Estimating Namibia's Equilibrium Real Exchange Rate

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ABSTRACT

This paper estimates the equilibrium real exchange rate for Namibia for the post independence period (1998 to 2012) using quarterly data. Increases in the ratio of investment to GDP and resource balance are associated with an appreciation of the real exchange rate. The terms of trade causes the real exchange rate to depreciate, which suggests that the substitution effect was dominant over the income effect. The real exchange rate adjusts to equilibrium rate while the speed of adjustment indicates that it takes about 4.4 quarters or 1.1 years for 50 percent of the deviation from the equilibrium to be corrected. There were periods of undervaluation and overvaluation of the real exchange, which means that the real exchange rate experienced misalignment.

Keywords: Equilibrium Real Exchange Rate; Namibia; Cointegration; Misalignment; Fundamentals

1.   INTRODUCTION

One of the main concerns of many developing countries is the estimation of the equilibrium real exchange rate. Estimating the equilibrium real exchange rate allows determination of whether the real exchange rate is in line with its long-run value or misaligned. It is important to understand the determinants of the real exchange rate. As Edwards (1988a) pointed out, 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 (1988a, p. 12) real exchange misalignment especially overvaluation discourages exports and can impact negatively the agricultural sector.

Although empirical studies on Namibia's real exchange rate are limited, there are notable studies such as Eita and Jordaan (2013) and Miyajima (2009). These studies estimated the real exchange rate as a function of fundamentals. The studies concluded that factors, such as openness of the economy, ratio of investment to GDP, productivity, and terms of trade are associated with real exchange rate appreciation. Miyajima (2009) concluded that although real exchange rate was misaligned, the level of Namibia's real exchange rate did not suggest that there was a competitiveness problem. Eita and Jordaan (2013) found that although the actual real exchange rate tracked the equilibrium real exchange rate, there were some misalignment, and real exchange rate misalignment impacted negatively on measures of economic performance. Miyajima (2009) used annual data for the period 1980 to 2006, while Eita and Jordaan (2013) used also annual data for the period 1970 to 2012 in order to estimate equilibrium real exchange rate for Namibia. Namibia became independent in 1990 and before that any policy related to the exchange rate and other economic policies were formulated by South Africa. Hence, estimation of the real exchange rate for Namibia should take these events into account. These two studies did not take into account the fact that Namibia became independent in 1990.

This paper differs from Eita and Jordaan (2013) and Miyajima (2009) in the sense that it takes into account the fact that Namibia became independent in 1990. It then uses post-independence data in order to estimate the

equilibrium real exchange rate and resulting misalignment for Namibia. This paper studies the behaviour of the real exchange rate in Namibia. 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 also 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 (1999) stated that real exchange rate misalignment in CFA Franc Zone was not distributed proportionary. Countries that have high shares of primary products in their exports experienced the largest real exchange rate misalignments. This makes estimation of the equilibrium real exchange rate and resulting misalignment for countries such as Namibia very important. Namibia has a significant share of primary products in its overall exports. It is likely that the country 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 or vector error correction methodology to estimate equilibrium real exchange rate and misalignment for Namibia. The study aims to estimate Namibia's equilibrium real exchange rate in the post-independence period (from 1998 to 2012). The rest of the paper is organised as follows. Section 2 discusses the theoretical analysis. Section 3 and 4 provide empirical analysis and estimation results, and Section 5 presents the conclusion.

2. THEORETICAL ANALYSIS

2.1 Analytical Issues

According to Corden (1994), the real exchange rate is defined as the price of tradable to non-tradable goods. It is specified as follows:

$$RER = \frac{P_T}{P_N} \tag{1}$$

Where *RER*, P_T, and P_N are real exchange rate, price of tradable, and prices of non-tradable goods. The ratio of tradable to non-tradable good prices is also referred to as the two good internal real exchange rate for tradable and non-tradable (Montiel, 1999; Zhang, 2001). An increase in the real exchange rate indicates depreciation, while a decrease (in RER) represents an appreciation.

Theoretically, equilibrium real exchange rate is defined as a rate which is in line with the achievement of internal and external balance at the same time. When internal and external balances are achieved simultaneously, the real exchange rate is expected to be in equilibrium (Williamson, 1985). Misalignment is then computed as the difference between the actual and equilibrium real exchange rates. The equilibrium real exchange rate and the resulting misalignment can be measured using various approaches. These approaches are purchasing power parity, black market premium, model-based and behavioural equilibrium exchange rate.

The purchasing power parity approach uses deviations of the actual real exchange from the base year in which the real exchange is assumed to be in equilibrium (Balassa, 1990). The shortcoming of this approach is that it assumes that the equilibrium real exchange rate remains unchanged for the full period This approach also does not take into account the changes in the equilibrium real exchange rate which are caused by the fundamentals.

