Dynamics of real effective exchange rate in Malawi and South Africa

Prepared by Kisukyabo Simwaka

This study investigates the main determinants of real effective exchange rate in Malawi and South Africa. In our empirical analysis, we conducted unit root and cointegration test in order to determine the time series properties of the data and establish whether there is a long run relationship between real effective exchange rate and explanatory variables. Having ascertained that almost all variables are integrated of order one and cointegrated, an error correction model is formulated and estimated for the two real effective exchange rate equations using the Ordinary Least Square (OLS) method.

The empirical results for both Malawi and South Africa are highly supportive of the real exchange rate model. In particular, we find a negative and significant relationship between real effective exchange rate and the degree of openness for both countries. On the other hand, while there is an inverse relationship between real effective exchange rate and governmernt consumption in the case of Malawi, a positive ralationship between real effective exchange rate and government consumption obtains in the case of South Africa. Additionally, whereas there is a positive relationship between real effective exchange rate and international capital flows in the case of Malawi, a negative relationship obtains in the case of South Africa.. However, results from both countries indicate a positive relationship between real exchange rate one hand and excess domestic credit and lagged real effective exchange rate on the other hand. They also indicate a negative relationship between real effective exchange rate and nominal devaluation in both countries.

The study yields some policy implications. First, it has been learnt that excessive domestic credit causes the real exchange rate to appreciate for both countries. This therefore calls for prudent fiscal and monetary policy measures. Such measures include mopping out excess liquidity from the market to stem the growth of money supply. For both countries, the most powerful policy is just an intermediate policy and can only be successful if there is fiscal discipline. With fiscal discipline there can be no excess liquidity. Second, the study has found that policies aimed at eliminating trade restrictions depreciate the REER. One policy implication that can be drawn from this finding is that the government should continue implementing trade liberalisation policies that it had already started in 1988.

Furthermore, developments in the external sector of the economy (changes in terms of trade, degree of openness and international capital flows) which are not under the control of domestic authorities seemingly contribute more to changes in real effective exchange rate. The policy implications are that the government ability in influencing the behaviour of real effective exchange rate is limited. This is because the ability of a small open economy like that of Malawi to insulate itself from external shock is limited, at best. In the long-run however, appropriate structural changes and conducive competitive policy could be designed and implemented. These may include export diversification (to counter deteriorating terms of trade in specific commodities) and implementing measures to limit market imperfection.

Based on the available evidence, it can be concluded that macroeconomic fundamentals play a vital role in explaining changes in real effective exchange rate in both Malawi and South Africa.

Key words: real effective exchange rate, stationarity, cointegration,

CHAPTER 1

INTRODUCTION

1.1 Motivation of the study

In the past few years exchange rates have attained great prominence in economic and policy discussion in developing countries. For example, it has been argued that the inappropriate exchange rate policies pursued by some countries in the late 1970s contributed to the international debt crisis of early 1980s. According to the World Bank (1984), overvalued exchange rates in many African countries have resulted into a dramatic deterioration in their agriculture and their external accounts. Others have argued that exchange rate policy triggered the disappointing outcome of the Southern cone (Argentina, Chile, and Uruguay) economic reforms and free market policies during the late 1970s (Edwards, 1989, p.3).

The distinction between nominal and real exchange rate has become increasingly important. While nominal exchange rate is a monetary concept that measures the relative price of two currencies, the real exchange rate (RER) is defined as the relative price of tradable to non-tradable goods.[1] The nominal effective exchange rate (NEER) is a weighted average of nominal exchange rates between a country and its most important trading partners. The equilibrium real exchange rate (ERER) is defined as the relative price of tradable goods to nontradable goods which, for a given sustainable values of the other relevant variables such as taxes, terms of trade, commercial policy, capital flows and technology, results in simultaneous attainment of internal and external balance. This means that when the RER is in equilibrium the economy is accumulating (or running down) assets at the 'desired' rate and the demand for domestic goods equates its supply. Internal equilibrium means that the non-tradable goods market clears in the current period and is expected to be in equilibrium in future. External equilibrium means that the current account balances (current and future) are compatible with long run sustainable capital flows. This implies that a country cannot be a net lender or net borrower forever. Eventually it has to pay its debt (Edwards, 1989 p.4).

The RER is often used as a guide to monetary and exchange rate policy. Movements in RER may influence investment decisions in the macro-economy. In a highly competitive world, however, the structure and direction of trade adapt to exchange rate changes in a rather complex manner and this requires a detailed analysis (Elbadawi, 1994).

Since individual countries have several trading partners, policy makers are concerned not merely with the bilateral real exchange rate, but with the real effective exchange rate (REER). The REER is the trade-weighted adjusted real exchange rate.[2]

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[1] RER is formulated as follows: $RER=Ex * P_F / P_D$; where Ex is the nominal exchange rate defined as the domestic price of foreign currency, P_F is the world price of tradables and P_D is the domestic price of non-tradables. (see Edwards, 1994 and Elbadawi, 1994).

[2]The REER is expressed as: REER= NEER * CPID/CPIF, where CPID is the domestic consumer price index and CPIF is the weighted average of the consumer price indices of Malawi's five biggest trade partners South Africa, Zimbabwe, the United States, the United Kingdom and Germany, and NEER is the nominal effective exchange rate. CPID represents domestic prices of non-tradables, CPIF represents world prices of tradables. For both Malawi and South Africa, a rise in REER signifies an appreciation.

In developing countries, the REER has become a policy target and in most exchange rate regime changes, the aim is to maintain a stable and competitive REER. A fundamental principle of open macroeconomics is that in order to have a sustainable macroeconomic equilibrium it is necessary for fiscal and monetary policies to be consistent with the chosen nominal exchange rate system. This means that the selection of an exchange rate system imposes limitations on macropolicies. If this inconsistency is violated, severe disequilibrium, usually concentrated on REER misalignment, will follow[3] (see Elbadawi, 1994; Montiel and Ostry, 1991).

Exchange rate policy is a necessary instrument for economic management and stabilization and adjustment policies in less developed countries (LDCs). Low inflation and international competitiveness have become major policy targets in most LDCs. For instance, high inflation has been a symptom of policy instability and has frequently been associated with policy uncertainty. Despite its significance in economic management and policy analysis, few studies have attempted to examine the determinants of real exchange rates in Malawi (see Lwesya 1997; Masiye, 1999; Bolnik, 1999). Even fewer have looked at more than one country (Elbadawi, 1989, Amin 1993).

1.2 Problem Statement

The past two decades have seen an enormous growth in literature on exchange rate policies. This should be least surprising due to the fact that exchange rate plays a crucial role in the success or failure of an open economy. However, a considerable proportion of empirical works have been done mainly in developed countries. It is therefore extremely important to do some ground-work on exchange rate in developing countries by employing models suitable for them.

1.3 Objectives and significance of the study

The main objective of this study is to analyse the determinants of REER and its equilibrium path for Malawi and South Africa using an analytical technique developed by Edwards (1986, 1989, 1990) and Elbadawi (1994). Since the REER is an indispensable variable for macroeconomic and sectoral performance, it is crucial to understand the REER so as to better manage it and restore the economies on a path of rapid growth and sustainable development. Furthermore, a thorough analysis of the determinants of the REER will help give policy inputs to assist in halting the current economic decline not only for the two countries but also for the rest of less developed countries (LDCs) and improve their competitiveness.

South Africa and Malawi are members of the same trading block (Southern Africa Development Community) but their economies are radically different; one is large diversified and industrialized while the other is small, agriculture – based with a highly import dependent industrial sector and dependent on agricultural export. These stark differences are sufficient grounds for a comparative analysis.

1.4 Organization of the paper

The rest of the paper is arranged as follows: an overview of the economies of Malawi and South Africa constitutes Chapter 2. Chapter 3 reviews literature relevant to the topic under study. Chapter 4 outlines the proposed analytical framework for the study while Chapter 5 presents the empirical results. The summary, conclusions and policy recommendations of the study are presented in Chapter 6.

[3] REER misalignment refers to a deviation of the real effective exchange rate from its equilibrium.

CHAPTER 2

OVERVIEW OF THE MALAWIAN AND SOUTH AFRICAN ECONOMIES

The aim of this chapter is to provide a brief background of the performance of the Malawian and South African economies in the context of exchange rate policy.

2.1 An Overview of the Malawian economy

2.1.1. Economic Developments

Our aim in this section is to provide the background within which the real effective exchange rate model is estimated for Malawi. Beginning from its independence in 1964 up to mid 1970s Malawi's economy recorded a steady growth rate in real gross domestic product (GDP) averaging about 6.5 percent annually. This gradually slowed down over the years reaching 1.9 percent between 1976 and 1980. Malawi's period of remarkable economic growth, driven primarily by extensive growth in agricultural sector, came to a halt in the early 1980s. Dramatic declines in terms of trade combined with droughts and the emergence of transport difficulties led to sharp declines in real GDP in 1980 and 1981. In the emerging crisis, a number of factors were identified as sources of weaknesses in the economy. These included: (a) inefficiencies in the production sector as a result of price controls; (b) poor performance in the smallholder agricultural sub-sector due to a pricing structure that favoured the large scale sub-sector; (c) inefficient public enterprises due to unsystematic and wasteful investment; (d) a narrow export base comprising mainly tobacco, tea and sugar, all of which face adverse world market conditions; (e) the heavy import dependence of the industrial and energy sub-sector; (f) a generally weak incentive framework and an overvalued exchange rate (Kalua ed. 1992).

To deal with these constraints several reforms were undertaken by the government in conjunction with the World Bank in the form of Structural Adjustment Loans (SALs). Beginning 1981, SAL1 included policy reforms involving producer prices, export diversification and energy programme, reform of pricing of goods and services provided by parastatals, and rationalization of network among Agricultural Development and Marketing Corporation (ADMARC), Malawi Development Corporation (MDC) and Press corporation. These issues continued into Structural Adjustment Programme 2, (SAL2), which introduced other issues including liberalization of prices controlled by ministry of trade and industry. SAL3 introduced, among others, an estate sector credit facility, the phased elimination of the subsidy on smallholder fertilizer, completion of price decontrol programme, tax reform and the partial liberalization of smallholder produce (Kalua ed. 1992).

As a result of these developments, some early signs of success began to show in the early years of 1982 and 1984 as economic growth returned. During this recovery period, further external shocks buffeted the economy. In 1984 the rail link through Mozambique was cut off completely; the terms of trade took another nose-dive from a temporary peak in 1984, driving down the dollar value of exports by 20 percent (World bank 1982). These shocks led to two successive years of crisis management in 1986 and 1987 that was manifested in falling GDP. Malawi adjusted to these additional external pressures primarily by resorting to tight exchange controls on imports.

A broad based recovery on output began in 1988 and continued through 1989. During the period 1986-1990 the growth in real GDP averaged 2.4 percent. This was aided by the restoration of fiscal discipline and relaxation of import controls, with increased imports of intermediate and capital goods financed by both higher export earnings and higher external inflows (World Bank 1990). Due to several natural disasters in certain sectors of the country real GDP growth averaged 1.2 percent between 1991 and 1995

2.1.2 Exchange Rate Policy

The management of exchange rate in Malawi has been pursued with three major policy objectives in mind. These include: firstly, attainment of growth in real income; secondly, maintenance of a viable balance of payments position; and finally, attainment of stable domestic prices (see Reserve Bank of Malawi website).

These objectives were attained to some extent in the 1970s; but, owing to both external and internal factors, they were difficult to achieve in the 1980s. In this section we look at the evolution of the exchange rate in Malawi by focusing on periods identified as first, the par value peg to the British pound sterling; second, the peg to the trade weighted basket of the United States (US) dollar and the British pound sterling; third, the peg to the Special Drawing Rights; fourth, the peg to the trade weighted basket of seven currencies [4]; and lastly, the floating regime.

2.1.2.1 British Pound Sterling /Malawi Pound par value system (1965-1973)

The use of exchange rate as an instrument of monetary policy began as early as 1965 when the Reserve Bank of Malawi became fully operational. In November 1964, four months after independence in July 1964, Malawi adopted its own currency, the Malawi Pound, which was pegged at par to the British Sterling. The Malawi Pound later became known as the Malawi Kwacha in early 1971. At that time the Malawi currency was pegged at par to the British Pound sterling and this continued until November 1973. During the period (1965-1973), the Malawi Pound moved in tandem with movements in the British Pound Sterling. Although currency pegs enabled the maintenance of stability of the Malawi Kwacha in the 1970s, they failed to do so in 1980s. Following the devaluation of the British Pound on 18 November 1967, Malawi was one of the sterling area members, which also devalued their currencies. Malawi accordingly devalued its pound by 14 percent in November 1968.

During the peg to the British pound sterling, many developed countries including the United Kingdom maintained a fixed exchange rate system with the gold or the US Dollar. On 14 February 1971 the currency was decimalised and a new currency, the Malawi Kwacha (MK), was adopted and pegged at MK2 to sterling, which lasted up to 18 November 1973. This was during the last stages of the Bretton Woods system,

[4] The currencies were the German Mark, Dutch Guilder, Japanese yen, United States dollar, British Pound Sterling, French Franc and the South African Rand.

established in 1944, based on a fixed but adjustable exchange rate regime, which broke up in March 1973 with the advent of generalized, managed floating (legitimized in January 1975). Under the Smithsonian Agreement – which lasted from 18 December 1971 to March 1973 – the British Pound was realigned from US$ 2.40 to US$2.60 and Malawi followed suit. However, on 23 June 1972, Britain broke away from the Agreement and floated sterling, which depreciated against the dollar in the process.

2.1.2.2 Peg to weighted basket of British Pound and the US Dollar (1973-1975)

With the floating of the sterling and the introduction of generalized dirty floating in March 1973, Malawi abandoned the single currency pegging system in favour of a basket-pegging regime. Three experiments with this system have been made so far. The first one involved pegging the Kwacha to a weighted average of sterling and the dollar from 19 November 1973 to 8 June 1975.[5]

2.1.2.3 The peg to IMF (SDR) (1975-1984)

Following the shift by the International Monetary Fund (IMF) in the valuation of the Special Drawing Rights (SDRs) from gold and the dollar to a basket of currencies on July 1974, Malawi adopted an SDR peg at MK1.0541 to the SDR, which lasted from 9 June 1975 to 16 January 1984. Again, the purpose was to avoid further excessive fluctuations and depreciations of the Kwacha as the Sterling progressively depreciated in early 1975. Further, it was thought that the transmission into the country of imported inflation would be attenuated considering the oil shocks of mid – 1970. To take account of Malawi's changing trading positions, the Kwacha had been pegged to a basket of seven currencies since 17 January 1984: the US dollar, the British pound, the German Deustchmark, the South African Rand, the French franc, the Japanese yen and the Dutch guilder (see Reserve Bank of Malawi website).

There was a marked change of policy in exchange rates management in 1980s from that of the 1970s described above. In the 1980s depreciations and devaluations were accepted as realistic measures for the enhancement of the balance of payments based on a number of considerations. First, as a price of foreign exchange it is expected that a realistic exchange rate is a necessary instrument for appropriately conditioning supply of and demand for foreign exchange. Second, exchange rate actions are supposed to alter relative prices, thereby inducing expenditure–switching effects. Indeed recent devaluations in Malawi have been instituted to maintain the international competitiveness of Malawi's products in the light of rising costs due to external transportation costs. As a primary commodity exporter, currency devaluations in Malawi have been used for restoring domestic producers' profitability in relation to competing external primary producers.

Third, the exchange rate has been used to complement structural adjustment measures. Two examples can be cited in this respect, one being that the exchange rate policy has been used to reform producer prices of small holder primary producers who sell to the Agricultural Development and Marketing Corporation (ADMARC). Pass – through devaluations have been anticipated to enhance incentives in this sub – sector. The other example is that devaluations have been used to effect diversification of the production base, especially in the promotion of non-traditional exports.

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[5] The justification for this move was two fold. First, it was designed to prevent depreciation of the Kwacha and second, to reduce wide fluctuations of the Kwacha experienced as it floated *pari pasu* with the sterling.

