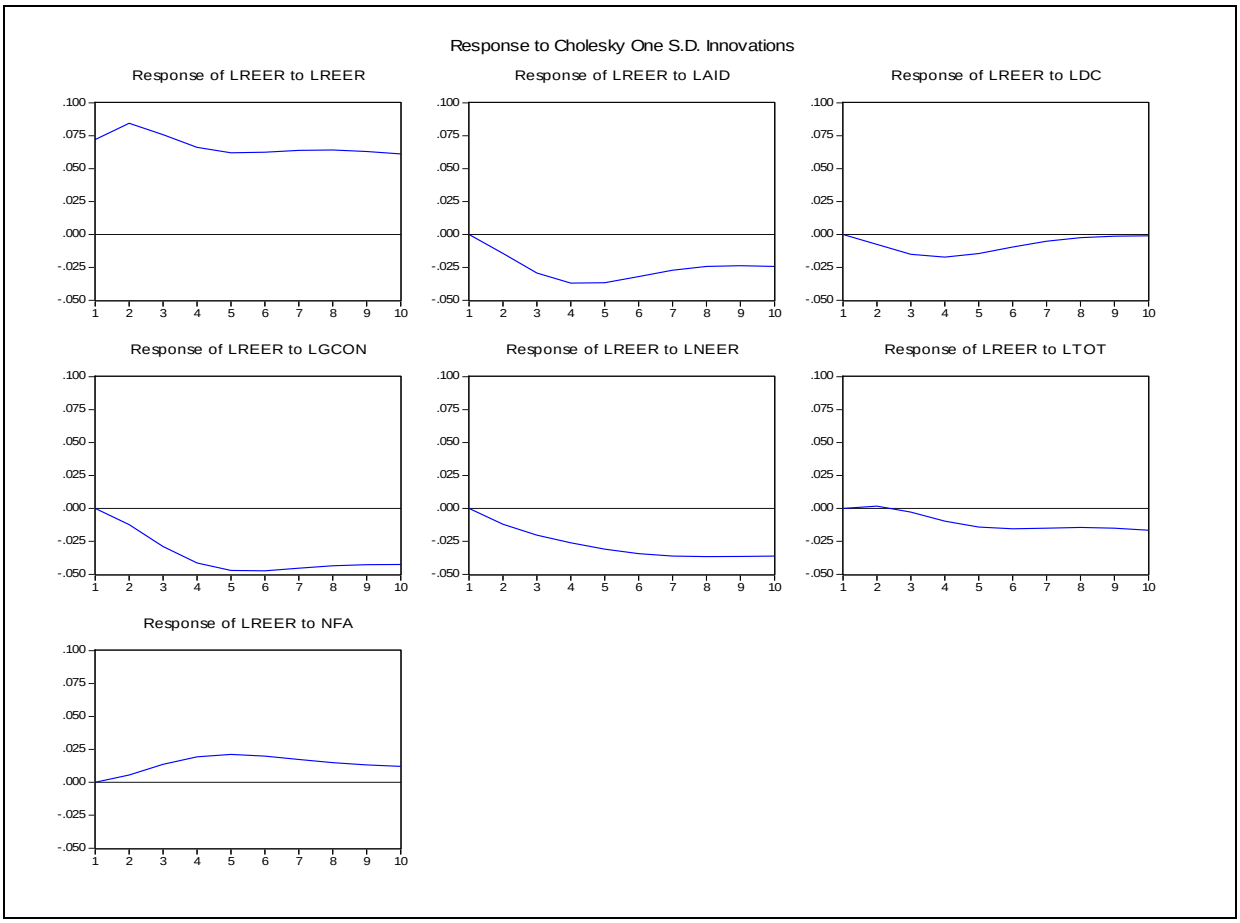


Table 5.10: Model 2 Malawi: Variance decomposition

Variance Decomposition of LREER:								
Period	S.E.	LREER	LAID	LDC	LGCON	LNEER	LTOT	NFA
1	0.07206	100	0	0	0	0	0	0
2	0.113666	95.38609	1.614979	0.454344	1.174664	1.109326	0.02301	0.237586
3	0.145566	85.25517	5.050317	1.34739	4.657273	2.612689	0.052167	1.024996
4	0.173467	74.5419	8.109915	1.943458	8.979558	4.113023	0.342518	1.969626
5	0.198266	66.84223	9.63683	2.027291	12.49834	5.580082	0.772663	2.642562
6	0.219956	62.35885	9.955588	1.839232	14.78429	6.974364	1.124623	2.963051
7	0.239011	59.95472	9.727223	1.604826	16.12976	8.198947	1.346645	3.037878
8	0.255976	58.55925	9.388443	1.408333	16.95946	9.198188	1.495784	2.990538
9	0.271316	57.52058	9.12537	1.255992	17.57083	9.989009	1.638948	2.899268
10	0.285463	56.55202	8.975298	1.136121	18.09632	10.62406	1.817241	2.798948

In the case of Zambia (Figures 5.6 and 5.7 in model 1) shocks to NFA and LCOPPER result, as expected, in an appreciation of the real exchange rate. The impact of copper is positive but it quickly dies: as copper prices rise, the exchange rate appreciates rapidly but the effect does not last for long unless there is another price rise. NFA and LAID, have a persistent and significant effect on the real exchange rate. In model 1 all the variables are not significantly different from zero compared to model 2. In the latter LGCON, LDC, LAID and NFA show a persistent effect on the exchange rate. A shock to the TOT begins with a small negative impact on the real exchange rate that the~ becomes positive. The same as in model 1, LCOPPER has a positive but very short-term effect.

Variance decomposition results in Tables 11 and 12 show that the most relevant variables that impact on the real exchange rate in model 1 is LAID (33%), NFA (23%) and LGCON (9%). As noted before the LCOPPER has a smaller significance compared to other variables and the impact diminishes with increases in the period in both models. In model 1 these findings are expected since Zambia's dependence on copper has diminished, mainly because of declining copper production and as a result its impact on the exchange rate is not as strong as in the previous years. Foreign aid on the other hand seems to have dominated in influencing real exchange rate movements.

