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J. H. Eita and M. M. Sichei

University of Pretoria

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Department of Economics

University of Pretoria

0002, Pretoria

South Africa

Tel: +27 12 420 2413

Fax: +27 12 362 5207

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ESTIMATING THE EQUILIBRIUM REAL EXCHANGE RATE FOR NAMIBIA

Joel Hinaunye Eita

Department of Economics, University of Pretoria, 2-25 House Jakaranda, Hatfield 0083

PRETORIA, Tel: +27(0)764242968, Email: hinaeita@yahoo.co.uk

and

Moses Muse Sichei

Department of Economics, University of Pretoria

ABSTRACT

This paper estimates the equilibrium real exchange rate and the resulting real exchange rate misalignment in Namibia during the period 1970 to 2004. The equilibrium real exchange rate is determined by trade and exchange restrictions (openness), terms of trade and ratio of investment to GDP. An increase in openness and ratio of investment to GDP cause the real exchange rate to appreciate. The real exchange rate was overvalued for almost the entire estimation period. It reached its equilibrium value in 1998. It is important to monitor the real exchange rate, and ensure that the divergence from the equilibrium value is minimised.

JEL Classification: F31, F41, C22, C32

Keywords: equilibrium real exchange rate, misalignment, cointegrating vector

1. INTRODUCTION

Equilibrium real exchange rate is defined as a rate, which is consistent with simultaneous achievement of internal and external equilibrium. Internal equilibrium is a situation where the non-tradable goods market clears, while external equilibrium is achieved when the current account is sustainable. Real exchange rate misalignment is a gap between actual and equilibrium real exchange rate. It is a sustained departure of the real exchange rate from its long run equilibrium value (Zhang, 2001, Edwards, 1989a, 1989b and Asfaha and Huda, 2002).

As Edwards (1988) pointed, the real exchange rate is expected to provide signals to economic agents in the economy. Information on the extent to which the real exchange rate diverges from its equilibrium level serves as a guide to policy makers to ensure that the real exchange rate does not send wrong signals to economic agents. Wrong signals can result in inefficient resource allocation and lead to reduction of the country's welfare. Misalignment of the real exchange rate could increase economic instability and distort investment decisions. Real exchange rate misalignment can result in welfare and efficiency costs. According to Edwards (1989a:12) real exchange misalignment especially overvaluation hurts exports and can wipe out the agricultural sector. It can also cause capital flight, which may be optimal from private perspective but a substantial cost in terms of social welfare.

Despite the fact that real exchange rate is an important variable in the economy, empirical research on the real effective exchange rate for Namibia is limited. This could be due to the fact that estimating the real exchange rate and real exchange rate misalignment is a

challenging task. It requires determining the equilibrium real exchange rate in the first place and then measuring the degree of deviation of the actual real exchange rate from this equilibrium value. In recent years, methods for estimating equilibrium real exchange rate have been advanced by new time series econometrics such as unit roots, cointegration and vector autoregression (VAR).

Namibia is a member of the Common Monetary Area (CMA), together with Lesotho, Swaziland and South Africa. The CMA is an asymmetric currency union dominated by South Africa. Namibia's currency, the Namibia dollar, is pegged to the South African rand on a one to one basis. Under these conditions, the equilibrium real exchange rate will not only be influenced by Namibian fundamentals, but as well as South Africa's. Pegged currencies are vulnerable to speculative attacks. It is important to examine trends over time in the indicators of a country's external competitiveness and balance of payments to assess whether its real exchange rate is likely to be consistent with a sustainable external account.

Devarajan (2001) showed that real exchange rate misalignment in CFA Franc Zone was disproportionately distributed. Countries whose exports are dominated by primary products experienced the largest real exchange rate misalignments. Estimation of the real exchange rate misalignments is necessary for the CMA. Namibia has a higher share of primary exports in overall exports in comparison to other members of the CMA. It is likely that Namibia experienced some real exchange rate misalignments in response to shocks that affected primary products.

This study is an application of the Johansen (1988, 1995) full information maximum likelihood (FIML) to estimate equilibrium real exchange rate and the resulting real exchange rate misalignment for Namibia. The study aims to estimate Namibia's equilibrium real exchange rate from 1970 to 2004. The analysis of how changes in the fundamental determinants affect the equilibrium real exchange rate can provide some additional guidance to the prevailing exchange rate policy. This could help to draw inference about the appropriate exchange rate regime for Namibia. The analysis shows that real exchange rate is determined by openness, terms of trade and ratio of investment to GDP. Increase in openness and ratio of investment to GDP cause real exchange rate to appreciate. The real exchange rate was overvalued for almost the entire estimation period. The speed of adjustment is 2.5 years. The rest of the paper is organised as follows. Section 2 discusses the theoretical framework. Section 3 and 4 provide empirical framework and estimation results, and section 5 presents the conclusion.

