REAL EXCHANGE RATE MISALIGNMENT AND ECONOMIC PERFORMANCE IN NAMIBIA

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Abstract

This paper estimates the real exchange rate misalignment and investigates its impact on economic performance and competitiveness of Namibia for the period 1970 to 2011 using cointegrated vector autoregression methods. The results show that there were periods of overvaluation and undervaluation of the real exchange rate. The analysis reveals that misalignment has a negative impact on the competitiveness and performance of the economy. Maintaining the real exchange rate out of equilibrium reduces economic performance and competitiveness. This suggests that policy makers should monitor the real exchange rate regularly and make the exchange rate policy part of trade promotion strategy.

Keywords: Economic Performance, Namibia, Autoregressions, Trade Promotion Strategy

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1. INTRODUCTION

The determination of whether the real exchange rate is misaligned with respect to its long-run equilibrium is a concern in many developing countries. It is generally acknowledged that one of the most important conditions for improving economic performance and macroeconomic stability is the correction of real exchange rate misalignment. If the real exchange rate is misaligned, it could increase economic instability and distort investment decisions which results in welfare and efficiency costs. According to Edwards (1989:12) real exchange rate misalignment, especially overvaluation, hurts exports and can wipe out the agricultural sector. It can also cause capital flight, which may be optimal from a private perspective but a substantial cost in terms of social welfare.

Real exchange rate misalignments occur in both fixed and floating exchange rate regimes. Asfaha & Huda (2002:1) pointed out that in fixed and adjustable exchange rate systems, real exchange rate misalignment reflects poor policy fundamentals which prevents the real exchange rate from adjusting to changes in the fundamentals. In floating exchange rate regimes bubble factors such as speculative attacks that move the exchange rate too much in relation to economic fundamentals are the primary cause of real exchange rate misalignments.

Despite the fact that real exchange rate is an important variable in the economy, empirical research on the real exchange rate and impact of its misalignment on economic performance in Namibia is limited. This paper studies the real exchange rate and misalignment for Namibia empirically. 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. Like others, 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) showed that real exchange rate misalignment in the CFA Franc Zone was disproportionally 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 Namibia. Namibia has a higher share of primary exports in overall exports in comparison to other members of the CMA. It is likely that the country experienced some real exchange rate misalignments in response to shocks that affected primary products.

To investigate the impact of real exchange rate misalignment on economic performance (proxied by exports, unit labour costs and agricultural sector), the study proceed in three steps. The first step is to estimate the equilibrium real exchange rate. The second step derives the real exchange rate misalignment, which is the difference between the forecasted (equilibrium) real exchange rate and the actual real exchange rate. The third step tests the impact of the real exchange rate misalignment (derived in step two) on economic performance.

The study applies the Johansen (1988, 1995) full information maximum likelihood (FIML) to estimate equilibrium real exchange rate and the resulting real exchange rate misalignment for Namibia. It then applies a vector autoregression (VAR) methodology in order to test the impact of real exchange rate misalignment on economic performance. The study covers the period 1970 to 2011. The analysis shows that real exchange rate is determined by openness, terms of trade, government expenditure, resource balance and ratio of investment to GDP. Increase in all explanatory variables cause the real exchange rate to appreciate. There were periods of overvaluation and undervaluation of the real exchange rate. The speed of adjustment is 1.07 years for 50 percent of the deviation to be eliminated. Real exchange rate misalignment has a negative effect on competitiveness and economic performance. The rest of the paper is organized as follows. Section 2 discusses the literature of the impact of real exchange rate misalignment on economic performance. Section 3 and 4 provide the theoretical and empirical framework. Section 5 presents estimation results, and Section 6 provides the conclusion.

2. IMPACT OF REAL EXCHANGE RATE MISALIGNMENT ON ECONOMIC PERFORMANCE

Real exchange rate misalignment has become a central issue in the analysis of macroeconomic policies in developing countries. As Kamnisky *et al.* (1997: 10) stated, persistent overvaluation of a currency is seen as an early warning of a currency crisis. Real exchange rate misalignment has a detrimental effect on the performance of the economy. A real exchange rate misalignment can result in welfare and efficiency costs. According to Pfeffermann (1985: 17-18) and Edwards (1989:12) real exchange misalignment, especially overvaluation, hurts exports and can wipe out the agricultural sector.

Real exchange rate misalignment, especially overvaluation undermines exports. It is well recognized that a dynamic export sector is important in the course of development. According to Pfeffermann (1985: 18), real exchange rate misalignment such as overvaluation, reduces other countries' incentive to import from that country, and this strikes at the core of the process of development. In addition to its contribution to total production, exports are important in developing countries because the availability of foreign exchange is one of the main determinants of the overall level of economic activity. Even in countries where export accounts for a small percentage of GDP, a shortfall in foreign exchange reserves can strain economic growth. Misalignment undermines incentives to produce for exports because it (export) loses competitiveness, and imports become relatively cheaper because of misalignment (mainly overvaluation). This can happen if import restrictions have not been imposed. According to Pfeffermann (1985) if import restrictions are imposed, imports may not become relatively cheaper. Exports are discriminated against because of inefficiencies and high costs associated with import restrictions, and any attempt to offset anti-export bias through subsidies may be unsuccessful because the budget deficit may be widened.

The effect of real exchange rate misalignment on agriculture was given a special mention by Pfeffermann (1985: 18) because in early stages of development and in many developing countries the agricultural sector is the key employer. The poorest people live in the rural areas and they are dependent on agriculture as a source of income. An overvalued real exchange rate harms the rural poor. According to Pfeffermann, where the internal terms of trade are biased against agriculture, causing migration to the urban areas, the need for imported foodstuffs rises and more pressure will be put on the balance of payments. If there are no adequate incentives on agriculture, the impact on development can be negative because there is a close relationship between agriculture and overall economic development. This can happen even if agriculture accounts for a smaller share of the economy. Pfeffermann extended this argument to other resource-based activities, that misalignment undermines incentives in forestry, mining and agro-industries. If imports are made relatively cheaper, misalignment not only discriminate against the development of domestic technologies, it also encourages relatively capital intensive methods of production through cheaper imports of capital goods which discourages employment creation. The real exchange rate needs to be realistic and conducive to rural prosperity in order to have a positive effect on growth and distribution of income.

