ESSAYS ON THE PROPOSED MONETARY INTEGRATION IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

by

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ESSAYS ON THE PROPOSED MONETARY INTEGRATION IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

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DECLARATION

I hereby declare that:

This PhD Thesis with the title *"Essays on the Proposed Monetary Integration in the Southern African Development Community"* submitted to University of Pretoria is my own original work and has not been submitted before to any other degree or examination in any other university. All sources of materials for this thesis have been fully acknowledged by means of a comprehensive list of references.

Signed: Date:

_____   _____

Mulatu Fekadu Zerihun

This Thesis is dedicated to

My mother Mrs. Gete Gebre and

My late father Mr. Fekadu Zerihun

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"**...**How you have helped him who is without power!
How you have sustained the arm that is without strength!
How you have counselled him who has no wisdom!
And how plentifully you have declared to him sound knowledge!" Job 26:2-4
"...ኃይል የሌለ ወን ምን ኛ ረዳ ኸው! ብር ታት የ ሌለ ወን ከ ን ድ ምን ኛ አ ዳን ኸው!
ጥበ ብስ የ ሌለ ወን ምን ኛ መከ ር ኸው! ብዙ እ ወቀ ትን ስ ምን ኛ ገ ለ ጥህ ለ ት!" መጽ ሐፈ ኢዮ ብ ፳፮:፪-፬

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ESSAYS ON THE PROPOSED MONETARY INTEGRATION IN THE SOUTHERN AFRICAN DEVELOPMEN COMMUNITY

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ABSTRACT

The objective of this thesis is to evaluate the readiness of SADC economies to complete the process of monetary integration in the region and to form a monetary union and adopt a common currency. This is done against the backdrop of optimal currency area (OCA) theory. Given this objective, the study hypothesizes that the majority of SADC economies in the region are potential candidates to bring the proposed monetary union into existence sometime in the future, if not in 2018 as proposed by SADC secretariat.

The study uses a mix of different methodologies ranging from developing a conceptual framework to empirical investigation in order to answer the research questions and to test the hypotheses. In addition to theoretical reviews and discussions, four findings emerge as fundamental from the four essays. First, from the Triples test the study has not found significant evidence to reject the null hypothesis of 'structural symmetry' among ten SADC member countries. 10 out of 15 members (i.e.66.67 percent) have exhibited structural symmetry in their real business cycles over the study period. However, close to 50 percent of the member states have weak cyclical co-movements with a low relative intensity. Taking the experience of the EMU where just five countries are able to create havoc in the entire union, we can safely say that the findings from the combined three tests from the first essay confirm that there is still work that needs to be done to coordinate economic policies in the region to improve real economic integration before entry into the proposed monetary union in 2018.

In Essay 2, the study finds that the generalised purchasing power parity (GPPP) hypothesis holds for SADC economies given the stationary panel of RER series with one

cointegrating relationship as exhibited by trace statistics and the existence of a long run co-integrating relationship amongst the system of real exchange rates. This implies that there is potential for relative prices to converge in the region in the long run, hence SADC is a potential OCA, based on the criteria of price convergence. However, the slow speed of adjustment towards GPPP long run equilibrium should be a warning for the possible ineffectiveness of policy to defend these countries against external shocks.

In Essay 3, the Brock, Dechert, and Scheinkman (BDS) test and Fourier approximation confirm the non linear nature of real exchange series in SADC economies. This finding further supports an OCA in the region comprising those countries included in the study. The findings in this essay further strengthen the findings from the previous two essays that claim that member states could constitute a monetary union in the region at some future date. Lastly, the fourth essay, using a long run dynamic panel model finds that there are common policy variables determining the real exchange rate (RER)/ the real effective exchange rate (REER) series of SADC economies. The RER/REER equilibrium analysis reveals that SADC economies are characterised by persistent misalignment. This calls for further policy coordination and policy harmonisation in the region.

By considering findings from all the four essays the study finds that nine SADC countries can potentially constitute SADC-OCA namely; Botswana, Madagascar, Malawi, Mozambique, Seychelles, South Africa, Swaziland, Tanzania and Zambia. Angola and Mauritius disqualified from a SADC-OCA at least for the sample period considered in this study. Lesotho, DRC, and Zimbabwe are not included due to data limitations, otherwise Lesotho could join the qualifying group of countries given long experience with the Common Monetary Area (CMA). To reap benefits SADC economic integration initiatives, it requires realistic time span, political will, common understandings and awareness, commitment and self-disciplined policy actions from member states and their fellow citizens.

Keywords: OCA, SADC, Structural Symmetry, Monetary Integration, Policy Coordination, PPP, GPP, Exchange Rate

LIST OF ACRONYMS AND ABBREVIATIONS

ARDL	Autoregressive Distributive Lag
AU	African Union
AfDB	African Development Bank
BDS test	(named after) Brock, Dechert, and Scheinkman
CMA	Common Monetary Area
COMESA	Common Market for East and Southern Africa
CPI	Consumer Price Index
DSGE	Dynamic Stochastic General Equilibrium
EMU	European Monetary Union
EPAs	Economic Partnership Agreements
GPPP	Generalised Purchasing Power Parity
MG	Mean Group
NEPAD	New Economic Partnership for Africa's Development
NNI	North –North-Integration
OAU	Organization of African Unity
OCA	Optimum Currency Area
PAEC	Pan-African Economic Community
PMG	Pooled Mean Group
PPP	Purchasing Power Parity
PTA	Preferential Trade Area
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
SACU	Southern African Customs Union
SADC	Southern African Development Community
SADCC	Southern African Development Coordination Conference
SSI	South - South -Integration
UNECA	United Nations Economic Commission for Africa

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CHAPTER 1

INTRODUCTION AND CONCEPTUAL FRAMEWORK

1.1   Background

The concept of monetary integration/union emanated from trade theory and open economy macroeconomics. Robert Mundell stated (UNECA, 2002)[1]

"*...monetary union is not everything but everything is nothing without it*",

We define monetary integration/union or a currency union as *an agreement among members of that union (countries or other jurisdictions) to share a common currency and a single monetary and foreign exchange policy* (Masson and Pattillo, 2005).

This definition embodies (1) a single currency or several currencies that are fully convertible at an irrevocably fixed exchange rate; (2) union-wide monetary policy that is determined by a single central bank or a system of central banks; and (3) a sole external exchange rate policy

In Africa, monetary integration has been in place since 1910 (Burgess, 2009). Monetary integration attempts should be evaluated in the context of their objectives, and their political, economic, and institutional setups on which they operate (Geda & Kibret, 2008). Regional economic integration, which can take the form of regional monetary union, can have positive welfare effects for the countries joining the union and leads to economic growth and poverty reduction (UNECA, 2010).

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[1]Robert Mundall, the 1999 Nobel Prize laureate, during his key note address at the Economic Commission for Africa meeting in Addis Ababa, Ethiopia.

One of the strongest justifications for regional integration in Africa is greater economic independence and development.

> *"The root of Africa's marginal role in the world economy is intrinsically linked to the limited strides made in regional integration"* (UNECA, 2012).

Given this fact, deeper regional integration in Africa promotes peace, security and stability by forcing a stronger commitment by members to unity. Within the AU regional integration fosters free movement of business people and investments; it also brings member states into a more coherent large market. For example, Elu &Price (2014) confirm that regional currency integration has counter-terrorism benefits as evidenced in the CFA Franc Zone by raising the cost of imported inputs used in the production of terror.

Explicit political agendas were targeted towards African Economic Union since the Abuja Treaty in 1991. In the African context, monetary union or economic integration go beyond purely economic aspects. Political commitment to regional monetary policy coordination is generally assumed to be the precondition and underlying driving force of any integration process. With the advent of the African Union (AU), there have been intense renewed efforts by member states to give priority to policy coordination and economic integration, as a way to enhance their bargaining power via a common negotiating position in the era of globalization.

The economic integration in southern African countries is one of the oldest economic integration initiatives in the world and can be traced back to the Southern African Customs Union (SACU) which was created in 1910 between South Africa and its neighbours. SADC is the largest regional economic grouping in sub Saharan Africa (SSA) (Burgess, 2009). The objective of the regional integration agenda in SADC is to create a fully integrated internationally competitive region to ensure economic growth and poverty reduction. The SADC region faces a number of challenges to achieving this goal but opportunities are all plentiful and the region is well positioned to take advantage of them (AfDB, 2011).

The objective of this thesis is to evaluate the readiness of SADC economies to complete the process of monetary integration. I employ various methodologies to arrive at sound conclusions about the proposed monetary integration in the SADC region. These methodologies include descriptive statistics, correlation analysis, measures of structural symmetry, panel co-integration and panel unit root tests, nonlinear econometric approaches, and dynamic panel data models, namely; mean group (MG) and pooled mean group (PMG) models.

My main contribution in this thesis is a comprehensive empirical investigation of the degree of real convergence towards the proposed monetary union in the region using recent databases. I provide additional source of references by applying methodologies never applied in the context of SADC before. Furthermore, this thesis can be an important source of scientific input for the stakeholders and policy makers in the SADC region to bring the proposed SADC monetary integration into existence.

1.2   Problem Statement

The main reasons for the economies of most African countries to remain detached from each other are overlapping membership of various Regional Economic Communities (RECs) and a lack of investment in the institutions and systems required for integration (UNECA, 2010; Jovanovic, 2006). In spite of these problems, SADC is moving towards the creation of a monetary union by 2018 (Belle, 2010).

There are mounting doubts about the economic and political feasibility of the monetary integration of SADC. The existing literature on the region only focuses on the Common Monetary Area (CMA), also known as the Rand Monetary Area. The literature on other monetary integration initiatives is largely biased towards north-north monetary integration (NNI), particularly the European Monetary Union (EMU). Furthermore, the original theory of optimum currency areas (OCA) did not take into account the attempts toward monetary

integration among developing and emerging market economies, collectively known as south-south monetary cooperation or integration schemes (SSI), which sprung up since the 1990s (Fritz, et al , 2010).

Given such theoretical gaps and the absence of research frameworks which go beyond the OCA theory, there are already mounting doubts about the economic and political feasibility of monetary integration in the region. This study sheds light on the economic feasibility of the proposed monetary union in the SADC region, with some policy implications, leaving the analysis of financial and political aspects of the integration process for a further study.

1.3   Research Questions and Objectives

I analyse the mounting doubts about the feasibility of monetary integration in SADC region. For this purpose, I seek answer the following questions:

1) Do SADC countries adhere to structural symmetry towards monetary integration?
2) Do SADC countries form an optimum currency area?
3) What policy coordination options are available to move SADC economies towards a successful monetary union?

I shall evaluate the readiness of SADC economies to complete the process of monetary integration in the region. To this end, I propose to:

a) Establish empirically whether SADC countries can form the proposed monetary union in the stipulated time frame and beyond;
b) Provide policy coordination measures to be addressed in an attempt to move SADC economies towards successful monetary integration;
c) Contribute to the literature on the economics of integration in the SADC region.

1.4   Hypothesis

A resurgence of regional economic integration initiatives among the recognised regional economic communities in Africa followed after the formation of the European Monetary Union (EMU) on January 1, 1999. I am optimistic about the SADC initiatives towards the proposed monetary union in a realistic time span, if not in 2018, based on my systematic study of successes and failures in EMU. Indeed, I am convinced that SADC will be a credible example for south-south economic integration in the African continent and globally.

Overall working hypothesis of the study is that the majority of the economies in the SADC region are potential candidates to bring about the proposed monetary union sometime in the near future, if not in 2018. This general hypothesis is based on the following two hypotheses:

(i) Most of the economies of the member states of SADC have shown a tendency of nominal convergence in respect of the convergence goals set by SADC Secretariat. These tendencies confirm that there may be adequate real convergence among SADC economies towards the proposed monetary union in 2018.

This hypothesis is based on my preliminary inspection of trends of some macroeconomic indicators in the region.

(ii) There may not be sufficient policy coordination to induce the proposed monetary union in 2018, given the existence of heterogeneous economies in the region.

1.5   Methodology and Data Sources

I use different methodologies to answer the research questions posed in this thesis. The methodologies range from developing a conceptual framework to empirical investigations.

(1) A nonparametric method called the Triples test, along with two other methods of testing the co-movement of real business cycles in the region (Chapter 4, first essay).

The Triples test was first developed by Randles et al. (1980) and Razzak (2001), respectively. I used the Triples test for its accessibility and superior results. The Triples test method is more efficient than many other methods used in the literature to detect symmetry. Furthermore, it is asymptotically distribution free, which means that the outliers and changes in the variance of the distribution of the time series cannot affect the test.