2.1.2.4 Peg to the weighted-basket of seven currencies (1984-1994)

Despite the devaluations carried out in 1982 and 1983, the country's external situation continued to deteriorate, which was made even worse by the disruption of the traditional transport routes to the maritine ports of Beira and Nacala due to the war that was going on in Mozambique. On 17 January 1984 authorities delinked the Malawi Kwacha from the SDR and pegged it to a trade weighted basket of seven currencies representing the geographical composition of Malawi's trade and the currencies used in settling the country's international transactions. During this trade- weighted regime, the middle rate of the Malawi Kwacha exchange rate as quoted by the Reserve Bank was determined on the basis of the daily calculations of the exchange rate of the US Dollars in terms of the SDR. Rates of other currencies, namely: the Canadian Dollar, the Deutsche mark, the French franc, the Yen, the South African Rand, among others, were quoted by the Reserve Bank of Malawi on the basis of the appropriate daily cross rates as communicated by the IMF. Frequent adjustments were made with the view to realigning the Kwacha with the basket taking into account inflation differentials.

Although the peg to the trade weighted basket of currencies managed to improve the current account balance from –11.8 percent of GDP in 1983 to a low of –1.7 percent in 1984, problems in the international trading routes intensified when Beira and Nacala routes were completely closed to Malawi traffic in 1984. This forced the country to rely on long overland routes to the ports of Durban in South Africa and Dar-es-Salaam in Tanzania, a change which significantly increased the country's c.i.f./ f.o.b. margin from 22 percent in the early 1970s to over 40 percent since 1984. This worsened the country's terms of trade; thereby forcing authorities to take active exchange rate changes. Thus the Kwacha was devalued by 10 percent on August 16, 1986; by 20 percent on February 7, 1987; by 15 percent on January 16 1988; by 7 percent on 24 March 1990; and twice in 1992, by 15 percent on March 28 and 22 percent, on July 11.

2.1.2.5 Floatation of the Malawi Kwacha (February, 1994)

Until 1994, Malawi operated on a fixed exchange rate system. Thus during the earlier Structural Adjustment Programme (SAPs) devaluations were implemented from time to time to make sure that the official exchange rate did not deviate very much from the market determined exchange rate that would rule had there been a freely floating exchange rate. The frequent devaluations that had been taking place before 1994 led to the proliferation of black markets and according to the SAPs this was conducive to smuggling. On February 7, 1994, authorities took a bold step by floating the Kwacha. The Malawi Kwacha consequently depreciated to MK15.00/1US$ and the real effective exchange rate declined substantially (see figure 1a and 1b below). Several factors contributed to the adoption of the floating exchange rate regime, including: fundamental disequilibria as revealed by balance of payments pressures emanating from the 1992/1993 drought; the withdrawal of non-humanitarian development assistance by the international community on account of good governance issues; and by the fact that several member countries of the then Preferential Trade Area (PTA) had already adopted various types of market determined exchange rates.

To support the floatation of the Kwacha, other measures were also implemented in 1994. A foreign exchange retention scheme whereby exporters of non-traditional exports were allowed to retain a major portion of their export earnings was instituted. Furthermore, exporters of traditional exports, that is, tobacco, tea and sugar were

allowed to open interest earning foreign denominated accounts with domestic banks. The last two measures were meant to encourage production for export.

Switching from the fixed regime to the floating one was meant to achieve certain objectives, which can be summed up as:(see Reserve Bank of Malawi website)

- Improvement of the country's export competitiveness
- Provide an efficient foreign exchange allocation mechanism
- Dampen speculative attacks on the Kwacha
- Restore both investor and donor confidence; among other objectives.

In the early form of the floating exchange rate regime, the following features were put in place:

- authorized dealer banks were free to buy and sell foreign exchange at freely determined market exchange rates;
- Foreign exchange bureaus were authorized to engage in spot transactions with the general public on the basis of exchange rates arrived at with their clients;
- foreign exchange brokers were authorized to match orders from buyers and sellers of foreign exchange on agency basis only;
- to determine the official exchange rate, the Reserve Bank convened weekly fixing sessions at which offers to buy and sell foreign exchange from general public were matched to arrive at a clearing rate; and
- exchange rates of other currencies were determined on the basis of the cross rates of the US dollar for the concerned currencies.

From the foregoing analysis of the evolution of Malawi's exchange rate, it can be noted that the country's exchange rate management was dominated by a fixed until recently in1994. In most of these pegs, authorities attempted to stabilize the value of the Malawi currency by pegging it to a major currency, a basket of two major currencies, and to the SDR. Exchange rate policy changed from one characterized mainly by the aim to insulate the domestic currency from fluctuations in foreign currency, mostly during the period before the adoption of Structural Adjustment Programs (SAPs) between the 1970s and early 1980s. In the pre-SAP period, roughly 1964-1979, intervention in the exchange rate was invoked by the need to adjust the parity of the Kwacha on the basis of a discretionary decision by the authorities.

During the peg arrangement, adjustments to the exchange rate were made after a careful assessment of some exchange rate indicators. The most commonly used indicator was the real effective exchange rate index. During the more than two years that followed, the Kwacha stabilized through constant, deliberate interventions of the Reserve Bank. This again changed during the third quarter of 1998 when the Kwacha was set free from its managed float, and accordingly depreciated by a significant margin.

Before the floatation of the Malawi Kwacha, the Reserve Bank of Malawi (RBM) was responsible for the distribution of foreign currency for importing goods and services. This was through issuance of open general license to all importers who would then use this license to purchase foreign currency. Exporters were required to sell their foreign currency within a specified period of time to the RBM at the official exchange rate. Now with the market based exchange rate, exporters are allowed to keep part of their export earnings in Foreign Currency Denominated Accounts (FCDAs) and sell the difference to authorized dealer banks (ADBs). Currently, the exchange rate is market based. The official exchange rate is calculated as the average of the exchange rates in the authorized dealer banks.

Figure 1(a) Nominal exchange rate for Malawi

Note: *An increase indicates a depreciation*

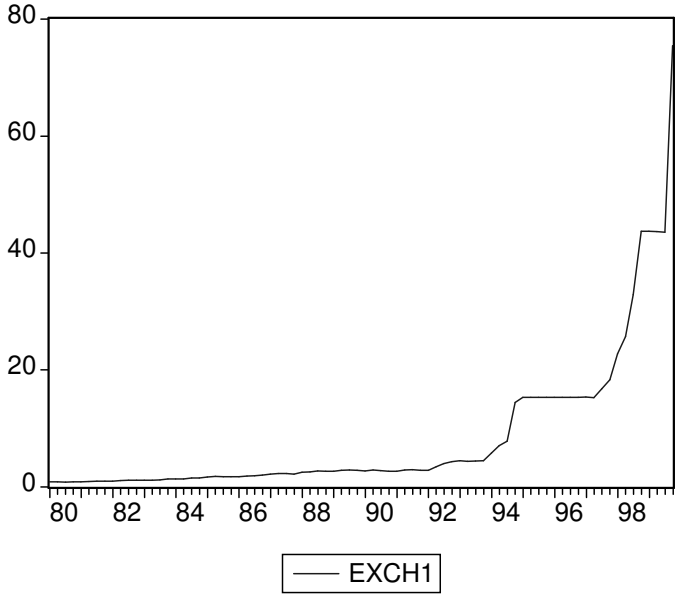
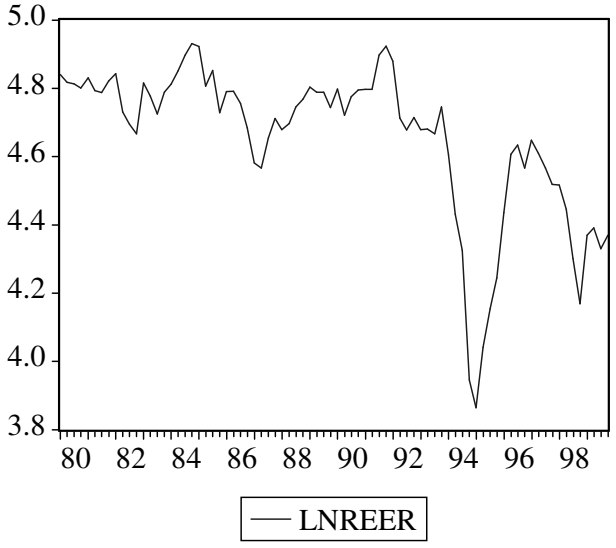


Figure 1(b) Real effective exchange rate for Malawi

Note: *An increase indicates an appreciation*
LNREER = log of real effective exchange rate



From figure 1(a) and 1(b) above, it can be seen that a decrease in nominal exchange rate expressed as Malawi Kwacha/United States Dollar, MK/US$, (in other words, an

appreciation) corresponds with an increase in the REER index (that is, an appreciation in the REER). An increase in the nominal exchange rate (in other words, a depreciation) corresponds with a decrease in the REER index (reflecting a depreciation in the REER).

Between 1970 and 1975, the RER had an appreciating trend. This could be explained by the fact that during this period there were massive capital inflows largely due to the official sector but also due to the private sector (including short-term capital inflows to the banking system). Interest rates adjustments which were used primarily to force those who had access to off-shore financing to borrow from abroad, also induced capital inflows. Consequently, this led to the appreciation of the Malawi Kwacha and the RER.

The period 1976 to 1977 experienced a modest depreciation. This was then followed by an appreciation from 1978. Inflationary pressures continued to be the major contributing factor of the RER appreciation. During the period 1981-1985, the nominal exchange rate (see figure 1a) and the RER had sharply and consistently depreciated. From Figure 1(b), it appears the REER tracked the RER as the REER during that period had episodes of depreciations as well. During this period, monetary authorities tried to restore the exchange rate whenever it appreciated.

The period 1992-1993 had experienced a modest RER depreciation followed by a significant decline in the value of the Kwacha in 1994-1995 (the REER also had a modest depreciation followed by a substantial drop in 1994 –see fig.1(b)). The large decline reflected the massive depreciations of the Kwacha occasioned by the market determination of the Kwacha in the foreign exchange on 7 February 1994.

As can be seen from figure 1(b), the RER depreciated sharply in 1994 (so did the REER-fig1b) but the authorities succeeded in fixing the exchange rate at MK15.3/US$ from January 1995 to June 1997. The real effective exchange rate strengthened to the levels of early 1990s but without the attendant controls on imports. Given now the lower tariff structure and the absence of quantitative restrictions, the rate was strongly overvalued. The authorities accordingly devalued it by 8% to MK17.2/US$ in August 1997.

2.2 Overview and background of the South African economy

2.2.1 Economic developments

South Africa undoubtedly achieved remarkable development in the 1960s with one of the highest growth rates in the world during that decade. Growth in the 1970s was much slower, with the economy registering high growth rates only during part of 1974 and again in 1979/80, owing to a boom in world commodity price of gold. In the recession of 1975-1977 real Gross National Product (GNP) remained almost stagnant (see Hutcheson, 1998). The main relatively poor performance was due to the instability of the world economy in this periodand the aggrevating effects of the disturbances following the Soweto riots in June 1976 and the unsettled political situation of South African neighbours. These factors discouraged foreign investment in South Africa. However, the economy grew significantly at a real rate of 4.2% in and in 1980 the real growth rate was 8 percent, as the high price of gold and other export commodities compensated for lack of foreign capital. Growth in the 1980s was even slower than in the 1970s, averaging only 1.4 percent per annum (See Hutcheson, 1998).

Among the factors that contributed to this poor performance included
(a) unfavourable commodity prices in international markets in particular weakening of the prices of gold, drought in 1983 and 1984; (b) the damaging effect of the political instability in causing a net outflow of foreign investment and (c) low overall investment in the economy in the late 1980s and 1990s. Real GDP fell by 4 percent between the

first quarter of 1989 and the first quarter of 1993 creating South Africa's longest recession of this century (See Hutcheson, 1998).

Severe drought, volatility of the political climate and international recession all played their part. The most serious manifestation of the recession was the decline in investment, which was equivalent to only 15 percent of GDP in 1992 and had been well below earlier levels (24 percent on average during 1982-85) since the late 1980s.

Following the remarkable democratic transformation and elections in April 1994, the government made an explicit commitment in at least two highly publicised programmes (the Reconstruction and Development Programme {RDP} and the Government's Growth, Employment and Redistribution strategy {GEAR}) to a long term development strategy for generating rapid and widely shared growth, but with a firm commitment in the short - to medium – run to macroeconomic stability. It appears that the initial assessment by international capital markets was of a sustained growth path, where the strength and sophistication of its financial markets, a strong civil society and a transparent and democratic governance were seen as areas of comparative advantage for South Africa. (See Hutcheson, 1998)

The overall performance of the South African economy since the elections in April 1994 has been disappointing. Real GDP growth slowed to 1.5 percent in 1998 and was only 1.7 percent in 1997, compared to 3.4 percent and 3.2 percent in 1996 and 1995, respectively. Apart from South Africa's labour market inflexibility, and a declining gold price from late1996, probably the most important factor affecting the growth performance has been the mode of liberalisation of the capital account and policy management of the large and volatile capital inflows from 1994 (Hutcheson, 1998)

2.2.2 Exchange Rate Policy

Beginning from December 1971 several changes have been made in the external value of the Rand in both directions. It was briefly linked to the floating pound in 1972. But from October 1972 only the Rand-United States (US) Dollar was fixed. In September 1975 the Rand (R) was devalued from R1 = US Dollar 1.40 to R1 =US Dollar1.15. In January 1979 the authorities freed the 'commercial' Rand's link with the dollar and allowed it to float. Non-residents were allowed to buy 'security' or financial Rand at a discount for direct investment purposes. In February 1983, the security Rand was abolished and merged with the commercial Rand for non-residents. Due to the outbreak of political disturbances in the second half of 1984, the Rand depreciated sharply against the dollar and all other major currencies, falling from R1 = US Dollar 0.80 in early 1984 to R1 = US Dollar 0.42 in January, 1985. In spite of the measures taken by the Reserve Bank to curtail speculation against the Rand, the escalation of violence generated a lack of confidence in the country politically and a further flight of capital led to the value of Rand falling to R1 = US Dollar 0.35 by august 1985. Coupled with the unwillingness of foreign banks to reschedule short-term loans, a moratorium on repayments was imposed in September 1985, together with the reintroduction of the two-tier system of exchange control on foreign investors. In March 1987, however, an agreement was reached with foreign creditor banks allowing a three year rescheduling of US dollar 13,000 million of outstanding debt (See Hutcheson, 1998).

The Reserve bank was unable to prevent a nominal effective depreciation of close to 19 percent between January 1993 and the end of July, 1994 (real depreciation was about 10 percent) despite borrowing from the International Monetary Fund (IMF) and significantly increasing other short-term foreign borrowing. In August 1994, the commercial Rand stood at R1 =US Dollar 0.28 and R1 =US$ 0.18 while the discount on the financial Rand was 20.59 percent reflecting the continued outflow of foreign capital.

By March 1995, however, the outflow had been reversed and the minister of finance, Christo Liebenberg, announced the termination of the dual exchange rate system (Hutcheson, 1998).

A highly pertinent factor in South Africa's exchange rate management in the period was the presence of exchange controls on both foreign and domestic investors at the time of elections. The unification of the dual exchange rate system in March, 1995 effectively brought to an end the exchange controls on foreign investors.

Later crises occurred in October 1996 and November 1997, resulting from contagious effects from the Asian crisis and decline in the price of gold and other metals. More recently, from April 1998, speculation saw the Rand reach a low of R6.35/US Dollar in July 1998 (i.e. some 40 percent below its average value of R3.61/US Dollar between the elections and the first crisis – see figure 2a and 2b). Although investors have generally revised sentiments about emerging markets in the aftermath of the Asian crises, domestic factors such as the widening current account deficit and poor growth prospects have damaged investor confidence in South Africa. Moreover, by the end of 1997, gross gold and other foreign exchange reserves measured only about ten weeks' worth of imports of goods and services (see Hutcheson, 1998).

