

## **CHAPTER 6. EMPIRICAL RESULTS OF REAL EXCHANGE RATE MISALIGNMENT AND ECONOMIC PERFORMANCE**

### **6.1 Introduction**

This chapter estimates the impact of real exchange rate misalignment (which was computed in Chapter 5) on some measure of economic performance. It then applies the VAR methodology to test the impact of these misalignments on some measures of economic performance. The chapter is organised as follows. Section 6.2 discusses the methodology for testing the impact of real exchange rate misalignment on economic performance. Section 6.3 presents the results of misalignment computed from the three-good model. Section 6.4 presents results for misalignments computed from the Cashin *et al.* model, and Section 6.5 concludes.

### **6.2 Impact of Real Exchange Rate Misalignment on Namibia's Economic Performance and Competitiveness**

In order to investigate the effect of the real exchange rate misalignment on the competitiveness of the Namibian economy impulse-response 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, capital outflows, unit labour costs and the performance of the agricultural sector. Impulse response analysis shows the behaviour of competitiveness in response to one unit increase in the real exchange rate misalignment. The variance decomposition analysis shows the percentage of variations in competitiveness accounted for by the real exchange rate misalignments. The VAR methodology was employed by Asfaha and Huda (2002) to investigate the impact of real exchange rate misalignment on

the competitiveness of the South African economy. To explain the VAR methodology, this study uses covariance stationary bivariate dynamic simultaneous equations model of  $x$  and  $y$  (see Enders, 2004: 240-318; Giannini, 1992: 1-82):

$$\begin{aligned}x_t &= \gamma_{10} - b_{xy}y_t + \gamma_{11}x_{t-1} + \gamma_{12}y_{t-1} + \varepsilon_{xt} \\y_t &= \gamma_{20} - b_{yx}x_t + \gamma_{21}x_{t-1} + \gamma_{22}y_{t-1} + \varepsilon_{yt}\end{aligned}\tag{24}$$

Where ;

Mean (Expected value):

$$\begin{pmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{pmatrix} = E \begin{bmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{bmatrix} = \begin{bmatrix} E(\varepsilon_{xt}) \\ E(\varepsilon_{yt}) \end{bmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}\tag{25}$$

Var-covariance matrix:

$$E[\varepsilon_{xt}\varepsilon_{yt}'] = \begin{bmatrix} E(\varepsilon_{xt}^2) & E(\varepsilon_{xt}\varepsilon_{yt}) \\ E(\varepsilon_{yt}\varepsilon_{xt}) & E(\varepsilon_{yt}^2) \end{bmatrix} = \begin{bmatrix} \sigma_x^2 & 0 \\ 0 & \sigma_y^2 \end{bmatrix} = M\tag{26}$$

Distribution:

$$\begin{pmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{pmatrix} \sim iid \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_x^2 & 0 \\ 0 & \sigma_y^2 \end{pmatrix} \right]\tag{27}$$

In this case both variables are potentially endogenous. The sample consist of observation from  $t = 1, \dots, T$ , with initial values  $(x_0, y_0)$ . Equation (24) above is called a structural VAR because it is assumed to be derived from some underlying economic theory. The exogenous error terms  $(\varepsilon_{xt}, \varepsilon_{yt})$  are independent and are interpreted as structural innovations.

The  $\varepsilon_{xt}$  are interpreted as capturing unexpected shocks to  $x$  that are uncorrelated with  $\varepsilon_{yt}$  (the unexpected shocks  $y$ ). In other words,  $\varepsilon_{xt}$  represents all factors other than  $y$  that influence  $x$ . The same interpretation can be given to  $\varepsilon_{yt}$  i.e. it represents all factors that influence  $y$  other than  $x$ .  $b_{xy}$  represents the effects of current (contemporaneous)  $y$  on  $x$  and  $b_{yx}$  represents the effects of current (contemporaneous)  $x$  on  $y$ . The endogeneity of  $x_t$  and  $y_t$  in Equation (24) is determined by the values of  $b_{xy}$  and  $b_{yx}$ . The reduced form

VAR is obtained by transferring contemporaneous relationships to the left-hand side of Equation (24):

$$\begin{aligned}x_t + b_{xy}y_t &= \gamma_{10} + \gamma_{11}x_{t-1} + \gamma_{12}y_{t-1} + \varepsilon_{xt} \\b_{yx}x_t + y_t &= \gamma_{20} + \gamma_{21}x_{t-1} + \gamma_{22}y_{t-1} + \varepsilon_{yt}\end{aligned}\tag{28}$$

This is written in matrix form as:

$$\begin{bmatrix} 1 & b_{xy} \\ b_{yx} & 1 \end{bmatrix} \begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} \gamma_{10} \\ \gamma_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{bmatrix}\tag{29}$$

Equation (28) can also be written in compact form as:

$$B_0 z_t = \gamma_0 + \Gamma_1 z_{t-1} + \varepsilon_t$$

where;

$$\begin{aligned}B_0 &= \begin{bmatrix} 1 & b_{xy} \\ b_{yx} & 1 \end{bmatrix} \\z_t &= \begin{bmatrix} x_t \\ y_t \end{bmatrix} \\\gamma_0 &= \begin{bmatrix} \gamma_{10} \\ \gamma_{20} \end{bmatrix} \\\Gamma_1 &= \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \\\varepsilon_t &= \begin{bmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{bmatrix}\end{aligned}$$

In order to get  $z_t$  on the right hand side, pre-multiply with  $B_0^{-1}$

$$B_0^{-1}B_0 z_t = B_0^{-1}\gamma_0 + B_0^{-1}\Gamma_1 z_{t-1} + B_0^{-1}\varepsilon_t$$

$$B_0^{-1}B_0 = I$$

$$z_t = B_0^{-1}\gamma_0 + B_0^{-1}\Gamma_1 z_{t-1} + B_0^{-1}\varepsilon_t\tag{30}$$

When written in matrix form matrix form, Equation (30) is the same as:

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} 1 & b_{xy} \\ b_{yx} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \gamma_{10} \\ \gamma_{20} \end{bmatrix} + \begin{bmatrix} 1 & b_{xy} \\ b_{yx} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} 1 & b_{xy} \\ b_{yx} & 1 \end{bmatrix}^{-1} \begin{bmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{bmatrix} \quad (31)$$