(2) Johansen's multivariate co-integration technique and panel unit root tests for the period 1995-2012, using monthly Consumer Price Index (CPI) and nominal exchange rate data (Chapter 5, second essay). In this essay I look for evidence of relative prices converging in the long run.

Recent cross-sectional dependence augmented frameworks of panel unit root tests as found in IPS (2003) and LLC (2002) are used due to superior power advantage over time series unit root tests.

(3) In Essay 3, I test for PPP in SADC. I use two nonlinearity tests: the nonparametric methodologies developed by Brock, Dechert, and Scheinkman, known as BDS test, and the Fourier stationary test.

The BDS test detects the *independently and identically distributed* (*iid*) assumption of the time series used in the analysis. The Fourier approximation mimics a wide variety of breaks and other types of nonlinearities.

(4) In Essay 4, I investigate the strength of exchange rate based policies to affect the real effective exchange rate and also evaluate the long run equilibrium real effective exchange rate to find evidence of policy coordination. I apply a panel data analysis of the mean group (MG) estimator, pooled mean group (PMG) estimator (Kamar and Naceur, 2007; Pesaran, et al., 1996) and Pedroni (2004) panel cointegration tests, to estimate the long-run relationship of the macroeconomic determinants of real exchange rate in the SADC region. The goal is to explore for the possibility policy coordination towards monetary integration in the region.

The following data sources are consulted to obtain relevant and undated data for the analysis in this study:

- World Bank's *World Development Indicators, and African Development Indicators*
- UN statistics, IMF's *International Financial Statistics*, and
- Other published UN and AU sources and publications including Central Banks of SADC member states.

1.6   Conceptual Framework of the Study

The conceptual framework of this study is synthesised by considering the OCA theory as an application of trade theory and part of open economy macroeconomics. The two strands of OCA theory along with other relevant concepts and methodologies are incorporated in the analysis of the OCA theory in line with the proposed monetary integration among SADC economies. Figure 1.1 shows the conceptual framework adapted for this thesis. All the concepts implied in this conceptual framework are discussed in the next chapter and briefly in the essay chapters as well (chapter 4-7).

Figure 1.1: Conceptual Framework of the Study
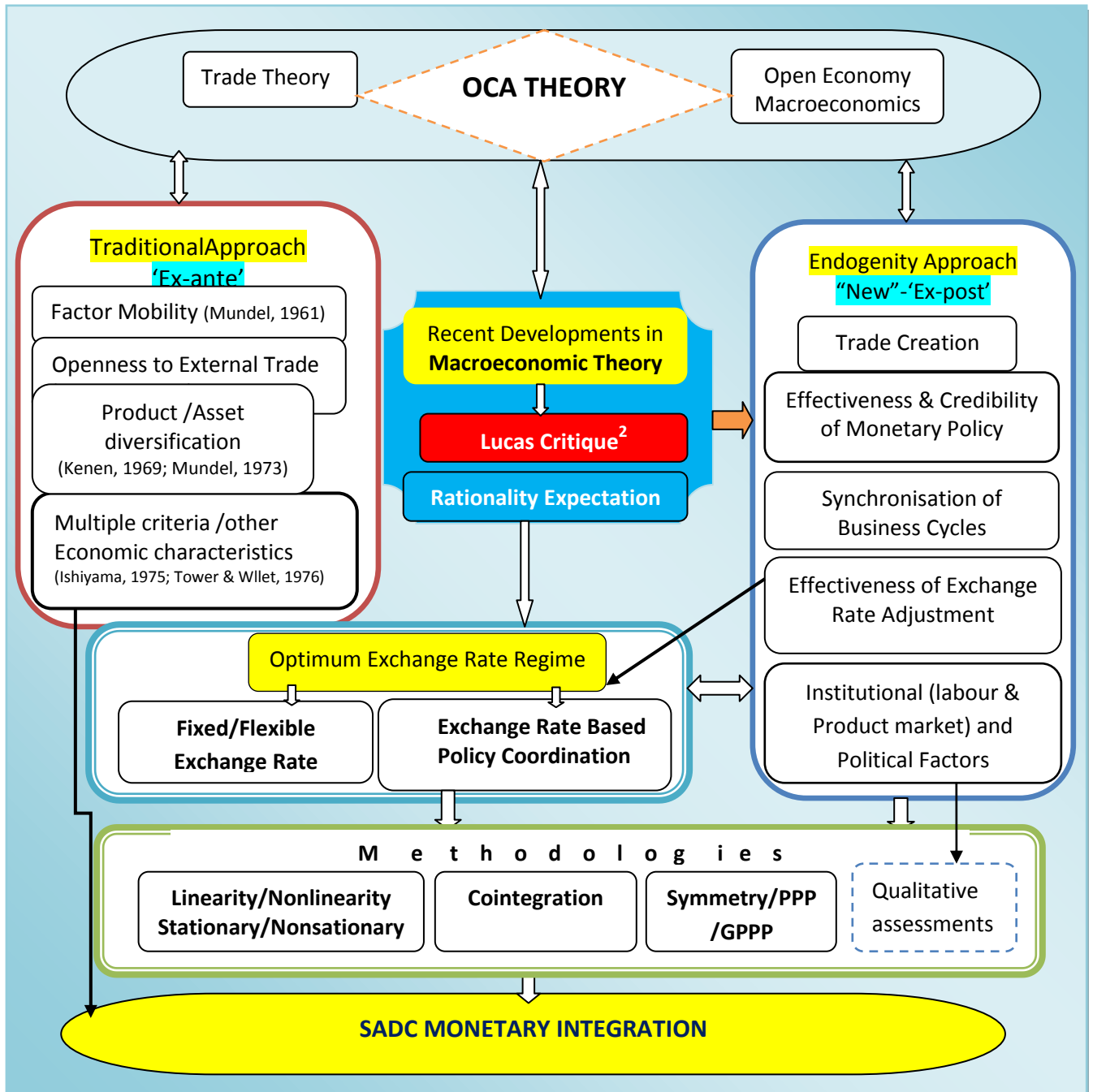
Source: Synthesised by the author

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[2] According to the Lucas Critique, a prediction based on historical data would be invalid if some policy change alters the relationship between relevant variables. If the policy change alters the relationship between the variables, then the historical relationship between the variables would differ in the future relationship (Broz, 2005). Details are discussed in section three.

1.7 Scope and Limitations of the study

Economic integration is a border area of study which encompasses monetary integration, fiscal and political union, and other social dimensions. Monetary integration by itself encompasses integration of financial and banking systems along with policy coordination for the ultimate adoption of a common currency. However, the scope of this thesis is limited to the empirical analysis of the feasibility of the proposed monetary integration among SADC economies just by considering few among many OCA criteria.

The other limitation of this study pertain to the low frequency annual data used in the analysis compared to studies in OECD countries, which used quarterly and even monthly data. However, the real GDP data used in this study provides the most comprehensive measure of economic activity and it is generally available for African countries on an annual basis. In essay 1 (chapter 4) and in essay 4 (Chapter 7) I used low frequency annual data which may not give the actual behaviour of macroeconomic variables among SADC economies. Moreover, SADC member countries like Lesotho, the Democratic Republic of Congo (DRC), and Zimbabwe are not included in three of the essays due to data limitations. In addition to empirical analysis done in this thesis more qualitative assessments are also imperative to understand the perceptions of stakeholders.

Therefore, in addition to this study, further studies suggested in the last chapter and more OCA criteria should be jointly considered for the meaningful application the findings in this thesis in the move towards the proposed monetary integration in the SADC region.

1.8 Structure of the Thesis

This thesis is structured as follows. The first three chapters of the thesis present introduction, conceptual framework, overview of economic integration in Africa and theoretical frameworks where the study anchors. Second, this thesis investigates the structural symmetry among Southern African Development Community (SADC) economies in order to establish the proposed monetary union, judged by Optimum Currency Area (OCA) theory. Third, it examines whether the SADC economies constitute an OCA according to the Generalised Purchasing Power Parity (GPPP) hypothesis. Fourth, it explores the purchasing power parity of SADC economies towards monetary union using non-linear econometric approaches. Fifth, it evaluates the strength of macroeconomic policy coordination in SADC as a prerequisite towards sensible monetary integration in the region. The last chapter concludes the thesis.

CHAPTER 2

THEORETICAL REVIEWS ON ECONOMIC INTEGRATION

2.1 Introduction

In the previous chapter, I highlighted the introduction and the conceptual framework of the study that evolved from the advancements in international trade theories and recent developments in open economy macroeconomics. These theories have shaped the evolution of OCA theory and of economic integration. In this chapter, I shall review theories relevant to economic integration. In particular, I adopt Javanovic's model (2006) of taxonomy of economic integration (Table 2.1).

I shall examine OCA theory and South-South Integration (SSI) in the light of the experiences of economic integration in Africa and SADC in particular (chapter 3). The discussions in the theoretical frameworks of economic integration are important in the empirical works in the proceeding chapters.

2.2 Theory of Optimum Currency Areas

The theory of optimum currency area (OCA) is my theoretical basis for analyzing monetary integration and monetary union[3]. The European monetary integration led to a renaissance of the theory of optimum currency areas (OCA) culminating in the 1999 award of the Nobel Prize to Robert Mundell (Salvatore, 2000). The theory of optimum currency areas (OCAs) is

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[3] In this thesis the terminologies monetary integration and monetary union are used interchangeably.

a useful starting point for any discussion on regional integration since it addresses the central question of whether or not a monetary union is ideal.

The optimum currency area is a region where factors of production are internally mobile but internationally immobile, so as to facilitate the intraregional redistribution of resources in response to demand shifts - economic homogeneity is a prescription to reduce the impact of asymmetric shocks (Mundell, 1961). These criteria outline a rigorous framework for monetary integration and provide a basis for future analysis of OCAs.

Table 2.1: Taxonomy of Economic Integration

Taxonomy of Economic Integration	Characteristics
Free Trade Area	• An agreement among countries about the elimination of all tariff and quantitative restriction on mutual trading
Customs Union	• Free trade are added to the common external tariff
Common Market and Economic Union	• Free movement of factors of production, goods and services with harmonized or coordinated national policies and transfer to the supranational level
Monetary and Fiscal Union	• To implement single currency and operate under single central bank with tax harmonization and fiscal sovereignty
Political Integration or Political Union	• Effective and democratic body at the supranational level

Source: Adapted from Jovanovic (2006)

Trade factors are an important addition to the theory of OCAs; the influence of openness in a currency area demonstrates that considerations of a country's trade behaviour are integral to determining optimality (McKinnon's 1963). In particular,

> "*if we move across the spectrum from closed to open economies, flexible exchange rates become both less effective as a control device for external balance and more damaging to internal price-level stability*"(McKinnon,1963).

On the issue of homogeneity, intraregional diversification is a buffer to the blow of an economic shock, particularly for specialized economies (McKinnon, 2004). This affirms Mundell's realization that:

> "*the use of a common currency (or foreign exchange reserves) allows the country to run down its currency holdings and cushion the impact of the loss, drawing on the resources of the other country until the cost of the adjustment has been efficiently spread over the future*" (Mundell, 1973).

OCA is defined as the optimal geographic domain of a single currency, or of several currencies, whose exchange rates are irrevocably pegged and might be unified. The single currency, or the pegged currencies, can fluctuate only in unison against the rest of the world. The domain of an OCA is given by the sovereign countries choosing to adopt a single currency or to irrevocably peg their exchange rates.

Optimality is defined in terms of several OCA criteria, including the mobility of labour and other factors of production, price and wage flexibility, economic openness, diversification in production and consumption, similarity in inflation rates, fiscal integration and political integration (Mongelli, 2002). Sharing the above criteria reduces the usefulness of nominal exchange rate adjustments within the currency area. Fostering internal and external balance reduces the impact of some types of shocks or facilitating the adjustment thereafter.

Countries would form a currency area in expectation that current and future benefits exceed costs. Table 2.2 summarises the main traditional OCA criteria and the effects of those criteria on the existing or proposed monetary union. Box 2.1 shows likely benefits of monetary union.

To sum up, OCA theory has faced numerous challenges and critiques well documented in literature (see Goodhart, 1995; Waltraud, 2001, among others); OCA theory has been evolving for the last fifty-four years and still is under refinement (Pomfret, 2005).

