EXPLORING EXCHANGE RATE BASED POLICY COORDINATION IN SADC

Mulatu Fekadu Zerihun
Department of Economics, Tshwane University of Technology, Pretoria,
South Africa and University of Pretoria, Pretoria, South Africa
Martinus C. Breitenbach
Department of Economics, University of Pretoria,
Pretoria, South Africa, and
Francis Kemegue
Business School, Framingham State University, Framingham,
Massachusetts, USA and University of Pretoria, Pretoria, South Africa

Abstract

This study evaluates the strength of policy coordination in Southern African Development Community (SADC) as well as real effective exchange rate stability as a prerequisite towards sensible monetary integration. The underlying hypothesis goes with the assertion that countries meeting Optimal Currency Area (OCA) conditions to a greater degree face more stable exchange rates. The quantitative analysis encompasses 12 SADC member states over the period 1995-2012. Correlation matrixes, dynamic pooled mean group (PMG) and mean group (MG) estimators, and real effective exchange rate (REER) equilibrium and misalignment analysis are carried out to arrive at the conclusions. The structural variables used in the PMG model show that there are common determinants of REER/RER in the region. However, the REER equilibrium misalignment analysis reveals that SADC economies are characterised by persistent overvaluation at least in the short term. This calls for further sustained policy coordination in the region. The findings in this paper have important policy implications for economic stability and for the attempt of policy coordination in SADC region for the proposed monetary integration to proceed.

1. Introduction

Cooperation and coordination is the core integration route for Africa (Article II, Organisation for African Unity (OAU) Charter). For monetary integration in sub-Saharan Africa (SSA) and in SADC to be successful and to produce stable real exchange rates (RERs), the degree of economic harmonisation and policy coordination may need to be strengthened.

Macroeconomic policy coordination remains vital even for more advanced monetary unions. A recent study by Dullien *et al*.(2013) in deducing lessons from the euro crisis for developing regions emphasize the need for the identification of both the stabilizing and destabilizing elements of regional monetary cooperation and integration. Such proactive measures would positively contribute to the stability of existing and proposed monetary unions around the globe.

Policy coordination among member countries is a prerequisite for deeper regional integration and monetary union. Simply looking at the differences between the main macroeconomic indicators does not bring much insight into the sources of divergence or the adequacy of a common policy response (Kamar & Naceur, 2007). Monetary integration should be mainly oriented by real, rather than nominal convergence objectives. It should also evolve gradually, supporting economic development and progress achieved in trade integration and macroeconomic coordination (Vieira &Vieira, 2010).

The recent euro zone financial crises suggest monetary unions involving heterogeneous economies may jeopardise growth and employment in some member states. Here, the underlying hypothesis is that countries meeting Optimal Currency Area (OCA) conditions face more stable exchange rates (De Grauwe, 2005). Two variants of exchange rates, namely real effective exchange rate (REER) and real exchange rate (RER) are used as dependent variables in the analysis. In general terms, the exchange rate can play a positive or negative role in the economic performance of national states or groups of countries opting to form monetary union. Stable exchange rates in a regional context requires coordination of the policies affecting the determinants of the exchange rate. The objective of this study is to identify the long-run determinants of REER/RER behaviour in SADC economies and to assess the degree of policy

coordination from 1995-2012. The study further assesses the impact of exchange rate based policy variables on REER/RER behaviour in each country and whether these effects are similar in magnitude and direction among SADC economies. This study also seeks to assess the degree of exchange rate based policy coordination among SADC economies. Once this is done, we evaluate exchange rate stability in SADC.

Uncoordinated macroeconomic policies in south-south economic integration have been a root cause of unsuccessful attempts towards monetary integration (Fritiz et al., 2010). Structural assymetries in macroeconomic variables are associated with major swings in the RER (Flores et al., 2000). In line with these findings, SADC member states have coordinated policy toward meeting the convergence criteria set by the SADC secretariat. However, moving closer to the convergence targets (Maastricht type criteria)[1] does not necessarily mean that members have followed coordinated policies to get there. There still may be insufficient policy coordination in the region insofar as it concerns the policies that affect the exchange rate.

To answer the questions posed and meet the objective stated above we investigate the degree of policy coordination among SADC countries using Mean Group (MG) and Pooled Mean Group (PMG) panel data models which has not been applied to SADC before. This study is different from previous studies that relate to policy coordination and RER in SADC economies. This study uses a new data base on REER developed by Darvas (2012b) for a relatively longer period of time and it includes more countries than earlier studies. In addition, using both RER & REER as the dependent variables makes the study much more comprehensive.

[1]These convergence criteria are presented in Article 121(1) of the Treaty establishing the European Community (EC Treaty). There are four of them (price stability, government finances (i.e. annual government deficit and government debt, exchange rates) and long-term interest rates)

2. Policy Coordination Attempts in SADC

SADC economies are diverse. The economies vary from oil-rich members such as Angola, natural resource abundant members such as the Democratic Republic of Congo (DRC), Mozambique and Botswana and diverse sector economies such as South Africa. The SADC region has an immense growth potential associated with natural resources availability.

SADC has been in existence since 1980. SADC launched a number of initiatives in order to move towards economic integration. The community pursues a linear model of economic integration, commencing with loose cooperation with successive deeper integration initiatives at later stages. The first major step in SADC toward economic integration involved the introduction of a Free Trade Area in August 2008. This was to be followed by a Customs Union in 2010, Common Market in 2015, Monetary Union in 2016 and single currency in 2018 (Kumo, 2011).

Before proceeding to the policy coordination attempts in the SADC region, it is valid to ask the question why policy coordination? This question is important even in a global scale. For example, Price and Elu (2014) using a Generalised Estimation Equation (GEE) framework reveal that the contraction in credit during the financial crisis of 2008-2009 had larger adverse growth effects on CFA Franc zone countries. The authors further recommend that the need for regulatory policies in the region.

The euro area financial crisis highlights the need to address “negative” macroeconomic divergence, which can hamper growth and threatens the long run convergence among member economies (Priewe, 2007). Without coordination, negative externalities arising from policy conflicts lead to (Pareto) inefficient outcomes. With coordination, outcomes may be efficient, which in turn raises the welfare of countries. For example, when countries agree that they desire to move together to a lower inflation target rate, as has been the case with Europe since the mid-1980s, a coordinated monetary policy could yield better outcomes.