Real exchange rate misalignment can cause capital flight, which may be optimal from a private perspective but a substantial cost in terms of social welfare. Although most analysis are more concerned about the impact of overvaluation, undervaluation of the currency can also affect the economy negatively through higher inflation and through discouraging consumption and investment. Kahn (1992: 13) argued that although undervaluation results in build up of reserves that can be used to repay previous debt or as a buffer against future adverse shocks, current account surpluses come at the expense of domestic absorption of resources. Consumption and investment are lower than they would have been. It is not a good development policy to run current account surpluses in order to finance private capital export. Development policy should focus on stimulating investment in the domestic economy instead of investing abroad. Kahn (1992) argued further that an undervalued real exchange rate has an impact on income distribution, in the sense that it redistributes income from labor to capital, but the extent of this would depend on how powerful trade unions are.

Real exchange rate misalignment cause an increase in unit labor cost and this would result in a deterioration of the competitiveness of the country. Asfaha and Huda (2002) investigated the effect of real exchange rate misalignment on unit labor cost in South Africa for the period 1985 to 2000. The investigation revealed that real exchange rate misalignment causes an increase in unit labor cost.

Through its effect on the competitiveness of the tradable sector versus the rest of the world and subsequent impact on investment, real exchange rate misalignment affects growth. Competitiveness, which is defined by Asfaha & Huda (2002: 2) as producing better products at lower costs than other countries competing in the international market, is an important determinant of the country's external payment position. The impact of real exchange rate misalignment on the competitiveness of a country can be a sustained problem and therefore it is crucial for those in policy making to constantly assess and adjust substantial real misalignments. This would help to avoid potential economic problems. In this study, the focus will be on the effect of real exchange rate misalignment on export, agricultural sector, and unit labor costs. They will be discussed later.

3. THEORETICAL FRAMEWORK

This section discusses the theoretical framework to estimate the equilibrium real exchange rate, and investigate the effect of real exchange rate misalignment on economic performance.

3.1 Analytical Issues

The production structure of the model is the key factor that affects the definition of the real exchange rate in the analytical model. The mostly used modeling frameworks are a 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 a government sector. The home country produces and consumes both exportable 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 assumes that government is not subject to capital control, and capital flows in and out of the country.

Fixed nominal exchange rate for commercial transactions characterizes the dual nominal exchange rate, while floating nominal exchange rate characterizes financial transactions. Floating nominal exchange rate takes whatever level is required to achieve asset market equilibrium. The assumption of a 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 (1988b) developed a model of real exchange rate determination for developing countries. This model of real exchange rate determination allows for both nominal and real factors to play a role 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.

3.2 Model Specification (for estimating equilibrium real exchange rate)

The model applied in this study is that of Edwards (1988b). 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 a vector of variables:

$$X_t = (REER, GOV, TOT, OPEN, INVGDP, RESBAL) \qquad (1)$$

where REER, GOV, TOT, OPEN, INVGDP and RESBAL are real effective exchange rate, government expenditure, terms of trade, openness of the economy, ratio of investment to GDP and resource balance, while X_t is *nx1* vector of variables.

3.3 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 (1988a, 1988b) identified among others, the following set of fundamentals affecting the equilibrium real exchange rate:

Government expenditure (GOV) is an important fundamental variable which determines the equilibrium real exchange rate. The effect of change in government expenditure on the equilibrium real exchange rate depends on the composition of the expenditure between tradable and non-tradable goods. If a greater share of the increase in government expenditure is on non-tradable goods there will be an increase in the demand for non-tradable goods in the short run and that raises up the prices of non-tradable goods. This results in real exchange rate appreciation. On the other hand, if a large share of the increase in government expenditure is directed towards tradable goods, the relative price of non-tradable goods will fall and the real exchange rate depreciates (Edwards, 1988b, Asfaha & Huda, 2002, and Mongardini, 1998).

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 (proxied by OPEN) 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 ERER 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 ERER. However, a decrease in tariff or liberalization causes ERER depreciation.

The ratio of investment to GDP (INVGDP) is another important fundamental determinant of the real exchange rate. 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 ERER. 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. Since the model for estimating equilibrium real exchange rate is specified and real exchange rate fundamentals are identified, the next subsection discusses the theoretical framework for investigating the effect of real exchange rate misalignment on economic performance.

Resource balance (RESBAL) is used as a proxy for capital control. Capital control can be defined as any restriction or control that causes impediments on free borrowing and lending to and from the rest of the world. Relaxation of capital control may cause the real exchange rate to appreciate or depreciate. According to Edwards (1988a: 8) if liberalization of capital controls raises the inflows of capital, it leads to the expansion of the monetary base. The expansion of the monetary base results in higher expenditure for all goods including non-tradable. Increase in the demand for non-tradable goods results in an increase in their prices and in order to maintain internal equilibrium in the current period, the equilibrium real exchange rate appreciates. The net effect of capital control on the equilibrium real exchange rate depends on the net inflow of capital.

As discussed in Section 1, the Namibia dollar is linked to the South African rand. This means that the real exchange rate of Namibia is also influenced by South African fundamentals. This may suggest that a model of real exchange rate that includes some South African fundamentals could be appropriate. However, including some South African fundamentals will also be problematic because a priori, there is not of determining which of the South African fundamentals should be included or excluded. For that reason, only Namibian fundamentals will be included in the estimation of the real exchange rate.