The black market premium approach uses the black market exchange rate to measure real exchange rate misalignment (Quirk et al., 1987). This approach has limitations in the sense that the information on the black market or parallel exchange rate is insufficient. Empirical studies could not establish a clear relationship between the black market premium and misalignment.

The model-based approach uses a formal model for estimating the equilibrium real exchange rate. The model-based approach has the ability to incorporate changes in the equilibrium real exchange rate. The macroeconomic balance which identifies internal and external equilibrium in order to calculate the real exchange rate through the application of comparative statics is one type of the formal model. According to Williamson (1994), it can run simulations using large macroeconomic models. Despite its advantages, Zhang (2001) argued that this model-based approach has problems which come from a significant quantity of parameter estimation and time lags in comparative static models. The size of the specification of the model in simulation of the models can also bring further problems.

The final approach is the behavioural equilibrium real exchange rate. This approach is different from the previous three approaches. It does not estimate the equilibrium real exchange rate from the macroeconomic balance. The equilibrium real exchange rate is determined by various explanatory variables. These explanatory variables are called fundamental determinants. The actual real exchange rate respond to movements in fundamentals. The real exchange rate is in equilibrium if its movements reflect change in the fundamentals (Edwards, 1988b, 1989). The actual real exchange rate is estimated as a function of its fundamental determinants. The estimated real exchange rate is then taken as the equilibrium real exchange rate. Real exchange rate misalignment is computed as the difference between actual and equilibrium real exchange rate. The choice of appropriate fundamental determinants is based on economic theory. Edwards (1988b, 1989, 1994) developed a model for estimating the real exchange rate. Mongardini (1998) and Baffes et al. (1999, 2001) extended Edwards's model. Various fundamental determinants of the real exchange rate were proposed under this model. This model is appropriate for developing countries because the data for the proposed variables are available. Developing countries have data limitations that are required for complex models. Hence, the behavioural model proposed by Edward is appropriate for many developing countries such as Namibia.

2.2   Specification of the Model

Based on Edwards (1988a), Mongardini (1998) and Baffes et al. (1999), the real exchange rate equation is expressed as:

$$\ln ERER_t = \beta' FUNDA_t^{per} \tag{2}$$

Where $ERER$, β, and $FUNDA_t^{per}$ are equilibrium real exchange rate, vector of coefficients of the long-run fundamental determinants, and vector of permanent values of fundamental determinants. The equilibrium real exchange rate is not observable in practice. Hence, Equation (2) should be estimated using actual or observable variable. Equation (2) is re-specified as:

$$\ln RER_t = \beta' FUNDA_t^{per} + \mu_t \tag{3}$$

Where RER is the actual real exchange rate and μ is the error term. The error term is assumed to have a zero mean and unit variance. When that assumption holds, it means that the real exchange rate and permanent values of the fundamental determinants are cointegrated. It is also expected that the real exchange rate will revert to its equilibrium in the long-run.

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 the real exchange rate and the fundamentals is expressed as vector of variables:

$$RER_t = (TOT_t, OPEN_t, INVGDP_t, RESBAL_t) \tag{4}$$

where RER is real exchange rate, TOT is terms of trade, $OPEN$ is openness of the economy $INVGDP$ is the ratio of investment to GDP and $RESBAL$ is resource balance.

The variables in Equation (4) were among the fundamental determinants of the equilibrium real exchange rate as identified by the literature. Terms of trade (TOT) defined as the ratio of export price index to import price index. This variable represents change in the international trade environment for the economy. An increase in the terms of trade improves the trade balance and generates high demand for non-tradable goods. An increase in the demand for non-tradable goods relative to tradable goods will cause the real exchange rate to appreciate. It is important to note that an improvement in the terms of trade can have income and substitution effects. If the substitution effect of domestic demand and supply overwhelms the income effect, an improvement in the terms of trade can cause the real exchange rate to depreciate. This means that the effect of terms of trade on the equilibrium real exchange rate is ambiguous. If the income effect dominates the substitution effect, an improvement in the terms of trade causes an appreciation of the equilibrium real exchange rate. However, if the substitution effect dominates the income effect, an improvement in the terms of trade causes the real exchange rate to depreciate (Coleman, 2008).

Trade and exchange restrictions (proxied by openness of the economy) refer to countries trade policy stance. This is reflected by the magnitude and structure of import tariffs and quotas. According to Edwards (1988a) an increase in trade restrictions such as tariffs and quotas will increase the domestic price of tradable goods and thus results in both substitution and income effects. The ERER could depreciate or appreciate depending on whether income or substitution effect of trade restriction dominates.