Figure 5.6 Model 1 Zambia: Impulse response

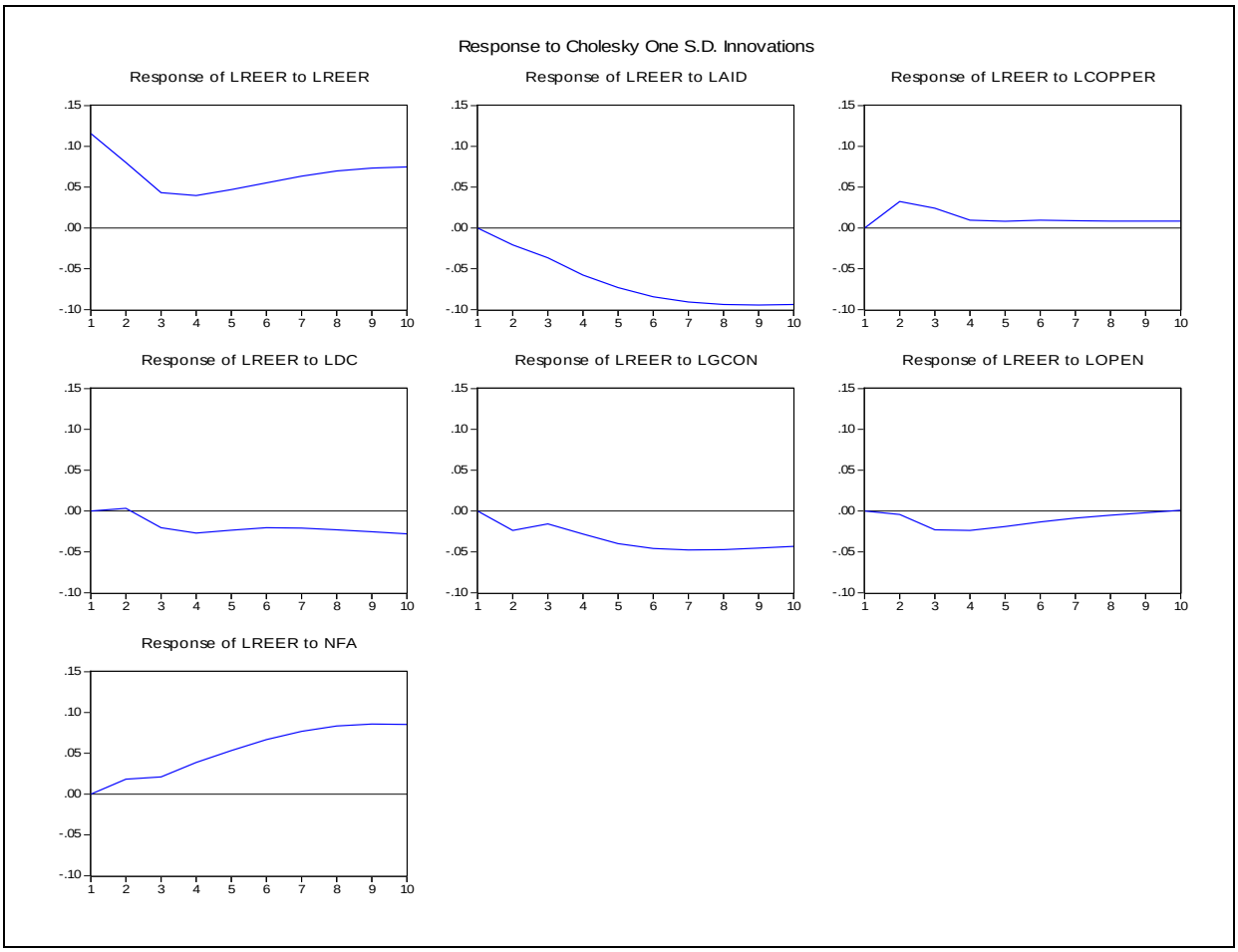


Table 5.11: Model 1 Zambia: Variance decomposition

Variance Decomposition of LREER:								
Period	S.E.	LREER	LAID	LCOPPER	LDC	LGCON	LOPEN	NFA
1	0.115705	100	0	0	0	0	0	0
2	0.149054	89.15383	1.963012	4.730398	0.052887	2.520511	0.074447	1.50492
3	0.166235	78.44017	6.398448	5.900713	1.562648	2.922093	1.958859	2.817073
4	0.190308	64.21392	14.06846	4.761693	3.184824	4.406859	3.051483	6.31276
5	0.221803	51.76437	21.23094	3.642579	3.452783	6.487085	2.987683	10.43456
6	0.258036	42.84146	26.3425	2.826774	3.182821	7.946859	2.47272	14.38686
7	0.296039	37.15402	29.40679	2.236671	2.913928	8.632745	1.963957	17.69189
8	0.333348	33.68308	31.11616	1.82743	2.769597	8.818677	1.571735	20.21331
9	0.368233	31.5694	32.09496	1.549371	2.746208	8.747267	1.290828	22.00196
10	0.4	30.25042	32.70358	1.356636	2.812478	8.585524	1.094494	23.19687

Figure 5.7: Model 2 Zambia: Impulse response

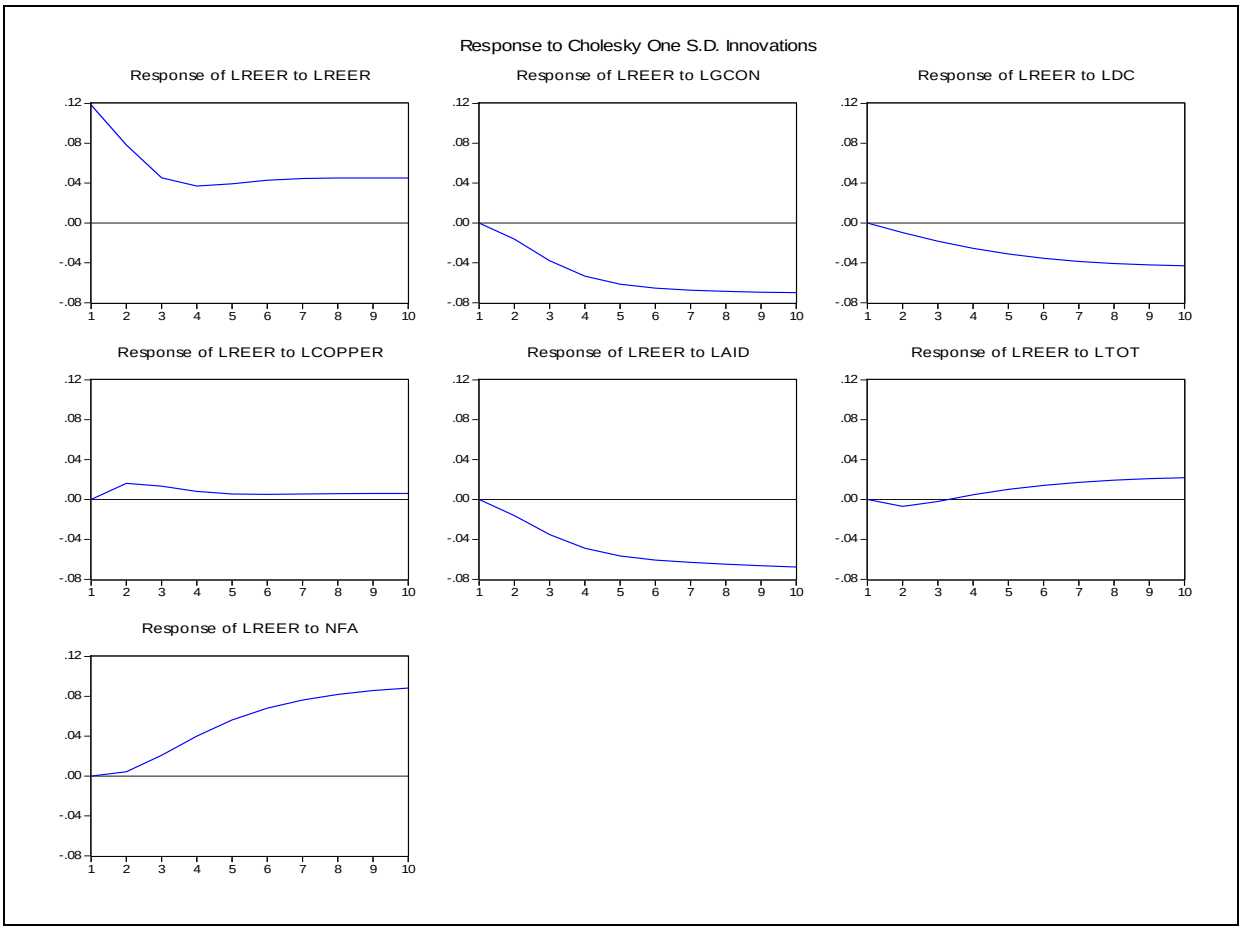


Table 5.12: Model 2 Zambia: Variance decomposition

Variance Decomposition of LREER:								
Period	S.E.	LREER	LGCON	LDC	LCOPPER	LAID	LTOT	NFA
1	0.118353	100	0	0	0	0	0	0
2	0.145242	95.4764	1.260824	0.451095	1.254607	1.243754	0.227565	0.085751
3	0.163675	82.87666	6.378518	1.608849	1.668334	5.584478	0.195636	1.687525
4	0.189018	65.98164	12.72783	3.011039	1.437218	10.86439	0.209102	5.768775
5	0.220273	51.77847	17.15312	4.210742	1.122091	14.60411	0.365474	10.76599
6	0.2538	41.84577	19.55857	5.123876	0.885767	16.70652	0.585132	15.29437
7	0.287317	35.06729	20.77216	5.801226	0.727056	17.84121	0.813267	18.97778
8	0.319824	30.29893	21.37778	6.300524	0.619855	18.50117	1.025227	21.87651
9	0.350952	26.82166	21.67384	6.668183	0.544038	18.94105	1.209123	24.14211
10	0.380588	24.21079	21.80571	6.940786	0.487496	19.27656	1.360521	25.91814

5.6 MISALIGNMENT

The long-run equilibrium relationship estimated above was used to estimate the quarterly value of Malawi and Zambia's equilibrium REER (EREER). The EREER estimated is a function of all the long-term equilibrium or permanent components of explanatory variables in the model and the parameter estimates from the preferred specification in the table above. An HP filter[12] was applied to each series to obtain the permanent components of the explanatory variable. The constant term was also adjusted so that the sample period means of the EREER and REER are equal.