> *Criticisms do not undermine the OCA approach, but as with the positive contributions, add to the number of considerations that are relevant and influence the weights which should be given to different considerations (*Willett, 2001*).*

Table 2.2: Traditional OCA Criteria and their Effects on the Common Currency Area

Traditional OCA criteria	Variables Effect
Labour mobility[4]	The greater the labour mobility (when wages and prices are not flexible) the easier it is to join/form a common currency area.
Wage and price flexibility	If there is wage and price flexibility in a common currency area, it will be easier to overcome asymmetric shocks and the common currency area will be more stable.
Openness	The more open the economy is, the stronger is the case for joining/forming a common currency area.
Diversification of production/exports	The more diversified the economy, the more attractive is a common currency area.
Size of economy	The larger the economy, the more attractive is the flexible exchange rate.
Inflation differential	If there is inflation differential between countries, it will be harder to maintain the fixed exchange rate.
Capital mobility	The higher the capital mobility, the harder it is to maintain a fixed exchange rate (except, of course, if the country joins a common currency area).

Source: author, adapted from Broz (2005)

Box 2:1 Benefits of Monetary Union

- The elimination of transactions costs and accounting costs.
- A removal of foreign exchange risk, which is considered a major obstacle to trade and cross border lending (Kenen, 1996; Rose, 2000).
- Creation of more transparent pricing system, which makes international price comparison easier.
- Gaining more credible monetary policy by adopting the strongest exchange rate commitment (Frankel, 1999).
- Monetary union arrangements are less susceptible to speculative attacks (Frankel, 1999).

Source: author, own compilation

Table 2.3 summarise the major development phases of the OCA theory based on study by Mongelli (2002).

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[4]Melitz (1991) asserts that Mundell's criterion of labour mobility loses its appeal once the belief in the long-runtrade -off between unemployment and inflation under the Phillips curve framework is abandoned.

Table 2.3: Main Development Phases of OCA Theory

Phase	Time Span	Achievements	Drawbacks, if any
Pioneering phase	1960s-70s	• Putting forward the OCA criteria • Debate on the borders of a currency area • Initiation of the analysis of the benefits and costs from monetary integration.	• Difficult to weigh and reconcile the diverse OCA properties as a unifying framework. • OCA properties had no clear empirical content
Reconciliation phase	During 1970s	• OCA criteria started to be analysed and weighed with one another to gauge their relative importance • A new "meta-property"(i.e., the similarity of shocks) • Analysis of the costs and benefits.	• Most OCA properties continued to lack an empirical content
...Loss of momentum in OCA studies....1970s-80s...	*...Problem of inconclusiveness, a weakening of the analytical framework behind the OCA theory, and a slow-down in the process of EMU...and the momentum revived later on...*		
Reassessment phase	1980s and 1990s	• New theory of OCA • Monetary integration was rekindled... *"One Market, One Money"* Report by EMU • *"One Money, One Market"*	• Belief in rationality of capital markets • Neoclassical bias of convergence → catching up • Politicians can use it for legitimizing extension of power • Belief that single monetary policy reduces shocks
Empirical phase	Since 1990s	• Studies of OCA properties have become very comprehensive and articulated • Better position/ harder position • New paradigms -- specialisation versus "endogeneity of OCA"	• EMU may represent a structural break • OCA theory hasn't articulated the south-south integrations

Source: Author adapted from Mongelli (2002)

2.3 Lucas Critique and Rational Expectations in OCA Analysis

The Lucas critique and rational expectations on the analysis of monetary unions is relevant in the consideration of recent developments in open economy macroeconomic analysis in relation to monetary unions. The Lucas critique and rational expectations provide important lessons for SADC.

2.3.1 Lucas Critique and OCA Analysis

The Lucas critique states that

> *It is inappropriate to estimate econometric models of the economy, in which endogenous variables appear as unrestricted functions of predetermined variables, if one proposes to use such models for the purpose of evaluating alternative economic policy regimes* (Lucas, 1976).

Some studies reject, while others support, the Lucas critique. Thus, I review the merits of these studies. My review is entirely derived from the studies on EMU. Other proposed monetary unions, like SADC, have not yet made major policy shifts towards the envisaged monetary union. Hence, it seems too early to apply the Lucas critique at this stage of the proposed SADC monetary union.

Frankel and Rose (1997) assumed that the OCA criteria are jointly endogenous when they applied the well-known "Lucas Critique" in their analysis of the suitability of euro zone countries for EMU. Indeed, some OCA criteria may be endogenous with respect to the process of monetary union which can bring about a change in the degree of flexibility of macroeconomic policy variables following full monetary integration (Quirici, 2005). Furthermore, a monetary union provide more highly synchronized business cycles because of increase in trade due to decrease in transaction costs and elimination of exchange-rate risk (Kapounek and Poměnková, 2012). Therefore recent studies support the hypothesis of the endogeneity of the OCA criteria during the last decade in EMU which advocates that:

The creation of EMU will facilitate rapid convergence of the participating economies, thus leading to the synchronization of economic cycles and making the need for fiscal integration and labour market flexibility less important (Mongelli, 2008).

Now the Lucas critique states that the transition to a new system of governance structurally changes economic relations and behaviour. This therefore renders irrelevant any predictions derived from the pre-transition phase. This is the essence of the contemporary criticism on the traditional OCA theory, the so-called '*endogenous OCA*':

The new structure of economic governance in the euro area creates new conditions and challenges that may exacerbate the problems of adjustability and rigidity of the European economy, making new forms of flexibility and associated measures for the deregulation of labour markets more imperative (Monastiriotis & Zartaloudis, 2010).

The empirical relevance of the Lucas critique was re-examined by a dynamic stochastic general equilibrium (DSGE) sticky price model where a weak central bank response to inflation generates equilibrium indeterminacy (Lubik & Surico, 2006, 2010). The studies conclude that the Lucas critique is alive and well.

Some studies argue that the relevance of the Lucas critique is limited in practice (Estrella & Fuhrer, 2003; Rudebusch, 2005). These studies suggest that tests for parameter stability in backward-looking specifications or reduced forms of macroeconomic relationships typically fail to reject the null hypothesis of structural stability in the presence of well-documented policy shifts. In particular, shifts in policy seem not to have any significant effects on the stability of backward representations of macroeconomic models for various historical episodes. For example, the findings of Van Bergeijk & Berk (2001), on the term structure in12 OECD countries, reveals that econometrically estimated behavioural equations for most EMU countries were stable even in the light of the creation of the euro.

The Van Bergeijk & Berk (2001) finding seems to refute the Lucas Critique. However, these authors conclude that the significant structural instability found for the euro area's core

country Germany, suggests that the Lucas Critique is relevant in the analysis of the impact of the creation (and future extensions) of EMU.

Fully-specified, optimisation based DSGE models for policy analysis are ideal for the Lucas' Critique. On the other hand, topics for future study are:

1. The relevance of the Lucas Critique for SADC countries; that is, econometric policy advice for SADC countries to join the proposed monetary union.
2. Sophisticated statistical tools to fill the gap in the literature in the interaction between each of the OCA criteria and monetary integration in the SADC region. Such empirical findings will help judge whether SADC will realise the anticipated benefits from this gigantic regional initiative.

2.3.2 Rationality of Expectations and OCA Analysis

The rationality of expectations by economic agents in the given monetary union and outside the union is an important macroeconomic factor in monetary integration analysis. Studies show that rational expectations minimize macroeconomic volatility in the presence of asymmetric shocks. This specification of expectations outperforms any other type in consideration: static, adaptive, regressive and extrapolative, as well as "hybrid" types (Torój, 2011).

The introduction of rational expectations in macroeconomics in the middle of the 1970s represented an intellectual revolution for the macroeconomic analysis and a serious challenge for large-scale, backward-looking econometric models that were used for policy analysis. Changes in policy have an immediate effect on agents' decision rules since they are inherently forward-looking and adapt to the effects of the new policy regime (Lucas 1976). Consequently, any policy evaluation based on backward-looking macroeconomic models is misleading whenever such policy shifts occur (Allsopp & Vines, 2010). Moreover, rationality of expectations should be considered as another OCA criterion based on the role of expectations

in the case of EMU; indeed, t*he forward-looking behaviour developed by agents might equip the economy with a strong stabilizing force inside the monetary union* (Torój, 2011).

Here I want to emphasise that the *awareness creation, economic education*, and *information campaign* in the process of any existing or proposed monetary union is important to develop the rationality of expectations and to avoid premature collapses. In the context of SADC and Africa in general, member states of economic communities need to work extensively in promoting consciousness of their fellow citizens in order to realise ongoing endeavours towards Pan-African Economic Community (PAEC).

Economic integration initiatives in Africa are often led by public sector organizations without public support and the support of private sector, thus, failing to produce positive consequences (Jurčić, 2010). In the current situation of xenophobic society, the '*Africa Unite*'[5] slogan will not move Africa as it did during early years of independence. Empowering citizens and broader stakeholders to make informed decisions may also reduce the existing pessimism about PAEC.

2.4 OCA Theory and South-South Integration

Both traditional monetary integration theory and its critiques are mainly designed for developed countries, referring predominantly to the euro area. Therefore, literature on OCA approaches in the analysis of south-south integration (SSI) initiatives, such as SADC, is scarce. The main background reference here is the article by Fritz and Mühlich (2010).

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[5]The most influential song by Bob Marley

We need to consider the *original sin hypothesis* when we discuss SSI. Original sin hypothesis put simply is '*the inability of a country to borrow abroad in its own currency and measured as the ratio of foreign currency–denominated gross debt to foreigners as a share of total gross debt to foreigners'* (Eichengreen &Hausmann, 2005*)*. This is the dominant case among developing countries. Hence, as stated by Fritz and Mühlich (2010), *the development of regional financial markets, that play a crucial role in minimizing exposure to currency and maturity mismatches, is critical.*

The original sin concept (Eichengreen, et al., 2005, Fritz &Metzger, 2006) evidences the particular importance of the denomination and composition of domestic and external debt for economic growth and development. Monetary integration is characterised by either the creation of a single currency or the adoption of a regional currency. The literature on original sin shows that a full monetary integration may reduce currency and maturity mismatches in regional balance sheets due to scale effects in portfolio diversification of an enlarged regional currency area (Eichengreen &Hausmann 2005; Panizza 2006). Thus, by definition, SSI is pursued by countries which accumulate debt in foreign currency, thereby most often suffering from a restricted lender of last resort function, balance sheet effects in the event of a currency devaluation and original sin and, as a result, small and undiversified financial markets. While levels and composition of internal and external debt may vary among the participating countries, SSI needs to deal with the specific monetary constraints of the member countries.

Intraregional hierarchies in terms of original sin and net creditor/net debtor relations play a crucial role for the success of an SSI project (Fritz and Mühlich, 2010). The authors further argue for a clear hierarchy in terms of indebtedness in foreign currency seems to provide favourable conditions for a successful SSI and may provide further perspectives for regional monetary integration and financial market development. In this sense, both stronger and weaker countries could benefit from regional monetary integration, with the larger economies

establishing potentially stabilising leading roles. Fritz and Mühlich (2010) conclude that *'intra-regional hierarchies, involving differing levels of original sin and indebtedness in foreign currency, constitute a major success factor for intra-regional exchange rate stabilisation and enhanced regional monetary SSI'*.

A regional monetary arrangement potentially generates economies of scale in regional financial markets. Thus, the potential stabilization gains of SSI need to be understood as a monetary strategy, including a specific exchange rate regime choice of the integrating countries. Emerging market economies are excluded from economic blocs based around the international key currencies. Given the international trend toward building economic blocs, it seems fruitful to understand the exchange rate regime options for developing and emerging market economies, from the perspective of their relation to the latter – *instead of the usually applied corner solutions perspective* (Priewe, 2006).

2.5 Summary

In this chapter I reviewed OCA theory, the Lucas Critique and other theories as they relate to and provide the theoretical perspectives to the four essays that form the core of this thesis. The four essays are strictly based on the view of traditional OCA criteria and do not explicitly consider endogenous OCA approach. This thesis favours traditional OCA approach for SSI on account of Priewe (2007) and other studies. Priewe (2007) finds that '*there is no vast enodogenity of the condition*' of an OCA after critically analyzing EMU. In the next chapter I look at the experience of African economic integration attempts with particular emphasis to SADC.

CHAPTER 3

EXPERIENCES OF ECONOMIC INTEGRATION IN AFRICA: THE CASE OF SADC

3.1 Introduction

In this section I begin with a brief historical background of economic integration initiatives in Africa in the post independence period. Since the early years of independence, regional integration and the creation of a pan-African common market has been a central vision of African leaders. Serious renewed efforts by member states to give priority to policy coordination and economic integration began with the advent of the African Union. On June 3, 1991, the African Economic Community was created and a call for an African Central Bank to follow by 2028 was made. The current plan is to establish an African Economic Community with a single currency by 2023. The question is does this plan be successful?

Deeper regional integration is thought of as a way to promote peace, security and stability by forcing a stronger commitment by members to unity within the AU. More recently, the AU has been emphasizing the economic benefits of deeper integration. Indeed, a common view is that Africa is becoming increasingly marginalized by globalization (Adepoju, 2001) and that governments see deeper integration as a way to enhance their bargaining power by achieving a common negotiating position.