This is a reduced form of the structural VAR and is also referred to as standard VAR model. If the inverse of  $B_0$  exists Equation (30) can be written as:

$$z_t = a_0 + A_1 z_{t-1} + e_t, \quad e_t = B_0^{-1} \varepsilon_t \sim iid(0, \sigma^2) \quad (32)$$

This is the equation used when estimating of Johansen cointegration method.

$$E[e_t e_t'] = B_0^{-1} M B_0^{-1} = \sigma^2$$

The reduced form parameters are:

$$a_0 = B_0^{-1} \gamma_0$$

$$A_1 = B_0^{-1} \Gamma_1$$

If the process  $z_t$  is stationary it has a Wold decomposition form of:

$$z_t = \mu + \Pi(L) e_t, \quad \Pi(L) = \sum_{k=0}^{\infty} \Pi_k L^k, \quad \Pi_0 = I \quad (33)$$

It is important to note that  $e_t = B_0^{-1} \varepsilon_t$ ,  $\varepsilon_t \sim iid(0, M)$  are the structural exogenous shocks,

$$z_t = \mu + \Pi(L) B_0^{-1} \varepsilon_t \quad (34)$$

Equation (34) can be rewritten as an orthogonal vector moving average form:

$$z_t = \mu + \eta(L) \varepsilon_t, \quad \eta(L) = \Pi(L) B_0^{-1}, \quad \eta_0 = B_0^{-1} \quad (35)$$

$$\eta(L) = B_0^{-1} + \Pi_1 B_0^{-1} L + \Pi_2 B_0^{-1} L^2 + \dots$$

$$\eta(L) = \eta_0 + \eta_1 L + \eta_2 L^2 + \dots$$

$$\text{or } \eta_i = \Pi_i B_0^{-1}$$

and this can be rewritten in a matrix form as:

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix} + \begin{bmatrix} \eta_{xx,0} & \eta_{xy,0} \\ \eta_{yx,0} & \eta_{yy,0} \end{bmatrix} \begin{bmatrix} \varepsilon_{xt} \\ \varepsilon_{yt} \end{bmatrix} + \begin{bmatrix} \eta_{xx,1} & \eta_{12,1} \\ \eta_{yx,1} & \eta_{yy,1} \end{bmatrix} \begin{bmatrix} \varepsilon_{xt-1} \\ \varepsilon_{yt-1} \end{bmatrix} + \dots \quad (36)$$

This illustration gives  $z_t$  as a function of past values of the orthogonal shocks  $\varepsilon_t$  instead of the nonorthogonal shocks  $e_t$ . Iterating out  $k$  periods, yields:

$$\begin{bmatrix} x_{t+k} \\ y_{t+k} \end{bmatrix} = \begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix} + \begin{bmatrix} \eta_{xx,0} & \eta_{xy,0} \\ \eta_{yx,0} & \eta_{yy,0} \end{bmatrix} \begin{bmatrix} \varepsilon_{x,t+k} \\ \varepsilon_{y,t+k} \end{bmatrix} + \dots + \begin{bmatrix} \eta_{xx,k} & \eta_{xy,k} \\ \eta_{yx,k} & \eta_{yy,k} \end{bmatrix} \begin{bmatrix} \varepsilon_{x,t} \\ \varepsilon_{y,t} \end{bmatrix} + \dots \quad (37)$$

This yields structural dynamic multipliers which can be interpreted as:

$$\frac{\partial x_{t+k}}{\partial \varepsilon_{x,t}} = \eta_{xx,k} \quad (38)$$

This is the effect of one unit change in the structural innovations of  $x_t$  at period  $t$  ( $\varepsilon_{xt}$ ) on consumption at period  $t+k$  ( $x_{t+k}$ ).

$$\frac{\partial x_{t+k}}{\partial \varepsilon_{y,t}} = \eta_{xy,k} \quad (39)$$

It is the effect of one unit change in the structural innovations of  $y_t$  at period  $t$  ( $\varepsilon_{yt}$ ) on  $x_t$  at period  $t+k$  ( $x_{t+k}$ ).

$$\frac{\partial y_{t+k}}{\partial \varepsilon_{x,t}} = \eta_{yx,k} \quad (40)$$

This is the effect of 1 unit change in the structural innovations of  $x_t$  at period  $t$  ( $\varepsilon_{xt}$ ) on income at period  $t+k$  ( $y_{t+k}$ ).

$$\frac{\partial y_{t+k}}{\partial \varepsilon_{y,t}} = \eta_{yy,k} \quad (41)$$

This is the effect of 1 unit change in the residuals of income at period  $t$  ( $e_{yt}$ ) on income at period  $t+k$  ( $y_{t+k}$ ). Equations (38) to (41) show that in this bivariate model there four impulse response functions.