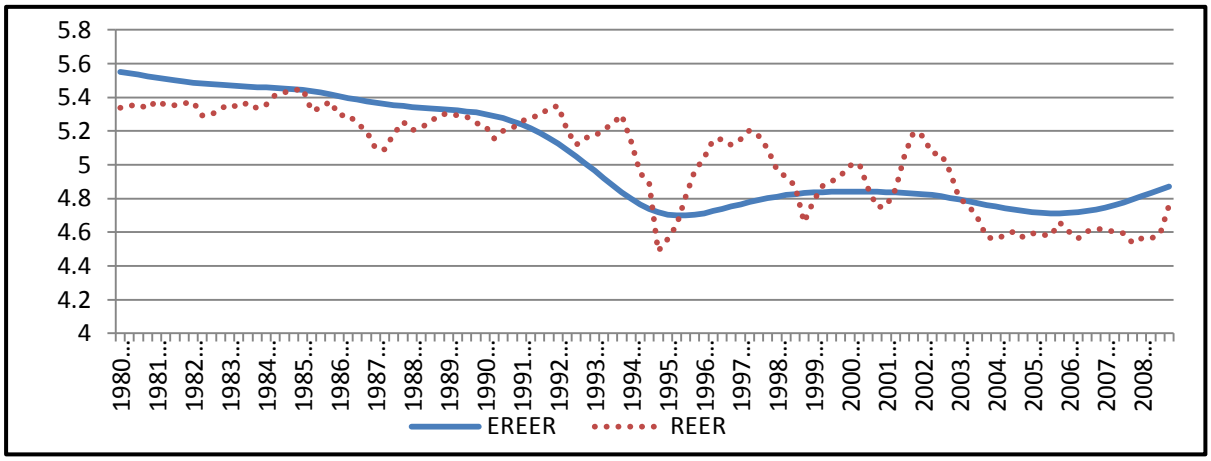
In model 1 for Malawi, the EREER shows a declining trend (depreciation) throughout the study period with a rapid depreciation in the early 1990s. This is followed by a period of stability and then by a fall again around 2004-2005 and a modest appreciation thereafter. In model 2, the EREER had an almost continuous depreciation, with stability seen only in the last three years of the study period. The movement of EREER in model 1 is more volatile than in model 2.

In model 1 REER is depicted as being undervalued from 1980 until 1991 similarly to model 2. From 1991-2004 there are periods of substantial overvaluations and minor undervaluation in model 2. Overvaluation in early 1990s can be explained partially by the drought the country experienced (1992 and 1994) which caused food prices to rise substantially (Mathisen (2003). There was a sharp decline in the exchange rate after 1994 due to a change in exchange rate regime from being pegged to a managed floatation. According to Mathisen (2003) the sharp decline was then reversed when the reserve bank pegged the nominal exchange rate together with expansionary monetary and fiscal policies which resulted in high inflation causing the REER to strengthen. During this period the exchange rate was overvalued. The REER is undervalued from 2004 to 2008 and specifically in 2006 when the exchange rate was pegged at what appears to be an undervalued level to the dollar. The two models are not substantially different in their findings. The timing of periods of under and overvaluation is similar but the magnitude of misalignment differs. Model 1 suggests that the periods of overvaluation were greater in magnitude than model 2, and model 2 suggests that the undervaluation in 1995 was greater than the measure in model 1.

[12] It is important to note that other methods (exponential smoothing and Kalman filter) of decomposing transitory and permanent components produce identical results for EREER pattern (Jongwanich, 2009)

Figures 5.8 and 5.9 present Model 1 and Model 2 for Malawi's EREER, LREER and misalignment.

Figure 5.8: Model 1: Malawi's EREER, LREER and misalignment



Misalignment

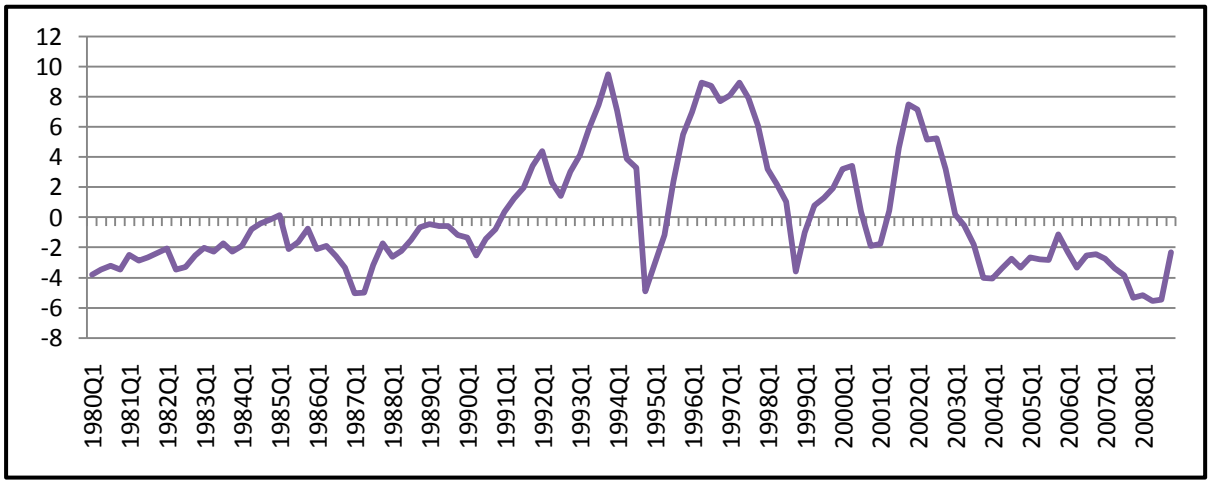
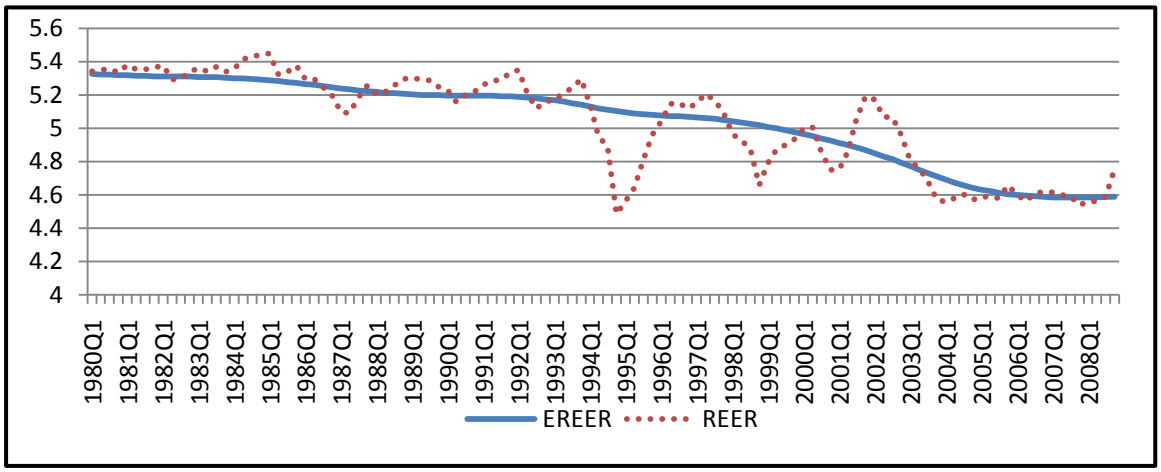
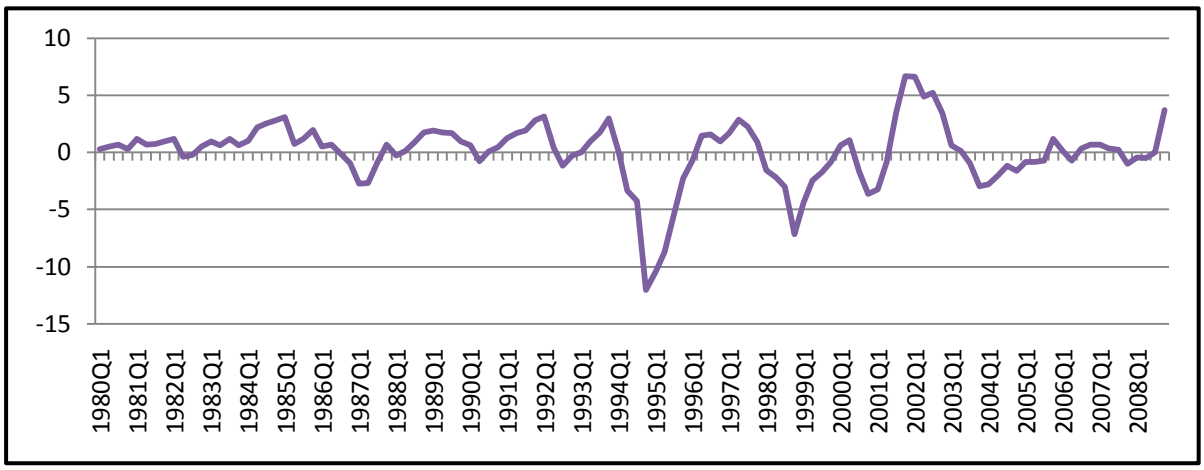