However, many African countries belong to multiple customs unions, development associations or other multi-country institutions with various objectives and envision various degrees of integration. Three generalised approaches occurred in the post-independence

period: Francophone countries which generally remained linked to the French Franc, former colonies of other European countries and Southern African economies which were generally drawn towards South Africa (Masson, 2008; Masson and Patillo, 2005). These differing approaches remain evident today, with the CFA Franc Zone (now linked to the Euro) and the CMA Rand Area, the only two single currency areas in Africa, with the other countries (generally colonies of Britain, Portugal, Spain and Belgium) using their own national currency. Together with these historical groupings, there has been renewed interest in regional cooperation, resulting in multiple regional economic communities (RECs) that are generally based upon geographical as well as historical circumstances.

Africa is known for its '*spaghetti bowl*' of different national and sub-regional RECs (Geda & Kibret, 2008). The eight RECs recognized by the African Union (AU), which form the ''pillars'' of the Pan-African Economic Community (PAEC), are moving towards implementing the Abuja Treaty at different speeds. While a single currency and a common central bank in Africa may remain aspirations for quite some time, strengthened policy coordination and macroeconomic convergence are entirely within the realm of feasibility in most sub regions of Africa (UNECA, 2010). Furthermore, regional integration offers significant "win-win" possibilities for the region's economies, particularly for landlocked economies. Integration offers possibilities to leverage and extend economic comparative advantage at a regional level in ways not accessible through national development programs (UNECA, 2010).

Regional integration also can be a tool for African countries to facilitate and manage their globalization. Advantages in managing regional "commons" and in creating new regional public goods are similarly accessible through strengthened regional integration (Mistry, 2000). However, the process toward integration is inherently complex and fraught with pitfalls that can easily stall or block progress. As noted above, not all countries stand to gain equally from integration or commensurately with the costs they incur. Some countries or sub-regions are

more advanced and politically prepared than others. Furthermore, large economies inherently are more self-reliant than small economies. These are just two examples, among webs of realities in the geography and political economy of Africa, of countries that must navigate in moving forward to integrate regionally.

3.2 Why Pessimism about Economic Integration in Africa?

The successful economic integration of Africa requires a minimum of rationalization: *first, it is essential to maintain a single large economic community in every sub region and thus precede to the necessary system changes (Diouf, 1994).* The African Union and the New Economic Partnership for Africa's Development (NEPAD) advocate that the same procedure that focus on trade facilitation through sub-regional preferential arrangements, should be followed establishing common currency areas and harmonization of macroeconomic policy (UNECA, 2010).

However, there is much pessimism about African economic integration efforts. To evaluate any project, there should be point of reference or scenario to base our conclusion on. For example, Diouf (1994) in his critical evaluation of African economic integration for the years 1995-2020, divides under the two scenarios: (a) a status quo scenario under both optimistic and pessimistic assumptions and (b) effective integration bearing positive transformations. See Box 3.1 for the likely outcomes of these two scenarios (breaking the first into three; status quo, pessimistic, optimistic, and reform scenarios).

Indeed, African socioeconomic development initiatives, including the African economic integration strategies, have been judged by models and theoretical concepts developed outside Africa. Findings from such academic applications rather than augmenting the continental initiatives, often create pessimism among stakeholders in the continent and outside. That is why some even call Africa as a *"hopeless continent"*. For example, the issue of a single

currency for Africa, was addressed as "…*Probably not, but selective expansion of existing monetary unions could be used to induce countries to improve their policies*" (Masson and Pattillo, 2005).

These authors arrived at this conclusion from two viewpoints: firstly, from the viewpoint of the existing challenges of EMU;

> "…*If the process of creating appropriate institutions was so difficult for a set of rich countries with highly competent bureaucracies that have cooperated closely for more than 50 years, then, realistically, the challenge for African countries must be considered enormous...*" (Masson and Pattillo, 2005)

Secondly, from the viewpoint that African monetary union has been motivated by the desire to counteract perceived economic and political weaknesses:

> *Regional groupings could help Africa in negotiating favourable trading arrangements, either globally or bilaterally. While the objective of regional integration seems well founded, it is unclear whether forming a monetary union would contribute greatly to it (Masson &Pattillo, 2005).*

Taking important lesson from on-going initiatives is acceptable. However, the conclusions on the PAEC from the EMU's viewpoint may not be robust enough. Judgmental and biased views have little or no input on African endeavours towards peace and development. Therefore, I pose the questions: Should Africa refrain from any integration efforts? Why so much pessimism about monetary integration Africa?

Box 3.1 highlights scenarios for African Economic Integration (1995-2020).

Box 3.1: Scenarios for African Economic Integration (AEI) (1995-2020)

I.   A status quo scenario
The current situation (*i.e. as in mid 1990s*), integration is characterized by a proliferation of economic communities. With the exception of one, SADC, these structures are all ineffective. They were created at different periods, without any master plan, and their actions which lack harmonization, denote overlapping and duplication which defy all reason. In such scenario, African integration exists only on paper.

II.   Pessimistic extrapolative scenario
In this scenario the various intergovernmental organizations (IGOs) are formally maintained with apparent activity (in fact strictly bureaucratic) by those lucky enough to have some financial resources. On the whole the IGOs continue to be a burden on the economies of member countries which get nothing in return. In the meantime, profuse lip-service is paid to integration as a means of development, symposia and conferences are held on economic integration as a factor of development. Yet the fate of economic communities will be variable depending on their degree of vulnerability.

II.   Reformist scenario
In this scenario genuine efforts are made by the various actors, notably African states, at revitalizing integration, but in a pluralist fashion, devoid of any pan-Africanist approach. Efforts are made to promote integration, but exclusively at the subregional and not at the continental level. This would amount to reinstating the original integration strategy, without innovation or change of perspective, but with a little more dynamism.

V.   Optimistic normative transformation
In this scenario the reaction of African governments to new trends in the global economy, at least in terms of the survival of the continent, might compel them finally to attain economic integration. This leads to an optimistic normative transformation scenario dictated by the Lagos *Plan of Action-implementation of integration through the effective operation of subregional economic communities and the Pan-African* Economic Community.

Source: Adapted from Diouf (1994)

Evaluations of prospective monetary unions in Africa tend to conclude that the involved economies do not comply with OCA requirements. Even if actual monetary unions, such as the US or the Euro zone, fail to conform to such conditions, studies involving African and non-African nations show that the distance to the OCA paradigm is much larger in Africa (Zhao and Kim, 2009).

> *The conclusion that African countries appear not to be ready for full monetary integration is rather robust, holding across time and geography and for studies assessing a variety of variables (Bayoumi &Ostry, 1997; Buigut and Valev (2006) Tsangarides (2008); Agbeyegbe (2008)).*

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More recently, in addition to providing a comprehensive survey of the OCA literature in the African context, an empirical analysis involving countries of EAC, SADC and the West African Monetary Zone, suggest that monetary integration would bring more costs than advantages, albeit in some cases for a narrow margin of benefits (Debrun, Masson and Patillo, 2010).

The inclusion of some countries in more than one community is part of the problem facing the integration of RECs (Angola, Botswana, Burundi, Democratic Republic of Congo, Malawi, Mauritius, Namibia, Seychelles, Swaziland, Rwanda, Zambia and Zimbabwe are all members of more than one REC). Different communities, at this stage at least, have created different timetables for the harmonisation of trade policies and dissolution of tariff and non-tariff barriers so that membership in multiple communities will complicate and confuse the harmonisation process. It would be preferable, earlier rather than later, to streamline the system of RECs to ensure there is no duplication of effort in terms of conflicting country membership.

Therefore, analyses of monetary integration in Africa indicate that most countries still have to follow a long route before being able to reap tangible economic benefits from monetary union, although some projects could in the future be successfully implemented. Current processes of integration should thus be gradual and slow, to allow for the consolidation of progress attained with required convergence criteria and to provide sufficient time to learn how to deal with fixed foreign exchange rates, for instance in a system of adjustable pegs, as European countries did within the European Monetary System.

3.3 The EU-Africa Economic Partnership Agreements on PAEC

The Economic Partnership Agreements (EPAs) are the culmination of a series of agreements among the African, Caribbean and Pacific (ACP) countries and the EU. EPAs succeed the Cotonou Agreement of 2000 that was revised in 2005.

The focus here is only on the EPA between EU and Africa. There have been intense debates about EU-Africa Economic Partnership Agreements (EPAs) in-and outside Africa recently. In particular, SADC will be the most affected region if the final outcome of the on-going negotiations comes out dividing its member states. Thus, in this subsection, I discuss how the prospects of PAEC are likely to be influenced by the changing institutional landscape, occasioned mainly by new bilateral and international trade agreements. However, there are agreements like negotiations under the World Trade Organization (WTO), especially the Doha Round, and non-agriculture market access negotiation. UNECA (2010) presents discussion on these agreements as well.

The EPAs are likely to produce dramatic changes in the institutional landscape under which intra-African trade will operate, depending on the final results of the negotiations in the other trade-related areas. Regional integration has been perceived as the strategy to generate development by overcoming multifaceted problems in the African continent since most African countries are small economies with small populations, low incomes and weak production structures. However, this grand strategy is under threat since EPAs pose a direct threat to the policy space of African governments and the aspiration of full economic integration (Kondo, 2012; McDonald et al., 2013). Indeed, many ACP countries submitted hastily drawn up liberalisation schedules that did not consider whether their commitments were in line with those of their neighbours – with significant implications for regional integration processes (Meyn, 2008). Furthermore, given the vast power asymmetries between the EU and the ACP, small states have limited bargaining power to shape the process and the outcome of the negotiations (Vickers, 2011).

Unlike most other ACP-EPA negotiations, the SADC small states are also caught between a rock (EU) and a hard place (South Africa). Both these parties compete to promote their own visions for regional integration. In the end, the EPA process split SADC into four sets of separate trade regimes with the EU, undermining the established regional integration project. The negotiation behaviour of the main parties, specifically the 'weaker' players, was a factor in the divisive outcome of the SADC EPA process (Vickers, 2011). Indeed, EPAs are a major problem in the Eastern and Southern African (ESA) region.

The degree to which regional integration can continue within the current COMESA and SADC frameworks must be questioned given that:

(1) ESA/COMESA has split with the emergence of the EAC EPA, which leaves the region with mainly least developed countries and island states – none of which are likely to champion regional integration;

(2) SADC lost most of its members during the EPA negotiating process. Therefore, economic integration centred on SACU (plus Mozambique). The other SADC countries have either tied their external tariffs to a different framework (Tanzania in EAC and Madagascar, Mauritius, and Zimbabwe in ESA) or are hardly involved in regional economic integration.

However, the recent paradigm shift the COMESA-EAC-SADC Tripartite Free Trade Area is hoped to address the challenges of overlapping membership through harmonising programmes across the three RECs (Erasmus & Hartzenberg, 2012).

In conclusion,

(1) All stakeholders within the region and outside the region need to contribute and effectively participate at all stages of the policy process.

(2) The SADC States should take the EPAs process as an opportunity to correct the tensions within the SADC regional integration agenda and reshape the region's geo

politics where member states make binding decision on where they fit; that is, decide either to remain in SADC or move to other REC, but not both.

Such a strong stand benefits committed members and in broader sense, realizes on-going endeavours towards harmonised successful PAEC with mutual benefit and harmony.

3.4 Experiences of SADC Economic Integration: Achievements and Challenges

3.4.1 Introduction

As exhibited in Box 3.2 the SADC[6] logo has a clear message of moving towards a common future. However, such move requires a coordinated and transparent effort from member states and the citizens of the region. Macroeconomic stability is important in promoting regional economic integration and is essential in developing robust regional financial and capital markets. Maintaining stability will require strengthened policy coordination and macroeconomic convergence, which over time and with varying speed, depending on the sub region, can become building blocks toward deep integration and monetary unification.

Box 3.2: SADC logo

Source: SADC Secretariat (2012)

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[6] The fifteen countries forming SADC are Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

Table 3.1 presents the summary facts and figures of SADC region. Most SADC countries have registered positive growth rates in 2011 and fixed investment growth (Figure 3.1). See Appendix A.1, A.2, and A.3 for illustrations of SADC real growth rate, economic growth rate, and gross fixed investment, respectively. Angola's growth (3.9%) in 2011 was spurred by oil sector growth, trade-related activities, agriculture, and construction sectors. South Africa experienced a 3.1% growth sustained by tertiary growth developments. Swaziland exhibited a much less favourable GDP growth rate (1.2%) with a small reduction from 2010 scores. This was mainly due to poor tertiary sector performance, related to increased fiscal short-term financial needs in 2010 and 2011.