3.4 Impact of the Real Exchange Rate Misalignment on Economic Performance and Competitiveness

In order to investigate the effect of real exchange rate misalignment on the competitiveness of the Namibian economy, impulse-response analysis and variance decomposition analysis of cointegrated VAR between the real exchange rate misalignment and some measures of competitiveness will be established. Measures of competitiveness will be proxied by export performance, unit labor costs and the agricultural sector. Impulse response analysis introduced by Sims (1981) shows the behavior of competitiveness in response to one unit increase in real exchange rate misalignment. The variance decomposition analysis shows the percent of variations in competitiveness accounted for by the real exchange rate misalignments.

4. EMPIRICAL FRAMEWORK

4.1 Data

The study uses annual data covering the period 1970-2011. Variables are in logarithms (indicated by *L* at the beginning of each variable). For the 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: $REER=NEER*(CPI/CPIF)^{wj}$, where NEER is the nominal effective exchange rate, CPI is the domestic consumer price index, wj 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 terms of trade (TOT) variable is computed as the ratio of the export price index to import price index and is used to represent changes in the international economic environment. These data are obtained from the Bank of Namibia and Central Bureau of Statistics of Namibia. Trade and exchange restrictions are proxied by openness of the economy (OPEN). This variable is computed as (EXPORT+IMPORT)/GDP. Data for export, import and GDP as well as the ratio of gross domestic investment to GDP (INVGDP) are also obtained from Cornwell *et al*. (1991), Hartmann (1986), the Bank of Namibia and Central Bureau of Statistics of Namibia. Resource balance which is a proxy for capital control is computed as: RESOURCE BALANCE =(EXPORT*TOT – IMPORT)/REAL GDP.

The data on the agricultural sector (LAGRIC) are obtained from the Central Bureau of Statistics, Bank of Namibia as well as Cornwell, Leistner and Esterhuysen (1991). Unit labor cost (LTUNITCOST) was computed as remuneration of employees divided by total output of the Namibian economy. Data for remuneration are taken from the Bank of Namibia, Cornwell *et al*. (1991) and Central Bureau of Statistics, while output data are sourced from Hartmann (1986) and various issues of the Bank of Namibia *Annual Report*. Data on government expenditure and for computation of resource balance were also obtained from the same sources.

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 1970-2011 period in Figure 1. Some key observations revealed include significant real effective exchange rate depreciation since 1985. This depreciation accelerated until 2002, before appreciation during 2003 – 2011 period. Openness increased from 1970 to 1983 and has been on a decreasing trend during the period 1984 to 2004. I then increased between the 2005 to 2011 period. The ratio of investment to GDP has been on a decreasing trend until the late 1980s. This was a pre-independence and characterized by political instability. This ratio increased during the 1990 - 2011 period. The period after 1990 is post – independence and politically stable. Hence, there was increase in the ratio of investment to GDP. Terms of trade deteriorated sharply in 1974 -1975 and improved between 1976 and 1986. It fluctuated between 1990 and 2011. Government expenditure has been on the increasing trend for the entire period, while resource balance fluctuated during the same period. Resource balance increased sharply between 2003 and 2010. It decreased in 2011.

4.2 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 fundamental 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 econometric methodology corrects for autocorrelation and endogeneity parametrically using a vector error correction mechanism (VECM) specification.

The study also employs the VAR methodology to test the impact of real exchange rate misalignment on economic performance and competitiveness. After estimating the equilibrium real exchange rate and the resulting real exchange rate misalignment, this study establishes impulse response analysis and variance decomposition techniques of cointegrated VAR between misalignment and measures of economic performance and competitiveness.

4.3 Univariate Characteristics of the Data

The estimation procedure entails the following: unit root tests, test for cointegration in the context of VAR, re-parameterization 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.

5. ESTIMATION RESULTS

5.1 Real Exchange Rate and Fundamental Variables

5.1.1 Testing for Reduced Rank

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

Figure 1. Real exchange rate and fundamental variables (all in logs)

Table 1. Johansen cointegration test results

Null hypothesis	Alternative hypothesis		0.05 Critical value	Probability value [b]
		Trace statistic		
r=0	r=1	113.7714[a]	95.754	0.002
r=1	r=2	75.248 [a]	69.819	0.017
r=2	r=3	45.629	47.856	0.079
r=3	r=4	23.573	29.797	0.219
r=4	r=5	9.400	15.495	0.329
r=5	r=6	1.112	3.841	0.292
		Maximum Eigenvalue statistic		
r=0	r>0	38.525	40.078	0.074
r≤1	r>1	29.618	33.877	0.148
r≤2	r>2	22.056	27.584	0.218
r≤3	r>3	14.173	21.132	0.351
r≤4	r>4	8.288	14.265	0.350
r≤5	r>5	1.112	3.841	0.292

[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 in Table 1 show that there are two 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 visualized as follows (VECM of order one):

$$\begin{bmatrix} \Delta LREER_t \\ \Delta LTOT_t \\ \Delta LINVGDP_t \\ \Delta LGOV_t \\ \Delta LOPEN_t \\ \Delta LRESBAL_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \\ \mu_5 \\ \mu_6 \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} & \gamma_{15} & \gamma_{16} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} & \gamma_{25} & \gamma_{26} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} & \gamma_{35} & \gamma_{36} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} & \gamma_{45} & \gamma_{46} \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & \gamma_{55} & \gamma_{56} \\ \gamma_{61} & \gamma_{62} & \gamma_{63} & \gamma_{64} & \gamma_{65} & \gamma_{66} \end{bmatrix} \begin{bmatrix} \Delta LREER_{t-1} \\ \Delta LTOT_{t-1} \\ \Delta LINVGDP_{t-1} \\ \Delta LGOV_{t-1} \\ \Delta LOPEN_{t-1} \\ \Delta LRESBAL_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \\ \alpha_{51} & \alpha_{52} \\ \alpha_{61} & \alpha_{62} \\ \alpha_{71} & \alpha_{72} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{21} & \beta_{31} & \beta_{41} & \beta_{51} & \beta_{61} & \beta_{71} \\ \beta_{12} & \beta_{22} & \beta_{32} & \beta_{42} & \beta_{52} & \beta_{62} & \beta_{72} \end{bmatrix} \begin{bmatrix} LREER_{t-1} \\ LTOT_{t-1} \\ LINVGDP_{t-1} \\ LGOV_{t-1} \\ LOPEN_{t-1} \\ LRESBAL_{t-1} \\ CONSTANT \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (2)$$