2. THEORETICAL FRAMEWORK

2.1 Analytical Issues

The production structure of the model is the key factor that affects the definition of the real exchange rate in analytical model. The mostly used modelling frameworks are tradable goods model, Mundell-Fleming model, the dependent economy model and the importable-exportable goods model (Montiel, 2003: 312).

The importable-exportable-nontraded goods model is suitable for developing countries. The model consists of exportable goods, importable goods and non-traded goods. The

economy is small and open. There is a dual nominal exchange rate system and the government sector. The home country produces and consumes both exportables and importables as well as non-tradable goods. People of the home country hold both domestic and foreign money. It is assumed that there is capital control and therefore no international capital mobility. It is also assumed that the private sector inherited a given stock of foreign money. The government uses both non-distortionary taxes and domestic creation to finance its expenditures and consumes importable and non-tradable goods. The government and private sector cannot borrow from abroad, hence there is no domestic public debt. Relaxing the assumption of no capital mobility, it assumed that the government is not subject to capital control, and capital flows in and out of the country.

Fixed nominal exchange rate for commercial transactions characterises the dual nominal exchange rate, while floating nominal exchange rate characterises financial transactions. Floating nominal exchange rate takes whatever level is required to achieve asset market equilibrium. The assumption of dual exchange rate system is made as a way of capturing that in many developing countries there is a parallel market for financial transactions. It is assumed that a tariff is imposed on imports and the proceeds are handed back to the public in a non-distortionary way. The exportable goods price in terms of foreign currencies is equal to unity.

Based on the three goods model, Edwards (1989b) developed a model of real exchange rate determination for developing countries. Detailed description of the model is also presented in Dorbusch (1974). This model of real exchange rate determination allows for

both nominal and real factors to play in the short run. Only real factors influence the equilibrium real exchange rate in the long run. This model captures the main macroeconomic features of developing countries, including Namibia.

2.2 Model Specification

The model applied in this study is that of Edwards (1989b). In this model, Edwards identified fundamental factors that determine the equilibrium real exchange rate. The fundamental determinants of the equilibrium real exchange rate are terms of trade, trade and exchange restrictions, government expenditure, capital controls and technology. The relationship between equilibrium real exchange rate (ERER) and the fundamentals is expressed as vector of variables:

$$X_t = (REER, TOT, OPEN, INV) \quad \dots (1)$$

where REER is real effective exchange rate, TOT is terms of trade, OPEN is openness of the economy and INV is ratio of investment to GDP.

2.2 Real Exchange Rate Fundamentals

Specification of the fundamental determinants of the equilibrium real exchange rate is the most important part of the model. In his empirical study of more than 30 developing countries, Edwards (1988, 1989b) identified among others, the following set of fundamentals affecting the equilibrium real exchange rate:

Terms of trade (TOT) defined as the ratio of export price index to import price index. This is an important external real exchange rate fundamental. Changes in TOT imply higher domestic prices of importables and generate intertemporal and intratemporal substitution effects as well as income effects. This makes the net effect on the equilibrium real exchange rate ambiguous. If the income effect overwhelms the substitution effect, an improvement in the terms of trade leads to equilibrium real exchange rate appreciation. Contrary to this, if the substitution effect dominates the income effect, an improvement in the terms of trade leads to real exchange rate depreciation. This argument is supported by Asfaha and Huda (2002:4) and Zhang (2001:86-89).

Trade and exchange restrictions refer to countries trade policy stance, which is reflected by the magnitude and structure of import tariffs and quotas. Edwards (1988: 7) pointed out that trade restrictions such as tariffs and quotas increase the domestic price of tradable goods and thus results in both substitution and income effects. The EREER could depreciate or appreciate depending on whether income or substitution effect of trade restriction dominates. An increase in tariffs leads to higher relative increase in the prices of non-tradable goods, and results in appreciation of EREER. However, a decrease in tariff or liberalisation causes EREER depreciation.