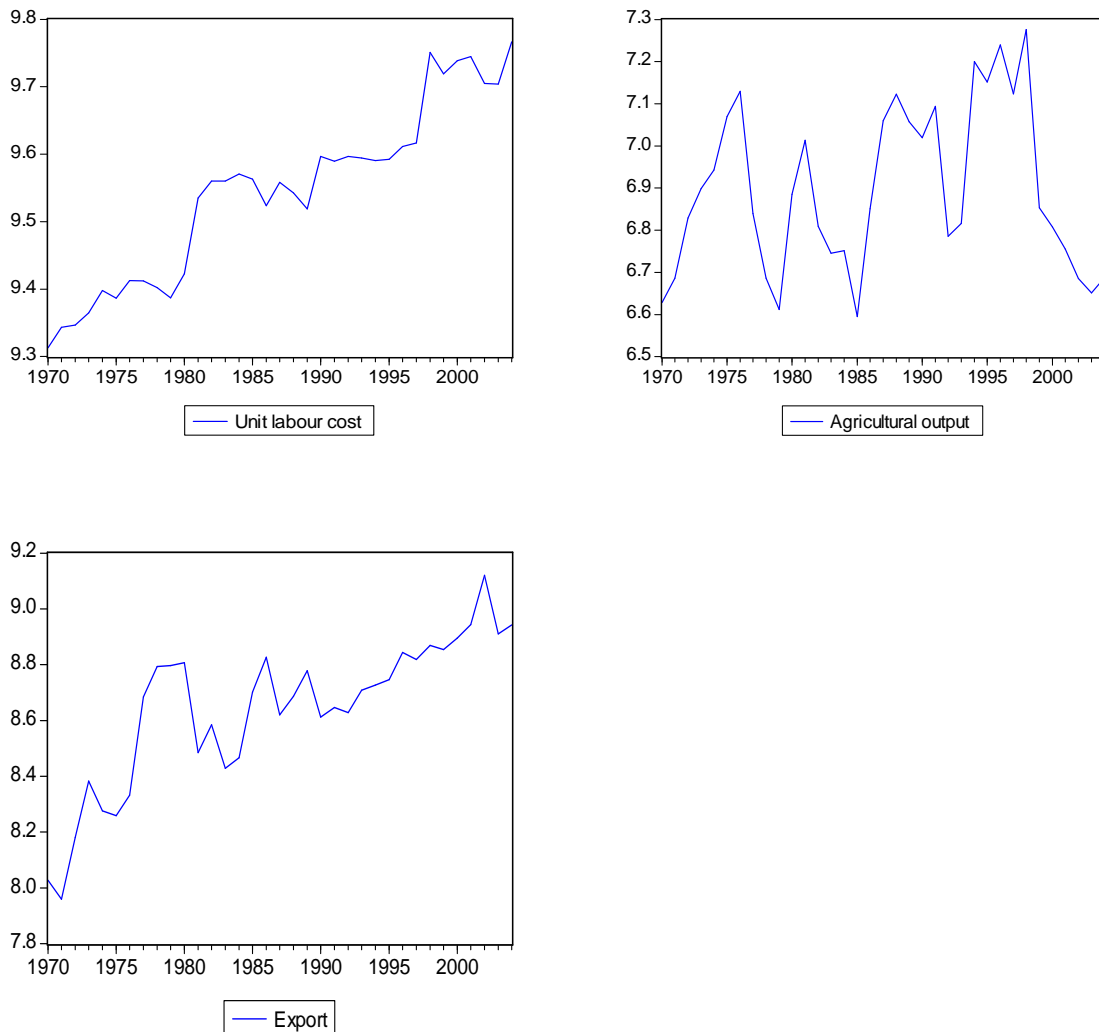
### 6.3 Real Exchange Misalignment Computed from the Three-Good Model (Fundamental Approach)

The three variables (export, agricultural sector and unit labour costs) are plotted in Figure 16. It shows that the unit labour cost in Namibia has risen since 1970. Export has also increased since 1970. The performance of the agricultural sector was erratic between 1970 and 2004.

The estimation procedure is as follows. Variables are tested for stationarity first. Second, a reduced-form VAR is estimated and diagnostic tests performed. Third, Johansen cointegration test is performed. Fourth, VECM is performed and finally impulse response and variance decomposition are performed. The diagnostic tests of the VAR are presented in Table 15 in the Appendix. 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 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 the unit root cannot be rejected for three variables. They are integrated of order one or I(1). The results of the unit root tests are presented in the Appendix.

**Figure 16. Some measures of economic performance and competitiveness (variables in log form)**



### 6.3.1 Testing for Reduced Rank

After testing for the 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 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 10 show 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 10. Cointegration test between misalignment and measures of economic performance and competitiveness**

Null hypothesis	Alternative hypothesis		0.05 Critical value	Probability value <sup>b</sup>
<i>Trace statistic</i>				
r=0	r=1	54.795 <sup>a</sup>	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
<i>Maximum Eigenvalue statistic</i>				
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

<sup>a</sup> Denotes rejection of the null hypothesis at the 0.05 level

<sup>b</sup> MacKinnon-Haug-Michelis (1999) p-values

### 6.3.2 Impulse response functions

In accordance with Johansen (1988), a VECM is constructed. It is important to state that the econometric analyses in this study are obtained using EViews software. One main limitation of this software is that structural factorisations are not available. However, since the default VECM orthogonalisation is Cholesky decomposition, the best approach is to order the variables based on own knowledge. The ordering of the variables is dictated by the need to have meaning impulse response functions from the VECM. The VECM orthogonalisation is the Cholesky decomposition which is lower triangular. The



variables are ordered as: unit labour cost, agricultural output, misalignment and export. The first variable (unit labour 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 17.