Policy coordination plays a major role in the formation of a currency union among countries intending to integrate and ultimately form a political union. Currency union in this context refers to an agreement between countries to fix exchange rates among them and coordinate monetary

policies. Most of the economies of the member states of SADC have shown a tendency of divergence in monetary policy, fiscal policy and foreign exchange reserves ratios in respect of the 2012 convergence goals (Kumo, 2011). The problem may pertain to insufficient real convergence in the region.

Both the symmetry and co-movement of business cycles in SADC show that there is not adequate symmetry in real business cycles of the economies in the region (Zerihun et al., 2014). Consequently, we expect a lack of policy coordination in SADC. In another study of RERs in SADC, there is evidence of a long run cointegration relationship (although weak) in a panel of SADC real exchange rates (Zerihun et al., 2013). We build on these earlier studies by modelling the relationship between REERs and its policy-related determinants, which are selected to reflect exchange rate policy decisions.

3. Real Exchange Rate as a Policy Variable

The exchange rate is at the heart of economic activity as it affects and is affected by all other policies, making policy coordination and harmonization essential for the success of a common currency. The RER/REER and its determinants are useful to assess policy coordination among a group of countries since it measures the development of the real value of a country's currency against a basket of currencies of the trading partners of that country (Darvas, 2012b).

As trade openness of countries increase, the role of the RER receives more attention. According to Eichengreen (2007), countries like Japan, Hong Kong, Singapore, South Korea, Taiwan, and now China have made extensive use of the RER as a policy to develop their economies. In African economies, there is insufficient flexibility in prices and wages, which makes the role of the RER as a policy variable unquestionably important to ensure that markets clear. Theoretically, RER behaviour is subject to the influence of many variables, such as monetary policy, government expenditure, terms of trade, degree of openness, and capital flows. Monetary policy ought to be conducted similarly in all countries for its impact on the exchange rate to be

the same, given that different monetary policy frameworks in member countries can result in disparate impacts on the RER.

Consequently, it is important to measure the effects of monetary policy, the budget deficit, trade policy, and government consumption on exchange rate behaviour for each country in a group in order to determine whether these effects are similar. If this is the case, we expect a high level of harmonization among members' policies. The formation of a monetary union would then bring about stability of the RER in a given region. If this is not the case, and if we find that these policies affect exchange rate behaviour differently in each country, we would expect that existing coordination is inadequate and there are potential dangers - a situation that requires further coordination and harmonization of macroeconomic policies as Kamar and Naceur (2007) argue in their analysis of the countries of Gulf Cooperation Council (GCC).

4. Data and Descriptive Analysis

In this section we discuss the policy variables chosen for the purpose of evaluating policy coordination in SADC. The policy variables selection was based on previous studies in developing regions by Kumar and Naceur (2007) and Elbadwi and Soto (2005). The choice of variables is limited by the availability of data. The purpose of this section is to conduct a preliminary analysis of policy variables, in line with Kamar and Naceur (2007) and Elbadwi and Soto (2005), which are complimentary to the findings in section five.

Annual data on the selected policy-induced variables of selected SADC countries from 1995-2012 was retrieved from the IFS, the IMF's International Financial Statistics data base. In addition, other international data banks (World Economic Outlook, IMF staff estimates), and Central Banks of SADC countries were also consulted. In this section we used both RER and REER as dependent variables. REER data for the cross country analysis are taken from the new Darvas (2012b) database for 178 countries.

There are many candidate explanatory variables in the analysis of exchange rate based policy coordination. This problem arises because the exchange rate is affected by (and affects) many macroeconomic variables. However, in the context of developing countries the variables shown in appendix 7.1 are more appropriate for analysing the determinants of exchange rates and policy coordination (see for example, Kamar and Naceur, 2007). Elbadawi and Soto (2005) go further to include variables like the impact of foreign aid and other often overlooked variables in their study. However, given data availability for the countries in the SADC region we include the chief macroeconomic variables only. Except for the variables with negative values the rest of the variables are converted to logarithmic form for ease of analysis. Appendix 7.2 presents the descriptive statistics of the variables used in this study. When we consider the standard deviation of the group statistics, the deviation from the mean is quite high ranging from 19 percent in the case of the REER to 310 percent in the case of net foreign assets (the result is not reported in appendix 7.2 because of its large value). This high standard deviation points to insufficient policy harmonisation and coordination efforts in the region during the period. To further highlight the result from group statistics we depict brief explanations and graphical illustrations of the variables in the study.

Table 1: Panel of countries and variables definition

Panel of Countries	**Dependent Variable**	**Independent/Explanatory Variables**	
		Variable Code	Definition
Botswana	**RER/ REER**	GEXP	Government Consumption = Public Consumption Expenditure / GDP (current, local currency)
Lesotho			
Madagascar		LIQ	Liquidity = Broad Money / GDP (current, local currency)
Malawi		OPEN	Degree of Openness = (Imports + Exports) / GDP (Constant, Local Currency)
Mauritius		TOT	Terms of Trade (Price of Exports to the Price of Imports)
Mozambique			
Namibia		CAPF	(Current Account Balance / GDP) (Current, USD)
Seychelles		TKF	Total Capital Flows (Net) (Current, USD)
South Africa		NKF	Net Capital Flows= the net of capital inflow and outflow (Current, USD)

Swaziland		NFA	Net Foreign Assets (current, local currency)
Tanzania		RESY	Stock of reserves at year-end / GDP (Current, USD)
Zambia			

Source: author

Table 2: Descriptive statistics of variables in the model

Summary statistics	REER	GEXP	CAB	TOT	LIQ	NFA	OPEN	NKF	RESY
Mean	105.4	28.6	-5.7	103.4	39.4	-	1.7	4.2	0.2
Standard Error	1.4	0.8	0.6	1.4	1.7	-	0.2	0.5	0.0
Median	104.6	26.2	-5.4	100	30.3	-	1.1	2.8	0.2
Standard Dev.	**19.9**	**12.0**	**9.4**	**21.2**	**25.6**	-	**2.5**	**7.4**	**0.2**
Kurtosis	2.1	0.8	0.6	1.5	0.5	-	15.0	6.6	4.2
Skewness	0.6	0.8	-0.4	0.4	1.3	-	3.7	2.0	2.1
Minimum	52.3	5.4	-38.8	45.9	12.5	-	0.1	-11.8	0.0
Maximum	180.1	67.7	17.2	171.6	117.4	-	16.2	36.1	1.1

Source: Calculated from sample data

Note: Statistics on total capital flows (TKF) are not reported in Table 7.2 &7.3 for the values of this variable are too large.

