

**AN ANALYSIS OF REAL EXCHANGE RATE DISEQUILIBRIUM IN
DEVELOPING COUNTRIES, WITH AN EMPIRICAL FOCUS ON
SOUTH AFRICA**

By


Tembo, George

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the degree of Master of Social Science.**

**School of Business
Department of Economics
University of Natal
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DECLARATION

I hereby declare that this thesis, except where explicitly indicated to the contrary in the text, is entirely a product of my own investigation and has not been submitted at any other university.

 22/01/99
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Tembo, George.

DEDICATION

To my father James William,

my mother Rosika Nyangwe,

my brothers and sisters

Kaluba, Clever, Wonderful (RIP), Better, Ben, Susan, William, Mathias and Stanly.

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Many thanks go to my supervisor, Prof. Mainardi, who patiently and timeously went through a number of submissions of parts of this research, and offered valuable advice here and there.

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ABSTRACT

Since the early 1970s, exchange rate fluctuations have characterised the behaviour of the external value of many currencies in both high- and low-income countries. Up-and-down movements in real exchange rates have been observed under fixed as well as flexible arrangements. This is in spite of the fact that many less developing countries (until the 1980s), unlike the major industrialised countries, opted to retain relatively rigid exchange rate systems after the collapse of the Bretton Woods system. Exchange rate volatility has been a subject of much concern in government, business and academic circles because it has been associated with negative effects on the performance of developing economies. Consequences of these large swings in exchange rates have included uncertainty and delays in business decisions, resource misallocation, interest rate volatility and real exchange rate misalignments. For the period, from 1970 to 1996, this study investigates the phenomenon of real exchange rate disequilibrium in developing countries, with an empirical and econometric examination of South African data. Using the ordinary least squares and the Engle-Granger cointegration techniques, this investigation found that government consumption of nontradables, the price of gold in rand, the overall terms of trade and the rate of depreciation are important determinants of the short-run behaviour of the real effective exchange rate in South Africa. With regard to the long-run the permanent components of the fundamentals - namely, technological or productivity improvement, trade policy, government consumption of nontradables, disposable income, capital flows, the terms of trade excluding gold and the rand price of gold -, were found to be significantly related to the equilibrium conduct of the real effective exchange rate. Instances of real exchange rate misalignment were found in both periods of fixed and flexible exchange rate management.

TABLE OF CONTENTS

	Page
DECLARATION	(i)
DEDICATION	(ii)
ACKNOWLEDGMENTS	(iii)
ABSTRACT	(iv)
LIST OF TABLES	(ix)
LIST OF FIGURES	(x)
1 INTRODUCTION	1
2 THEORETICAL ASPECTS OF REAL EXCHANGE RATES - EQUILIBRIUM AND DISEQUILIBRIUM	5
2.1 Introduction	5
2.2 Definitions of the real exchange rate and theoretical measurements	5
2.3 Some theoretical and empirical problems with real exchange rate measurements	9
2.4 The equilibrium real exchange rate	12
2.5 The behaviour of the equilibrium real exchange rate	15
2.5.1 Shocks that affect the equilibrium real exchange rate	16
2.5.1.1 Technological progress	16
2.5.1.2 Terms of trade	16
2.5.1.3 Trade policy	17
2.5.1.4 Government expenditure and disposable income	17
2.5.1.5 Capital flows	18
2.6 Why only sustainable values of the fundamentals determine the ERER, and not temporary real or monetary values	19
2.7 Misalignment	21

2.7.1 Misalignment under a predetermined nominal exchange rate system	22
2.7.2 Misalignment under a floating nominal exchange rate system	23
2.7.3 Misalignment under a multiple nominal exchange rate system	25
2.8 How should the authorities deal with misalignment	27
2.9 Conclusion	29
3. NOMINAL EXCHANGE RATE POLICY: CHOICE AND PRACTICE, WITH PARTICULAR REFERENCE TO THE ISSUE OF RER DISEQUILIBRIUM IN LESS DEVELOPING COUNTRIES	31
3.1 Introduction	31
3.2 The real targets approach	33
3.2.1 A model showing adjustment under fixed prices	35
3.2.2 The gold standard	37
3.2.3 The role of money illusion	39
3.2.4 Other weaknesses of the real targets approach	41
3.2.5 Two other desirable features of flexibility	42
3.3 Experience with flexible exchange rates in LDCs	43
3.4 The exchange rate as a nominal anchor	46
3.4.1 The importance of credibility	48
3.5 LDCs' experience with nominal anchors	50
3.6 Capital flows	53
3.6.1 Capital flows, monetary and exchange rate policies	58
3.7 Conclusion	60
4. A CASE STUDY: SOUTH AFRICA	62
4.1 Introduction	62
4.2 Exchange rate policy and developments in South Africa	62
4.3 Real exchange rate movements between 1970 and 1996	67

4.3.1	The period from 1970 to 1979	68
4.3.2	The period from 1979 to 1988	69
4.3.3	The period from 1988 to 1996	72
4.4	An empirical model for RER dynamics	73
4.4.1	The equilibrium real exchange rate	75
4.4.2	Macroeconomic policies	76
4.4.3	Exchange rate policy	77
4.5	The real exchange rate equation to be estimated	77
4.5.1	Concerns about stationarity	78
4.5.2	Cointegration	80
4.6	Operationalisation of variables	83
4.6.1	The real exchange rate	83
4.6.2	Technological progress	85
4.6.3	Commercial or trade policy	85
4.6.4	Government consumption of nontradables	86
4.6.5	Disposable income	86
4.6.6	Capital flows	86
4.6.7	Terms of trade	87
4.6.8	The price of gold	87
4.6.9	Macroeconomic policy	87
4.6.10	Exchange rate policy	89
4.7	Results	89
4.7.1	A short-run equation for the RER	89
4.7.2	Application of the two step Engle-Granger procedure	97
4.7.1	The first step of the Engle-Granger approach	97
4.7.2	The second step of the Engle-Granger method:	
The error-correction regression		102
4.7.3	Real effective exchange rate disequilibrium	104
4.8	Conclusion	106

5. CONCLUSION	107
APPENDIX A	111
APPENDIX B	113
APPENDIX C	114
APPENDIX D	116
APPENDIX E	119
APPENDIX F	120
BIBLIOGRAPHY	121

LIST OF TABLES

	Page	
2.1	Some conditions of internal and external equilibrium	14
2.2	One-off responses of the EREER to changes in fundamentals	18
3.1	Types of exchange rate regimes	32
4.1	Operational variables	88
4.2	RER equations with some collinear variables	90
4.3	Tests for stationarity	92
4.4	Short-run equations for the RER	94
4.5	Results of ADF-tests on permanent components of fundamentals	98
4.6	Long-run equations obtained by the first step of the Engle-Granger method	99
4.7	Estimated Correlation matrix of Variables	101
4.8	Error-correction regression	102

LIST OF FIGURES

2.1	Sectoral output as the RER changes	7
2.2	Effects of temporary changes in fundamentals and money supply on the RER	20
2.3	Dornbusch's model of overshooting exchange rates following a monetary shock	24
3.1	An inflexible price adjustment model	36
4.1	Nominal and real exchange rate paths	67
4.2	Exchange rates and terms of trade	69
4.3	Gold price and exchange rates	70
4.4	Rand and dollar gold prices	71
4.5	Paths for the ERER and REER	104

1 INTRODUCTION

Since the early 1970s, exchange rates in both less developing and developed countries have become highly volatile. This is in spite of the fact that until the 1980s, a lot of less developing countries (LDCs) operated relatively fixed exchange rate regimes. The instability in exchange rates has caused much concern not only among academicians, but also policymakers in government, the business community, domestic financial institutions and global financial institutions such as the International Monetary Fund (IMF) and the World Bank.

In some countries where exchange rate instability has been particularly pronounced, the real domestic price of some goods relative to the world level has doubled or trebled in just a few years. In other words, these countries have experienced real exchange rate (RER) appreciations that have scaled down the level of their international competitiveness. Such experiences could not be more unwelcome, especially given the widely shared desire among LDCs to get exports moving.

Exchange rate volatility has made it difficult for businesses to operate with a long-term view because of the uncertainty and unreliable signals occasioned by non-stable currencies. The fact that a lot of LDCs have poorly developed financial structures compounds the problem, because it means that usually there are no futures markets¹ for absorbing the risks posed by unanticipated exchange rate changes to international transactions.

Another concern with exchange rate instability, and one which is close to the heart of this study, is that the RER tends to diverge from the path of the equilibrium real exchange rate (ERER). Over the last 25 years, growing interest in the phenomenon of RER disequilibrium has spurred academicians and policymakers to embark on the worthwhile but difficult enterprise of identifying the determinants of RERs and ERERs. The task is not an easy one, for it appears, apart from definitional hurdles, there is not a uniform and permanent set of RER fundamentals for each and every country

¹ This comment does not apply to some of the LDCs, for example, the so-called newly industrialised countries and South Africa (on which a case study will be conducted).

definitional hurdles, there is not a uniform and permanent set of RER fundamentals for each and every country for all time.

With the phenomenon of RER disequilibrium, policymakers especially have been interested in the implications of RER misalignments for the design of exchange rate management. Here, interested parties have sought to learn the best exchange rate policy framework to put in place so as, most effectively, to attain the goal of internal and external equilibrium. It has been said that countries with flexible exchange rate arrangements have experienced more exchange rate instability than those with rigid arrangements. But RER disequilibrium is known to have occurred in both flexible and fixed exchange rate systems. Therefore, it would appear that the phenomenon of RER misalignment has spared neither floating nor fixed exchange rate systems.

In coming to the rescue of economically poorly performing LDCs or ones in crises, the IMF and the World Bank, have invariably recommended more flexible nominal exchange rate arrangements. In particular, as part of the structural adjustment programme, LDCs have been strongly advised to devalue their currencies. The poor performance of the export sector, in the eyes of the two Bretton-Woods institutions, is a symptom of overvalued exchange rates. Therefore, to make the export commodities of LDCs cheaper and more price-competitive internationally, a policy of devaluation or depreciation has been uniformly recommended for all LDCs. The rationale for devaluation seems not to have ended here. Further, it has been suggested that through devaluation, resources will be redirected from the nontradable to the more productive tradables sector. Given the development policy re-orientation that many LDCs have adopted away from the 1970s emphasis on import-substitution towards today's accent on export-promotion, this reasoning appears sound.

But the policy of devaluation has not been easily implemented in LDCs. The inflationary effects of devaluation have prompted serious food riots in some LDCs, and have also led to the fall of some governments (Edwards, 1989:2). Obviously, the harmony that may characterise the theory of devaluation or depreciation has not always been translated into smooth practices. The failure of devaluation in some LDCs, but also its success in others, has led policymakers and academicians

to inquire deeper into the underlying assumptions of this policy, in part, as it relates to the issue of RER misalignments.

Part of the proposed panacea for RER misalignments and balance of payments problems in LDCs has consisted of an insistence on tight monetary and fiscal policies. Loose macroeconomic arrangements have been blamed for RER disequilibrium in LDCs. The stipulation of macroeconomic discipline is one which governments have not found easy to follow, given the ever-growing demands on national purses. Accustomed to the traditional practice of encouraging growth and reducing unemployment through the stimulant of liberal macroeconomic policies, a number of LDCs have from time to time succumbed to the temptation of the short-run benefits of expansive monetary and fiscal policies. Therefore, the expected discipline of reform has not always been whole-heartedly embraced and implemented by LDCs.

The aim of this study is to explore the issue of RER disequilibrium in LDCs with the following objectives in mind:

1. To come up with reasonable definitions of major working concepts such as the RER, ERER and RER misalignment.
2. To advance an acceptable set of determinants for the RER and ERER in LDCs.
3. To map out the paths of the ERER and the RER, and investigate possibilities of and reasons for misalignments in South Africa..
4. To consider the implications of the issue of RER disequilibrium for the choice of an exchange rate regime in LDCs.

In pursuit of these objectives, the discussion of this dissertation will proceed as follows:

Chapter 2 will delve into the theory of RER behaviour in LDCs. In this chapter, major working concepts such as the RER, the ERER and misalignment will be clarified. At the theoretical level, a number of fundamentals will be proposed as determinants of ERER behaviour. In addition to the fundamentals, macroeconomic policies and exchange rate policies will be hypothesised as determinants of RER behaviour. The corrective instrument of devaluation will be discussed, and then a conclusion to the chapter bringing the major ideas of the chapter together will be presented.

Chapter 3 will deal with the implications of the phenomenon of RER disequilibrium for the design of exchange rate policies in LDCs. Here, the desirable attributes of the real targets and nominal anchor approaches towards the maintenance of RER equilibrium will be highlighted. Factors that can and have led to the poor performance of either perspective in this regard will also be discussed from the points of view of both theory and experience.

Chapter 4 will present a case study of South Africa. It is here that a dynamic model of RER behaviour, comprising Edwards' (1989:133) and Elbadawi's (1994:101) hypothesised elements of an automatic adjustment mechanism, macroeconomic and exchange rate policies will be applied to South African data. Estimations of this model and some of its components, using the ordinary least squares (OLS) technique and the more advanced Engle-Granger (1987) cointegration and error-correction modeling strategy will be attempted, and results presented and discussed.

Finally, chapter 5 will conclude the study by summarising major arguments and findings. Some recommendations will also be made.

2 THEORETICAL ASPECTS OF REAL EXCHANGE RATES - EQUILIBRIUM AND DISEQUILIBRIUM

2.1 Introduction

This chapter deals with the theory underlying the phenomenon of RER disequilibrium in LDCs. Apart from trying to clarify the meaning of some major concepts, it is also the aspiration of this chapter to arrive at a plausible set of determinants for the behaviour of the RER and the ERER. These determinants will not only shed light on the causes of exchange rate movements, but also provide a basis on which, later in chapter 4, to try to map out the paths for the RER and the ERER. The chapter also proposes how to close the gap between the actual and ERER.

This chapter is organised as follows. The next section presents a number of conceptual and formal definitions of the RER. Section 2.3 examines a number of proxies that have been proposed for measuring the RER, bringing out some problems associated with them. In section 2.4, some definitions of the ERER are examined, paying particular attention on the purchasing power parity (*ppp*) and the tradables-nontradables (Salter-Swan) based perspectives. Section 2.5 deals with the reaction of the ERER to several real shocks. In section 2.6, the reasons why changes in money supply and temporary movements in real variables do not shape the long-run RER are considered. The issue of misalignment, under different nominal exchange rate regimes, is tackled in section 2.7. Then, in section 2.8, some mechanisms for correcting RER disequilibria are explored. Section 2.9, brings together some of the major ideas discussed in the chapter in summary form.

2.2 Definitions of the real exchange rate and theoretical Measurements

The present state of international economics does not provide one definition of the RER, but a number of them.

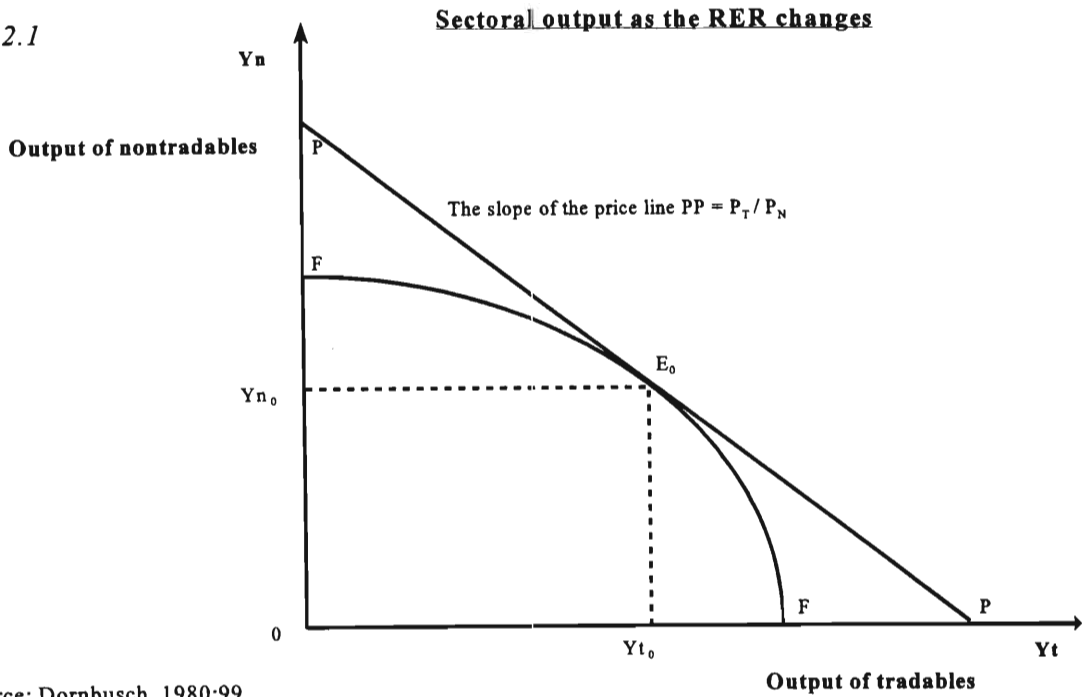
Traditionally, the purchasing power parity (*ppp*) approach has been used to define the RER. According to this perspective, the *ppp* RER (e_{ppp}) is equal to the nominal exchange rate (E) multiplied by the ratio of "the" foreign price level (P_f) to "the" domestic price level (P_d): $e_{ppp} = E P_f / P_d$. If P_f and P_d are consumer price indexes, e_{ppp} measures the relative price of foreign to domestic consumption; if P_f and P_d are producer price indexes, e_{ppp} measures the relative price of the foreign to the domestic production basket.

Within the *ppp* purview, there is a wage-rate based RER which is defined in terms of relative unit labour costs in the tradables sector. Formally this exchange rate may be expressed as follows: $R_w = E_n (L^*_{ulc} / L_{ulc})$, where R_w stands for the wage-rate based exchange rate, E_n the nominal exchange rate in local currency, L_{ulc} home country unit labour costs in domestic currency and L^*_{ulc} unit labour costs in the rest of the world in domestic currency (Gerson and Khan, 1988:125).

Most of the contemporary theoretical literature defines the real exchange rate (e) as the domestic price of tradable (P_T) relative to nontradable goods¹ (P_N): $e = P_T/P_N$ (Dornbusch, 1980:102; Krueger, 1982; Frenkel and Mussa, 1984; Neary and Purvis, 1983; Corden, 1994:67-69). To illustrate this concept the discussion will turn to figure 2.1(a). Here it is assumed that labour is mobile but that capital is fixed in the two sectors of the economy. Consequently, the production possibilities frontier FF is drawn concave to the origin, depicting diminishing marginal returns to labour. The slope of the price line PP gives us the relative price of tradables, and graphically defines the RER ($e = P_T/P_N$). For a given value of the RER, efficient production takes place where the price line is tangent to the production possibilities frontier. In the case of figure 2.1(a), the economy will produce at E_0 , where an output combination of Y_{n_0} of nontradables and Y_{t_0} of tradables will be realised.

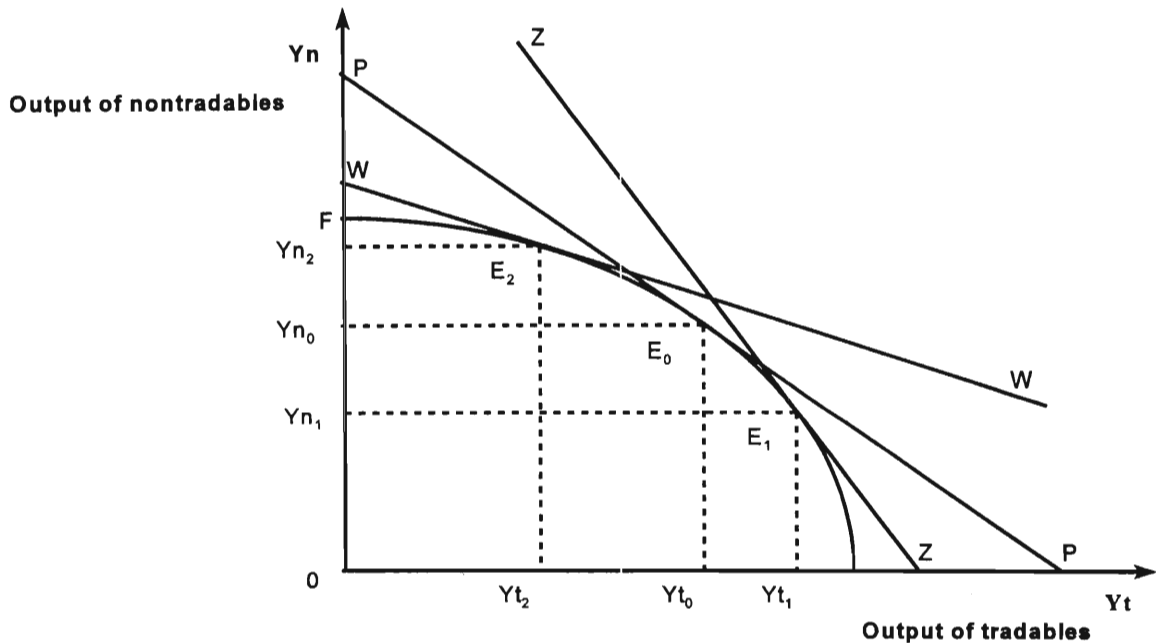
¹ Le Fort (1988:338) defines nontradables as commodities that under the current technology, tastes, trade restrictions, transport costs and international prices cannot be traded internationally and thus their prices are decided domestically. Tradables are goods that are actually exported or imported and their close substitutes produced domestically; their prices in international currency are determined abroad.

Figure 2.1



Source: Dornbusch, 1980:99

- (a) *The production possibilities frontier FF has a bowed out shape, indicating diminishing marginal returns to labour due to fixed capital in both sectors of the economy. Equilibrium output levels Y_{n_0} and Y_{t_0} are determined at the point E_0 where the price line PP is tangent to the production possibilities frontier FF.*



- (b) *Initial equilibrium is at E_0 . With the rise in the price of tradables, the new price line ZZ becomes steeper than the initial price line PP, generating a new equilibrium at E_1 , where the output of tradables has expanded from Y_{t_0} to Y_{t_1} , and that of nontradables declined from Y_{n_0} to Y_{n_1} . A rise in the price of nontradables shifts the price line to WW (Supposing initial equilibrium to have been at E_0). The equilibrium point now becomes E_2 , where producers raise the output of nontradables from Y_{n_0} to Y_{n_2} , and reduce the production of tradables from Y_{t_0} to Y_{t_2} .*

This conception of the RER provides an incentive guide for resource allocation across the tradables and nontradables sectors. When e rises the tradables sector becomes relatively more profitable than the nontradables sector, and resources are expected to shift from the nontradables sector to the tradables sector. This is shown in figure 2.1(b) by the economy's movement from E_0 to E_1 on the production possibilities curve. At E_0 the price line ZZ is steeper than that at E_1 (PP), reflecting the rise in e . As more resources are committed to the production of tradables output in that sector rises from Y_{t_0} to Y_{t_1} . Conversely, when e falls the nontradables sector becomes relatively more lucrative and resources are expected to move from the tradables sector to the nontradables sector. In terms of figure 2.1(b), the rise in the price of nontradables results in the relatively flatter price line WW . Assuming that the price change is occurring from the initial position E_0 , the price change raises the production of nontradables from Y_{n_0} to Y_{n_2} .

The tradables-nontradables based definition of the RER can also be seen as a measure of international competitiveness for the tradables sector of a country. The relative price of tradables yields the relative price of producing tradables domestically. A decline in e represents a RER appreciation², implying an increase in the domestic cost of producing tradables. Holding relative prices in the rest of the world constant, the decline in e deteriorates the country's degree of international competitiveness, the country now producing tradables relatively more expensively than before. Conversely, a rise in e signifies a RER depreciation, an improvement in international competitiveness and relatively much cheaper domestic production of tradable goods (Edwards, 1989:5).

Some support for the *ppp* hypothesis, especially for tradable commodities, has been advanced by some authors (Lee, 1976; Hakkio, 1992; Lothian and Taylor, 1993; Rogoff, 1996), but the greater weight of evidence appears to corroborate the tradables-nontradables RER perspective (Krugman and Obstfeld, 1994; Frenkel, 1978; Edwards, 1989; Elbadawi, 1994). This has increasingly become the case because the price indices used in the latter studies take account of the difference between tradable and nontradable goods.

²The opposite is true for the South African Reserve Bank determined Real Effective Exchange Rate.

The measurement of the RER using e carries one weakness: uniform taxes for all tradable goods are assumed. But in a many goods economy, it is usually the case that a differential tax structure obtains. A limited solution to this problem would be to generate sector specific RERs which take respective taxes into account. This remedy, though, is a narrow one and lacks the quality of a comprehensive measure of competitiveness. A more representative and economy-wide index is suggested by Dornbusch (1980:99): $e = E P_T / P_N$. This overall index excludes taxes on trade, but should it be required it can be manipulated to include sectoral taxes³.

The two-sector economy RER e is a composite measure which can be disaggregated into two other RERs. Tradables can be broken down into importables and exportables. If one is interested in determining the competitiveness of importables relative to non-tradables the importables RER can be calculated using the following formula: $e_m = E P_m^* / P_n$, where e_m signifies the importables RER, E the domestic currency nominal exchange rate, P_m^* the foreign price of importables and P_n the domestic price of non-tradables. Similarly the exportables real exchange rate can be defined as $e_x = E P_x^* / P_m$, where P_x^* is the foreign price of exportables. In both definitions it is assumed that the law of one price holds (Holden, 1988:4), so that the domestic and foreign prices of importables are equal. Similarly, the domestic and foreign prices of exportables are assumed to be the same, when expressed in the same currency⁴.

2.3 Some theoretical and empirical problems with real exchange rate measurements

The theoretical definitions of the RER described above must be translatable into observable equivalents if they are to be of practical application. Given that the elements of the various formulae for the RER are not directly computed (for example, the price of nontradables),

³A sector-specific (or good specific) index of the RER adjusted by the effects of taxes (or subsidies) is achievable. Suppose sector j is subject to a tax of t_j , the RER index would be given by $e_{Tj} = E P_j^* (1+t_j) / P_N$ (Edwards, 1989:7).

⁴ See Holden (1988:4) for the Harbeger definition of the RER.

any attempt at calculating the RER usually adopts some proxies. In this section the goodness of some of the proxies that have been suggested for estimating the RER and other matters related to the measurement of the RER will be addressed.

For the construction of the *ppp* based RER four alternative price indices have traditionally been put forward: (1) consumer price indices at home and abroad, (2) wholesale price indices, (3) GDP deflators, and (4) wage rate indices. Commonly, the domestic and foreign CPIs are used for arriving at the *ppp* RER (deVries, 1968). Since the CPIs include a wide range of goods and services it has been argued that the *ppp* RER can provide a comprehensive measure of competitiveness (Genberg, 1978). An obvious advantage of this index is its ready availability as data on CPIs for each country is computed and published periodically.

One weakness in the *ppp* measure of the RER is it does not "capture changes in the relative incentives guiding resource allocation across the tradables and nontradables sectors" (Edwards, 1989:6). Secondly, in-built within the *ppp* definition are assumptions similar to those governing the law of one price which states that identical goods in different countries fetch the same currency price, when transactions are costless and free from trade barriers. Extending this logic to a group of commodities the absolute version of the *ppp* theory, formally presented by David Ricardo and popularised by Gustav Cassel (1928), says that an identical reference basket of goods sells for the same price across countries, when price is expressed in the same currency. In this case the exchange rate is given by the ratio of the foreign to the domestic price levels. But in the real world transport costs, trade barriers, monopolistic practices and differences in the composition of commodity baskets used for measuring inflation, among other factors, seriously and consistently violate *ppp* restrictions, stifling profitable arbitrage and making it difficult for prices to converge in the long-run (Krugman and Obstfeld, 1994:414; Clark et al, 1994:4). In this case, deviations of the actual real exchange rate do not return to the *ppp* level.

Given the shortcomings associated with CPIs, one might consider using WPIs, characteristically made up of largely tradables. But the highly homogenous nature of tradables and the fact that prices for these commodities across countries tend to be nearly the same, does

not permit sufficient variation in the RER to allow the measurement of actual changes in competitiveness (Keynes, 1930; Officer, 1982).

Some of these difficulties could be solved by using the GDP deflator, especially that it is a reliable index of aggregate production and not subject to direct distortions arising from price controls (Edwards, 1988; Barro, 1983). Using the GDP deflator presents some hurdles: it is not readily available for most developing countries, and, like the CPI, contains a large component of nontradables.

The ratio of unit labour costs has been used to compute the RER (Artus, 1978; Artus and Knight, 1984; Houthaker, 1962; Maciejewski, 1983). This index has some problems. Being wage-rate based, the index is sensitive to cyclical productivity changes. Second, figures for the index are not easily available. Third, since labour is taken into consideration but other factors of production are omitted, the index is insensitive to differences in capital-labour ratios across countries, and, therefore, biased. Fourth, one would expect marginal rather than average or unit labour costs to determine the allocation of labour.⁵ Fifth, it is difficult to determine costs proper to labour from a total including payments, not only due to capital, but also accruing to rental of land and intermediate goods and primary commodities.

So far the discussion has considered some proxies for the *ppp* based RER. Some contemporary authors have made some attempts at finding proxies for the relative price of tradables. Adopting traditional price indices, Kravis and Lipsey (1983) and Merle Holden (1988:27) have combined the GDP deflators for the government and services as a surrogate for the price of nontradables and GDP deflators for the rest of the economy as a proxy for the price of tradables. The severest hurdle with this indicator is that national account data, from which the deflators are obtained, are available on a yearly basis only and with a lot of delays (Edwards, 1988:55).

⁵ Profit maximisation requires that a firm hire inputs of labour up to the point where the marginal revenue product of labour equals the marginal factor cost of labour (Ruffin R.J. and Gregory P.R., 1983:595-598).

A simple proxy for the RER is where the price of tradables is represented by the foreign country's WPI, and the price of nontradables is represented by the domestic country's CPI: $RER = (E \text{ WPI}^*) / \text{CPI}$ (Harbeger, 1986; Diaj-Alejandro, 1986; Edwards, 1989:88). Such an index tells us the RER between two countries. Given the fact that any given country trades with many other countries, it is conceivable that as many bilateral indices as trading partners of a country could be achieved. These indices might suggest contradictory movements of the RER. While some may be showing a real currency appreciation, others could be indicating a depreciation. Since each one of the bilateral RERs depicts only part of the behaviour of the RER, a fuller and more balanced picture can be captured by the following proxy multilateral index:

$$MRER_{kt} = \frac{\sum_{i=1}^n \alpha_{ki} E_{it} \text{WPI}_{it}}{\text{CPI}_{kt}}$$

where,

$MRER$ = the multilateral RER for country k in period t ,

α_{ki} = weight of country i in terms of country k 's trade with the rest of the world,

E_{it} = the nominal exchange rate between country i and country k in period t , in country K 's currency,

WPI_{it} = the wholesale price index of country i in period t , in country i 's currency, and

CPI_{kt} = the consumer price index of country k in period t in country K 's currency.