5.1.2 Long-run Restrictions

The long-run restrictions were done in line with the Edwards model in the theoretical framework. The structural approach to time series modeling 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):

$$\begin{bmatrix} \Delta LREER_t \\ \Delta LTOT_t \\ \Delta LINVGDP_t \\ \Delta LGOV_t \\ \Delta LOPEN_t \\ \Delta LRESBAL_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \\ \mu_5 \\ \mu_6 \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} & \gamma_{14} & \gamma_{15} & \gamma_{16} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} & \gamma_{25} & \gamma_{26} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} & \gamma_{35} & \gamma_{36} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & \gamma_{44} & \gamma_{45} & \gamma_{46} \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & \gamma_{55} & \gamma_{56} \\ \gamma_{61} & \gamma_{62} & \gamma_{63} & \gamma_{64} & \gamma_{65} & \gamma_{66} \end{bmatrix} \begin{bmatrix} \Delta LREER_{t-1} \\ \Delta LTOT_{t-1} \\ \Delta LINVGDP_{t-1} \\ \Delta LGOV_{t-1} \\ \Delta LOPEN_{t-1} \\ \Delta LRESBAL_{t-1} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \\ \alpha_{51} & \alpha_{52} \\ \alpha_{61} & \alpha_{62} \\ \alpha_{71} & \alpha_{72} \end{bmatrix} \begin{bmatrix} 1 & 0 & \beta_{31} & \beta_{41} & \beta_{51} & \beta_{61} & \beta_{71} \\ 0 & 1 & \beta_{32} & \beta_{42} & \beta_{52} & \beta_{62} & \beta_{72} \end{bmatrix} \begin{bmatrix} LREER_{t-1} \\ LTOT_{t-1} \\ LINVGDP_{t-1} \\ LGOV_{t-1} \\ LOPEN_{t-1} \\ LRESBAL_{t-1} \\ CONSTANT \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (3)$$

Since there are more than one cointegrating vector, 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 cointegrating 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 a real exchange rate equation without a terms of trade variable is possible. In the second cointegrating relation (the terms of trade equation, LTOT) the real exchange rate variable does no play an important role in the determination of the terms of trade, implying that one 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:

$$\begin{aligned} LREER = {} & 0.641LINVGDP + 0.047LGOV + 0.735LRESBAL + 0.414LOPEN - 0.782 \\ & (6.028) \qquad\qquad (1.738) \qquad\qquad (4.896) \qquad\qquad (1.995) \end{aligned} \quad (4)$$

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

- A one percent increase in ratio of investment to GDP is associated with an appreciation of the real exchange rate by 0.64 percent. This is similar to the results obtained by Mathisen (2003) for Malawi.
- A one percent increase in government expenditure causes the real exchange rate to appreciate by 0.047 percent. This is comparable to the results obtained by Elbadawi (1994) for Chile and India, and by Edwards (1988) for developing countries.
- A one percent increase in resource balance (a proxy for capital control) causes the real exchange rate to appreciate by 0.735 percent. This coefficient can also be favorably compared to those obtained by Elbadawi (1994) for Chile, Ghana and India.
- A one percent increase in openness is associated with an appreciation of the real effective exchange rate by 0.414 percent. This is consistent with the results obtained by Asfaha and Huda (2002) for South Africa, and Zhang (2001) for China.

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

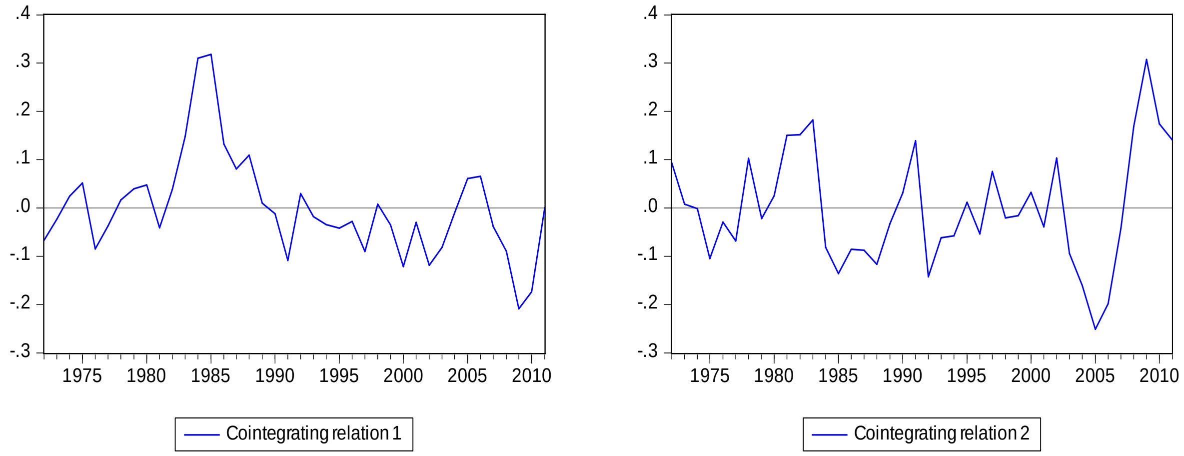
$$LTOT = -2.787LINVGDP - 0.773LGOV - 4.502LRESBAL - 4.153LOPEN + 38.605 \quad (5)$$
$$(-4.854) \qquad (-5.289) \qquad (-5.556) \qquad (-3.711)$$

The results of Equation (5) can be summarized as follows:

- An increase in investment to GDP causes terms of trade to decrease. A one percent increase in investment to GDP causes terms of trade to decrease by 2.787 percent.
- A one percent increase in government expenditure causes terms of trade to decrease by 0.773 percent.
- An increase in resource balance by one percent is associated with a decrease in the terms of trade by 4.502 percent.
- A one percent increase in openness causes the terms of trade to decrease by 4.152 percent.