The ratio of investment to GDP (INVGDP) also has a significant impact on the real exchange rate. According to Edwards (1989), an investment tends to shift consumption towards tradable good and this will cause the real exchange rate to depreciate. However, if the increase in investment shifts consumption in favour of non-tradable goods, the real exchange rate will appreciate. Mathisen (2003, p. 7) noted that the expected sign is ambiguous as supply side effects depend on the relative ordering of factor intensities across sectors.

Capital control is proxied by resource balance (RESBAL). Any restriction that makes it difficult to lend to or borrow from the rest of the world is regarded as capital control. A reduction of capital control can depreciate or appreciate the real exchange rate. If the reduction of capital control causes an increase in capital inflows, the monetary base will expand. An expansion of the monetary base causes an increase in expenditure on goods such as non-tradable. An increase in the demand for non-tradable goods will results in real exchange rate appreciation. If the liberalisation of capital does not cause an increase in capital inflows, the real exchange rate will depreciate.

3. EMPIRICAL ANALYSIS

3.1 Data

The paper uses data covering the period 1998-2012. This study differs from previous studies conducted in Namibia. Previous studies used data even before Namibia's independence. This paper uses quarterly data for the post-independence period. It also use quarterly data compared to annual data (with limited observations) in previous studies. Variables are in logarithms. The data for real effective exchange rate (REER) variable, were obtained from the Bank of Namibia.

Terms of trade *(TOT)* is computed as the ratio of export price index to import price index. The data for computing the terms of trade were obtained from the Bank of Namibia and Namibia Statistics Agency.

Openness of the economy *(OPEN)* is used as a proxy for trade and exchange restrictions. It is computed as *(EXPORT+IMPORT)/GDP*. Data for calculating the terms of trade were obtained from Bank of Namibia and Namibia Statistics Agency. The data for ratio of gross domestic investment to GDP *(INVGDP)* were also obtained from the Bank of Namibia, Namibia Statistics Agency, and Central Bureau of Statistics of Namibia.

Resource balance (RESBAL) is a proxy for capital control and is computed as: RESBAL= (EXPORT*TOT - IMPORT)/REAL GDP. Data for computing this variable are obtained from Bank of Namibia and Namibia Statistics Agency.

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 1998-2012 period in Figure 1. Some key observations revealed

include significant real effective exchange rate depreciation trend since 2002. This depreciation trend accelerated until 2008. The real exchange rate was on an appreciating trend between 2009 and 2012. Openness increased and was on an upward trend during the period 1990 to 2012. The ratio of investment to GDP has been fluctuating, although on an upward trend. Resource balance increased significantly between 1998 and 2008. It was on a decreasing trend between 2009 and 2012.
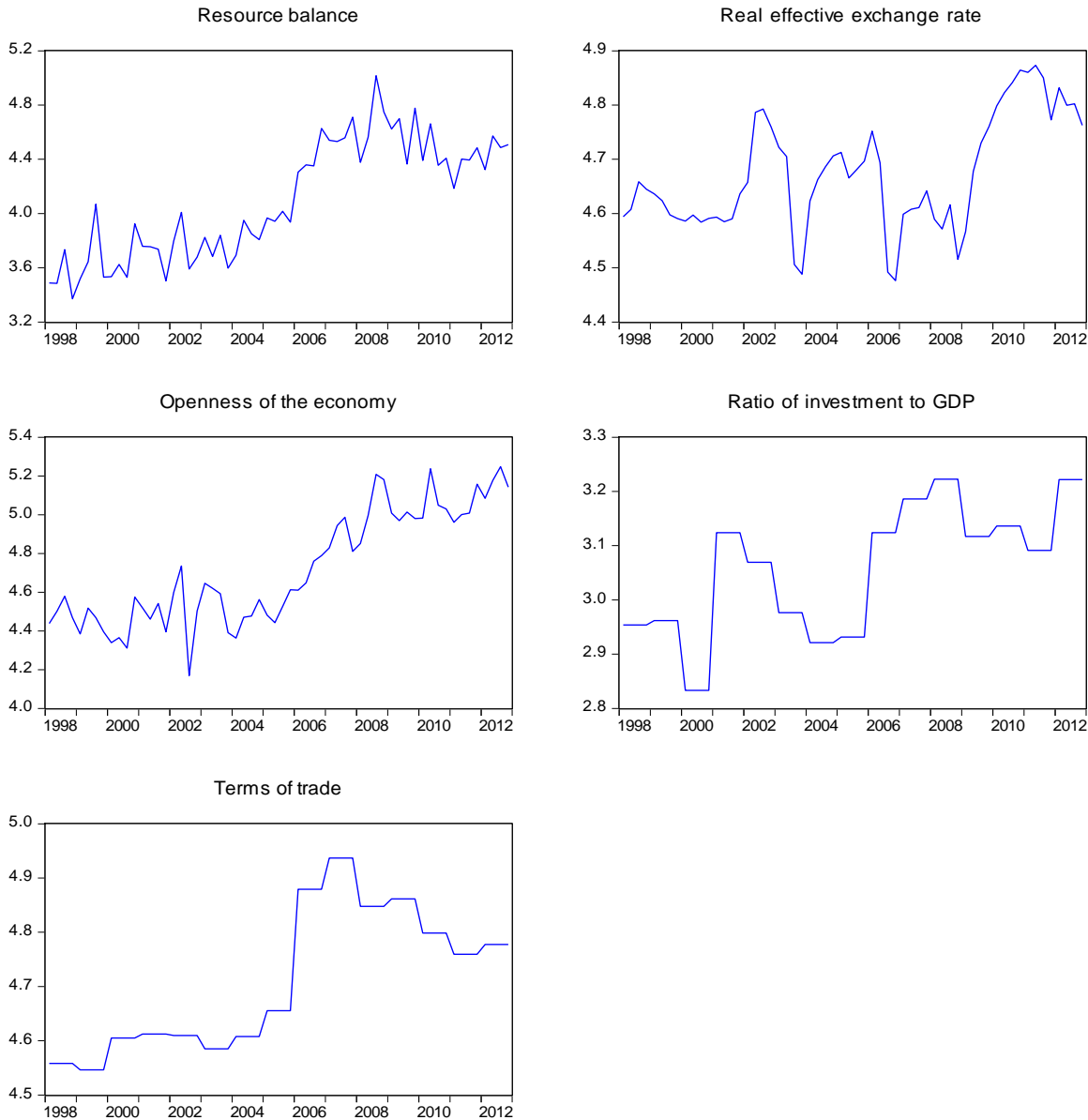
Figure 1: Real Exchange Rate and Fundamental Determinants (Variables are in Natural Logarithms)