Table 3.1: Summary facts and figures of SADC region

Indicator	Information	Indicator		Data
Member states	15	Trade	Total Import	USD $91,608.15 (million)
			Total Export	USD $89,151.33 (million)
Year Established	1992	Average Government Debt (2011; % of GDP)		40.4%
Land Area	554 919 km²	Average Life Expectancy (2009)		55.1
Total Population	277 million	Average HIV Prevalence Rate (2009)		12.6 %
GDP Annual Growth Rate (2011)	5.14 %	Gender (proportion of seats held by women in parliament)- 2011		34%
GDP (2010)	USD $575.5 Billion	GDP Contribution: Services		51 %
Inflation (2011)	7.7 %	GDP Contribution: Industry		32 %
Fiscal Balance (2012)	-3.6 %	GDP Contribution: Agriculture		17 %

Source, SADC Secretariat (2012)

Figure 3.1: SADC Real GDP Growth Rate (%) in 2010 & 2011
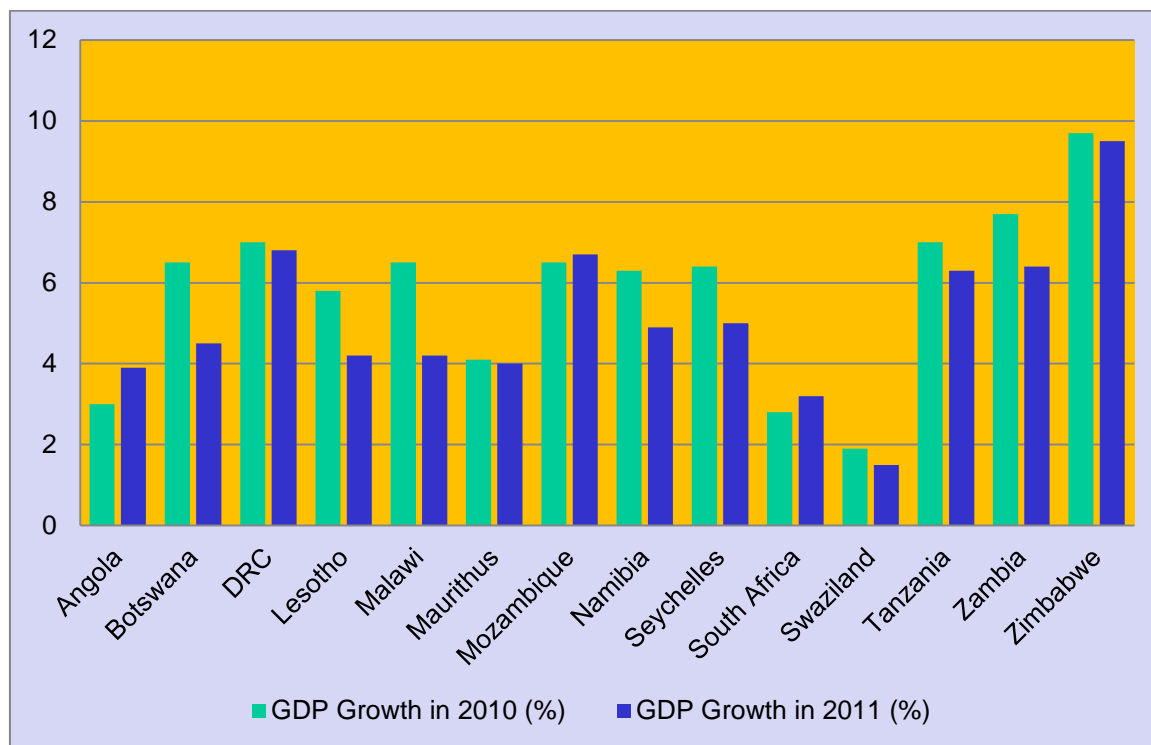
Source: author computed WDI database

SADC economies are heavily dependent on trade, especially in agricultural products for their exports and for their imports, machinery, fuels, chemicals, and other inputs related to production. Recently, trade with the outside world has outweighed intra-SADC trade primarily because the economic structure of the SADC states has changed only marginally (Intra-SADC Trade Performance Review, 2007). Indeed, all SADC states belong to more than one regional integration grouping with binding commitments on trade matters; for example, commitments to both COMESA and SADC.

Member countries of SADC have been engaged in a series of trade liberalisation activities, such as, negotiating and signing bilateral trade agreements and even negotiating at the multilateral level under the World Trade Organization (WTO) in order to increase the intra-SADC trade and enhance the ultimate regional integration. Moreover, the political and

economic motives have shaped the regional integration process. Commitments have been undertaken over time, geared towards creating conditions for enhanced free trade through the reduction of and complete removal of tariffs on products traded within the region.

A number of bilateral trade agreements negotiated between SADC member states exist within the region, even though some SADC member states haven't signed bilateral trade agreements within SADC. Engaging in bilateral trade agreements could be seen as fast-tracking benefits of trade liberalisation between contracting parties, rather than waiting for all regional members to open up their territories to free trade. Furthermore, the political, cultural, socioeconomic, and geographical setup (see Figure 3.2) of SADC region puts the region in a better position than other PAEC countries. Furthermore, as outlined in Box 3.3 the region has exhibited modest achievements so far.

Figure 3.2: Geographical Location of SADC Region

Box 3.3: Some Achievements in SADC

- Creating initiatives to coordinate customs procedures and instruments (including electronically exchanging customs data);
- Developing a single customs administrative document (SADC CD) to harmonize customs declarations in the SADC;
- Passing a law on a SADC customs model to facilitate the coordination of customs in national legislations;
- Adopting a nomenclature of common tariffs;
- Proposing and developing a regional transit framework;
- Initiating a review of rules of origin in 2007;
- Creating a software on trade facilitation: for example, the promotion of a single counter at border posts and to implement SADC Transit Chain Bond Guarantee regulations;
- Updating non-tariff obstacles to inform, monitor and eliminate non-tariff obstacles in 2007;
- Harmonizing trade liberalization through a tripartite task force comprising SADC, COMESA and EAC;
- Drafting protocols on trade and the free movement of people, goods, capital and services; and
- Developing a regional qualifications framework for coordinating education systems in the region to facilitate the free movement of people and manpower.

Source: UNECA, 2010, pp.15

3.4.2   SADC Macroeconomic Policy Convergence and Challenges

SADC economic activity is hampered by infrastructural problems, energy sector inefficiencies, and strong dependency of primary commodities, uncertainty from financial stress in the Euro Area and a possible rise in oil prices (UNECA, 2010). Thus, economic developments in SADC economies have been affected by recent global uncertainty and financial turmoil in the Euro Area. Consequently, according to SADC performance indicators, economic activities have declined. Given rising oil and food prices, most member countries experienced a rise in domestic inflation rates (IMF, 2012). This underscores the need for sound fiscal and monetary policies in order to sustain macroeconomic stability and robust economic growth. Moreover, it urges the need for extensive reforms to unlock the region's productive potential, promote trade and financial sector development as buffers to mitigate disruptive effects associated to the increasingly uncertain global environment.

SADC economies have adopted the Maastricht type convergence criteria in their major macroeconomics variables (Table 3.1). Most of the member states have achieved those criteria, except during the recent years of global financial crisis. However, the EMU experience proves that meeting those criteria does not guarantee successful monetary union in 2018 in the region. On average, main macroeconomic convergence indicators deteriorated slightly in 2011. Budget deficit to GDP and Public debt to GDP ratios increased slightly, while reserves (import cover in months) were somehow reduced. Nevertheless, budget deficit and public debt to GDP convergence targets were met in this period. In line with an uncertain international environment, SADC countries generally adopted soft economic policies as a general strategy to prompt growth. In general, reference interest rates were either maintained or reduced.

Table 3.2: Maastricht Type Macroeconomic Convergence Goals of SADC

Criteria	2008	2012	2015	2018
Inflation	<10%	5%	5%	3%
Budget deficit, % GDP	<=5%	3% as an anchor, proportion1%	3% as an anchor, proportion1%	3% as an anchor, proportion1%
Foreign debt, % GDP	< 60%	< 60%	< 60%	< 60%
Foreign reserve/ covered by exports	>= 3 month	> 6 month	> 6 month	> 6 month
Central bank debt	< 10% of the previous year tax revenue	< 10% of the previous year tax revenue	< 5% of the previous year tax revenue	< 5% of the previous year tax revenue

Source: Kumo (2011).

See SADC performance against monetary integration targets that are depicted from Table 3.3–3.6 and Figure 3.3-3.6.

Table 3.3: SADC Annual Inflation Rate Average (2008-2011)

Country	Inflation (Period Average)			
	2008	**2009**	**2010**	**2011**
Angola	13.2	13.99	15.3	11.38
Botswana	12.6	8.2	6.9	8.5
DRC	17.9	46.1	23.5	15.5
Lesotho	10.8	7.3	3.6	5
Malawi	8.7	8.4	7.4	7.6
Mauritius	9.7	2.5	2.9	6.5
Mozambique	10.3	3.25	12.7	10.35
Namibia	10.3	8.8	4.5	5
Seychelles	37	31.7	-2.4	2.5
South Africa	9.9	7.2	4.3	4.6
Swaziland	12.6	7.5	4.5	6.1
Tanzania	10.3	12.1	5.5	12.7
Zambia	12.4	13.5	8.5	8.7
Zimbabwe	231.2m	6.5	3.1	3.5
SADC Average	**13.52**	**12.64**	**7.16**	**7.71**
2004-2008	**Single digit inflation rate by 2008**			
2009-2012	**5% inflation rate by 2012**			

Source: SADC RED Papers

Table 3.4: SADC Budget Balance as the % of GDP (2008-2011)

Country	Budget Balance as percentage of GDP			
	2008	**2009**	**2010**	**2011**
Angola	8.8	-4.9	6.8	8.9
Botswana	4.2	-10.9	-6.2	-3.3
DRC	-0.5	0.6	1.25	-1.1
Lesotho	4.7	-3.8	-5	-6.4
Malawi	-6.5	-5.7	1.9	0.4
Mauritius	-3.3	-3	-3.2	-3.2
Mozambique	-2.5	-5.5	-3.7	-3.5
Namibia	2	1.9	-7.1	-9.8
Seychelles	5.7	11.1	7.8	0.9
South Africa	0.9	-0.7	-5.5	-4.2
Swaziland	-1.5	-7.1	-11	-9.5
Tanzania	-1.7	-6.1	-6.5	-11.8
Zambia	-2.5	-2.6	-3.1	-2.9
Zimbabwe	-11	0	-2.9	0
SADC Average	**-0.23**	**-3.68**	**-3.42**	**-3.57**
2004-2008	**Deficit smaller than 5%n of GDP**			
2009-2012	**Deficit 3%as an anchor within a band of 1%**			

Source: SADC RED Papers

Table 3.5: Table 3.5: Percent of Public Debt/GDP Ratio (2008-2011)

Country	Public debt as percentage of GDP			
	2008	**2009**	**2010**	**2011**
Angola	17.6	22.6	21.7	20.4
Botswana	4.5	16.1	17.8	18.5
DRC	91.8	113.5	28.3	33.1
Lesotho	55	40.1	36.8	34.8
Malawi	31.6	40.8	35	34.7
Mauritius	51.9	59.6	57.4	57.2
Mozambique	40.5	39.3	47.7	44.8
Namibia	18.9	17.8	15.9	26.8
Seychelles	223	117	84	81
South Africa	31.4	45.4	54.8	57.2
Swaziland	16	12	13.9	15.7
Tanzania	31.5	37.1	43.1	48.2
Zambia	26.7	26.4	21.3	20
Zimbabwe	147.7	109.8	94.3	90.3
SADC Average	**56.29**	**49.82**	**40.86**	**41.63**
2004-2008	**Less than 60% of GDP**			
2009-2012	**Less than 60% of GDP**			

Source: SADC RED Papers

Table 3.6: SADC Months of Import Cover (2008-2011)

Country	Months of Import Cover			
	2008	**2009**	**2010**	**2011**
Angola	5	3.8	6.6	7.8
Botswana	22	19	15	17
DRC	0.1	2	1.78	1.66
Lesotho	8.5	6.8	5.9	4.7
Malawi	2.4	1.9	3.1	2.3
Mauritius	5.2	7.1	7	6.3
Mozambique	4.3	5.4	5.8	5.8
Namibia	5.7	4	3	3.2
Seychelles	1.1	1.6	2.3	2.4
South Africa	3.7	4.7	4.5	4.4
Swaziland	4.6	4.1	2.9	2.3
Tanzania	4.3	5.7	5.3	4.9
Zambia	2.1	5.1	4.7	4.5
Zimbabwe	0.3	1.3	1.1	0.8
SADC Average	**4.95**	**5.18**	**4.93**	**4.86**
2004-2008	**Not less than 3 months by 2008**			
2009-2012	**Not less than 6 months by 2012**			