All t-statistics are statistically significant, and the results are consistent with *a priori* expectations and literature. However, the second cointegrating vector is not important. The most important is the results of the first cointegrating vector (the real exchange rate equation). That is because the focus of this study is on the real exchange rate. Cointegration relations are plotted in Figure 2. They appear to be stationary.

Figure 2. Cointegration Relations



5.1.3 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 a cointegrated system, a variable not responding to the discrepancy from the long-run equilibrium 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 normalized variable in the long run equation to equilibrium.

Table 2. Exogeneity test

	Cointegration equation 1	Cointegration equation 2.
ΔLREER	-0.477	-0.059
	(-5.687)	(-3.955)
ΔLTOT	0.000	0.000
ΔLINVGDP	0.000	0.000
ΔLGOV	0.000	0.063
		(3.502)
ΔLRESBAL	0.000	-0.061
		(-5.015)
ΔLOPEN	0.000	0.000

LR test for binding restriction (rank=2): χ^2 (8) 8.496, probability 0.131

As shown in Table 2, the exogeneity test indicates that in the real effective exchange rate equation (Cointegration equation 1) terms of trade, openness, ratio of investment to GDP, government expenditure and resource balance 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 and resource balance play a role in bringing the terms of trade to equilibrium. Government expenditure moves terms of trade away from equilibrium. Other variables are weakly exogenous.

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 a 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 -0.477, the cointegrating relationship is stable. It shows that 47.77 percent of the gap between real exchange rate and its equilibrium value is eliminated in the short run. This speed of adjustment is higher than that obtained for South Africa by MacDonald and Ricci (2003) using a similar framework. The number of years required to eliminate a given misalignment can be derived from these estimates. The time required to remove or dissipate *x* percent of a shock (disequilibrium) is determined as: $(1-\beta)^t = (1-x)$, where *t* is the required number of periods and β is the coefficient of the error correction term. This implies that the adjustment takes 1.07 years for 50 percent of the deviations to be eliminated. This adjustment speed is faster than the 2.1 years obtained by MacDonald and Ricci (2003) for South Africa, although the data were quarterly. It is lower than the speed of adjustment obtained by Baffes *et al*. (1999) for Burkina Faso, but higher than 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 1.07 years is also lower than that obtained by Mathisen (2003) for Malawi. The adjustment period for Malawi is 11 months although the data for Malawi was quarterly.

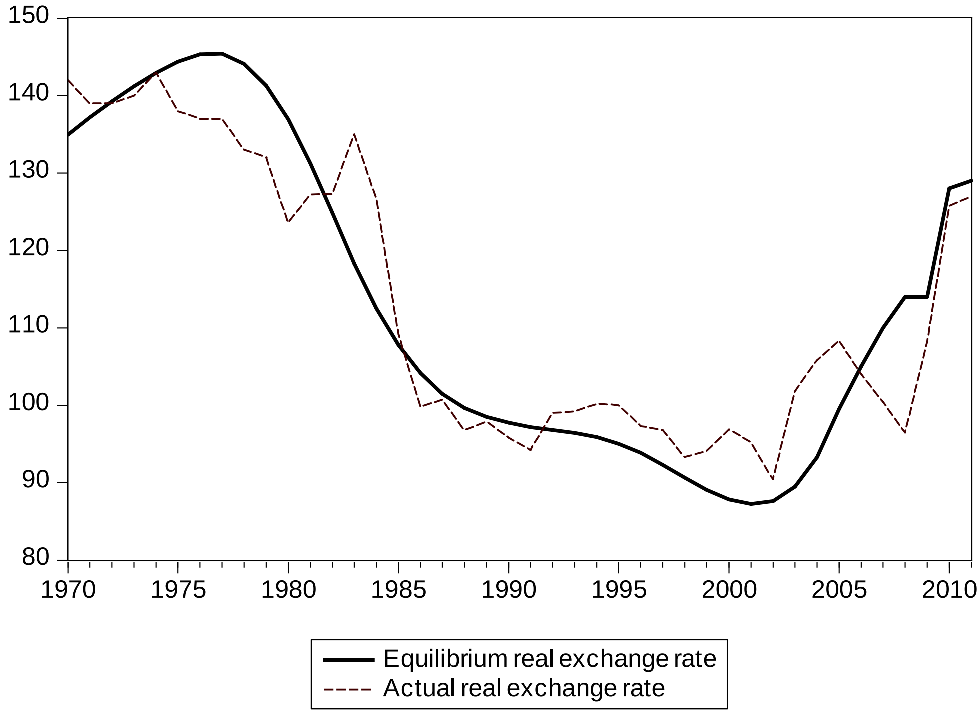
5.1.4 Robustness of the Results

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

5.1.5 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 (in Equation 4) on the permanent values of the fundamentals. A Hodrick-Prescott 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 3 shows the actual and equilibrium real exchange rate.

Figure 3. Actual and Equilibrium real effective exchange rate



The real exchange rate was overvalued during the periods 1970-1972, 1982-1985, 1992 - 2006. The highest overvaluation was during the period 1980, 2007, and 2008. The real exchange rate was undervalued during the periods 1970-1971, 1983-1985 and 1992 to 2005. The highest undervaluation happened in 1983 – 1984 and 2003 to 2004. Misalignment of the real exchange rate is shown in Figure 4.