The ratio of investment to GDP (INVGDP). According to Mongardini (1998:14) investment is more import intensive than consumption, and an increase in the ratio of investment to GDP will increase absorption, worsen the current account and lead to depreciation of the EREER. However, Mathisen (2003: 7) noted that the expected sign is

ambiguous as supply side effects depend on the relative ordering of factor intensities across sectors.

3. EMPIRICAL FRAMEWORK

3.1 Data

The study uses annual data covering the period 1970-2004. Variables are in logarithms. For real effective exchange rate (REER) variable, the data published by the Bank of Namibia and International Monetary Fund (IMF) are used. The REER is calculated by using the geometric average formula as: $REER = NEER * (CPI / CPIF)^{w_j}$, where NEER is the nominal effective exchange rate, CPI is domestic consumer price index, w_j is the weight of the respective trading partner, and CPIF is the consumer price index of respective trading partners. An increase in REER is an appreciation and a decrease is depreciation.

The variable terms of trade (TOT) is computed as the ratio of export price index to import price index is used to represent changes in international economic environment. These data are obtained from the Bank of Namibia and Central Bureau of Statistics of Namibia. Trade and exchange restriction is proxied by openness of the economy (OPEN). This variable is computed as $(EXPORT + IMPORT) / GDP$. Data for computation of this variable as well as the ratio of gross domestic investment to GDP (INVGDP) are also obtained from the Bank of Namibia and Central Bureau of Statistics of Namibia.

The real effective exchange rate and the main fundamental variables used in the empirical estimation of the equilibrium real exchange rate are plotted over the 1970-2004 period in Figure A1. Some key observations revealed include significant real effective exchange rate depreciation since 1985. This depreciation accelerated until 2002, before appreciation in 2003 and 2004. Openness increased from 1970 to 1983 and has been on a decreasing trend during the period 1984 to 2004. The ratio of investment to GDP has been on a decreasing trend until the late 1980s. It has been on an increasing trend since the 1990s.

3.2 Estimation Method

This study employs the Johansen's FIML in order to investigate the existence of a long-run cointegrating relationship between the real exchange rate and the explanatory variables. The estimation is done in terms of Equation (1). The Johansen FIML was used by MacDonald and Ricci (2003) to estimate the equilibrium real exchange rate for South Africa. This econometrics methodology corrects for autocorrelation and endogeneity parametrically using a vector error correction mechanism (VECM) specification.

3.3 Univariate Characteristics of the Data

The estimation procedure entails the following: unit root tests, test for cointegration in the context of VAR, reparameterisation of VAR in VECM, dynamic analysis and finally

computation of the degree of misalignment. The unit root test results are presented in table A1 in the appendix.

4. ESTIMATION RESULTS

4.1 Testing for Reduced Rank

The trace and maximum eigenvalues are presented in table 1 below.

Table 1. Johansen cointegration test results

<i>Null hypothesis</i>	<i>Alternative hypothesis</i>		<i>0.05 Critical value</i>	<i>Probability value^b</i>
<i>Trace statistic</i>				
$r=0$	$r=1$	78.26887 ^a	54.07904	0.0001
$r=1$	$r=2$	39.16862 ^a	35.19275	0.0177
$r=2$	$r=3$	14.32702	20.26184	0.2675
$r=3$	$r=4$	3.167077	9.164546	0.5500
<i>Maximum Eigenvalue statistic</i>				
$r=0$	$r>0$	39.10025 ^a	28.58808	0.0016
$r\leq 1$	$r>1$	24.84160 ^a	22.29962	0.0216
$r\leq 2$	$r>2$	11.15995	15.89210	0.2402
$r\leq 3$	$r>3$	3.167077	9.164546	0.5500

^a Denotes rejection of the null hypothesis at the 0.05 level

^b MacKinnon-Haug-Michelis (1999) p-values

The trace statistics and the maximum eigenvalue show that there are 2 cointegrating vectors. These statistics confirm the appropriateness of proceeding with the vector error correction methodology (VECM). Since there are two cointegrating vectors the VECM is visualised as follows (VECM of order one):

$$\begin{bmatrix} \Delta LREER_t \\ \Delta LTOT_t \\ \Delta LOPEN_t \\ \Delta LINVGDP_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} \end{bmatrix} \begin{bmatrix} \Delta LREER_{t-1} \\ \Delta LTOT_{t-1} \\ \Delta LOPEN_{t-1} \\ \Delta LINVGDP_{t-1} \end{bmatrix} + \dots \quad (2)$$

$$\begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \\ \alpha_{51} & \alpha_{52} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{21} & \beta_{31} & \beta_{41} & \beta_{51} \\ \beta_{12} & \beta_{22} & \beta_{32} & \beta_{42} & \beta_{52} \end{bmatrix} \begin{bmatrix} LREER_{t-1} \\ LTOT_{t-1} \\ LOPEN_{t-1} \\ LINVGDP_{t-1} \\ C \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix}$$