Figure 2(a) Nominal Exchange rate for South Africa

Note*: An increase indicates a depreciation*

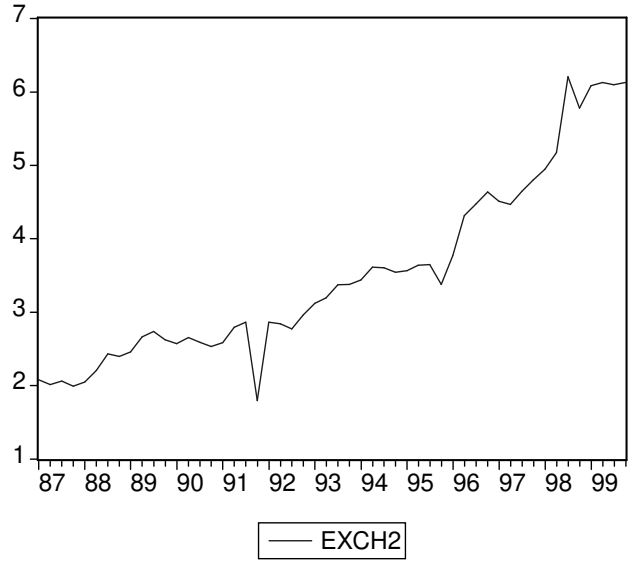
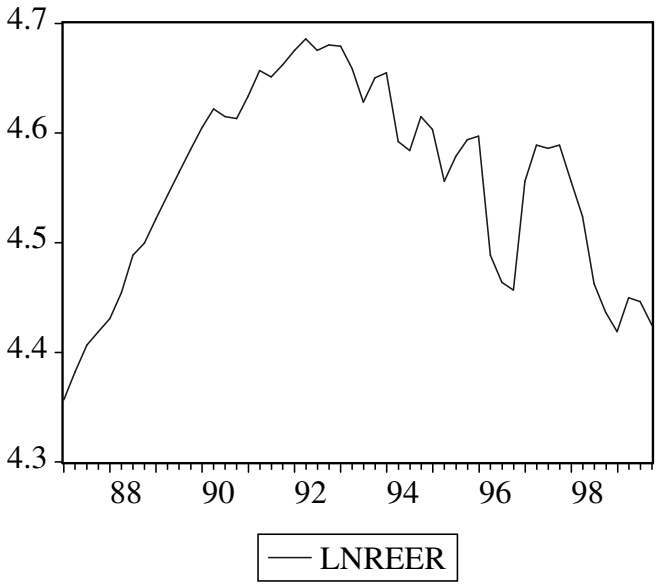


Figure 2(b) Real effective exchange rate for South Africa

Note: *An increase indicates an appreciation*
LNREER = log of real effective exchange rate



From figure 2(a) and 2(b) above, it can be seen that a decrease in nominal exchange rate expressed as Rand/US$ (in other words, an appreciation) corresponds with an increase in the REER index (reflecting an appreciation in the REER). An increase in the nominal exchange rate (in other words, a depreciation) corresponds with a decrease in the REER index (reflecting a depreciation in the REER).

The direction of exchange rate movements in South Africa was dictated by the gold price and political developments. However, both nominal and RER appreciated in response to rising gold prices in 1980 and 1982 and depreciated significantly after the political events of 1984. The period 1984 to 1988 had greater incidence of external and internal real shocks. One of them was the removal of capital controls on non-residents. The Rand depreciated sharply due to fall in direct investment in South Africa and a decline in gold price (Barr and Kahn, 1995). The behaviour of RER was highly volatile between 1979-1988 and somewhat less unstable during 1988-1994.

CHAPTER 3

LITERATURE REVIEW

3.1 Theoretical Literature

In the majority of empirical models the Real Exchange Rate (RER) is calculated from a purchasing power parity relation. This indicates an underlying tendency of movements in the nominal exchange rate to offset movements in the ratio of foreign and domestic price levels (see among others Edwards, 1994; Elbadawi, 1994; Faruqwee, 1995).

Usually, the relationship is formulated as follows:

$$RER_t = Ex_t * P^f{}_{Tt} / P_{NT} \qquad (1)$$

Where Ex_t is the nominal exchange rate defined as the domestic price of foreign currency, $P^f{}_{Tt}$ is the world price of tradables and P_{NT} is the domestic price of non-tradable goods, and all variables are in logs. Generally Ex_t and $P^f{}_{TN}$ are trade weighted. There are different empirical measures of RER used in the literature, but the most frequently used is the multilateral index. This index is also referred to as the real effective exchange rate (see footnote 2, p.1).
Snape (1988) presents a number of reasons why some empirical studies use the Purchasing Power Parity (PPP) approach rather than the ratio of domestic price of tradables to domestic price of non-tradables. First, he argues that the idea of price relation between tradable and non-tradable goods breaks down in situations where no clear distinction exists between tradable and non-tradable goods. Second, in circumstances where import competing goods are not substitutes for imports, or where the *ad valorem* effects of subsidies and trade barriers change, the domestic price of tradable goods is not linked to the world price market, and changes in the domestic tradable-non-tradable price ratio may not accurately be reflected in the real exchange rate. Finally, domestic pressures can change both the prices of tradables and non-tradables and the terms of trade. In such a situation, importable and exportable goods prices cannot be combined to obtain an aggregate tradable goods result.

3.1.1 Equilibrium Real Exchange Rate

Mundell (1971) using a macroeconomic model of a monetary economy provided an early formal analysis of the determination of the equilibrium real exchange rate. Assuming a case of a small open economy that faces given prices, Mundell defined the equilibrium real exchange rate as the relative price of international to domestic goods that simultaneously equilibrates the money market. Even though Mundell did not explicitly use the term real exchange rate, his analysis rigorously described how the equilibrium relative price of tradables to non- tradables is described. A problem with this model and a number of other models of the equilibrium real exchange rate is that they do not allow

for a distinction between the effects of temporary and permanent changes in the determinants of the real exchange rate.

Later, Edwards (1988) developed a real intertemporal model with optimizing consumers and producers to analyse the determination of the equilibrium real exchange rate. He starts the analysis with a general equilibrium model of the determination of the RER that is consistent with the simultaneous attainment of internal and external equilibrium.

Edwards (1988, 1989b) starts from the portifolio decisions and divides the economy into the demand side, supply side, government sector and the external sector. The model considers a small open economy with three sectors (exportables, importables and non-tradables), for which the international price of traded goods is assumed to be exogenous while that of non-tradables is endogenously determined by the forces of demand and supply in the domestic market (Elbadawi and Sato, 1994).

The long run equilibrium RER is a function of real variables only – the fundamentals. It implies that higher levels of absorption, trade taxes and government expenditure on non-traded goods are consistent with a more appreciated REER. The effects of TOT and total government expenditure on the RER cannot be determined *a priori.* Thus whenever there are changes in these variables, there will be changes in the ERER.

The effect of an increase in total government expenditure on the EREER depends on the composition of this expenditure. If it falls fully on tradables, the ERER will tend to appreciate. But if it falls fully on tradables then there will be an equilibrium real depreciation (Edwards 1990, Elbadawi and Sato 1994). Usually the effects of these fundamentals on the ERER and RER are similar. More information about the effects of the fundamentals is given in chapter 4 under section 4.2.

The concept of equilibrium real effective exchange rate (RER) is only theoretical since it is not observable. In the literature, the equilibrium RER is referred to as the "appropriate" exchange rate. As already discussed in relation to Edwards (1989) intertemporal model, the appropriate RER is that RER that is consistent with with internal and external equilibrium. In his model, there is not one equilibrium value of the real exchange rate, but rather a path of equilibrium RERs. Internal equilibrium means that the non-tradable goods market clears in the current period and is expected to be in equilibrium in the future periods. External equilibrium on the other hand is attained when the current account balances (current and future) are compatible with long sustainable capital flows (Edwards 1989, Elbadawi and Sato 1994) The equilibrium real exchange rate (ERER) is obviously not a fixed number that does not change over time. This therefore implies that when there are changes in any of the other variables that affect the countries internal and external equilibrium, there will also be changes in the ERER. The ERER is therefore a function of fundamentals. These fundamentals and the RER jointly determine the country's internal and external position. Edwards (1988) distinguishes between the external and domestic RER fundamentals. The external RER fundamentals include international terms of trade, international transfers including foreign aid and world real interest rates, while the domestic RER fundamentals include those variables that are directly affected by policy decisions (for instance import tariffs, import quotas and export taxes, exchange and capital controls, the composition of government expenditure) and those that are independent of them, for instance, technological progress.

3.2 Empirical Literature

Few studies have been conducted to explain real exchange rate movements in Malawi and other countries. Even fewer have looked at a more than one country. Most studies have concentrated on explaining the domestic rate of inflation, where the nominal exchange rate enters as one of the explanatory variables (see Canetti and Greene, 1991; Killick and Mwega, 1989; Mwega, 1990; Ndung'u, 1993, 1995). Others have estimated a money demand equation where nominal exchange rate enters as one of the explanatory variables (Adam, 1992). Only few of these studies attempt to establish a statistical relationship between money and the exchange rate. For example, in Canneti and Greene (1991) and Ndung'u (1995), money supply growth, inflation and exchange rate (among other variables) are analysed in a vector autoregressive model. The authors find that money supply growth drives nominal exchange rate movements , or even directly explain the movements in the real or nominal exchange rate.

In his analysis, Edwards (1988) used pooled data for the period 1962-1985 for 12 countries (Brazil, Columbia, Elsavador, Greece, India, Israel, Malaysia, Malaysia, the Philippines, South Africa, Srililanka, Thailand and Yugoslavia). To estimate the relationship between real exchange rate (RER) and its determinants, he used the following partial adjustment model: RER = f (terms of trade, government consumption, capital controls, exchange controls, technical progress, domestic credit, real growth, nominal devaluation)

All the variables were in logs except domestic credit, real GDP growth and nominal devaluation. The coefficients of terms of trade were found to be negative and significant at conventional levels. This indicated that improvements in terms of trade results in real exchange rate appreciation. The index proxying exchange and trade control was significantly negative indicating that a relaxation of the extent of impediments to international trade resulted in equilibrium real exchange rate depreciation. The coefficient of real growth was found to be positive and significant implying that economic growth is associated with increases in the relative price of non-traded goods, thus appreciating the RER.

He also tried to investigate the view that the reaction of the real exchange rate to liberalization depends on whether these policies are temporary or permanent. He decomposed capital flows and exchange controls into permanent and temporary components. He found that while the permanent control variable had a significantly negative effect on the real RER, a temporary increase in this variable had an insignificant positive effect. Regarding capital flows, however, the results were not conclusive.

Ndung'u (1993) looked at the dynamics of the domestic price level, exchange rate and the foreign price level. He estimated an equilibrium real effective exchange rate that encompassed different exchange rate regimes, estimated as a cointegrating vector that spanned these three variables. This equilibrium real effective exchange rate was compared with the nominal and real effective exchange rates and showed periods of overvaluation during the fixed exchange rate regime. The floating or (partial float) covered only one year and created a depression. This reflected the stiff depreciation in 1993 and thus lowered the real rate but quickly returned to its original level. Further analysis showed that the rate of inflation and exchange rate changes drive each other, while the foreign rate of inflation and the real effective exchange rate drive the nominal exchange rate changes.

In the second part of the paper, he identified two significant cointegrating vectors that spanned the data. He chose a linear combination of the variables that were most significant. The vectors helped in performing the Granger Non Causality tests with stationary variables both in log differences and in stationary linear combinations. The

results showed that inflation was predicted by exchange rate changes and changes in international reserves with strong reverse effects. That is, the variables drive each other. Domestic credit and real income growth predicted inflation. Exchange rate changes were predicted by changes in domestic credit with reverse effects, while changes in domestic credit and international reserves drove each other. When money supply growth was incorporated, it showed that it drives the exchange rate changes and the rate of inflation with no reverse effects.

In the dynamic analysis, the results showed that the rate of inflation and exchange rate changes were dominant in accounting for their own innovations and were little aided by shocks in other variables. This was not the same with the growth in domestic credit and international reserves. Thus, for the growth of domestic credit and international reserves, the domestic rate of inflation and exchange rate changes were dominant in accounting for their innovations. Shocks to these variables were transmitted to the innovations in the exchange rate changes and inflation. The paper therefore conclude that exchange rate and domestic price level are important variables in macroeconomic stability and that the exchange rate changes together with the rate of inflation drive each other and other macro variables.

Elbaldawi (1994) developed and implemented equilibrium real exchange rate (ERER) to Chile, Ghana, and India. He specifies a log linear model where the ERER is a function of terms of trade, degree of openness, ratio of net capital inflow to GDP, the ratio of government expenditure to GDP and the ratio of current government expenditure to total government expenditure.

After testing and verifying that a long run equilibrium relationship exists between RER and economic fundamentals an error correction model is estimated. For the cases of Chile and India, the results strongly support the error correction model, with the coefficient of the error correction term all negative and, less than one, and highly significant. The corresponding estimate for Ghana is also negative and less than one but is moderately significant. The elasticities are estimated at 0.78, 0.71, and 0.67 for Chile, Ghana and India, respectively.

Lwesya (1997) examined the determinants of real exchange rate (RER) in Malawi. To achieve this, a model of RER determination was developed and empirically estimated. The study also investigated the effects of incorrect real exchange rate alignment on macroeconomic performance, focussing on growth in real gross domestic product, export and import performance.

Results from the cointegration equation showed that in the long run, the degree of opennness and capital flow strongly influence the RER. Based on the error correction model, the study found that unsustainable government deficits and excess supply of domestic credit appreciate the RER. After the values of of the RER misalignment from the cointegrating equation were calculatedand regressed on various measures of macroeconomic performance, real exchange rate misaligment adversely affected economic growth, import and export performace.

The findings provided evidence of the importance of sustainable macroeconomic policies that prevent the RER from becoming misaligned. In Particular, there was need for the government to undertake measures such as tightening of fiscal expenditures, as this would help reduce excessive borrowing of government from the banking system.

Montiel (1997) developed a model in which long run equilibrium exchange rate is defined as the real exchange rate that is compatible with steady state equilibrium for the economy net international creditor position, conditioned on permanent values of a

variety of policy and exogenous variables. The main objectives of the paper were to identify relevant set of variables, and explore the direction of their influence in the context of the analytical model, which was intended to be transparent yet sufficiently general so as to accommodate a wide variety of factors that could potentially influence the long run real exchange rate.

In his rigorous analysis, Montiel identifies several variables, which are thought to have an impact on the Equilibrium Real Exchange Rate (ERER). He classifies the first group of factors as domestic supply factors. He argues that the most venerable theory regarding long run real exchange rate determination is the Balassa-Samuelson effect. This was incorporated in the analysis in the form of an asymmetric productivity shock following traded goods sector. The ERER appreciates because excess demand is created in the non-traded goods sector. Second, changes in the composition of government spending between traded and non-traded goods affect the long run ERER in different ways. Additional tax -financed spending on non-traded goods creates incipient excess supply in that market, requiring a real appreciation to restore equilibrium. On the other hand, tax financed increases in spending on traded goods put downward pressure on the trade balance, and requires a real depreciation to sustain external balance.

The third category is changes in international economic environment. The aspect of the world economic environment analysed by Montiel consists of the Terms of Trade (TOT) for domestic economy, the availability of external factors, the level of real interest rates, and the world inflation rate. Improvement in the TOT and increases in the flow transfers received, tend to appreciate the ERER, the former by improving the trade balance and creating excess demand for non traded goods, and the latter through positive effects on the current account. On the other hand, reduction in real interest rate and increases in the world inflation cause the long run ERER to depreciate. Lower world interest rate cause capital inflows which reduce the country's net creditor position over time, and the long run loss of net interest receipts requires a real depreciation to maintain external balance. Changes in the world inflation affect the ERER through effects on transaction costs associated with changes in real money balances.