Table 3: The overall correlation among structural variables

	LREER	LGEXP	CAB	LTOT	LLIQ	NFA	LOPEN	NKF	LRESY
lnREER	1								
lnGEXP	-0.0400	1							
CAB	-0.0289	**-0.3860**	1						
lnTOT	-0.0197	0.1501	0.2858	1					
lnLIQ	0.1527	0.2620	-0.0353	-0.0916	1				
NFA	0.1668	-0.1129	-0.0605	0.1985	0.1720	1			
LOPEN	**0.4116**	-0.0956	0.1026	-0.0254	0.1339	0.4159	1		
NKF	-0.1569	-0.2547	**-0.4811**	-0.1171	-0.1171	-0.0123	0.0327	1	
lnRESY	-0.3078	-0.3074	-0.1629	-0.0318	-0.0318	-0.0060	0.0938	0.2260	1

Source: Calculated from database

Table 4: REER pair wise correlation among SADC countries

REEX	BWA	LSO	MDG	MWI	MUS	MOZ	NAM	SYC	ZAF	SWZ	TZA	ZMB
BWA	1											
LSO	0.05	1										
MDG	0.29	-0.34	1									
MWI	-0.54 [b]	-0.55	0.07	1								
MUS	0.29	0.93	-0.53 [c]	-0.60	1							
MOZ	-0.41 [c]	-0.13	0.52	0.27	-0.15	1						
NAM	-0.42 [c]	-0.93 [a]	0.09	0.60 [a]	-0.45	0.22	1					
SYC	-0.10	-0.64 [a]	-0.56 [c]	0.58	-0.52	-0.10	-0.02	1				
ZAF	-0.38	0.76 [a]	-0.56	-0.04	0.68	0.03	-0.68 [a]	-0.14	1			
SWZ	0.17	0.96 [a]	-0.34	-0.59 [a]	0.97	-0.05	-0.96 [a]	-0.55 [b]	0.77 [a]	1		
TZA	-0.45 [c]	-0.75 [a]	0.09	0.71 [a]	-0.72	0.29	0.72 [a]	0.64 [a]	-0.23	-0.68 [a]	1	
ZMB	0.40	0.41	0.29	-0.71 [a]	0.39	-0.20	-0.80 [a]	-0.81	-0.23	0.33	-0.68 [a]	1

Source: author, calculated from sample data

Notes: [a], [b], [c] shows 1%, 5% and 10% levels of significance correlations respectively.

Overall Correlations

Before setting up the model, we make use of correlation analysis to give us some idea of the relationship among the variables under investigation. Correlation analysis provides a convenient way to see how REER and the policy variables are related in the region. It provides us with some intuition of what we can expect in the econometric model. Table 7.3 depicts the overall correlation among the variables included in this study. As shown in Table 7.3, in the SADC region the REER has a relatively strong correlation with the trade openness variable, followed by net foreign assets, liquidity (proxy variable for money supply), budget balance, terms of trade, current account balance, government expenditure, net capital flow and stock of reserves, respectively. There are positive and negative correlations between the *LREER* (in logarithmic form) and the rest of the explanatory variables. Considering the second column of Table 7.3 the variables all carry, theoretically, the correct signs. For example, *lnLIQ* - the proxy variable for monetary policy has positive sign implying that an increase in money supply is associated with an increase (depreciation) in the *lnREER*. The proxy variable for budget balances is associated with a REER appreciation (Kamar &Naceur, 2007). The sign of government expenditure is also negative which shows that production

in the trade sector becomes more efficient than in the non-trade sector, which leads to a REER appreciation. Increased efficiency translates into higher wages which, in turn, allow consumers to expand their demand for non-traded goods, thus leading to higher prices for non-traded goods (Elbadawi & Soto, 2005). Some of the time series trends and correlations that we observe in the data are discussed below. The main essence of presenting the descriptive statistics and graphical illustration of fundamentals in this section is to supplement the findings in the next section. It also provides an indication of the short run behaviour of the variables whereas the models in the next section focus mainly on the long run behaviour of dependent and explanatory variables in the study.

RER vs. REER

In the previous two chapters we used RER as dependent variable. However, in this section we use both the RER and REER. However, in the analysis of regional groups of countries REER may not work best because of differences in trading partners of member countries. For this reason the PMG estimation results obtained from using both variants of exchange rate are discussed in section 7.7. Chinn (2006) shows that the exchange rate is the key relative price in international finance; as well as in goods and asset markets. The RER measures the relative price of goods between two countries. That is, the real exchange rate tells us the rate at which we can exchange goods of one country with goods of another country.

Before discussing the time series and correlation analysis of the REER, briefly consider the calculation of the REER. Darvas (2012b) calculated CPI based REER as follows:

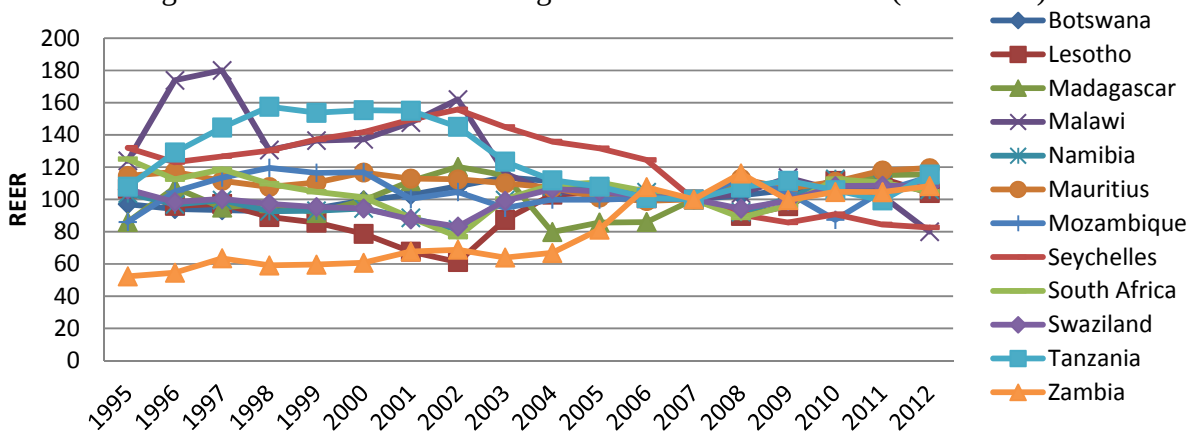
$$REER_t = \frac{NEER_t . CPI_t}{CPI_t^{foreign}} \qquad (7.1)$$

where $REER_t$ is the *real effective exchange rate* of the country under study against a basket of currencies of trading partners, CPI_t is the consumer price index of the country under study, $NEER_t$ is the nominal effective exchange rate of the country under study, and $CPI_t^{foreign}$ is the geometrically weighted average of CPI indices of trading partners. This approach is more advanced than the conventional RER calculation. In this case rather than just one major trade partner country (commonly the US) '*N*' number of trading partners with geometrically weighted

averages are considered. The broader basket is calculated against 172 trading partners. For the details on the computation see Darvas (2012b).

Figure 1 shows the correlation among REER series of SADC countries. From Figure 1 one can infer that after 2007/08 the REER series is symmetrical and converging. However, the REER of most of the member states are weakly correlated. The REER of only few countries like Lesotho, Malawi, Swaziland, and Tanzania are strongly correlated with at least five member states, whereas, Botswana is the least correlated in the series.

Figure 1: Real Effective Exchange Rate of SADC Countries (1995-2012)

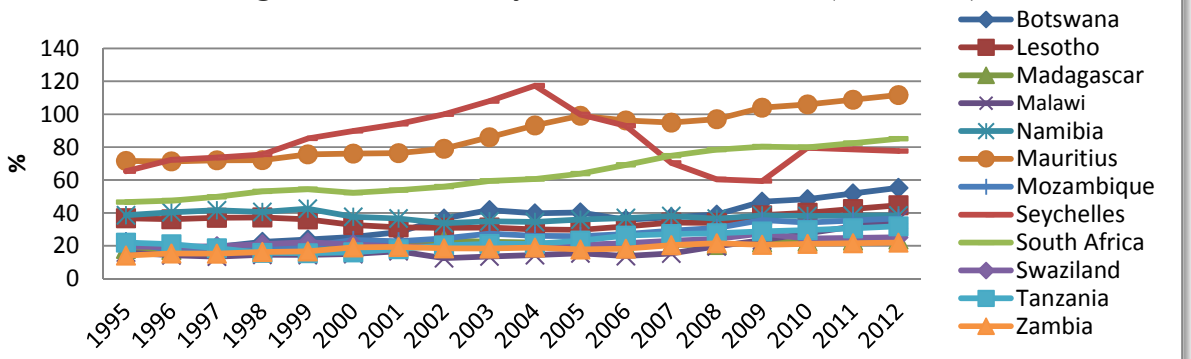


Source: author, estimated from database

Monetary policy

When we look at broad money supply (percent of GDP), the proxy variable for liquidity, in Figure 2, it is completely diverging for member states like the Seychelles, Mauritius, and South Africa. Money supply in the rest of the sample of countries looks as if it is converging. However, the correlation matrix in appendix A.4 shows weak correlations, with the exception of few member countries.

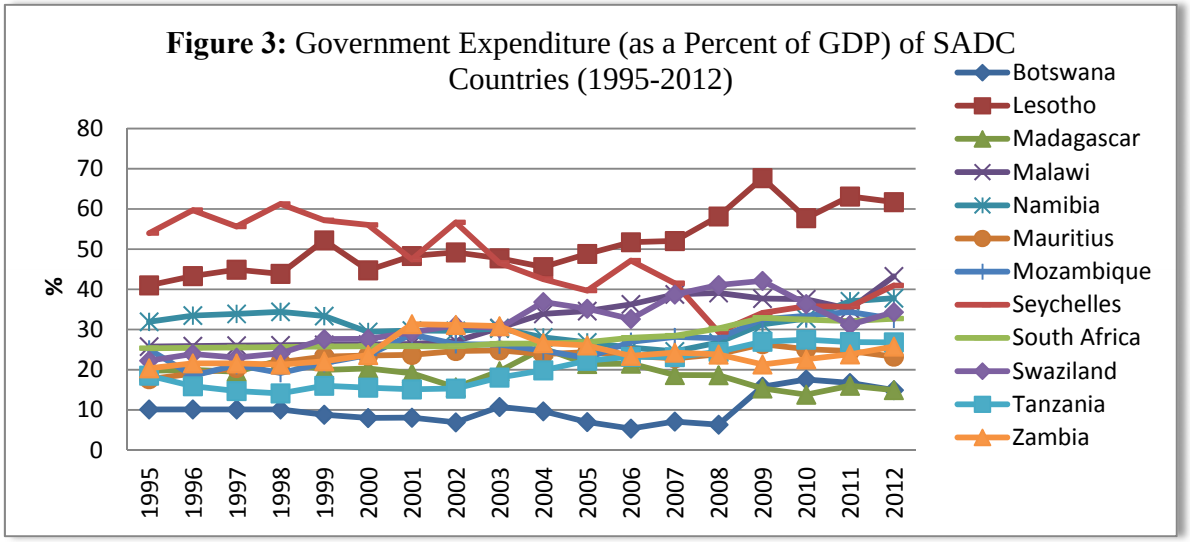
Figure 2: Broad Money as a Perecent of GDP (1995-2012)



Source: author, estimated from database

Government Expenditure

As shown in Figure 3, government expenditure as percent of GDP in the region is converging. It has been in a range of from 10-40 percent except in the case of Lesotho which has been more than 50 percent on average throughout the sample period.