2.4 The equilibrium real exchange rate

Thus far, some conceptual, formal and operational definitions of the RER have been analysed. Now, the exposition will move to consider a unique instance of the RER called the equilibrium real exchange rate (ERER).

According to the *ppp* approach the ERER is constant (Aghevli *et. al*, 1991). This constant is the value that the RER took during a past period when the external market was in equilibrium. But this definition of the ERER contains a serious loophole. The *ppp* perspective of the ERER fails to take into account changes in real determinants such as productivity improvements, trade barrier adjustments and changes in taxation - to mention a few - all of

which impinge on the behaviour of the ERER, thus making it non-constant.

As was seen in section 2.2, a number of authors (Frenkel, 1981; Harberger, 1986; Dornbusch, 1987; Edwards, 1989) define the RER in terms of a double-sector based ratio. From that framework Edwards provides an alternative and theoretically more appealing definition of the ERER: it is the "relative price of tradables to nontradables that, for given sustainable (equilibrium) values of other relevant variables - such as taxes, international prices, and technology - results in the simultaneous attainment of internal and external equilibrium" (1989:8). *Internal* equilibrium is attained when the market for nontradable goods clears in the current period, and is expected to clear in future periods as well. *External* equilibrium is achieved when "the intertemporal budget constraint that states that the discounted sum of a country's current account has to be equal to zero is satisfied" (Edwards, 1989:8). In the words of Elbadawi (1994:94) external equilibrium holds when present and future current account balances are compatible with long-run sustainable capital flows.

For Clark *et al.*(1994:12), internal balance is the level of output consistent with both full employment and a low, sustainable level of inflation - a state of macroeconomic stability with a non-accelerating rate of inflation. Taking the capital account as the counterpart to the current account, Clark *et al.* describe external balance as the desired net flow of assets between economies in the absence of significant institutional or governmental distortions, a view quite similar to that of Elbadawi above.

From the foregoing one may wonder as to what the optimal capital account level is. A current account target of zero, though simple, is unrealistic and unappreciative of benefits of net flows accruing to savers and investors across countries. Basing current account targets on short-term flows would be ill-advised given their reversible and volatile nature. This leaves estimates based on long-term flows as a more appealing standard for the desired level of net flows.

External balance can also be perceived from the growth point of view. Due to the highly unreliable or irregular nature or just scant availability of capital inflows, a country might find itself persistently affronted by unaffordable balance of payments deficits. In this case a country

could decide to maintain a surplus on the current account by limiting growth to a certain percentage. South Africa introduced and maintained a growth ceiling of 3% from 1985

Author	Internal balance	External balance
Edwards, 1989:8	The quantity demanded equals the quantity supplied of nontradables today and in the future	The discounted sum of a country's current account equals zero.
Elbadawi, 1994:94		Present and future current account balances are compatible with long-run sustainable capital flows.
Van de Walt and De Wet, 1993:4; De Wet, 1995:474		In the presence of severe constraints on the capital account, the level of output is compatible with the maintenance of a surplus on the current account.
Clark et al., 1994:12-13	The level of output is consistent with both full employment and a low, sustainable level of inflation - a state of macroeconomic stability with a non-accelerating rate of inflation.	The desired net flow of assets between economies occurs in the absence of significant institutional or governmental distortions.
Williamson, 1994:179-180	The level of effective demand can sustain the highest level of activity consistent with the control of inflation	The current account outcome is sustainable.

Table 2.1

Some conditions of internal and external equilibrium

to the mid 1990s (J.S. Van der Walt and G.L. de Wet, 1993:4; G.L. de Wet, 1995:474). This policy measure was taken by the authorities in order for the country to continue meeting its international debt payment obligations, following the massive capital flight and the withdrawal of external sources of finance that characterised domestic and world opposition to South Africa's racial policies. Alternatively, a country could set boundaries within which the current account could be permitted to be in deficit in relation to the level of total output. For instance, the Central Bank of Chile has an explicit medium-term target for current account deficits to lie between 3 and 4 percent of GDP. This measure was introduced to counter the severe deficit that followed the unsustainable heavy inflows of capital between 1978 and 1982 (Williamson, 1995:14).

Table 2.1 above briefly presents some major characterisations of internal and external equilibrium found in the literature.

2.5 The behaviour of the equilibrium real exchange rate

It has been observed in section 2.4 that contrary to the position of the *ppp* school of thought, particularly the type presented by Cassel (1928), the ERER is changeable. The ERER varies with adjustments in any real factor impinging upon a country's internal or external equilibria, for example, import tariffs, export taxes, real interest rates and capital controls. Such immediate determinants of the ERER are called RER *fundamentals* (Edwards, 1989:16). The ERER responds not only to current values of fundamentals, but also their expected future movements. This is because of the possibilities of intertemporal substitution in consumption through foreign borrowing and lending, and in production via investment, and anticipated future events such as awaited future removals of capital controls. In other words, the ERER is a forward looking function of the fundamentals (Elbadawi, 1994:95): it is shaped not only by the present but also the expected future conduct of real variables. Transitory real shocks tend to affect the ERER in the short run only, while permanent real disturbances are inclined to determine the long-run path of the ERER, so that it is possible to distinguish between short-run and long-run ERERs (Edwards, 1989:17)

It is commonly held in international economics that the ERER is determined by real variables only; in the long-run monetary variables have no effect on the ERER. This section, will attempt a theoretical configuration of the behavioural response of the ERER to some real disturbances, namely, changes in technology or productivity, terms of trade, tariffs, government expenditure and capital flows.

2.5.1 Shocks that affect the Equilibrium Real Exchange Rate

The following real shocks are widely discussed in the international economics literature as important determinants of the behaviour of the ERER:

2.5.1.1 **Technological progress**

Advancements in technology can take place in the tradables or nontradables sectors. Such productivity improvements, apart from raising output, also tend to stimulate upward pressures on wages in both sectors (Balassa, 1964; Samuelson, 1964; Pretorius and Smal, 1994:26). The increase in wages in the nontradables sector is reflected in the rise in the price for nontradables. Wage changes in the tradables sector are expected not to have a bearing on the price for tradables, since, for a small and open developing economy, prices for exports are decided on the world market. Consequently, the rise in the price of nontradables leads to an appreciation of the RER.

However, Edwards (1989:48), paying closer attention on the opposing impacts of increases in income and production on prices, contends that if the supply effect of technological progress outstrips the demand effect the price of nontradables will tend to decline, generating an equilibrium real depreciation. It appears that the direction of movement in the ERER due to output and demand augmenting effects of technological improvement is not given *a priori*. If the downward pressures on the price level due to increased output supercede the upward pressures due to the rise in wages, a RER depreciation will occur, and vice versa. Should the resultant two antagonistic forces be equal in strength, a change in productivity will issue in no adjustment to the RER.

2.5.1.2 **Terms of trade**

Terms of trade is defined as the ratio of the price of exports to the price of imports. In LDCs, mostly raw materials are exported, indicating low levels of diversification in the range of goods produced as compared to industrial countries. These primary commodities have over the years commanded unstable and generally declining prices on the world market. This downward trend in world prices of primary commodities, attended by rising prices of imports of intermediate and finished products, implies that LDCs have been experiencing worsening terms of trade.

Income and substitution effects are associated with changes in the terms of trade. As consumers have less real income due to the decline in the terms of trade, the demand for nontradables goes down, exerting downward pressures on the price for nontradables and leading to a real depreciation (Cottani *et al.*, 1990; Edwards, 1989; Aghevli *et al.*, 1991; Ostry and Khan, 1992). The resultant excess supply and declining prices in the nontraded goods sector induces producers to shift to the more lucrative tradables⁶ sector where relative prices are higher and real wages lower. If nontradables are substitutes to tradables, a decline in the terms of trade could encourage consumers to shift consumption to nontradables. If the increase in demand for nontradables is sufficiently large, especially given that LDCs typically experience short-or medium-term constraints in adjustments of nontradable sector supply, a real appreciation could ensue. In this case the substitution effect overrides the income effect.

2.5.1.3 Trade policy

A reduction in the tariff rate makes imports cheap. This encourages consumers to spend more of their income on importables than on nontradables or exportables. The consequent excess supply of nontradables and exportables reduces the price of nontradables, but has no influence over the price of tradables since it is determined on the world market. As the price of nontradables falls relative to that of tradable commodities, the ERER depreciates. An increase in tariffs is expected to generate opposite results, that is, a rise in the price of nontradables and the appreciation of the ERER.

2.5.1.4 Government expenditure and disposable income

The composition of Government expenditure affects the ERER. If the level of Government spending on nontradables increases, the price of nontradables will rise, leading to an ERER appreciation (Cottani *et al.*, 1990). But increases in expenditure on tradables by the Government are expected to have no effect on the exogenously decided price for tradables. Changes in fiscal measures can also influence the behaviour of the ERER. A relaxation of taxes

⁶The decline in the terms of trade implies higher prices for importables.

could increase disposable income and demand for nontradables, again, placing appreciationary pressures on the ERER.

2.5.1.5 Capital flows

Various researchers in international economics (McKinnon, 1976; Edwards, 1989; Cottani *et al*, 1990) have shown the significant influence that massive changes in capital flows have on the behaviour of the ERER. Interest rates which are higher than the world level, the relaxation of controls on public and private foreign borrowing and increases in foreign aid or

Type of shock	Effect on ERER	Author
Technological progress (tradables sector)	Positive Ambivalent	Aghevli <i>et al</i> (1991) Edwards (1989)
External terms of trade	Positive Ambivalent	Ostry and Khan (1992), Aghevli <i>et al</i> (1991), Cottani <i>et al</i> (1990) Elbadawi (1994)
Tariffs (export subsidies, import taxes; when importables and nontradables are normal goods)	Negative	Cottani <i>et al</i> , (1990), Edwards (1989), Aghevli <i>et al</i> (1991)
Government expenditure	Ambivalent	Elbadawi (1994), Edwards (1989)
Government consumption of nontradables	Negative	Ostry and Khan 1992), Aghevli <i>et al</i> (1991), Edwards (1989), Elbadawi (1994), Montiel and Ostry (1991)
Disposable income spent on nontradables	Negative	Aghevli <i>et al</i> (1991)
Capital flows	Negative	Elbadawi (1994), Ostry and Khan (1992), Cottani <i>et al</i> (1990), Edwards (1989), Aghevli <i>et al</i> (1991),

Table 2.2

One-off responses of the ERER to changes in fundamentals

The table shows the effects of real variables on the ERER. The signs hold equally good for the influence of the fundamentals on the RER. "Ambivalent" here means that the effect is not known a priori; it can be either positive or negative. "Negative" signifies a RER appreciation, "Positive" signifies a RER depreciation.

grants can lead to increases in capital inflows. The resultant rise in real money holdings causes the demand and price for nontradables to go up and the currency to appreciate.

Capital outflows, such as happened in South Africa during the economic boycott of the

former Apartheid government, are expected to lead to a reduction in the demand for nontradables and a real equilibrium depreciation. South Africa, together with many other developing countries, experienced massive capital inflows in the 1970s. This was due to the overly free and uncautious lending policies adopted by many western banks, which acted as a conduit for the excessive oil revenues generated by oil producing countries when oil prices shot up in 1973. For many LDCs the serious debt burdens that they faced later in the 1980s (1985 for South Africa) began about this time.

Table 2.2 above summarises the relationship between changes in some real variables and the behaviour of the ERER.

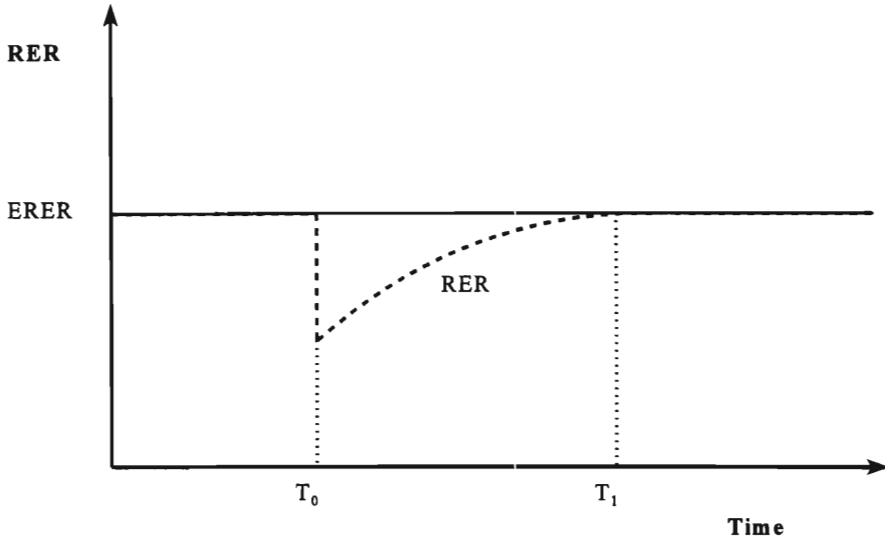
2.6 Why only sustainable values of the fundamentals determine the ERER, and not temporary real or monetary values.

The ERER is a long run and real phenomenon, determined by enduring real conditions brought about through the equilibrating conduct of real factors, the fundamentals. Following this approach two conclusions can be deduced. Firstly, monetary changes, which by definition are not real, are not considered determinants of the ERER. Secondly, transitory movements in fundamentals have no influence over the path of the ERER. These inferences can be demonstrated using figures 2.2 (a) and 2.2 (b). Here, the relationship between one-off changes in money supply or temporary movements in real variables and the long-run RER will be considered. The examination is conducted, among many other possibilities, under two extreme exchange rate systems, one fixed, the other, floating.

Suppose, at time T_0 , the monetary authorities in a small country increased money supply. Under a fixed exchange rate system, the immediate impact of this expansionist intervention, would be reflected in higher domestic prices. In figure 2.2 (a), it can be seen that the RER goes down, indicating a real appreciation. The real product wage falls in the nontradables sector, inducing producers to employ more labour and increase the supply of nontradables. Consumers find nontradables expensive and tend to shift expenditure towards tradables. These reactions of producers and consumers will tend to dampen domestic prices, and over time as the excess

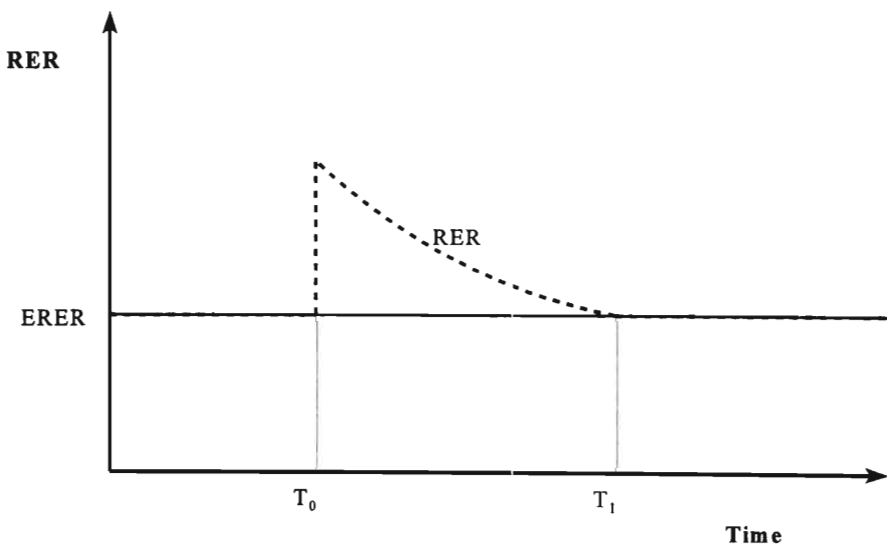
Figure 2.2

Effects of temporary changes in fundamentals and money supply on the RER



Source: Edwards, 1989:67

(a) Under a Fixed Exchange Rate System



Source: Edwards, 1988:13

(b) Under a Flexible Exchange Rate System

demand for money fades away, the domestic price level will fall, raising the RER until it reverts to the sustainable long-run level at time T_1 .

Figure 2.2 (b) depicts the impact of excess money balances introduced at time T_1 , but now in an economy governed by a free exchange rate system. Since the nominal exchange rate is expected to be more flexible than the price level, the expansionist monetary policy immediately leads to a RER depreciation at time T_1 . But as prices slowly adjust upwards, the RER falls back to the steady state level. At time T_1 , the full effect of the change in money supply is exhausted and from then onwards, the RER is at its sustainable level.

Here it can be observed that in both examples the real fundamentals did not change. Consequently, the ERER level stayed the same. Therefore, it follows that although changes in money supply influence the behaviour of the RER in the short-term, they have no bearing on the long-run course of the RER. These observations hold equally good for the effect of temporary changes in the fundamentals. For instance, suppose there was a temporary upsurge in capital inflows at time T_1 . Even in this case, figures 2.2 (a) and 2.2 (b) show what would happen. Hence, it can be said that neither one-off changes in money supply nor transitory alterations in real variables determine the ERER.

2.7 Misalignment

Having explained what the RER and the ERER are - concepts which are critical to our understanding of RER disequilibrium - this exposition is now in a position to discuss the economics of RER misalignment or disequilibrium. RER misalignment is defined as "sustained deviations of the actual RER from its long-run equilibrium level" (Edwards, 1989:8). If the actual RER is below the equilibrium level, the actual RER is said to be overvalued, and if it is above the equilibrium level, the actual RER is said to be undervalued.

Misalignment can occur for many reasons, for instance, due to transitory expansionary monetary policies, unsustainable or inconsistent fiscal policies, or temporary changes in real variables. For example, between 1990 and 1995 many LDCs temporarily received heavy

injections of capital which exerted downward pressures on their RERs. Mexico, one of them, ended up experiencing such an overvalued currency that the peso, its currency, collapsed in December 1994 (Edwards, 1995).

The achievement and maintenance of a sustainable macroeconomic equilibrium requires that fiscal and monetary policies be consonant with the chosen nominal exchange rate system. Disharmony between the two can lead to disequilibrium. In what follows some possible effects of the interaction between macroeconomic procedures and the RER under three nominal exchange rate regimes will be considered, that is, the predetermined nominal exchange rate, floating exchange rate and non-unified exchange rate systems.

2.7.1 Misalignment under a predetermined nominal exchange rate system

Examples of a predetermined nominal exchange rate regime include fixed, crawling and managed rates. Where the exchange rate system is fixed, E in the RER formula $e = E P_T/P_N$ is set by the monetary authority. If P_N rises faster than P_T , e will fall, representing a real appreciation. One clear situation where upward pressures are likely to be placed on the price of nontradables is where a government pursues a high fiscal deficit under a fixed exchange rate system. One or a combination of the sources of finance could be employed to clear a deficit, for example, borrowing, export receipts, capital inflows and printing money. Developing countries have been observed to finance fiscal imbalances through money creation. This remedy requires a certain rate of inflation to finance the deficit. The price for nontradables will move according to the domestic rate of inflation while the price for tradables will change in line with the world rate of inflation. Now, if the domestic rate of inflation called for to settle the deficit lies above the world rate of inflation, the RER will appreciate.

Another example of serious discord between macroeconomic policies and a predetermined exchange rate system is where domestic credit expands at a rate higher than the real demand for money. Such an expansionist monetary arrangement would lead to increased demand for tradables, nontradables and financial assets. While the excess demand for tradables would tend to weaken the trade balance, reduce the level of international reserves and raise debt

above the long-run sustainable level, the excess demand for nontradables would lead to higher prices for those commodities, and a RER appreciation. If the RER appreciation does not follow from changes in the fundamentals of the EREER, it represents a misalignment (Edwards, 1988:11). The deviation of the RER from the equilibrium path between times T_1 and T_2 in figure 2.2 (a) signifies misalignment.

2.7.2 Misalignment under a floating nominal exchange rate system

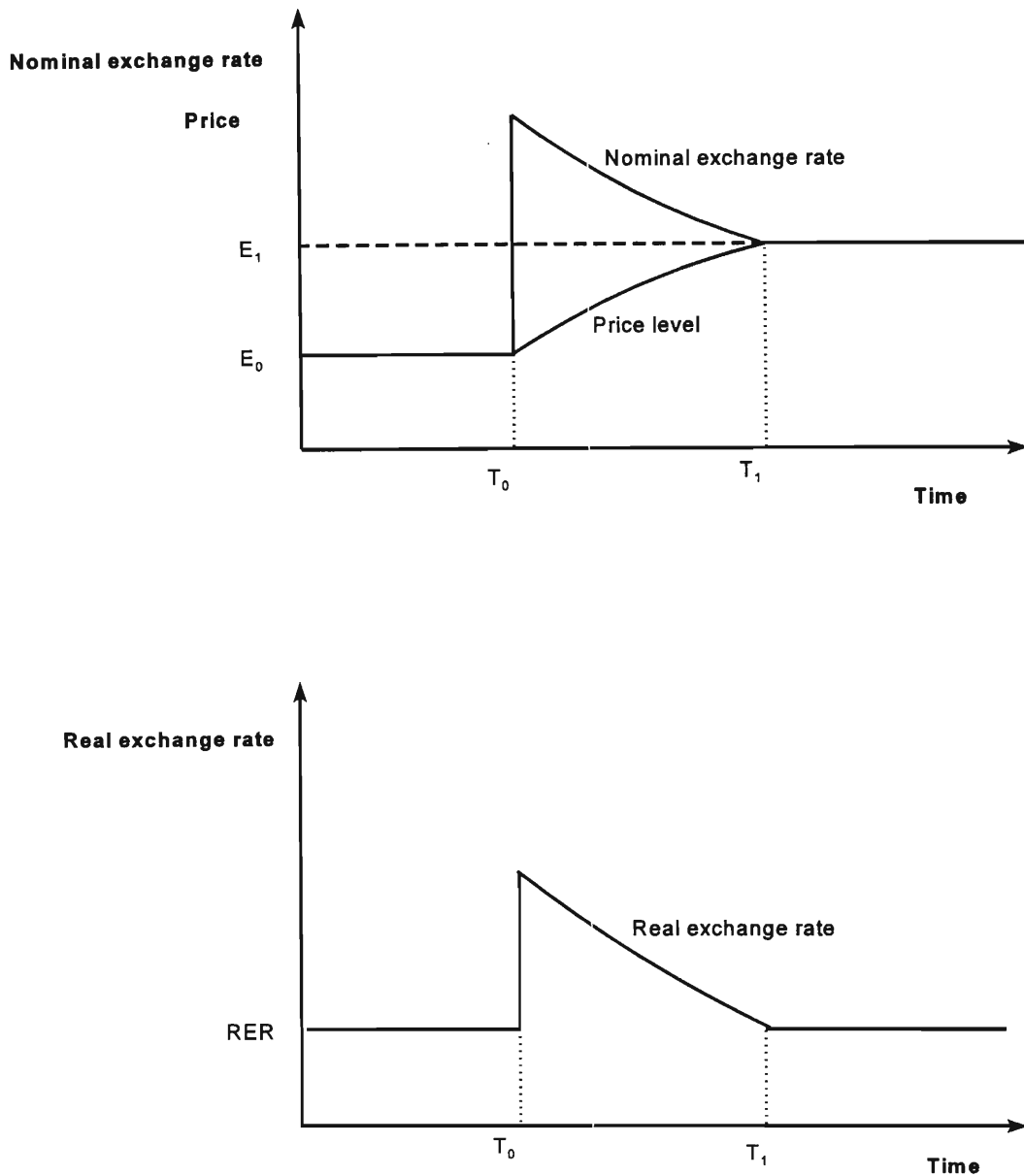
Unlike under a predetermined system where the authorities decide the rate of exchange, under a floating exchange rate system the nominal rate is not fixed but determined by market forces of demand and supply. Both the exchange rate and domestic prices respond to changes in macroeconomic policies, but at different paces. Flexible exchange rates, behaving like asset prices, quickly adjust to changes in market factors. Unlike exchange rates, prices for goods react slowly and much less spontaneously to shocks due, among other reasons, to rigid contracts and adjustment costs which characterise goods markets.

The differences in the speeds of reaction to market changes between the goods and foreign exchange markets are reflected in the behaviour of the RER. This is evident in Dornbusch's RER overshooting model (1976) where he discusses the influence of monetary policies on the RER. A monetary expansion will cause an immediate depreciation of the exchange rate beyond the long-run equilibrium level. Prices of nontradable goods, however, will not change in the short-run. But later, domestic prices will go up to a higher equilibrium consistent with the new stock of money, and the nominal exchange rate will fall to a lower post-expansion equilibrium level.

In figure 2.3, the upper diagram shows us what happens in the foreign exchange and goods markets when money supply rises above the real demand for money at time T_0 . Here it is assumed that the foreign exchange market is flexible and the one for goods rigid. Given such assumptions, the change in money supply will quickly result in a nominal depreciation, as excess real balances are translated into higher demand for foreign exchange. With the passage of time the size of surplus money falls, and correspondingly, the nominal exchange rate adjusts back to

Figure 2.3

Dornbusch's model of overshooting exchange rates following a monetary shock



Source: Dornbusch, 1976

Money supply is increased at time T_0 . In response, the nominal exchange rate depreciates spontaneously, while prices remain the same. As excess demand for money is gradually absorbed, the nominal exchange rate falls. Meanwhile, prices slowly adjust themselves upwards. At time T_1 , equilibrium is restored in the foreign exchange and goods markets, but at higher levels of price and the nominal exchange rate. In the lower diagram the RER shoots up at time T_0 , but as real money balances fall with rising prices, the RER is realigned to the equilibrium level at time T_1 .

its long-run equilibrium level.

Unlike the nominal exchange rate, prices will react less spontaneously to the increase in money supply. It is only gradually that prices will succumb to the upward pressures attending the change in money supply. In terms of figure 2.3, this can be seen by the gradual nature of the ascendancy of the price level between T_1 and T_2 . As these adjustments in the goods and foreign exchange markets take place, the RER undergoes some changes. According to the lower diagram of figure 2.3, the immediate nominal depreciation brought about by the increase in money supply is reflected in a simultaneous RER depreciation. But as the nominal exchange rate falls and prices rise after T_1 , the RER declines back to the equilibrium level. Since no change to the real fundamentals of the ERER has taken place, the behaviour of the RER as a consequence of the change in money supply signifies a departure of the RER from the equilibrium path.

2.7.3 Misalignment under a multiple nominal exchange rate system

Under this system different international transactions are subjected to different nominal exchange rates so that an economy could be governed by two or more real exchange rates. What happens to the rest of the economy as a result of changes in macroeconomic policies is a function of the type of multiple rates system in place.

A non-unified exchange rate system could be made up of a number of predetermined nominal rates. The *modus operandi* of such a system would resemble that of a single fixed exchange rate system. For the two-or-more fixed exchange rate system operates in the same way as a consolidated one with taxes on some external transactions (Kamin, 1994:209). As was observed earlier in section 2.7.1, inconsistent macroeconomic policies will cut back the stock of international reserves, accelerate domestic inflation above the world rate and lead to a RER overvaluation.

Another type of a non-unified exchange rate system is where current account transactions are carried out using a fixed exchange rate, while capital account transactions are governed by a

floating rate. Such a dual exchange rate system is usually designed to separate the relatively stable real side of the economy from the effects of the usually volatile nature of capital markets. This attempt to shield the real output sector from the turbulence of the capital market does not foreclose the possibility of changes in the floating exchange rate from having effects on the RER. For example, suppose a country promoted a liberal monetary policy. The practice of such an expansionist policy direction is expected to lead to an increase in the demand for all goods and services and financial assets. The rise in the demand for non-tradables would be expected to lead to higher prices for those goods and an appreciation of the RER. As residents demand more foreign assets, the floating rate is expected to depreciate. The fall in the free rate would imply lesser real income for the residents of the country and reduced demand for all goods and services, leading to a fall in the price for nontradables. Thus the real-income adjusting effects of changes in the floating rate would constitute secondary effects on the official RER.

Under another non-unified exchange rate arrangement current account transactions could be governed by a fixed exchange rate for one set of goods and by a free rate for the other group of commodities. An activist monetary policy would cause a RER appreciation for the first set of goods subject to a fixed exchange rate. But for the second set of commodities subject to the market determined nominal rate the direction of movement for the RER is not known *a priori*. The increase in money supply beyond the real demand for money would generate upward pressures on both the free nominal exchange rate and the domestic price level. Whether the RER will appreciate or depreciate or retain its level will depend on which of the two will have the dominant influence. If prices are sticky but the nominal exchange rate flexible, the RER under consideration will depreciate in the short-run.

The existence of exchange controls enables the emergence of an informal market for foreign exchange. So, a non-unified exchange rate system could be made up of a fixed and an illegal regime. Such a system would function in a manner similar to the previously discussed dual exchange rate system with a floating and predetermined exchange rate structure. Edwards (1988:16) draws out some distinctions. Firstly, given that the informal market is not legal, the expectations and costs of detection will decide the gap between the official and freely floating rates. Secondly, the gap between the rates will also be influenced by expectations about changes

to the political system. Thirdly, expectations and fear of detection will determine what proportion of exporters' earnings will be declared before the authorities and what amount brought in illegally. An increase in money supply will raise both domestic prices for nontradables and the informal market nominal exchange rate. As the official rate appreciates the level of international reserves is expected to go down. Prices of exports expedited by the official rate will tend to command a lower price than those transacted through the informal rate, worsening the balance of payments. Faced by such a situation the authorities may elect to devalue the official rate so as to get rid of the parallel market (Lizondo, 1986).

From the above discussion two types of misalignment can be identified - macroeconomic induced misalignment and structural misalignment (Edwards, 1988:21). Macroeconomic induced misalignment takes place when discord between macroeconomic policies and the official nominal exchange rate leads to a divergence of the RER from the equilibrium path. Sections 2.7.1, 2.7.2 and 2.7.3 have demonstrated how expansive monetary policies can generate RER disequilibrium, under various shades of nominal exchange rate regimes. Structural misalignment occurs when the short-run behaviour of the RER fails to reflect changes in the long-run determinants of the ERER. For example, a rise in government expenditure is expected to make the relative price of tradables to drop in order for equilibrium to be maintained in the economy. If the conduct of the actual RER does not respond to the adjustment of the ERER due to the rise in government spending, the RER will become structurally misaligned. Structural misalignment can also be as a consequence of the temporary behaviour of the fundamentals.