Figure 5.9: Model 2: Malawi's EREER, LREER, and misalignment



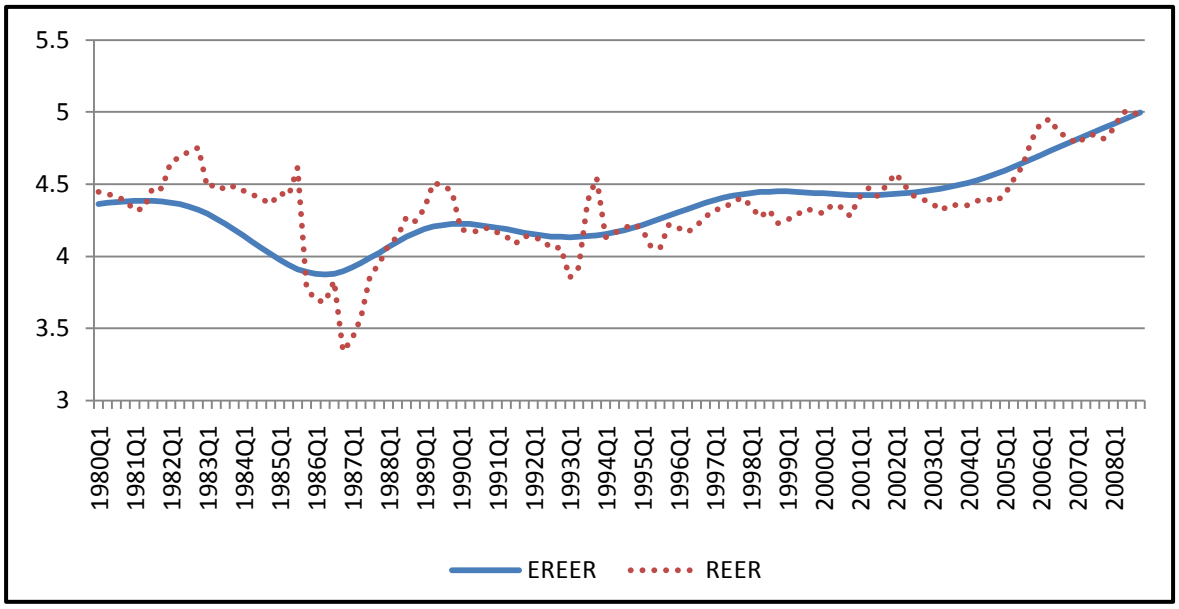
Misalignment



EREER in models 1 and 2 for Zambia are similar even though OPEN is replaced by TOT in model 2. Misalignment in models 1 and 2 are also similar in trend. Overvaluation of REER is seen in the early 1980s when the exchange rate was pegged to a number of currencies. Mkenda (2001) found similar results with the exchange rate for exports. Prior to 1985, the exchange rate was fixed or pegged to another currency and was consequently overvalued. In 1985 when the government intended to market determine the exchange rate in an effort to combat the external imbalance, the auctioning system was adopted and this resulted in a sharp decline in the exchange rate. During this period the real exchange rate depreciated and was undervalued. The auctioning regime was abandoned for a fixed exchange rate in 1987 (Mkenda, 2001). The exchange rate changed from an undervaluation prior 1994 to an overvaluation as it became market determined and exchange controls were relaxed. The discrepancy between the exchange rate in Zambia and the equilibrium REER is not large

especially after 1994 when the majority of exchange control restrictions had been removed. This is depicted in both models. Both models accurately represent the EREER in Zambia as they are not significantly different and the periods of under and overvaluation are very similar in time and magnitude. Figures 5.10 and 5.11 below pertain to Zambia