Source: SADC RED Papers

Figure 3.3: SADC Countries Trend of Inflation from 2005-2017 (excluding Zimbabwe)
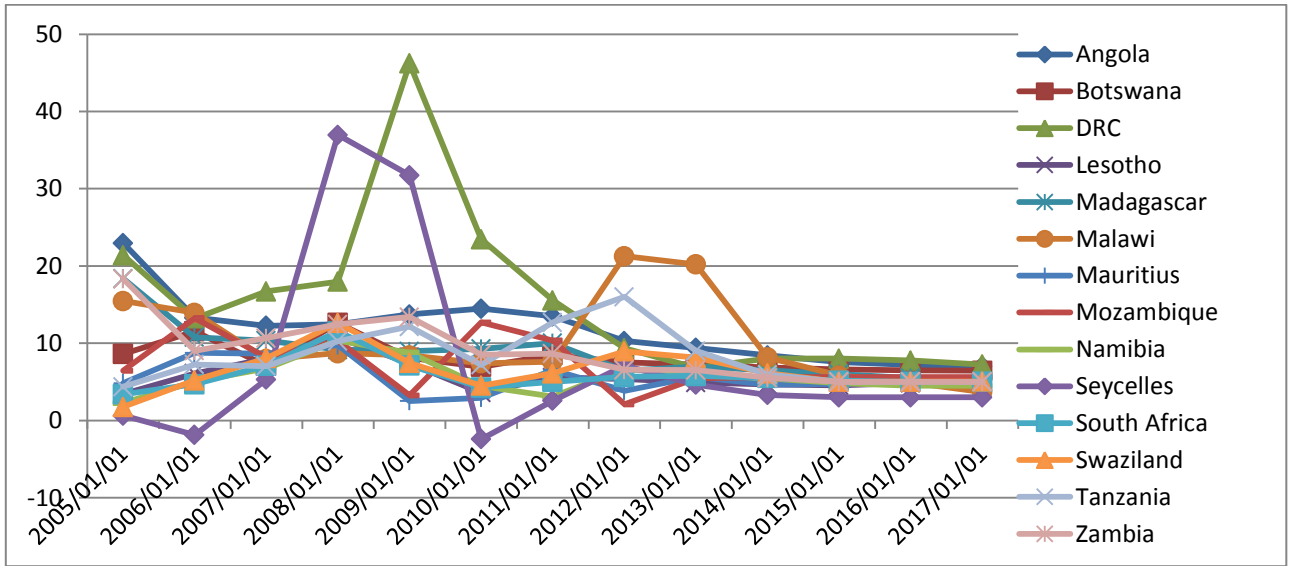
Source: author computed from WDI database

Figure 3.4: SADC Countries Trend of CAB from 1992-2009
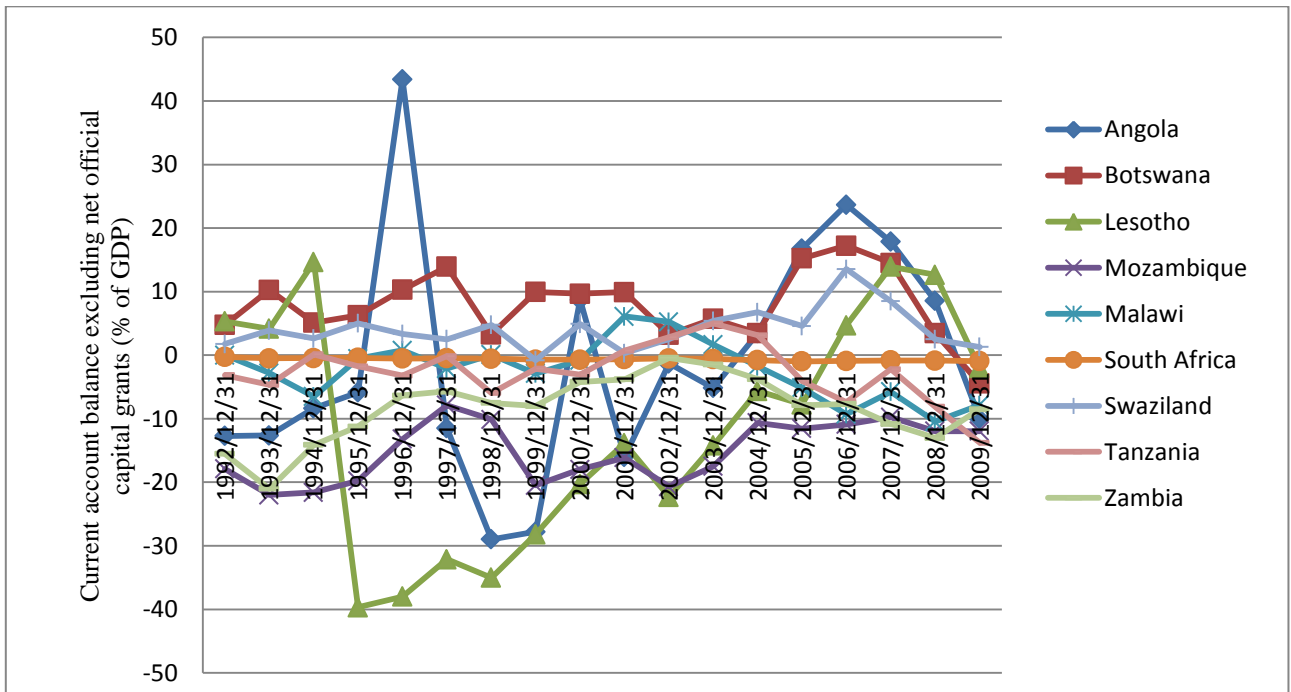
Source: author computed from WDI database

Figure 3.5: Gross National Savings: Percent of GDP (Percent of GDP)
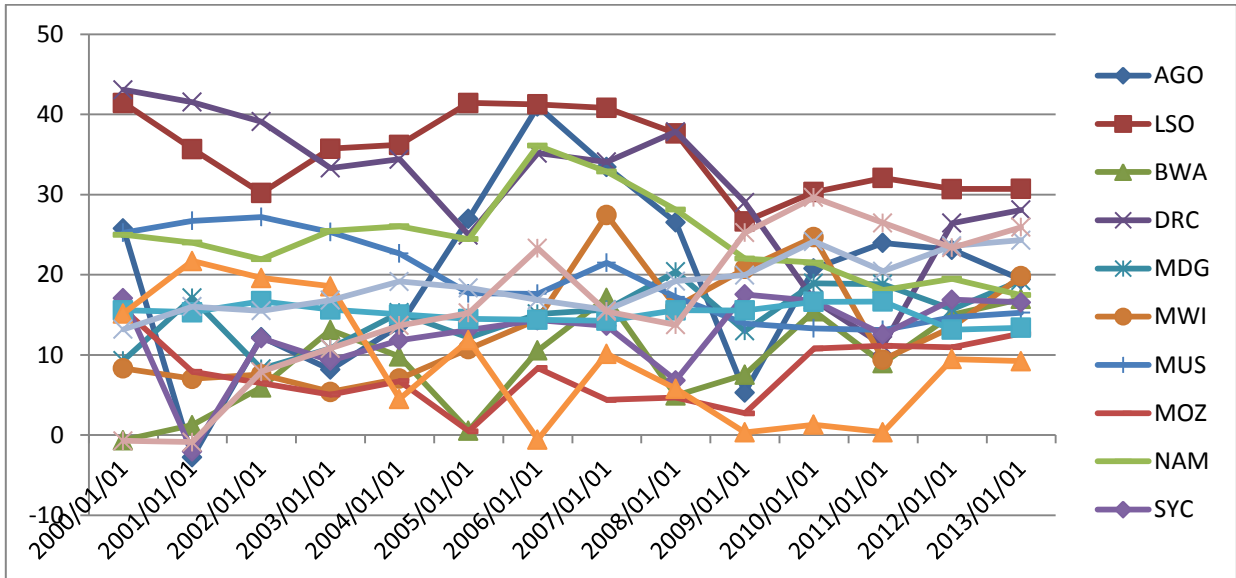
Figure 3.6: SADC Countries Trend of Debt from 2000-2013 (excluding Zimbabwe)
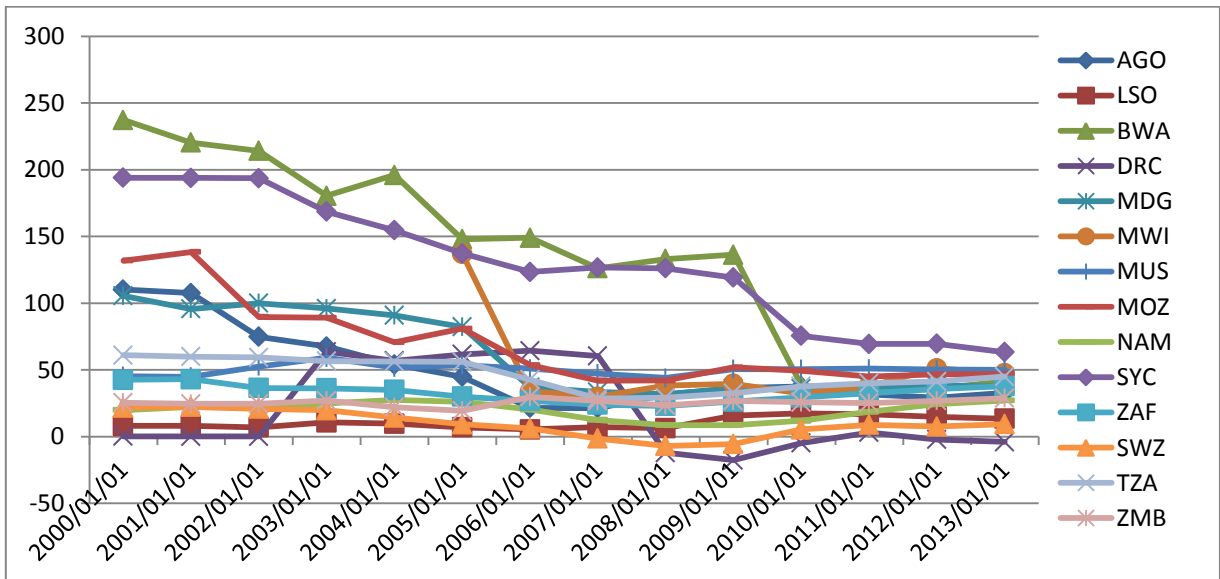
Source: author computed from WDI database

Figure 3.7: General government budget deficit: Percent of GDP (Percent of GDP)
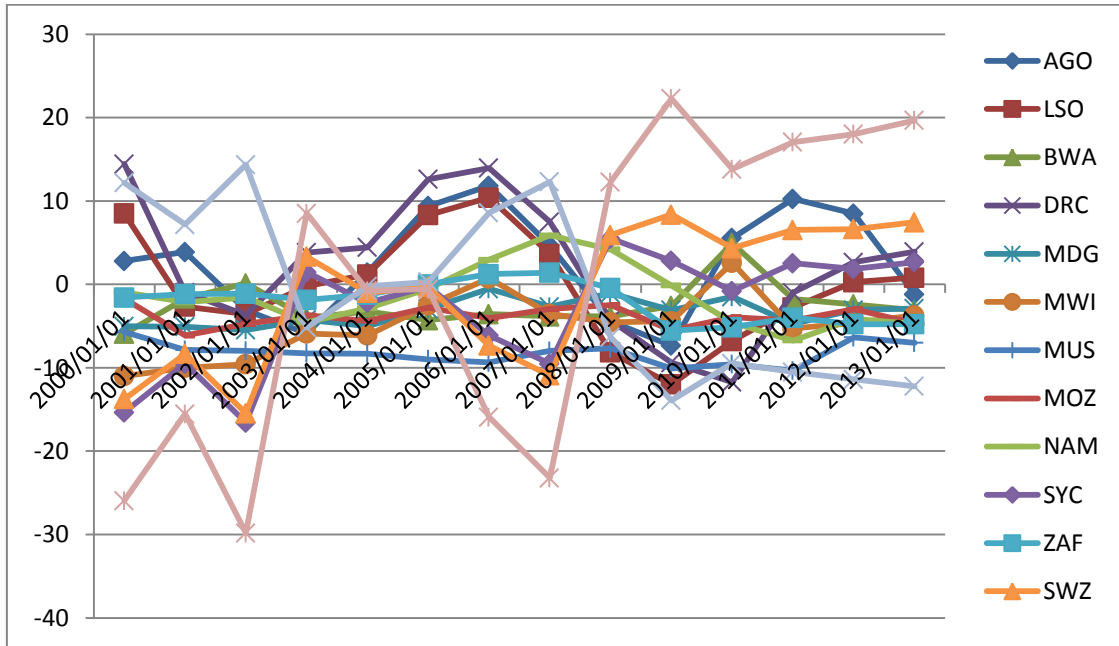
Source: author computed from WDI database

3.5 Summary

This chapter looked at the developments in Africa and more specifically in the SADC region, with regard to real as well as monetary integration. It also looked at the real economic performance of SADC economies to try and understand the economic potential of the region. In this chapter I highlighted the structure of SADC economies and the economic challenges that they have faced so far as they shift their economies toward more advanced monetary and financial systems and toward monetary union.