2.8 How should the authorities deal with misalignment?

With regard to macroeconomic induced misalignment part of the solution is to reverse the inconsistent monetary or fiscal policies. Then the economy can be left to adjust automatically back to equilibrium over time. Alternatively, some supplementary measures can be added onto the restrictive macroeconomic policies. The wisdom behind these reinforcing remedies is inspired by some problems that attend automatic adjustment. The removal of macroeconomic policy disharmony is not shortly afterwards followed by a reversion of the RER to the equilibrium

level. The commodity market, as will be elaborated further in chapter 3, usually takes time to adjust prices downwards. Meanwhile, if the disequilibrium is in the form of a RER appreciation under a fixed exchange rate regime, the export sector will remain uncompetitive, imports will rise - worsening the current account balance, and foreign exchange reserves will continue to run down. Inflexibility in domestic prices and wages could result in reduced output and more unemployment.

One effective measure that policy-makers can adopt to speed up the process of realignment is that of a devaluation. Rather than wait for prices to crawl up to restore equilibrium a steady state can be quickly attained by adjusting the domestic price of tradables. A devaluation achieves this end by raising the RER through a higher P_T (which equals EP_T^*). A nominal devaluation (by increasing E) is transmuted into a real devaluation. The implementation of this policy measure is meant to improve the competitiveness of the export sector and to strengthen the balance of payments position of the devaluing country.

Whether the devaluation is successful or not relies on the stringency of the prevailing fiscal and monetary policies, the degree of flexibility of domestic prices and the initial conditions. If macroeconomic policies remain lax or if domestic prices rise by the same proportion as the nominal exchange rate, devaluation will not work. Devaluation will also be ineffective if the initial conditions are of equilibrium: within the short-run the price of nontradables will rise and the RER will not be affected in the medium- or long-term.

Even if the authorities adhered unrelentingly to demand management policies, a nominal devaluation is still likely not to be translated one for one into a real devaluation in the medium- and long-term. This is due to some offsetting forces set in motion by the devaluation itself. Wages may go up, as well as prices of imported inputs, leading to a higher price level for finished domestic products. Such developments in the labour and goods markets could raise the price of nontradables, toning down the effect of the nominal devaluation over time (Edwards, 1988:30). A number of studies have been conducted to determine the effects of devaluation (Cooper, 1971; Donovan, 1981; Bautisa, 1981; Morgan and Davis, 1985). Overwhelmingly, the evidence suggests that initially a devaluation strongly influences relative prices, but with time its impact on the RER wanes.

A devaluation, if accompanied by appropriate macroeconomic policies, is expected to generate expenditure reducing, expenditure switching and domestic price augmenting effects. The expenditure reducing effect arises from the higher domestic prices or reductions in real domestic money or real assets which tend to contract spending on all goods (Aghevli et. al, 1991). The expenditure-switching effects come about because of the upsurge in the price of tradables, inducing consumers to allocate expenditure away from and producers resources towards tradables. In the same vein consumers substitute expenditure towards the relatively cheaper nontradables sector, while the fall in prices motivates producers to move resources away from that sector. Thirdly, with a devaluation, the domestic price of imported intermediate inputs is expected to soar, as they now have to be purchased from outside at a higher price (Edwards, 1989: 80; Aghevli et. al, 1991).

A nominal devaluation is expected to restore balance in the external sector. While a real overvaluation makes a country's output expensive for the rest of the world, a real devaluation (or depreciation), holding other factors constant, augments world demand for a country's products as they become relatively cheaper. Such behaviour of the RER has important consequences for the balance of payments. While a real revaluation (or appreciation) usually leads to a deterioration of the current account as the gap between exports and imports widens in favour of imports, a devaluation (or a depreciation) usually improves the current account. With respect to the latter it is being assumed that the world demand for exports and the country's demand for imports are both price elastic. According to du Plessis (1994:271), the simultaneous imposition of the same rate import tariffs and export subsidies raises the relative price of tradables with respect to nontradables, spelling the same effect as a successful devaluation.

2.9 Conclusion

This chapter has analysed a number of conceptual and empirical definitions of the RER and ERER. Between the *ppp* and tradables-nontradables purviews towards the definition of exchange rates, it is the tradables-nontradables definition that appears to be growing in appeal. The latter perspective takes account of the differential sectoral effects of RER movements, and recognises the changing influence that fundamentals bear on the ERER, so that the latter is not

constant. Theoretically, this chapter has suggested technological or productivity improvement, the external terms of trade, trade policy, government consumption of nontradables, disposable income and capital flows as a plausible set of determinants for the behaviour of the ERER. The chapter has also established that although only the permanent values of the fundamentals determine the behaviour of the RER in the long-run, transitory values of fundamentals, macroeconomic and exchange rate policies generate short-run RER movements. Should an economy experience RER overvaluation, this chapter has proposed devaluation as a remedy.

Now, reading chapter 2, or similar literature elsewhere, an intellectual or policymaker may want to know whether these conclusions have any relevance for the design and practice of exchange rate policy in LDCs. Vice-versa, does the choice of a given nominal exchange rate regime really matter when it comes to the issue of RER disequilibrium? Matters surrounding this question are taken up by the succeeding chapter.

3 NOMINAL EXCHANGE RATE POLICY: CHOICE AND PRACTICE, WITH PARTICULAR REFERENCE TO THE ISSUE OF RER DISEQUILIBRIUM IN LESS DEVELOPING COUNTRIES

3.1 Introduction

Having defined the RER as EP^*/P , it follows that adjustments in any one of the variables that is a part of the formula will tend to change the value of the RER. Chapter two considered some of the factors that would lead to changes in the domestic and foreign price levels, and ultimately to alterations in the value of the RER. In that same chapter the nominal exchange rate was mentioned as a possible policy instrument for eliminating RER misalignment. Theoretically this must be obvious. The nominal exchange rate, certainly to the extent that it appears in the RER formula, must be an important determinant of RER behaviour. But practically, the corrective role of the nominal exchange is not always assured. Whether this variable is available as a policy tool or not depends on a country's choice of an exchange rate system. If a country elects to mediate its external transactions using some form of adjustable or flexible exchange rate system, then a devaluation or depreciation becomes an accessible means for influencing the value of the RER. But if a country adopts a fixed exchange rate system, the nominal exchange rate would have no changing influence over the value of the RER. Given these comments about the role of the nominal exchange rate, it becomes interesting to explore some major reasons why a country would prefer one exchange rate system to another. In particular, this chapter will try to explore the implications of the choice of a nominal exchange rate system for the ERER.

In what follows, this chapter seeks to review some literature on the two important approaches to exchange rate management. The next section will present the thinking underlying the real targets approach and, section 3.3, LDC experience with flexible exchange rates. Then section 3.4 will deal with the theoretical issues surrounding the nominal approach and, section 3.5, LDC experience with

Basically Fixed Regimes: Pegged Exchange Rates

1. Visa-vis a single currency: economies that peg to major currency international currencies with no or rate parity adjustments; economies that announce a prearranged schedule of exchange rate adjustments against the currency of peg (the exchange rate changes, but at a fixed pace).
2. Visa-vis a currency basket: economies that peg to a basket of currencies of their main trading partners or to standardised currency composites such as the European currency unit (Ecu) or the SDR.
2. Within pre-established margins: economies that peg to a single currency or a currency basket within certain (typically narrow) margins.
3. Fixed but adjustable peg: the arrangement that prevailed under the Bretton Woods par value system.

Basically Flexible Regimes: Adjustable and Flexible Exchange Rates

1. Indicators: economies that adjust their currencies automatically to changes in selected indicators, such as developments in the real effective exchange rate.
2. Managed float: economies that adjust their exchange rates frequently on the basis of judgements made following developments in variables such as reserves and the payments position.
3. Independent float: economies that let markets and market forces determine the exchange rates for their currencies.

Guitian, 1994:16

Table 3.1

Types of exchange rate regimes

fixed exchange rates.¹ Lastly, in section 3.6, this chapter will treat of the topical and heatedly contested issue of capital flows and their implications for exchange rate policy.

3.2 The real targets approach

The goal of the real targets approach is to achieve international competitiveness. As such, an overvalued RER would be hardly supportive of this goal. In terms of the definition of the RER, two scenarios would attain or enhance competitiveness. First, the larger the value of the numerator (the product EP^*), *ceteris paribus*, the more price competitive an economy tends to be. The realisation of such an outcome is heightened the higher the values of the nominal exchange rate and the foreign price level. Second, the lower the value of the domestic price level (P), *ceteris paribus*, the more price competitive the economy becomes. Out of the three possible formula variables (E , P^* and P) that could bring about changes in the RER, the real targets approach, isolates and employs the nominal exchange rate as a policy tool for steering the RER to some desirable level. A curious reader may want to know why.

To begin to consider this question, one of the obvious places in the international economics literature where one could start from is the elasticities approach to the balance of payments: for in that mechanism, the nominal exchange rate is utilised to bring about important real economic consequences (Du Plessis, 1994:236-241). According to the elasticities perspective, movements in the nominal exchange rate, among other effects in the economy, can lead to important changes to the balance of payments of a country. In particular, two opposite directions of movement in the exchange rate have come to be associated with specific balance of payments outcomes. First, a currency appreciation, holding other factors constant, is expected to make imports cheap, and exports expensive, tending to cause a current account deficit. Second, a currency depreciation, *ceteris paribus*, is supposed to raise the price of imports and lower the price of exports, inclining

¹ The phrases “flexible exchange rates” and “fixed exchange rates” will be used quite extensively in this chapter. The meanings attached to these expressions follow those of Guitian (1994:16), in table 3.1.

export revenues to be larger than import payments and tending to generate a trade surplus.

These results are standard expectations of the elasticities approach. Assuming certain demand and supply elasticities, a currency devaluation or depreciation would clear a trade deficit, while a currency appreciation or revaluation would get rid of a surplus². These methods for correcting external imbalances have been evoked here, not for purposes of discussing the elasticities approach *per se*, but to bring out a well known theoretical application with derivations from the real targets approach to exchange rate policy. For in the elasticities approach, alterations in a nominal variable (the nominal exchange rate) bring about a real outcome (a balance of payments adjustment).

In the main, the real targets approach employs the nominal exchange rate, with the support of other policy instruments, to achieve real ends (Guitian, 1994:27). These real objectives could include a full employment equilibrium level of output establishing balance in both the internal and external sectors of the economy. Apart from the link between nominal and real values, the real targets approach also assumes that fiscal and monetary policies are separate from exchange rate policy, that the government can responsibly employ exchange rate and other instruments and that devaluation has long-lasting effects worth pursuing (Corden, 1994:66)

The adjustment mechanism for a RER misalignment discussed in chapter 2 is consistent with the real targets approach. In that correction method, the nominal exchange rate is devalued or depreciated so as to realign the RER with the equilibrium level. Since the problem is one of overvaluation, where international competitiveness has been scaled down and could spell a deficit in the balance of payments, the increase in the nominal exchange rate amounts to the usage of a nominal variable to achieve some desirable real values in the external balance.

When the nominal exchange rate is devalued or depreciated so as to improve the balance of

² In order for the elasticities approach to work, the Marshall-Lerner condition would have to be satisfied. Furthermore, macroeconomic behaviour in terms of the absorption and monetary approaches to the balance of payments would have to be consistent.

payments position, exchange rate policy is said to be aimed at improving competitiveness. It has been observed that developing countries generally design their exchange rate policies to maintain external competitiveness at a level consistent with a sustainable balance of payments position. In view of the critical role of the RER in maintaining external competitiveness, the nominal exchange rate should not be allowed to deviate very far from its equilibrium level. Because this equilibrium level is determined endogenously, exchange rate policy needs to take into account the impact of various shocks on the RER (Aghevli *et al.*, 1991:8).

Under the real targets approach, it is assumed that international markets are imperfect (Krugman, 1989:9,23), so that prices do not fully respond to market signals. Given that prices are sticky, competitiveness or maintenance of RER equilibrium become difficult to promote through adjustments in domestic and foreign price levels. This leaves the nominal exchange rate, as figure 4 below is trying to depict, as the only effective lever with which to redirect the RER should it stray away from the equilibrium path.

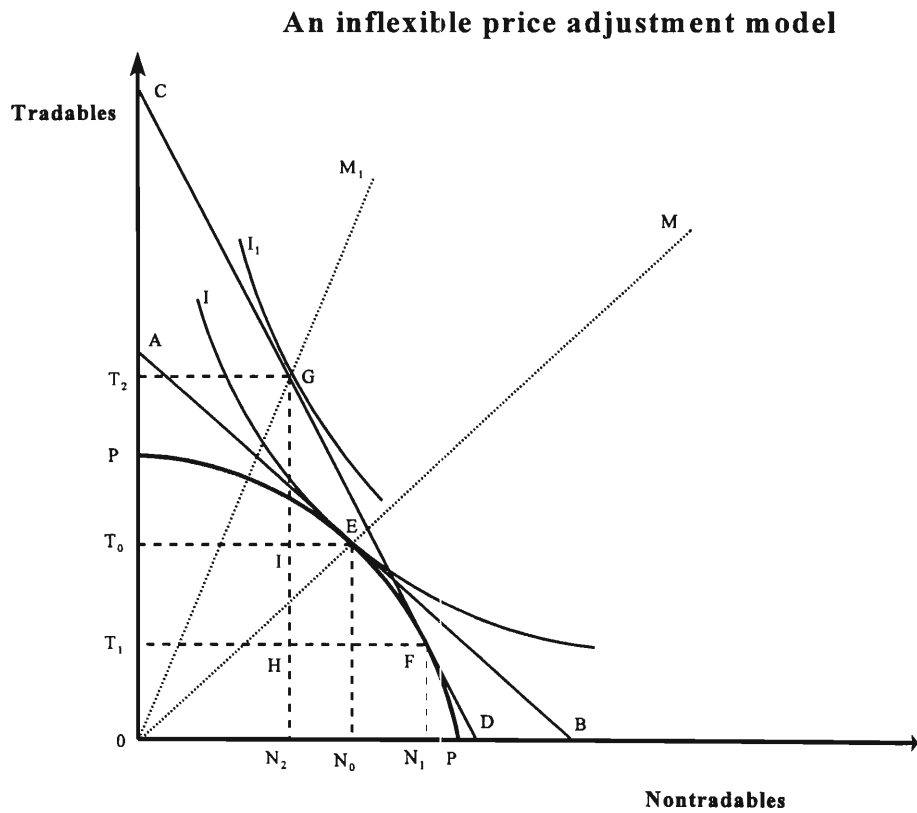
3.2.1 A model showing adjustment under fixed prices

Figure 4 below seeks to show how flexibility in the nominal exchange rate can help to achieve real changes in the economy under conditions of domestic wage and price rigidities, but mobile factors of production. Specifically, figure 4 displays how internal and external balances can be achieved through the instrumentality of the nominal exchange rate. At E the economy is at equilibrium, both internally and externally, so that the following is true:

- (1) The quantities of nontradables demanded and supplied are equal.
- (2) The quantities of tradables demanded and supplied are equal.
- (3) Actual real money balances equal desired money balances.
- (4) The slope of the AB price-line gives us the RER, but AB is also the budget-line for the economy. Consumption in the economy is taking place according to the indifference curve I, so that where the indifference curve I is tangent to the budget line AB at E, income equals expenditure.

Suppose the economy expanded domestic credit or money supply. The resultant appreciation of the RER is suggested by the slope of the new price-line CD, which is steeper than the equilibrium price-line AC. The shift in the price-line defines a new point of production in the economy F, where ON_1 of nontradables and OT_1 of tradables are produced. Due to the rise in the price of nontradables and the fall in the price of tradables, more nontradables and less tradables are produced at F than at

Figure 3.1



Note: OM and OM_1 are consumption-expenditure lines.

This model was constructed on the basis of my reading of chapter 4 of Reichel (1978).

E.

Given the shape of the indifference curves, consumption must now take place at G, where ON_2 of nontradables and OT_2 of tradables are demanded. The point G lies outside the production possibilities frontier PP. Given that the economy is producing at F, and consumption is taking place

at G, a surplus of N_1N_2 nontradables and a shortage of T_1T_2 tradables will occur, signifying imbalance in both the internal and external markets.

The shortage could be financed by drawing down reserves or borrowing or capital inflows. LDCs reliance on these financing measures has usually proven problematic, in many instances, having led to the depletion of foreign reserves, heavy indebtedness and destabilising short term capital flows. The latter have been observed to lead to RER overvaluation in a lot of LDCs. Clearly, such measures are not sustainable in the long-run. The economy needs to return to the steady-state level of economic activity at E. Meanwhile, the surplus in the nontradables sector is costly for producers. A fall in the price of nontradables could help rid the economy of the surplus, but this does not happen because wages and prices are sticky downwards. An increase in the price of tradables could reduce the shortage of tradables, but the price of tradables is exogenously determined. With both price variables unavailable as adjustment levers, this leaves the nominal exchange rate as a possible policy variable for affecting the behaviour of the RER.

A higher value of the nominal exchange rate reduces the slope of the price-line, and the adjustment can continue until production and consumption revert to the long-term equilibrium point E. During the adjustment the higher relative price of tradables induces more production of tradables in short supply to substitute for less production of nontradables in excess supply. Similarly, more consumption of the now cheaper nontradables in excess supply substitutes for less consumption of the now expensive tradables in short supply. Both markets continue to adjust until the shortage and surplus are cleared at E. It must be emphasised here that the adjustment process will not work without the support of fiscal and monetary discipline.

3.2.2 The gold standard

The appeal of the real targets approach can be magnified by looking at the gold standard, an alternative alignment procedure designed to operate under conditions of flexible prices. During the gold standard, an alternative alignment procedure was designed to operate under conditions of

flexible prices. The price of a currency was fixed in terms of gold. Exchange rates between national currencies were therefore set at permanent rates. Suppose the following exchange rate $E_{R/ZK} = P/P^*$, where $E_{R/ZK}$ is rand per Zambian kwacha, P is the price level in South Africa in rand and P^* is the price level in Zambian kwacha in Zambia. If this exchange rate were fixed, its maintenance would require purchasing power parity across the two countries. Differences in economic developments between the two countries would make *ppp* difficult to maintain and require an adjustment in the relative price of national currencies. However, fixing the exchange rate implies that adjustment towards equilibrium would have to be effected through changes in the price levels (P, P^*) (Riechel, K., 1978). If national price levels do not vary, the exchange rate will be artificial and out of line. So even at the nominal exchange rate level, price rigidities across countries would require adjustments in the nominal exchange rate to maintain equilibrium.

The classical approach adjustment mechanism to the balance of payments was supposed to work as follows. Imagine two countries A and B. Suppose the price level in country A dropped. Movements of goods and services would respond to differences in prices between the economies. The fall in the price level in country A would induce a rise in both domestic and international demand for country A's goods. Hence, in keeping with the gold standard philosophy, money and gold assets backing that money, would flow from country A to country B. This increase in demand for country A's goods would tend to raise country A's price level. At the same time, the higher price level in and the flow of money from country B would tend to dampen demand for country B's goods, putting downward pressures on the price level in country B. Upward pressures on country A's price level, and downward pressures on country B's price level would continue until prices across the two countries were equal again. Changes in prices would be followed by movements in exports and imports. This implied adjustments in in-payments for exports and out-payments for imports, so that price equality brought about by perfect arbitrage across countries ensured automatic balance of payments.

But the working of this spontaneous apparatus could only be guaranteed by markets operating under fully flexible prices, ultimately a system of exchange where the assumptions of

perfect competition are in place. The flexibility of prices is a function of the flexibility of production costs, notably of labour costs. While the flexibility of nominal wages remained high until about the middle of the nineteenth century, the balance of payments under the gold standard operated without serious problems. Growth in unionisation, however, made prices sticky downwards. In a situation where labour contracts are inflexible, a decline in money supply will not lead to a fall in wages and prices. As a consequence, RER overvaluation is likely to occur. In that event, unemployment may rise and output decline. Mass unemployment in the 1920s and early 1930s led to a number of industrialised countries to suspend their currencies from the gold standard. They depreciated their currencies in the hope of improving their international competitiveness. Where minimum values for the elasticities of demand and supply were satisfied, the strategy worked (Reichel, K, 1978:2-3).

3.2.3 The role of money illusion

An examination of the function of flexible exchange rates as a substitute for the downward inflexibility of domestic prices finds the role of money illusion essential (Poniachek, 1979:14). With a flexible exchange rate system, it is thought that output and employment stability - ultimately, internal and external balance - would be maintained by getting rid of price rigidities. Producers would not like to see prices of their goods fall, and similarly, workers are unhappy to see their wages fall. Where declines in nominal returns to factors of production are unacceptable, price flexibility tends to be more easily attained through a system of adjustable exchange rates, "...they can make the price of each country's labour and products flexible ... as translated into the currencies of other countries" (Yeager, 1966:97).

Through a flexible exchange rate regime, rigidity in nominal factor prices is overcome by flexibility in real factor prices. Such an arrangement enables the economy to avoid changes in nominal prices which tend to be accompanied by unemployment. In this light it is reasonable to say that a flexible exchange rate system offers a more tolerable avenue for adjusting the real income of a community. This proposition assumes the existence of money illusion: in such circumstances the

decline in income that the economy is not willing to take becomes more agreeable to the public when it is effected through changes in the exchange rate (Poniachek, 1979:15).

Should money illusion not exist, that is, should the reduction in real wages and prices through exchange rate variations not be acceptable, a flexible exchange rate system would fail to bring about output stabilisation. If real wages are rigid downwards, then changes in exchange rates will bear no effect on real economic activity. Under such circumstances, an economy saddled by a misaligned RER, will tend to stay in disequilibrium protractedly. A depreciation will induce compensating increments in wages, so that a percentage rise in the nominal exchange rate will be matched by an equal percentage rise in the domestic price level, spelling no change in the RER. It is easy to see here that when real wages refuse to fall, repeated depreciations can lead to an exchange rate and cost-of-living wage spiral (Corden, 1972). In spite of the constraint that the effectiveness of flexible exchange rates seems to face in the absence of money illusion, some proponents of floating restore their confidence in the system by appealing to the wealth effect that a fall in the nominal value of an exchange rate is expected to bring about. Even if factor prices rise with depreciation, the level of real output will be affected by the fall in real income occasioned by the drop in real wealth attending a depreciation (Cooper, 1972).

In reality, the existence of money illusion relies on what the contract between unions and employers involves and on the degree to which an economy is open (as represented by the ratio of tradables to GDP). With regard to the latter, labour could bargain for either a nominal wage or a real wage. Now, where wage agreements ensure that wages move in the same direction and by the same magnitude as prices of foreign goods, and where wages are fixed in terms of foreign exchange, money illusion tends to be absent. In such a situation a deficit in the balance of payments will be hardly removed through depreciation: individuals adjust to price changes very quickly (McKinnon, 1972). Changes in the RER are hard to induce through nominal devaluations (or depreciations), in an economy which has adapted to inflation through mechanisms like widespread indexation (Williamson, 1995:8). Where the latter is the case, the nominal exchange rate is hardly available as a tool with which to get rid of RER disequilibrium.

3.2.4 Other weaknesses of the real targets approach

Apart from wage indexation, a number of problems confront the real targets approach to exchange rate policy. First, elasticities of demand and supply, as has usually been the case for developing country products, may not satisfy the minimum values sufficient for changes in the nominal exchange rate to yield satisfactory balance of payments outcomes (Du Plessis, 247). Second, where competitiveness is maintained through an exchange rate rule³, the determination of the RER being theoretically and practically not easy, serious difficulties could arise when the RER is set at the wrong level. In this case, a RER rule could perform better against temporary shocks than against enduring disturbances. The fact that it is hard to determine *ex ante* how long a given shock is going to last compounds the problem. Third, in spite of the perceived favourable effects of a flexible exchange rate regime on the external position, the pursuit of a real target with a nominal instrument may deprive a small open economy of an anchor for domestic prices. Serious price upsurges can occur, especially if the currency is over-depreciated. Experience in LDCs suggests that inflationary pressures can assume a permanent nature, and even become hyper-inflationary (Aghevli *et al.*, 1991:10, 11). Certainly, hyper-inflation does not bode well for the RER, which under conditions of galloping inflation tends to deviate from the path of equilibrium. Fourth, flexible exchange rates have been observed to have negative consequences for international trade and investment, because of the uncertainty in contracts and investments that they create. The fact that future exchange rates are not known motivates firms to procrastinate investments in export capacity. Fifth, volatility in flexible exchange rates has been associated with RER misalignments (Isard, 1995:196-197).

All these negative aspects of flexibility, as section 3.4 will suggest, tend to recommend the alternative nominal anchor approach.

³ A RER rule can be adopted whereby the nominal exchange rate is adjusted continuously and automatically, in response to a differential between domestic and foreign price levels, so as to maintain the RER close to its equilibrium level (Aghevli *et al.*, 1991:8)

3.2.5 Two other desirable features of flexibility

In addition to the real target objective of competitiveness or desirable output developments, other features recommend the choice of a flexible exchange rate system:

1. Private speculation is expected to provide temporary liquidity financing.

Here, the analysis will be based on the most extreme case of flexible exchange rates. In a floating exchange rate system, the supply of and demand for foreign exchange is expected to be determined by market forces, so that shortages and surpluses of foreign exchange are cleared by the market. In other words the foreign exchange market is expected to be at equilibrium. This is in contrast with a fixed exchange rate system where the monetary authorities must have sufficient reserves to back up the parity. In a floating system, when a currency depreciates due to an incipient deficit, speculators, driven by profit expectations, are expected to shift funds from the appreciating currency to the depreciating currency. Until the exchange rate changes have their full effect on the balance of payments, the funds will finance the temporary credit requirements of the incipient balance of payments deficit. Ideally, chances of achieving these results improve the closer the foreign exchange market operates in line with the assumptions of perfect competition. If speculators act irrationally or do not possess the means with which to forecast market trends correctly or base their judgments on imperfect information, they may not fund the balance of payments deficit. Speculative activity can destabilise the economy: capital flows which are unrelated to the real cost and competitive conditions of an economy can induce currency variations that cause price-wage spirals (Poniachek, 1979:16-17), tending to lead the RER away from the equilibrium trajectory.

2. Insulation of the economy from external disturbances.

A flexible exchange rate arrangement, in principle, indicates a desire to accept no constraint on the pursuit of any particular domestic economic policy package. Exchange rate fluctuations are expected to keep the effects of domestic policies within, and the effects of outside policies outside. The policy option is tantamount to keeping national economic policy free from international constraints. (Guitian, 1994:17; Poniachek, 1979:21). Specifically, proponents of flexible exchange rates hold that under such a regime monetary policy can be pursued without limitations from balance

of payments considerations. Having insulated the domestic economy from outside influences this way, the adoption of a flexible exchange rate regime could suggest a preference for a closed system (Guitian, 1994:17)

3.3 Experience with flexible exchange rates in LDCs

Even after the abandonment of the Bretton Woods system in 1971, most of the LDCs continued to fix their exchange rates. But since the 1980s a growing number of LDCs have adopted flexible exchange rate regimes. Amazingly, this development has taken place in spite of the absence of sufficiently developed institutional arrangements in many of these countries. A number of reasons have compelled these countries to change their exchange rate systems, and the next paragraph will briefly review the economic rationale for this trend.

Between 1985 and 1992, all developing countries that floated their currencies did so because of balance of payments problems. For some of the countries, the balance of payments difficulties may have been a symptom of RER overvaluation. Most of them made the change as part of the IMF conditionality for receiving its support. The maintenance of any form of fixed exchange rate system requires the government to keep a large stock of international reserves. Short of such reserves, the market will find the fixed exchange rate system hard to believe, and consequently may mount significant pressures against the currency. Quirk (1994:136) observes that a lot of LDCs found themselves short of the necessary reserves to sustain the fixed exchange rate system. Bolivia, Venezuela and Brazil - to mention a few LDCs - were seriously short of reserves to meet their international debt or import requirements before floating. Fixing the exchange rate requires relevant market information. Given the poorly developed infrastructure in many LDCs, governments usually set rates with large errors. The macroeconomic instability that followed the adoption of reforms in many developing countries - for example in Brazil, Peru, Romania and Russia - tended to promote the informal market for foreign exchange. Floating the exchange rate was expected to stem such side-stream transactions (Quirk, 1994:134,136).

In a study of the experience of several LDCs that run floating exchange rate systems between 1985 and 1992, Quirk (1994:141) makes some observations. As regards exchange rate movements, experiences among LDCs were varied. Some currencies' behaviour was similar to that which occurred before they were floated. In several countries (the Philippines, Uruguay, Guyana, Peru, Guatemala and South Africa), the official exchange rate remained less depreciated than the parallel market rate, while the opposite was the case in some countries (Brazil, Venezuela and Zaire). In many countries the new floating arrangements consolidated the process of RER depreciation and promoted international price competitiveness. However, in some countries, a decline in competitiveness was experienced due to high domestic inflation (Brazil and Peru), or strengthening of economic policies (El Salvador and Guatemala), or larger depreciations in neighbouring countries (Paraguay). Domestic rates of inflation above the world rate tended to engender RER misalignments.

The macroeconomic effects of floating are not easy to isolate from those of other economic factors. Some of the literature, however, associates better performance in terms of balance of payments, inflation and output in LDCs with floating (Perez, 1994:154). After floating (within the period 1985-1992), six countries recorded faster GDP growth (Bolivia, Nigeria, Peru, Philippines, Uruguay and Venezuela). But some countries growth performance worsened (Brazil and Paraguay) (Quirk, 1994:141).

A RER target policy can be in conflict with internal stability (Erol and Wijnbergen, 1997:1717). Higher exchange rates can feed back on domestic inflation and fuel a cycle of devaluation-inflation, urging the RER away from the equilibrium level. Turkey pursued an inward-orientated development strategy in the 1960s and 1970s. In spite of the initial success of the programme, a foreign exchange and debt crisis overran Turkey around 1980. The country embarked on an export-led development strategy with the instrumentation of an attractive RER regime. A flexible exchange rate regime was introduced, a passive crawling peg from 1981 to 1988 and a partially market determined exchange rate system in August 1988. The nominal devaluation or depreciations resulted in real devaluations, greatly improving the performance of the balance of

payments and reducing the budget deficit (Erol and Wijnbergen, 1997:1718). Sancho, however, policy has shifted from external competitiveness to internal stability. This policy change has meant slowing down RER devaluations, largely, to bring down inflation and slacken foreign debt service pressures on the government budget. Relief of the fiscal balance through lower devaluations is not sustainable because lower devaluations require persistent increases in interest rates (Erol and Wijnbergen, 1997:1722). As a consequence of the low devaluation policy, Turkey experienced a confidence crisis in 1994, emanating from the domestic foreign exchange market. The confidence crisis undermined the stability of the domestic financial system. It would appear here that if Turkey wanted to fight inflation, the solution would not be through low devaluations, high interest rates which put upward pressures on the price level, but perhaps, a credible fixed exchange rate system. As will be observed in sub-section 3.4.1, such credibility would be expected to spring from the demonstrated resolve of the authorities to stick to consistent policies.