Figure 5.10: Model 1: Zambia's EREER, LREER and misalignment



Misalignment

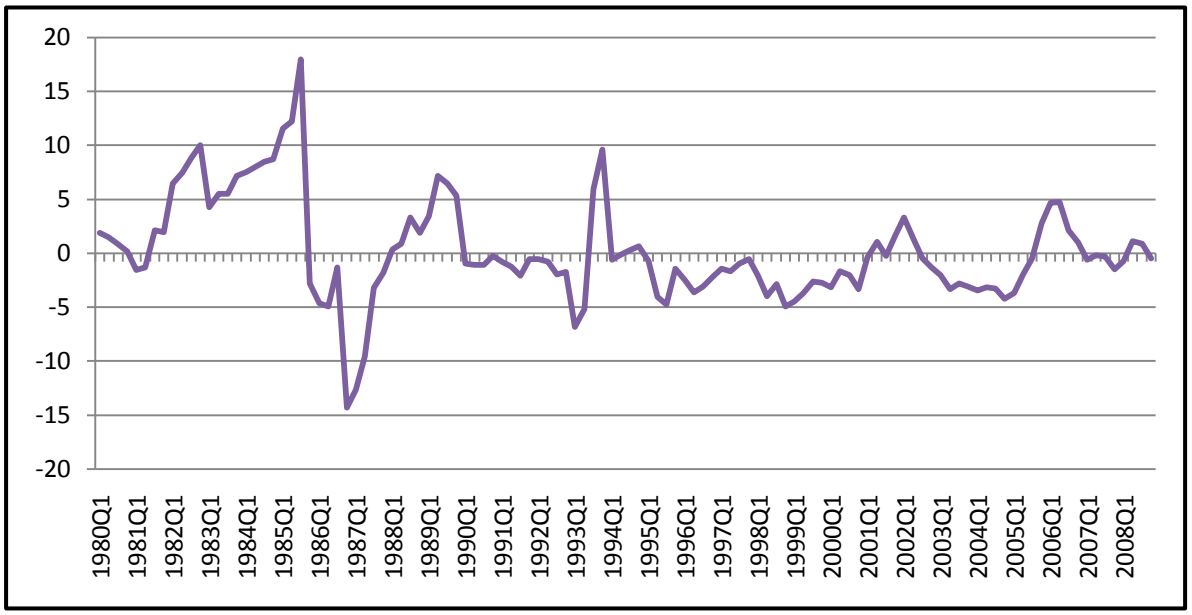
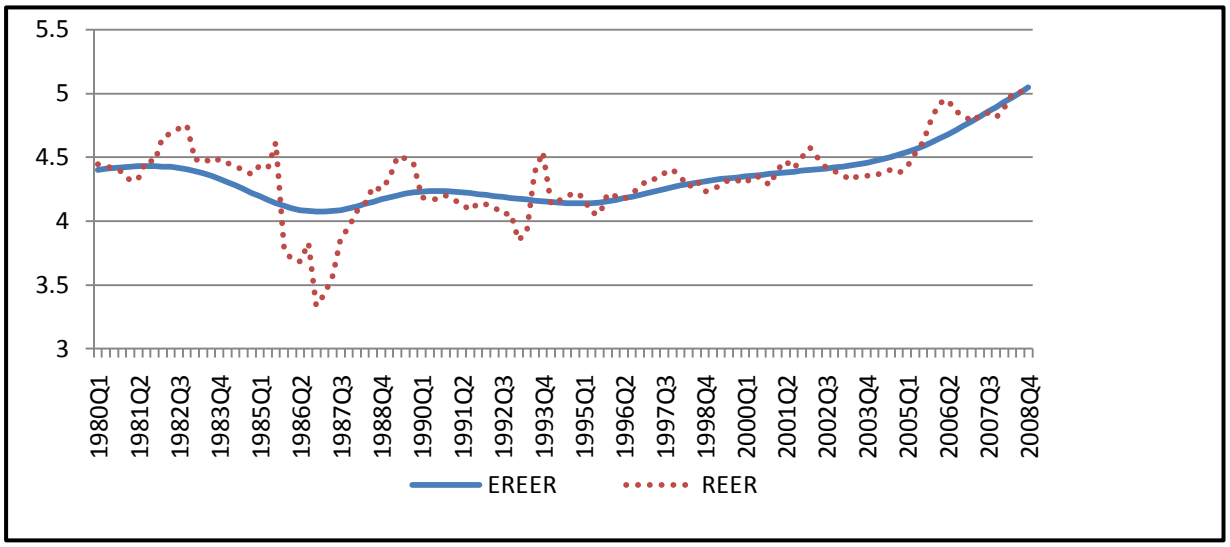
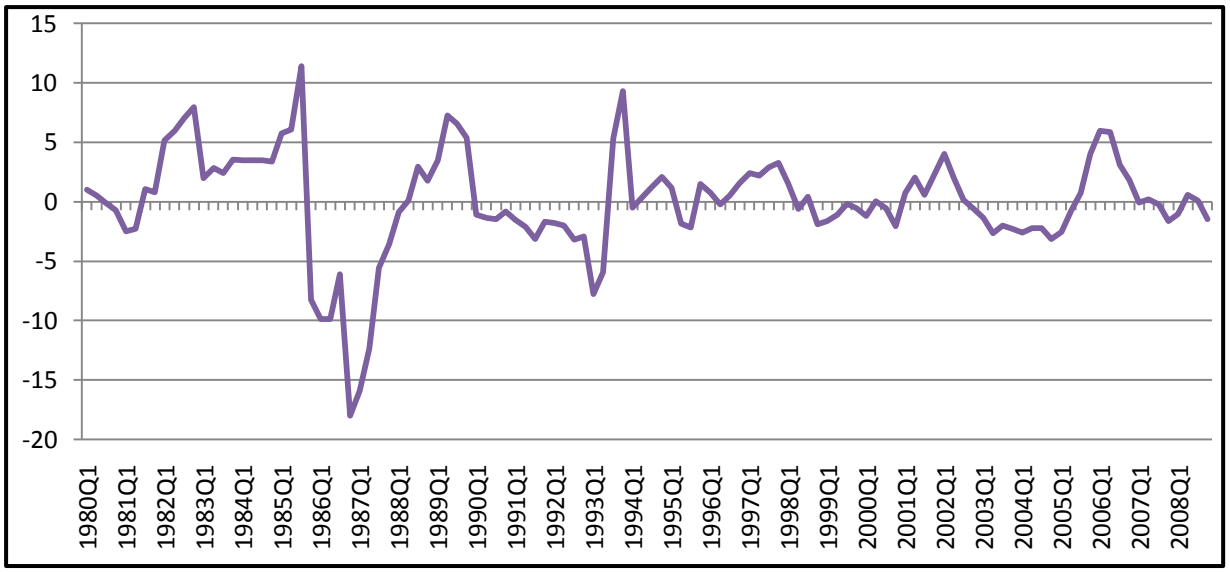


Figure 5.11: Model 2: Zambia's EREER, LREER and misalignment



Misalignment



5.7 SUMMARY OF FINDINGS

This chapter analysed the relationship between real exchange rate and selected macroeconomic variables that influence its movements. The chapter also analysed the adjustment of real exchange rate following shocks to the determinants. The first step was the graphical analysis used to analyse the properties of the time series. This was followed by unit root tests and stationarity tests, which are formal tests. The majority of the variables are integrated of order one. To further understand the data series in terms of whether there is a trend or intercept

component, we performed conditional analysis tests and two assumptions were dominant, that of an intercept only and trend with intercept. Both assumptions were employed in co-integration tests and the assumption with meaningful results was selected.

We found co-integration between real exchange rate and its determinants, except TECHNO, meaning the real exchange rate is susceptible to permanent changes as the fundamentals change. TECHNO was excluded in the co-integration test because there were no meaningful results when it was included. For instance, should TECHNO be included in the model then LREER become exogenous. Two models for each country were identified. In some cases where LOPEN and LTOT are included in the same model the model fails to perform well. Evidence of co-integration made it possible to estimate VECMs and we thus determined both long and short run relationships. Variables found to have a long-run relationship with real exchange rate in Malawi are LAID, LGCON, LDC, LNEER, NFA and LTOT. In Zambia, LAID, LGCON, LDC, NFA, LCOPPER and LTOT had a long-run relationship with the real exchange rate. As expected, in Malawi, an increase in LAID, LGCON and LTOT resulted in real exchange rate depreciation and LDC, NFA and LNEER resulted in an appreciation. In Zambia, LAID, LGCON, LOPEN and LTOT also resulted in real exchange rate depreciation and LDC, NFA and LCOPPER resulted in an appreciation.

An interesting result found in Zambia is that in model 2 foreign aid showed a greater effect on the real exchange rate than copper price movements. This can be explained by the declining dependence of the Zambian economy on copper export revenue as copper production declined over the years. We also found that the respective exchange rates in both countries experienced periods of misalignment. In Malawi models 1 and 2, speed of adjustment is respectively -0.11 and -0.27. It is -0.45 and -0.47 in Zambia for models 1 and 2 respectively. Model 1 for Malawi seems to represent the most appropriate equilibrium exchange rate taking into account the exchange rate regimes over the study period. In the case of Zambia both models are acceptable Foreign aid has proven to be important in exchange rate movements in both countries but this were not really expected in the case of Zambia.

CHAPTER 6

CONCLUSIONS, POLICY RECOMMENDATIONS, LIMITATIONS AND AREAS FOR FURTHER STUDY

6.1 SUMMARY AND CONCLUSIONS

This study analysed the behaviour of the real exchange rate and the relationship between the real exchange rate and its determinants. Real exchange rate dynamic adjustment is observed if there is a shock to the determinants. A number of studies have been conducted for , estimating equilibrium real exchange rate for different countries and making it possible to determine real exchange rate misalignment. Determining the correct level of the real exchange rate is important as RER is an indicator of a country's external competitiveness (Edwards, 1989). With constant changes in real exchange rate determinants, determining the appropriate equilibrium exchange rate level at different points in time is thus important.

The study commenced by discussing the importance of the real exchange rate and the theory behind it. The foreign exchange market is the most liquid of all global financial markets. A number of studies, for both developed and developing countries, were reviewed. Some of the variables identified in the literature as impacting on the RER include terms of trade, openness, government consumption, foreign aid, interest rate differentials, commodity prices, domestic credit, net capital inflows, the Balassa-Samuelson effect and the nominal exchange rate. For most developing country studies, data availability was raised as a limitation in measuring the equilibrium exchange rate.

The second part of the study presented an economic overview of Malawi and Zambia. Both countries experienced similar changes in their exchange rate regimes. Two dominate characteristics of exchange rate regimes experienced are fixed and flexible rates. It is observed that when the exchange rates shifted from being fixed to flexible there was initially exchange rate depreciation. Over the years restrictive laws were relaxed and eventually the exchange rates were market determined in both countries. In this study attention was focused on the possible impact of foreign aid to Malawi's exchange rate and the impact of changes in copper prices to Zambia's exchange rate because of their overall economic significance to each country. Although other variables were included in the estimation model it was shown that copper production in Zambia has diminished over the years. As a result, its impact on the exchange rate may not be as

significant as it was previously. Both countries received assistance from abroad but the relative magnitude of aid in Malawi is much greater.