4.2 Long-run Restrictions

The long-run restrictions were done in line with Edwards model in the theoretical framework. The structural approach to time series modelling uses economic theory to model the relationship among the variables of interest. Unfortunately, economic theory is often not rich enough to provide a dynamic specification that identifies all of these relationships. Furthermore, estimation and inference are complicated by the fact that endogenous variables may appear on both the left and right sides of equations. Economic theory provides guidance on the variables to be included in the estimation, but some variables do not necessarily need to be included in the estimation. Testing for the long-run parameter will help to identify which variable should be included in the estimation and which ones should not be included in the estimation. Four long-run restrictions were imposed on the two cointegrating vectors as shown in equation (3):

$$\begin{bmatrix} \Delta LREER_t \\ \Delta LTOT_t \\ \Delta LOPEN_t \\ \Delta LINVGDP_t \end{bmatrix} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \\ \alpha_{51} & \alpha_{52} \end{bmatrix} \begin{bmatrix} 1 & 0 & \beta_{31} & \beta_{41} & \beta_{51} \\ 0 & 1 & \beta_{32} & \beta_{42} & \beta_{52} \\ & & & & \\ & & & & \\ & & & & \end{bmatrix} \begin{bmatrix} LREER_{t-1} \\ LTOT_{t-1} \\ LOPEN_{t-1} \\ LINVGDP_{t-1} \\ C \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad \dots (3)$$

Since there are more than one cointegration vectors, it is not sensible to take the unrestricted estimates of the vectors in β directly as meaningful long-run parameter estimates. It is important to impose and test restrictions on the elements of β in an attempt to obtain the structural relationship between the variables.

In the first cointegrating vector, long-run zero restriction was imposed on terms of trade because it is a dependent variable in the second cointegrating vector. Zero restriction was imposed on the real effective exchange rate because it is a dependent variable in the first cointegrating vector. The long-run restrictions show that in the first cointegration relation (real exchange rate equation, LREER) terms of trade (LTOT) does not play an important role in the determination of the real effective exchange rate for Namibia. In other words we can have a real exchange rate equation without terms of trade variable. In the second cointegration relation (the terms of trade equation, LTOT) the real exchange rate variable does no play an important role in the determination of terms of trade, implying that we can have a terms of trade equation without real exchange rate variable. The long-run cointegration equation for real effective exchange rate for Namibia can be written as:

$$LREER = 0.375LOPEN + 0.603LINVGD\text{P} + 2.684 \quad \dots (4)$$

(1.530) (5.957) (7.670)

The t-statistics are in parentheses. The results in equation (4) can be summarised as follows:

- A 1 percent increase in openness is associated with an appreciation of the real effective exchange rate by 0.375 percent. This is consistent with the results obtained by Asfaha and Huda (2002) for South Africa.
- A 1 percent increase in ratio of investment to GDP is associated with an appreciation of the real exchange rate by 0.60 percent. This is similar to the results obtained by Mathisen (2003) for Malawi.

The results of the second cointegrating vector are presented in equation (5):

$$LTOT = 0.589LOPEN + 0.141LINVGD\text{P} + 4.174 \quad \dots (5)$$

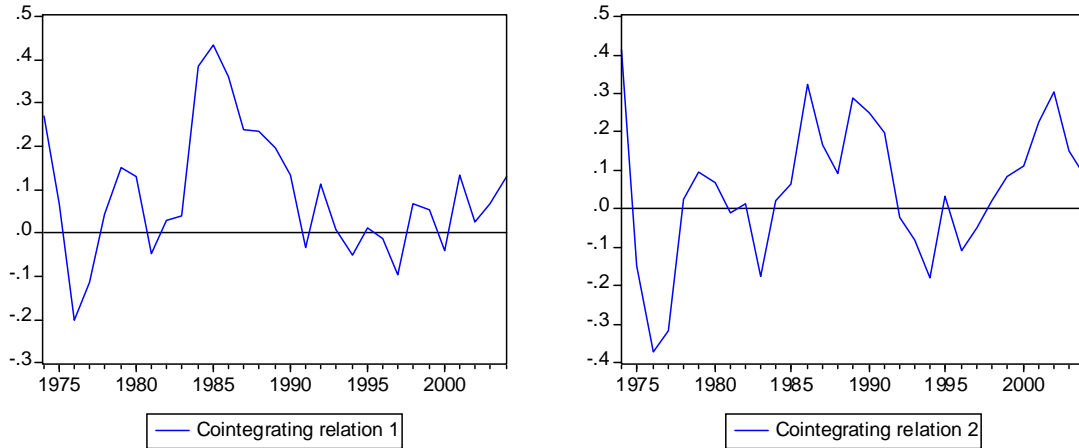
(2.810) (1.631) (143.963)