Figure 4. Misalignment of the real effective exchange rate

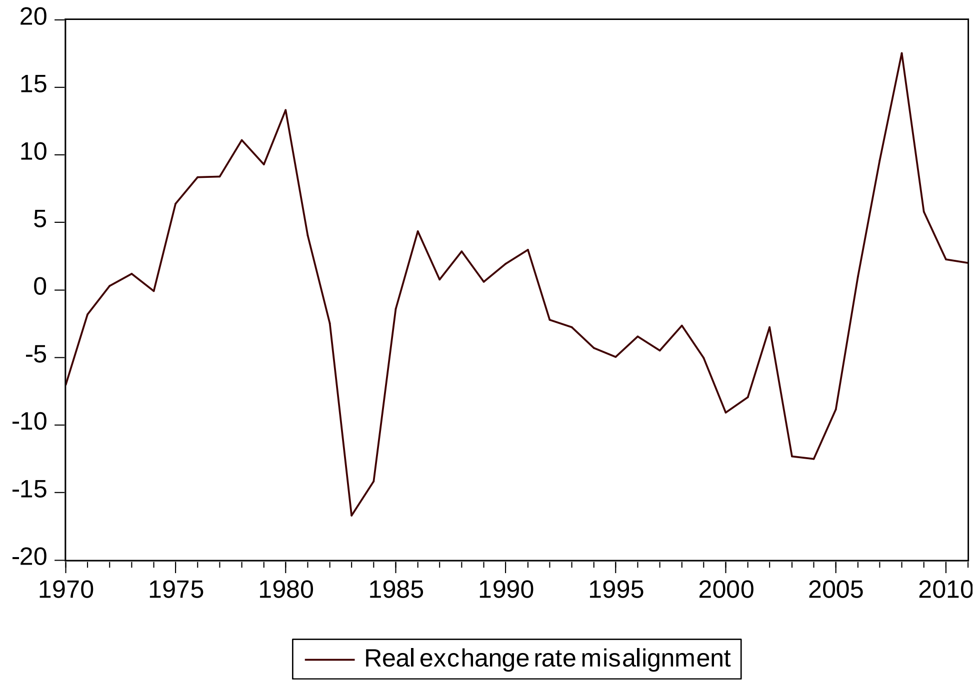


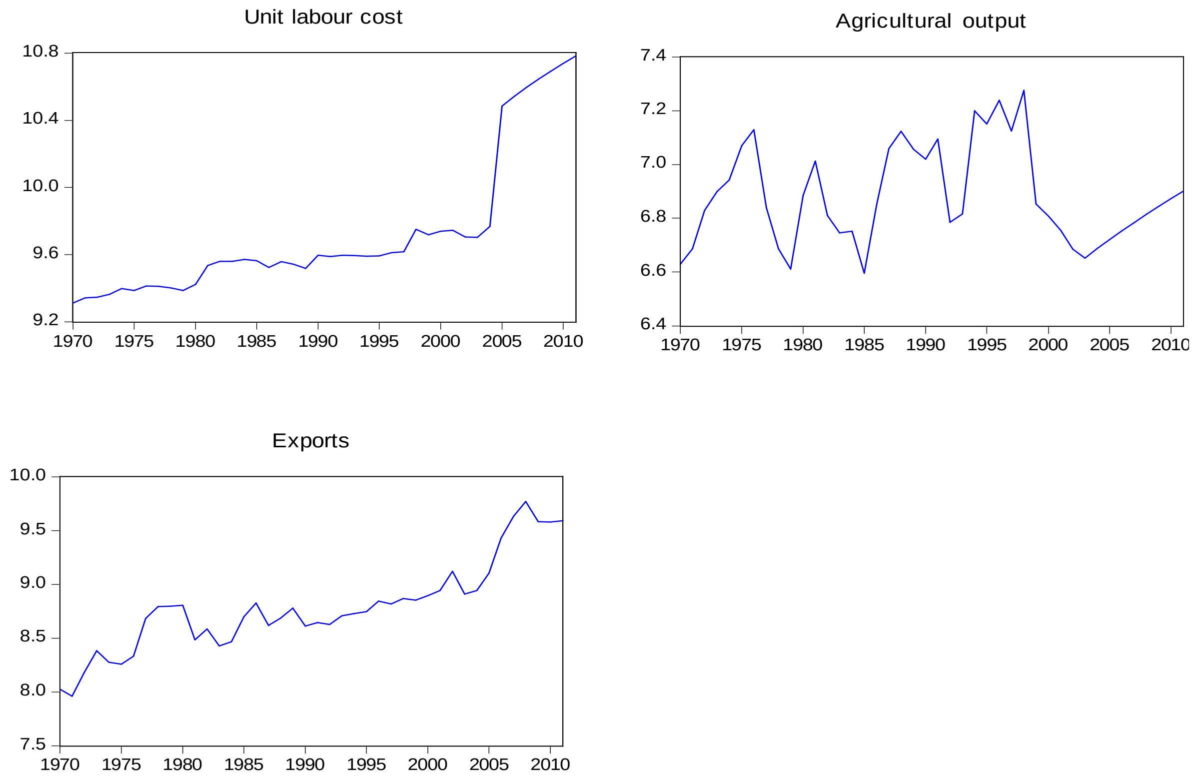
Figure 4 shows that the highest misalignment occurred in 1980 and 2002. Real exchange rate misalignment was low between 1987 and 2001. The period 1970 to 1989 is associated with political instability and challenges for independence. The period 2001 to 2002 is associated with the weakening of the Namibia dollar. The Namibia dollar strengthened during 2003 to 2004.

5.2 Results of the Impact of the Real Exchange Rate Misalignment on Economic Performance and Competitiveness

This subsection investigates the impact of real exchange rate misalignment computed in subsection 5.1 on economic performance. The three variables (export, agricultural sector and unit labor costs) measuring economic performance are plotted in Figure 5. It shows that unit labor cost in Namibia has risen since 1970, while export has also increased since 1970. The performance of the agricultural sector has been erratic between 1970 and 2011. Export has been on an increasing trend between 1970 and 2011.

The estimation procedure is as follows. Variables are tested for stationarity first. Second, a reduced-form VAR is estimated and diagnostic tests performed. Third, a Johansen cointegration test is performed. Fourth, a VECM is performed and finally impulse response and variance decomposition are performed. The diagnostic statistics show that the VAR is stable as no unit lies outside the unit circle. There is no serial correlation and no heteroscedasticity. The error term is white noise. The diagnostic tests of the VAR are not presented here but obtainable from the authors on request. The variables were formally tested for stationarity or unit root. With the exception of agricultural output, all variables are non-stationary in levels. The null hypothesis of a unit root cannot be rejected for the three variables. They are integrated of order one or I(1). The results of unit root test are presented in the Appendix.