To determine the long-run and short-run relationships between the exchange rate and its determinants, the study employed the Johansen co-integration and the error correction methodology. This technique has been widely used in recent studies to determine the equilibrium exchange rate. Other estimation techniques are available, but the Johansen one has several advantages over them. To increase the number of observations for estimation some data series were interpolated. The study used Malawi and Zambia's quarterly data from 1980:1 to 2008:4. Most variables were first differenced stationary Two models were identified for each country, with different combination of variables as some variables did not perform well when included together; for example TOT and OPEN. The model that best expressed the equilibrium exchange rate was chosen.

Results showed that in both countries there is co-integration between the real effective exchange rate and its determinants. This proves that the real exchange rate is subject to permanent changes due to changes in its determinants. With this result, VECMs, were estimated to obtain the long- and short-run parameters. Variables found to have a long-run relationship with real exchange rate in Malawi are LAID, LGCON, LDC, LNEER, NFA and LTOT. As expected, in Malawi, an increase in LAID, LGCON and LTOT resulted in real exchange rate depreciation and LDC, NFA and LNEER resulted in an appreciation. In Zambia, LAID, LGCON, LDC, NFA, LCOPPER and LTOT had a long-run relationship with the real exchange rate. LAID, LGCON, LOPEN and LTOT resulted in real exchange rate depreciation while LDC, NFA and LCOPPER resulted in an appreciation.

Lagged first difference of LREER and LNEER had a short-run effect on the real exchange rate for Malawi. In the case of Zambia, lagged first of LCOPPER and lagged second difference of LDC impacted the real exchange rate in the short-run. The signs of the variables were the same for both countries though the impact on the real exchange rate differed. That the results LCOPPER for Zambia were not strongly significant and therefore somewhat surprising and can possibly be explained by the sharp decline in Zambian copper production over the study period (Mkenda, 2001 and Figure 3.13). *A priori* it was not obvious that the signs would be the same as some variables, for example foreign aid, can result in either an appreciation or depreciation of the exchange rate depending on whether the aid is tied or not and whether it is used to purchase domestic goods or imports. Indeed, the author's expectaction at the start of the study was that

foreign aid would result in a strengthening of the exchange rates and resultant overvaluation. This expectation proved to be incorrect.

The speed of adjustment coefficient showed that in Malawi in models 1 and 2, 11% and 27% of the variation in the real exchange rate from its equilibrium adjust each quarter respectively. The speed of adjustment for Zambia in both models was 45% and 47% respectively. Foreign aid has proven to be important in exchange rate misalignment in both countries. The exchange rates for both countries had periods of misalignments. The results for Zambia are interesting in that the two equilibrium exchange rates are not very different. The periods and extent of under and overvaluation are very similar. The results cannot be compared with those of Mkenda (2001) who calculated three separate exchange rates (exports, imports and internal). Both models 1 and 2 appear to be appropriate representations of the EREER for Zambia. In the case of Malawi, models 1 and 2 indicate the same periods on over and undervaluation but with different magnitudes. The speed of adjustment in model 2 is closer to that found for Malawi by Mathisen (2003), but the magnitude of the misalignment shown by Mathisen (2003) is much greater than in model 2 and is closer to that revealed in model 1. Given that Malawi experienced balance of payments and exchange rate crises and switched from fixed to more flexible and finally floating exchange rate regimes over the study period, the greater magnitude of the misalignments revealed in model 1 seem more realistic.

6.2 POLICY RECOMMENDATIONS

Since the results have shown that there is a long-run relationship between the real exchange rate and its determinants, the governments of both countries may consider influencing one variable that may also have an influence on the other variables and the exchange rate. This shows how monetary and fiscal policies' stance of a country must be supportive of each other so as to minimise exchange rate misalignment. An example is foreign aid inflows; it has increased in many developing countries including Malawi and Zambia. It was expected for foreign aid to impact the real exchange rate of Malawi as the country has received substantial inflows. Policies may be implemented to ensure that foreign assistance is directed to sectors in the economy that benefit the economy. For example, since agriculture is the dominant sector in Malawi, developing that sector may result in creating jobs, purchasing machinery and all resources needed and thus developing the country from with-in. In other words making use of the resources the country possesses. There is therefore a need to monitor aid inflows in order to maintain an appropriate level that will not harm the growth of the economy.

The results have shown that even the exchange rate of Zambia is greatly impacted by changes in foreign aid. The problem faced in developing countries is that such assistance is directed to largely foreign goods consumption leading to the depreciation of the currency. On the other hand, appreciation of the Kwacha has an adverse impact on domestic exports ('Dutch disease'). It is important therefore for the government and policy makers to direct foreign aid, where possible, to sectors of the economy that may boost economic growth and improve the welfare of people in the long-run.

6.3 LIMITATIONS AND AREAS FOR FURTHER STUDY

The main problem that most developing country studies face is data availability. Proxies had to be used in cases where measures of the appropriate variable were not available; for example growth rate of GDP per capita was used to measure technological progress since non-traded goods prices were not available. To add to data issues, only low frequency data were available for most variables though high frequency data was preferred. In this study, data were interpolated and that may have caused problems for the results and their interpretation. The choice of proxies may also have affected the results and thus, for further research, different proxies could be used. The study attempted to identify those variables that are suggested in the literature and those that were relevant to Malawi and Zambia. It may be possible that as time progresses some variables could become more or less relevant and their impact on exchange rate movements changes. Further studies will be required to consider the possible impact of such changes.

REFERENCES

ADAM, C.,1999. Financial Liberalisation and Currency Demand in Zambia. **Journal of African Economies**.8:3,268-306

ADENAUER, I., and VAGASSKY, L., 1998. Aid and the real exchange rate: Dutch Disease effects in African countries. **Intereconomics: Review of International Trade and Development**. 33: 177-85.

AFRICAN ECONOMIC OUTLOOK., 2010a. **Malawi Overview**. [Online] Available: http://www.africaneconomicoutlook.org/en/countries/southern-africa/malawi/ [Accessed 16/11/10]

AFRICAN ECONOMIC OUTLOOK.,2010b. **Zambia Overview**. [Online] Available:http://www.africaneconomicoutlook.org/en/countries/southern-africa/zambia/ [Accessed 22/11/10]

ALBEROLA, E., and LOPEZ, H., 2001. Internal and external exchange rate equilibrium in a cointegration framework. An application to the Spanish peseta**. Spanish Economic Review. 3, 23-40**

ARON, J., ELBADAWI, I. A., and KAHN, B., 2000.**Real and monetary determinants of the real exchange rate in South Africa.** In Elbadawi, I. A. and Hartzenberg, T. Development issues in South Africa. London: Macmillan

AZIAKPONO, M., and OBASA, S. B., 2004. Financial liberalisation, currency substitution and savings in Nigeria. **South African Journal of Economic and Management Sciences**. 7 (2): 316-340.

AZIAKPONO, M., 2005. Financial development and economic growth in Southern Africa. In: Granders, M. and Pinaud, N. (eds). **Reducing capital cost in Southern Africa**. Development Centre Studies (OECD).

AZIAKPONO, M., 2008. **The depth of financial integration and its effects on financial development and economic performance of the SACU countries.** PhD Thesis: Bloemfontein Department of Economics at the University of the Free State.

BOVA, E., 2008. **Exchange rate management for commodity booms: Examining Zambia's copper exports.** Development Viewpoint (19). [Online] Available: https://eprints.soas.ac.uk/7334/1/DevelopmentViewpoint19.pdf [Accessed 13/09/09]

BOVA, E., 2009. **Is The Zambian Kwacha A Commodity Currency? The Co-Movement between Copper Prices and the Exchange Rate. NCCR Publications**. Working Paper No 2009/11

BROOKS, C., 2008. **Introductory econometrics for finance.** Cambridge: Cambridge University Press

BURGER, P., 2008. **Money, Credit and Interest: Searching For a Credit Channel in South Africa.** The Regulatory Environment and its Impact on the Nature and Level of Economic Growth and Development in South Africa. Conference, School of Economics University of Cape Town

CASHIN,P.,CESPEDES, L.F., and SAHAY,R., 2004. Commodity currencies and the real exchange rate. **Journal of Development Economics**.75:239-268

CATAO, L.A.V., 2007. Why Real Exchange Rates? **Finance and Development**.44:3

CERRA, V., TEKIN, S., AND TURNOVSKY, S. J., 2008. **Foreign Aid and Real Exchange rate Adjustments in a Financially Constrained Dependent Economy.** IMF Working

Paper. WP/08/204

CHEN, J., 2007. **Behavioral Equilibrium Exchange Rate and Misalignment of Renminbi: A Recent Empirical**. Study Dynamics, Economic Growth, and International Trade conference paper. [Online] Available: http://www.degit.ifwkiel.de/papers/degit_12/C012_013.pdf [Accessed 28/04/ 2010].