The next four chapters comprise the four essays that form the core of the thesis and provide evidence of the readiness of SADC states to form a monetary union, based on OCA criteria.

CHAPTER 4

TESTING FOR STRUCTURAL SYMMETRY TOWARDS SADC MONETARY INTEGRATION

(ESSAY I)

4.1 Abstract

In this chapter I investigate the structural symmetry among Southern African Development Community (SADC). Structural symmetry is an important factor in evaluating the potential for creating a monetary union among member countries. In particular, I check for compliance with the OCA criteria, with specific reference to business cycle synchronization. SADC can ill afford a repeat of the financial and fiscal instability as in the EU. The EU experienced ex-ante structural economic differences and asynchronous business cycles prior to monetary union.

The Triples test is used to analyse each member country's business cycles for symmetry and then evaluate SADC countries' ratio of relative intensity of co-movements in business cycles with co-SADC country versus that of major trade partners. I show that not all countries in SADC conform to the OCA criteria, which is judged both by asymmetrical business cycles and weak co-movements in business cycles.

4.2 Introduction

African Union (AU) member states want to establish regional monetary integration to further overall integration and bring about significant economic benefits to the continent. Overlapping membership to various Regional Economic Communities (RECs) and a lack of investment in the institutions and systems required for integration, are the main reasons why the economies of most African countries remain detached from each other, in spite of many attempts to integrate African economies on a regional basis (UNECA, 2010; Jovanovic, 2006).

In the southern part of the continent, the SADC economies are moving towards the creation of a monetary union by 2018 (Belle, 2010). The SADC economic integration is one of the oldest economic integration initiatives in the world and can be traced back to the Southern African Customs Union (SACU) which was created in 1910 between South Africa and its neighbours.

The launch of the European Monetary Union (EMU) in the early 2000s sparked renewed interest in the creation and expansion of monetary unions across the world (Alesina et al., 2002; Masson and Pattillo, 2005, and Jefferis, 2007). For meaningful and effective monetary union in different parts of Africa, it is important to learn from already established monetary unions in the world.

Currently the viability of the European monetary system is questioned, as a result of the crisis that started in Greece and culminated into a crisis for the whole euro zone. Portugal, Italy, Ireland, Greece and Spain (together known as the PIIGS) are now depending on their rescue from the strong EU economies. Many studies confirmed that, the PIIGS, and particularly Greece, did not comply with Optimal Currency Area (OCA) criteria, prior to accession, when measured against the criteria of business cycle synchronisation.

I propose to ascertain which countries in SADC could join in monetary matrimony (union) without running the risk of destabilising the union, as was the case with the PIIGS. Therefore, I investigate the similarity of business cycles of SADC countries by evaluating (1) each country's real GDP (measure of business cycle) for symmetry and (2) real shocks by pairing SADC countries with each other, with non-SADC African countries and with major external trade partners[7] and the co-movement in business cycles.

4.3 Co-movement and Optimum Currency Area Theory

A fundamental assumption[8] of the theory of optimal currency areas is: *asymmetric, country specific shocks represent a key element in the choice of an exchange rate regime or of adopting a common currency.* There are two broad approaches to modern OCA theory: the *traditional* and *endogenous approaches* (Tavlas, 2009).

The traditional approach assumes that a country's characteristics are invariant to the adoption of a common currency. The requirements for joining or forming a monetary union are the symmetry of shocks, the mobility of factors, the diversification of factors of production, the similarity of inflation rates, the flexibility of wages and prices and the capacity of risk sharing(Tapsoba, 2009). If the business cycles in countries forming a monetary union diverge considerably, a common monetary policy will not be optimal for all countries concerned (De Haan, 2008) since countries in the downward phase of the cycle, might prefer a more

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[7] *According to OECD Fact Book(2011)major trade partners of SADC countries are; Belgium, France, Germany, Italy, Netherlands, Portugal, United Kingdom, Canada, Japan, Korea, Turkey, United States, Brazil, China and Hong-Kong, India, and Russian Federation.*

[8]*See the classic works of Mundell, 1961; McKinnon, 1963; Kenen, 1969; and Ingram, 1973 to its modern applications and revisions.*

expansionary monetary policy, while countries in the upward phase of the cycle might prefer a more restrictive policy stance.

In contrast, the endogenous approach assumes that a monetary union alters the economic structure of members. The endogenous approach assumes that business cycle movements become more similar over time for countries that join a monetary union. Indeed, the monetary union itself could act as a catalyst for business cycle synchronisation, by reducing foreign exchange transaction costs and therefore promoting trade integration across countries (Corsetti & Pesenti, 2002). However, as a counter argument, monetary integration could lead to greater specialisation in production, thus lowering output correlation and making regions more vulnerable to local shocks (Eichengreen, 1992; Krugman, 1993).

The findings of Frankel and Rose (1998) supports endogenous OCA theory: stronger trade links raise income correlations. Supporters of endogenous OCA theory state that the OCA criterion may be satisfied ex-post even if it fails ex-ante (Corsetti & Pesenti, 2002). Here the assertion is that the EU crisis could have been avoided had the PIIGS complied with OCA criteria prior to accession to the EMU. This assertion evidences a warning to SADC to be cautious of moving towards monetary union.

I now briefly consider the literature on business cycle synchronisation in the EU and the PIIGS, mainly *ex post* empirical evidence. The Euro crisis was a result of the Maastricht Convergence Criteria's[9] departure from the original OCA criteria (Artner & Rona, 2012).

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[9]The convergence criteria, sometimes also called Maastricht criteria, are conditions that Member States of the European Union must fulfil to join in economic and monetary union and to use the euro as official currency.

Some elements of economic heterogeneity have increased the likelihood of asynchronous business cycle fluctuations at a regional level in EMU. Such fluctuations work against achieving the common goals of a currency area (Corsetti, 2008). For example, the correlation coefficients between the cyclical components of industrial production and unemployment rates for selected Central and Eastern European Countries (CEECs) against Germany and the EU showed a relatively high degree of business cycle correlation for the CEECs with Germany; much higher than for Portugal or Greece (Maurel and Boone, 1998). Technologically inferior production systems and a lower competitive position of countries, such as Greece, resulted in a lack of cyclical convergence with the Euro area (Gouveia and Correia, 2008). Little sign of future convergence in the Euro area can be found (Crowley and Lee, 2005).

A Bayesian dynamic factor model measured the co-movements of output, investment and consumption among Euro area countries for the period, 1991-1998, before the formation of the monetary union and the period after, namely, 2000-2010 (Lehwald, 2012).The co-movements of the main macroeconomic variables increased for core European countries from the first to the second period, while it decreased for most PIIGS economies. Indeed, the correlation of Greece's main macroeconomic variables with the rest of the Euro members reduced after accession to the EMU (Böwerand, 2006).

Before we infer lessons from EMU in the context of SADC in line with structural asymmetry of business cycles, it is important to note that there are factors other than the lack of cyclical convergence within the euro area, may have contributed to the crises that started in Greece. For example, a clash between economic and political forces within the euro area (Darvas, 2012) and a sovereign debt crisis in Europe (Martin and Waller, 2012; Mongelli, 2013).

Indeed, countries with less competitive advantage in the euro zone do not benefit from the Union (Artner and Rona, 2012). The German export-led growth strategy was shown to generate large trade and current account deficits and imbalances throughout the euro-zone in the 2000s (Weeks, 2013).

Many issues within the framework of OCA theory need to be resolved before adopting monetary union in SADC (Jovanovic, 2006).Traditional OCA theory emphasises the importance of symmetrical business cycles. Symmetrical business cycles are helpful if there is one common currency, hence one common exchange rate and one common monetary policy with which to stabilise the economies of the union in the face of external shocks. On the other hand, asymmetric real shocks weaken the case for a common currency, as member states of a monetary union lose their ability to use domestic exchange- and interest rate policies for stabilisation purposes. Indeed, general inferences of studies on traditional OCA theory undertaken so far, explicitly state that a common currency and single monetary policy may not be appropriate for all SADC countries.

On the other hand, some authors obtained results supportive of a monetary union comprising a relatively small group of countries, usually including South Africa; sometimes with other Common Monetary Area (CMA) countries.[10]Such findings should not be surprising: similar results had been obtained for the core euro-area countries prior to the formation of European monetary union. In fact, many studies carried out from late 1990s to 2007, show that results are mixed and countries in the region with a higher share of trade with South Africa exhibit relatively higher co-movements in output growth (Tavlas 2009, p.24).

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[10]CMAs were South Africa, Lesotho, Swaziland, and Namibia (Grandes, 2003; Masson and Patillo, 2005; and Wang et al., 2006).

Empirical evidence in support of endogenous OCA theory is weak: there is no evidence that member countries' business cycles consistently move closer together over time after having become part of a monetary union. In fact, empirical evidence suggests that the business cycles of Greece, for example, tended to diverge more from other EMU members after accession. For this reason, a sober policy option in the presence of asymmetric business cycles and weak co-movement of business cycles would be to not to accede to membership of a monetary union. For this reason, I support a policy of compliance to these OCA criteria prior to accession.

Previous literatures surveyed contain mixed evidence so far as the symmetry and co-movement of various macro variables of SADC member countries are concerned. In the next section, I introduce and apply methodologies that provide robust results in the study of time-series cycles. However, these methodologies have not been used before to study business cycles in SADC. Hence, it makes two new contributions to the study of monetary integration and specifically the analysis of business cycle symmetry and co-movement in SADC, namely updated data and new techniques.

4.4   Data and Methodology

4.4.1   Data

I use the annual real GDP data measured in 2005 constant US dollar prices for all fifteen SADC countries, as well as for Africa's fifteen major trade partners for the years 1970 – 2010. Real GDP is preferred since it is the most comprehensive measure of economic activity and is generally available for African countries on annual basis (Tapsoba, 2009; Mendonça, et al, 2011). Data were obtained from the World Bank's *World Development Indicators,* UN *statistics,* and the IMF's *International Financial Statistics*.

I use the first difference of the log GDP, which I also use for the Triple's test, to get the GDP growth rates. Countries like Botswana, Swaziland, Mauritius, Seychelles, Lesotho, Mozambique, Tanzania, Malawi, and Angola have exhibited real GDP growth rates above the SADC average over 41 years (Table 4.1). However, most of these countries have high standard deviations in their growth patterns. South Africa and Tanzania have the most stable real GDP growth rates in the region. The column of skewness measures a lack of symmetry about the mean in a frequency distribution: the closer the value is to zero, the more symmetrical the distribution.

Table 4.1: Descriptive Statistics of Growth Rate in Real GDP of SADC (1970-2010)

Country	Code	Mean	Median	Std. Dev.	Skewness	Kurtosis	p-value[11]
Angola	AGO	4.06	3.15	8.43	-0.20	5.06	0.023
Botswana	BWA	9.10	8.44	6.05	0.93	4.77	0.004
Dem.Rep.of Congo	DRC	0.35	0.57	5.68	-0.52	2.42	0.296
Lesotho	LSO	4.65	3.60	7.08	0.78	4.93	0.005
Madagascar	MDG	1.55	1.71	4.40	-0.94	4.76	0.004
Mozambique	MOZ	4.58	5.62	5.38	-1.17	5.13	0.000
Mauritius	MUS	5.29	5.03	4.31	0.44	10.46	0.000
Malawi	MWI	4.22	4.34	5.83	-0.84	4.06	0.034
Namibia	NAM	3.49	3.37	3.44	0.94	4.48	0.008
Swaziland	SWZ	5.66	3.24	9.28	3.37	17.70	0.000
Seychelles	SYC	4.83	5.32	5.98	0.08	2.20	0.569
Tanzania	TZA	4.38	4.46	2.34	-0.74	3.34	0.141
South Africa	ZAF	2.58	2.84	2.34	-0.41	2.28	0.360
Zambia	ZMB	2.34	3.04	4.07	-0.46	2.48	0.384
Zimbabwe	ZWE	1.77	1.59	5.57	0.00	1.99	0.417
SADC (Average)		**3.92**	**3.75**	**5.34**			

Source, own calculations

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[11]Jacque-Bera test for normality. It is test for the nested null hypothesis of normality *i.e. skewness is zero and excess kurtosis is zero*. In Table 4.1 shows that the calculated p-value is greater than any usual significance level (such as α= 0.10, 0.05 or 0.01) to suggest that there is no evidence to reject the null hypothesis of a normal distribution for the daily returns of the Real GDP of SADC countries included in the sample.