Finally, trade liberalisation analysed in the form of a reduction in exports subsidies, is associated with the long run real depreciation. The effect works by channeling into non traded goods sector. The emergence of incipient excess supply in the non-traded goods market dictates the nature of the adjustment in the RER. Montiel's model is summarized as follows: ERER = f (domestic supply side factors, fiscal policy, changes in commercial policy)

Ogun (1998) specifies models of real effective exchange rate (REER) and export in order to analyze the real exchange movements in terms of misalignment and volatility in the growth of non-oil exports in Nigeria for the period spanning the years 1960 to 1990. In particular, the export equation, estimated by the Engle-Granger technique, is specified as a function of foreign real income, relative prices, TOT, REER volatility and misalignment. Its counterpart, the real exchange rate is specified as a function of TOT, net capital inflows, an index of severity of the trade restriction and capital, government expenditure of non-tradable, technological progress, index of macroeconomic imbalances, and REER lagged by one period. Both equations are estimated using the Engle-Granger approach and ordinary least square method. Econometrically interesting findings are obtained. For the real exchange rate equation, all coefficient have the expected signs except for TOT, all are statistically significant at the conventional 5 percent level. The results from the non-oil export equations show that REER misalignment occurring in the current period adversely affects the country's non-oil exports and the current and lagged values of the REER volatility exerts a negative effect on the growth of non-oil export. Based on this available evidence, Ogun (1998)

concludes that the introduction and maintenance of the policies that would reduce REER misalignment and produce a stable exchange system in Nigeria would serve to benefit the growth of the country's non-oil exports.

Bolnik (1999) implemented the now standard approach of Edwards (1989), Kawai and Ohara (1997), Mongardini (1998) and others to model equilibrium real exchange rate, linking the 'fundamental determinants' in the context of the Salter-Swan-Corden dependent model to Malawi. His main objective was to find the path of real exchange rate that is needed to achieve, simultaneously, internal and external balance. An exposition of a simplified version of Montiel (1997) model served to explain the main concepts and justify the empirical implementation.

Several fundamental assumptions were made regarding the economy in question including that: (a) It was first assumed that the economy is a price taker in the world market; (b) there are two sectors producing traded and non-traded outputs Q_T and Q_N respectively; (c) third, output in each sector is produced with a fixed, sector- specific factor and homogeneous mobile labour; and (d) fourth, the economy is open, and has a predetermined nominal exchange rate and flexible domestic wages.

With the above assumptions, two real exchange rate models were specified. In the first equation the exchange rate was specified as a function of terms of trade (TOT), degree of openness, smallholder output of maize, floating rate dummy and, finally, a proxy for capital inflows- the ratio of imports minus exports to gross domestic product (GDP). The second model was specified with similar variables except that the floating dummy was replaced by government consumption as a ratio of GDP. Alternation of the two variables, "government consumption" and a "floating rate dummy" was necessitated by the fact that with the two lags in the underlying Vector Autoregression (VAR), there were not enough degrees of freedom to permit inclusion of all variables in the model.

Several important econometric results are reported. In both specifications, the null hypothesis of 'no cointegration' was rejected at 1 percent level by the Johansen likelihood ratio test. Also, the Engle-Granger test showed that there was cointegration. The signs of the coefficients were as expected in all cases except that of the coefficient on the floating rate in the Johansen implementation of the second equation. With the Johansen method, all the coefficients are significant at 5 percent or less; with the 1996 nominal exchange rate of K16.40 to a dollar in 1997, the equilibrium exchange rate was K18.30 in the 1996 and K20.90 in 1997. The rate of overvaluation was 20% in 1996, worsening to 27% in 1997.

Ndung'u (1999) analysed the effects of expansionary monetary policy on the real and nominal exchange rate. The results showed that excess domestic credit or excess money supply feed into the cyclical movements of the real exchange rate. In addition, the cyclical movements of the real exchange rate drive each other with excess money supply growth.

Masiye (1999) looked at the determinants of real effective exchange rate in Malawi. He began by looking at two models: the simple naïve-no-change model which predicts the future exchange rate as its recent past level and the structural model of exchange rate determination following Edwards (1988) work on exchange rate determination for the developing countries. The findings of the naïve model indicated that its own past level significantly influenced the real effective exchange rate in a positive way. The findings of a structural model (both from the Ordinary Least Squares and Two Stage Least Squares estimates) indicted that the real effective exchange rate was influenced by such fundamentals as the degree of openness, terms of trade, government consumption,

excess domestic credit, capital flows as well as technological progress proxied as the growth of real GDP.

CHAPTER 4
METHODOLOGY

4.1 Model specification

This chapter outlines the analytical framework that will be used in this paper. The major motivation is to assess factors affecting REER for Malawi and South Africa.

The REER model we use in this study is adopted from Edwards (1988, 1989, 1990), and Elbadawi (1994):

$$LogREER = a_0 + a_1 \log TOT_t + a_2 \log GCON_t + a_3 \log TP_t + a_4 \log CF_t + a_5 \log OPN_t + e \quad (2)$$

Where

REER = real effective exchange rate defined.

TOT = terms of trade defined as the ratio of export price (index) to import price index.

GCON =government consumption on non-tradable goods measured by recurrent expenditure.

TP =technical progress measured by the industrial production index.

CF =capital inflows measured as the difference between net change in reserves and trade balance scaled by GDP.

OPN =trade orientation measured as ratio of the sum of exports and imports to GDP.

e =the white noise process.

t =time index and a_0 to a_5 are the parameters to be estimated.

In the short run however, the real exchange rate movements respond to both real and monetary disturbances. In the short run model, therefore, EXSDC, a variable measuring excess supply of domestic credit, is included in the model. Excess supply of

domestic credit in this study will be measured as the difference between growth in domestic credit and growth in real GDP.

$$EXSDC = (\Delta \quad D_t \ / \ DC) - \Delta \ln Y_t) \qquad (3)$$

This assumes that the demand for domestic credit has a unitary elasticity with respect to real income. The specific model to be estimated is then as follows:

$$\text{Log REER} = a_0 + a_1 \log TOT_t + a_2 \log GCON_t + a_3 \log TP_t + a_4 \log CF_t$$
$$a_5 \log OPN_t + a_6 PENDUM + a_7 \log REER_{t-1} + a_8 \log EXSDC_t + U$$

Where PENDUM is the political economy dummy designed to capture policy changes.

4.2 Definitions of Variables and Expected Signs

(1) *International terms of trade*

This is defined as the ratio of the world price of the country's exports to the world price of imports. The expected sign for the terms of trade coefficient can either be positive or negative. Conventionally, an improvement in terms of trade improves the current account resulting in an appreciation of the real effective exchange rate. A decline in terms of trade worsens the current account leading to the depreciation of the real effective exchange rate.

(2) *Government consumption*

In the context of the present work, this can be defined as the ratio of government recurrent expenditure to GDP. As for the sign on government consumption, the effect of changes of this variable on REER will depend on whether the expenditure is directed towards the tradables or non-tradables sector. When spending is directed towards the non-traded goods sector, the price of the non-traded goods rises relative to that of traded goods thereby appreciating the real effective exchange rate. The reverse is true when expenditure is directed to the traded goods sector (Elbadawi and Sato, 1994). Thus the anticipated sign is not clear.

(3) *Technological Progress*

According to Bela Balassa (1964), a faster technological progress is usually associated with stronger productivity in the tradables sector than in the non-traded goods sector. This tends to appreciate the REER, because prices of the non-tradables tend to rise relative to prices of the tradables. Hence the expected sign for technological progress is positive.

(4) *International Capital Flows*

Changes in capital flows are influenced by removal of domestic capital controls, autonomous increases in foreign grants, and a fall in world interest rates leading to a rise in foreign borrowing. Capital inflows are accompanied by increased consumption of both traded and non-traded goods. If part of the increase in absorption is directed towards the non-traded goods sector of the economy, the price of the non-traded goods rises relative to the price of traded goods, thereby causing the real effective exchange rate to appreciate. (Forsu, 1992). Therefore the expected sign for international capital flows can either be positive or negative.

(5) *Degree of openness*

Defined as the ratio of the sum of imports and exports of goods and services over GDP, this ratio is influenced by factors affecting trade such as tariffs, quotas, as well as subsidies, in which case the ratio represents trade policies. An import quota decreases

openness of the economy and causes REER to appreciate by improving the current account. On the other hand, trade liberalisation through tariff reductions or removal of quantitative restrictions increases imports and worsens the current account balance, thereby causing the RER to depreciate (Obadan, 1994). Thus a negative sign is anticipated for degree of openness.

(6) *Lagged REER*
According to Edwards (1988b) the lagged REER should have the expected positive partial effect. This is not surprising especially in the light of the consideration of the time series properties of the REERs. In most cases, the current value of a variable is influenced in a positive way by its past value. Hence a positive sign is expected for this variable.

(7*) Excess domestic credit*
This variable captures the effect of domestic credit policy and is defined as the difference between growth in domestic credit and growth in real GDP (IMF 1994). From economic theory, excess domestic expansion correlates inversely with the REER, such that an increase in domestic credit should cause the REER to appreciate. Excessive monetary expansion lowers interest rates (nominal and real), boosts the domestic demand for non-traded goods, thereby causing the REER to appreciate (Obadan, 1994). Therefore a positive sign is anticipated for this variable.

4.3 Data sources
The study uses secondary quarterly data for the period spanning the years 1980 to 1999 for Malawi and 1987 to 1999 for South Africa. The selection of the study periods was dictated by the availability of data. All the data required were been obtained from International Monetary Fund, *International Financial Statistics*, Yearbook, various issues; and National Statistic Office, *Monthly Statistical Bulletin*, various issues.

The application of the model specified in section 4.1 required data in the following variables: real effective exchange rate, external terms of trade, Government consumption, exports, imports, GDP, foreign and domestic price index, nominal exchange rates, technological progress and domestic credit.

Due to usual data limitations in most developing countries including Malawi some of the fundamentals have been proxied by other variables hence caution should be exercised with estimates resulting from the use of the proxies. For instance, technological progress has been proxied by the industrial production index. Quarterly GDP series were generated since analysis of the study is on quarterly basis and quarterly GDP figures are not produced. Hence, industrial production index will be used in this study to convert annual GDP to quarterly GDP even though it might not be the best converting scheme given that Malawi mainly produces primary commodities. Also due to the problem of finding data on government consumption for Malawi, the ratio of total government expenditure to GDP, GCON, has been used. However, in the case of South Africa, data on government consumption was readily available.

4.4 Estimation Technique

Estimation will be by Ordinary Least Squares (OLS) but before doing it a number of tests have to be undertaken. We begin by testing for stationarity.[6] The test for stationarity is meant to examine the order of integration of the variables. We test for

[6] A variable is considered to be stationary if the effect of a random disturbance dampens out over time. A variable that exhibits no tendency to return to its original value following a disturbance is said to be non-stationary

stationarity to ensure that we are not analyzing inconsistent spurious relationships. The existence of non-stationarity in a time series implies that the series have a unit root. The Augmented Dickey-Fuller test for unit roots indicates whether an individual series x is stationary or not, by running an equation of the form;

$$X = a + bX_{t-1} + \sum_{i=1}^{k} cidX_{t-i} + e_t \qquad (6)$$

Where dX are the first differences of the series, and t is the current time period measured in quarters. The other unit root test is the Phillips Perron (PP) test.

After determining the presence of unit root in the variables, the next stage is to test for cointegration.[7] First, a cointegrating equation is estimated. Cointegration methodology requires that the variables in the cointegrating equation be both non-stationary and integrated of the same order. The residuals of the cointegrating regression, which provide information about the long run relationship among variables are then tested for stationarity using two procedures-the Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test. Stationarity of the residuals from the cointegrating equation indicate presence of cointegration.

A cointegration regression is as follows:

$$\log REER_t = a_0 + a_1 \log TOT_t + a_2 \log GCON_t + a_3 \log TP_t + a_4 \log CF_t + a_5 OPN_t + a_6 PENDUM + a_7 \log REER_{t-1} + a_8 EXSDC_t + u \qquad (7)$$

If the existence of cointegration is established, then the error correction model will efficiently represent the relationship between the dependent and independent variables[8] (see Engle and granger, 1987). So the final stage is to estimate an error correction model. In constructing the error correction model, the error correction term obtained by running the cointegrating regression is included as one of the explanatory variables. All I(1) variables are entered in first differences. The error correction model represents the short run dynamics of the real effective exchange rate.

The representative error correction equation consistent with the assumed equation 7 is given below:

$$\Delta REERt = b_0 + b_{1i} \sum_{i=0}^{4} \Delta(REER_{t-1}) + b_{2i} \sum_{i=0}^{4} \Delta(TOT)_{t-i} + b_{3i} \sum_{i=0}^{4} \Delta GCON_{t-i} + b_{4i} \sum_{i=0}^{4} \Delta EXSDC_{t-i} + b_{5i} \sum_{i=0}^{4} \Delta(TP)_{t-i} + b_{6i} \sum_{i=0}^{4} \Delta(OPN)_{t-i}$$

[7] Non-stationary variables are said to be cointegrated if their linear combination is itself stationary. Cointegration implies presence of long run equilibrium relationship between dependent and independent variables.

[8] A short run equation would otherwise be estimated in the absence of cointegration.

$$+ b_{7i} \sum_{i=0}^{4} \Delta(CF)_{t-i} + b_8 ECT_{t-1} \qquad (8)$$

where Δ is the first difference operator, ECT_{t-1}[9] is the error correction term obtained as a residual from equation (7). The error correction term coefficient shows the amount of disequilibrium or strength of adjustment that is transmitted each period to the real effective exchange rate. The error correction term forms the long run part of equation (8) while the variables in differences form the short run part of the error correction model. Note that all variables in equation (8) are I(0). From Hendry's general to specific approach, four lags are first included on the explanatory variables and one lag on the error correction term to obtain an over-parameterised equation.

4.4.1 Testing for Unit-Root

A series is said to be integrated of order zero, denoted I(0), if it is stationary in levels. On the other hand, if a series needs to be differenced once to become stationary it is said to be integrated of order one denoted I(1). The primary problem, which arises from attempting to analyse a non-stationary series, is that the usual standard tests of significance are invalid. Thus a different distributional theory is required for non-sationary processes.

We begin our empirical investigation by presenting table 1(a) and 1(b) the test results of the null hypothesis of the presence of a unit root.[10] Two widely used tests of a unit root – the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) test – are performed. The PP test is more powerful than the ADF test. The null hypothesis of a unit root is tested against the alternative hypothesis of stationary data. If the test statistic is less than the critical value (in absolute terms), the null hypothesis is rejected and we conclude that the data has no unit root. If, on the other hand, the test statistic is greater than the critical value we fail to reject the null hypothesis and the inference is that there is a unit root. The results of table 1(a) and 1(b) for level variables indicate that the null hypothesis cannot be rejected at the 5% significance level for all variables except for capital flows, nominal devaluation and excess domestic credit. However, results in table 2(a) and 2(b), for the first difference variables indicate that the null hypothesis is rejected at the 5% significance level for most variables. Thus the level variables in the model are I(1) except capital flows, nominal devaluation and excess domestic credit.

Table 1(a): tests for a unit root in level variables (Malawi)

Variable	ADF	PP
LNIPI	-0.099914	- 0.925730
	(1)	(3)
LNOPN	-0.217977	- 0.446265
	(1)	(3)
LNREER	-0.510796	- 0.593634
	(1)	(3)
LNRGCON	-0.663546	- 0.622346
	(1)	(3)
LNTOT	-0.016282	- 0.043032

[9] The current period error correction term is not a valid regressor. Its inclusion will render our system singular (see Adam 1992).

[10] we use two unit root tests here in particular the PP test is used since it is a generalization of the Dickey Fuller test procedure but does not require the errors to be serially uncorrelated or homogenous. Instead, the PP allows the residuals to be weakly dependent and heterogeneously dependent.

	(1)	(3)
NOMDEV	-4.2110	- 4.262444
	(1)	(3)
EDC	-7.403408	- 7.267621
	(1)	(3)
CF	-6.053298	- 6.086578
	(1)	(3)

Critical values for ADF are –2.5926 at 1%, -1.9444 at 5% and –1.6179 at 10%. For the PP test the critical values are –2.5922 at 1%, -1.9443 at 5% and –1.6179 at 10%. The values in the parentheses below the ADF denote the number of lags for the variable while those below the PP test denote the truncation lags for the equation.