CHIPILI, J.M., 2009. **Modelling Exchange Rate Volatility in Zambia** .[Online] Available:http://www.csae.ox.ac.uk/conferences/2009-EDiA/papers/377-Chipili.pdf [Accessed 18/05/2010]

CLARK, P. B., and MACDONALD, R., 1999. **Exchange rates and economic fundamentals: A methodological comparison of beers and feers.** In MacDonald, R. and Stein, J., editors, Equilibrium Exchange Rates, pages 285-322.

COPELAND, L.S.,1994. **Exchange rates and international finance**. 2nd ed Mass: Addison-Wesley.

COTTANI, J. A., CAVALLO, D. F., and KHAN, M. S., 1990.Real Exchange Rate Behaviour and Economic Performance in LCDs. **Economic development and Cultural Change**.39,1:61-76

DEVARAJAN, S.,1997 . Real Exchange Rate Misalignment in the CFA Zone**. Journal of African Economies**.6,1: 35-53

DI BELLA, G., LEWIS, M., and MARTIN, A., 2007. **Assessing competitiveness and real exchange rate misalignment in low-income countries.** IMF Working Paper. WP/07/201

EDWARDS, S.,1989. **Real exchange rate, devaluation and adjustment: exchange rate policy in developing countries**. Cambridge: The MIT Press

EITA, J.H., JORDAAN, A.C., AND HARMSE.C., 2006. Equilibrium Real Exchange Rate and Commodity Prices: The Case of Namibia. ***Botswana Journal of Economics***.3, 6: 35-41

FAGERNÄS, S., and SCHURICH, C., 2004. **The Fiscal Effects of Aid in Malawi.** Economics and Statistics Analysis Unit (ESAU), Overseas Development Institute. Working Papers No 7**.** [Online] Available http://www.odi.org.uk/resources/download/1848.pdf [Accessed 09/ 11/ 2010].

HINKLE, L.E., and MONTIEL, P.J., (eds).Exchange rate misalignment: concepts and measurement for developing countries. In, Hinkle,L.E., and Montiel, P.J .,(eds).**Exchange rate misalignment: concepts and measurement for developing countries.** A World Bank research publication. New York: Oxford University Press

HINKLE, L, E and NSENGIYUMVA, F .1999. External Real Exchange Rates: Purchasing Power Parity, the Mundell-flemming Model, and Competitiveness in traded Goods. In, Hinkle,L.E., and Montiel, P.J .,(eds).**Exchange rate misalignment: concepts and measurement for developing countries.** A World Bank research publication. New York: Oxford University Press

HOLDEN, M., 1991.Real Exchange Rates and their Measurement. **South African Journal of Economics**.59, 1:1-8

IIMI, A., 2006. Exchange rate misalignment: **An application of the behavioral equilibrium exchange rate (BEER) to Botswana.** IMF Working Paper, WP/06/140 Washington, IMF

IMF.,2010. **IMF Executive Board Approves Three-Year US$79.4 Million Extended Credit Facility Arrangement for Malawi.** Press Release No. 10/52 February 19.

INDEX OF ECONOMIC FREEDOM., 2010a. **Malawi.** [Online] Available: http://www.heritage.org/Index/Country/Malawi [Accessed 28/11/10]

INDEX OF ECONOMIC FREEDOM., 2010b. **Zambia**. [Online] Available: http://www.heritage.org/index/country/zambia [Accessed 28/11/10]

JOHANSEN, S., 1988 .Statistical analysis of co-integrating vectors. **Journal of Economic Dynamics and Control** .12, 231-.254.

JOHANSEN, S., 1995. **Likelihood-based inference in cointegrated vector autoregressive models**. Oxford: Oxford University Press.

JONGWANICH, J., 2009. **Equilibrium Real Exchange Rate, Misalignment and Export Performance in Developing Asia.** Asian Development Bank. ADB Economics: Working Paper Series No.151

JOYCE, J. P., and KAMAS, L., 2003. Real and nominal determinants of real exchange rates in Latin America: short-run and long-run equilibrium. **The Journal of Development Studies**. 39, 6: 155-182.

KAMAR, B., and NACEUR, S.B., 2007. **GCC Monetary Union and the Degree of Macroeconomic Policy Coordination.** IMF Working Paper WP/07/249

KEMME, D. M., and ROY. S., 2006. Real exchange rate misalignment: Prelude to crisis. **Economic Systems.** 30: 207-230

KENNEDY, P., 2003. **A guide to econometrics.** 5th ed. Cambridge, Mass.: MIT Press

LANE, P.R., 1999. What Determines the Nominal Exchange Rate? Some Cross-Sectional Evidence. **The Canadian Journal of Economics**. 32,1: 118-138

LEVY,V.,1987. Anticipated Development Assistance, Temporary Relief Aid and Consumption Behaviour of Low-Income Countries. **Economic Journal**. 97:446-58

LI, Y., and ROWE, F., 2007. Aid **Inflows and the Real Effective Exchange Rate in Tanzania.** Policy Research Working Paper 4456

MACDONALD, R., and RICCI, L. A., 2004. Estimation of the equilibrium real exchange rate for South Africa. **South African Journal of Economics.**72, 2: 282-304

MACDONALD, R.,2007. **Exchange rate Economics: Theories and Evidence**. Routledge

MALI, E., 2010**.** The Volatility of the Exchange Rate: A Case of the Zambian Kwacha. **Economics Association of Zambia. 29 June, 2010**

MALLIK, G.,2008. Foreign Aid and Economic Growth: A Cointegration Analysis of the Six Poorest African Countries. ECONOMIC ANALYSIS & POLICY. 38: 2,251-260

MASTERS, W. A., and IANCHOVICHINA, E., 1998. Measuring Exchange Rate Misalignment: Inflation Differentials and Domestic Relative Prices. **World Development**. 26, 3:465-477

MATHISEN, J., 2003. **Estimation of the Equilibrium Real Exchange Rate for Malawi**. IMF Working Paper. WP/03/104

MELECKY, M., and KOMÁREK, L., 2007. The Behavioural Equilibrium Exchange Rate of the Czech Koruna. **Transition Studies Review.**14, 1: 105–121

MKENDA, B. K., 2001. **Long-run and short-run determinants of the real exchange rate in Zambia**. Göteborg University Working Papers in Economics no 40. [Online] Available: http://gupea.ub.gu.se/dspace/bitstream/2077/2888/1/gunwpe0040.pdf [Accessed 28/04/ 2010].

MONTIEL, P.J., 1999. Determinants of the Long-Run Equilibrium Real Exchange Rate: An Analytical Model. In Hinkle L.E., Montiel P.J. (1999) **Exchange Rate Misalignment, Concepts and Measurement for Developing Countries.** A World Bank Research Publication, Oxford University Press.