Figure 5. Measures of economic performance and competitiveness (variables in log form)



5.2.1 Testing for Reduced Rank

After testing for a unit root, the next step is to check whether the variables are cointegrated. If the variables are I(1) and cointegrated, the best way to do a VAR in a non-stationary world is to use the standard Johansen test and model a vector error correction model (VECM). The parameters of interest will have standard distribution in this context. On the other hand, if the variables are non-stationary and are not cointegrated, then the VAR in first differences imposes the appropriate restrictions. The results of the cointegration test presented in Table 3 shows that there is one cointegrating vector. Since the variables (export, misalignment, unit labour cost) are non-stationary in levels and there is one cointegrating vector, VAR in first differences would be inappropriately specified. VECM need to be constructed to structural analysis in the VECM context. VECM is a restricted VAR designed for use with non-stationary variables that are known to be cointegrated.

Table 3. Cointegration test between misalignment, and measures of economic performance

Null hypothesis	Alternative hypothesis		0.05 Critical value	Probability value [b]
		Trace statistic		
r=0	r=1	54.795[a]	54.079	0.043
r=1	r=2	33.918	35.195	0.068
r=2	r=3	17.628	20.262	0.111
r=3	r=4	3.913	9.165	0.425
		Maximum Eigenvalue statistic		
r=0	r>0	20.876	28.588	0.348
r≤1	r>1	16.291	22.300	0.278
r≤2	r>2	13.714	15.892	0.107
r≤3	r>3	3.913	9.165	0.259

[a] Denotes rejection of the null hypothesis at the 0.05 level
[b] MacKinnon-Haug-Michelis (1999) p-values

5.2.2 Impulse response functions

In accordance with Johansen (1988), a VECM is constructed. The ordering of the variables is dictated by the need to have meaning impulse response functions from the VECM. The VECM orthogonalization is the Cholesky decomposition which is a lower triangular. The variables are ordered as: unit labor cost, agricultural output, misalignment and export. The first variable (unit labor cost) is not affected by any other variable in the VAR or it is the least affected contemporaneously, and the last variable (export) is the one that is affected by all variables in the VAR. The impulse response results are presented in Figure 6.

Figure 6. Impulse response of misalignment and economic performance

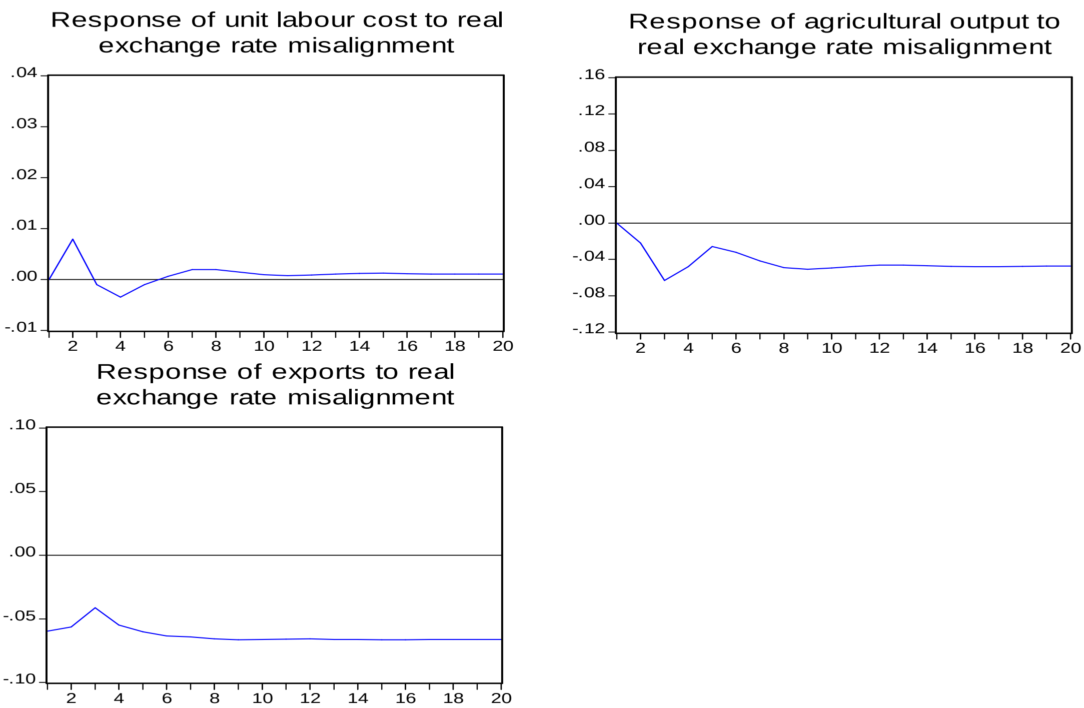
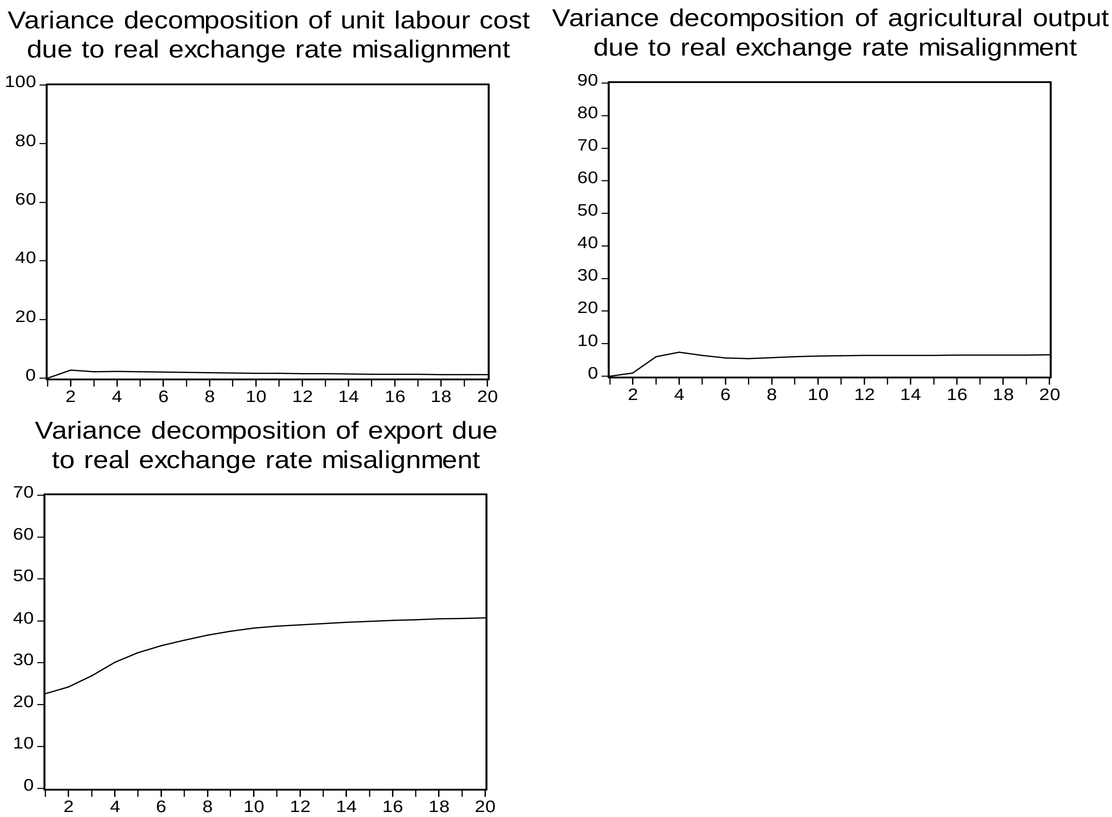