3.2   Estimation Method

This study employs Johansen (1988, 1995) or the vector error correction model (VECM) 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 (4). The VECM was used by MacDonald and Ricci (2004) to estimate the equilibrium real exchange rate for South Africa. It was also used by Eita and Jordaan (2013) to estimate the equilibrium real exchange rate for Namibia.

3.3 Unit Root Test

Unit root test of the variables is the first step before estimation of Equation (1). This entails testing whether the variables are stationary or non-stationary. This paper uses the Augmented Dickey-Fuller (ADF) to test for unit roots of the variables (Dickey & Fuller, 1981). The results of unit root test are presented in Table 1. Table 1 shows that all variables, except *OPEN* are I(1). They are non-stationary in levels and become stationary on first difference.

Table 1: Unit Root Test Results

Variables	Model	Levels	Differences
lnREER	Constant & trend	-3.292	-6.401***
	Trend	-2.222	-6.460***
	None	0.324	-6.508***
lnTOT	Constant & trend	-1.314	-7.543***
	Trend	-1.430	-7.567***
	None	0.764	-7.549***
lnOPEN	Constant & trend	-4.176**	-6.672***
	Trend	0.168	-6.607***
	None	1.991	-8.623***
lnINVGDP	Constant & trend	-2.660	-7.472***
	Trend	-1.734	-7.532***
	None	0.548	-7.549***
lnRESBAL	Constant & trend	-1.472	-8.539***
	Trend	-1.471	-8.616***
	None	-2.421	-12.871***

Note: */**/*** Indicates rejection of the null hypothesis of unit root at 10/5/1 percent significance level.

4. ESTIMATION RESULTS

4.1 Cointegration Test Results

The trace and maximum eigenvalues statistics are presented in Table 2 below.

Table 2: Cointegration Test Results

Trace Test				Maximum Eigenvalue Test			
H_0	H_a	λ_{trace}	5% critical value	H_0	H_a	λ_{max}	5% critical value
r = 0	r ≥ 0	103.83*	76.97	r = 0	r = 1	47.75*	40.96
r ≤ 1	r ≥ 1	64.18*	54.07	r = 1	r = 2	31.56	34.81
r ≤ 2	r ≥ 2	31.53	35.19	r = 2	r = 3	19.14	28.59
r ≤ 3	r ≥ 3	17.18	20.26	r = 3	r = 4	15.07	22.30
r ≤ 4	r ≥ 5	5.78	9.16	r = 4	r = 5	8.33	15.89

Note: * indicates rejection of the null hypothesis of no cointegration at 5 percent.