MONTIEL, P.J., 2003.**Macroeconomics in emerging markets.** Cambridge: Cambridge University Press

MONTIEL.P J and HINKLE.L E, 1999. Exchange rate misalignment: An overview. In HINKLE, L.E., and MONTIEL, P.J., 1999.**Exchange rate misalignment: concepts and measurement for developing countries.** A World Bank research publication. New York: Oxford University Press

MUHANGA,I., and SOLETI, K., 2008. **Foreign portfolio investors in Africa: the case of Zambia.** IFC Bulletin No 31IFC. Conference on "Measuring financial innovation and its impact", Basel, 26–27 August 2008 [Online] Available http://www.bis.org/ifc/publ/ifcb31af.pdf [Accessed 22/11/10]

MUNGULE, K, O., 2004. **The determinants of the real exchange rate in Zambia**. AERC Research Paper 146. African Economic Research Consortium. Nairobi Kenya

OSTERWALD-LENUN, M., 1992. A note with Quartiles of the asymptotic distribution of the ML cointegration rank test statistics. **Oxford Bulletin of Economics and Statistics**. 54: 461-472

RESERVE BANK OF MALAWI., 2000. **Exchange and Interest Rate Determination in Malawi: Past and Present.** [Online] Available: **http://www.rbm.mw/publications/index.asp?suburl=rp** [Accessed 18/09/09]

RESERVE BANK OF MALAWI., 2000-2010. Various monetary policy committee minutes. [Online] Available: http://www.rbm.mw/mpcmeetingminutes.aspx [Accessed 16/11/10]

SATO, L. J .,2001. **Monetary Policy Frameworks in Africa: The Case of Malawi.** International Conference on Monetary Policy Frameworks in Africa at the South African Reserve Bank, Pretoria, South Africa. [Online] Available http://www.reservebank.co.za/internet/Publication.nsf/LADV/9CD00895CF13D9CF422570510040CC98/$File/malawi.pdf accessed 03/05/2010 [Accessed 16/11/10]

SEDDIGHI, R. H., LAWLER, A. K., and KATOS, A. V., 2000. **Econometrics: A practical approach.** New York: Routledge.

SIMWAKA, K., 2007. **Modelling and Forecasting the Malawi Kwacha –US Dollar Nominal Exchange Rate.** MRPA Paper No. 3327:7. [Online] Available: http://mpra.ub.uni-muenchen.de/3327/1/MPRA_paper_3327.pdf [Accessed 18/05/2010]

TAKAENDESA, P.,2006. **The behaviour and fundamental determinants of the real exchange rate in South Africa.** Rhodes unpublished thesis.

THE AFRICAN REPORT.,2010. **Weak copper, shaky politics hit Zambian kwacha**. [Online] Available:http://www.theafricareport.com/last-business-news/3290723Weak%20copper,%20shaky%20politics%20hit%20Zambian%20kwacha.html. [Accessed 18/05/2010]

TERRA, C., and VALLADARES, F .,2010. Real exchange rate misalignments. **International Review of Economics & Finance.** 19, 1: 119-144

WHITE, H., 1992, The Macroeconomic Impact of Development Aid: A Critical Survey. **Journal of Development Studies.** 28, 2:163-240.

WHITE, H., and WIGNARAJA, G., 1992. Exchange rates, Trade liberalization and Aid: The Sri Lankan Experience. **World Development**.20, 10:1471-1480

WILLIAMSON, J., 1994. **Estimating equilibrium exchange rates**. Washington: Institute for International Economics.

WILLIAMSON, J., 2008, **Exchange Rate Economics**, Working Paper Series WP 08-3, Peterson Institute for International Economics.

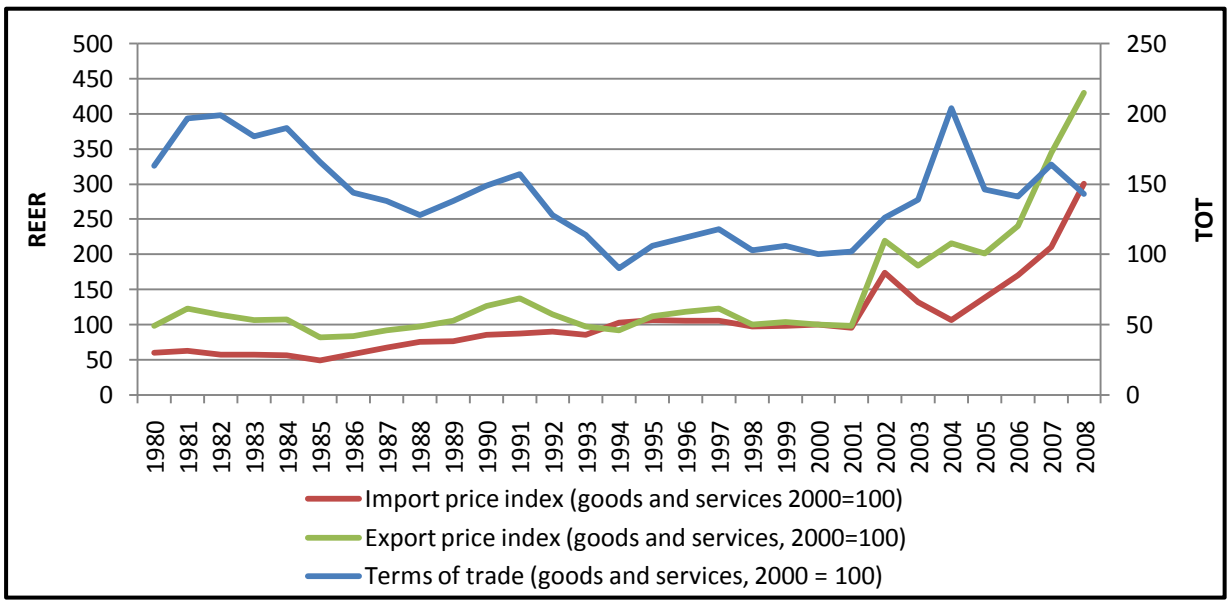
WORLD BANK DATABASE., 2010. [Online] Available: http://databank.worldbank.org/ddp/home.do?Step=1&id=4 [Accessed 10/10/2009]

ZHANG, Z., 2001. Real Exchange Rate Misalignment in China: An Empirical Investigation. **Journal of Comparative Economics**.29: 80-94

APPENDIX

Appendix A

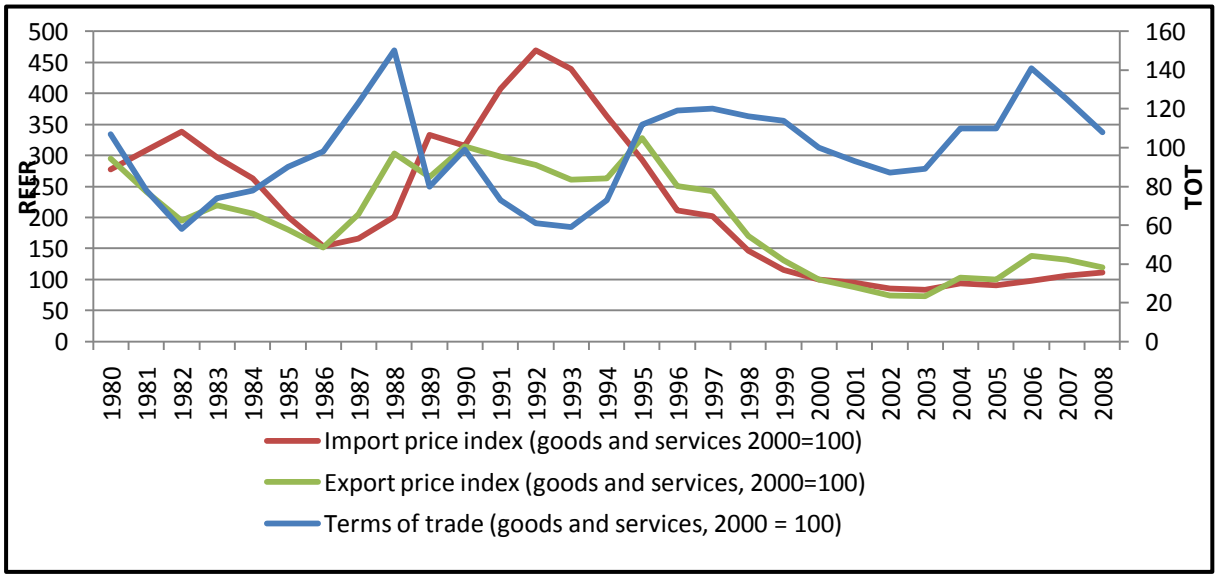
Terms of trade: Malawi: 2000=100



Data Source: Thompson Data Stream (2010) and World Bank (2010)

Appendix B

Terms of trade: Zambia: 2000=100



Data Source: Thompson Data Stream (2010) and World Bank (2010)