Table 1(b): tests for a unit root in level variables (South Africa)

Variable	**ADF**	**PP**
LNIPI	-0.010898	- 0.43414
	(1)	(3)
LNOPN	0.684641	0.878583
	(1)	(3)
LNREER	-0.043891	0.232084
	(1)	(3)
LNRGCON	-0.238188	- 0.200491
	(1)	(3)
LNTOT	0.771432	0.676839
	(1)	(3)
NOMDEV	-4.269890	- 5.269890
	(1)	(3)
EDC	-4.925718	- 7.645255
	(1)	(3)
CF	-2.248739	- 2.886521
	(1)	(3)

Critical values for ADF are –2.6090 at 1%, -1.9473 at 5% and –1.6192at 10%. For the PP test the critical values are –2.6081 at 1%, -1.9471at 5% and –1.6191 at 10%. The values in the parentheses below the ADF denote the number of lags for the variable while those below the PP test denote the truncation lags for the equation.

Table 2(a): Test for a unit root in the first difference variables (Malawi)

Variable	**ADF**	**PP**
DLNIPI	-23.01518	- 20.89321
	(1)	(3)
DLNOPN	-13.84312	- 13.57073
	(1)	(3)
DLNREER	- 5.607385	- 6.673397
	(1)	(3)
DLNRGCON	-10.55565	- 25.53823
	(1)	(3)
DLNTOT	-7.957723	-11.12373
	(1)	(3)

The critical values for ADF are –2.5929 at 1%, -1.9445 at 5% and –1.6180 at 10%. For the PP the critical values are –2.5926 at 1%, -1.9444 at 5% and –1.6173 at 10%

Table 2(b): Test for a unit root in the first difference variables (South Africa)

Variable	ADF	PP
DLNIPI	-9.061767 (1)	- 11.90485 (3)
DLNOPN	-6.372140 (1)	- 6.198960 (3)
DLNREER	- 5.073439 (2)	- 4.920890 (3)
DLNRGCON	-6.707748 (1)	- 5.451290 (3)
DLNTOT	-7.750886 (1)	-5.196016 (3)

The critical values for ADF are –2.6100 at 1%, -1.9474 at 5% and –1.6193 at 10%. For the PP the critical values are –2.6090 at 1%, -1.9473 at 5% and –1.6193 at 10%

4.4.2 Cointegration Test

In order to establish whether the variables are in fact cointegrated, the unit root test is carried out on the error correction terms. The estimation procedure is important for two main reasons. First, we need to know the plausibility of estimating an error correction model that incorporates the long run information lost by differencing the variables. The variables are differenced to make them stationary so that we can carry out tests of significance using the usual inferential procedures. Second, we want to know the speed of adjustment of the REER to the long run equilibrium level. The validity of the REER model as a long run representation depends on whether there is a long run equilibrium relationship between the REER and fundamentals. With the optimal lag of 1, in the case of Malawi, the ADF statistic is –2.995233 and that of Phillips Perron with the optimal lag of 3, is –2.687021. The critical values for the ADF and PP at 5% level of significance are –1.9445and –1.9443, respectively. In the case of South Africa, still with the optimal lag of 1, the ADF statistic is -3.493218 and that of Phillips Perron with the optimal lag of 3 is –3.136610. The critical values for the ADF and PP at 5% level of significance are –1.9473 and –1.9443, respectively. Both tests confirm that the residuals from the long-run model are stationary at 5% level of significance. This indicates presence of cointegration.[11]

4.4.3 Granger Causality Test

With the order of integration established, and a long run equilibrium relationship between REER and some of its determinants found, it is useful to test the existence and direction of causality between real effective exchange rate on one hand and its determinants on the other hand. Owing to its popularity in this type of work, the Granger (1969) causality test[12] is used for this purpose. Results of this test are

[11] From a statistiscal point of view the cointegration of integrated series can be equivalently represented by an error correction modeling framework, which combines both the long run adjustments and short run dynamics of the series.

[12] The Granger causality test results should be interpreted with a grain of salt because of causality or non-causality due to omitted variables. Unless all important variables have been included in the model, one cannot make the right conclusion. It is also argued that Granger

presented in table 3(a) and 3(b) below. The results reveal no endogeneity between the vector of explanatory variables and the dependent variable. Thus the use of Ordinary Least Squares (OLS) in this case is valid. Results of the test indicate that, in the case of Malawi, nominal devaluation, capital flows, and changes in government consumption Granger-cause changes in real effective exchange rate in a unidirectional manner. Likewise, in the case of South Africa, capital flows, nominal devaluation, changes in industrial production and terms of trade Granger-cause changes in REER and not vice-versa. The results further support the use of OLS technique as an appropriate estimation technique.

CHAPTER 5

REGRESSION RESULTS AND INTERPRETATION

5.1 The Long-run Model

Having established that there is no two-way causation between the vector of explanatory variables and the dependent variable, by using Granger (1969) method, we proceed with our estimation using the OLS estimation procedure.

The long-run model for Malawi and South Africa is given as follows:

$$\text{Log}(REER_t) = \alpha_0 + \alpha_1 \text{Log}(IPI_t) + \alpha_2 \text{Log}(OPN_t) + \alpha_3 \text{Log}(REER_{(t-1)}) + \alpha_4 \text{Log}(GCON_t) + \alpha_2 \text{Log}(TOT_t) + u$$

Results of the long run real effective exchange rate equations for Malawi and South Africa are given in Table 4(a) and 4(b), respectively, below:

Table 4: The Long-run Real Effective Exchange Rate equations

	Malawi	**South Africa**
VARIABLE	COEFFICIENT	COEFFICIENT
Constant	0.786215	-0.963024
	(1.643206)	(-1.821328)
Log IPI$_t$	-0.010070	0.010296
	(-0.189035)	(0.155033)
Log OPN $_t$	-0.114808	-0.086442)
	(-2.507146**)	(-4.292480)***
Log REER$_{t-1}$	0.875164	0.791078
	(17.22700***)	(11.41300)***
Log GCON $_t$	0.012771	0.047884
	(0.591427)	(2.719411)***
Log TOT $_t$	0.060324	0.426782
	(1.151479)	(3.332962)***
Adjusted R-Squared	0.853887	0.923149

Causality test cannot distinguish between short and long run causality. The argument is that a variable X may have only transitory effects on another variable Y but the long run behaviour of X can be invariant to the behaviour of Y.

DW	1.376312	1.803167
F-Statistic	92.16693	108.1095
Prob (F-Statistic)	0.000000	0.000000

Note: The values in the parentheses are t-values.
***, **, * indicate significance at 1 percent, 5 percent, and 10 percent respectively.

The solved (static) long run models appear reasonable from a theoretical perspective. Kremers and Lane (1992, p720) have however argued that the reported t-statistics are invalid from a statistical perspective when used in the context of the first step of this estimation process, although they may still provide a useful guide to modeling at a practical level. This is so because the variables included in the cointegrating equation must all be non-stationary, and this contradicts the assumption on which the usual asymptotic tests are based. Nevertheless, like many authors (see Kremers and Lane 1992 p.730) these test results are provided because even if they are not strictly statistically valid they may still provide some (albeit informal) guidance in assessing how closely the data conforms to the hypotheses (p.730)

5.2 The Short-Run Model

The short-run models are estimated with I(0) variables only. All the variables are differenced once except capital flows, nominal devaluation and excess domestic credit which are not differenced because they are already I(0). When cointegration holds, for any shock that causes disequilibrium there exists a well defined error adjustment process such as the error correction mechanism (ECM) that invariably pushes the system towards the long-run equilibrium. Information about the nature of the dynamic process around the embedded long-run solution is contained in an over-parameterized model. However our short run real effective exchange rate model is guided by the principle of parsimony. In estimating the error correction models, we start from a general over-parameterized model and then proceed to reduce the model until we arrive at the preferred model. The main function of the general model is to allow us to identify the main dynamic properties of the model and to ensure that the dynamics of the model have not been constrained by too short a lag length. The general models for both countries are shown in appendix 2. As can be seen from appendex 2, it would be difficult to interpret the equations in a meaningful way. To obtain an interpretable form of the models, the insignificant lags are gradually eliminated (see Huang 1994). The simplification and reduction strategy is guided by a number of statistical and economic considerations. At every stage several tests have been performed to ensure that the parametarization is general enough to pass various diagnostic tests relating to the properties of the residuals. The models are then reduced to parsimonious final equations obtained through the dynamic modeling approach which are reported in tables 5(a) and 5(b).

Table 5(a): The preferred Short-Run Real Effective Exchange Rate model for Malawi[13]

VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT[13]
Constant	0.029119	*NDEVAL*	-0.106315
	(4.121712)		(1.736436)*
DLog(IPI$_{t-3}$)	0.005987	*NDEVAL$_{(t-1)}$*	-0.854598
	(0.228814)		(13.74537)***
DLog (OPN$_{t-1}$)	-0.068103	*NDEVAL$_{(t-4)}$*	-0.225436
	(-2.486817)***		(2.958197)***
DLog (OPN$_{t-3}$)	-0.041214	*CF$_{(t-3)}$*	0.111708
	(-1.462193)		(2.340890)**
DLog (OPN$_{t-4}$)	-0.060797	*EDC$_t$*	0.091894
	(-2.432940)***		(2.269925)**
DLog (GCON$_{t-1}$)	-0.025407	*EDC$_{(t-4)}$*	-0.127772
	(-2.866706)***		(-2.259842)**
DLog (GCON$_{t-2}$)	-0.018066	*D94*	-0.007561
	(-1.847220)*		(-0.592267)
DLog (GCON$_{t-3}$)	-0.015362	*Dlog(REER$_{t-1}$)*	0.073206
	(-1.839115)*		(1.074071)
DLog (TOT$_{t-3}$)	0.021286	*ETC$_{(t-1)}$*	-0.257922
	(0.614485)		(-6.585944)***
Adjusted R-Squared	0.811222		
DW	1.814718		
F-Statistic	19.70557		
Prob (F-Statistic)	0.000000		
Ramsey (2) (F-Stat)		=0.359871	prob:0.55098
Serial Correlation (2) (obs. *R-squared)		=0.650192	prob:0.722458
White Heteroscedasticity (obs. *R-squared)		=39.72701	prob:0.195304
Histogram Normality(JB)		=0.324589	prob:0.850191
ARCH		=0.683226	prob:0.411209

Note: The values in the parentheses are t-values.
***, **, * indicate significance at 1 percent, 5 percent, and 10 percent respectively.

The preferred model has a standard error, σ, that is quite small. The goodness of fit of the model (i.e. the percentage of the total variation in the dependent variable explained by the independent variables) as explained by the R^2 is large. This is almost the same for the adjusted R^2.

Furthermore as part of the model specification exercise, we conduct diagnostic tests on the model. This is done realizing that in applied economics research, it is not uncommon to estimate a totally meaningless model and yet obtain 'correct signs' and obtain a high coefficient of multiple determination, (R^2). Arize (1989) points out the ease with which high t-values can be obtained without there being any relationship between variables whatsoever. For instance, the high R^2 may be caused by spurious correlations arising from the model being inappropriately specified. Kramer et. al (1985) have suggested that conventional regression output be supplemented with a battery of diagnostic tests since this will make it harder for results to appear significant because of a researcher's intentional or unintentional data mining process. " It is only from a

[13] The cusum stability test on the error correction mechanism shows that the model is stable in the periods of study for both countries since the residuals lie within the 5% level of significance bounds. Results are given in appendices 3.

model that appears to be consistent with the data that one can hope to make valid inferences" (Arize 1989, p245)

As can be observed from Table 5(a), the diagnostic tests are all insignificant at 5 percent level of significance. This implies that the model is well specified, that there are no problems of autocorrelation of the second order, that the errors are homoscedastic, and that the errors are normally distributed. There is also no serious problem of multicollinearity among the variables (see appendix 1 for an elaborate discussion on these tests) and that the real effective exchange rate function is stable by the CUSUM test (see appendix 2). Appendix 4 shows the graph of actual and fitted values of the real effective exchange rate of the error correction model. Although the fitted values closely track actual values, the fitted values appear to underestimate the actual values from 1992 onwards. Both values and the residuals pick up a structural break in 1992 and 1994 depicting freeze of non-humanitarian aid in 1992 and confirming the policy change that took place in 1994.[14]

Based on the battery of diagnostic tests, the error correction model for Malawi can be accepted as a well-specified model in the statistical sense. This implies that the estimated model parameters can be given their proper economic interpretation.

From Table 5(a) (for Malawi) it can be observed that the coefficient of technical progress in the previous third quarter has the expected positive sign though not significant. However, this agrees with the assertion that a faster technological progress is usually associated with stronger productivity in the tradable goods sector than in the non-traded goods sector. This tends to appreciate the REER, because prices of non-tradable goods tend to rise relative to prices of the tradables.

The degree of openness coefficients in the previous first, third and fourth quarters have negative signs and are significant. This indicates that a 1 percent increase in the first difference of the degree of openness in the previous first and fourth quarter yields a 0.07 percent and 0.06 percent decrease in the real effective exchange rate, respectively. This finding suggests that trade liberalization through tariff reductions or removal of quantitative restrictions increases imports and worsens the current account thereby causing the real effective exchange rate to depreciate. A similar result was obtained by Elbadawi and Sato (1994).

Government consumption changes in the previous first, second and third quarters have negative effects on the real effective exchange rate and significant at 10 percent significance level. The implication is that is that 1% increase in the first difference of government consumption in the previous first, second and third quarters elicits a 0.03 percent, 0.02 percent and 0.02 percent decrease in the real effective exchange rate, respectively. That is, suggests that government expenditure in Malawi depreciates the REER. This is true when more spending is directed the traded goods sector relative to the non-traded goods sector. This is the case because the price of traded goods rises relative to the price of non-traded goods, thereby depreciating the real exchange rate. The result is not surprising considering that in the case of Malawi, we used total government expenditure as a proxy for government consumption. Total government expenditure, unlike just recurrent expenditure, is spent on both tradable and non-tradable goods sector. Obadan (1994) and Edwards (1989) both found the same

[14] Non-humanitarian donor support was suspended in 1992 on account of governance issues. In the first quarter of 1994, government instituted a policy change which involved an abandonment of fixed exchange rate which had been in existence since 1984 to the so called floating exchange rate regime. This is expected to have influenced the exchange rate dynamics in that year.

results. The impact of international terms of trade on real effective exchange rate in the previous third quarter is positive but insignificant.

The coefficients of nominal devaluation in the current, the previous first and fourth quarter are all negative and significant at 10 percent significant level. Hence a 1 percent nominal devaluation in the current, the previous first and fourth quarter results in a 0.10 percent, 0.86 percent and 0.23percent increase in the real exchange rate, respectively. Therefore suggests that nominal devaluation leads into depreciation of the real effective exchange rate.

International capital flows are a significant determinant of real effective exchange rate. Its coefficient is positive and significant at 5 percent significance level. This entails that a 1 percent increase in capital flows in the previous third quarter yields a 0.11 percent increase in the real effective exchange rate. The implication is that part of an increase in absorption resulting from capital inflows is directed towards the non-traded goods sector of the economy, thereby resulting into an increase in the price of non-traded goods relative to traded goods, thereby causing the exchange rate to appreciate.

Excess domestic credit is a significant determinant of real effective exchange rate. Its coefficients are positive and negative in the current and previous fourth quarters respectively and are both significant at 5 percent significance level. This implies that a 1 percent increase in the current and previous fourth quarter excess domestic credit elicits a 0.09 percent and 0.13 percent increase and decrease in the real effective exchange rate, respectively. These results are interesting because theory postulates that excess domestic credit expansion correlates inversely with the REER. The positive coefficient of the domestic credit for the previous fourth quarter indicates that as monetary policies becomes expansionary (increased domestic credit), interest rates are lowered thereby boosting the domestic demand for non-traded goods, and thereby causing the real effective exchange rate to appreciate. The results are consistent with those found by Edwards (1989) and Ghura and Greenes (1990).

The dummy representing a major exchange rate policy in 1994 is negative but statistically insignificant at standard levels. The coefficient of REER for the previous first quarter is positive but also statistically insignificant.