**Figure 17. Impulse response of economic performance and competitiveness to misalignment**

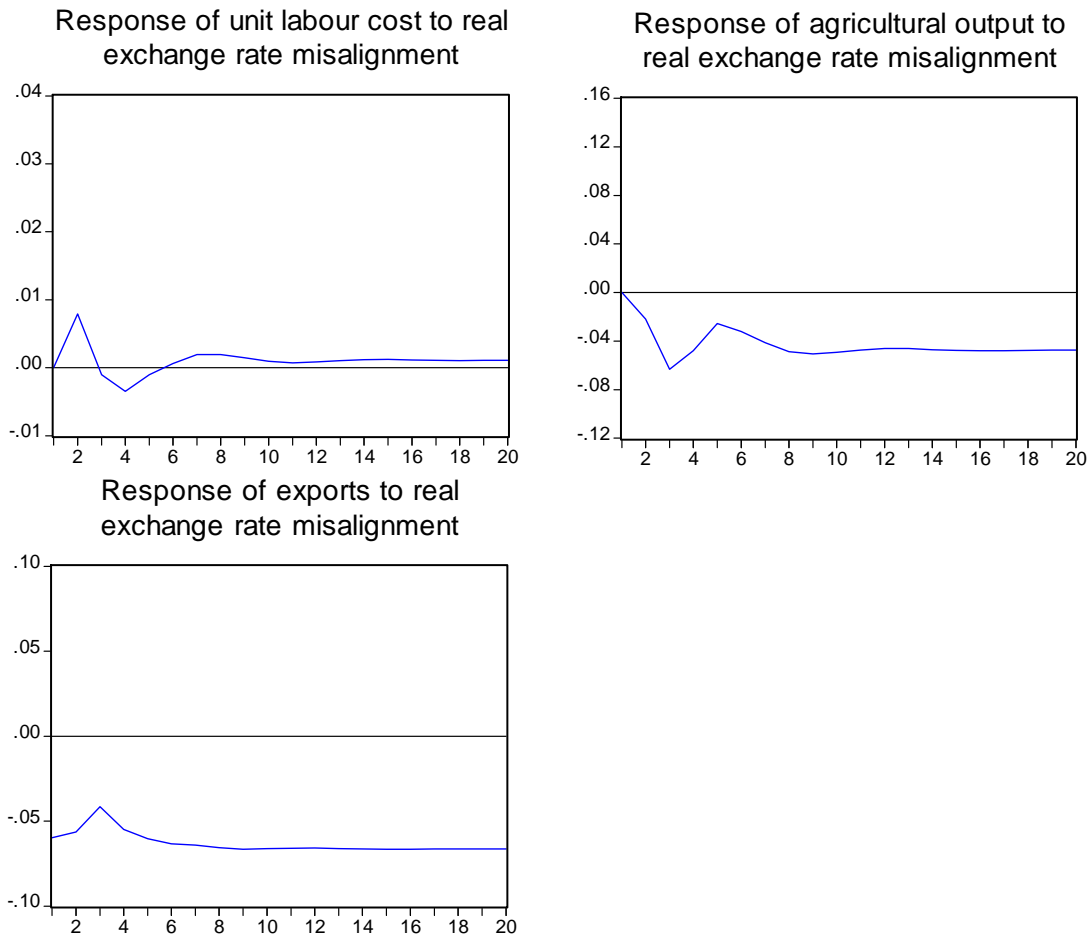
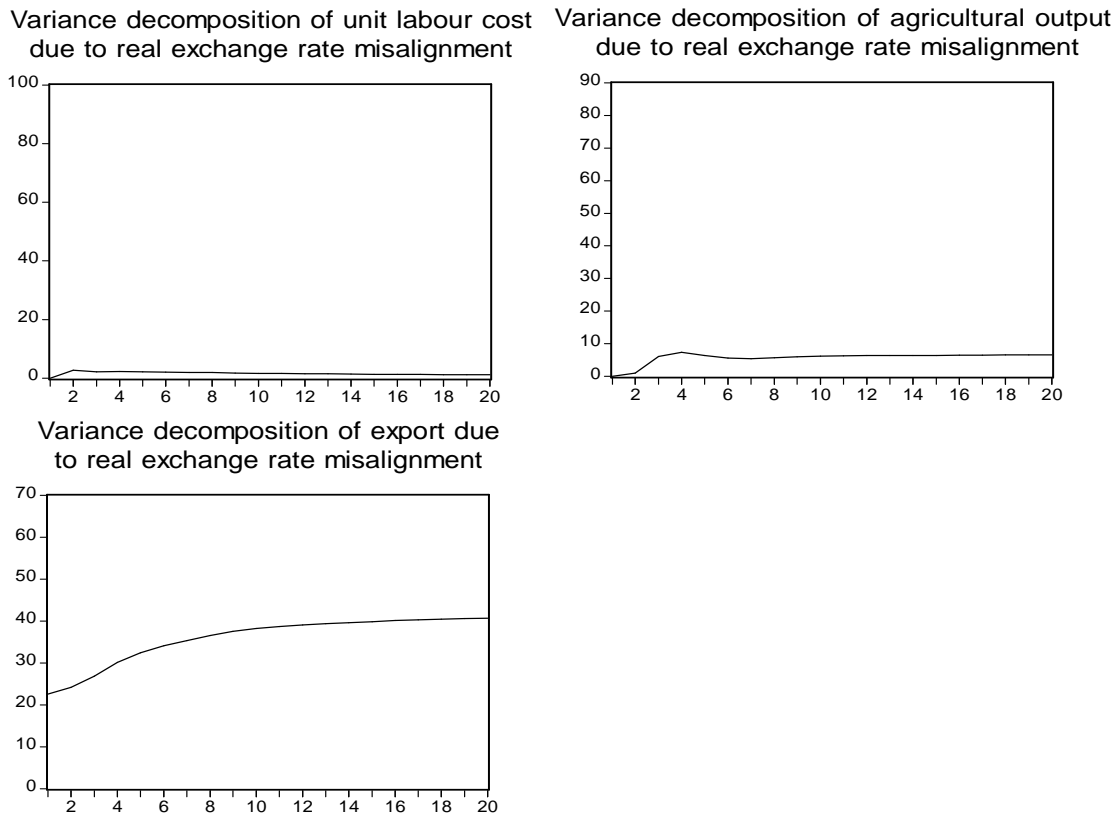


Figure 17 shows the response of measures of economic performance or trade competitiveness to a positive one standard deviation shock in the real exchange rate misalignment. The results show that the real exchange rate misalignment causes unit labour cost to increase. It causes a decrease in agricultural output and a decrease in export. The results are in accordance with theoretical expectation. They are also similar to those obtained by Asfaha & Huda (2002) for South Africa.

### 6.3.3 Variance decomposition Analysis

Figure 18 presents the forecast variance decomposition to assess the importance of the real exchange rate misalignment in accounting for variation in measures of economic performance or trade competitiveness at various time horizons. The results show that the real exchange rate misalignment accounts for a smaller percent of variation in unit labour cost and agricultural output. It accounts for about 2 percent of the variation in unit labour 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 18. Variance decomposition of measures of economic performance and competitiveness**



## 6.4 Misalignment computed from the Cashin *et al.* Model (real exchange rate and commodity prices)

### 6.4.1 Univariate Characteristics of Data and Test for Reduced Rank

The estimation procedure is similar to that of the three-good model. A reduced form VAR is estimated and diagnostic tests performed. Diagnostic statistics of the VAR are presented in Table 16 in the Appendix. Secondly, the cointegration test is performed. The results of the cointegration test are presented in Table 11. Table 11 indicates that there is no cointegration between real exchange rate misalignment and measures of economic performance. Since the variables are non-stationary and there is no cointegration VAR in first differences will yield appropriate results.