In its attempt to grapple with the debt crisis, among a number of policy reform measures (for example, fiscal constraints), Mexico introduced a crawling peg exchange rate system (the *tablita*) in 1982. Massive devaluations initially led to a surplus on the current account. But with time, Mexico had a problem with devaluations attended by high inflation and rising interest rates. The rate of devaluation lagged behind the rate of inflation from 1983 to 1985, leading to a RER appreciation and overvaluation. Both the primary balance and current account deteriorated. The 1985 earthquake and 1986 drop in oil prices compounded Mexico's problems. Exports dropped drastically by about US\$8 billion from 1985 to 1986. Subsequent reform measures were in part exchange rate based. By the end of 1987, the soar in prices was approaching hyperinflation. To fight inflation, and through the same action restore RER alignment, Mexico adopted a fixed exchange rate regime (Reichmann, 1994:159-161).

From the foregoing, it would appear that although the real target approach has been pursued with some success in some LDCs, this favourable experience has skirted some of the countries. Price instability and serious RER misalignments in some countries, have added weight to the view

of some policymakers and academicians that instead of output considerations, the goal of exchange rate policy should be financial stability. This proposition forms a core position of the nominal anchor approach, the subject of the succeeding section.

3.4 **The exchange rate as a nominal anchor**

The nominal anchor approach to the exchange rate constitutes the alternative perspective to the real targets approach. As the nomenclature for the approach might suggest to the reader, in contrast with the real targets approach, the nominal anchor approach seeks to achieve a nominal target with a nominal variable. Although the nominal anchor approach is concerned about competitiveness and output stabilisation, strongly discounting the existence of money illusion, it objects to the notion that nominal exchange rate adjustments lead to lasting real economic changes. In this regard, attempts at moving the RER in line with the equilibrium level through the device of the nominal exchange rate would flounder in the long-run. According to the nominal anchor theory, the best role for the exchange rate is to provide a nominal anchor for the economy as a way of attaining price stability, or more generally, as a tool for making sure that domestic price performance is in line with the evolution of prices abroad. This view receives much support from the presence of wage indexation in inflationary situations. The expectation that exchange rate adjustments will generate changes in real variables is reduced where wages are indexed, because real wage rigidity cuts any bond between exchange rate changes and competitiveness.

The case for the nominal anchor approach is largely constructed on the weaknesses of the real targets approach, mainly, the inflationary effects of flexible exchange rates that, among other consequences, have been observed to lead to RER misalignment. Among many desirable properties of the nominal anchor approach, this discussion will single out two: (1) the role of the nominal exchange rate as an anti-inflation policy variable, (2) the role of the nominal exchange rate as a source of credibility for the financial market. In both instances, the fulfilment of these roles would

help to align the RER with its equilibrium level. Given this corrective secondary effect, it must be clear that although the primary focus of the nominal anchor approach lies on bringing down inflation, the attainment of internal and external equilibrium remains a major desired outcome of its policies.

While the real targets approach is microeconomic, the nominal anchor approach is macroeconomic. The latter dimension emphasises the importance of establishing a clear and credible anchor as an element of a policy strategy aimed at domestic price level stability, a nominal variable (Guitian, 1994:4). Through the device of a fixed exchange rate, a given LDC's domestic rate of inflation is anchored to the inflation rate of its major trading partners. This means that domestic policies, unlike under a flexible exchange rate regime, must be constrained. As a consequence fiscal and monetary policies cannot be pursued without regard for potential pressures on the fixed exchange rate commitment. Adopting a fixed exchange rate system is tantamount to imposing a constraint on national economic policies. In the real targets approach, the exchange rate follows, but in the nominal anchor approach, the exchange rate leads other nominal variables such as domestic price and wage inflation.

If a fixed exchange rate is going to be sustained, the rate of growth of domestic credit or money supply must not exceed a certain upper limit. For a small open economy, the upper limit is determined by the rate of growth of the demand for money. The latter is a function of the rate of growth in real output, the world rate of inflation and the income elasticity of the demand for money. Given these conditions, freedom for the rate of growth of domestic credit will tend to be greater under three scenarios: (1) the higher the rate of world inflation, (2) the higher the rate of growth of real income, and (3) the larger the income elasticity of demand for money (Aghevli *et al.*, 1991:14).

Three steps could be associated with the nominal anchor approach. First, the government commits itself to a fixed nominal exchange rate regime. Second, the government aligns domestic policies to the maintenance of the fixed rate. This point is pertinent for LDCs where budget deficits have, more often than not, been monetised, so that fiscal policy is part of monetary policy. In this

case, a reduction in money supply would necessitate a contraction in the budget deficit. Third, assuming that the constraint holds, private agents are expected to modify their price and wage-setting in line with the monetary, fiscal and exchange rate policies. The extent to which the exchange rate is credible in the eyes of the private sector will determine how far the third step is realised. (Corden, 1994:75).

Some LDC governments have tried to circumvent the macroeconomic constraint imposed by a fixed exchange rate system. This can be done through import controls or running down reserves or external borrowing. For many of the LDCs that have applied these measures, the economic consequences have at times been disastrous. For example, after introducing import controls, the rate of inflation in Nigeria shot up from 23 % in 1983 to 40% in 1984, and the RER appreciated by about 64% (Corden, 1994:73). It is also known that external borrowing led to the debt crises and the collapse of currencies in many LDCs in the 1980s.

3.4.1 The importance of credibility

The success of a nominal anchor, as far as maintaining RER equilibrium is concerned, relies not only on government but private behaviour as well. Thus the policy can fail not only if macroeconomic policies are lax, but also because private price and wage-setting are slow to adjust. If financial discipline is to be attained and, as a result, private agents' confidence in the system gained and preserved, the authorities must fix the exchange rate permanently, and not change it from time to time. However, many LDCs governments have succumbed to the temptation of raising output or employment in the short-term through periodic devaluations. Such policy digressions do not augur well for retaining the system's credibility, and in such circumstances private agent behaviour is prone to divert from the desired predictions of the nominal anchor approach.

The last point of view is an outcrop of the rational expectations revolution in macroeconomics as propounded in the credibility and time-consistency literature. According to this school of thought, governments tend to abuse discretionary powers to alter the exchange rate. By

means of unexpected devaluations, the government hopes to decrease real wages, and thus increase employment and supply. Rational market participants will recognise the authorities incentive to cut down unemployment through monetary surprises and react by anticipating the surprises. This will render the devaluations ineffective. The effect of imperfect monetary policy credibility on expected inflation will be self-validating, leading the economy to a higher rate of inflation and, most likely, RER disequilibrium (Edwards, 1995:15).

One fundamental position of the credibility and time consistency literature is that policy commitment is welfare superior to policy discretion. If the government can credibly commit itself to low or no inflation, society will be better off: employment will be the same as when discretion is exercised, but inflation will be lower (Edwards, 1995:15). But rational market participants find it hard to believe government pronouncements. Short of acceptable and effective means of tying government hands, announcements about the authorities desire to fight inflation will be generally judged as unreliable. By the late 1980s, it had come to be held that an open economy with a relatively poor monetary policy credibility could bring down its inflation by fixing the exchange rate. For example, a country could fix its currency against the currency of a country with a relatively high anti-inflation credibility. In such an arrangement, the fixed exchange rate acts as a commitment technology which the authorities could employ to constrain themselves. By so doing the authorities hope to persuade the market that they not only intend but actually will apply fiscal and monetary discipline to lower inflation. If the adoption of a fixed exchange rate leads the public to believe these statements, then the interaction between government and private sector actions will not be inflationary. This blend of purpose and action between public and private agents will tend to promote external and internal balance by relieving the RER of pressures to appreciate, and possibly, get misaligned.

There are some obvious ways of trying to build confidence in a fixed exchange rate. The

government could relinquish the power to alter the exchange rate or the level of money supply.⁴ Examples of settings where government discretionary latitude over exchange rate movements has been surrendered this way include the franc de la Communauté Financière d'Afrique (the CFA franc zone) and the Exchange Rate Mechanism (ERM) of the European Monetary System. In a number of countries, including South Africa, the autonomy of the central bank, the organisation tasked with designing and conducting monetary policy, is enshrined in the constitution. The crises and collapse of both the CFA and the ERM (1992-1993), however, should make us realise that not even the guarantees of market determined exchange rates and independent monetary policy fully assure the credibility of a fixed exchange rate (Aghevli *et al.*, 1991:16).

Apart from a fixed exchange rate, other avenues for promoting the public's faith in the authorities' dedication to price stabilisation exist, for example, promulgating an inflation or monetary target. It has been said though that a nominal exchange rate target ought to be preferred to a money or inflation target, largely because the authorities have no direct control over inflation or money supply (capital flows tend to be uncontrollable). Pronouncements on the last two variables tend to be non-specific and hard to believe. In contrast, a nominal exchange rate target has the advantage of being readily observable or transparent.

3.5 LDCs' experience with nominal anchors

According to Calvo and Vegh (1994), since the 1940s, many developing countries have suffered from chronic inflation.⁵ Countries such as Argentina, Brazil, Chile, Israel, Mexico, Peru and Uruguay have experienced long periods of inflation, obviously, exposing them to RER misalignment. This is especially so, given the fact that inflation in the major trading partner

⁴ To be credible, such arrangements must be based on certain institutional arrangements that make it costly to reverse the surrender of power or to alter the exchange rate.

⁵ By Harberger's (1981) definition, a country's is experiencing chronic inflation if its annual inflation rate is 20% or more for at least five consecutive years.

industrialised countries, tended to be lower. In trying to fight inflation a number of developing countries have, among other policy measures such as tight monetary and fiscal practices, used the nominal exchange rate as an anchor for domestic inflation. Studies conducted by a number of authors on the relationship between the use of the nominal exchange rate and inflation have produced mixed and sometimes controversial results. A broad overview of LDC experiences suggests that fixed exchange rates have been associated with both low and high levels of inflation.

There are countries such as Thailand, India, Pakistan, Indonesia and Sri Lanka which have been characterised as low inflation countries (that is, prior to 1994). These countries' exchange rate was fixed in nominal terms for fairly long periods of time, sometimes to the United States dollar or British pound, and at other times to a currency basket. The fluctuations of major currencies after they were floated in 1973 made it difficult for pegged currencies to remain as genuine nominal anchors, leading to the abandonment of pegging. Was it the case that the low-inflation in the five Asian countries was due to fiscal and monetary policies pursued due to the constraint imposed by a fixed exchange rate? Could their low-inflation be explained in terms of the exchange rate's function as a nominal anchor? Corden (1994:80) is of the view that the real commitment was not to the exchange rate as such, but to low inflation and hence, to conservative domestic monetary and fiscal policies.

The commitment to a fixed exchange rate in the Asian countries up to 1981 has not been unflinching. Devaluations took place before 1981, and there have been devaluations and depreciations from 1982 onwards. If there was a certain amount of stability in the nominal exchange rate before 1981 the reasons appear to have had to do with fears of losing prestige due to a devaluation and the well justified belief that devaluation was inflationary. A number of other LDCs maintained fixed or near-fixed nominal exchange rates post the 1973 breakup of the Bretton Woods system (Costa Rica until 1980, Kenya and Mexico until 1976, Morocco and Nigeria until 1984, Turkey until 1981). In spite of the fixed exchange rate system Costa Rica, Mexico, Nigeria and Turkey have experienced high inflation. But Kenya and Morocco have not experienced sustained upward price-level movements. All these countries have employed quantitative

restrictions for balance of payments purposes at various times. It would appear from Corden's (1994:80-81) study of 17 developing countries that commitment to a fixed exchange rate has not been consistent, except for Cote d'Ivoire and Cameroon that were part of the franc zone.

Turkey's experience with exchange rates and inflation makes interesting reading. From 1977, the country moved from relatively low to high inflation. This change is associated with an exchange rate policy shift from a fixed rate to a crawling peg. The adoption of a more flexible exchange rate arrangement was in line with the real targets approach. Through this means the country was trying to remove the RER appreciation that took place between 1974 and 1979 and to eradicate the deficit in the current account. For a while exports expanded and the balance of payments performance was held as an example of the corrective effect of flexibility. But with massive devaluation, inflation reached 100% in 1980. For Turkey, the years during which the country pursued a nominal anchor recorded lower levels of inflation than when exchange rate flexibility governed external transactions. From 1960 to 1970, when the exchange rate was fixed against the dollar, the average rate of inflation was less than 5%, while from 1971 to 1977 inflation averaged 18%. But afterwards inflation rose from an average of 37.5% between 1981 and 1986 to 75% between 1988 and 1989 (Corden, 1994:81).

From the above discussion, it appears that there has not been a definite empirical relationship between the exchange rate system and financial discipline, and the effect of the latter on maintaining RER alignment. According to Aghevli *et al* (1991:20), the experience of many LDCs in the 1970s and 1980s suggests that the average rate of inflation has been lower in countries with pegged exchange rates than in countries with more flexible rates. But this evidence is not beyond doubt. Against the predictions of the nominal anchor approach, many of the LDCs with a pegged exchange rate have undergone inflationary episodes due to the lack of unwavering loyalty to appropriate financial policies. But at the same time, many of the countries with flexible arrangements have experienced low inflation because of following prudent financial policies. In the light of these considerations it becomes difficult at the empirical level to say that fixed exchange rate

arrangements have truly brought about low inflation in LDCs. Pertinently, Edwards (1995:24) highlights the lack of clarity in the direction of causation between fixed exchange rates and low inflation: is it that those countries that have run fixed exchange rates for a long time have had lower inflation, or is it that those countries with lower inflation have been able to maintain a fixed rate? The evidence we have so far does not seem to persuade us one way or the other.

Considering the positive and negative aspects of both the nominal and real targets approaches to exchange rate management, it appears difficult to point at one of them as the best practice for a LDC. From the points of view of both theory and experience the exposition above seems to suggest that each approach presents a combination of some advantages and some disadvantages towards the goal of maintaining an ERER. The twin objectives of output and financial stability appear desirables countries can ill-afford to pursue separably. In the long-run, one objective does not appear less important to achieve than the other, particularly if the goal of attaining RER alignment is to be realised.

Next, the issue of capital flows as it relates to exchange rate and macroeconomic policies within the context of the issue of RER disequilibrium in LDCs will receive attention.

3.6 **Capital flows**

One of the very topical issues today in both academic literature and the financial sections of the popular electronic and print media concerns the subject of capital flows. With the collapse of East Asian currencies and the attending widely felt effects of the financial crisis, the subject of the relationship between capital flows and exchange rate policy has come to the fore. Therefore, the discussion on exchange rate policy in LDCs presented by this section, by bringing in the implications of massive capital flows for exchange rate policy design and performance in LDCs, hopes to incorporate a crucial element into the subject.

Since the abandonment of the Bretton Woods system in 1973, the world has witnessed

increasing levels of gross and net capital flows, in some cases with destabilising consequences. Between 1990 and 1991, about US\$91 billion, mostly short-term capital, moved into the Mexican economy (Edwards, 1997:7). Residents increased their consumption spending, leading to a real appreciation and overvaluation of the Mexican peso. In 1994, huge capital outflows were associated with the collapse of the peso. For Latin America as a whole, net capital inflows increased from an annual average rate less than US\$11 billion during 1985 to over US\$60 billion in 1994. These huge capital movements have similarly been recorded in Asia where net capital inflows increased from an annual average rate less than US\$20 billion to more than US\$50 billion per year from 1992 to 1994. In some of the countries, shifts in net capital flows exceeded 2.5% of GDP, while in some cases the shifts run over 5% of GDP (Isard, 1995:223). Unlike in Latin America, as the discussion will spell out later, the capital inflows in East Asia did not lead to problems of RER appreciation or overvaluation.

But why have such voluminous movements in capital taken place in many of the LDCs? A review of literature on capital flows suggests a number of reasons. For Mexico, progress in the economic reform process, a decline in the terms of trade, increased investor confidence due to the reduction in Mexico's perceived degree of risk and interest rates higher than in the rest of the world encouraged investors to pump in money between 1990 and 1993. Korea and a number of Asian countries began to experience big inflows of capital from 1988 and 1989, respectively, owing to declining profit margins in the United States and Japan, and the out-performance of United States and Japanese stock markets by Asian stock markets (Calvo *et al.*, 1997:340,357, 368; Isard, 1995:223).

In general, other causes of capital inflows could be divided into external and domestic ones. On the external front, plausible causes include recessions abroad, a rise in the global demand for a country's major exports, and an increase in the willingness of investors to enhance investment efficiency by portfolio and risk diversification. Domestically, possible reasons for capital inflows include shifts in the balance of power in favour of the interests of capital owners, a reduction in the rate of taxation of capital income, significant steps to deregulate and liberalise the domestic financial

system, the availability of attractive investment opportunities and the relaxation of capital controls (Guitian, 1997:74-76).

What have been the consequences of capital flows in LDCs? The repercussions of capital flows have been both positive and negative. On the positive side, international capital mobility has facilitated the transmission of savings to countries where the productivity of investment is relatively high, improving world welfare gains. It has also expanded the set of feasible time profiles for aggregate national consumption (Isard, 1995:206).

Calvo *et al.* (1997:376) identify three concerns for policymakers regarding capital inflows: (1) Since capital inflows are typically associated with RER appreciation and with increased exchange rate volatility (RER misalignments), it is feared these may adversely affect the export sector.

(2) Capital inflows, particularly when massive, may not be properly intermediated and, therefore, may lead to a misallocation of resources.

(3) Capital inflows, especially when of a “hot money” variety, could be reversed on short notice, possibly leading to a domestic financial crisis. The recent East Asian and South African experiences of weak currencies are cases in point (1997-1998).

It has been observed (Isard, 1995:206) that in Latin America increases in capital inflows have tended to reduce domestic savings and to raise consumption rather than increase investment. Similarly, it has also been the case that with an uncompetitive exchange rate (arising from increased consumption of domestic goods), investments have tended to happen in the nontradables rather than in the tradables sector, so that when capital inflows cease, economies fail to service increased debt. Therefore, it can be said that inflows of capital can sometimes hamper rather than promote the growth of exports, and so arrest rather than boost growth. The debt and financial crises of Mexico make a good example of the economic harm that capital inflows can bring.

The consequences of capital inflows in Latin America need not be the case for all countries.

In a study investigating the comparative macroeconomic effects of capital inflows into Latin America and Asia between 1984 and 1991, Calvo *et al.* (1997:359-360) found differences between the two regions. First, where as in Latin America (excepting Chile) capital inflows led to RER appreciation, for most countries in Asia sustained RER appreciation was not the norm. This difference is attributable to a number of reasons among which are:

(I) In Latin America most of the capital inflow was spent on consumption spending, while in Asia it financed investment.

(ii) Unlike Latin American countries, some of the Asian countries, most notably Malaysia and Thailand, responded to the capital inflows by cutting down government spending. These fiscal restraints reduced pressure on the RER by dampening aggregate demand generally and, specifically, by reducing public consumption which, more than private sector consumption, tends to be more tilted towards nontradables.

(iii) In contrast with Latin American countries, tight monetary policies in many Asian countries managed to check growth in monetary aggregates, reducing aggregate demand and taking away pressure from nontradables prices.

Second, the composition of capital inflows differed between Latin America and Asia. Calvo *et al.* (1997:361), show that foreign direct investment accounted for 20% of the increase in capital inflows into Latin America. This implies that 80% of capital inflows was in form of short-term capital. But in Asia, foreign direct investment constituted 40% of the increase in capital inflows. The difference in capital inflows composition indicates why concerns over speculative capital or “hot money” and their reversibility (for the period in question) have been larger for Latin America than for Asia (Hanson, 1997:393-394).

Allowing capital flows to be intermediated by banks creates the risk that banks may not find sound investments for their new deposit balances, or would end up with a mismatch between the maturities of their assets and the maturities of their liabilities. The latter problem would be particularly distressing if the capital inflow was a fleeting experience, and the build up of deposit balances likely to be soon reversed. This problem is believed to have been, in part, at the centre of

the recent financial crisis in Asia (See Mishkin (1997) for a related discussion).

To the extent that capital flows can cause upward and downward pressures on both the nominal and RER, the design and implementation of any exchange rate-based macroeconomic stabilisation arrangement can ill-afford to slight the role of capital mobility. The volume of internationally mobile capital, the speed with which it can move from one currency (or country) to another have increased dramatically since the 1970s. For foreign exchange markets, this has meant that it is almost impossible to maintain for a long time a nominal exchange rate that market participants regard to be seriously overvalued. The exchange rate must not appear to be artificially strong, otherwise market expectations will turn against it, most likely leading to a massive capital outflow and balance of payments problems.

In terms of capital flows, especially when it comes to hot money, credibility of the exchange rate regime is important. The collapse of the Bretton-Woods system was mainly because of rising capital mobility and the failure of the United States, and some other leading industrial countries, to adhere to credible domestic policies required to sustain given rates. With the end of the Bretton Woods system, the United States and other developed countries started floating their currencies. But many of the LDCs continued to fix their exchange rates until 1982. The scale of capital mobility in LDCs increased for them as well, and many of these economies became destabilised. Post the 1980s LDCs' debt crisis, with a few exceptions, many of these countries have opted for flexible exchange rate systems (Corden, 1994:85; Mussa, 1994:289).

Whether it is the nominal anchor or the real target approach under consideration, as far as maintaining RER equilibrium goes, capital mobility stands a potentially disrupting factor. In either approach, at any point in time, there will be a policy determined nominal rate. The rate must be believable, or else a given currency will be attacked by speculators. In fact, the whole policy package entailed by an exchange rate commitment ought to be credible for an exchange rate to be maintained. Thailand, until recently, and Mexico until 1973, followed consistent policies: while they did, market sentiment hardly rose against their currencies. But perceived subsequent departures

from macroeconomic policy consistency, have at times led to RER disequilibrium and disruptive capital flights.

3.6.1 **Capital flows, monetary and exchange rate policies**

In the literature on the advantages and disadvantages of flexible and fixed exchange rates some relationships linking capital flows with monetary and exchange rate policies are posited. With regard to flexible exchange rates, it is said that domestic monetary policy autonomy and effectiveness can be attained even in the presence of an open capital account. In the case of a fixed exchange rate system, it is held that monetary independence and effectiveness can only be achieved in the presence of capital controls. Both arguments, as what follows will suggest, are spurious in the long run.

Under a flexible exchange rate regime, the efficacy and independence of monetary policy, in an environment of free capital movements, can only be preserved if monetary policy elements are not seriously out of agreement with monetary policies abroad. In a world where owners of factors of production are quick to invest where returns are highest, resources tend to move towards areas with high quality monetary management practices. Faced with this reality, proponents of flexibility argue that it is precisely because of the incentive for resources to migrate that a floating exchange rate system is designed to adjust when confronted by shocks such as sudden and massive capital movements. On the basis of this argument, it would have to be acceptable that an economy can choose its own inflation rate. This way of thinking, however, must be deeply flawed for in the long run, resources tend to seek financially stable environments. Capital will shun settings where the authorities are trying to offset price instability with exchange rate instability.

Equally, the belief that capital controls will ensure the independence and effectiveness of monetary policy in a fixed exchange rate system is misguided. As with flexible exchange rates, resources will tend to seek the area with the most reliable and promising monetary arrangement. Proponents of fixed exchange rates propose to contain the migratory tendencies of capital through

quantity restrictions, and not through price adjustments. Similarly, it could be claimed here, that through the attainment of monetary autonomy by capital controls, a country could choose its own rate of inflation. Except in the short run, the argument is fallacious. The inclination for capital to flow out may be temporarily contained, but would not be removed completely. In the long-run the propensity will be for the effectiveness of capital controls, and hence monetary independence, to fade away, and for national inflation to be similar to that abroad. Like in a flexible exchange rate system, resources will in the long-run locate in financially stable environments and will run away from areas where price instability is transitorily checked by capital controls (Guitian, 1997:80).

The moral behind the last two paragraphs is that in an increasingly globalising world, no country can afford to design and pursue economic policies in isolation. The independence of monetary policy and economic management can only be more apparent than real. Given these considerations, it would not be amiss to stress here that promoting national objectives at the expense of international goals will in the long-run tend to prove futile.

Given the potentially destabilising nature of capital flows, and the well recorded RER misaligning effects of capital movements in LDCs at a number of points in the history of these countries, one might wonder as to how these countries have dealt with capital flows. Calvo *et al.* (1997:376) list a number of policy measures through which LDCs have responded: trade policy, fiscal tightening, central bank sterilised and nonsterilised intervention of capital inflows, a rise in marginal reserve requirements on bank deposits and more regulated bank investments in equity and real-estate markets.

Among the many various types of methods for coping with capital flows, capital controls have been applied openly and widely and, even today, continue to generate much debate in academic and policymaking circles. Impediments to international capital movements have taken many forms in LDCs. First, there have been direct quantitative checks on the external asset and liability positions of domestic residents, sometimes the classification “residents” excluding financial institutions. Second, some countries have adopted separate exchange rates for commercial and

financial transactions, or imposed taxes on international capital transactions or on income from external capital holdings (Isard, 1995:207).

The goodness of capital controls in curtailing economically disruptive capital flows relies on the extent to which the authorities are able to render ineffective the various means by which capital account transactions legally or illegally circumvent the laid down structures and procedures. Over the last two decades, the authorities' efforts in this regard have been weakened by a number of factors: the unceasing introduction of new financial products and services, the proficiency of financial markets and intermediaries in migrating between different regulatory jurisdictions throughout the world and the revolution in information processing and communication technologies. With the failure of capital controls in meeting their objectives⁶ many LDCs have decided to remove barriers to international capital flows, and industrial countries have by and large eliminated them (Mathieson and Rojas-Suarez, 1993). But such total relaxation of controls is not easy, and perhaps, not the last word for many countries. Only in this very decade free capital movements have been blamed for serious exchange rate volatilities, misalignments and financial crises in the European Union (1992-1993) and recently in East Asia.

3.7 Conclusion

In this chapter, the real targets and nominal anchor approaches to exchange rate management have been reviewed, both in terms of theory and the experience of LDCs. In particular, the implications of both approaches for RER behaviour have been highlighted. Evidently, it cannot be said that the performance of any of the two perspectives is *a priori* superior in terms of maintaining internal and external balance. At the level of observation, it is clear that experiences of RER disequilibrium have occurred under either of the approaches to exchange rate management. It is also

⁶ Largely due to ever rising costs of maintaining controls on capital flows.

clear that the success of each approach requires the authorities' unwavering adherence to consistent macroeconomic policy practices. Today, the high degree of capital mobility poses a serious challenge to the design and implementation of exchange rate and monetary policies. In the next chapter, a case study of South Africa is carried out. The South African exchange rate policy framework has at a number of times borne features of the nominal anchor and real target approaches. Therefore, from the point of view of this chapter, it would be interesting to learn how chosen exchange rate regimes have performed in relation to the issue of RER disequilibrium.

4. A CASE STUDY: SOUTH AFRICA

4.1 Introduction

With the background of the discussion held in chapters 2 and 3, this chapter will conduct a case study of South Africa. Three major elements appear to determine the behaviour of the RER, namely, the fundamentals, macroeconomic policies and exchange rate policies. In keeping with this conclusion, a model of the RER used by Edwards (1989) consisting of the three forces will be applied to the study of South Africa.

This chapter is organised as follows. Section 4.2 will address exchange rate policy and developments in South Africa. Section 4.3 will analyse RER movements in South Africa between 1970 and 1996. The empirical model for RER dynamics and components of it are presented in sections 4.4 and 4.5. The studies conducted by Edwards (1989) and Elbadawi (1994) using models for RER dynamics are briefly reviewed in section 4.5. All the variables that will be used in this study are operationally defined in section 4.6. Section 4.7 presents and interprets the results. Section 4.8 draws the chapter to a close.

4.2 Exchange rate policy and developments in South Africa

Since 1970, South Africa has operated not a single but a number of exchange rate regimes (De Kock Commission, 1985:4-5). Broadly, both fixed and floating exchange rate systems have been implemented. The country entered the 1970s under the Bretton Woods fixed exchange rate system. With the demise of the Bretton Woods system in August 1971, the South African authorities decided to peg the rand to the United States dollar, which along with other major currencies of industrialised countries had just been floated. In June 1972, the rand was pegged to the British pound, but in October 1972, the rand was pegged again to the United States dollar. Two years later, in June 1974, some form of independent managed floating was introduced. The rand's

first experience with flexibility was short-lived, for in June 1975, the authorities reverted to a fixed exchange rate system by pegging the rand to the United States dollar.

South Africa practiced a dual exchange rate regime for the first time in February 1976, when it introduced the securities rand.¹ Following the recommendation of the De Kock Commission, in January 1979, independent managed floating was introduced. At the same time the securities rand was replaced by the financial rand. In August 1983, the South African Reserve Bank SARB stopped quoting the spot exchange rate for the rand, and instead permitted more market determination of the rate. In February, 1983, the financial rand was abolished, so that from then onwards until the debt crisis of 1985, a unified floating exchange rate, with SARB intervention, operated in South Africa. In September, 1985, following the debt crisis and massive capital outflows, the financial rand was reintroduced. This dual exchange rate system continued until March 1995, when the financial rand was removed, and the exchange rate re-unified again.

From what has been said above, it is clear that South Africa has experimented with both fixed and floating exchange rate systems. Broadly, one could say that from the Bretton Woods era until January, 1979, South Africa operated largely a fixed exchange rate system. But, afterwards, until today, the country has run an increasingly flexible exchange rate system, with growing market determination of the rate of the rand and reduced SARB intervention. Realistically speaking, it must be said here that the authorities' intervention in the foreign exchange market can be expected to stay protractedly, at least as long as governments continue to perceive the role of the central bank in this regard as one of smoothing out fluctuations of the exchange rate. Looking at the many changes in the exchange rate regime that have taken place since 1970, some authors are of the view that this simply reflects the indecision of the authorities as to what the optimal exchange rate system for South Africa ought to be (Kahn, 1993; Parikh and Kahn, 1997)

¹ A market in blocked balances directly transferable between non-residents. The balances could only be used to buy certain shares and certain government securities and semi-gilts, often at a large discount relative to the commercial rand (Mohr *et al.*, 1988:22).

Another important issue pertaining to exchange rate policy in South Africa has had to do with the use of exchange rate policy to control capital flows. It is in this context that the practice of a dual or multiple² exchange rate system emerged in South Africa. Exchange controls in South Africa date back to June, 1961. In that month, the authorities introduced the blocked rand, in their attempts to stem massive capital outflows that followed the 1960 Sharpeville massacre. Non-residents were forbidden from repatriating their funds, except by selling South African shares to other non-residents.