Source: author, estimated from database

The Degree of Openness

In this study degree of openness (*lnOPEN*) bears a positive sign in relation to *lnREER*. It implies that in relative terms, trade liberalisation among member states has led to REER depreciation. However, in most cases the exact sign of trade liberalisation is indeterminate (Kamar &Naceur, 2007). With the exception of Tanzania, the rest of the SADC economies exhibit consistent convergence of their capital flows over the time period.

5. Methodology

This section discusses the methodologies used to assess policy coordination among the 12 SADC countries in the study. It then proceeds to discuss the methodology used to evaluate the stability and misalignment of REERs in the SADC region. The emphasis of this section is largely on the Pooled Mean Group (PMG) panel data model specification which is best suited for assessing the long run relationship between REER and its determinants).

5.1 Panel unit root and cointegration tests

To estimate a long run relationship we need to carry out a cointegration test for our series of REERs. Before proceeding to the modelling exercise, the cross country panels are tested for the presence of a unit root. We use four types of panel unit root testing techniques: *Levin-Lin-Chu unit root test, Im-Pesaran-Shin unit root test, Breitung unit root test and the Hardi LM test*. As summarised in Table 5 there are many panels with a unit root, which makes the conventional cointegration test and standard panel data analysis techniques invalid. For details see Pesaran and Smith (1995), Loaysa and Ranciere (2005), and Kamar and Naceur (2007).

Table 5: Panel Unit Root Tests

Variable	Ho: Panels contain unit roots Ha: Panels are stationary		Ho: All panels contain unit roots Ha: Some panels are stationary	
	Levin-Lin-Chu	**Breitung (λ)**	**Im-Pesaran-Shin**	**Hadri LM test**
lnREER	-2.3530***	-1.3958*	-1.6065	19.7785***
lnGEXP	-0.7160	0.4926	-1.2116	19.0743***
BUDG	-3.7155***	-4.2896***	-2.2973***	1.5566**
CAB	-1.9774**	-3.7156***	-1.9084*	10.9367***
lnTOT	-1.1378	2.4598	-0.8375	26.2365***
lnLIQ	-0.7233	3.2664	-0.5159	26.3993***
NFA	-1.0135	-3.3993***	-2.4573***	19.5140***
LOPEN	-2.3460***	-1.1388	-1.8381*	20.4339***
NKF	-3.5581***	-0.8321	-2.9112***	24.8022***
lnRESY	-5.1054***	-0.3612	-1.9253*	20.5233***

Source: Computed from sample data

*Notes: *, ***, *** rejects the null hypothesis at 10%, 5% and 1% levels of significance respectively. Automatic selection of lags based on SIC using Bartlett kernels. See Table 1 for variables definitions.*

Furthermore, we use a co-integration test for the series of REERs to estimate a long run relationship. A cointegrating relationship exists among RER series of SADC countries (Zerihun et al., 2013). Moreover, Pedroni (2004) panel cointegration tests reveal that panel-ADF and group-ADF statistics and panel-PP and group-PP statistics significantly reject the null hypothesis of no cointegration in this study (see Table 7.6). Results from panel-ADF and group-ADF statistics have better small sample properties with reliable results (Pedroni, 2004 and Das et al., 2012). Thus, the variables in the main equation move together in the long run.

Table 7.6: Pedroni residual cointegration test result

Series: lnREER , lnGEXP, lnLIQ, lnOPEN , lnRESY				
Included observations: 216; Cross-sections included: 12				
Null Hypothesis: No cointegration				
Trend assumption: Deterministic intercept and trend				
Automatic lag length selection based on SIC with a max lag of 2				
	Statistic	**Prob.**	**Weighted Statistic**	**Prob.**
Panel v-Statistic	-0.931910	0.8243	-1.982379	0.9763
Panel rho-Statistic	2.805147	0.9975	2.851414	0.9978
Panel PP-Statistic	-2.576906	0.0050	-3.644384	0.0001
Panel ADF-Statistic	-4.167592	0.0000	-3.825930	0.0001
Group rho-Statistic	4.410330	1.0000		
Group PP-Statistic	-6.058493	0.0000		
Group ADF-Statistic	-4.916577	0.0000		

Source: author

5.2 Methodology for testing the long run relationship among policy variables

The next step is to estimate the magnitude of such relationship using dynamic panel models. In this study Mean Group (MG) and Pooled Mean Group (PMG) panel data dynamic models are used because of their convenience with the data set and for comparison of the results from the analysis. The PMG model was first introduced by Pesaran et al. (1996, 1999) and has gained substantial popularity among researchers since it pools long run relationships between countries and also analyse the short run dynamics. For a detailed discussion on these models see Asteriou (2009). Following Kamar and Naceur (2007) the equation to be estimated is specified as:

$$\ln \text{REER} = \alpha_{0,\text{i}} + \delta_1 \text{lnGEXP} + \delta_3 \text{CAB} + \delta_4 \text{lnLIQ} + \delta_5 \text{lnOPEN} + \delta_6 \text{lnTOT} + \delta_7 \text{NFA} + \delta_8 \text{TKF} + \delta_9 \text{NKF} + \delta_{10} \text{lnRESY} \quad (7.2)$$

where the constant term $\alpha_{0,\text{i}}$ is allowed to differ between the countries in the sample, denoted by 'i'. Variables in equation (2) are as defined in Table 7.1 except the logarithmic term (*ln*) included for those series with positive values. Series with negative values are not converted into logarithmic form. Our panel data set consists of (N) =12 countries and the number of periods (T) =18. As mentioned above when a panel consists of a unit root employing standard panel data analysis techniques like a dynamic fixed effects model is not appealing to use (Elbadawi, et al., 2012). To overcome these limitations, Pesaran, Shin, and Smith (1999) propose the PMG model. The PMG model according to these authors is useful to assess whether monetary, fiscal, trade and financial policy variables from cross countries in a region (like SADC) have identical effects on the REER in the long run. To describe the PMG estimator, assume an autoregressive distributive lag (ARDL) (p, q,...q) dynamic specification of the form:

$$\text{Y}_{\text{it}} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{j=0} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (7.3)$$