The regression results also show that the error correction term obeys the basic tenet of error correction mechanism since it has a negative sign and less than one. The implication of the statistical significance of the error correction term at the conventional level is that there exists an equilibrium relationship between the REER and macroeconomic fundamentals. The finding indicates that 26 percent of the disequilibrium accumulated from the previous period, is corrected in the current period. Thus the speed of adjustment to the long run equilibrium path is relatively slow and gradual.

Table 5(b): The preferred Short-run Real Effective Exchange Rate model for South Africa

VARIABLE	COEFFICIENT	VARIABLE	COEFFICIENT
Constant	0.010841	*DLog (TOT$_t$)*	-0.267642
	(-1.441422)		(3.043380)***
DLog(IPI $_t$)	-0.124964	*DLog (TOT $_{t-1}$)*	0.212938
	(-3.060931)***		(2.123968)**
DLog (IPI $_{t-1}$)	-0.137164	*NDEVAL $_{t-2}$*	-0.214678
	(-2.440415)**		(-2.092534)**
DLog (IPI $_{t-3}$)	-0.167363	*CF $_t$*	-1.03669
	(-2.874711)***		(-3.774667)***
DLog (OPN $_t$)	0.070309	*CF $_{t-2}$*	-0.638821
	(-2.028787)**		(-1.923292)*
DLog (OPN $_{t-1}$)	- 0.133087	*CF $_{t-4}$*	1.0509936
	(-5.210364)***		(-3.649755)***
DLog (GCON $_t$)	0.037821	*EDC $_{t-2}$*	0.004265
	(2.214232)**		(2.109051)**
DLog(GCON $_{t-1}$)	0.067649	*DLog REER $_{t-1}$*	0.102798
	(4.046080)***		(0.818314)
DLog (GCON $_{t-2}$)	0.068814	*ECTt-1*	-0.630841
	(4.172774)***		(-6.760768)***
DLog (GCON $_{t-3}$)	0.051523		
	(3.152317)***		
DW	2.296292		
F-Statistic	9.954252		
Prob (F-Statistic)	0.000000		

Ramsey (2) (F-Stat)	=1.832740	prob:0.186632
Serial Correlation (2) (obs. *R-squared)	=2.700946	prob:0.259118
White Heteroscedasticity (obs. *R-squared)	=37.41188	prob:0.404126
Histogram Normality(JB)	=0.193543	prob:0.907764
ARCH	=1.079644	prob:0.473184

Note: The values in the parentheses are t-values.
***, **, * indicates significance at 1 percent, 5 percent, and 10 percent respectively.

The preferred model has a standard error, σ, that is quite small. The goodness of fit of the model (i.e. the percentage of the total variation in the dependent variable explained by the independent variables as explained by the R^2) is also large. This is almost the same for the adjusted R^2.

Furthermore as part of the model specification exercise, we conduct diagnostic tests on our model. As can be observed from Table 5(b), the diagnostic tests are all insignificant at 5 percent level of significance. This implies that the models are well specified, that there are no problems of autocorrelation of the second order, that the errors are homoscedastic, and that the errors are normally distributed. There is also no serious problem of multicollinearity among the variables (see appendix 1 for an elaborate discussion on these tests) and that the real effective exchange rate function is stable by the CUSUM test (see appendix 2). The graph of actual versus fitted values of the error correction model (see appendix 4) indicates a structural break in 1996 and 1997

confirming currency crises that took place in those years although fitted values closely track actual values.[15]

Based on the battery of diagnostic tests, the error correction model for South Africa can be accepted as a well-specified model in the statistical sense. This implies that the estimated model parameters can be given their proper economic interpretation.

From Table and 5(b) (for South Africa) it can be observed that the coefficients of technical progress in current, the previous first and third quarter have negative signs and significant at 5 percent level of significance. This implies that a 1 percent increase in the first difference of technological progress in the current, the previous first and third quarter elicits a 0.12 percent, 0.14 percent and 0.17 percent decrease in the real effective exchange rate, respectively. This suggests that technological progress depreciates the real effective exchange rate.

The degree of openness coefficients in the current and previous first quarter have negative signs and significant at 5 percent. This implies that a 1 percent increase in the first difference of the degree of openness in the current and previous first quarter yields a 0.07 percent and 0.13 percent decrease in the real effective exchange rate, respectively. Once again, this suggests that trade liberalization through tariff reductions or removal of quantitative restrictions increases imports and worsens current account, thereby causing the real effective exchange rate to depreciate. A similar result was obtained by Elbadawi and Sato (1994).

Government consumption changes in the previous first, second and third quarters are have negative effects on the real effective exchange rate and are significant at 5 percent significance level. The implication is that a 1 percent increase in the first difference of government consumption in the previous first, second and third quarters elicits a 0.07 percent, 0.07 percent and 0.05 percent decrease in the real effective exchange rate, respectively. This, too, suggests that government expenditure depreciates the REER in South Africa. This is not surprising since in the case of South Africa, data for government consumption was readily available. Usually, when spending is directed towards the non-traded goods sector, the price of non-traded goods rises relative to that of traded goods thereby causing the REER to appreciate. Obadan (1994) and Edwards (1989) both found the same results.

The impact of international terms of trade on real effective exchange rate in the current and previous first quarter is positive and significant at 5% implying that a 1 percent increase in the first difference of the degree of openness in the current and previous first quarters elicits a 0.27 percent and 0.21 percent increase real effective exchange rate, respectively. This is in line with *a priori* reasoning that, conventionally, an improvement in the terms of trade improves the current account resulting in the appreciation of the REER.

The coefficient of nominal devaluation in the previous second quarter is negative and significant at 5 percent significance level. Hence a 1 percent nominal devaluation in the previous second quarter results in a 0.21 percent decrease in the real exchange rate. Therefore nominal devaluations depreciate the REER.

[15] Currency crises in October 1996 and November 1997 triggered largely by contagious effects from the Asian crisis and also fall in the prices of gold and other metals. When dummies were introduced in the error correction model to capture the said crises, they were highly insignificant and were thus dropped from the model altogether.

International capital flows variable has two coefficients that are positive while the other one is negative but all are significant at 10 percent significant level. This entails that a 1 percent increase in capital flows in the current, previous second and previous fourth quarter yields a 1.03 percent, 0.64 percent decrease and 1.05 percent increase in REER, respectively. This is not surprising since part of the increase in absorption resulting from capital inflows can be directed to the non-traded goods sector of the economy thereby resulting into an increase in the price of non-traded goods relative to traded goods thereby causing the real exchange rate to appreciate. On the other hand, if the increase in the absorption is directed towards the traded goods sector, the price of the traded goods sector rises relative to the non-traded goods sector thereby resulting into a depreciation of the real exchange rate.

Excess domestic credit is a significant determinant of real effective exchange rate. Its coefficient for the previous second quarter is positive and significant at 5 percent level. This implies that a 1 percent increase in excess domestic credit in the previous second quarter elicits a 0.004 percent increase in the real effective exchange rate. This indicates that as monetary policies become expansionary (increased domestic credit), interest rates are lowered thereby boosting the domestic demand for non-traded goods, and thereby causing the real effective exchange rate to appreciate. The results are consistent with those found by Edwards (1989) and Ghura and Greenes (1990).The coefficient of REER for the previous first quarter is positive but statistically insignificant.

The regression results also show that the error correction term obeys the basic tenet of error correction mechanism since it has a negative sign and less than one. The implication of the statistical significance of the error correction term at the conventional level is that there exists an equilibrium relationship between the REER and macroeconomic fundamentals (i.e. the dependent variable is cointegrated with the explanatory variables - Adam, 1992). The finding indicates that 63% of the disequilibrium accumulated from the previous period, is corrected in the current period. Thus the speed of adjustment to the long run equilibrium path is relatively fast.

Table 6: Summary of the signs of the coefficients of the determinants of REER from the preferred short run models

Variable	sign	
	Malawi	**South Africa**
IPI	+	-
OPEN	-	-
GCON	-	+
TOT	+	+

NDEVAL	-	-
CF	+	-
EDC	+	+
REER(-1)	+	+

Note: where there different signs for different lags of the same variable in the same country, the most frequent sign has been chosen for the variable for purposes of simplicity. However, no explanation will be given for those variables that are insignificant.

As can be seen from table 6, there is a negative relationship between real effective exchange rate and degree of openness for both counties. This implies that trade liberalisation through tariff reductions or removal of quantitative restrictions increases imports and worsens current account, thereby causing the REER to depreciate.

On the other hand, while there is an inverse relationship between real effective exchange rate and government consumption in the case of Malawi, a positive relationship between real effective exchange rate and government consumption obtains in the case of South Africa. This suggests that government consumption appreciates REER in Malawi and depreciates it in South Africa. This is not surprising since the impact of government consumption on REER depends on whether government spending is on the traded sector or non-traded sector of the economy. For instance in the case Malawi, the results suggest that government spending is on non-traded sector.

Additionally, whereas there is a positive relationship between REER and international capital flows in the case of Malawi, a negative relationship obtains in the case of South Africa. The implication is that, for Malawi, part of an increase in absorption resulting from capital inflows is directed towards the non-traded goods sector of the economy that raises the price of non-traded goods relative to traded goods thereby causing the REER to appreciate. As for South Africa, the increase in absorption goes towards the traded goods sector thereby resulting into a depreciation of the REER.

However, the results from both countries indicate a positive relationship between REER on one hand and excess domestic credit and lagged REER on the other hand. They also indicate a negative relationship between real effective exchange rate and nominal devaluation in both countries. Therefore, for both Malawi and South Africa, monetary expansion appreciates the REER.

CHAPTER 6
CONCLUSION AND POLICY IMPLICATIONS

6.1 Summary and conclusions

This study has attempted to establish the determinants of the real effective exchange rate in Malawi and South Africa. Specifically, contributions of attendant economic fundamentals such as technological progress, degree of openness, government consumption, nominal devaluation, international capital flows, excess domestic credit, *inter alia*, towards the determination of real effective exchange rate were sought.

The Granger causality tests indicate no endogeneity in the data and as such OLS method of estimation was applied. The stationarity tests using the augmented Dickey-Fuller and Phillips – Perron tests confirmed that all the variables, except Nominal devaluation, excess domestic credit and capital flows, were integrated of order one. This called for first differencing to avoid spurious results. In order to test whether the I(1) time series were cointegrated or not, we carried out the unit root test on the error correction terms. The results indicate that error correction terms for both countries are stationary at 5% level of significance. This implies that among the integrated variables there exists a linear combination, which itself is stationary. This justified the use of the error correction mechanism.

In the long-run, in the case of Malawi technological progress has a negative sign while in the case of South Africa it has positive sign. The degree of openness have the expected positive sign and significant at 5 percent level. Government consumption, lagged real effective exchange rate and terms of trade also have the expected positive signs and are all significant at the conventional 5 percent level for South Africa while for Malawi, terms of trade and government consumption coefficients are not significant.

The short run results indicate current and lagged coefficients of technological progress in South Africa have negative signs which imply that technological progress depreciates REER. The coefficients are also significant at 5 percent level. As for Malawi, technological progress for the current quarter has a positive sign but insignificant 5 percent level. The degree of openness variable has negative signs for both Malawi and South Africa and also significant except for degree of openness in the previous third quarter for Malawi.

Government consumption variable for Malawi has negative sign while that of South Africa has positive sign. This is not surprising since the impact of government consumption on real effective exchange rate depends on whether government spending is on the traded sector or non-traded sector of the economy. The terms of trade variable has the positive signs for both countries indicating that an improvement in terms of trade appreciates the real effective exchange rate. The nominal devaluation variable for both Malawi and South Africa has a negative sign. This implies that nominal devaluation depreciates the REER in both countries.

The capital flows variable for Malawi has positive signs while that of South Africa have negative signs. Once again, the effect of capital flows on real effective exchange rate depends on whether the capital flows are spent on the traded or non-traded sector. If the capital flows are spent on non-traded goods sector then the price of non-traded goods rise relative to that of traded goods. The opposite happens when capital flows are spent on traded goods. So the impact can be either positive or negative. The excess domestic credit variable has positive signs for both countries implying that monetary expansions appreciate the REER in both countries. The lagged real effective exchange rate variable for both countries has positive signs.

6.2 Policy Recommendations

The findings in this analysis offer significant challenges to the formulation of exchange rate policy in both Malawi and South Africa. First, the presence of cointegration or long run co-movements between variables for both countries from a policy point of view, indicates the effectiveness of targeting only one variable (in this case real effective exchange rate) in influencing the long run movements of other variables.

Second, excessive domestic credit, in the short run, causes the real effective exchange rate to appreciate for both countries. This therefore calls for prudent fiscal and monetary policy measures. Such measures include mopping out excess liquidity from the market to stem the growth of money supply. For both countries, the most powerful policy is fiscal discipline through tightening government expenditure. Monetary policy is just an intermediate policy and can only be successful if there is fiscal discipline. With fiscal discipline there can be no excess liquidity.

Third, the study has found that policies aimed at eliminating trade restrictions depreciate the REER. One policy implication that can be drawn from this finding is that both governments should continue implementing trade liberalisation policies that they had already started in the 1980s. This is so because most less developed countries' real effective exchange rates are said to be overvalued according to the International Monetary Fund. Therefore the REERs should depreciate till they reach their equilibrium levels since these levels are referred to as appropriate levels in literature.

Fourth, some of the determinants of real effective exchange rate do not have the same direction of effects for both countries (for instance government consumption and capital flows). This is not surprising since These economies are radically different in that Malawi is a small, agricultural based economy with a highly import dependent economy while South Africa is a large diversified, industrilised economy. Yet improving intra-trade in a trading block (in this case SADC) necessarily means coordinating some common economic policies. Proper coordinated macroeconomic policies would seem very crucial for economic growth and development. These stark differences pose a great challenge for a more integrated regional economy.

Furthermore, developments in the external sector of the economy (changes in terms of trade, degree of openness and international capital flows) which are not under the control of domestic authorities seemingly contribute more to changes in real effective exchange rate. The policy implications are that the government ability in influencing the behaviour of real effective exchange rate is limited. This is because the ability of a small open economy like that of Malawi to insulate itself from external shocks is limited. In the long-run however, appropriate structural changes and conducive competitive policy could be designed and implemented. These may include export diversification (to counter deteriorating terms of trade in specific commodities) and implementing measures to limit market imperfection.

6.3 Limitations of the Study and Directions for Future Research

There are three main areas where this study has fallen short. First is the problem of measurement of variables. This calls for making constructs of some variables or using proxy variables for other variables. In this study, the industrial production index is taken as a proxy for technical progress. Constructs have been made for such variables as excess domestic credit, capital flows, and the degree of openness. For purposes of this study, excess domestic credit is defined as the rate of growth of domestic credit minus rate of growth of GDP. Capital flows are defined as the difference between net change in reserves and trade balance. The degree of openness is measured by ratio of the sum of imports and exports of goods and services to GDP. Government consumption is captured by the ratio of total government expenditure to GDP. Data on GDP is available only on annual basis. Quarterly GDP data were, therefore, extrapolated from the industrial production index that is available on quarterly basis.

Second, future research on real effective exchange rate in Malawi, South Africa and other Less Developed Countries (LDCs) should aim at determining the seasonal structure of the variables using seasonal unit root tests and determining whether the variables are seasonally integrated. As noted by Adam (1992) test for unit roots are frequently biased and have low power in distinguishing stationary series. Thus it is recommended that inference on the order of integration should be drawn on the basis of one or more tests. Future research should therefore try to use other tests as Sargan Barava tests to provide a cross check for the tests. Furthermore, future research should try to use the Johansen Multivariate procedure for cointegration, which is recommended in the case where there may be multiple cointegrating vectors. Additionally, a seasonal dummy variable could be included to capture the effects of seasonality on real effective exchange rate in Malawi. The flow of foreign exchange in Malawi is seasonal because of its dependence on agriculture (mainly tobacco) as the main foreign exchange earner.