In February, 1976, through the new arrangement of the securities rand, non-residents could transfer blocked balances directly between each other. The De Kock Commission, perceiving the restricted number and type of financial instruments tradable under the securities rand as a discouragement to investors, proposed the financial rand. The adoption of the latter in January, 1979, widened investment opportunities for non-residents a bit further. As was observed at the beginning, the financial rand was later removed, reinstated and then abandoned in 1995. Capital controls have not affected only non-residents, but residents as well. And even though a lot and most of the severity of controls have been done away with, the capital account has not been entirely liberalised. The South African authorities have adopted a gradualist approach towards the removal of capital controls (Theron, 1998:48; Mohr *et al.*, 1988).

The cautious approach of the SARB towards capital account liberalisation is not without justification. As was observed earlier in chapter three, capital account liberalisation eventually led to RER misalignments in the Southern Cone countries in the 1970s. Only recently, the large inflows of short-term capital (appreciating the RER) which were followed by massive outflows in 1997 (depreciating the RER), constitute the closest reminder of the disruptive nature that free capital flows can assume today. The event simply encourages a conservative attitude towards moves to expose further the performance of the current account or the real side of the economy to the

² A multiple exchange rate system enters the discussion because apart from any two official exchange rate systems that the authorities may have put in place, an illegal or parallel exchange rate system operated outside the legal ones (Edwards, 1989:115).

possibility of future capital account fluctuations.

The hesitation of the authorities to articulate the optimal exchange rate policy framework for South Africa, noted earlier, has been reflected elsewhere. Similarly, and perhaps not surprisingly, the objective of exchange rate policy in South Africa has been given several descriptions, with shifting emphases overtime. Over the years, the purposes of exchange rate policy have included: (1) stabilising the balance of payments in the face of real shocks, (2) protecting the gold mining industry, (3) providing a stable environment for manufacturing exporters, and (4) fighting inflation.

Wing on Nuffra

The first objective suggests an extension of part of the spirit behind the Bretton Woods system and has entailed adjustments to the nominal exchange rate, especially during the period of fixation. Such policy actions were in keeping with the real targets approach, and very much linked to concerns about maintaining a favourable external balance position. Some examples will demonstrate the point. The rand was devalued in December 1971 with the aim of reducing the current account deficit (De Kock Commission, 1985:5). This devaluation was expected to improve the international competitiveness of exporters of primary, gold and manufacturing commodities. As a matter of fact, export earnings rose and the balance of payments improved, but, as the discussion in chapter 3 in relation to consequences of devaluation showed, inflation went up. Secondly, the short-lived first experiment with flexibility from 1974 to 1975 saw the rand delinked from the United States dollar because the authorities believed that the fluctuations of the dollar did not reflect underlying South African balance of payments and economic conditions (Holden and Holden, 1985:351).

The second objective reflects the importance that gold has played to the South African economy. Cognisant of the critical revenue generating role filled by the gold industry for many years, the authorities have deemed it appropriate to protect the industry from irregular dollar gold price performance. This has been done by promoting an above domestic production cost real gold

price through adjustments in the nominal exchange rate. Practically, until 1988, this has meant that a fall in the dollar gold price has been attended by a depreciation of the rand in order to maintain the profitability of gold production in rand terms.

But while protecting the gold sector, the third and fourth objectives have been served poorly. First, a weak rand has made the production of export manufacturing commodities cost-uncompetitive internationally. This has been so because the import content of manufacturing in South Africa is high and devaluation or depreciation simply increases the import bill for the manufacturing sector. Second, while a depreciation might have been in the interest of gold production, it tended to augment the general price level, causing inflation, and possibly leading the RER away from its equilibrium path. This means that a depreciation was only a fleeting solution to the problem of declining gold prices. For the rise in inflation would eventually lead to higher wages in all sectors, including gold mining. Rising wages in the gold sector would require more depreciation, and more depreciation would lead to higher wages. And so the cycle could repeat itself, each depreciation leading to a higher level of inflation. These rising episodes of depreciation and inflation could seriously lead to RER misalignment. The authorities realised that if they were going to fight inflation, around 15% in the 1980s, exchange rate policy could no longer be used to protect gold production. The policy of using the exchange rate exclusively in support of gold production was terminated in 1988 (Addleson, 1989). From then onwards, the authorities aspiration has been to bring about exchange rate stabilisation as part of the broader monetary policy quest for financial stabilisation.

The discussion on exchange rate policy, capital flows and the objectives of exchange rate policy presented in the above paragraphs holds some important implications for the behaviour of both the nominal exchange rate and RER in South Africa. The analysis of the path of the foreign relative to the domestic price level, that immediately follows below, will attempt to draw out these implications for RER movements in South Africa between 1970 and 1996.

4.3 Real exchange rate movements between 1970 and 1996

On the basis of instability, graphical inspection of the schedule for the real effective

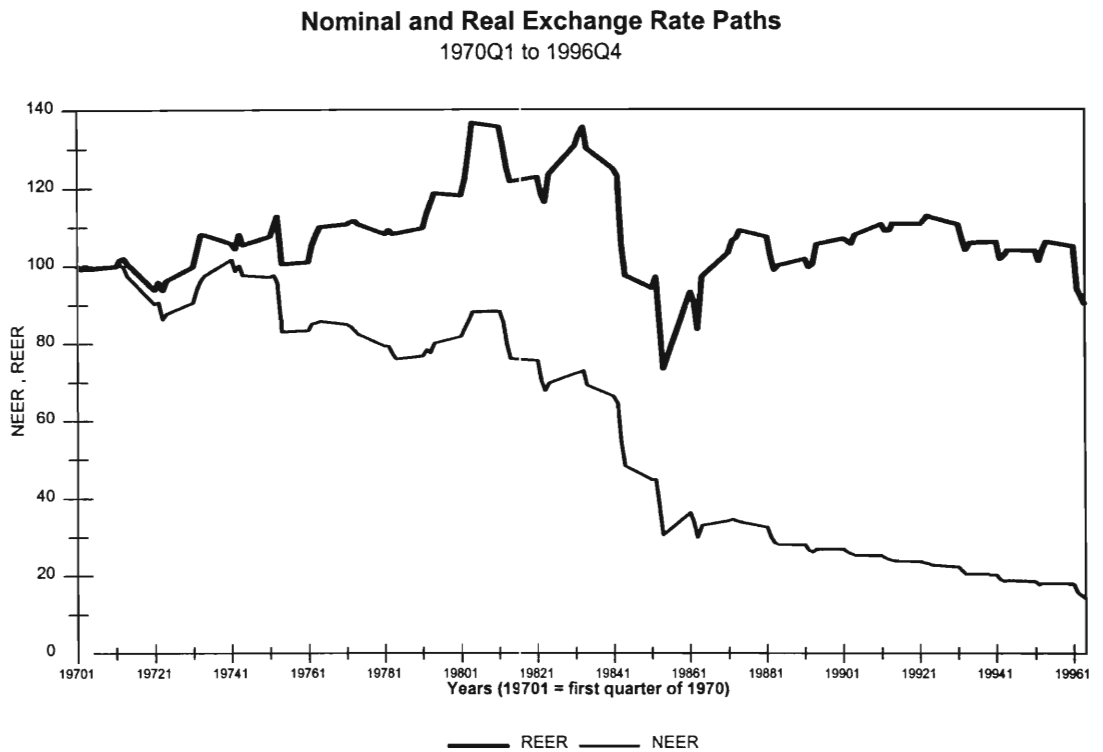


Figure 4.1 The base year for the NEER and REER is the first quarter of 1970.

exchange rate (REER) in figure 4.1 suggests that the period of study can be divided into three sub-periods for purposes of analysis, namely, from 1970 to 1979, from 1979 to 1988, and from 1988 to 1996.

Calculated coefficients of variation for the real effective exchange rate (REER) for the three periods are 0.056515, 0.15043 and 0.052643, respectively, while those for the nominal effective exchange rate (NEER) are 0.094923, 0.38680 and 0.17599, respectively. The coefficients of variation indicate that the second period was the most volatile, while the third was the least for the

REER.

4.3.1 The period from 1970 to 1979

In this period, South Africa operated largely a fixed exchange rate system. Both the nominal exchange rate and RER show some mild up-and-down movements, with the RER tending towards slight appreciation and the nominal exchange rate towards depreciation. On the whole, the RER appears to be relatively stable. The relative stability of the RER in this period lends support to the assertion that fixed exchange rates tend to bear a stabilising effect on the domestic rate of inflation and the RER. But this is far from saying that fixation always succeeds in putting a firm lead on domestic inflation. The fact that the RER tends towards appreciation in this period suggests that in spite of the largely fixed exchange rate regime, the domestic price level, at a number of times and in overall terms, did rise faster than the world level. In particular, the general downward adjustment of the nominal exchange rate was not one-for-one translated into a similar tendency for the REER to fall. This suggests the presence of some counter forces which tended to push the domestic price level higher than the fall in the nominal exchange rate. As was observed in chapter three, apart from other influences, the devaluations of the rand which took place during the first period, themselves could have helped to augment domestic inflation.

Looking at figure 4.2, it seems evident that the overall terms of trade (TOTIG), generally experienced an upward movement between 1970 and 1980. But the terms of trade excluding gold (TOTXG), seem to have deteriorated over the same period. Obviously, as figure 4.3 later shows, the overall terms of trade performed better because of the decidedly rising trend that the price of gold assumed over the period. The overall improvement in the total terms of trade could have contributed towards the slight upward movement in the REER. The upsurge in oil prices in 1973, accounted for the decline in the partial terms of trade (TOTXG, especially), but the rise in the price of gold appears to have more than compensated for the downward pressure of the oil shock on the overall terms of trade. Assuming that the income effect was dominant over the substitution effect,

the added income arising from the improvement in the terms of trade may have been spent on

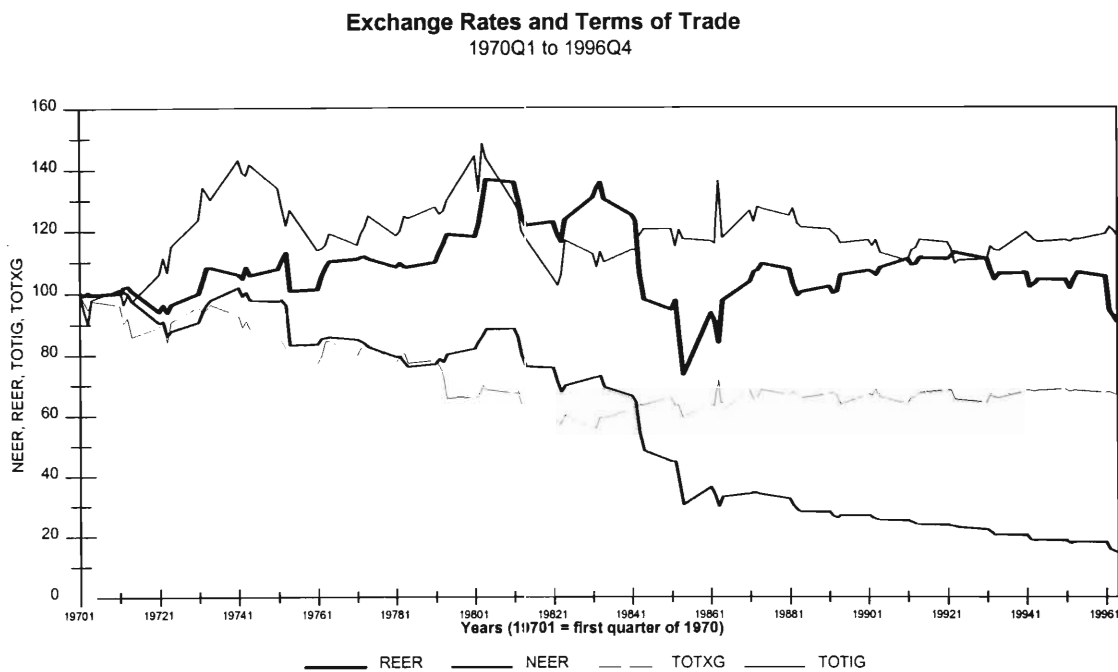


Figure 4.2 *TOTXG = terms of trade excluding gold. TOTIG = terms of trade including gold*

domestic goods, tending to strengthen the real rand.

With regard to the observed rise in the REER, this study would be interested in establishing the consequences for the ERER. Would it be the case that the slight overall REER appreciation experienced between 1970 and 1996 represented a departure from the equilibrium path? The tests that lie further ahead hope to come up with a position on this question.

4.3.2 The period from 1979 to 1988

This period was characterised by volatility in both the real and nominal exchange rate. After reaching its highest peak ever in the first quarter of 1980, the real dollar gold price plummeted. To

ensure profitability in domestic gold production, the authorities intervened in the foreign exchange market to maintain a depreciated nominal exchange rate. As figure 4.4 illustrates, this meant that while the price of gold in dollars was falling, its rand equivalent was rising, providing protection for gold production.

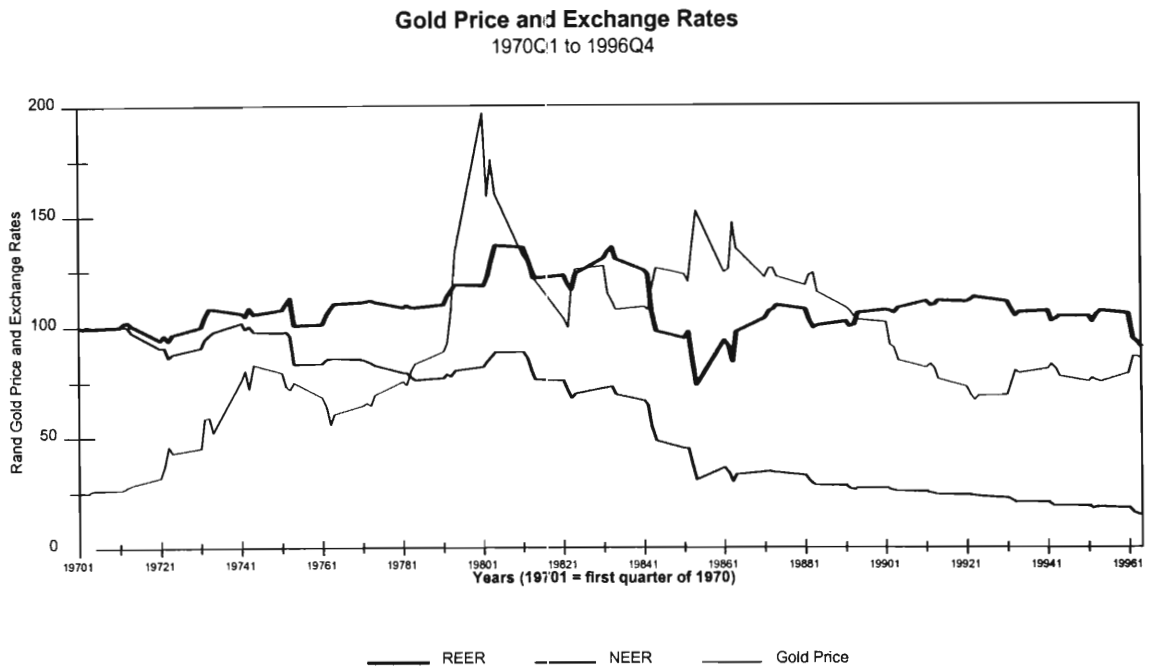


Figure 4.3 The base year for all the series is the first quarter of 1970.

The fall in the dollar price of gold may not have been the only reason for the weak and highly unstable rand. As other authors have claimed elsewhere (Addleson, 1989; Kahn, 1993), increased political pressure against the apartheid system, the intensification of sanctions, the growing disinvestment campaign, the capital account liberalisation of 1983 and the debt crisis of 1985 all contributed towards the instability of the exchange rate.

The sharp falls in the rand between February 1981 and August 1982, and between May 1983 and January 1985 appear to have been preceded by a loose monetary policy stance by the SARB (Addleson, 1989:5). Artificial stimulation of the economy occurred in 1983, and after the 1984-

1986 recession. These expansionist practices increased liquidity in the economy, adding downward pressures on the rand and ultimately raising the domestic price level. However, until 1985, the decline in the rand was greater than the rise in inflation, so that the REER generally moved in the same direction as the NEER (see figure 4.1).

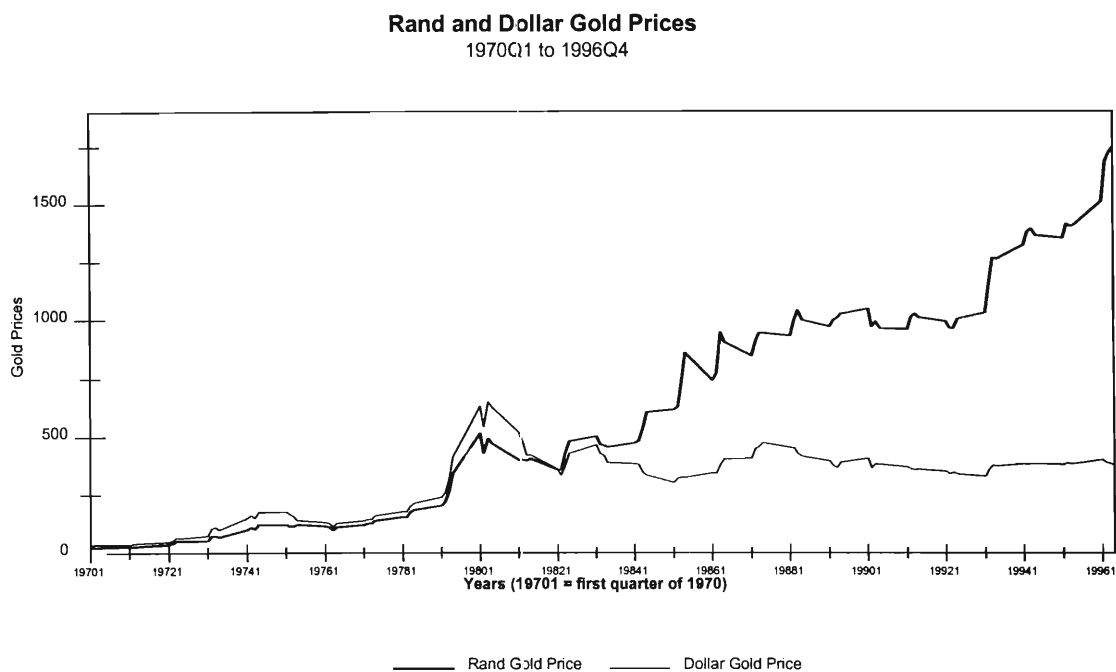


Figure 4.4 The two prices of gold are expressed in nominal terms

In this period, a number of factors dealt a negative blow on the manufacturing sector. First, the volatility of the floating rand created much uncertainty in investment decisions. Second, the inflation arising from the decline in the rand fed into pressures for higher wages. Third, since the manufacturing sector depended heavily on imports - especially of capital equipment goods, the weaker rand simply made production costs to soar. So, although a depreciation might theoretically have been expected to make exports internationally cheaper, the high import dependency of the manufacturing sector in South Africa took away the competitive edge that otherwise could have been the case.

4.3.3 The period from 1988 to 1996

In the last period, although South Africa continued to pursue a floating exchange rate policy, both the nominal exchange rate and REERs appear relatively stable, in fact with smoother fluctuations than even the first period. Immediate credit for the stability in exchange rates in this period goes to the SARB. In 1988, the SARB made a fundamental shift in the direction of monetary and exchange rate policies. First, it was decided that the nominal exchange rate would no longer be used to protect the gold sector. Second, the authorities, in the interest of financial stabilisation, chose to fight inflation. This meant that monetary policy would be tight. The high interest rate strategy (with other measures) that ensued, was a success. Annual inflation climbed down from an average of 15% in the 1980s to below 10% by 1993. Real interest rates, which had been negative, became positive.

Evidently, as was observed in chapter three, low inflation and exchange rate stability can also be associated with a flexible exchange rate system. One important factor to such an achievement, holding other factors constant, is a consistent monetary policy environment such as the conservative monetary practices promoted by the South African authorities in this period. Obviously, shocks from other variables can change the picture. The recent severe weakness experienced by the rand (1997-1998) due to outflows of short-term capital must remind us that compliant macroeconomic policies alone are not sufficient to guarantee exchange rate or financial stability.

Of singular importance to this study is to find out the determinants of the behaviour of the the REER and its equilibrium in South Africa. Using fundamentals the study will attempt to arrive at and map out the trajectory of the ERER. Then, by comparing the movements of the RER against those defined by the path of ERER, this study will try to establish whether the movements of the RER described in the three periods represent instances of RER disequilibrium. So the study now moves to conduct a formal investigation into these.

4.4 An empirical model for real exchange rate dynamics

The model that will be applied to the study of South Africa follows that advanced by Edwards (1989:133) and extended by Elbadawi (1994:99, 101). As such the equation is an extension of the more basic and earlier models presented by Dornbusch (1973) and Calvo-Rodriguez (1977). The major elements of the theoretical analysis of chapter 2 can be captured by the following equation of RER dynamics:

$$\Delta \ln e_t = \sigma \{ \ln e_t^* - \ln e_{t-1} \} - \gamma \{ M_t - M_t^* \} + \tau \{ \ln E_t - \ln E_{t-1} \}, \quad (1)$$

where,

Δ = change,

\ln = logarithm

e = real exchange rate,

e^* = the equilibrium real exchange rate,

M = an index of macroeconomic policies (proxy),

M^* = the sustainable level of macroeconomic policies (proxy),

E = the nominal exchange rate,

t = at time t ,

σ , γ , and τ = positive parameters that capture the most important dynamic aspects of the adjustment process.

Equation (1) suggests that changes in the RER are brought about by one or a combination of three major forces, corresponding to the three terms of the equation. The first force consists of the autonomous propensity of the actual RER to get rid of disequilibrium. This self-correcting mechanism is represented by the partial adjustment term $\sigma \{ \ln e_t^* - \ln e_{t-1} \}$. In the latter term, σ captures the speed with which self-realignment occurs. If the value of σ equals 1, misalignment of the RER from the path of equilibrium will be removed completely within one period. Thus, the lower the value of σ , the longer it will take the self-adjustment mechanism to bring back the RER to the level consistent with external and internal balances. As was observed in both chapters 2 and

3, under a fixed exchange rate regime, the self-correction process is expected to take place through adjustments in the price of nontradables. To the extent that capital mobility and wage indexation rules affect the ease with which the price of nontradables is able to change, these two factors, among others, determine the magnitude of σ . Given the downward inflexibility of prices and wages, discussed in chapter 3, the value of σ in a LDC is expected to be small. This implies that a realignment process that relies solely on the self-correction mechanism would tend to be protracted, and most likely, to be attended by reduced output and high unemployment.

The second major source of changes in the RER in equation (1) is macroeconomic policies, represented by $\gamma (M_t - M_t^*)$. If macroeconomic policies are unsustainable and inconsistent with the chosen exchange rate regime, M_t will be greater than M_t^* . As a consequence, pressures towards a RER appreciation will mount (that is, $\delta \log e_t < 0$). Should macroeconomic policies be excessively expansive, the effects of the large values of $(M_t > M_t^*)$ and/or γ will overrun the self-adjustment force, accelerating disequilibrium overtime.

According to equation (1), the third and last determinant of RER movements is defined by the term $\tau (\ln E_t - \ln E_{t-1})$. This term suggests that changes in the nominal exchange rate are positively related to changes in the RER. Specifically, a nominal devaluation (depreciation) will bring about a real devaluation (depreciation) in the short-run. The parameter τ will determine the actual magnitude of real depreciation that will attend an alteration of the nominal exchange rate. The value assumed by the parameter itself will depend on the structural and institutional characteristics of the economy³. The bigger the value of τ , the greater the impact of a change in the nominal exchange rate on the RER. From the discussion in Chapter 2, τ is expected to be less than 1. The effect of a nominal exchange rate devaluation is expected to last only in the short-run. Whether or not a nominal devaluation is actually translated into any real devaluation will rely on what happens to the other two terms in equation (1). As was noted in chapter 2, if the initial

³ Such characteristics include the degree of openness of the economy, the weight of importables in the basket used to calculate the domestic price level and the extent to which changes in the nominal exchange rate are translated into the domestic price of importables.

condition (captured by $\ln e_t^* - \ln e_{t-1}$) is one of overvaluation, and the accompanying macroeconomic policies ($M_t - M_t^*$) are not expansionist, a nominal devaluation (depreciation) will be helpful in redirecting the RER towards the equilibrium level.

Equation (1), by highlighting the three interactive forces, successfully brings to the fore the major implications of the theoretical exposition in chapter 2. This modeling strategy has been judged an adequate one because it embodies three basic elements:

- (1) It specifies the ERER as a forward-looking function of the fundamentals,
- (2) It allows for a flexible dynamic adjustment of the RER toward the ERER, and
- (3) It takes account of the influence of short-to medium-run macroeconomic and exchange rate policies (Elbadawi, 1994:95).

4.4.1 The equilibrium real exchange rate

The estimation of equation (1) requires that a forward-looking equation for the ERER ($\ln e_t^*$) be specified. For South Africa the following fundamentals (all in real terms, and in this study at 1990 prices) have been posited as important determinants of the behaviour of the ERER:

- (1) technological progress,
- (2) commercial policies (tariffs),
- (3) government expenditure,
- (4) disposable income,
- (5) capital flows,
- (6) the rand gold price, and
- (7) the terms of trade.

Thus, a linear function relating the ERER to the explanatory variables outlined above can be expressed in the following way:

$$\ln e_t^* = \beta_0 + \beta_1 \ln (\text{Tecnpro})_t + \beta_2 \ln (\text{Tarif})_t + \beta_3 \ln (\text{Gcn})_t + \beta_4 \ln (\text{Disp})_t + \beta_5 \ln (\text{Capflo})_t + \beta_6 \ln (\text{Rgop})_t + \beta_7 \ln (\text{Tot})_t + \mu_t,^4 \quad (2)$$

where,

Tecnpro = technological or productivity improvement,

Tarif = trade policy,

Gcn = government consumption of nontradables,

Disp = disposable income,

Capflo = capital flows,

Rgop = rand gold price,

Tot = terms of trade, and

μ = the error term.

4.4.2 Macroeconomic policies

Similarly, the estimation of equation (1) requires a spelling of the term for macroeconomic policies. Some of the literature in the field suggests the following denotations for the bracket ($M_t - M_t^*$):

(1) the excess supply of credit, defined as the rate of growth of credit minus the lagged rate of growth of GDP, or simply the rate of growth of domestic credit minus the rate of growth of GDP.(Edwards, 1989:137; Elbadawi, 1994:102).

(2) the rate of growth of domestic credit (Edwards, 1989:136).

⁴ Equation (2) surfaces in many but similar forms within the empirical tradition of literature on the ERER (see, for example, Edwards, 1989:153; Elbadawi, 1994:98; Elbadawi, 1992; Mundlak *et al.*, 1987).

4.4.3 Exchange rate policy

The last component of equation (1) can be interpreted directly as the term representing devaluation or depreciation ($\ln E_t - \ln E_{t-1}$), or in other words, changes in the nominal exchange rate.

4.5 The real exchange rate equation to be estimated

Substituting equation (2) in equation (1), as well as replacing all the defined terms of equation (1) produces the following econometric equation for the RER:

$$\begin{aligned} \Delta \ln e_t = & \sigma\beta_0 + \sigma\beta_1 \ln (\text{Tecnpro})_t + \sigma\beta_2 \ln (\text{Tarif})_t + \sigma\beta_3 \ln (\text{Gcn})_t + \sigma\beta_4 \ln (\text{Disp})_t + \sigma\beta_5 \ln (\text{Capflo})_t \\ & + \sigma\beta_6 \ln (\text{Rgop})_t + \sigma\beta_7 \ln (\text{Tot})_t - \sigma \ln e_{t-1} - \gamma \ln (\text{Macroeco})_t + \tau (\text{Nomdep})_t + \mu_t \end{aligned} \quad (3)$$

where,

Macroeco = Excess supply of credit or the rate of growth of domestic credit, and

Nomdep = Nominal exchange rate depreciation.

Moving $\ln e_{t-1}$ from the left side of the equation to the right, and then factorising out yields:

$$\begin{aligned} \ln e_t = & \sigma\beta_0 + \sigma\beta_1 \ln (\text{Tecnpro})_t + \sigma\beta_2 \ln (\text{Tarif})_t + \sigma\beta_3 \ln (\text{Gcn})_t + \sigma\beta_4 \ln (\text{Disp})_t + \sigma\beta_5 \ln (\text{Capflo})_t \\ & + \sigma\beta_6 \ln (\text{Rgop})_t + \sigma\beta_7 \ln (\text{Tot})_t + (1 - \sigma) \ln e_{t-1} - \gamma \ln (\text{Macroeco})_t + \tau (\text{Nomdep})_t + \mu_t. \end{aligned} \quad (4)$$

Replacing combinations of σ and β_s in equation (4) with λ ,

$$\begin{aligned} \ln e_t = & \lambda_0 + \lambda_1 \ln (\text{Tecnpro})_t + \lambda_2 \ln (\text{Tarif})_t + \lambda_3 \ln (\text{Gcn})_t + \lambda_4 \ln (\text{Disp})_t + \lambda_5 \ln (\text{Capflo})_t + \lambda_6 \ln \\ & (\text{Rgop})_t + \lambda_7 \ln (\text{Tot})_t + (1 - \sigma) \ln e_{t-1} - \gamma \ln (\text{Macroecon})_t + \tau (\text{Nomdep})_t + \mu_t. \end{aligned} \quad (5)$$

Equations (2) and (5) can be estimated using ordinary least squares. Edwards (1989:137, 139), estimates an equation of RER dynamics with a form similar to equation (5). The fundamentals included in Edwards' study are the external terms of trade, the level and composition of government consumption, controls on capital flows, exchange and trade controls (that is, import tariffs), technological progress and capital accumulation. In addition, Edwards's equation includes variables for macroeconomic and exchange rate policies. The equation was estimated using pooled data from a sample of twelve LDCs⁵. The sample was chosen on the basis of data availability.

4.5.1 Concerns about stationarity

Using ordinary least squares and instrumental variables techniques, Edwards (1989) obtained significant t-statistics for all the variables. Furthermore, Edwards' estimated coefficients for equation (1) were all statistically significant, producing a partial adjustment coefficient of 0.19.

In applying Edward's model, two diagnostic concerns appear to be relevant to this study. First, given the multi-variable and time series nature of the equation and the fact that most of the variables are represented by proxies, the model is highly likely to be troubled by the problem of multi-collinearity. Second, unlike Edwards who dealt with pooled data, this study will employ time series data. Therefore, following today's conventions in econometrics, it is imperative that all series be tested for stationarity. The latter condition is necessary for assuring the goodness of the statistical properties of estimators. This point is quite important and will receive further elaboration in what follows.