**Table 11. Cointegration test between misalignment and measures of economic performance and competitiveness**

Null hypothesis	Alternative hypothesis		0.05 Critical value	Probability value <sup>b</sup>
<i>Trace statistic</i>				
r=0	r=1	49.849	54.079	0.113
r=1	r=2	29.233	35.193	0.191
r=2	r=3	15.107	20.262	0.220
r=3	r=4	5.946	9.165	0.195
<i>Maximum Eigenvalue statistic</i>				
r=0	r>0	20.616	28.588	0.367
r≤1	r>1	14.126	22.300	0.451
r≤2	r>2	9.161	15.892	0.419
r≤3	r>3	5.945	9.165	0.195

<sup>a</sup> Denotes rejection of the null hypothesis at the 0.05 level

<sup>b</sup> MacKinnon-Haug-Michelis (1999) p-values

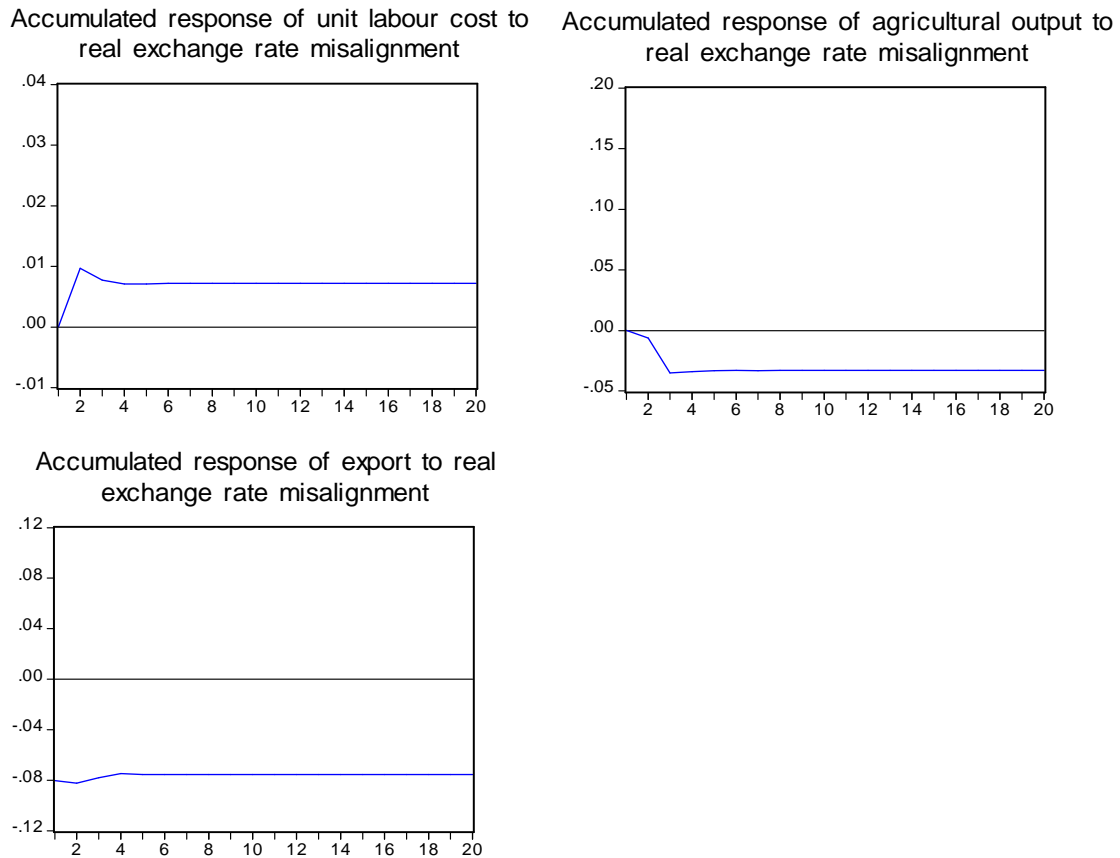
Unrestricted VAR in first differences is estimated because the variables are non-stationary and not cointegrated. Long-run restrictions are imposed on the variables while the short-run dynamics are freely determined. The order of the variables is the same as the one under misalignment derived from the three-good model. The long-run restrictions

are that each of the three variables (unit labour cost, agricultural output and export) is only influenced by real exchange rate misalignment. For example, unit labour cost is only influenced by real exchange rate misalignment, and not by agricultural output and export. The same applies to agricultural output and export.

#### 6.4.2 Impulse Response

The impulse responses are displayed in Figure 19. The resulting impulse responses were cumulated in order to obtain the impulse responses since the variables were entered in first differences in the VAR. The impulse responses are in line with the theory and empirical literature. They are similar to those obtained under the fundamental approach. A positive real exchange rate misalignment shock causes an increase in unit labour cost. A positive real exchange rate misalignment shock leads to a decrease in agricultural output as well as a decrease in export.