There are two cointegrating vectors as shown by the trace and maximum eigenvalues statistics in Table 2. These cointegration results suggest that it is now appropriate to do a VECM. When there are two cointegrating vectors, the VECM is presented as:

$$\Pi y_{t-1} = \alpha\beta' y_{t-1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \\ \alpha_{51} & \alpha_{52} \\ \alpha_{61} & \alpha_{62} \end{bmatrix} \begin{bmatrix} 1 & 0 & \beta_{31} & \beta_{41} & \beta_{51} & \beta_{61} \\ 0 & 1 & \beta_{32} & \beta_{42} & \beta_{52} & \beta_{62} \end{bmatrix} \begin{bmatrix} \ln REER_{t-1} \\ \ln OPEN_{t-1} \\ \ln INVGDP_{t-1} \\ \ln TOT_{t-1} \\ \ln RESBAL_{t-1} \\ C \end{bmatrix} \tag{5}$$

4.2 VECM Results

The VECM results comprising of long run and short run are presented in Table 3. The first part of the Table contains long-run results, while the second part has short run results. The t-statistics are in squared brackets. The first cointegrating equation is that of real exchange rate. The second cointegrating equation is that of openness. The first cointegration equation is the equation of interest because it is on real exchange rate. Hence, the focus of this paper will be on real exchange rate (first cointegrating equation). The Δ operator indicates that the variables are in difference form.

Table 3: VECM Results (Long Run and Short Run)

LR test for binding restrictions (rank = 2):					
Chi-square(4)	3.283157				
Probability	0.511605				

Cointegrating Eq:	Cointegrating Equation 1	Cointegrating Equation 2			
LNREER(-1)	1.000	0.000			
LNOPEN(-1)	0.000	1.000			
LNINVGDP(-1)	-1.711	-1.517			
	[-4.193]	[-4.461]			
LNTOT(-1)	2.398	2.990			
	[3.503]	[5.242]			
LNRESBAL(-1)	-0.481	-1.230			
	[-2.365]	[-7.255]			
C	-8.778	-9.139			
	[-3.845]	[-4.804]			

Error Correction:	ΔLNREER	Δ LNOPEN	Δ LNINVGDP	Δ LNTOT	Δ LNRESBAL
Cointegrating Equation 1	-0.144	0.480	0.246	0.166810	0.000000
	[-2.047]	[2.634]	[3.809]	[3.017]	[0.000]
Cointegrating Equation 2	0.000	-0.678	0.000	-0.211	0.000
	[0.000]	[-2.958]	[0.000]	[-3.366]	[0.000]

The long run results in Table 3 show that resource balance and ratio of investment to GDP are associated with an appreciation of the real exchange rate. A one percent increase in the ratio of investment to GDP causes the real exchange rate to appreciate by 1.7 percent. If resource balance which is a proxy for capital control increases by one percent, real exchange rate will appreciate by 0.48 percent. The positive impact of the ratio of investment to GDP on real exchange rate is in line with the results of Mathisen (2003) for Malawi. It is also in line with Eita and Jordaan (2013).

Terms of trade is associated with a depreciating real exchange rate. A one percent increase in the terms of trade causes real exchange rate depreciate by 2.398 percent. This is not consistent with Eita and Jordaan (2013), Mathisen (2003), MacDonald and Ricci (2005). This suggests that the substitution of effect of dominated the income effect during the estimation period.

The results of the second cointegrating vector (which is the openness equation) show that investment to GDP and resource balance causes the level of openness to increase. Terms of trade is associated with an increase in openness. All t-statistics for the variables in both cointegrating equations are statistically significant.

Cointegration relations are plotted in Figure 2. They appear to be stationary. This suggests further that the estimated model is stable.
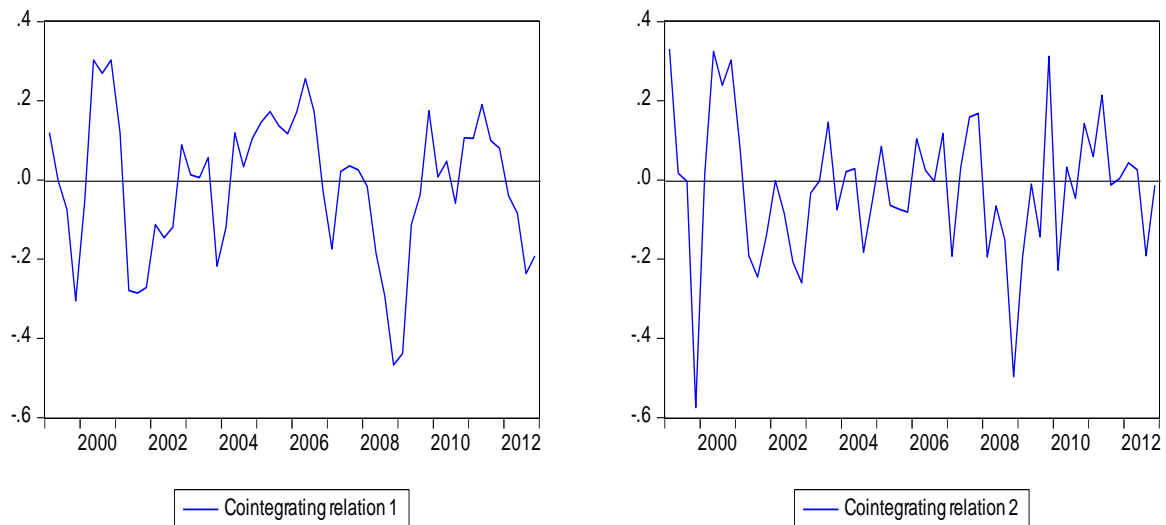
Figure 2: Cointegration Relations