Any estimator assumes the underlying data-generating process to be stationary. In this regard, the ordinary least squares technique holds some assumptions about the first, second and third

⁵ The twelve countries are Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, the Philippines, South Africa, Sri Lanka, Thailand and Yugoslavia.

moments of variables. Defining stationarity in a weak sense⁶, it is assumed that the mean and variance of data series are constant over time, and that the covariance between two periods is determined by the distance between them, and not the time at which the covariance is considered (Charemza and Deadman, 1993). Where any or a combination of these assumptions is violated, a time series is held to be nonstationary.

A problematic consequence of running regressions on the basis of nonstationary processes is that regressions tend to be spurious (Granger and Newbold, 1974; Hendry, 1986). In such circumstances, all diagnostic statistics, except the Durbin-Watson statistic, are prone to point towards a good model, with significant t-statistics and high coefficients of determination. But these impressive results are generated because nonstationarity biases conventional tests towards rejecting the null hypothesis of no relation, even when it is true. Typically, when time series are not stationary, regression analysis will exhibit a low Durbin-Watson statistic. The lack of constancy in the first three moments of variables makes the statistical properties of regression analysis of doubtful validity.

This study involves time series data, most likely with nonstationary series. So as to avoid the problem of spurious regression, all variables used to estimate equation (5) will be tested for unit-roots. This investigation will be conducted using the Box-Pierce and Augmented Dickey Fuller tests for nonstationarity. All variables found to be nonstationary will be differenced before using them in ordinary least squares regression analysis. Differencing has become a standard procedure for removing unit roots from a series.⁷

⁶ A strictly stationary process is one whose joint and conditional distributions are both invariant with respect to displacement in time (Pindyck and Rubinfeld, 1991:445).

⁷ Sometimes, it is the case that a given series is not integrated. In this case, no amount of differencing can remove unit roots from the series (Charemza and Deadman, 1993:133).

4.5.2 Cointegration

While differencing may help to get rid of nonstationarity of series, another problem appears with the solution. By analysing only the differences of time-series, important information about potential long-run relationships between the levels of economic variables is lost (Davidson *et al.*, 1978). In the context of this study, this means that the equation for the RER would not have a long-run solution. The method of cointegration and error-correction modelling advanced by Engle and Granger (1987) attempts a solution to this problem.

It is believed in economic theory that certain pairs⁸ of economic variables should not diverge from each other by too great a divide, at least in the long-run. The theoretical discussion in chapter 2, as well as literature in the field, suggests that in the long-run the RER will be related to the ERER in the following way:

$$\ln e_t = \beta \ln e_t^* + \mu_t \quad (6)$$

Now if $\ln e_t$ and $\ln e_t^*$ are both $I(1)$ ⁹, and are $CI(1,1)$ ¹⁰ and have the cointegrating vector $[1, \beta]$, with deviations of $\ln e_t$ from $\ln e_t^*$ $I(0)$, a model in first differences including an error-correction mechanism can be formulated;

$$\Delta \ln e_t = \beta_1 \Delta \ln e_t^* - \beta_2 (\ln e_{t-1} - \beta \ln e_{t-1}^*) + \varepsilon_t \quad (7)$$

where Δ signifies a first difference operator, so that $\Delta \ln e_t = \ln e_t - \ln e_{t-1}$.

⁸ The number of variables could be more.

⁹ $I(1)$ means integrated of order one.

¹⁰ $CI(1,1)$ means cointegrated of order one one.

Rearranging the last term equation (7) becomes

$$\Delta \ln e_t = \beta_1 \Delta \ln e_t^* + \beta_2 (\beta \ln e_{t-1}^* - \ln e_{t-1}) + \varepsilon_t \quad (8)$$

Equation (8) can be incorporated into a dynamic error correction specification for South Africa as follows:

$$\Delta \ln e_t = \beta_1 \Delta \ln e_t^* + \beta_2 (\beta \ln e_{t-1}^* - \ln e_{t-1}) + \gamma \Delta \ln (\text{Macroeco})_t + \tau \Delta (\text{Nomdep})_t + v_t \quad (9)$$

Expanding equation (9) using the fundamentals in equation (2):

$$\Delta \ln e_t = \beta_2 (\beta \ln e_{t-1}^* - \ln e_{t-1}) + \beta_1 [\beta_1 \Delta \ln (\text{Tecnpro})_t + \beta_2 \Delta \ln (\text{Tarif})_t + \beta_3 \Delta \ln (\text{Gcn})_t + \beta_4 \Delta \ln (\text{Disp})_t + \beta_5 \Delta \ln (\text{Capflo})_t + \beta_6 \Delta \ln (\text{Rgop})_t + \beta_7 \Delta \ln (\text{Tot})_t] - \gamma \Delta \ln (\text{Macroeco})_t + \tau \Delta (\text{Nomdep})_t + v_t \quad (10)$$

where,

β_2 = coefficient of the error correction mechanism,

$\beta_1 \beta_i$ = coefficients capturing the short-run effects of temporary changes in the fundamentals,

γ = a coefficient capturing short-run effects due to expansive macroeconomic policies, and

τ = coefficient capturing the short-run effect of nominal exchange rate depreciation.

The Engle-Granger (1987) solution involves a two step procedure. First, equation (6) will be estimated using ordinary least squares,¹¹ and the residuals μ_t will be tested for stationarity. Second, should the residuals be found to be stationary, equation (10) will be estimated by replacing β with the ordinary least squares estimate of β in equation (6). Ultimately, the value of the Engle

¹¹ For a two variable model, see appendix F for Phillips' and Loretan's (1991) alternative autoregressive method for estimating the long-run equation.

and Granger technique lies in its ability to produce an equation like (10) with cointegrated variables and an error-correction term, but not liable to the problems of spurious regression.

In a similar study, Elbadawi (1994:101, 104-111) applied the Engle-Granger approach. Using annual data, Elbadawi employed the method of cointegration and error-correction modeling to study the dynamic behaviour of the RER in three countries: Chile (1967 - 1990), Ghana (1967 - 1990) and India (1967 - 1988). As fundamentals, Elbadawi hypothesised the terms of trade, trade policy, government consumption of nontradables and capital flows. In addition to these fundamentals, the error-correction equation for the RER included domestic credit expansion as a term for macroeconomic policy and rate of depreciation as a term for exchange rate policy.

Overall, Elbadawi found the fundamentals to have been significantly shaping the behaviour of the ERER during the period of study. Macroeconomic and exchange rate policies were found to bear short-run effects on the behaviour of the RER. Further, the elasticities for the error-correction term (- 0.78 for Chile, 0.71 for Ghana and 0.67 for India) all had significant t-statistics¹², except the one for Ghana. Using the long-run equation for the RER (estimated using OLS) and permanent values for the fundamentals, Elbadawi plotted the schedules for the real and ERER over each country's study period. The permanent values of the fundamentals were largely calculated using a five-year moving-average decomposition technique. Gaps between the RER and ERER represented misalignment. Periods shown by the calculated indexes to have experienced divergences between the RER and ERER actually reflected well-known episodes of overvaluation in Chile and Ghana, suggesting that the modeling strategy had been successful.

¹² In other words, the error-correction terms were significantly related to movements in the RER.

4.6 Operationalisation of variables¹³

Most of the variables used to estimate equations in this study lack direct counterparts which can be used to represent them. In fact, among all the variables, only the terms of trade have direct time-series data. The rest of the variables have had to be represented by proxies. All the data is real, with 1990 set as the base year. Many of the series used in this study were collected already in real form. Those that were nominal, for instance the rand price of gold and domestic credit extension, were deflated by the CPI. Since the equations to be estimated are linear, all the series were transformed into natural logarithms, except capital flows, whose negative values have no definition in logarithms. Expressing the variables of an equation in logarithms gives the advantage that coefficients can be directly interpreted as elasticities (Gujarati, 1995:166).¹⁴

The following are the empirical definitions that were given to the variables used in this study.

4.6.1 The real exchange rate

Section 2.1 of Chapter 2 defined the RER as the relative price of tradables. Similarly, the

¹³ All the data series used in this study were extracted from the SARB data-base on the internet (<http://www.resbank.co.za/economics/econ.html>). Quarterly time-series figures, from 1970 to 1996, were taken from the latter source in form of zip files: these were unzipped (using PKUNZIP) into a usable form and downloaded into Quattro-Pro and Microfit spreadsheets.

¹⁴ Generally, SARB figures have some problems. A careful inspection of the SARB Quarterly Bulletins, supposedly a book equivalent of the data published on the internet, reveals some inconsistencies. Sometimes different publications will report different figures for the same year or quarter. The constant revision or highly provisional nature of the data implies that errors of measurement are unavoidable by any study relying on SARB data. Any statistics and interpretations generated on the basis of such data must take cognisance of possible discrepancies in the figures used. The problem of errors in the data supplied by the SARB has been noted and discussed by Barr and Sharp (1996).

SARB computes a purchasing *ppp*-based multilateral RER index called the real effective exchange rate (REER). The REER is described as the ratio of the foreign to the domestic price level.¹⁵

Although the two definitions are numerically different, they are both theoretically¹⁶ and empirically highly correlated. Edwards (1989:90), computed correlation coefficients to compare the trade weighted multilateral RERs. With a correlation coefficient exceeding 0.9, it was clear that the two indexes move closely together. For purposes of this study, the REER will be used as a proxy for the RER. The REER has been used as a proxy for the RER by a number of authors (Minardi, 1995; Parikh and Kahn, 1997; Gerson and Kahn, 1988).

It is important to note here that the movements of the REER supplied by the SARB are to be interpreted with a sign opposite to that given to the RER index in chapters two and three. Accordingly, a rise in the REER signifies an appreciation, and a fall, a depreciation. It also follows that the signs describing the relationship between fundamentals and the ERER in table 2.2 equally assume opposite symbols when the same fundamentals are now related to the REER.

The SARB does not provide quarterly data for the REER, but monthly data. Therefore, quarterly figures for the REER were computed for this study by calculating four three-month averages for each year from 1970 to 1996.

¹⁵ The currencies and respective trade weights used to calculate the REER are: the United States dollar (51.7%), the British pound sterling (20.2%), the German mark (17.2%) and the Japanese Yen (10.9%) (Dykes, 1998:2).

¹⁶ Theoretically, the RER has been defined as: (1) $E P_T / P_N$, and (2) $E P^*/P$, operationally represented by the first and second proxies in the main text, respectively. Now, for small open economies, the price of tradables is determined by world prices, therefore $P_T = EP^*$. The domestic price level P is an index of P_N and P_T , that is, $P = P_T^\alpha P_N^{(1-\alpha)}$. Substituting the above into EP^*/P , we get $RER = P_T / P_T^\alpha P_N^{(1-\alpha)}$. The two definitions may not necessarily be numerically equivalent, but they are highly correlated (Gerson and Kahn, 1988:126; Parikh and Kahn, 1997:5).

4.6.2 Technological progress or productivity

In terms of the data-source, the labour-output ratio would have served as a reasonable proxy for productivity, but quarterly figures are not available. Following others who have conducted similar investigations, technological progress or productivity growth is represented by the rate of growth of real GDP (Edwards, 1989:136) and by the time trend (Elbadawi, 1994:107). The rate of growth of real GDP is not a very good proxy for productivity or technological progress because it is determined by many other factors. The argument for using this variable, as well as the trend, lies in the postulated Ricardo-Balassa effect¹⁷ (Cottani et al., 1990:67).

4.6.3 Commercial or trade policy

A comprehensive data series on tariffs in South Africa for the period of study is not available. A measure of an implicit tariff will be calculated using the ratio of tariff revenues to imports. This proxy has been used by Edwards (1989:136). Second, a proxy defined as the ratio of the sum of imports and exports to GDP has been used by Elbadawi (1994:98) and Cottani *et al.* (1990:66). The latter proxy can be interpreted as an indicator of trade policy restrictions such as tariffs and quotas. For example, an import quota would reduce openness and be expected to lead to a RER appreciation. But if the simultaneous imposition of the same rate import tariffs and export subsidies leads to the same effect as a devaluation, as Du Plessis (1994:271) contends, then a depreciation could follow the imposition of an import quota or tariff. The two proxies for trade policy are theoretically not the best. For much as the degree of openness of an economy may be influenced by the extent of protection, trade depends on many other factors as well, including the RER itself. However, in the absence of reliable data, the study will rely on the two inferior substitutes. Of course, this means that any interpretation of results must be conducted with great care.

¹⁷ Ultimately, David Ricardo (1771/1821) and Balassa (1964), posited the existence of a negative relationship between economic growth and the equilibrium relative price of tradables. Note: a negative relationship in terms of the ERER of chapter two.

4.6.4 Government consumption of nontradables

Since figures for the government's expenditure on nontradables are not available, three proxies are used by this study, namely, the ratio of public sector expenditure to GDP, the ratio of government consumption to GDP and real consumption expenditure by government. The first two proxies are used by Edwards (1989) and Elbadawi (1994). The third proxy attempts to measure government expenditure directly. Although government consumption includes some outlays on traded commodities, these proxies appear sensible, largely because most of the expenditure by government falls on nontradable services. With regard to the first two proxies, if the rate of increase in government expenditure exceeds the rate of economic growth, it is expected that the domestic price level will grow at a quicker pace than the foreign price level, leading to a RER appreciation.

4.6.5 Disposable income

This variable was represented by two proxies. The first proxy is the real gross national disposable income and the second, the ratio of gross national disposable income to GDP. Should the rate of growth in personal disposable income be larger than that of domestic output, residents will be expected to spend more on all goods and services, placing upward pressures on the domestic price level. But if fiscal policy is tightened, higher taxes will mean less disposable income and less money to spend, and therefore, less pressure for inflation to rise.

4.6.6 Capital flows

Capital flows can be proxied by net capital flows. Presently, the SARB provides annual data for net capital inflows, but not quarterly values. Minardi (1996) used long-term capital movements as a proxy for capital flows, and this study will use the proxy. But also, this study will proxy capital flows by the ratio of the difference between imports and exports to GDP employed by Elbadawi (1994). The difference between imports and exports suggests the balance that the capital account

must retain in order for the overall balance of payments to be in equilibrium. This approach is quite reasonable, given the fact that the capital account is the counterpart of the current account.

4.6.8 Terms of trade

The SARB reports two types of terms of trade: the total terms of trade, called the terms of trade including gold, and the partial terms of trade excluding gold. Movements of the two indexes are not identical, as figure 4.2 illustrates. Both of these indexes will be used in this study, so as to consider the possibility of differential effects of these variables on the RER.

4.6.9 The price of gold

This study will use the real price of gold in rand to represent the price of gold. Alternatively, the real price of gold in terms of US dollars could have been used.

4.6.10 Macroeconomic policy

Two proxies for macroeconomic policy are used here: first, the rate of growth of real domestic credit extension by all financial institutions in South Africa, and, second, the rate of growth of domestic credit minus the lagged rate of growth of real GDP. Both of these proxies are used by Edwards (1989:137). As was observed in both chapters two and three, if the rate of growth of domestic credit out-runs the rate of growth of domestic output, there will be a tendency for the RER to appreciate. Elbadawi (1994:107), proxies macroeconomic policies as

(change in domestic credit) - world inflation - nominal devaluation - real GDP growth rate.

$$M2_{(t-1)}$$

Similarly, Cottani *et al.* (1990:66) use domestic credit creation in excess of devaluation, foreign inflation and real GDP growth as a surrogate for macroeconomic policy. Much as this study tried to incorporate the last two proxies, it failed to overcome the obstacle of finding consistent quarterly

Variable	Description of measurement
A: Real Exchange Rate	
1. LNREER	real effective exchange rate.
B: Productivity or Technological Progress	
1. TREND 2. LNPRGDPAJ	real GDP.
C: Commercial or Trade Policy	
1. LNCUST 2. LNRXM GDP	customs revenue / GDP. (exports plus imports) / GDP.
D: Government Consumption of Nontradables	
1. LNPRPSXP 2. LNGRCNSX 3. LNRCONX	public sector expenditure / GDP. consumption expenditure by general government / GDP. real consumption expenditure by general government.
E: Disposable Income	
1. LNRPDISP 2. LNRDISGDP	real gross national personal disposable income. gross national personal disposable income / GDP.
F. Capital Flows	
1. RLTCAP 2. RFLOW	real long-term capital. (imports - exports) / GDP.
G. Terms of Trade	
1. LNTOTXG 2. LNTOTIG	terms of trade excluding gold. terms of trade including gold.
H. The Price of Gold	
1. LNRRANDGP	real price of gold in rand.
I. Macroeconomic Policy	
1. LNRCRED 2. LNCREDS	rate of growth of real domestic credit extension by all financial institutions. rate of growth of domestic credit minus the lagged rate of growth of real GDP.
J. Exchange Rate Policy	
1. DEPREC	the nominal effective exchange rate at time t minus the nominal effective exchange rate at time $t-1$

Table 4.1 **Operational Variables** (all variables, except capital flows, expressed in natural logarithms)

data for foreign inflation.

4.6.11 Exchange rate policy

Exchange rate policy is represented by the depreciation (devaluation) of the NEER. The difference between the NEER at time t and the NEER at time $t-1$ represents depreciation (devaluation).¹⁸

To summarise, all the variables defined above and employed in this study appear in table 4.1.

4.7 Results¹⁹

4.7.1 A short-run equation for the RER

The model for RER dynamics defined by equation (5) was estimated using a number of combinations of proxies for variables. Equations (5.1) to (5.3) in table 4.2 were typical of the results obtained by the method of ordinary least squares. In all the equations, significant t-statistics were obtained for disposable income, the terms of trade, depreciation and the lag of the RER, suggesting that these variables are significantly related to the behaviour of the RER. But the t-statistics for technological progress or productivity, trade policy, capital flows, the price of gold, and domestic credit growth were consistently not significant. All the other diagnostic statistics, namely, the coefficient of determination, the F-test for joint determination and the Durbin h statistic, suggest that the equations represent satisfactory models.

These results resemble those reported by Edwards (1989:139). The major worrisome factor

¹⁸ That is, if the difference is positive.

¹⁹ All equations in this study were estimated using Pesaran and Pesaran's Microfit 4.0 software (1997). See Appendix F for the steps followed to carry out the process of estimation.

Variable	Eqn 5.1	VIF	Eqn 5.2	VIF	Eqn 5.3	VIF
CONST	-0.41386 (-0.2553)		0.81136 (1.6931)		-0.11036 (-0.07930)	
TREND			0.3511E-3 (1.0183)	99.7001^		
LNPRGDPAJ	0.047555 (0.6739)	99.304^			0.025859 (0.48580)	57.01254^
LNCUST	0.004612 (0.57962)	53.591^	0.00242 (0.29908)	55.5556^		
LNRXMGDP					-0.0054 (-0.80421)	38.85^
LNPRPSXP	0.051576 (2.7276)*	1.6727	0.049416 (2.6132)*	1.6831	0.055272 (2.9766)*	1.62742
LNRPDISP	0.0 (-2.299)*	23.331^	0.0 (-2.3517)*	37.25782^	0.0 (-2.1454)*	26.47604^
RLTCAP	0.1423E-9 (1.3903)*	1.5081	0.1791E-9 (1.7353)	1.5377		
RFLOW					1.0415 (1.5953)	1.50752
LNTOTXG	-0.056486 (-2.670)*	7.9669	-0.063490 (-2.8223)*	9.06043	-0.066235 (-3.2245)*	7.57518
LNRRANDGP	0.003051 (0.47436)	6.6622	0.007056 (1.5631)	3.30229	-0.3875E-4 (-0.007313)	4.56163
LNRCRED	-0.008821 (-0.3375)	26.205^	-0.00795 (-0.33645)	21.56102^		
LNRCREDS					-0.013655 (-0.52481)	3.28073
DEPREC	0.94910 (39.531)*	1.1890	0.94614 (39.067)*	1.21717	0.93783 (40.5200)*	1.11474
LNREER(-1)	0.90325 (68.091)*	1.5168	0.90707 (71.1409)*	1.40978	0.90228 (66.9999)*	1.63071
R ² R ² (adj.)	0.98911 0.98797		0.98917 0.98805		0.98920 0.98808	
F(10, 96)	871.7462		877.0707		879.5318	
DW	2.0554		2.0814		2.0224	
D.h-statistic	-0.28936		-0.42461		-0.11706	

Table 4.2

RER equations with some collinear variables

For the Durbin h-statistic, the area of acceptance of the null hypothesis of no serial correlation in the error term lies between ± 1.96 . * means that the t-statistic is significant at the 5% level. ^ indicates that the variable is highly collinear. The dependent variable is LNREER.

presented by these results is the presence of many non-significant t-statistics in spite of some significant t-statistics. Since such an outcome could be a symptom of multicollinearity, variance inflating factors (VIF)²⁰ were computed for each variable as a way of trying to detect the problem. According to this method, if the VIF exceeds 10, a given variable is said to be highly collinear. As shown in the table a number of variables failed the test, casting serious doubts on the accuracy of the coefficients and t-statistics obtained. The presence of multicollinearity tends to enlarge the standard errors of ordinary least squares estimators so that the t-ratio of one or more coefficients tends to be insignificant. This raises the possibility of accepting the null hypothesis even when it is false (Gujarati, 1995:327).

This study tackled the problem of multicollinearity by differencing the variables. But by differencing the variables in equation (6), the technique could render the series stationary. Therefore, it appears here that by using stationary variables in estimating equation (6), two purposes can simultaneously be attained. First, a resolution to the problem of multicollinearity is possible. Second, a short run equation for the RER compliant with the OLS estimator's assumption of the stationarity of data-series is also achievable. Table 4.3 reports the results of the Augmented Dickey Fuller (ADF) test for the presence of unit roots in the dependent and regressor variables used by this study.

All the variables were found to contain unit roots, except the ratio of public sector expenditure to GDP (LNPRPSXP), the ratio of the difference between imports and exports to GDP (RFLOW), depreciation (DEPREC), the lag of the REER, the terms of trade including gold (TOTIG) and the real rand price of gold (LNRRANDGDP). All the variables that appear nonstationary in table 4.3 became stationary after differencing once, so that it can be said that they are integrated of order one (I(1)). Stationary variables are integrated of order zero (I(0)).

Using stationary variables, short-run equations for the RER were estimated by the technique

²⁰ For an explanation of the usage of variance inflation factors, see Appendix

Variable	ADF	Decision
LNREER DLNREER	-1.5380 -2.9488	I(1) I(0)
LNPRGDPAJ DLNRGDPA	-1.5487 -4.3097	I(1) I(0)
LNCUST DLNCUST	-1.1585 -3.4793	I(1) I(0)
LNRXMGDP DLNRXMGD	-2.2627 -3.4428	I(1) I(0)
LNPRPSXP	-4.0946	I(0)
LNGRCNSX DLNGRCNSX	-0.70563 -3.5234	I(1) I(0)
LNRCONX DRCONX	0.54757 -4.0834	I(1) I(0)
LNRPDISP DRPDISP	-0.55764 -6.3310	I(1) I(0)
LNRDISGDP DRDISGDP	-1.8586 -6.8637	I(1) I(0)
RLTCAP DRLTCAP	-2.1795 -6.5783	I(1) I(0)
RFLOW	-3.5997	I(0)
LNRRANDGP DRRANDGP	-2.9916 -3.8427	I(0) / I(1) I(0)
LNRCRED DLNRCRED	-0.76606 -4.3359	I(1) I(0)
LNRCREDS DLNCREDS	-1.2027 -4.0972	I(1) I(0)
DEPREC	-3.8831	I(0)
LNREERL (LNREER(-1))	-3.1999	I(0)
LNTOTXG DLNTOTXG	-2.1574 -4.7683	I(1) I(0)
LNTOTIG	-3.7537	I(0)
ADF CRITICAL VALUE (95%)	-2.8889	

Table 4.3

Tests for stationarity (for the period from 1970 to 1996)

of OLS. Equations (5.4) to (5.9) in table 4.4 represent typical results that were achieved for the basic equation (5).

In five of the six equations, the proxy for technological or productivity improvement appears significantly negatively related to the REER. In equation (5.4), a 10% rise in real GDP growth is expected reduce the REER by 2.2%. In spite of the significant t-statistic, the negative sign of the coefficient for technological progress is not consistent with theory. For, instead of an appreciation, the result suggests that an improvement in productivity brings about a depreciation of the RER. That the coefficient is not positive could be explained by the fact that the rate of growth is a poor proxy for technological progress or productivity. The trend was included in a number of equations as a proxy for technological or productivity improvement, but its t-statistic was not significant.

The proxies measuring trade policy all emerged not significantly related to the behaviour of the RER. The estimated coefficient associated with the ratio of tariff revenues to imports was negative, while the coefficient related to the ratio of the sum of imports and exports to GDP was positive. The latter result indicates that trade liberalisation measures in South Africa over the period of study have not led to any significant depreciation of the RER.

All proxies for government consumption of nontradables were found to be not significantly related to the RER, except the ratio of public sector expenditure to GDP. By the latter measurement, taking equation (5.4) for illustration, a 10% increase in government expenditure would on average increase the RER by 4.6%.

Surprisingly, capital flows have not had a significant effect on the RER over the period of study, although all measures of this variable carry the correct sign. This could be explained by the tight monetary policy stance and the intervention that the SARB has from time to time exercised in the foreign exchange market from 1988 onwards. Through the latter mechanism, the authorities try to mop up excess liquidity that might build up due to capital inflows. Significant t-statistics for

Variable	Eqn. 5.4	Eqn. 5.5	Eqn. 5.6	Eqn. 5.7	Eqn. 5.8	Eqn. 5.9
CONST	0.45517 (4.3069)*	0.42367 (3.8314)*	0.36451 (3.3625)*	0.30021 (5.2207)*	0.45509 (4.3045)*	0.17817 (2.6277)*
DLNRGPA	-0.21999 (-1.9013)*	-0.21907 (-1.8852)	-0.2884 (-2.5214)*	-0.37137 (-3.0553)*	-0.29080 (-2.5284)*	-0.35214 (-3.0320)*
DLNCUST	-0.00235 (-0.26458)	-0.00225 (-0.25223)		-0.00334 (-0.334)	-0.00215 (-0.24216)	
DLNRXMGD			0.041034 (1.6712)			-0.35214 (-3.0320)*
LNPRPSXP	0.045968 (2.8855)*	0.064143 (3.4733)*	0.062736 (3.4002)*		0.046301 (2.9157)*	0.052485 (3.1413)*
LNGRCNSX				0.040364 (1.3108)		
DRLTCAP			-0.0000 (-0.35635)			
RFLOW	0.80901 (1.3405)	1.1361 (1.7834)		-0.26959 (-0.41846)	0.81730 (1.3561)	0.13539 (0.22753)
DRPDISP	-0.0... (-0.90793)	-0.0... (-1.0018)	-0.0... (-1.2691)	-0.0... (-1.3944)		-0.0... (-1.1246)
DRDISGDP					-0.030014 (-0.89686)	
LNRRANDGP	0.020440 (6.1068)*	0.019859 (5.2619)*	0.020184 (5.3093)*	0.014877 (4.9545)*	0.020331 (6.0652)*	0.014719 (5.0887)*
LNTOTIG	-0.055753 (-3.2845)*	-0.058501 (-3.1442)*	-0.046582 (-2.6277)*		-0.055857 (-3.2914)	
DLNTOXG				0.00248845 (0.078479)		-0.0032114 (-0.10236)
DLNRCRED	-0.041481 (-0.64696)	-0.036982 (-0.57357)		-0.0458 (-0.64869)		-0.030014 (-0.44195)
DLNCREDS			-0.023245 (-0.36533)		-0.042299 (-0.66075)	
DEPREC	0.94826 (41.3370)*]	0.95539 (39.0546)*	0.95974 (38.8517)*	0.92253 (37.1502)*	0.94831 (41.3389)*	0.94391 (39.4325)*
LNREERL	-0.080928 (-6.6753)*	-0.083725 (-6.7308)*	-0.08193 (-6.6501)*	-0.068257 (-5.3336)*	-0.080992 (-6.6833)*	-0.078499 (-6.2480)*
K11973 Q11982 FINR8385 POLIT85		---- ---- ---- -0.013249 (-1.9085)*	---- ---- ---- ----			
R2	0.95108	0.95322	0.95298	0.94160	0.95107	0.94671
R2(Adj.)	0.94598	0.94610	0.94582	0.93552	0.94597	0.94116
F-statistic	186.6238	133.8910	133.1798	154.7972	186.5833	170.5621
DW	1.9481	2.0042	2.0218	1.8247	1.9460	1.9000

Table 4.4

Short-run equations for the RER (estimated for the period 1971 2nd quarter - 1996 4th quarter)

capital flows conducted on data prior to 1988 seem to vindicate this point.

Movements in the amount of real gross national disposable income do not seem to be related to movements in the RER. All the measures of this variable, apart from insignificant t-statistics, showed a negative relationship to the RER rather than a positive one expected by theory. With growing fiscal expenditures that the state has had to deal with over the years, it is hardly likely that tax rates would be dramatically reduced to permit increased domestic expenditure by residents.

The price of gold, without fail in all equations, appears significantly related to RER behaviour. On average, the coefficient for the rand price of gold is 0.02, suggesting that a 10% increase in the price of gold will induce a 0.2% appreciation of the RER. As was said earlier, an improvement in the price of gold is expected to lead to a RER appreciation for two reasons. One, the increased revenue due to a hike in the international price of gold raises the level of national income, which places more money in the hands of households to spend on all goods. Two, when the authorities increased the rand price of gold to maintain the profitability of gold production prior to and up until 1988, the weakness in the rand was eventually reflected in higher production and consumption prices generally.

The overall terms of trade are negatively and significantly related to the RER. A 10% increase in the total terms of trade in equation (5.4) will on average lead to a 5.6% depreciation of the RER. The sign of the coefficient contradicts the assumption that the income effect dominates the substitution effect of changes in the terms of trade. With a negative sign, it appears rather that it is the substitution effect that is dominant. The inclusion of both the overall terms of trade and the price of gold in an equation is possible here since differencing appears to have removed the problem of multicollinearity.²¹, and the two variables are not equivalent. Unlike the terms of trade including gold, the partial terms of trade excluding gold variable is not significant and appears with

²¹ This assumption was tested. The coefficient of each variable did not change much when the other variable was dropped. The VIF tests also suggested the absence of multicollinearity.

contradictory signs.

The measures for macroeconomic policy appear not significantly related to the RER and, contrary to theory, carry a negative sign. In spite of the activist monetary policies pursued before 1988, the difference between the rate of growth in domestic credit extension and rate of growth in output, has not led to a RER appreciation over the period of study. This result could be the case because of the tight monetary measures that have characterised the post 1988 period. Alternatively, the unexpected result could also be because the proxies used are not good enough.