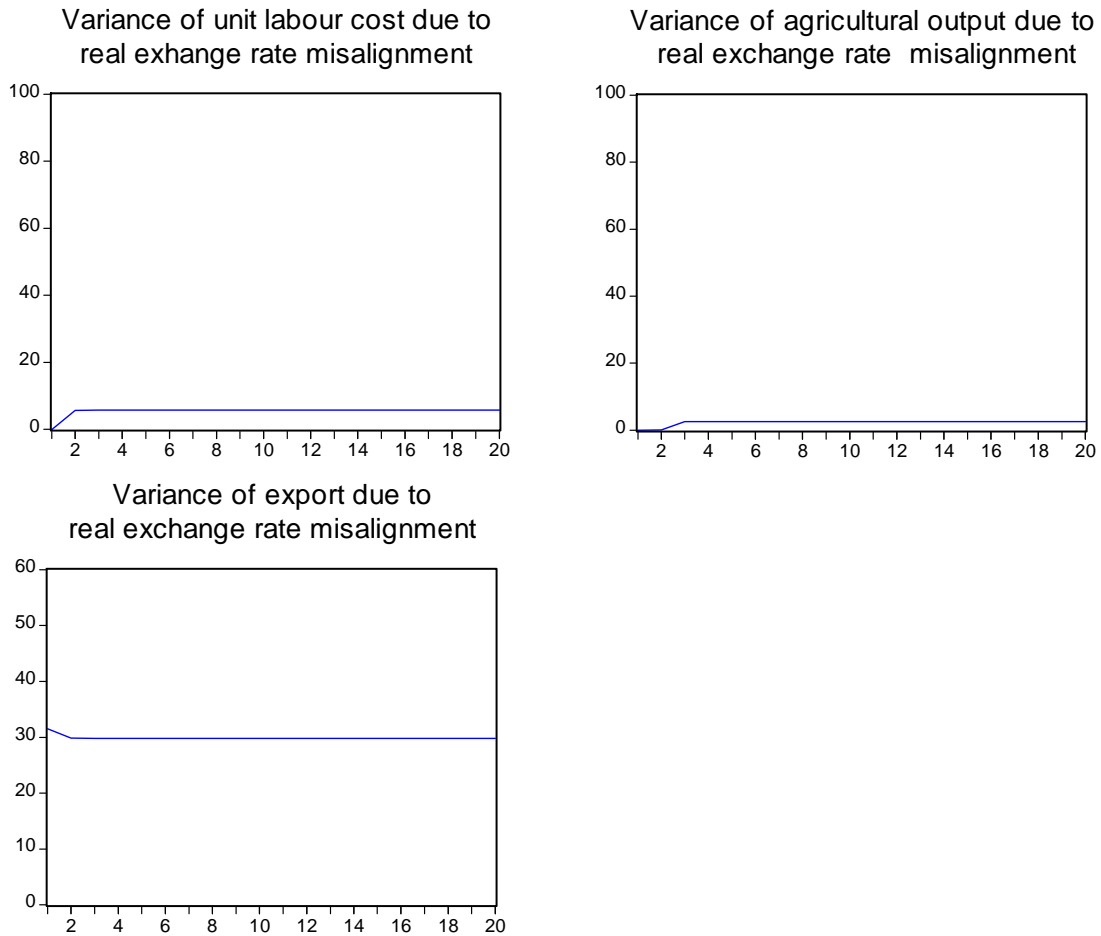
**Figure 19. Impulse response: response to Cholesky one standard innovations**



### 6.4.3 Variance Decomposition Analysis

While the impulse assesses the signs and magnitudes of responses to the real exchange rate misalignment, variance decomposition tests the relative importance of the real exchange rate misalignment shocks in accounting for variation in measures of economic performance and competitiveness. Figure 20 displays the variance decomposition of the unit labour cost, agricultural output and export. The real exchange rate misalignment accounts for about 6 percent of the variation in unit labour cost and about 3 percent of the variation in agricultural output. It accounts for about 30 percent of the variation in export. Although the signs of the response of measures of economic performance are in line with theory and empirical literature, the impact is relatively small.

**Figure 20. Variance decomposition**



## 6.5 Conclusion

This chapter investigated the impact of real exchange rate misalignment on some measures of economic performance and competitiveness. A VAR methodology was applied to Namibia to test the impact of the real exchange rate misalignment (computed in Chapter 5) on economic performance and competitiveness. The impact of the real exchange rate misalignment obtained from both the three-good model and the Cashin *et al.* model shows that the real exchange rate misalignment has a negative impact on export performance and agricultural output. It causes deterioration of competitiveness because it causes an increase in unit labour cost. The results are consistent with the findings of the empirical literature.

Despite its negative impact on economic performance and competitiveness, the real exchange rate misalignment accounts for a very small percent of variation in the unit labour cost and agricultural output. However, it accounts for about 30 to 38 percent of the variation in export.

The results confirmed that Namibia's trade competitiveness is affected negatively by real exchange rate misalignments. 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. This resulted in a number of countries adopting a growth strategy that is led by export with the aim of building a competitive economy. One such example in Namibia is the Export Processing Zones (EPZ) established in 1996, with the aim of encouraging export-oriented manufacturing industry in order to increase employment and investment in the country (Bank of Namibia, 2001). The exchange rate policy in this regard plays a vital role in the expansion of export. This study indicated that the real exchange rate misalignment hampers export and competitiveness. It is necessary for policy makers to monitor the real exchange rate and ensure that it is in line with its long run value. As suggested in Chapter 4 the real exchange rate misalignment can be corrected by having price and wage flexibility, since other policies such as devaluation cannot be used due to Namibia's membership of the CMA.

## 7. CONCLUSION

### 7.1 Introduction

This chapter presents a summary of the study, major conclusions and policy implications. The objective of this study is to estimate the equilibrium real exchange rate and the resulting real exchange rate misalignment for Namibia. It then investigated the impact of real exchange rate misalignment on measures of economic performance and competitiveness.

### 7.2 Methodology

The methodology in this study uses the existing literature and models to estimate the equilibrium real exchange rate and the resulting real exchange rate misalignment as well as the impact of those real exchange rate misalignments on economic performance and competitiveness.

Firstly, the background on exchange rate and monetary policy in Namibia is discussed and then the fundamental literature on the real exchange rate is reviewed and discussed extensively. After investigation of the theories and empirical literature regarding the hypotheses and signs of the coefficients of the determinants of the real exchange rate, time series techniques were applied. The econometric technique applied to estimate the equilibrium real exchange rate and the resulting real exchange rate misalignment was the Johansen (1988, 1995) full information maximum likelihood. The Johansen methodology has advantages in the sense that the estimated coefficients, the  $\beta$  vector can be used to prove a measure of the equilibrium real exchange rate and therefore the expression of the gap between the actual real exchange rate and its equilibrium level. It also derives estimates of the speed of adjustment of the real exchange rate to its equilibrium level.



The first step in the Johansen methodology is to test if there is cointegration between the variables and if that is so the VECM is estimated and the coefficients as well as the speed of adjustment are obtained. The permanent components of the determinants of the real exchange rate are isolated from their transitory components. The Hodrick-Prescott filter is used to smooth the variables. After smoothing the variables the coefficients are then imposed on the smoothed variables (determinants of real exchange rate) to derive the equilibrium real exchange rate. The Real exchange rate misalignment is the difference between equilibrium and actual real exchange rate.

Once the real exchange rate misalignments are computed, the next step is to use the VAR methodology to estimate the impact of the real exchange rate misalignment on measures of economic performance and performance such as export, unit labour cost and the agricultural sector.