Third, the present study did not give particular attention to such issues as the decomposition of fundamentals into cyclical (temporary) and permanent components and examine their effects in the determination of the real effective exchange rate. For instance, this study would have tried to investigate the view that the reaction to liberalization depends on whether the policies are temporary or permanent. This would have been done by decomposing capital flows and the degree of openness variable into temporary and permanent variables and examine their effects on the real effective exchange rate.

Finally, it might be equally interesting to use smallholder maize output as one of the explanatory variables in the case of Malawi. In recent years, smallholder maize output has varied hugely mainly owing to droughts of unprecedented severity. Lower maize output means a deterioration of the current account stemming from private imports via Mozambique or Government imports, and hence a depreciation of the currency. These shortcomings, however, will remain future areas of research for the author.

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Appendix 1 Diagnostic Checks

The Breusch-Godfrey Serial Correlation LM test

This test generally used for higher order serial correlation. In this test the order p is specified, which is thought to be determining the disturbances. In the present study we tested the presence of second order autocorrelation. The null hypothesis tested is that the coefficients of the lagged residuals are zero. A significant Observed *R-squared implies autocorrelation problems. In our results the Observed *R-squared are insignificant at 5% level signaling no problem of autocorrelation of second order.

The White Heteroscedasticity (no cross terms)

The test is applicable only to the residuals from least squares regression. It tests the null hypothesis that the coefficients of the variables in the augmented regression are zero. This test is for general model specification. The null hypothesis underlying this test assumes that the errors are both homoscedastic and independent of the regressors and that the linear combination is correct. Failure of any one or more of these conditions could lead to a significant test statistic. In our results, the Observed *R-squared are insignificant implying that the coefficients of the variables in the augmented regression are all zero. This is to say that the errors are homoscedastic.

The Histogram Normality Test

This tests whether errors are normally distributed or not. The null hypothesis for the test is that skew-ness is equal to zero and kurtosis is equal to three. The test uses the Jarque – Bera statistic under the null hypothesis of normality. A significant Jarque - Bera statistic points to non-normality of the series. In our results this test is applied on residuals and the test statistics are clearly insignificant hence we fail to reject the null hypothesis of normality. This implies that the errors are normally distributed.

The Ramsey Reset Test

There are two types of errors we can make when specifying the population regression. These are:
.We could include wrong variables in the equation by either omitting relevant variables or inclusion of irrelevant variables.
.Choosing an incorrect functional form of the model.
The most important consequence of omitting relevant variables is that our parameter coefficients will be biased and inconsistent. On the other hand, if we introduce irrelevant variables in the equation, OLS estimation will lead to less efficient results.

The Ramsey Reset test, therefore, is concerned with specification errors, which include some of the following: omitted variables, incorrect functional form, and correlation between explanatory variables and the residuals. The F-statistic tests the hypothesis that the coefficients on the forecast vectors are all zero. In our study the F-statistic is insignificant implying that our model is well specified.

The LM ARCH test

This is a test for autoregressive conditional heteroskedasticity. The null hypothesis is that there is no conditional heteroskedasticity in the error terms. On the basis of the results shown above, we fail to reject the null hypothesis at 5% level of significance. We therefore conclude that there is no significant ARCH behaviour in the error terms.

Granger Causality test

The Granger causality test is used to test whether there is a two-way causation between variables. It is of paramount importance because the nature of causality between variables influences the type of estimation that will be used.

Table3(a) : Pairwise Granger Causality Results (Malawi)

Null Hypothesis	F-Statistic	Prob
CF does not Granger cause DLNREER	2.16058	0.08877
DLNREER does not Granger cause CF	0.37345	0.68968
NDEVAL does not Granger cause DLNREER	70.5962	0.0000
DLNREER does not Granger cause NDEVAL	1.85564	0.16375

DLNOPN does not Granger cause DLNREER	0.63415	0.42835
DLNREER does not Granger cause DLNOPN	0.00031	0.98610
DLNIPI does not Granger cause DLNREER	0.06198	0.93995
DLNREER does not Granger cause DLNIPI	0.71654	0.49189
DLNRGCON does not Granger cause DLNREER	2.19587	0.0651
DLNREER does not Granger cause DLNIPI	0.34264	0.71101
DLNTOT does not Granger cause DLNREER	0.01162	0.32604
DLNREER does not Granger cause DLNIPI	0.98845	0.72283
EDC does not Granger cause DLNREER	1.26406	0.14826
DLNREER does not Granger cause DLNIPI	0.28870	0.86247

Table3(b) : Pair-wise Granger Causality Results (South Africa)

Null Hypothesis	F-Statistic	Prob
CF does not Granger cause DLNREER	2.18586	0.07288
DLNREER does not Granger cause CF	2.04442	0.15333
NDEVAL does not Granger cause DLNREER	6.34782	0.00052
DLNREER does not Granger cause NDEVAL	1.94020	0.12361
DLNOPN does not Granger cause DLNREER	1.06182	0.39797
DLNREER does not Granger cause DLNOPN	0.87208	0.50971
DLNIPI does not Granger cause DLNREER	2.19721	0.06375
DLNREER does not Granger cause DLNIPI	0.84489	0.87282
DLNRGCON does not Granger cause DLNREER	2.07331	0.13788
DLNREER does not Granger cause DLNIPI	0.97318	0.38586
DLNTOT does not Granger cause DLNREER	2.16895	0.07574
DLNREER does not Granger cause DTOT	0.67349	0.72438
EDC does not Granger cause DLNREER	0.10945	0.89657
DLNREER does not Granger cause DLNIPI	0.12742	0.88069

Multicollinearity

One of the assumptions of multiple regression model is that there is no exact linear relationship between any independent variable in the model. If such a linear relationship does exist, we say that the independent variables are perfectly collinear. In such a situation, it is impossible to calculate least squares estimate of parameters

In a test for multicollinearity, a correlation matrix is used. This test is useful because it indicates to the researcher whether serious correlations exist among the variables used in the regression. Economists generally trust that correlation between variables above 50% indicates serious multicollinearity and this may bias the regression results. Table 8 below shows the correlation matrix of the variables used in this analysis and clearly there are no serious correlations among variables.

Table 6(a): The Correlation Matrix (Malawi)

Variable	LNREER	LNIPI	LNOPN	LNGCON	LNTOT	NDEVAL
LNREER	1.00000	-0.2093	-0.295682	-0.019855	0.426437	0.154666
LNIPI	-0.20939	1.0000	-0.088863	-0.460078	-0.065703	-0.094229
LNOPN	-0.29568	-0.0888	1.00000	0.120161	-0.078031	-0.023247
LNGCON	-0.01985	-0.4600	0.12016	1.000000	-0.111910	-0.022087
LNTOT	0.42643	-0.0657	-0.07803	-0.111910	1.000000	0.073183
NDEVAL	0.15466	-0.0942	-0.02324	-0.022087	0.073183	1.000000

Variable	CF	EDC
LNREER	0.0521161	-0.043481
LNIPI	-0.098004	-0.088557
LNOPN	-0.012920	-0.176610
LNGCON	-0.046363	0.2182111
LNTOT	-0.183264	-0.104543
NDEVAL	-0.010289	-0.013114
CF	-1.000000	0.279650
EDC	0.279650	1.000000

Table 6(b): The Correlation Matrix (South Africa)

Variable	LNIPI	LNOPN	LNREER	LNGCON	LNTOT	NDEVAL
LNIPI	1.0000	-0.1651	-0.17004	-0.32186	0.0738	0.1147
LNOPN	-0.1651	1.0000	0.07268	-0.16389	0.3532	-0.20627
LNREER	-0.1700	0.0726	1.0000	0.25473	0.0862	-0.16311
LNRCON	-0.3218	0.1638	0.25473	1.0000	-0.0314	-0.05019
LNTOT	-0.0738	0.3533	0.0862	-0.0314	1.0000	0.17237
NDEVAL	0.1147	0.2063	-0.1631	-0.0501	0.1723	1.00000

Variable	CF	EDC
LNIPI	-0.1081	-0.2575
LNOPN	0.0361	-0.0795
LNREER	-0.1138	0.1746
LNGCON	0.0566	0.0948
LNTOT	-0.1594	-0.0356
NDEVAL	-0.2289	0.0247
CF	1.0000	-0.0446
EDC	-0.0446	1.0000

Appendix 2 Model Results

General Model results (1987:1 – 1999:4) (t-values in the brackets) – Malawi

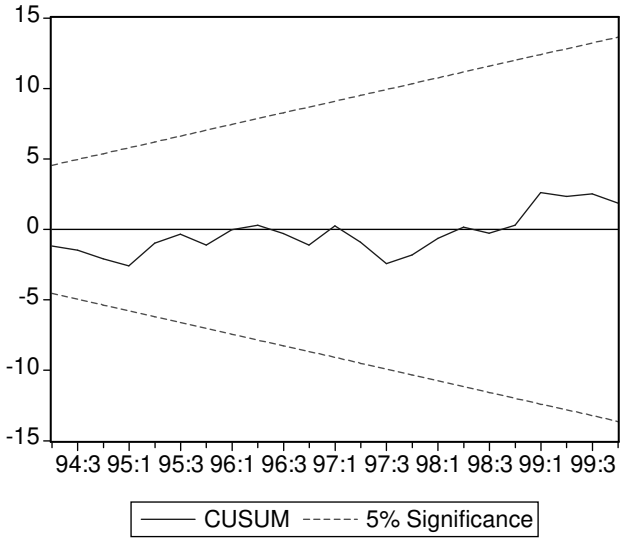
Lags	0	1	2	3	4
Variable					
Constant	0.0129				
	(1.1113)				
DLNIPI	0.13808	0.10274	0.0668	0.1149	-0.0759
	(1.6105)	(0.9316)	(0.6073)	(1.0889)	(-0.7021)
DLNOPN	-0.0392	-0.1141	-0.04173	-0.0715	-0.1075
	(-0.8298)	(-2.1754)	(-0.7344)	(-1.3346)	(-2.1573)
DLNGCON	-0.0083	-0.0506	-0.0425	-0.02501	-0.00321
	(-0.5518)	(-2.4462)	(-2.0050)	(-1.3145	(-0.2353)
DLNTOT	-0.01511	0.0134	-0.0167	0.0676	0.0491
	(-0.3202)	(0.2920)	(-0.3607)	(1.3465)	(0.9805)
NDEVAL	0.1025	0.8163	-0.1571	-0.16612	0.1224
	(1.3873)	(9.4888)	(-0.9630)	(-1.4258)	(1.1359)
CF	-0.0091	-0.14026	0.0458	0.0579	0.09838
	(-0.1281)	(-1.5869)	(0.5269)	(0.8283)	(1.4998)
EDC	0.0642	0.6809	0.03411	0.05057	-0.18205
	(0.9571)	(0.8096)	(0.4452)	(0.6341)	(-1.8334)
DLNREER		0.0929			
		(0.6516)			
ECT		-0.1816			
		(-2.5213)			

General Model results (1987:1 – 1999:4) (t-values in the brackets) – South Africa

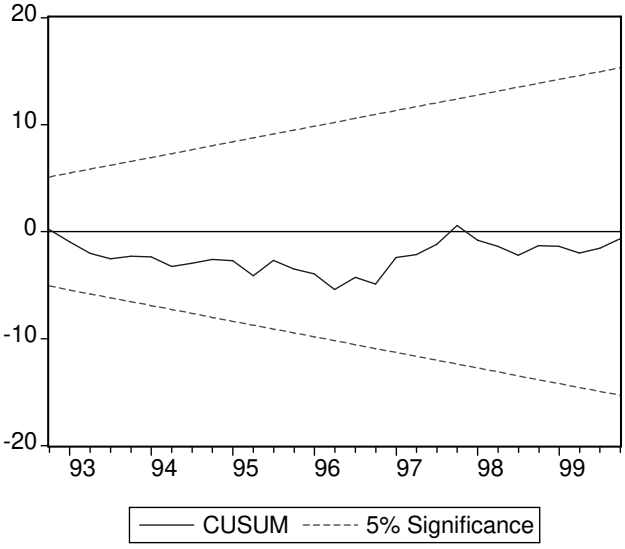
Lags	0	1	2	3	4
Variable					
Constant	0.02215				
	(-1.119)				
DLNIPI	-0.1065	-0.1295	0.0189	-0.1272	
	(-0.6524)	(-1.1678)	(0.1425)	(-0.9286)	(0.6524)
DLNOPN	-0.1775	-0.1861	0.0119	-0.0555	0.0469
	(-2.178)	(-2.415)	(0.2137)	(-1.4933)	(0.7334)
DLNRGCON	0.0552	0.0745	0.05317	0.0242	-0.0669
	(2.2162)	(2.8444)	(2.2483)	(0.7304)	(-1.574)
DLNTOT	0.4023	0.3200	-0.0662	0.0579	0.1011
	(2.8198)	(2.1602)	(-0.4196)	(-0.3321)	(0.6227)
NDEVAL	-0.3561	-0.0719	-0.1979	-0.2381	0.06746
	(-1.8947)	(0.4549)	(-1.054)	(-1.3136)	(0.4180)
CF	-0.5026	-0.3801	-1.2121	0.0820	0.06746
	(-0.9998)	(-0.6713)	(-1.7234)	(0.1419)	(1.6767)
EDC	0.00141	0.0015	0.0033	0.00158	-0.00027
	(0.51337)	(0.64643)	(1.0739)	(0.5411)	(-0.0755)
DLNREER		0.1121			
		(0.4953)			
ECM		-0.6167			
		(-2.2262)			

Appendix 3 CUSUM TEST

Malawi

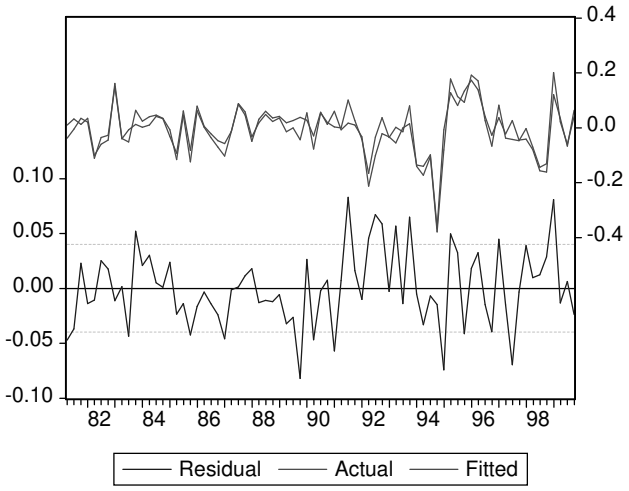


South Africa

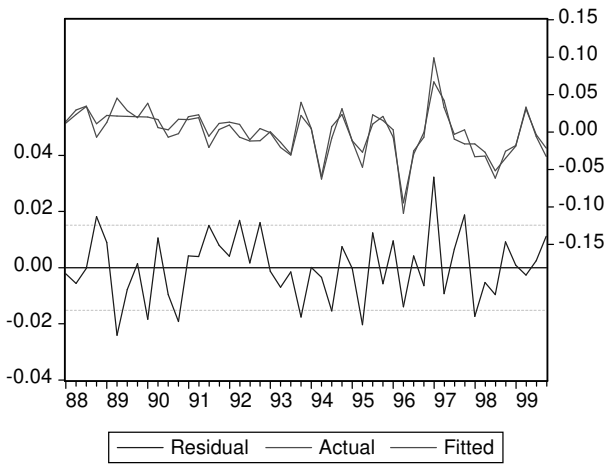


Appendix 4 Error Correction Models

Actual versus Fitted Values (Malawi)



Actual versus Fitted Values (South Africa)