where the number of groups, i=1,2,...,N, and the number of time periods, t=1,2,...,T, X_{it} is a (kx1) vector of explanatory variables, Y_{it} is a short hand notation for the dependent variable (lnREER), δ_{it} the (kx1) coefficient vectors, λ_{ij} scalars, μ_i is the group effect, and ε_{it} is the error

term. Time trends and other fixed regressors may be included. If the variables in equation (2) are, for example, I (1) and cointegrated, the error term is an I (0) process for all 'i'. Given this condition the model in equation (3) can be rewritten in the following error correction model (ECM) form, which uses the maximum likelihood approach for parameter estimation, by stacking the time-series observations as follows:

$$\Delta \mathrm{Y}_{\mathrm{it}} = \phi_i (Y_{i,t-1} - \theta_i^{'} X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^{\bullet} \Delta Y_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}^{'*} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (7.4)$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$, $\theta_i = \sum_{j=0}^{q} \dfrac{\delta_{ij}}{1 - \sum_k \lambda_{ik}}$, $\lambda_{ik}^{*} = -\sum_{\mathrm{m=j+1}}^{\mathrm{p}} \lambda_{\mathrm{im}}$ $\mathrm{j} = 1,2,...,\mathrm{p}-1$

and $\delta_{ij}^{*} = -\sum_{\mathrm{m=j+1}}^{\mathrm{p}} \delta_{\mathrm{im}}$ $\mathrm{j} = 1,2,...,\mathrm{q}-1$ (7.5)

The parameter ϕ_i is the error correcting speed of adjustment term. If $\phi_i = 0$, then no long run relationship is expected to exist. This parameter is expected to be significantly negative under the hypothesis that the variables show a return to long-run equilibrium. Of particular importance is the vector $\theta_i^{'}$ which contains the long-run relationship between the dependent and explanatory variables. For the purpose of comparison of the two long run parameters from the PMG estimation, we can also estimate the MG estimator of the error correction coefficient ϕ_i as follows:

$$\hat{\phi} = N^{-1} \sum_{i=1}^{N} \phi_i \text{ , with the variance } \hat{\Delta}\hat{\phi} = \frac{1}{N(N-1)} \sum_{i=1}^{N} \left(\hat{\phi}_i - \hat{\phi} \right)^2 \qquad (7.6)$$

We use the Hausman type test *(H)*is applied to the differentiation between MG and the PMG estimates to test the poolability of the long run parameters. Studies confirm that two conditions must be satisfied to use PMG as efficient long run relationship estimator:

- *the hypothesis of homogeneity must hold; and*
- *the assumption of poolability must be valid.*

Otherwise, the MG estimators would normally be preferred. Thus, we can form the test statistics as follows:

$$H = \hat{q}'\left[\text{var}\left(\hat{q}\right)\right]^{-1}\hat{q} \sim \chi^2_{\text{k}}, \qquad (7.7)$$

where $\hat{q}$ is a (kx1) vector of the difference between the MG and PMG estimates, and var($\hat{q}$) is the corresponding covariance matrix. Under the null hypothesis the two estimators are consistent, but PMG is efficient.

5.3 REER equilibrium and misalignment

For the analysis of REER equilibrium we use the same explanatory variables (policy variables and determinants of the REER) to estimate the long run equilibrium REER for all SADC countries under study. Applying the following simple procedures and assumptions we can estimate the REER equilibrium and its misalignment patterns to examine the misalignments among the SADC member countries' REERs. Furthermore, the exercise in this sub section enables us to judge whether the prevailing misalignments are converging or not over time. Assume that the REER at any time t is given by:

$$\log REER_t = \hat{\alpha} + \hat{\beta}'\text{F}_\text{t} \qquad (7.8)$$

where $\hat{\alpha}$ is the intercept 'F' stands for the long-run fundamentals and the corresponding parameters $\hat{\beta}'$ are the estimated regression coefficients. Equation (8) estimates the actual long run REER. Using a time series decomposition (e.g. Hodrick-Prescott procedure) we can decompose the fundamentals into permanent (F) and transitory ($F - \tilde{F}$) components. We use the following model proposed by Elbadawi et al. (2012) to construct the equilibrium REER:

$$\log \tilde{REER}_t = \bar{\alpha} + \hat{\beta}'\tilde{\text{F}}_\text{t} \qquad (7.9)$$

where $\hat{\beta}'$ are the coefficients estimated in the long-run regression and $\bar{\alpha}$ is the intercept that reflects the specificity of each country, only when significant. Finally, the REER misalignment is given by subtracting equation (7.9) from equation (7.8) as shown in equation 7.10.

$$REERmisalignment\ (t) = (\log REER_t - \log \tilde{RERE}_t).100\,\% \qquad (7.10)$$

where positive values indicate REER undervaluation and negative values indicate REER overvaluation.

6. Results and Discussion

Following stepwise regression procedures in the regression analysis, explanatory variables were added to the regression one at a time in a sequential order starting from monetary variables (i.e. for the reason that theoretically these variables affect REER more than other variables), then fiscal variables, and capital flow variables. Variables with an insignificant effect are dropped from the regression. By doing so the robustness of the model is ensured. The estimation results in Table 7.7 are obtained by regressing equation (7.2), following both MG and PMG methodologies specified in section 5.1.Out of ten macroeconomic structural explanatory variables used in the estimation five of them come out as significant determinants of REER among SADC economies. These variables are proxies for monetary, fiscal and trade policy. from the broad category of monetary policy, fiscal policy, and trade policy. This implies that SADC member states can use these policy variables as policy instruments to ensure exchange rate based policy coordination in the region to realise those anticipated benefits from on-going integration process.

Here only those explanatory variables with a significant effect on the REER are reported. As shown in Table 7.1, the PMG estimates provide much more efficient estimates of the long-run coefficients than the MG estimates. As described in section 7.6.2, the PMG estimator imposes the restriction that all the series in the panel share the same long-run coefficients which is not the case in MG estimator. However, for this restriction to be valid and to accept the PMG estimations we conducted a *Hausman test*[2] to verify the case.