4.3   Exogeneity Test and Speed of Adjustment

The loading matrix α_s measures the speed of adjustment to equilibrium. It also measures the responsiveness of the variable in the equation respond from the long-run equilibrium relationship (responsiveness from disequilibrium). The responsiveness to disequilibrium as measured by the α_s is closely related to weak exogeneity. If the variable is weakly exogenous, it means that such variable does not respond to disturbances from the long-run equilibrium. This may suggest that there are some inflexibilities which prevent the process of adjustment. A variable that plays a role in bring the dependent or normalised variable to equilibrium is not weakly exogenous. The bottom part of Table 3 shows that in the first cointegrating vector, resource balance is weakly exogenous. Openness, ratio of investment to GDP and terms of trade are not weakly exogenous, but they move real exchange rate away from equilibrium. Real exchange rate is also not weakly exogenous. Table 3 shows that disequilibrium in the real exchange rate is corrected by the real exchange rate itself. Real exchange rate plays a role in adjusting itself to equilibrium.

The second cointegrating vector shows that real exchange rate, ratio of investment to GDP and resource balance are weakly exogenous. Disequilibrium in the level of openness is corrected by openness itself and terms of trade. It means that openness and terms of trade are not weakly exogenous.

If there are temporary deviation of the real exchange rate from its long run value, the adjustment process requires it to its equilibrium value. The adjustment process will take place if the coefficient of the error correction model (ECM) is negative and statistically significant. The value of the ECM coefficient should be between 0 and 2.

The ECM term of -0.144 shows stability of the cointegrated relationship between variables. It also indicates that 14.44 percent of the deviations of the real exchange rate from its equilibrium is adjusted in the short run. This suggests that it takes about 4.4 quarters or 1.1 years to eliminate 50 percent of the deviation of real exchange rate from its equilibrium (misalignments) in Namibia. This adjustment speed is faster when compared to the 2.1 years obtained by MacDonald and Ricci (2003, 2004) for South Africa, and Mathisen's 11 months for Malawi. It is lower than the speed of adjustment obtained by Baffes et al. (2001) for Burkina Faso and Ivory Coast.

4.4   Equilibrium Real Exchange Rate

The long-run results in Table 3 are used to estimate the equilibrium real exchange rate and the resulting misalignments. Equilibrium real exchange rate is the rate which is in line with the long-run value of its fundamental determinants. The equilibrium real exchange rate was derived as follows. Firstly, the permanent values of the

fundamentals determinants of the real exchange rate were computed. The permanent values were computed using the Hodrick-Presscott filter. The Hodrick-Presscott filter with smoothing factor of 1600 was applied to compute the permanent values of the fundamentals. The long-run coefficients were then imposed on the permanent values of the fundamentals in order to derive the equilibrium real exchange rate. The actual and equilibrium real exchange rates are presented in Figure 3.
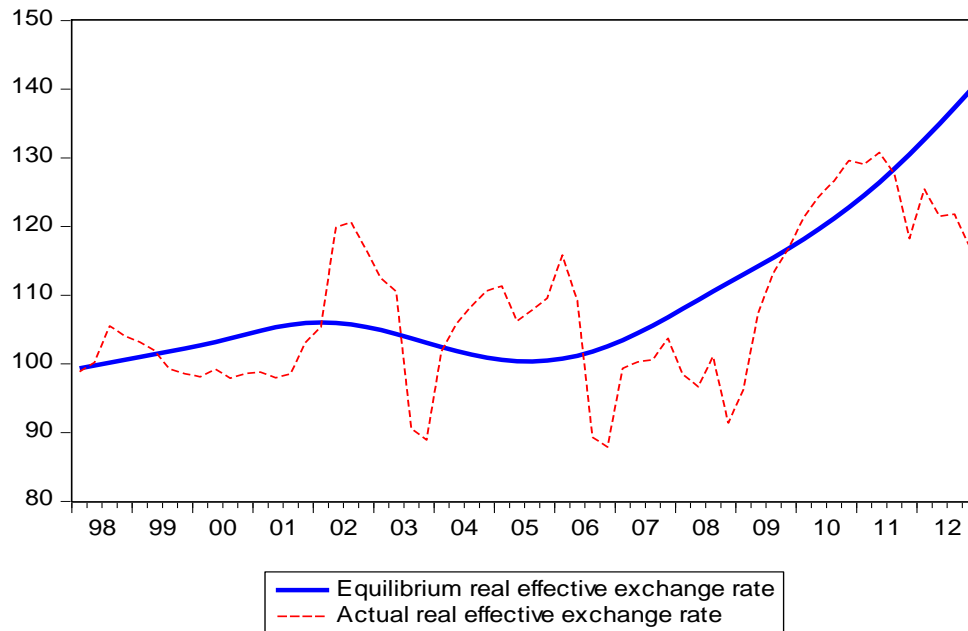