The results of Equation (5) can be summarised as:

- The results of the second cointegrating vector (for terms of trade) show that openness and investment have positive impact, but this is not important. The most important is the results of the first cointegrating vector.
- All t-statistics are statistically significant, and the results are consistent with *a priori* expectation and literature.

Cointegration relations are plotted in figure 1. They appear to be stationary.

Figure 1. Cointegration Relations



4.3 Exogeneity Test and Speed of Adjustment

The loading matrix α_s determine into which equation the cointegrating vectors enter and with what magnitudes. It measures the speed of adjustment and the degree to which the variable in the equation respond from the long-run equilibrium relationship. The elements of matrix α_s relate to the issue of weak exogeneity. In cointegrated system if a variable does not respond to the discrepancy from the long-run equilibrium, it is weakly exogenous. This implies that there are rigidities, which limit the adjustment process. If the variable is not weakly exogenous, it means that it plays some role in bringing the normalised variable in the long run equation to equilibrium.

Table 2. Exogeneity test

	Cointegration equation 1	Cointegration equation 2.
Δ REER	-0.399 (-4.174)	0.375 (4.373)
Δ TOT	0.000	-1.024 (-6.317)
Δ LOPEN	0.000	0.000
Δ LINVGDP	0.000	0.000
LR test for binding restriction (rank=2): χ^2 (5)		8.496,
		probability 0.131

As shown in Table 2, exogeneity test shows that in the real effective exchange rate equation (Cointegration equation 1) terms of trade, openness, ratio of investment to GDP are weakly exogenous and do not play any role in bringing the real effective exchange rate to equilibrium. Disequilibrium in the real exchange is corrected only through adjustment in itself. The second cointegrating vector shows that real exchange rate does not play any role in bringing the terms of trade to equilibrium. It moves terms of trade away from equilibrium. Only terms of trade plays a role in bringing itself to equilibrium.

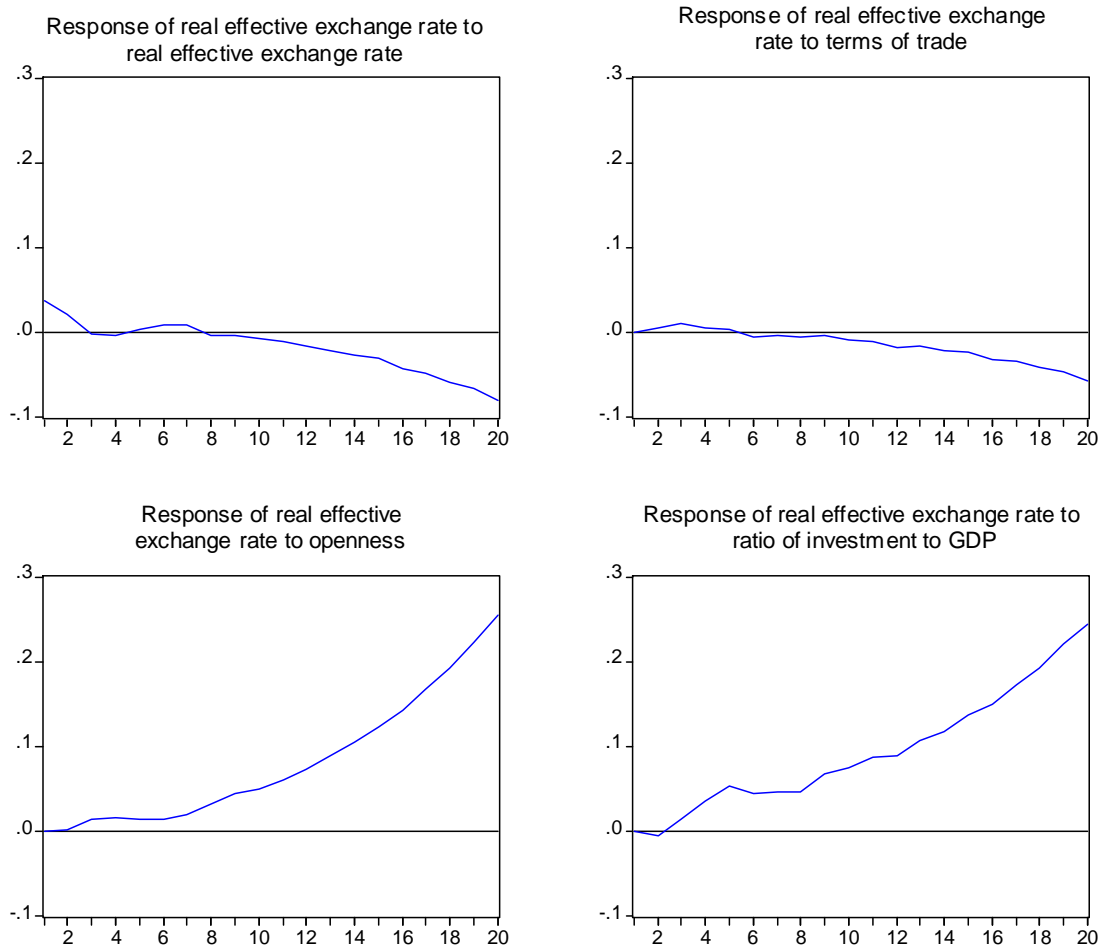
As Mathisen (2003: 16) stated, if there is a gap between the real exchange rate and its equilibrium value, the real exchange rate will converge to its equilibrium value. The adjustment requires that the real exchange rate move towards new equilibrium level or return from its temporary deviation to the original equilibrium.