Figure 6 shows the response of measures of economic performance or trade competitiveness to a positive one standard deviation shock in real exchange rate misalignment. The results show that real exchange rate misalignment causes unit labor cost to increase. It causes a decrease in agricultural output and a decrease in export. The results are in accordance with theoretical prediction. They are also fairly comparable to those obtained by Asfaha & Huda (2002) for South Africa.

5.2.3 Variance decomposition Analysis

Figure 7 presents the forecast variance decomposition to assess the importance of real exchange rate misalignment in accounting for variation in measures of economic performance or trade competitiveness at various time horizons. The results show that in the short run real exchange rate misalignment account for smaller variation in unit labor cost and agricultural output. It accounts for about 2 percent of the variation in unit labor cost and just over 6 percent of the variation in agricultural output. The real exchange rate misalignment accounts for about 22 percent of the variation in the short run and about 40 percent of variation of export in the long run. These results can be interpreted that real exchange rate misalignment accounts for approximately 2 to 36 percent of the long-run variation in measures of economic performance or trade competitiveness of the Namibian economy.

Figure 7. Variance decomposition of measures of economic performance and competitiveness



6. CONCLUSION

The objective of this paper was to estimate the equilibrium real exchange rate and resulting real exchange rate misalignment, and then test the impact of misalignment on economic performance for Namibia. The real exchange rate is determined by openness, terms of trade, government expenditure, resource balance and ratio of investment to GDP. Increase in both explanatory variables cause the real exchange rate to appreciate. Real exchange rate misalignment was computed and the results showed that there were periods of overvaluation and undervaluation. This suggests that it is important for policymakers to monitor the real exchange rate regularly and ensure that it does not diverge widely from its equilibrium value. The VAR methodology was implemented to test the impact of real exchange rate misalignment on economic performance. The results are consistent with *a priori* expectations. Real exchange rate misalignment causes an increase in unit labor costs, and a decrease in agricultural output and export. Although variance decomposition analysis shows that real exchange rate misalignment accounts for more than 30 percent of the variation in export, it accounts for less than 20 percent of the variation in unit labor cost and agricultural output. The results confirm the negative effect of real exchange rate misalignment on the competitiveness of the Namibian economy.

It is important for the country to achieve a high level of export and remain competitive in order to have a sustainable level of growth. Exchange rate policy in this regard plays an important role in the expansion of exports. This study indicated that real exchange rate misalignment hampers export and competitiveness. Policy makers should use the exchange rate as part of the export promotion strategy.

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APPENDIX

Table A1. Unit root test

Variable	Model	ADF	Joint Test(F-statistic)	Conclusion
LAGRIC	constant and trend	-2.595	Φ_3 =2.925	
	constant	-2.773*		I(0)
LEXPORT	constant and trend	-3.079	Φ_3 =3.654	
	constant	-2.283	Φ_1 =2.020	
	none	1.077		I(1)
LREER	constant and trend	-0.823	Φ_3=1.065	
	constant	-1.417	Φ_1=1.629	
	none	-1.144		I(1)
LINVGDP	constant and trend	-2.044	Φ_3=1.606	
	constant	-1.723	Φ_1=1.700	
	none	-0.548		I(1)
LOPEN	constant and trend	-2.058	Φ_3=3.838	
	constant	-0.280	Φ_1=2.087	
	none	-1.146		I(1)
LTOT	constant and trend	-3.291*		I(0)
MISALIGNMENT	constant and trend	-0.367	Φ_3=2.686	
	constant	-0.614	Φ_1=0.377	
	none	0.731		I(1)
LTUNITCOST	constant and trend	-3.158	Φ_3=5.862	
	constant	-0.921	Φ_1=1.993	
	none	2.044		I(1)
LRESBAL	constant and trend	-3.888**		I(0)
LGOV	constant and trend	-1.515	Φ_3=2.207	
	constant	-1.543	Φ_1=2.382	
	none	7.678		I(1)

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

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

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