As reported in Table 7.7 the Hausman joint test is not significant at the 90 percent confidence interval. This indicates that the restriction on the long run coefficients' homogeneity *is not* rejected by the data. This again proves the superiority of PMG estimates over MG estimates. Therefore, our interpretation of the results displayed in Table 7.7 goes with the coefficients of PMG long run and short run estimates, respectively. The error correction coefficient (*Phi*) carries

[2]Hausman test is a test used to compare PMG with MG similar to comparing fixed effect and random effect estimations.

the expected negative sign but with lower value (-0.25). However, such lower value coefficients are common in most of the cross country studies conducted in developing regions (for example, see Elbadawi, *et al.*,2012). The interpretation goes with message that in the long run the REER converges to the equilibrium, however, at very slow rate. Only 2.5 percent disequilibrium dissipates per year in the region.

Let's consider the impact of other significant policy variables in the equilibrium REER in the model. The liquidity variable *(lnLIQ),* proxy variable for money supply, and the degree of openness *(lnOPEN),* the ratio of the sum of values of imports and exports to GDP bear very high point elasticity coefficients with positive values which lead to higher depreciation of REER in the region. For example, a 10 percent increase in liquidity would lead to a 7.3 percent increase in the REER which is a significant amount of depreciation in the REER. Similarly, a 10 percent increase in trade values would lead to a 4.4 percent increase (depreciation) in the REER.

The other three variables have negative point elasticity coefficients implying that positive shocks from these variables have an appreciation effect on the REER. For example, a 10 percent increase in government expenditure and budget balance would result in a 4.8 and 2.2 percent appreciation respectively, of the REER. These two variables of fiscal policy can be instrumental in addressing inflation differentials among SADC economies which is one of the requirements of OCA criteria.

The last five variables defined in Table 7.1 are all proxies of capital flow. Only the stock of international currency reserves as a ratio to GDP *(lnRESY)* comes out with a significant impact on the REER. Similar to the fiscal policy variables interpreted above, a 10 percent increase in the stock of international currency reserves in the SADC region would result in a 1.8 percent appreciation in the REER of member countries (at 1 percent level of significance). This result is an indication that SADC central banks can use their international currency reserves as an optional policy instrument to address the potential impacts of capital flow fluctuations. Although the focus of this paper is on the long run REER and policy coordination, the ECM model indicates that the degree of openness (from MG model) and the stock of international currency

reserves (from PMG model) are the only two variables with significant short run impacts on the REER (at 5 percent and 1 percent level of significance, respectively).

Table 7.7: Econometric Results: Estimated Long Run Parameters

a) Dependent Variable: log (REER)

Variables	**Pooled Mean Group**			**Mean Group**		
Long-run coefficients	Coef.	Std.Error	P-value	Coef.	Std.Error	P-value
(ln)Liquidity	0.73	0.105	0.000	0.387	0.305	0.204
(ln)Gov. expenditure	-0.48	0.120	0.000	-0.83	0.236	0.000
(ln) Degree of openness	0.44	0.084	0.000	0.04	0.243	0.845
(ln) Reserve stock	-0.18	0.23	0.000	-0.24	0.067	0.000
	Joint Hausman Test: 2.05 (0.8417) Test: Ho: difference in coefficients is not systematic					
Error Correction (ϕ_i)	-0.25	0.775	0.001	-0.84	0.157	0.000
Short-run coefficients	**Coef.**	**Std.Error**	**P-value**	**Coef.**	**Std.Error**	**P-value**
(ln)Liquidity	0.23	0.174	0.184	0.74	0.293	0.800
(ln)Gov. expenditure	-0.12	0.123	0.315	-0.08	0.113	0.458
(ln) Degree of openness	-0.18	0.087	0.315	-0.84	0.157	0.000
(ln) Reserve stock	-0.13	0.045	0.004	-0.01	0.047	0.848
Constant term	0.8	0.24	0.001	3.7	1.06	0.001
Log likelihood	322.3718			276.8795		
Number of Obs.	192			192		
Number of Countries	12			12		

Source: author - from estimation result

Notes:

In the joint Hausman test the null hypothesis is not rejected, so we can conclude that the PMG estimator, the efficient estimator under the null hypothesis is preferred.

We also estimated equation (7.2) using the real exchange rate (RER) as a dependent variable. The results from this regression are reported in Table 7.8.

Table 7.8: Estimated parameters using real exchange rate (RER) as dependent variable

b) Dependent Variable: log (RER)

Source: author - from estimation result

Considering the results in Table 7.8, we found that all the major macroeconomic policy variables can be used to achieve policy coordination in the region. Trade policy has a statistically significant impact in both short run & long run. Fiscal policy has a significant impact only in the short run. Monetary policy has a significant impact only in the long run. The Stock of reserves at year end/GDP (RESY) has a statistically significant impact in both the short run and long run.

The other important result is from the REER misalignment analysis described in this section. Figure 7.4 and 7.5 below are obtained by using the econometric procedures shown in equations (7.8), (7.9) and (7.10). As shown in Figure 7.6, Mozambique and Zambia are extreme outliers in the group. REER equilibrium and its misalignment analysis reveal that SADC economies are characterised by persistent overvaluation with a seemingly unlikely mean reverting trend at least in the short run. REER misalignment has been in the negative range for the whole period of study. This persistent overvaluation in *lnREER* among SADC economies can be an indication of a low level of financial deepening and a higher tendency for currency crises in the SADC region

as documented in studies by Dehesa *et al*. (2007) for both industrial and developing countries and Burkart and Coudert (2002) for emerging economies.