A significant error term between zero and negative two implies that the long run equilibrium is stable. Since the ECM term is -0.399, the cointegrating relationship is stable. It shows that 39.9 percent of the gap between real exchange rate and its equilibrium value is eliminated every year. This implies that the adjustment takes 2.5 years. This adjustment speed is comparable to 2.1 years obtained by MacDonald and Ricci (2003) for South Africa, although the data were quarterly. This is lower than the speed of adjustment obtained by Baffes *et al.* (2001) for Burkina Faso, but similar to the one for Ivory Coast. The adjustment estimated for Burkina Faso was -0.94 and for Ivory Coast was -0.39. The adjustment period of 2.5 years is also lower than the obtained by Mathisen (2003) for Malawi. The adjustment period for Malawi is 11 months although the data for Malawi was quarterly.

4.4 Impulse Responses and Variance Decomposition

Impuse responses, introduced by Sims (1980), shows the response of real exchange rate to shocks in fundamental determinants. The impulse response are plotted only for the first cointegration relation (real exchange rate equation). They are plotted in figure 2.

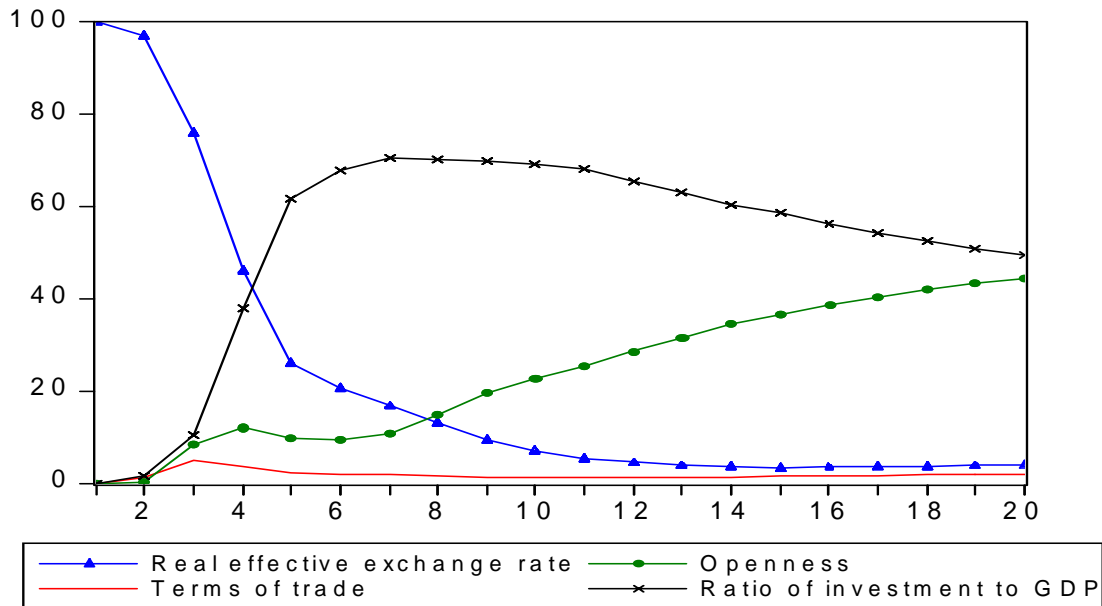
Figure 2. Impulse response: response to Cholesky one standard deviation innovations