Appendix 5 Data used in Estimation

(a) Malawi

YEAR	LNREER	LNIPI	LNOPN	LNREER1	LNRGCON	LNTOT	NDEVAL	EDC	PENDUM	CF
1980.1	4.8404	4.190866	4.29467	4.82543	3.127331	4.028917	-0.035	0.026	0	0.458
1980.2	4.817455	4.55556	3.884446	4.8404	2.485656	3.941776	-0.006	-0.014	0	0.327
1980.3	4.813484	4.654722	4.008551	4.817455	2.683962	3.972177	-0.02	0.059	0	0.027
1980.4	4.801066	4.404766	4.183088	4.813484	2.881947	3.90942	-0.003	0.099	0	-0.009
1981.1	4.830631	4.14091	4.156693	4.801066	3.682635	3.91462	0.022	0.017	0	0.141
1981.2	4.792977	4.595928	3.909861	4.830631	2.295661	4.058545	0.029	0.014	0	0.19
1981.3	4.787408	4.825028	3.884117	4.792977	2.583545	4.103635	0.016	0.146	0	-0.017
1981.4	4.822215	4.579955	3.950301	4.787408	2.789815	4.142023	0.01	0.098	0	-0.137
1982.1	4.842532	4.049522	3.989632	4.822215	3.334309	4.108576	-0.078	0.045	0	0.034
1982.2	4.73048	4.527749	3.664126	4.842532	2.560478	4.190412	-0.063	0.001	0	0.137
1982.3	4.694828	4.788741	3.783712	4.73048	2.669379	4.238012	-0.073	0.026	0	-0.1
1982.4	4.666453	4.541698	3.958391	4.694828	2.585732	4.192378	0.144	0.031	0	0.048
1983.1	4.816484	4.228293	4.133389	4.666453	3.340846	4.236133	0.002	0.059	0	0.218
1983.2	4.777273	4.62957	3.788861	4.816484	2.255598	4.22391	-0.009	0.025	0	0.122
1983.3	4.725084	4.902307	3.475841	4.777273	2.514708	4.124874	-0.068	0.054	0	0.019
1983.4	4.788574	4.703295	3.853885	4.725084	2.702367	4.179451	-0.004	-0.033	0	0.059
1984.1	4.811696	4.314684	4.090838	4.788574	3.086943	4.869609	0.002	0.044	0	0.041
1984.2	4.851483	4.610755	3.961194	4.811696	2.427278	4.839372	0.041	0.027	0	0.056

1984.3	4.897243	4.876723	3.66832	4.851483	2.474688	4.731098	0.031	-0.016	0	-0.02
1984.4	4.930798	4.67367	3.929332	4.897243	2.552487	4.602467	-0.002	-0.065	0	-0.11
1985.1	4.922678	4.293469	4.103602	4.930798	2.784394	4.841585	-0.112	0.087	0	-0.125
1985.2	4.806313	4.602868	3.750186	4.922678	2.591666	4.59512	0.04	0.049	0	0.134
1985.3	4.853045	4.893877	3.680772	4.806313	2.505036	4.429626	-0.128	-0.027	0	0.011
1985.4	4.728538	4.64564	3.819184	4.853045	2.689954	4.213016	0.08	0.17	0	0.003
1986.1	4.790404	4.302983	3.782415	4.728538	3.310543	4.219214	-0.058	0.079	0	-0.077
1986.2	4.791733	4.684997	3.669467	4.790404	2.467676	4.122932	-0.033	0.089	0	-0.092
1986.3	4.756001	4.881361	3.686276	4.791733	2.494114	4.691256	-0.07	-0.018	0	-0.003
1986.4	4.68472	4.638025	3.727667	4.756001	2.562639	4.241471	-0.121	-0.047	0	-0.086
1987.1	4.581287	4.244774	3.810234	4.68472	3.423513	4.217594	-0.079	0.117	0	0.068
1987.2	4.567053	4.544464	3.65276	4.581287	2.140654	4.171923	0.001	-0.033	0	0.121
1987.3	4.654722	4.894476	3.811075	4.567053	2.377785	4.33559	0.011	-0.015	0	-0.002
1987.4	4.71187	4.652245	3.863883	4.654722	2.791472	4.144879	-0.114	0.002	0	0.026
1988.1	4.679164	4.479607	3.753543	4.71187	3.441603	4.066117	-0.005	0.081	0	0.149
1988.2	4.696929	4.610158	3.739454	4.679164	2.059621	4.223177	0.002	-0.167	0	-0.21
1988.3	4.745367	4.854371	4.106323	4.696929	2.058346	4.557449	0.013	-0.068	0	0.049
1988.4	4.768224	4.705016	3.976161	4.745367	2.508705	4.382402	0.012	0.075	0	-0.026
1989.1	4.803119	4.600158	3.953376	4.768224	3.454707	4.187987	0.013	0.099	0	0.245
1989.2	4.788491	4.731803	3.862034	4.803119	1.444091	4.239887	0	0.014	0	0.258
1989.3	4.788325	4.861362	3.955312	4.788491	2.087534	4.369701	0.001	-0.032	0	0.125
1989.4	4.743975	4.796617	3.949666	4.788325	2.485823	4.441474	-0.026	0.11	0	0.05
1990.1	4.798019	4.772378	3.78723	4.743975	3.076436	4.260229	-0.039	0.052	0	0.158
1990.2	4.721174	4.810557	3.855262	4.798019	2.216373	4.252398	0.036	-0.077	0	0.192
1990.3	4.775588	4.963544	4.165921	4.721174	2.750918	4.209842	0.028	-0.015	0	0.103
1990.4	4.795295	4.962145	4.015788	4.775588	2.361703	4.1753	0.012	0.118	0	-0.049
1991.1	4.797937	4.635699	3.891228	4.795295	3.329128	4.229316	-0.003	0.254	0	0.088
1991.2	4.797029	4.883559	3.83579	4.797937	1.818239	4.215909	0.024	0.066	0	0.182
1991.3	4.897093	5.082025	4.079028	4.797029	2.174752	4.219325	0.049	-0.193	0	0.035
1991.4	4.923551	5.061962	4.080702	4.897093	2.490889	4.252368	0.007	0.077	0	0.058
1992.1	4.879995	4.796617	3.787955	4.923551	3.034087	4.239887	-0.185	0.306	0	0.176
1992.2	4.713038	4.872139	3.976105	4.879995	0.827241	4.228936	-0.166	0.163	0	0.267
1992.3	4.678328	5.04278	4.275819	4.713038	2.351947	4.208226	-0.013	0.01	0	0.127
1992.4	4.714831	4.94805	4.214392	4.678328	2.888815	4.132449	0.016	0.022	0	0.14
1993.1	4.678514	4.683981	3.75455	4.714831	2.901641	4.081744	0.022	0.155	0	0.172
1993.2	4.680649	4.787492	3.645659	4.678514	2.552877	4.032164	0.005	0.047	0	0.128
1993.3	4.666359	4.970508	3.789313	4.680649	2.4703	4.015594	0	-0.075	0	0.089
1993.4	4.746149	4.942356	3.801985	4.666359	2.668755	4.026559	-0.2	-0.072	0	0.066
1994.1	4.60517	4.783316	3.60596	4.746149	3.183746	4.006109	-0.177	0.402	1	0.161
1994.2	4.431412	4.770685	3.870284	4.60517	2.441042	4.033248	-0.116	0.051	1	0.119
1994.3	4.325589	4.945919	4.255173	4.431412	2.671455	4.061271	-0.467	-0.006	1	0.169
1994.4	3.945651	4.811371	4.549943	4.325589	2.706249	4.08109	-0.062	0.055	1	0.309
1995.1	3.864092	4.677491	3.963951	3.945651	3.285075	4.029558	-0.02	0.052	1	0.093
1995.2	4.040768	4.769837	3.8835	3.864092	2.662355	3.987714	0.022	-0.146	1	-0.061
1995.3	4.153556	4.997212	3.937086	4.040768	2.760326	4.009632	0.017	0.026	1	0.011
1995.4	4.245491	4.820282	4.254946	4.153556	0.966984	4.007798	0.025	0.076	1	0.13
1996.1	4.436633	4.646312	3.831355	4.245491	2.990971	4.009632	0.06	0.154	1	0.214
1996.2	4.607168	4.83652	3.676149	4.436633	2.649856	3.990243	0.04	0.016	1	-0.056
1996.3	4.633952	5.024538	3.866147	4.607168	2.613593	4.002244	0.004	-0.077	1	-0.115
1996.4	4.566013	4.892377	3.890309	4.633952	2.786492	4.059275	0.008	-0.029	1	0.01

1997.1	4.647655	4.843163	3.627642	4.566013	1.630025	4.11171	-0.07	0.159	1	0.201
1997.2	4.610158	4.823743	3.608753	4.647655	1.25704	4.180001	-0.011	-0.031	1	-0.05
1997.3	4.567053	4.76072	4.32233	4.610158	3.059739	4.187146	-0.024	0.03	1	-0.16
1997.4	4.519176	4.929642	3.943967	4.567053	2.703239	4.179744	-0.064	0.07	1	0.046
1998.1	4.516448	4.916105	3.569758	4.519176	2.961296	4.19237	-0.084	0.173	1	0.074
1998.2	4.445823	4.856707	3.862013	4.516448	2.33389	4.127276	-0.136	0.153	1	-0.004
1998.3	4.301088	4.794716	4.333046	4.445823	2.39562	4.097046	-0.268	-0.332	1	-0.148
1998.4	4.168988	4.694737	4.677007	4.301088	2.845723	4.098864	0.034	-0.031	1	-0.214
1999.1	4.370081	4.763284	3.801047	4.168988	2.684645	4.064572	0.02	0.688	1	0.246
1999.2	4.390986	4.799091	4.018381	4.370081	2.69773	4.071588	-0.008	0.05	1	0.075
1999.3	4.330207	4.678142	4.357875	4.390986	3.013376	4.052133	-0.044	0.048	1	-0.095
1999.4	4.370207	4.748144	3.968536	4.330207	3.116932	4.088494	-0.068		1	-0.061

(b) South Africa

YEAR	LNREER	LNIPI	LNOPN	LNREER1	LNRGCON	LNTOT	NDEVAL	CF	EDC
1987.1	4.356709	4.632785	1.937158	4.330733	2.456507	4.464067	0.003	-0.028	0.126
1987.2	4.382027	4.628887	1.892057	4.356709	2.495104	4.442887	-0.008	-0.013	0.029
1987.3	4.406719	4.653008	1.999451	4.382027	2.488401	4.476655	-0.023	-0.017	0.033
1987.4	4.418841	4.659658	2.00364	4.406719	2.548038	4.50092	-0.048	-0.011	0.035
1988.1	4.430817	4.699571	2.042388	4.418841	2.608083	4.524394	-0.104	-0.011	0.087
1988.2	4.454347	4.673763	2.105962	4.430817	2.574824	4.538068	-0.026	-0.005	0.041
1988.3	4.488636	4.730039	2.095192	4.454347	2.44226	4.528289	0	-0.01	0.039
1988.4	4.49981	4.70953	2.237193	4.488636	2.646458	4.51426	-0.039	-0.01	0.027
1989.1	4.521789	4.725616	2.196002	4.49981	2.758553	4.539778	-0.021	-0.014	0.127
1989.2	4.543295	4.694096	2.343151	4.521789	2.741678	4.575638	0.022	-0.015	0.061
1989.3	4.564348	4.691348	2.310256	4.543295	2.776767	4.559126	-0.008	-0.011	-0.006
1989.4	4.584967	4.684905	2.236338	4.564348	2.794656	4.567364	-0.031	-0.014	0.01
1990.1	4.60517	4.67656	2.246121	4.584967	2.84671	4.589244	-0.002	-0.02	0.052
1990.2	4.622027	4.687671	2.264987	4.60517	2.870169	4.541165	-0.026	-0.01	0.041
1990.3	4.615121	4.659658	2.334568	4.622027	2.950578	4.557869	-0.024	-0.013	0.022
1990.4	4.613138	4.689511	2.292131	4.615121	3.021546	4.533244	-0.004	-0.021	0.048
1991.1	4.633758	4.656813	2.285846	4.613138	3.113915	4.513384	-0.005	-0.019	0.092
1991.2	4.656813	4.670958	2.388946	4.633758	3.139616	4.519939	-0.02	-0.017	0.022
1991.3	4.651099	4.635699	2.45419	4.656813	3.10324	4.553561	-0.022	-0.015	0.077
1991.4	4.662495	4.636669	2.374441	4.651099	3.13371	4.560696	-0.02	-0.023	-0.901
1992.1	4.675629	4.520701	2.373044	4.662495	3.194706	4.561532	-0.009	-0.019	10.35
1992.2	4.685828	4.596129	2.404871	4.675629	3.270785	4.516667	-0.028	-0.023	0.059
1992.3	4.675629	4.768988	2.488401	4.685828	3.292647	4.578929	-0.007	-0.014	0.325
1992.4	4.680278	4.671894	2.523246	4.675629	3.312694	4.570372	-0.016	-0.007	0.245
1993.1	4.67935	4.407938	2.510899	4.680278	3.345826	4.5564	-0.049	-0.005	0.01
1993.2	4.658711	4.511958	2.57009	4.67935	3.37499	4.60517	-0.038	-0.023	0.049
1993.3	4.62791	4.695011	2.662495	4.658711	3.405654	4.55682	0.008	-0.011	0.049
1993.4	4.650144	4.669084	2.602764	4.62791	3.416644	4.548917	-0.012	-0.013	0.092
1994.1	4.654912	4.519612	2.595628	4.650144	3.448812	4.498253	-0.07	-0.011	0.025
1994.2	4.592085	4.519612	2.711577	4.654912	3.49581	4.49981	-0.033	-0.007	0.057
1994.3	4.583947	4.563306	2.835329	4.592085	3.509424	4.547965	0.012	-0.019	0.025

1994.4	4.615121	4.600158	2.792391	4.583947	3.276163	4.590868	-0.023	-0.019	0.033
1995.1	4.603168	4.626932	2.884857	4.615121	3.486243	4.618185	-0.061	-0.015	0.042
1995.2	4.55598	4.62791	2.876723	4.603168	3.501586	4.579852	0.023	-0.006	0.012
1995.3	4.578826	4.65396	2.994832	4.55598	3.522559	4.61145	0	-0.01	0.027
1995.4	4.594109	4.631812	2.909357	4.578826	3.557232	4.648804	0.05	-0.021	0.04
1996.1	4.597138	4.630838	2.989362	4.594109	2.740582	4.64823	-0.114	-0.002	0.058
1996.2	4.488636	4.646312	3.038696	4.597138	2.624741	4.629863	-0.033	0.001	0.035
1996.3	4.463607	4.645352	3.171994	4.488636	2.767074	4.677398	-0.038	0.007	0.038
1996.4	4.45667	4.640537	3.128382	4.463607	2.652819	4.666265	0.084	-0.025	0.052
1997.1	4.55598	4.674696	3.142556	4.45667	2.839663	4.68675	0.023	-0.024	0.009
1997.2	4.589041	4.695011	3.180675	4.55598	2.748104	4.706101	-0.014	-0.049	0.044
1997.3	4.585987	4.668145	3.226646	4.589041	2.766948	4.707727	-0.039	-0.013	0.049
1997.4	4.589041	4.652054	3.239227	4.585987	2.687916	4.704291	-0.004	-0.023	0.039
1998.1	4.55598	4.666265	3.205101	4.589041	2.809101	4.721708	-0.04	-0.041	0.084
1998.2	4.52396	4.644391	3.22736	4.55598	2.825833	4.649761	0.043	-0.034	0.012
1998.3	4.462454	4.609162	3.41217	4.52396	2.845955	4.629277	0.018	0.034	0.03
1998.4	4.436752	4.60517	3.283389	4.462454	2.767576	4.612543	-0.024	-0.001	0.001
1999.1	4.418841	4.600158	2.620748	4.436752	2.268408	4.5933	0.03	-0.021	0.054
1999.2	4.449685	4.597138	2.592565	4.418841	2.168939	4.591477	0.001	-0.011	0.024
1999.3	4.446174	4.628887	2.741549	4.449685	2.348036	4.570786	0.006	-0.02	0.024
1999.4	4.424847	4.647271	2.796793	4.446174	2.432209	4.60056	0.007	-0.031	0.21

Appendix 6 Definition of Variables

LNREER	log of real effective exchange rate
LNIPI	log of industrial production index
LNRGCON	log of government consumption
LNOPN	log of openness
LNTOT	log of terms of trade
NDEVAL	nominal devaluation
CF	capital flows
EDC	excess domestic credit
D1994	dummy variable representing a major policy in 1994