### 7.3 Literature

Chapter 2 discussed the fundamental literature on the real exchange rate, the analytical and the theoretical model for estimation of the equilibrium real exchange rate for Namibia. The three-good model defines the real exchange rate as a function of fundamentals variables which can be classified into external and domestic. External fundamentals include variables such as terms of trade, international transfers, and world real interest rates. Domestic fundamentals are those variables which can directly be influenced by policy decisions and those that cannot be affected by policy decisions. These variables include import tariffs, import quotas, export taxes, exchange and capital control, subsidies and composition of government expenditure. Technology is also part of domestic fundamentals but non-policy related.

Increases in tariffs and import quota are expected to cause real exchange rate appreciation. Relaxation of capital control may affect the long-run path of the real exchange rate positively or negatively. This depends on whether liberalisation of capital

increases or decreases the inflow of capital. Trade restrictions normally proxied by openness refer to the country's trade policy stance and this is mainly reflected in tariffs and quotas may influence the real exchange rate. Increase in trade restrictions increase the domestic prices of tradables and thus results in both income and substitution effects. Trade restrictions can depreciate or appreciate the equilibrium real exchange rate depending on whether the income or substitution effect dominates. The impact of government expenditure can cause real exchange rate appreciation or depreciation. This depends on the composition of government expenditure. Increase in the ratio of investment to GDP will increase spending, deteriorate the current account and cause real exchange rate depreciation. However it is noted that the expected sign is ambiguous and it depends on the relative ordering of the factor intensity across sectors.

Chapter 3 discussed the relationship between commodity prices and real exchange rate. Despite the fact the three-good model or fundamental approach is the most widely used in empirical estimation, it has been criticised for relying mainly on terms of trade. The model of the real exchange rate and commodity prices suggests that since developing countries rely more on the export of primary commodities, commodity prices can have a significant impact on the real exchange rate of developing countries. Terms of trade is very broad, and commodity prices could be a better explanatory variable of the changes in real exchange rates of developing countries. Namibia is a commodity exporting country and it is more likely that commodity prices have a potential to explain a greater part in its real exchange rate movement.

Chapter 4 reviewed the literature and models for assessing the impact of real exchange rate misalignment on economic performance. Real exchange rate misalignment has now become a central issue in the economies of developing countries. It has a detrimental effect on the economy and can result in welfare and efficiency costs. It was found out that it can cause reduction in export and can wipe out the agricultural sector. It can also cause capital flight. Countries such as Namibia that have exports dominated by primary commodities experience the highest real exchange rate misalignment compared to those with few primary commodities in their exports or well diversified exports. Different

methodologies and models that can be used to investigate the impact of real exchange rate misalignment on economic performance were discussed. A number of studies tested the impact of real exchange rate misalignment on economic performance and competitiveness. Regardless of which measure is used, real exchange rate misalignment has a negative impact on economic performance.

## 7.4 Empirical Results

The methodology outlined in Section 7.2 is implemented in this study to estimate the equilibrium real exchange rate and resulting real exchange rate misalignment for Namibia. The estimation was based on the three-good model which models the real exchange as a function of fundamentals and the Cashin *et al.* model of real exchange rate and commodity prices. The equilibrium real exchange rate for both models (three-good and Cashin *et al.*) was estimated using the Johansen FIML. According to the three-good model, the real exchange rate is determined by openness, government expenditure, resource balance, terms of trade and ratio of investment to GDP. An increase in both variables causes the real exchange rate to depreciate. The results are in line with the *a priori* expectation.

Variance decomposition analysis showed the real exchange rate accounts for about 30 percent of the variation in itself, while terms of trade account for approximately 50 percent of the variation in the real exchange rate. Investment to GDP ratio accounts for just under 30 percent between periods 4 and 8 and under 10 percent for the rest of the periods. Government expenditure, openness and resource balance each account for just less than 10 percent of the variation in real exchange rate.

The real exchange rate (estimated from the three-good model) was overvalued during the periods 1970-1972, 1982-1985, 1992-1995 and 1999 to 2004. It was undervalued for the periods 1973-1981, 1986-1991 and 1996 to 1998. The highest real exchange rate misalignment was in 1980 and 2002-2004. The speed of adjustment is 1.07 years for 50 percent of the misalignment or deviation to be eliminated.

The estimation results from the model of the real exchange rate and commodity prices show that an increase in commodity prices cause real exchange rate appreciation and this confirms the theory and findings of the literature. An improvement in technology proxied by GDP per capita is also associated with real exchange rate appreciation. The impulse responses show that both variables do not return to equilibrium and this may suggest that policy has been slow in responding to shocks that affect the economy. Variance decomposition revealed that commodity prices account for about 20 percent of the variation in real exchange rate, while GDP per capita accounts for less than 5 percent. The speed of adjustment is 1.7 years and this is longer than the one obtained under the three-good model. The estimation showed that real exchange rate was overvalued during the periods 1972-1977, 1982-1984 and 1992 -1997.

After computation of the real exchange rate misalignment, the VAR methodology was implemented to examine the impact of real exchange rate misalignment on some measures of economic performance and competitiveness.

A VAR methodology was applied to Namibia to test the impact of real exchange rate misalignment (computed in Chapter 5) on economic performance and competitiveness. The impact of the real exchange rate misalignment obtained from both the three-good model and the Cashin *et al.* model shows that the real exchange rate misalignment has a negative impact on export performance and agricultural output. It causes deterioration of competitiveness because it causes an increase in unit labour cost. The results are consistent with those of the empirical literature.

Despite its negative impact on economic performance and competitiveness, the real exchange rate misalignment accounts for a very small percent of variation in unit labour cost and agricultural output. However, it accounts for about 30 to 38 percent of the variation in export and this is not really significant.

## 7.5 Overall Conclusion and Policy Implications

This study estimated the equilibrium real exchange rate and resulting real exchange rate misalignment using a theoretical model and application of time series econometric techniques. The analysis revealed that the long-run real exchange rate is not constant as postulated by the purchasing power parity. When there are changes in the variables that affect the country's internal and external balance, there will also be changes in the equilibrium real exchange rate. The three-good model or fundamental approach revealed that the real exchange rate needed to achieve equilibrium when the ratio of investment to GDP, terms of trade and openness are high will not be the same when these variables are low. The equilibrium real exchange rate depends on these fundamental variables.