Exchange rate policy, as measured by the coefficient of depreciation or devaluation, has a highly significant positive impact on the RER. The coefficient of nominal depreciation in table 4.4 ranges from 0.92 to 0.96, for instance indicating, in equation 5.4, that a 1% nominal exchange rate depreciation leads to a 0.95% RER depreciation. The size of the depreciation coefficient tends towards, but is still less than 1. This result indicates that depreciation remains potentially a powerful lever for affecting the behaviour of the RER towards the ERER. However, a major problem for a policy of depreciation (devaluation) in South Africa is that the fall in the value of the rand tends to be translated highly into upwards adjustments in the domestic price level. Money illusion is largely absent. In other words a fall in the external value of the rand is inclined to usher in a domestic rate of inflation higher than that of its major trading partners, raising concerns about RER misalignment.

The coefficients for the lagged RER are negative and quite low. This implies that without other intervention measures, the actual RERs, once out of alignment, will converge very slowly toward the equilibrium level (Edwards, 1989:141).

A number of dummy variables were inserted in the equations to take care of the oil price shock in 1973 (K11973:1 for the first quarter of 1973, 0 otherwise), the drought in 1982 (Q11882:1 for the quarter of 1982, 0 otherwise), the abolition of the financial rand and capital control liberalisation between 1983 and 1985 (Finr8385: 1 from 1983 to 1985, 0 otherwise) and political disturbances in 1976 and from 1983 to 1985 (POLIT85: 1 for every quarter in 1976 and from 1983

to 1985). By and large, the dummies appeared not to carry much influence on the RER. But the dummy for political disturbances emerged significant in equation (5.5). The negative sign of the coefficient for the dummy supports the theoretical expectation that increased political activities put depreciatory pressures on the REER.

So far, the regression results that have been discussed deal with the short-run. In what follows, the presentation of results will focus on attempts at finding a specification which combines both long-run and short-run properties of the RER.

4.7.2 Application of the two-step Engle-Granger procedure

4.7.2.1 The first step of the Engle-Granger approach

The first step of the Engle-Granger (1987) approach entails the estimation of a long-run relationship using the simple OLS technique. Since, as argued in chapter 2, the long-run path of the REER is determined by the permanent components of the fundamentals, the explanatory variables included in the long-run equation had to be decomposed into permanent and temporary components. The technique of decomposition employed by this study is that of a moving average.²² Following Edwards (1989) and Elbadawi (1994), it was assumed that the mean of the number of years needed to eliminate an exogenous shock is five years. In terms of quarterly data this translates into twenty quarters required to get rid of a disturbance. Therefore, the permanent components of the fundamentals were proxied by twenty-quarter moving averages. The immediate cost of effecting this method was the loss of 19 observations.

The attainability of a long-run equation requires that the variables involved be cointegrated. Table 4.5 gives a summary of major findings of ADF tests for stationarity conducted on the

²² Alternatively, the more advanced Beveridge and Nelson (1981) method of decomposition can be used.

real GDP, the ratio of the sum of imports and exports to GDP, the ratio of public sector expenditure to GDP, disposable income, the real rand price of gold, the terms of trade (excluding gold), capital flows and political disturbances have been significant determinants of the ERER over the period of study in South Africa. The negative sign of capital flows is negative, contrary to theory. Perhaps, this could make sense, among other possible explanations, when one considers the fact that the SARB has on many occasions intervened to tone down the inflationary effects of capital inflows on the domestic price level. But the extent of capital outflows has been too huge at times (for example,

Variable	Equation 2.1	Equation 2.2	Equation 2.3
CONST	-71.8238 (-2.092) *	15.5303 (0.432)	43.027 (1.139)
PLNPRGDAJ	3.0135 (2.362) *	-0.6457 (-0.459)	-1.7831 (-1.200)
PLNCUST	.....	.....	.....
PLNRXMGDP	0.3723 (2.475) *	0.5645 (4.447) *	0.3560 (2.174) *
PLNPRPSXP	0.1800 (0.499)	0.5157 (1.887) *	0.7503 (2.463) *
PLNGRCNSX	.....	.....	.....
PLNRCONX	.....	.....	.....
PDRPDISP		-0.0 (4.015) *	0.0 (3.586) *
PLNRDISGDP	2.2344 (2.058) *	.....	.....
PRLTCAP	.....	-0.0 (-9.279) *	-0.0 (-9.277) *
PRFLOW	-100.87 (-5.675) *	.....	.....
PLNRRANDGP	0.3641 (2.039) *	0.112 (0.660)	0.1792 (1.022)
PLNTOTXG	1.9711 (5.675) *	0.7022 (2.430) *	0.855 (2.900) *
GOP80Q1			
Q11982			
FINR8385			
POLIT85			-0.0091 (-2.241) *
R2	0.52	0.68	0.70
R2 (adj.)	0.48	0.65	0.66
F-calculated	12.5	24.11	16.55
DW statistic	0.50586	0.73662	0.93817
ADF statistic	-4.2785	-4.7524	-4.4868
(ADF critical) (95%)	(-3.4632)	(-3.4632)	(-3.4632)

Table 4.6

Long-run Equations obtained by the first step of the Engle-Granger method

... means that another proxy for the same variable was used in the given equation. * Indicates that the t-statistic (in brackets) is significant at the 5% level.

in the events leading up to the 1985 debt crisis) for the authorities to effectively counter the attendant severe weakening of the rand. The real rand price of gold appears not significantly related to the ERER in some of the equations. This could be explained by the reduced role that the price

of gold has come to play in South Africa's exchange rate policy. When OLS tests were carried out on data up to 1988, the real rand price of gold consistently emerged significantly related to the ERER. In spite of these positive remarks about the results in table 4.5, it is difficult to attach reliable quantitative meanings to the actual coefficients obtained in the equations. What immediately follows will try to explain why this is the case.

The long-run equations (2.1) to (2.3) are bedeviled by two diagnostic problems. First, the combination of significant and non-significant t-statistics, as well as high and zero coefficients, in some equations suggests the presence of multicollinearity. This problem is confirmed by the matrix of correlation coefficients presented in table 4.7. In equation (2.1), the collinearity of variables is not severe enough to prevent the generation of significant statistics. In fact in that equation, all the variables, except one, have significant statistics. However, the high coefficients in excess of 1 appear dubious. Since many of the variables are highly collinear, tests on individual explanatory variables are not reliable, but, as others have suggested elsewhere (Gujarati, 1995:234; Griffiths, Hill and Judge, 1993:335-336), the overall F test for joint determination will indicate whether the dependent variable is related to the various regressors. In this case the F statistics are significant at all conventional levels. Removing some of the collinear variables was considered but not adopted. This decision was taken because collinear series in this instance are many, and eliminating the variables caused serious specification biases in all the equations.

Second, the low DW statistic indicates residual autocorrelation. This problem was expected, since the variables employed in the equations are not stationary. With respect to this anticipated weakness in the first step of the Engle-Granger technique, opinion among econometricians is divided. Those that are strict would not use this step because of the problem of nonstationarity.²³ But Charemza and Deadman (1992:156) and Elbadawi (1994, who uses this method), contend that the properties of OLS estimators involved here are not all bad. These authors believe that under

²³ West (1988), suggests a superior method for computing standard errors of a regression with nonstationary variables.

MAVGDP	MAVGDP	MAVXMGDP	MAVPSXP	MAVPDISP	MAVRLTCAP	MAVTOTXG
	1.0000	-.97997	-.40135	.96852	-.70176	-.88647
MAVXMGDP	-.97997	1.0000	.51691	-.99185	.65079	.78957
MAVPSXP	-.40135	.51691	1.0000	-.52342	.11807	.13684
MAVPDISP	.96852	-.99185	-.52342	1.0000	-.57558	-.76594
MAVRLTCAP	-.70176	.65079	.11807	-.57558	1.0000	.70583
MAVTOTXG	-.88647	.78957	.13684	-.76594	.70583	1.0000
MAVGOP	.59403	-.43560	.24762	.38157	-.71056	-.84647
GOP80Q1	-.10159	.10002	.22247	-.099707	.021667	.091754
Q11982	-.044468	.067957	.094292	-.064117	-.071778	.018375
FINR8385	.043256	.088341	.22540	-.059266	.030701	-.33042
POLIT85	-.15784	.25329	.15704	-.21696	.23655	-.087449
.....						
MAVGDP	MAVGOP	GOP80Q1	Q11982	FINR8385	POLIT85	
	.59403	-.10159	-.044468	.043256	-.15784	
MAVXMGDP	-.43560	.10002	.067957	.088341	.25329	
MAVPSXP	.24762	.22247	.094292	.22540	.15704	
MAVPDISP	.38157	-.099707	-.064117	-.059266	-.21696	
MAVRLTCAP	-.71056	.021667	-.071778	.030701	.23655	
MAVTOTXG	-.84647	.091754	.018375	-.33042	-.087449	
MAVGOP	1.0000	-.048550	.054816	.40088	.16975	
GOP80Q1	-.048550	1.0000	-.010989	-.040600	-.048099	
Q11982	.054816	-.010989	1.0000	-.040600	-.048099	
FINR8385	.40088	-.040600	-.040600	1.0000	.84410	
POLIT85	.16975	-.048099	-.048099	.84410	1.0000	

Table 4.7 Estimated Correlation Matrix of Variables (at 5% level of significance)

some general assumptions the estimators are consistent. Given that the model applied to the study of South Africa follows that of Elbadawi, this study elected to proceed with the simple first step of the Engle-Granger method.

In circumstances where the calculation of long-run coefficients is not at stake, differencing the equations, as was done in section 4.7.1, may have remedied both problems of multicollinearity and residual correlation. But here, differencing would only compound the problem since long-run properties of the series would be lost in the process, defeating the very end of the present exercise.

4.7.2.1 **The second step of the Engle-Granger method: the error correction regression.**

The residuals from equation (2.1) were incorporated into an error-correction specification with short and long-run components. The model used here is that defined by equation (10) in section 4.5.2. The results are presented in table 4.8.

Equation 10.1		
Regressor	Coefficient	T-Ratio
CONST	0.21089	12.999 *
ECM	-0.08032	-3.391 *
DPLNPRGDAJ	-3.2257	-1.587
DPLNRXMGDP	-0.2307	-0.518
DPLNPRPSXP	0.4576	1.173
DPLNRDISGDP	0.0312	0.050
DPRFLOW	-10.67	-0.583
DPLNRRANDGP	0.4281	1.636
DPLNTOTXG	0.9450	1.688
DLNCREDS	-0.0635	-0.862
DEPREC	0.9787	30.398 *
<hr/>		
R ² (adj.)	0.94	
F (14, 72)	103.96	
DW	1.5819	
ADF	-5.6928	
(ADF critical, 95%)	(-3.4645)	

Table 4.8 **Error-correction regression** (all the variables in the equation are stationary)

The error correction regression in table 4.8 is typical of the results that were obtained.

Consistently, the coefficient for the error-correction term was significant and negative. Rewriting the error-correction term in terms of equation (10)²⁴, it becomes positive. Compared with those obtained by Edwards and Elbadawi (0.19, and 0.67, 0.71, 0.78, respectively), the coefficient for the error-correction term is very low. Leaving the system to rely on the automatic adjustment mechanism alone, an error-correction coefficient of 0.08 means that in one year approximately a twelfth of a given deviation of the (logarithm of the) REER from its equilibrium value will be eliminated. The sluggishness of the self-realignment mechanism here definitely adds strength to the position that a policy of devaluation ought to be used to quicken the adjustment process.

The other variable whose t-statistic emerged significant in the error-correction regression was depreciation. With a coefficient close to 1 and comparatively a very high t-statistic, most of the behaviour of the changes in the REER appears explained by movements in this exchange rate policy variable. Again, as in section 4.7.1, the high value of the depreciation coefficient, *ceteris paribus*, signifies the great potential that lies in nominal exchange rate adjustments for rectifying RER movements away from the steady-state path.

The t-statistics for the short run effects of the real fundamentals were not significant and some of the coefficients carried theoretically unexpected signs. These results were surprising because, according to theory, the permanent component of fundamentals, together with the temporary components, macroeconomic and exchange rate policies, are expected to have a significant bearing on the short-run behaviour of the REER. One possible reason for these disappointing results could be the fact that some of the proxies used are not very good. Another may be because of inconsistencies that have been known to characterise SARB data. The t-statistics may have emerged non-significant for similar reasons. But, it could also be because of the highly restrictive monetary policies that the authorities have implemented since 1988.

²⁴ That is, $(\ln e^*_{t-1} - \ln e_{t-1})$, instead of the opposite arrangement of terms which gives the equivalent but negative sign for the error-correction term.

4.7.3 Real effective exchange rate disequilibrium

Figure 4.5 was constructed by plotting the series of the fitted logarithms of the EREER (from equation 2.3) and the REER. Gaps between the two are supposed to represent misalignment.²⁵ In spite of the diagnostic problems associated with equations (2.1) to (2.3), the graphs drawn from fitted values of the equations appear to reproduce known episodes in the history of REER behaviour in South Africa. A number of comments can be made about the features of the schedules in figure 4.5.

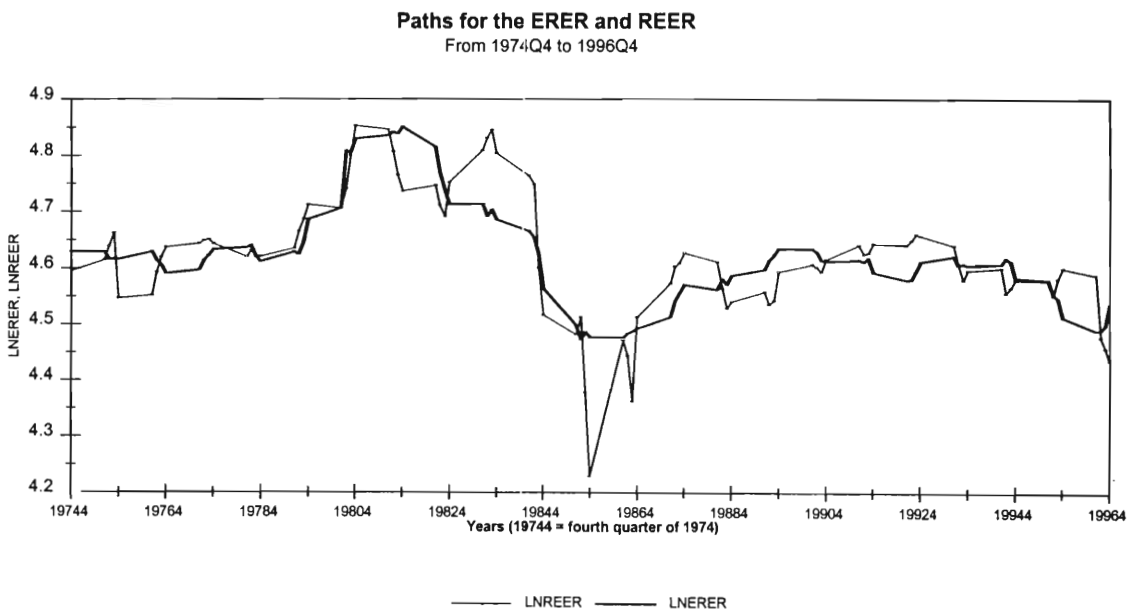


Figure 4.5 **Paths of the actual and equilibrium real exchange rate**

In overall terms, it appears reasonable to say that the path of the REER stayed relatively closer to that of the EREER during the period of fixation (before January 1979) than during the period of floating. This observation would appear to provide some empirical support for the position that, in contrast to the time of fixed exchange rates, the era of flexible arrangements has been

²⁵ See appendix D for quantitative estimates of misalignment

characterised by more incidences of REER misalignments. The trajectories of the ERER and the REER also seem to suggest that, although misalignments are present in both periods, the margins of the severest instances of REER disequilibrium are widest under flotation.

Towards 1980, the rise in the real price of gold appears to have led to a REER overvaluation. But the fall in the REER, mainly due to the protectionist stance of the authorities towards gold production, soon translated into a real devaluation and a REER undervaluation. However, the fall in the rand must have been followed by a rise in the general domestic price level, leading to a REER overvaluation between 1982 and the 1984. Another factor that might have caused inflation at this time could have been the loose monetary policy that prevailed until 1988. The well-known period of serious disturbances, towards 1985, is captured by a dramatic undervaluation of the REER. In those years the intensification of the disinvestment campaign, increased internal organised resistance to apartheid, tightening trade sanctions, capital account liberalisation and massive capital outflows, all acted together to weaken the rand, culminating in the 1985 debt crisis. These forces were so strong that 1985 witnessed the most pronounced undervaluation of the rand within the period of study.

Subsequent to the 1985 debt crisis, the domestic price level rose so that until 1988, the REER was overvalued. But in 1988, the authorities decision to implement tight monetary policies helped to keep generate a more competitive REER. After the 1994 elections, as South Africa's relations were being normalised, a lot of capital flowed into the country. It is believed (Dykes, 1998) that the flow of funds from outside led to the overvaluation of the rand. Given that these funds were largely short-term, their stability could not be assured. Consequently, among other reasons, when sentiment spread in the market that the REER was overvalued, "hot" money quickly flowed out of the country in 1996, leading to a REER undervaluation. Following the East Asian financial crisis, with the recurrence of similar outflows in 1997 and the attending severe weakness in the NEER, it has been said (Dykes, 1998:3) that the REER has not ceased its downward trend, and may actually still be undervalued today.

Lastly, the proposition that the EREER is not constant appears supported by the changes in the schedule of the EREER in figure 4.5. These movements are not away from equilibrium since they merely reflect changes in the behaviour of the permanent components of the fundamentals.

4.8 Conclusion

This chapter has reviewed exchange rate policy and developments in South Africa over the period of study (1970-1996). Clearly, South Africa has experimented with a wide range of nominal exchange rate regimes and has attached not a single but a number of objectives to exchange rate policy. The period of flotation appears to have been characterised by greater exchange rate instability and more pronounced incidences of misalignment than the era of fixation. A dynamic model of REER behaviour has been applied to South African data. In the short-run government consumption of nontradables, the price of gold in rand, the overall terms of trade and the rate of depreciation have been found to significantly determine the behaviour of the REER in South Africa. Technological or productivity improvement, trade policy, capital flows, disposable income, the terms of trade excluding gold and domestic credit expansion appear to have had no significant short-run relationship to REER movements over the period of study. In the long-run, the permanent components of the fundamentals have been found to be significantly related to the REER. The error-correction term was found to be significant, although its coefficient was quite low. In spite of some diagnostic difficulties associated with the estimation of the long-run equation, the plot of the schedules for the EREER and REER showed periods of misalignment which correspond to some well known episodes about REER movements in South Africa.

These results must be interpreted within the context of the type of data that this study employed. The point raised earlier in section 4.6 about the reliability of SARB data is important. In addition, the fact that some of the variables were represented by poor surrogates is also not to be overlooked.

5. CONCLUSION

This study has considered both formal and descriptive definitions of the RER and ERER from the *ppp* and tradables-nontradables points of view. The tradables-nontradables approach has been proposed as the more dynamic and appealing perspective for a number of major reasons. One, the approach takes account of the sectoral impacts of RER movements on production and consumption decisions. For LDCs that have discarded the 1970s' philosophy of import-substitution in preference for an export-driven strategy of development, the tradables-nontradables definition of the RER provides an incentive guide for allocating resources between the tradable and nontradable sectors of the economy. Two, the description of the ERER as the relative price of tradables to nontradables, that for given values of fundamentals, ensures simultaneous equilibrium in the internal and external sectors, captures the changing reality of ERER behaviour. This position contrasts with that of the *ppp* purview, which, erroneously, posits a constant value for the ERER.

This dissertation has come up with a plausible set of determinants for the ERER, namely, technological or productivity improvement, trade policy, government consumption of nontradables, the external terms of trade, disposable income, capital flows and the rand price of gold (for South Africa). These fundamentals are the sole determinants of the long-run behaviour of the RER, although they bear short-run effects as well. The other important variables which generate short-run changes in the RER have been hypothesised to be macroeconomic and exchange rate policies. Nominal exchange rate adjustments, specifically devaluations/depreciations, have been argued to be effective instruments for getting rid of RER overvaluations. In part, the success of a policy of devaluation has been demonstrated to rely on the authorities' strict adherence to consistent fiscal and monetary policies. Other factors which can promote or weaken the efficacy of flexible arrangements in redressing RER disequilibrium are the prevalence or absence of wage indexation or money illusion.

It has been argued by this study that flexibility itself can be a source of RER misalignment. This is because of the inflationary effects of devaluations. A fixed exchange rate system, if credible,

can provide a nominal anchor for the domestic price level. When accompanied by appropriate macroeconomic policies, a rigid exchange rate arrangement can, as a secondary effect, help to maintain RER equilibrium. But in the absence of credibility, particularly when fiscal and monetary policies are loose, the domestic price will tend to rise above the world level, and so induce a RER misalignment. Overall, it has been observed in this study that the choice of a particular nominal exchange rate regime does not necessarily allay the possibility of RER misalignment. In fact misalignments have been observed in both systems of exchange rate management.

In the case study of South Africa, a number of observations were made about South Africa's exchange rate policy framework and environment. First, South Africa has experimented with both floating and fixed exchange rate regimes. Second, the vacillation that the authorities have shown in deciding on the optimal exchange rate system for the country has also been reflected in the lack of clearly defined and permanent objectives for exchange rate policy. Before 1988, at the expense of the performance of the other sectors of the economy (for instance, manufacturing), exchange rate policy tried to maintain profitability in gold production. But that policy was abandoned in 1988, and since then a tighter monetary policy regime has been in place, seeking to enhance the competitiveness of the economy as whole. Third, South Africa has experienced destabilising capital flows. As far back as 1961, exchange controls were in place as part of capital control measures aimed at shielding the real side of the economy from the disruptive effects of the capital account. Over the years, capital control measures have gradually been scaled down, but have not been removed completely.

As regards exchange rate developments, this study has observed that the period of flotation in South Africa has experienced greater exchange rate volatility than that of fixed exchange rates. Specifically, the period between 1979 and 1988 registered dramatic up and down movements of both the nominal exchange rate and RER due to real, monetary and political shocks. Between 1988 and 1996, relative stability in the RER was achieved largely due to consistent macroeconomic policies. Recently, this relative calm has been disturbed by large inflows and outflows of short-term capital.

A dynamic model of RER behaviour, made up of three major forces - an automatic adjustment mechanism, macroeconomic and exchange rate policies, was applied to South African data using the OLS and cointegration with error-correction procedures. In spite of some diagnostic problems of multicollinearity and residual autocorrelation, having rendered the data stationary by differencing, government consumption of nontradables, the price of gold in rand, the overall terms of trade and the rate of depreciation were found to be important determinants of the short-run behaviour of the REER in South Africa. However, technological or productivity improvement, trade policy, capital flows, disposable income, the terms of trade excluding gold and domestic credit expansion appear to have had no significant short-run influence on REER movements over the period of study (1970-1996). In the long-run, the permanent components of the fundamentals - namely, technological or productivity improvement, trade policy, government consumption of nontradables, disposable income, capital flows, the terms of trade excluding gold and the rand price of gold, were found to be significantly related to the equilibrium conduct of the REER.

The estimation of the error-correction equation produced a significant statistic for the error-correction term with a low coefficient. In conformity with theory, this means that in a situation of REER misalignment, if the system were left to rectify itself, the process of automatic adjustment would take a very long time. Surprisingly, the smoothed series of the fundamentals did not appear to bear much influence on the short-run behaviour of the REER. In spite of the loose monetary regime that characterised the period before 1988, the proxy for macroeconomic policies did not yield a significant t-statistic. However, exchange rate policy appears to command a highly significant impact on the behaviour of the REER in South Africa. Therefore, exchange rate adjustments as a policy instrument, are potentially a powerful lever which the authorities can use to realign the REER when in disequilibrium. Given the protracted nature of the self-adjustment mechanism just mentioned above, the prospect of a quick adjustment offered by a policy of devaluation is alluring. But, the Reserve Bank in South Africa should cautiously recourse to such a remedy. This is because the absence of money illusion, the high levels of labour unionisation and the high import-dependent nature of domestic production, usually mean that depreciations will most likely be followed by higher levels of inflation.

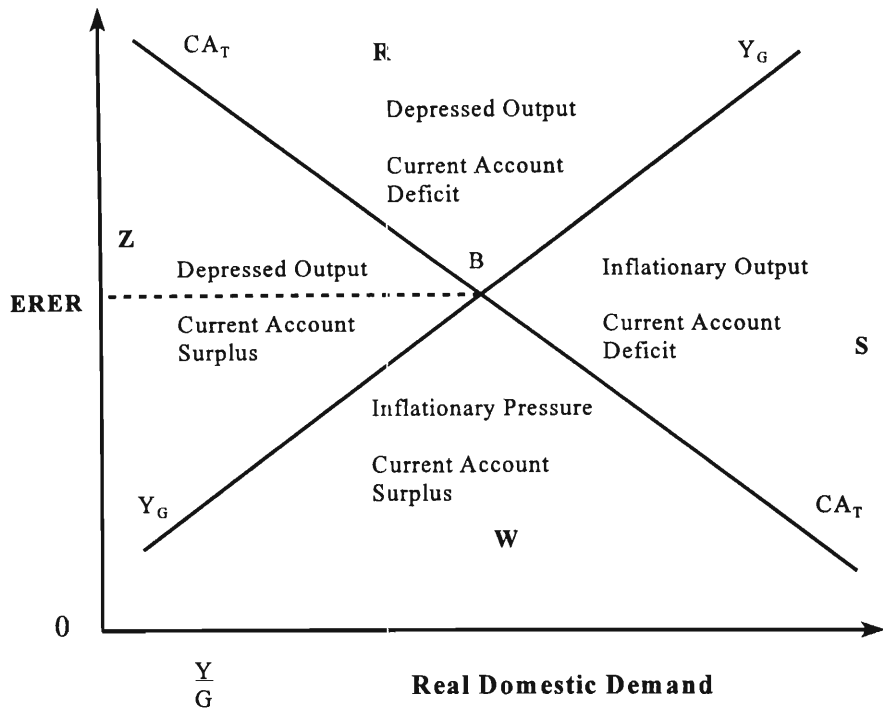
In spite of some diagnostic difficulties associated with the estimation of the long-run equation, the plot of the schedules for the EREER and REER showed periods of misalignment which correspond to some well-known episodes of REER developments in South Africa. In particular, the economic and political shocks that led to the 1985 debt crisis produced an unprecedented level of REER undervaluation. Comparing the two periods of fixed and flexible exchange rate arrangements (1970-1979 and 1979-1996, respectively), it appears REER misalignments occurred under both systems of exchange rate management. This observation tends to lend support to the view that unless macroeconomic policies are consistent, REER misalignment can occur regardless of the degree of flexibility or rigidity designed for the nominal exchange rate. In this respect, the prevailing strict monetary and fiscal arrangement in South Africa appears to serve the goal of REER alignment well.

Contrary to the *ppp* purview, but in agreement with the tradables-nontradables approach, the plot of the schedule for the EREER in South Africa indicates that the path of the EREER has not been constant. Variations in the trajectory of the EREER imply that as fundamentals have assumed changing values over the years, the figures for the EREER have also been changing.

Given the data or diagnostic problems that were encountered by this study, it is highly recommended that future works in this field seek better proxies for variables and more reliable figures. To estimate the error-correction regression, this study used the Engle-Granger approach. Perhaps, more advanced methods such as the Johansen (1988) cointegration technique could produce better results. Such superior modeling strategies are recommended to future researchers in this area of study.

APPENDIX A

Internal and external balance



Source: Clark et al., 1994

A rise in the RER represents an appreciation, and a decline, a depreciation

The diagram above represents combinations of the real exchange rate and output which establish equilibrium in the internal and external markets. The internal market is at equilibrium along the $Y_G Y_G$ schedule. The $Y_G Y_G$ schedule is generated in the goods market and at each point on it the exchange rate is consistent with the equality of aggregate demand and output.

The external market is at equilibrium along the $CA_T CA_T$ schedule where the current account is equal to its steady state level. The $CA_T CA_T$ schedule represents different combinations of the exchange rate and output for which the asset market - that is, the foreign exchange and money markets - is at equilibrium.

The intersection of the two schedules at B represents a unique point where joint equilibrium in the internal and external markets is attained; this point yields one possible point

along the path of equilibrium real exchange rates.

For any point to the right of $Y_G Y_G$ real demand is greater than the full employment level; this excess real domestic demand is satisfied by domestic output (quadrant W) or imports (quadrant S). As the exchange rate appreciates imports rise and exports fall - more domestic demand is needed to reach the same level of output, hence the schedule slopes upwards. The area to the left of $Y_G Y_G$ shows points where real domestic output is below its full potential.

Above the $CA_T CA_T$ schedule the current account is higher than the equilibrium level, and below the $CA_T CA_T$ schedule the current account falls short of its full employment level.

In quadrant S, both the current account and output levels are above their equilibrium levels, representing a current account deficit.

In quadrant R, output is below its potential but the current account is above its equilibrium level, leading to a current account deficit.

In quadrant Z, both real demand and current account levels are below equilibrium steady states, and the current account is in surplus.

In quadrant W, although real demand is above its potential, the current account is below its full employment level, so the current account is in surplus.

Changes in macroeconomic variables cause the $Y_G Y_G$ and $CA_T CA_T$ schedules to shift, leading to an appreciation or depreciation of the ERER. Suppose government expenditure on nontradables in South Africa increased. Nominal income would expand but the rise in prices would shift the $Y_G Y_G$ schedule leftwards, generating a real appreciation. Another example, suppose the price of gold plummeted, and export losses decreased the current account equilibrium surplus. The $CA_T CA_T$ schedule would shift downwards, causing an equilibrium real depreciation, and a decline in domestic real demand.

APPENDIX B

For a k -variable regression model (Y , intercept, and $(k-1)$ regressors), the variance of a partial regression coefficient can be expressed as

$$\text{var}(\beta_j) = \frac{s^2}{\sum x_j^2} \cdot \left(\frac{1}{1-R_j^2} \right)$$

$$\text{var}(\beta_j) = \frac{s^2}{\sum x_j^2} \cdot \text{VIF}_j$$

where β_j is the (partial) regression coefficient of the regressor X_j , R_j^2 is the R^2 in the (auxiliary) regression of X_j on the remaining $(k-2)$ regressors and VIF_j is the variance-inflation factor. As R_j^2 increases toward unity, that is, as the collinearity of X_j with the other regressors increases, the VIF also increases and in the limit it can be infinite.