Figure 3: Equilibrium Real Exchange Rate

If the actual real effective exchange rate is above its equilibrium value, it is overvalued. There is an undervaluation of the real exchange rate if the actual real exchange rate is below its equilibrium value. Figure 3 shows that the real exchange rate was overvalued for the periods 1998Q1 – 1999Q2; 2002Q1 – 2003Q2; 2004Q1 – 2006Q3; and 2010Q1 -2011Q3. Real exchange rate undervaluation took place during the periods 1999Q3 – 2002Q1; 2003Q2 – 2004Q1; 2006Q2 – 2009Q3; and 2011Q3 – 2012Q4. The real exchange rate was more overvalued between 1975 and 1989 compared to the period 1990 to 2002. The difference between actual and equilibrium real exchange is real exchange rate misalignment. Real exchange rate misalignment is therefore computed as:

$$MISALIGNMENT_t = REER_t - EREER_t \qquad\qquad (6)$$

Where *MISALIGNMENT* is the real exchange rate misalignment, *REER* is the actual real effective exchange rate, and *EREER* is the equilibrium real effective exchange rate estimated in equation (results in Table 3). If the result of Equation (3) is positive, the real exchange rate is overvalued. The real exchange rate will be undervalued if the result of Equation (6) is negative. Figure 4 presents the results of real exchange rate misalignments. Figure 4 shows that the highest undervaluation was in the first quarter of 2006, while highest overvaluation was in the fourth quarter of 2012.
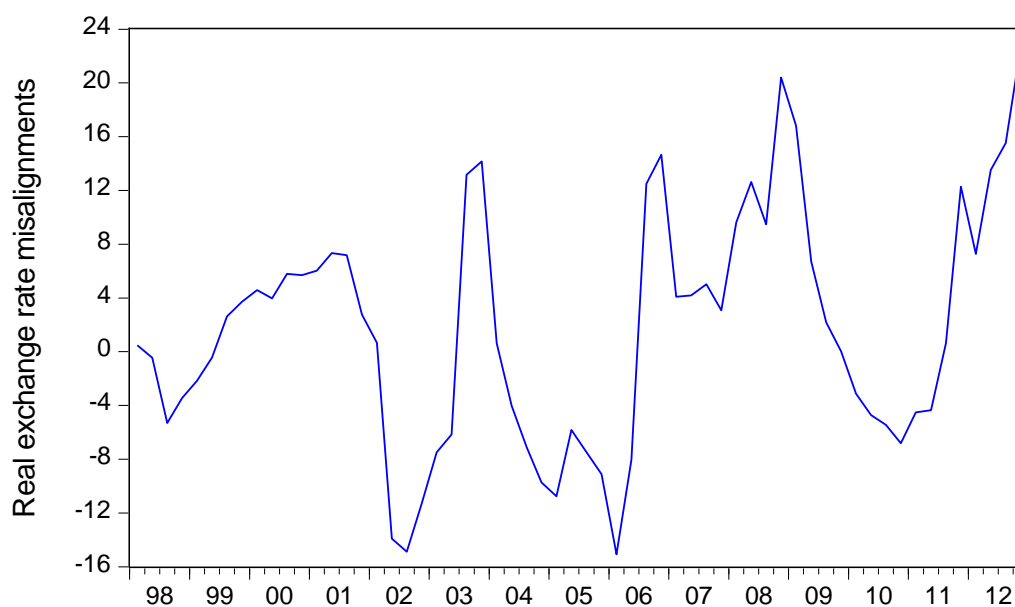
Figure 4: Real Exchange Rate Misalignments