Since Namibia is a commodity exporting country, fluctuations in the prices of commodities can have a greater role in the determination of the country's real exchange rate. The investigation revealed that this is indeed the case. Real prices of commodity exports have an impact on the real exchange rate. An increase in commodity prices causes the real exchange rate to appreciate. The results also confirmed the postulation of the Balassa-Samuelson hypothesis that increase in productivity results in real exchange rate appreciation. This confirms again that the real exchange rate is not constant. It responds to changes in the variables that affect internal and external balance. It is also important to note that there is not one single equilibrium real exchange rate, but a path of equilibrium real exchange rates over time. Only permanent changes in determinants can drive the real exchange rate.

The impulse response analysis from the estimated Cashin *et. al* model showed that the real exchange rate does not return to equilibrium immediately in response to shocks in the fundamentals. This suggests that there could be some structural rigidities that prevent the system from returning to equilibrium. However, given the fact that Namibia cannot use the exchange rate a policy instrument, there is not much that policy makers can do because monetary policy is limited. The exchange rate and monetary policies are

determined by the South African Reserve Bank. Shocks to the Namibian economy have to be absorbed by using fiscal policy as a means of adjustment. Both models' results showed that Namibia's real exchange rate was misaligned. The impact of real exchange rate misalignment on economic performance was tested. The results confirmed that Namibia's economic and trade competitiveness are affected negatively by real exchange rate misalignments. The results also confirm the theory and literature postulating that keeping the real exchange rate at wrong levels results in the reduction of the country's welfare. Misalignment causes reduction in export and reduces the performance of the agricultural sector. Although agriculture accounts for about 7 percent of Namibia's GDP, the Labour Survey of 2000 revealed that it remains the largest employer accounting for 30 percent of the total employment. The poorest Namibians live in rural areas and are dependent on agriculture for employment. A real exchange rate which is not realistic harms the poorest. A realistic real exchange rate is conducive to rural prosperity and can have a positive effect on growth and income distribution.

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. This resulted in a number of countries adopting a growth strategy led by export in order to build a competitive economy. One such example in Namibia is the Export Processing Zones (EPZ) established in 1996, with the aim of encouraging export-oriented manufacturing industry in order to increase employment and investment in the country (Bank of Namibia, 2001). Exchange rate policy in this regard plays an important role in the expansion of export. This study indicated that real exchange rate misalignment hampers export and competitiveness. The analysis has shown that maintaining the real exchange rate out of equilibrium reduces Namibia's welfare. This suggests that it is important for policy makers to monitor the real exchange rate and its determinants regularly to ensure that it does not send wrong signals to economic agents.

Real exchange rate misalignment can be corrected or reduced by changing the nominal exchange rate and adjusting the actual real exchange rate to the long-run equilibrium real exchange rate. Changes in the fundamentals could be used to move the actual real

exchange rate to equilibrium. Misalignment can also be corrected by having price and wage flexibility, and other policies such as devaluation. The monetary arrangements in the CMA imply that Namibia cannot change the nominal exchange rate or devalue the currency to correct for misalignment. Although pegging to nominal anchor has the advantage of achieving price stability and credibility, it prevents the monetary policy from responding to the needs of the economy. The country loses monetary independence and the exchange rate policy as an instrument of adjustment to shocks. In a flexible exchange rate regime a country has monetary independence and when unemployment is high and growth is low, the monetary authority can increase money growth by lowering interest rates. The currency depreciates and asset prices increase and this would mitigate the downturn in economic performance. Furthermore, deterioration in the world market for a country's export should result in depreciation of the local currency. This would stimulate production and encourage economic growth without any deliberate action by the monetary authority. Under a pegged exchange rate system or nominal rigid anchor depreciation of the local currency cannot happen.

It was stated that Namibia and South Africa suffer from different shocks because the two economies have different compositions of exports and GDP. Namibia has linked its monetary policy rigidly to the South African rand through the CMA. The implication of this linking is that exogenous fluctuations in the rand create movements in the country's monetary conditions which may not be favourably related to the needs of Namibia. The Bank of Namibia stated that the CMA has enabled Namibia to maintain price and financial stability, but monetary policy is determined by one country (South Africa) in this *de facto* monetary union. This makes it difficult for Namibia to adjust its nominal exchange rate and correct real exchange rate misalignment. A more equitable solution where decision making power is exercised by all member states is needed. This argument is supported by Alweendo (2004). The theory of optimum currency area suggests that the loss of the exchange rate as an instrument of correcting shocks (or real exchange rate misalignment) can be reduced if labour is mobile between countries. Labour mobility between Namibia and South Africa is very low and cannot be used as an instrument of

adjustment. Alternatively, policies that promote wages and price flexibility need to be pursued in order to enable the economy to adjust to shocks.

It is important for the economy to respond to shocks that affect economy. In the Namibian context the most important shocks are the sustained changes in the prices of export commodities. If policymakers do not adjust to these shocks it could result in real exchange rate misalignment. Some flexibility would be required if real exchange rate misalignment is to be avoided.

In his proposal for monetary policy regimes for small commodity exporters, Frankel (2003) suggested that small countries that want nominal anchor and are concentrating on the production of mineral or agricultural commodity, should peg their currencies to the prices of those of commodities. In this case, movements in the value of their currencies that result from fluctuations in world commodity market would not be an external source of volatility. Namibia's export is concentrated on the export of few products (fish, beef, diamonds, uranium, copper and other mineral products) and this may suggest that the country is a good candidate for pegging its currency to the prices of commodity exports. Alternatively, it is suggested that as a commodity exporting country, Namibia can have either a flexible nominal exchange rate regime which facilitates slow change of relative inflation rate or price and wage flexibility to facilitate the maintenance of a nominal exchange rate peg. This may contribute in addressing the current problem of real exchange rate misalignment. The implication of pegging to the prices of commodities is that Namibia should leave the CMA. However, it is important to state that this move will go against efforts towards regional integration such as the plan to establish a monetary union in SADC by 2016. That is because Namibia is a proponent of regional integration.