Some authors therefore use the VIF as an indicator of multicollinearity. The larger is the value of VIF_j , the more “troublesome” or collinear is the variable X_j . As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if R_j^2 exceeds 0.90), that variable is said to be highly collinear. VIF is not a full-proof measure of multicollinearity as a high R_j^2 can be counterbalanced by a low value for the numerator or a high value for the denominator of the first term.

Gujarati, 1995:338-339.

APPENDIX C

Variable	ADF statistic (ADF critical value)	Decision
LNPRGDPAJ		
mavgdp	-1.5924 (-3.4614)	I(2)
dmavgdp	-2.1727 (-3.4620)	I(1)
d2mavgdp	-3.7262 (-3.7262)	I(0)
LNCUST		
mavcust	-1.9294 (-3.4614)	I(2)
dmavcust	-2.1062 (-3.4620)	I(1)
d2mavcust	-3.8779 (-3.4626)	I(0)
LNPRXMGDP		
mavxmgdp	-1.3939 (-3.4614)	I(2)
dmavxmgdp	-1.1585 (-3.4620)	I(1)
d2maxmgdp	-4.8758 (3.4626)	I(0)
LNGRCNSX		
mavgrcnx	-4.0298 (3.4614) *	I(0) *
dmagrconx	-2.5113 (-3.4620)	I(1)
d2mgrcnx	-2.8063 (-3.4626)	I(0)
LNRCONX		
mavrconx	-1.1953 (-3.4614)	I(2)
dmavrconx	0.91614 (-3.4620)	I(1)
d2marconx	-4.8087 (-3.4626)	I(0)
LNRPDISP		
mavpdisp	-2.2354 (-3.4614)	I(1)
dmavpdisp	-4.6005 (-3.4620)	I(0)
LNRDISGDP		
mavdisgdp	-1.6209 (-3.4614)	I(2)
dmadisgdp	-3.0935 (-3.4620)	I(1)
d2mdisgdp	-6.7926 (-3.4626)	I(0)
RLTCAP		
mavrltcap	-0.42163 (-3.4614)	I(2)
dmarltcap	-2.4620 (-3.4620)	I(1)
d2mrltcap	-5.3504 (-3.4626)	I(0)
RFLOW		
mavrflow	-2.89972 (-3.4614)	I(2)
dmavrflow	-2.6502 (-3.4620)	I(1)
d2marflow	-3.5843 (-3.4626)	I(0)
LNTOTXG		
mavtotxg	-1.7385 (-3.4614)	I(2)
dmavtotxg	-1.9769 (-3.4620)	I(1)
d2matotxg	-4.3050 (-3.4626)	I(0)
LNRRANDGP		
mavgop	-1.5924 (-3.4614)	I(2)
dmavgop	-2.1727 (-3.4620)	I(1)
d2mavgop	-3.7262 (-3.4626)	I(0)

*Variables in capitals are fundamentals as defined in table 4.1. Those in bold format are the permanent components of the given fundamentals. Each permanent component is followed by its first and second differences indicated by variables beginning with "d" and "d2", respectively. * indicates that the autocorrelation function could not confirm the result of stationarity suggested by the ADF test.*

APPENDIX D

Misalignment of the actual from the equilibrium RER

Year	LNREER	LNREER	Misalignment (percentages)
19744	4.5953218	4.628986	-0.732574
19751	4.6148565	4.6295136	-0.317608
19752	4.6391206	4.6163887	0.4900058
19753	4.662023	4.6167054	0.9720583
19754	4.5462691	4.6160738	-1.535428
19761	4.5515936	4.6288432	-1.6972
19762	4.5929964	4.6143576	-0.465082
19763	4.6195661	4.6059031	0.295764
19764	4.6372178	4.5907116	1.0028891
19771	4.6437497	4.596878	1.0093495
19772	4.6487723	4.6146308	0.734419
19773	4.6504622	4.6226429	0.5982046
19774	4.6432364	4.6326499	0.2279975
19781	4.6200916	4.6368834	-0.36345
19782	4.6303505	4.6402516	-0.213832
19783	4.6200916	4.6193137	0.0168389
19784	4.6205841	4.6114109	0.1985301
19791	4.6342758	4.6280473	0.1344005
19792	4.6654183	4.6240832	0.8859893
19793	4.6872723	4.6465023	0.8698028
19794	4.7127083	4.6867218	0.5514131
19801	4.7067335	4.7067335	-1.07e-08
19802	4.7417677	4.8082057	-1.401124
19803	4.8003531	4.8053671	-0.104451
19804	4.8529933	4.8303782	0.4660042
19811	4.8461013	4.8357761	0.2130609
19812	4.8072399	4.8414901	-0.712471
19813	4.7652177	4.8386777	-1.541586
19814	4.7368123	4.850722	-2.404775
19821	4.7469591	4.8153731	-1.441218
19822	4.7113004	4.7700303	-1.246575
19823	4.6917148	4.7386364	-1.000095
19824	4.7523538	4.7126894	0.8346257
19831	4.8092532	4.7143782	1.9727612
19832	4.8315352	4.692074	2.8864784
19833	4.8457869	4.7027578	2.9516169
19834	4.8043762	4.686306	2.4575538

19841	4.7637397	4.6657148	2.0577296
19842	4.7490685	4.6540832	2.0000836
19843	4.6004591	4.6246321	-0.525447
19844	4.5164847	4.5636536	-1.044371
19851	4.4821359	4.4986734	-0.368966
19852	4.512799	4.4737189	0.8659838
19853	4.3792311	4.4864198	-2.447661
19854	4.2296522	4.4782139	-5.876647
19861	4.4719435	4.4768076	-0.108769
19862	4.4439054	4.4839837	-0.901872
19863	4.3628863	4.4880013	-2.867711
19864	4.5132742	4.4924153	0.4621673
19871	4.5735763	4.5131869	1.3203984
19872	4.603402	4.5425829	1.321177
19873	4.6092618	4.5551106	1.1748353
19874	4.62716	4.5715178	1.2025132
19881	4.6117154	4.5621602	1.0745502
19882	4.5646259	4.5810276	-0.359321
19883	4.5291527	4.5715855	-0.936883
19884	4.5408094	4.5871387	-1.020288
19891	4.557799	4.5982484	-0.887476
19892	4.5361059	4.6140804	-1.718976
19893	4.5425853	4.6234411	-1.77995
19894	4.5945473	4.6353846	-0.888821
19901	4.6071349	4.6340619	-0.584463
19902	4.6026002	4.6292778	-0.57962
19903	4.5945473	4.6146221	-0.436928
19904	4.6163409	4.6131184	0.0698062
19911	4.6416628	4.6156677	0.5600397
19912	4.6254302	4.6122452	0.2850546
19913	4.6269969	4.6186308	0.1808113
19914	4.6442947	4.5936378	1.0907355
19921	4.6411806	4.5801933	1.3140475
19922	4.6496335	4.5803021	1.4911161
19923	4.6611093	4.5954603	1.4084432
19924	4.6573198	4.6127477	0.957033
19931	4.641052	4.6219949	0.410621
19932	4.609295	4.6064587	0.0615336
19933	4.5800233	4.6080632	-0.612221
19934	4.59697	4.605815	-0.192409
19941	4.6010618	4.6088087	-0.168373
19942	4.5569249	4.6182219	-1.345141
19943	4.5665679	4.6135561	-1.028959

19944	4.5799891	4.5840769	-0.089254
19951	4.5786551	4.5798637	-0.026396
19952	4.5522616	4.5547178	-0.053957
19953	4.5821062	4.5474191	0.7570122
19954	4.6012291	4.5135171	1.906273
19961	4.5889731	4.4901649	2.1531649
19962	4.4780563	4.4912848	-0.295409
19963	4.4592963	4.5003326	-0.920242
19964	4.4366726	4.5370453	-2.262342

Misalignment is given by

$$\frac{(\text{LNRER} - \text{LNERER}) * 100}{\text{LNRER}}$$

Note: Misalignment is calculated here without establishing a base period when internal and external equilibrium were simultaneously attained.

APPENDIX E

The long-run relationship in equation (6), can be estimated using an autoregressive distributed lag model (ADL) (Charemza and Deadman, 1992:157-158; Phillips and Loretan, 1991). The unrestricted ADL(n, n) model for the variables $\ln e_t$ and $\ln e_t^*$ can be expressed as:

$$\ln e_t = \sum_{i=1}^n \alpha_i \ln e_{t-i} + \sum_{i=0}^n \beta_i \ln e_{t-i}^* + e_t \quad (11)$$

where α_i and β_i are coefficients and e_t is an error term. The long-run coefficient β^* is derived from estimated OLS coefficients as follows:

$$\beta^* = \frac{\sum_{i=0}^n \beta_i}{1 - \sum_{i=1}^n \alpha_i} \quad (12)$$

APPENDIX F

The procedure for estimation has been designed to proceed as follows:

- (i) As a starting point, the simple model advanced by Edwards (1989) will be used to test the goodness of the data collected by this study to satisfy some important assumptions of the OLS technique. Should the tests find that the assumptions are in place, then, the advanced methods of cointegration and error-correction modeling involved in the steps below will not be necessary.
- (ii) The long-run equation will be estimated using the permanent components of the fundamentals. The latter will be given by five-year moving averages of the fundamentals. This step assumes that all variables have been tested for stationarity. It is the latter test that will determine whether the fundamentals are cointegrated and usable to formulate a long-run equation.
- (iii) If step two succeeds, an error-correction model will be estimated, incorporating short-run effects of the fundamentals, macroeconomic policy and exchange rate policy.
- (iii) Values for the EREER path will be derived using coefficients from the long-run equation
- (iv) The paths for the EREER and RER will be plotted in form of graphs. Divergences of the RER from the equilibrium trajectory will represent misalignment. Corresponding values of misalignment will be calculated using the following formula:

$$\frac{(\text{LNRER} - \text{LNERER}) * 100}{\text{LNRER}}$$

BIBLIOGRAPHY

- Abedian, I., "Fiscal policy and economic growth" in I. Abedian and B. Standish, (eds.) *Economic Growth in South Africa* (Capetown, Oxford University Press Southern Africa, 1992), pp. 25-54.
- Addleson, M., *A Decade of Floating the Rand* (Johannesburg, Centre for Business Studies Graduate School of Business Administration, 1989).
- Aghevli, B.B., Mohsin S.K., and P. J. Montiel, "Exchange rate policy in developing countries: some analytical issues", *International Monetary Fund Occasional Papers* 78 (1991).
- Artus, R.J., "Methods of Assessing the Long-Run Equilibrium Value of an Exchange Rate", *Journal of International Economics*, 1978, Vol. 8, pp. 277-299.
- Artus, R.J. and M. Knight, "Issues in the Assessment of the Exchange Rates in Industrial Countries", *International Monetary Fund Occasional Papers* 29 (1984)
- Balassa, B., "The Purchasing Power Parity Doctrine; A reappraisal", *Journal of Political Economy*, 1964, Vol. 72, pp. 584-596.
- Barro, R., *Real Determinants of the Real Exchange Rate* (Chicago, University of Chicago, 1983)
- Barr, G.D.I. and B. Kahn, "Testing for Purchasing Power Parity in South Africa in the presence of Real Shocks", *Journal of Studies in Economics and Econometrics*, 1995, Vol. 19, No. 1.
- Barr, G.D.I., and L. Sharp, "The Problem of Revised GDP Figures in South Africa", *South African Journal of Economics*, 1996, Vol. 64, No. 4, pp. 305-319.
- Bautisa, R., "Exchange Rate Changes and LDC Export Performance under Generalised Currency Floating", *Weltwirtschaftliches Archiv* 17(3), pp. 443-468.

Beveridge, S. and C. Nelson, "A New Approach to Decompositions of Economic Time Series into Permanent and Transitory Components with Particular Attentions to Measurement of the Business Cycle", *Journal of Monetary Economics*, Vol. 7, pp. 151-174.

Calvo, G. and C. Rodriguez, "A Model of Exchange Rate Determination Under Currency Substitution and Rational Expectations", *Journal of Political Economy*, 1977, Vol.85, pp. 611-625.

Calvo, G. and Carlos A. Vegh, "Inflation Stabilisation and Nominal Anchors", in R.C. Barth and C.Wong (eds.), *Approaches to Exchange Rate Policy: Choices for Developing and Transition Economies* (Washington, D.C., IMF Institute, 1994), pp. 90-113.

Calvo, A. G., L.Leiderman and C.M. Reinhart, "Capital Infows to Latin America with Reference to the Asian Experience", in S. Edwards (ed.), *Capital Controls, Exchange Rates and Monetary Policy in the World Economy* (Cambridge, Cambridge University Press, 1997), pp. 339-382.

Charemza, W.W. and D.F. Deadman, *New Directions in Econometric Practice: General to Specific Modelling, Cointegration and Vector Autoregression* (Vermont, Edward Elgar Publishing Company, 1993).

Clark, P., L. Bartolini, T.Bayoumi, and S. Symansky, "Exchange Rates and Economic Fundamentals: A Framework for Analysis", *International Monetary Fund Occasional Papers* 115(1994).

Cassel, G., *Postwar Monetary Stabilisation* (New York, Columbia University Press, 1928)

Cooper, R., *Exchange Rate Devaluation in Developing Countries*, Princeton Essays on International Finance 58 (Princeton, N.J., Princeton University Press, 1971).

Cooper, R.N., "Monetary Theory and Policy in an Open Economy", *Scandinavian Journal of Economics*, 1976 (1972), Vol. 78, No.2

Corden, W.M. "Monetary Integration", *Essays in International Finance*, no. 93 (April, 1972) (Princeton, N.J.: International Finance Section, Princeton University).

Corden, W.M., "Exchange Rate Policy in Developing Countries", in R.C. Barth and C.Wong (eds.), *Approaches to Exchange Rate Policy: choices for developing and transitional economies* (Washington, D.C., IMF Institute, 1994), pp. 65-89.

Cottani, J.A., D.F. Cavallo, and M.S. Khan, "Real Exchange Rate behaviour and Economic Performance in LDCs, *Economic Development and Cultural Change* (October 1990), pp. 61-76.

Crockett, A.D. and S.M. Nsouli, "Exchange Rate Policies for Developing Countries", *Finance in Developing Countries*, 1977, Vol. 13, No. 2.

Davidson, J.H., Hendry, D.F. Srba and S.Yeo., "Econometric Modelling of the Aggregate Time-Series Relationship Between Consumer's Expenditure and Income in the United Kingdom", *Economic Journal*, 1978, Vol. 88, pp. 661-692.

De Kock Commission, *South Africa - Monetary System and Monetary Policy: Final Report of the Commission of Inquiry into the Monetary System and Monetary Policy in South Africa*, May 1985.

De Vries, M., "Exchange Depreciation in Developing countries", *IMF Staff Papers*, 1968, Vol. 15, pp. 560-602.

De Wet, G.L., "The Prognosis for Growth and Development in South Africa", *South African Journal of Economics*, 1995, Vol. 63, pp. 473-488.

Diaj-Alejandro, C., "Real Exchange Rates and Terms of Trade in the Argentine Republic 1913-1976" in M.Syrquin and S. Teitel (eds.) *Trade, Stability, Technology and Equity in Latin America* (New York, Academic Press, 1983)

Donovan, D., "Real Responses Associated with Exchange Rate Action in Selected Upper Credit Tranche Stabilisation Programs", *IMF Staff Papers*, 1981, Vol. 28, pp. 698-727.

Dornbusch, R., "Tariffs and Non-Traded Goods", *Journal of International Economics*, 1974, Vol. 4, pp. 177-185.

Dornbusch, R., "Expectations and Exchange Rate Dynamics", *Journal of Political Economy*, 1976, Vol. 84, pp. 1161-1167.

Dornbusch, R., "Exchange Rate Economics: Where Do We Stand?", *Brookings Papers on Economic Activity* (1980), No. 1.

Dornbusch, R., *Open Economy Macroeconomics* (New York, Basic Books, Inc. Publishers, 1980).

Dornbusch, R., "Special Exchange Rates for Commercial Transactions", in S.E. and L. Ahamed (eds.), *Economic Adjustment and Exchange Rates in Developing Countries* (Chicago, University of Chicago Press, 1986).

Dornbusch, R., "Purchasing Power Parity", in *The New Pelgrave: A Dictionary of Economic Theory and Doctrine* (London, Macmillan, 1987).

Du Plessis, S.P.J., *International Economics. Second edition* (Durban, Butterworth Publishers (Pty) Ltd, 1994)

Dykes, D., *Nedcor: Guide to the Economy*, 1998, July.

Edwards, S., *Real Exchange Rates, Devaluation, and Adjustment; Exchange Rate Policy in Developing countries* (Cambridge, The MIT Press, 1989).

Edwards, S., *Exchange Rate issues in Developing and Transitional Economies* (November 1995), paper presented to the African Economic Research Consortium research workshop on Exchange Rates.

Edwards, S., "Exchange rates, inflation, and disinflation: Latin American experiences", in S. Edwards (ed.), *Capital Controls, Exchange Rates and Monetary Policy in the World Economy* (Cambridge, Cambridge University Press, 1997), pp. 301-338.

Elbadawi, I., "Real Overvaluation, Terms of Trade Shocks, and the Cost to Agriculture in SSA: The Case of Sudan", *Journal of African Economies*, 1992, Vol. 1: No. 1 (March).

Elbadawi, Ibrahim A., "Estimating Long-Run Equilibrium Real Exchanger Rates", in J. Williamson (ed.), *Estimating Equilibrium Exchange Rates* (Washington, D.C., Institute for International Economics, 1994), pp. 92-131.

Elbadawi, I. and Raimundo Soto, *Real Exchange Rates and Macroeconomic Adjustment in Sub-Saharan Africa and other Developing Countries* (November 1995), paper presented to AERC Bi-Annual Research Workshop in Johannesburg.

Engle, R.F. and C.W.J. Granger, "Cointegration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 1987, Vol. 55, pp. 251-276.

Erol, T. and S. Van Wijnbergen, "Real Exchange Rate Targeting and Inflation in Turkey: An Empirical Analysis with Policy Credibility", *World Development*, 1997, Vol. 25, pp. 1717-1730.

Frenkel, J.A., "A monetary Approach to the Exchange Rate; Doctrinal Aspects and Empirical Evidence", *Scandinavian Journal of Economics*, 1976, Vol. 78.

Frenkel, J. and M. Mussa, "Asset Markets, Exchange Rates and the Balance of Payments", in P.B. Kenen and R.W. Jones (eds.), *Handbook of International Economics* (Amsterdam: Holland, 1984).

Genberg, H., "Purchasing Power Parity under Fixed and Flexible Exchange Rates", *Journal of International Economics*, 1978, Vol. 8, pp. 247-76

Gerson, J. and B. Kahn, "Factors Determining Real Exchange Rates in South Africa", *South African Journal of Economics*, 1988, Vol. 56, pp. 124-133.

Granger, C.W.J. and P. Newbold "Spurious Regressions in Econometrics", *Journal of Econometrics*, 1974, Vol. 2, pp. 111-120.

Griffiths, W.E., R.C. Hill and G.G. Judge, *Learning and Practicing Econometrics* (Canada, John Wiley and Sons, 1993).

Guitian, M., "The Choice of an Exchange Rate Regime", in R.C. Barth, C. Wong (eds.), *Approaches to Exchange Rate Policy: Choices for Developing and Transition Economies* (Washington, D.C., IMF Institute, 1994), pp. 13-36.

Gujarati, N. D., *Basic Econometrics*, (New York, McGraw-Hill Inc, 1995).

Hakkio, C., "A Re-examination of Purchasing Power Parity", *Journal of International Economics*, 1992, Vol. 18, pp. 265-277.

Hanson, A.J., "Opening the Capital Account: Costs, Benefits and Sequencing", in S. Edwards (ed.), *Capital Controls, Exchange Rates and Monetary Policy in the World Economy* (Cambridge, Cambridge University Press, 1997), pp. 383-429.

Harberger, C.A., "In Step Out of Step with the World Inflation: A Summary History of Countries, 1952-1976)", in J.M. Flanders and A. Razin (eds.), *Development in an Inflationary World* (New York, Academic Press, 1981).

Harberger, C.A., "Economic Adjustment and the Real Exchange Rate", in S. Edwards and L. Ahmed (eds.), *Economic Adjustment and Exchange Rates in Developing Countries* (Chicago,

University of Chicago Press, 1986)

Hendry, F. D., "Econometric Modelling with Cointegrated Variables: An Overview", *Oxford Bulletin of Economics and Statistics*, 1986, Vol. 48, pp. 201-212.

Holden, M.G. and P. Holden, "Alternative Measures of Exchange Rates and Exchange Rate policy in South Africa", *South African Journal of Economics*, 1985, Vol. 53, pp. 351-365.

Holden, M., "Definitions and Calculations of Real Exchange Rates: An Application to South Africa". Occasional Paper No. 20 (Durban, Economic Research Unit University of Natal, 1988)

Holden, M., "Real Exchange Rates and their Measurement", *South African Journal of Economics*, 1991, Vol. 59, pp. 1-15.

Houthakker, H., "Exchange Rate Adjustment" in *Factors Affecting the US Balance of Payments* (Washington D.C., Government Printing Office, 1962)

[Http://www.resbank.co.za/economics/econ.html](http://www.resbank.co.za/economics/econ.html)

Isard, P., *Exchange Rate Economics* (Cambridge, Cambridge University Press, 1995).

Johansen, J., "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, 1988, Vol. 12, pp. 231-254.

Kahn, B. "Foreign exchange policy, capital flight, and economic growth" in I. Abedian and B. Standish (eds.), *Economic Growth in South Africa* (Capetown, Oxford University Press Southern Africa, 1992), pp. 74-98.

Kahn, B., "The South African Exchange Rate Policy and International Competitiveness", in P.H. Baker, A. Boraine and W. Kafchick (eds.), *South Africa and the World Economy in the 1990s* (Capetown, The Brookings Institution, 1993), pp. 137-147.

Kahn B. and A. Parikh, "Determinants of Real Exchange Rates in South Africa; A short-run and long-run analysis", *Journal of Studies in Economics and Econometrics* (1997), Vol. 21, pp. 1-20.

Kamin, S, "Multiple Exchange Rate Systems: The Case of Argentina" in Richard C. Barth and C. Wong (eds.) *Approaches to Exchange Rate Policy: Choices for Developing and Transition Economies* (Washington, DC, IMF Institute, 1994)

Keynes, M.J., *A Treatise on Money* (London, Macmillan, 1930)

Kravis, B.I. and R.E. Lipsey, *Toward an Explanation of National Price Levels*. Princeton Studies in International Finance 52 (Princeton, N.J.: Princeton University Press, 1983)

Krueger, A.O, "Analysing Disequilibrium Exchange-Rate Systems in Developing Countries", *World Development*, 1982, Vol. 10, pp. 1059-1068.

Krugman, R.P., *Exchange-Rate Instability* (London, The MIT Press, 1989).

Krugman R.P. and M. Obstfeld, *International Economics* (New York, Harper Collins College Publishers, 1994)

Lee, M.H., *Purchasing Power Parity* (New York, Marcel Dekker, 1976).

Le Fort, G.R., "The relative price of Nontraded Goods, Absorption, and Exchange Rate Policy in Chile, 1974-1982" *International Monetary Fund Staff Papers*, 1988, Vol. 35, pp. 336-370.

Lizondo, J.S., "Exchange Rate Reunification". Paper presented at Economic Society Meetings, 1986, Cordoba, Argentina.

Lothian, J.R., *Multi-Country Evidence on the Behaviour of Purchasing Power Parity under the Recent Float*, (Mimeo, Fordam University, 1994).

Lothian, J.R. and M.P. Taylor, "Real Exchange Rate Behaviour: The recent Float from the Perspective of the Past Two Centuries", *Journal of Political Economy*, (forthcoming).

Maciejewski, P., "Real Effective Exchange Rate Indices: A Re-Examination of the Major Conceptual and Methodological Issues", *International Monetary Fund Staff Papers*, 1983, Vol. 30, pp. 491-541.

Mainardi, S., "Economic Growth and Exchange Rate Misalignment: The Role of Gold in South Africa", *Savings and Development*, 1996, Vol, 20, pp. 407-430.

Mathieson, J.D. and L. Rojas-Suarez, "Liberalisation of the Capital Account: Experiences and Issues", *International Monetary Fund Occasional*, 1993, Paper 103.

Mckinnon, I. R., "Optimum Currency Areas", *American Economic Review*, 1963, Vol. 53, pp. 717-725.

McKinnon, R.I., "Monetary Theory and Controlled Flexibility in the Foreign Exchanges" in E. Classen and P. Salin (eds.), *Stabilisation Policies in Interdependent Economies* (Amsterdam, North-Holland Publishing Co., 1972).

McKinnon, R., "International Transfers and Non-Traded Commodities: The Adjustment Problem", in D.M. Leipziger (ed.), *The International Monetary System and the Developing Nations*, US Agency for International Development, 1976.

Mishkin, S.F., "Understanding Financial Crises: A Developing Country Perspective", *Annual World Bank Conference on Development Economics*, (New York, Word Bank, 1997), pp. 29-62.

Mohr, P.J., C. Van der Merwe, Z.C. Botha and J. Inggs, *The Practical Guide to South African Economic Indicators* (Johannesburg, Lexicon Publishers, 1988).

Montiel, P.J. and J.D. Ostry, "Macroeconomic implications of Real Exchange Rate Targeting in Developing Countries", *International Monetary Fund Staff Paper*, 1991, Vol. 38, pp. 872-900.

Morgan, T. and A. Davis, "The Concomitants of Exchange Rate Depreciation: Less Developed Countries, 1971-1973", *Economic Development and Cultural Change*, 1982, Vol. 31, pp. 101-130.

Mundlak, Y., D. Cavallo, and R. Domench, "Effects of Trade and Macroeconomic Policies on Agriculture and Economic Growth: Argentina 1913 - 1984", Paper presented at a workshop on Trade and Macroeconomic Policy's Impact on Agriculture, sponsored by the International Food Policy Research Institute, Annapolis, 1987, MD (27-29 May)

Mussa, M., "Key Issues in Exchange Rate Policy Today", in R.C. Barth and C. Wong (eds.), *Approaches to Exchange Rate Policy: Choices for Developing and Transitional Economies* (Washington, D.C., IMF Institute, 1994), pp. 286-292.

Neary, P. and D. Purvis, "Real Adjustment and Exchange Rate Dynamics", in J. Frenkel (ed.), *Exchange Rates and International Macroeconomics* (Chicago, University of Chicago Press, 1983)

Officer, L., *Purchasing Power Parity and Exchange Rates: Theory, Evidence and Relevance*. Contemporary Studies in Economic and Financial Analysis 34 (Greenwich, Conn.:JAI Press, 1982)

Ostry, J.D. and K.S. Khan, "Response of the Equilibrium Real Exchange Rate to Real Disturbances in Developing Countries", *World Development*, 1992, Vol. 20, pp. 1325-1334.

Perez, L.P., "Experiences with alternative Exchange Rate Systems: Case Study of Venezuela", in Richard C.B., C. Wong (eds.), *Approaches to Exchange Rate Policy* (Washington, D.C., IMF Institute, 1994), pp. 152-156.

- Pesaran and Pesaran, *Microfit 4.0: Windows Version* (Oxford, Oxford University Press, 1997).
- Phillips, P.C.B. and M. Loretan, "Estimating Long-Run Economic Equilibria", *Review of Economic Studies*, 1991, Vol. 5, pp. 407-436.
- Pindyck, S. R. and D.L. Rubinfeld, *Econometric Models and Economic Forecasts* (New York, McGraw-Hill, Inc, 1991).
- Ponjacheck, A.H., *Monetary Independence under Flexible Exchange Rates* (Lexington, Lexington Books, 1979).
- Pretorius and Smal, "A Macroeconomic Examination of the Price-Formation Process in the South African Economy", *South African Reserve Bank: Quarterly Bulletin*, 1994, March, No. 191, pp. 25-36.
- Quirk, J. P., "Recent Experience with Floating Exchange Rates in Developing Countries", in Richard C.B., C. Wong (eds.), *Approaches to Exchange Rate Policy* (Washington, D.C., IMF Institute, 1994), pp. 133-147.
- Riechel K., *Economic Effects of Exchange-Rate Changes* (Lexington, Lexington Books, 1978).
- Reichmann, T., "Case Study of Mexico (1982-1991)" in R.C. Barth and C.Wong (eds.) *Approaches to Exchange Rate Policy: Choices for Developing Countries and Transition Economies* (Washington, D.C., IMF Institute, 1994), pp. 157-165.
- Ricardo, D., *On the Principles of Political Economy and Taxation*, E.C. Donner (ed.), G. Gell and Sons, 1971 (originally published in 1821).
- Rogoff, K., "Purchasing Power Parity Puzzle", *Journal of Economic Literature*, 1996, Vol. 34, pp. 647-668.

Salter, W., "Internal and External Balance: the Role of Price and Expenditure Effects", *Economic Record*, 1959, Vol. 35, pp. 326-338.

Samuelson, P.A., "Theoretical notes on trade problems", *Review of Economics and Statistics* (May 1964), pp. 145-154.

South African Reserve Bank Quarterly Bulletin (SARB), various issues.

Swan, T., "Longer run problems of the balance of payments", in H. Arndt and M. Corden (eds.), *The Australian Economy: A Volume of Readings* (Melbourne Australia, Cheshire Press, 1963).

Taylor, M.P. "An Empirical Examination of Long-Run Purchasing Power Parity using Cointegration Techniques", *Applied Econometrics*, 1988, Vol. 20, pp. 1368-1381.

Theron, N., "Can South Africa Afford Full Liberalisation of Exchange Controls?: Some Lessons from International Experience", *South African Journal of Economics*, 1998, Vol. 66, pp. 47-67.

Van der Walt, J.S. and G.L. De Wet, "The constraining Effects of Limited Foreign Capital Inflow on the Economic Growth of South Africa", *The South African Journal of Economics*, 1993, Vol. 61, pp. 3-12.

Vega, D., *Discover Word Perfect Suite 8* (Chicago, IDG Books World Wide, 1997).

West, K.D., "Asymptotic Normality, when Regressors have a Unit Root", *Econometrica*, 1988, Vol. 56, pp. 1397-1417.

Whitaker J. "Monetary policy for economic growth" in Iraj Abedian and Barry Standish (eds.) *Economic Growth in South Africa* (Capetown, Oxford University Press Southern Africa, 1992), pp. 55-73.

Willet, T., "Exchange Rate Volatility, International Trade and Resource Allocation", *Journal of International Money and Finance*, Supplement (March 1986).

Williamson, J., *Exchange Rate Policy and Development Strategy* (December 1995), paper presented to the Research Workshop of the African Economic Research Consortium in Johannesburg.

Yeager, L.B., *International Monetary Relations: Theory, History and Policy* (New York: Harper and Row, 1966).