Real exchange rate responds negatively to shocks from itself from the 9th period onwards. Shocks to terms of trade have a slight negative impact on the real exchange rate. This may suggest that the substitution effect dominates the income effect, hence a shock to terms of trade cause real exchange rate to depreciate. Shocks to openness and ratio of investment to GDP cause the real exchange rate to appreciate. The positive impact of openness' shock to real exchange rate suggests that there has been increase in trade and exchange restrictions or slow liberalisation of trade. They both do not return to

equilibrium. This indicates that policymakers are slow in responding to shocks on the economy.

Figure 3. Variance decomposition of real effective exchange rate



Variance decomposition which is another important way of testing the relative importance of shocks in fundamental determinants in accounting for variations in real exchange rate, shows that from the first to the sixth period real exchange rate is only affected by the shocks from itself. From the seventh period real exchange rate shocks accounts less than 20 percent of the variations in the real exchange rate. Terms of trade shocks accounts for less than 5 percent of the variations in the real exchange rate. Openness accounts between 20 and 40 percent of the variations in the real effective exchange rate, while investment account for over 50 percent from the fourth period.

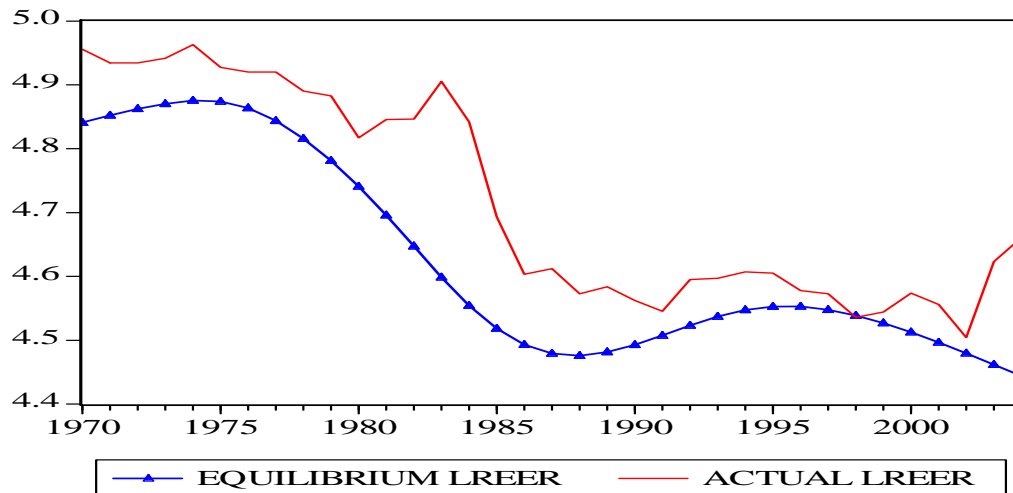
4.5 Robustness of the Results

In order to assess robustness of the results, several diagnostic tests have been performed. The results pass all the tests such as stability of VAR, normality, heterosecdasticity and lag exclusion test. Results can be obtained from the authors on request.