5.   CONCLUSION

The purpose of this paper was to estimate the equilibrium real exchange rate for Namibia. This paper differs from previous papers on Namibia. Previous papers estimated the real exchange rate using even pre-independence annual data. This paper only uses post-independent quarterly data. It has taken into account the fact that Namibia became independent in 1990 and combining pre-independence and post-independence data may not be appropriate. That is because before 1990, all decisions related to the exchange rate were formulated and implemented by South Africa. 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), resource balance, and ratio of investment to GDP. An increase in the ratio of investment to GDP and resource balance causes the real exchange rate to appreciate. Terms of trade is associated with a depreciation of the real exchange rate. This is not in line with the results of previous studies on Namibia. While previous studies on Namibia concluded that the income effect dominates, this study found evidence which suggest that the substitution effect dominated during the period 1998 to 2012. About 14.4 percent of the deviation from the equilibrium real exchange rate is corrected in the short run through adjustment in the real exchange rate itself. This speed of adjustment suggests that it takes about 1.1 years for the real exchange rate to adjust to its long run value (50 percent of the deviations to be eliminated). The speed of adjustment is slightly lower than what was previously obtained for Namibia.

There were some periods of real exchange rate misalignments. That means the real exchange rate experienced some undervaluation and overvaluation. These results indicate that it is important for policy makers to monitor the real exchange rate regularly and realign the real exchange rate to its equilibrium value.

AUTHOR INFORMATION

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REFERENCES

1.   Baffes, J., Elbadawi, I. A., & O'Conell, S. A. (2001). Single equation estimation of the equilibrium real exchange. In L. E. Hinkle & P. J. Montiel (eds.), *Exchange misalignment: Concepts and measurement for developing countries*. New York: Oxford University Press.
2.   Balassa, B. (1990). Incentive policies and export performance in sub-Saharan Africa. *World Development, 18*(3), 383-391.
3.   Coleman, S. (2008). Estimating the equilibrium real exchange rates in the franc zone. *Journal of African Economies, 17*(4), 600-634.
4.   Corden, W. M. (1994). *Economic policy, exchange rates and the international system*. Oxford: Oxford University Press.
5.   Devarajan, S. (1999). Estimates of Real exchange rate misalignment with a simple general-equilibrium model. In L. E. Hinkle & P.J. Montiel (eds), *Exchange rate misalignment: Concepts and measurement for developing countries*. New York: Oxford University Press.
6.   Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica, 49*(4), 1057-1072.
7.   Dornbusch, R. (1974). Tariffs and nontraded goods. *Journal of International Economics, 4*, 177-185.
8.   Edwards, S. (1988a). *Exchange rate misalignment in developing countries*. (World Bank Occasional Paper, No. 2/New Series). Washington, World Bank.
9.   Edwards, S. (1988b). Real and monetary determinants of real exchange rate behaviour: Theory and evidence from developing countries. *Journal of Development Economics, 29*, 311-341.
10.   Edwards, S. (1989): Exchange rate misalignment in developing countries. *World Bank Research Observer, 4*(1), 1-24.
11.   Eita, J. H., & Jordaan, A. C. (2013). Real exchange rate misalignment and economic performance in Namibia. *Corporate Ownership and Control, 10*(2), 352-367.
12.   Johansen, S. (1988). Statistical analysis of cointegrating vectors. *Journal of Economic Dynamics and Control, 12*, 231-254.
13.   Johansen, S. (1995). *Likelihood based inferences in cointegrated vector autoregressive models*. Oxford: Oxford University Press.
14.   MacDonald, R., & Ricci, L. (2004). Estimation of the equilibrium real exchange rate for South Africa. *South African Journal Economics, 72*(2), 282-304.
15.   Mathisen, J. (2003). Estimation of the equilibrium real exchange rate for Malawi. (IMF Working Paper, WP/03/104). Washington DC., International Monetary Fund.
16.   Miyajima, K. (2009). Namibia's real exchange rate performance. *South African Journal of Economics, 77*(2), 228-244.
17.   Mongardini, J. (1998). Estimating Egypt's equilibrium real exchange rate. (IMF Working Paper, WP/98/5). Washington DC. International Monetary Fund.
18.   Montiel, P. J. (1999). Determinants of the long-run equilibrium real exchange rate: An analytical model. In L. E. Hinkle & P. J. Montiel (Eds.), *Exchange rate misalignment: Concepts and measurement for developing countries*. World Bank, Oxford University Press.
19.   Quirk, P. J., Christensen, B. V., Huh, K., & Sazaki, T. (1987). Floating exchange rates in developing countries: Experience with auction and interbank market. (IMF Occasional Paper, 53) Washington D.C.
20.   Williamson, J. (1985). *The exchange rate system*. Washington DC: Institute for International Economics.
21.   Williamson, J. (1994). *Estimating equilibrium exchange rate*. Washington DC: Institute for International Economics.
22.   Zhang, Z. (2001). Real exchange rate misalignment in China: An empirical investigation. *Journal of Comparative Economics, 29*, 80-94.

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