Figure 7.4: RER Misalignment Using Heterogenous Intercepts

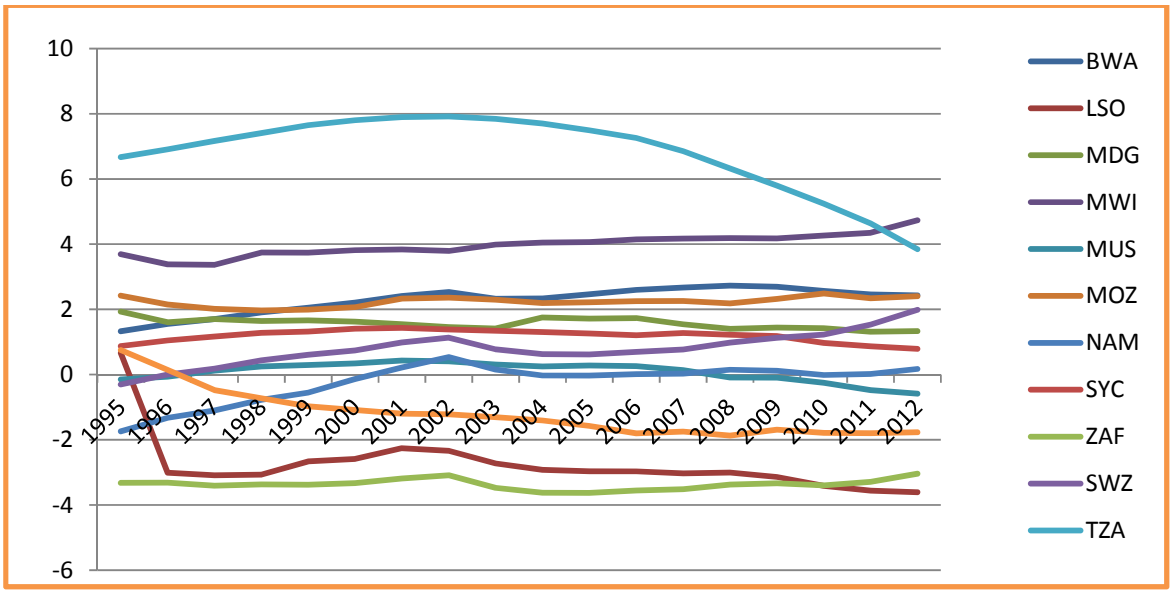
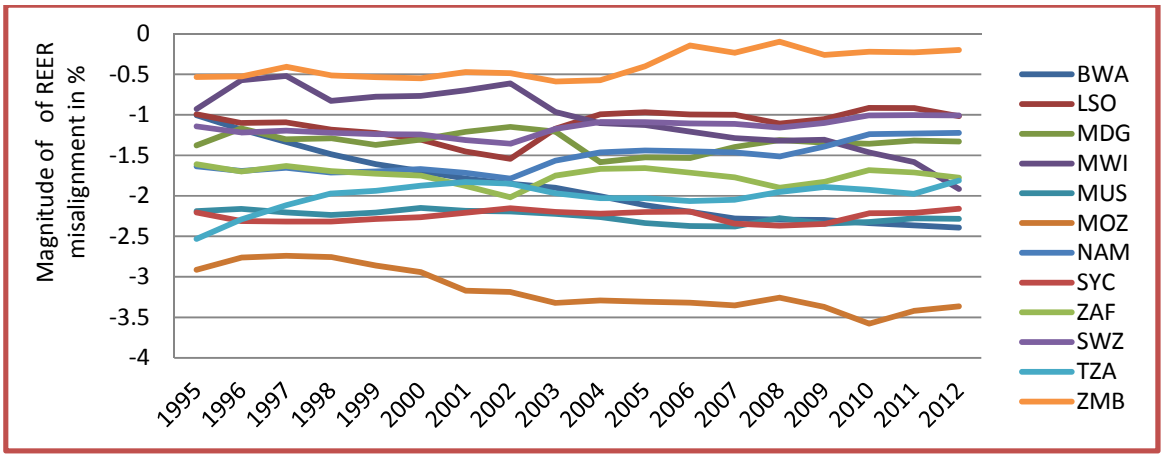


Figure 7.5: REER Misalignment Using Heterogenous Intercepts



Source: author, estimated from database

When we evaluate RER misalignment in Figure 7.4, even though there is still persistent RER misalignment in region, its deviation is not wider when compared to other developing countries.. This is a promising result and encouraging for further policy coordination in the region. The

findings in this case also confirms persistent misalignment in RER is still indicative of lower financial deepening and a potential tendency for currency crisis in the SADC region.

To answer the research question of whether there is sufficient policy coordination among SADC economies to form the proposed monetary union in 2018 or not, we need to consider our long run estimation result under PMG and the value of RER/REER misalignment. When we consider the long run PMG model, all the long run coefficients of the policy variables significantly affect the REER and the coefficient signs are in accordance with exchange rate theory. However, the slow adjustment towards the long run equilibrium and the high deviation of the REER from the equilibrium REER (misalignment) imply that the existing policy coordination among SADC economies is not sufficient for monetary union. Monetary integration and policy coordination should therefore be strengthened before considering monetary union.

7. Conclusion and Policy Implications

The objective of this paper is to identify and estimate the long-run determinants of REER behaviour in the SADC economies, at least insofar as it concerns the policy-related variables which affect the REER. To meet this objective we investigate the degree of policy coordination among SADC countries. The paper assesses the impact of different macroeconomic variables on REER behaviour in each country and whether these effects are similar in magnitude and direction. To this end the study explores the possibilities for exchange rate based policy coordination towards monetary integration in SADC. The quantitative analysis encompasses 12 SADC member states over the period 1995-2012. Correlation matrixes, dynamic models of PMG and GM estimators, and RER equilibrium and misalignment analysis are carried out.

Out of ten macroeconomic structural explanatory variables used in the estimation five of them come out as significant determinants of REER among SADC economies. These variables are from the broad category of monetary policy, fiscal policy, and trade policy. This implies that SADC member states can use these policy variables as policy instruments to ensure exchange rate based policy coordination in the region and to realise the anticipated benefits from an on-

going integration process. The underlying hypothesis that the study investigates goes with the assertion that countries meeting OCA conditions to a greater degree face more stable exchange rates. However, the study finds that SADC economies are characterised by persistent overvaluation with a seemingly unlikely mean reverting trend at least in the short period of time. As the findings in the paper confirms, persistent overvaluation in REER is indicative of lower financial deepening and a higher tendency for currency crisis in the SADC region. This calls for further policy coordination and policy harmonisation in the region. These findings are consistent with earlier studies in other developing regions. The findings in this paper have important policy implications for financial sustainability and opt for welfare-gaining monetary integration in the region, accompanied by more coordinated REER policies.

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