4.6 Equilibrium Real Exchange Rate

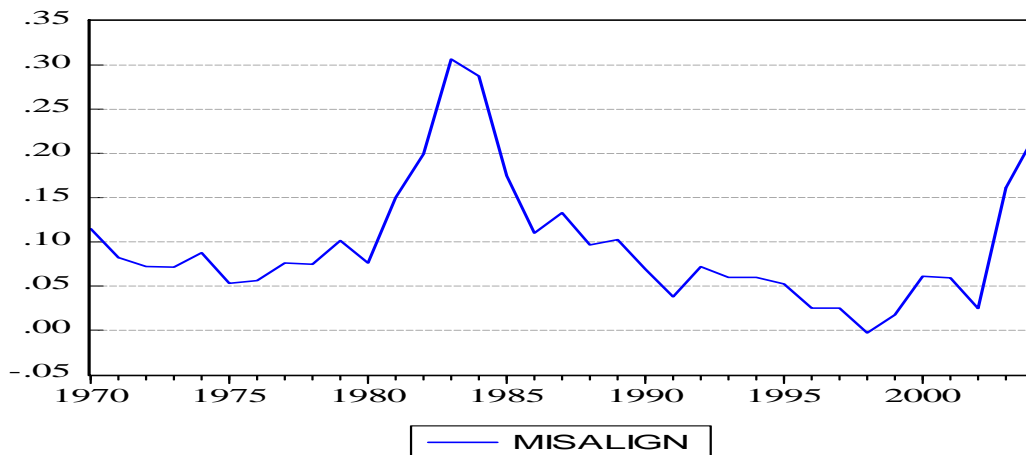
The long-run relationship above allows estimate of the equilibrium real exchange rate to be calculated. As defined earlier, this is the level of the real exchange rate that is consistent with the long-run with the equilibrium value of the fundamental variables. The equilibrium real exchange rate was obtained by imposing the coefficients of the long-run equation on the permanent values of the fundamentals. Hodrick-Presscott filter with a smoothing factor of 100 was used to smooth the variables. This smoothing factor is what Hodrick and Prescott suggested for annual data. Figure 4 shows the actual and equilibrium real exchange rate.

Figure 4. Actual and Equilibrium real effective exchange rate



When the actual real effective exchange rate is above the equilibrium, it is overvalued, and when it is below the equilibrium, it undervalued. Even though the actual real effective exchange rate has been on depreciating trend since 1975, it was overvalued for almost the entire estimation period, except in 1998 when it reached its equilibrium value. The real exchange rate was more overvalued between 1975 and 1989 compared to the period 1990 to 2002. Misalignment of the real exchange rate is shown in figure 5.

Figure 5. Misalignment of the real effective exchange rate



The real exchange rate is likely to differ from the equilibrium level at any time because changes in the fundamental determinants change the equilibrium level. Namibia experienced higher overvaluation between 1979 and 1989. Overvaluation decreased between 1990 and 2000. It increased again between 2001 and 2004. The period 1970 to 1989 is associated with political instability and challenges for independence. The period 2001 to 2002 is associated with the weakening of Namibia dollar (linked to South African rand), while the period 2003 to 2004 is associated with strengthening of dollar (Namibia).

5. CONCLUSION

This study estimated the equilibrium real exchange rate as a function of the fundamentals. Namibia's real exchange rate is determined by terms of trade, trade and exchange restrictions (proxied by openness) and ratio of investment to GDP. The restricted results show that

terms of trade has no impact on real exchange rate. A one percent increase in openness cause real exchange rate to appreciate by 0.37 percent, and a one percent increase in the ratio of investment to GDP cause real exchange rate to appreciate by 0.60 percent. The exogeneity test shows that terms of trade, openness and ratio of investment to GDP do not play any role in returning the real exchange rate to equilibrium. About 39.9 percent of the deviation from the equilibrium real exchange rate is corrected every year through adjustment in the real exchange rate. The speed of adjustment showed that it takes about 2.5 years from the real exchange rate to return to equilibrium.

The real exchange rate was overvalued for almost the entire estimation period. Overvaluation was high during the period 1979 to 1989 compared to the period 1990 to 2002. This suggests that policy makers should monitor the real exchange rate regularly and correct misalignments.

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6. APPENDIX

Table A1. Unit roots test

Variable	Model	ADF	Joint Test(F-statistic)	Conclusion
LREER	constant and trend	-0.823647	$\Phi_3=1.065166$	
	constant	-1.416635	$\Phi_1=1.629941$	
	none	-1.143572		I(1)
LTOT	Constant and trend	-3.291164*		I(0)
LOPEN	Constant and trend	-2.057879	$\Phi_3=5.961816^*$	I(0)
LINVGD	Constant and trend	-2.044487	$\Phi_3=1.6060983$	
	Constant	-1.722857	$\Phi_1=1.700096$	
	none	-0.548387		I(1)

*/**/** Significant at 10/5/1 percent significance level

Critical values for the Φ_3 and Φ_1 are from Dickey Fuller (1981: 1063)

“General to specific” iterative procedure in Enders (2004: 213) is used

Figure A1. Real Effective Exchange Rate (index 1995=100) and Key Fundamental Determinants.