4.4.2 Methodology

The three methodologies in this chapter namely; the Triples test, the test for bilateral co-movement, and relative intensity of co-movements (RICM), are inspired from the study by Kemegue and Seck (2014).

The Triples Test

The nonparametric method called the Triples test was first developed by Randles et al. (1980) and later introduced to the economics literature by Verbugge (1997) and Razzak (2001), respectively. For the mathematical details of Triples test see (Razzak, 2001:232-35 and Breitenbach et al, 2012, Yilani, 2012). I adopt the Triples test because the test is:

1. Accessible and has superior results[12].
2. More efficient than many other methods used in the literature to detect symmetry.
3. Asymptotically distribution free, which means that the outliers and changes in the variance of the distribution of the time series cannot affect the test.

To perform the triples test, we face the problem of decomposing the series into trend and cyclical components. To carry out the triples test, the series needs to be decomposed and de-trended to leave only the cyclical component of the series. We use the Baxter and King (1999) filter (B-K filter) to do this. Here it is worth mentioning that the Hodrick and Prescott (1997) (HP) filter does the same thing. However, given the low frequency of most African data, we prefer the B-K filter. The B-K filter was developed as a method to isolate business cycle components by applying moving averages to macroeconomic data and provides better results where only annual data is available (see for example, Inklaar et al., 2008 and Tapsoba, 2009).

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[12]Randles et al. (1980), shows Monte Carlo results for power comparisons. Eubank et al. (1992) suggests that the test is the test of choice against unimodel alternatives to symmetry found in Granger and Anderson (1978).

The band pass filter designed by Baxter and King (1999) passes through the components of the time series with fluctuations between 6 (18 months) and 32 (96 months) quarters, removing higher and lower frequencies. Then I apply the Triples test to evaluate the symmetry of the classical cycles. Intuitively, the Triples test counts all possible triples from a sample of size $N (i.e., \binom{N}{3})$ combinations) of a univariate time series. The triple of observations is skewed to the right if the middle observation is closer to the smallest observation than it is to the largest observation and *vice versa*. Thus, if $\hat{\eta}$ is equal to 0, the univariate time series is symmetric; if it is positive, the time series falls slowly but rises quickly and *vice versa.*

When most of the triples are right-skewed, the time series is said to be asymmetric. If $i, j, and\ k$ are three distinct integers such that $1 \leq i, j, k \leq N$,the triple of observations x_i, x_j, x_k forms a right triple or skewed to the right if the middle observation is closer to the smallest observation than it is to the largest observation:

Right triple   <u>   x   x   x   </u>

Left triple   <u>   x   x   x   </u>
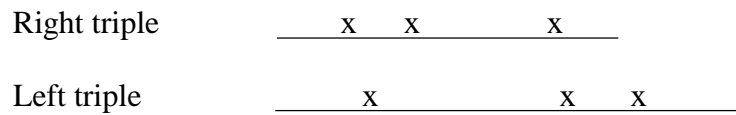
Formally, let $x_i,...,x_N$ denote a random sample drawn from $F(x-\theta)$ where F(.) is a cumulative distribution function for a continuous population with $F(0) = \frac{1}{2}$ and θ is the median of the χ population. Let,

$$f^*(x_i, x_j, x_k) = \left[\left(sign(x_i + x_j - 2x_k) + sign(x_i + x_k - 2x_j) + sign(x_j + x_k - 2x_i) \right) \right]^3, \qquad (4.1)$$

where $sign(u) = -1, 0, or\ 1$ as u $<, =, or > $ o. Then we say x_i, x_j, x_k forms a right triple if $f^*(x_i, x_j, x_k) = \frac{1}{3}$. Note that $f^*(x_i, x_j, x_k)$ can only assume the values $-\frac{1}{3}, 0, \frac{1}{3}$.

We define *a left triple* (looks skewed to the left) as any (x_i, x_j, x_k) for which $f^*(x_i, x_j, x_k) = -\frac{1}{3}$ (again see the figure above). Finally, when $f^*(x_i, x_j, x_k) = 0$, the triple is neither right nor left skewed. This last event, however, has probability zero when sampling from a continuous population. The proposed test statistics is then the *U statistics* given by:

$$\hat{\eta} = \binom{N}{3}^{-1} \sum_{i<j<k} f^*(x_i, x_j, x_k) \tag{4.2}$$

Then

$$\hat{\eta} = \frac{\left[(\textit{number of right triples}) - (\textit{number of left triples})\right]}{\left[3\binom{N}{3}\right]} \tag{4.3}$$

That is, a U statistics estimate is given as:

$$E(\hat{\eta}) = \eta = \Pr\{X_1 + X_2 - 2X_3 > 0\} - \Pr\{X_1 + X_2 - 2X_3 < 0\}, \tag{4.4}$$

with

$$\text{var}(\hat{\eta}) = \binom{N}{3}^{-1} \sum_{c=1}^{3} \binom{3}{c} \binom{N-3}{3-c} \zeta_c \tag{4.5}$$

where

$$\zeta_c = \text{var}\left[f_c^*(x_1, ..., x_c) \right] \tag{4.6}$$

and

$$f_c^*(x_1, ..., x_c) = E[f^*(x_1, ..., x_c, X_{c+1,...} X_3)] \tag{4.7}$$

If $\sigma A^2 = 9\zeta_1$, then $N^{1/2} = (\hat{\eta} - \eta)/\sigma_A$, has a standard normal limiting distribution (Randles et al., 1980).

Now I discuss the appropriate hypotheses to be tested. First note that if the underlying distribution is symmetric, $X_1 + X_2 - 2X_3$ has the same distribution as $-X_1 - X_2 + 2X_3$, and therefore, $\eta = 0$. Hence we can use $\hat{\eta}$ as a statistic for testing

$$H_0 : \hat{\eta} = 0 \text{ versus } H_1 : \hat{\eta} \neq 0 \tag{4.8}$$

This is a two-sided test, but could possibly be a one-sided test. This test is used to test the hypothesis whether the distribution is symmetric around the unknown median θ against a broad class of asymmetric alternatives. The Triples test interpretation goes with the hypothesis test of equation (8). If we have significant evidence to reject the null hypothesis, then it means asymmetry. If we fail to reject the null hypothesis, then the opposite holds true.

The simple nature of $f^*(.)$ makes $\zeta_1, \zeta_2, and\ \zeta_3$ expressible in terms of probabilities, and thus it is possible to use U statistics to estimate these quantities consistently as follows:

$$\zeta_1 = \text{var}[f_1^*(x_1)\}, with\ f_1^*(x_1) = E[f_1^*(.)] \tag{4.9}$$

$$\zeta_1 = N^{-1} \sum_{i=1}^{N} \left(f_1^*(x_i) - \eta \right)^2 \tag{4.10}$$

where

$$f_1^*(x_i) = \binom{N-1}{2} \sum_{\substack{j<k \\ j \neq i \neq k}} \sum f_1^*(x_i, x_j, x_k) \tag{4.11}$$

Similarly,

$$\zeta_2 = \frac{1}{\binom{N}{2}} \sum_{j<k} \sum f_2^*(x_i, x_k) - \hat{\eta})^2 \tag{4.12}$$

Where

$$f_2^*(x_i, x_k) = \frac{1}{N-2} \sum_{\substack{i=1 \\ j \neq i \neq k \\ i \neq k}} f^*(x_i, x_j, x_k) \; , \tag{4.13}$$

And,

$$\zeta_3 = \frac{1}{9} - \hat{\eta}^2 \tag{4.14}$$

Replacing each with ζ_i and $\zeta_i^{\wedge}$ in the expressions σ_N and σ_A gives the estimators $\hat{\sigma}_N$ and $\hat{\sigma}_A$. Both estimators are consistent because each $\zeta_i^{\wedge}$ is written as a linear combination of U statistics. To test the hypothesis in (8), the Triples test is defined based on $T_1 = n^{1/2} \hat{\eta} / \hat{\sigma}_N$ and an associated test based on $T_2 = n^{1/2} \hat{\eta} / \hat{\sigma}_A$ so that they *reject* H_0 as $|T_i| > Z_{(\alpha/2)}$ as the upper percentile of the standard normal distribution. Note that these tests are asymptotically distribution free, provided only that the underlying distribution is not degenerate. Although I have illustrated how to construct an asymptotically distribution-free test of (8), we should keep in mind that the parameter 'η' is defined in terms of the distribution of the triple X_1, X_2 and X_3 rather than the original F distribution. Results from Triple test are reported in Tables 4.2 and in the other tables are reported in the appendix.

Test for bilateral co-movement

Next I evaluate the bilateral co-movement of cycles by first considering pairs of SADC countries and pairs of SADC versus main trading partner countries. I follow Croux et al. (2001) on the definitions of dynamic and static correlations. In the particular case of a bivariate analysis and the notion of cohesion introduced by Tripier (2002), we can have the following notation specifying the coherency of the real GDPs of every pair of countries in our data sample.

Let $r_{xy}(w)$ denote the first co-movement index. We define it as:

$$r_{xy}(\omega) = \frac{S_{xy}(\omega)}{\sqrt{S_x(\omega)S_y(\omega)}} \qquad , \qquad (4.15)$$

where $S_{xy}(\omega)$ is the cross spectrum between real GDPs of pair of countries, $S_x(\omega)$ and $S_y(\omega)$ are the spectrum of every pair of countries in our analysis. This index in equation (4.15) measures the correlation between the complex representations of X_t and Y_t at frequency ω. According to Tripier (2002), to obtain a more convenient measure of co-movement, the squared coherency, $r_{XY}^2(\omega)$, is then generally preferred in the literature. It is defined by:

$$r_{XY}^2(\omega) = \frac{\left|S_{xy}(\omega)\right|^2}{S_x(\omega)S_y(\omega)} \qquad (4.16)$$

To obtain results from equation (4.16), we apply a simple regression to each pair of countries and extract the R^2 of the regression as a measure of the strength of the connection between the cyclical components of real GDP between the pair of countries in the region and among major trade partners. The results from this process are reported in Table 4.4.

Lastly, using the coefficient of determination computed in equation (4.16), I compute SADC countries' ratio of relative intensity of co-movements (RICM) versus each other and that of major trade partners as follows:

$$RICM = \frac{\sum SADC R^2}{\sum nonSADC R^2} = \frac{\sum\limits_{y=SADC} r_{XY}^2}{\sum\limits_{y=nonSADC} r_{XY}^2} \qquad (4.17)$$

The results from equation (4.17) are reported in Table 4.5.

4.5 Results and Discussions

In this section, firstly I present results from the Triples test and graphical illustration of the co-movements in log real GDP. Secondly, I present evidence of bilateral co-movements, using the coefficient of determination as a measure of cyclical co-movements. Thirdly, I discuss the index of relative intensity of co-movement as a measure of relative strength of co-movement between pairs of member states and pairs of member states and their trade partners.

4.5.1 The Triples Test Results

We now consider the appropriate hypotheses to be tested. Firstly, if the underlying distribution is symmetric, $X_1 + X_2 - 2X_3$, has the same distribution as $-X_1 - X_2 + 2X_3$, and therefore, $\eta = 0$ .Hence we can use $\hat{\eta}$ as a statistic for testing the following null hypothesis given in equation (4.8).

The Triples test statistics for symmetry for SADC countries are shown in Table 4. 2. The null hypothesis of symmetry stated in equation (4.8) is rejected only in the case of Malawi, Mozambique, South Africa, Swaziland and the Democratic Republic of Congo (DRC) (Table 4.2). When the p-value is greater than 0.05, we fail to reach significance; therefore the test results for the balance of SADC countries are not statistically significant implying that 10 out of 15 member states have exhibited structural symmetry (Table 4.2).

Table 4.2: Triples test statistics for symmetry (Obtained by Difference of log GDP)

Country code	$H_0: \acute{\eta} = 0$	The Triples H_0: the univariate time series is symmetric			U-stat	P-value ($\alpha=0.05$)
		Ksi1(ζ_1)	Ksi2(ζ_2)	Ksi3(ζ_3)		
AGO	0.0285	0.0045	0.0230	0.1103	0.8328	0.1977
DRC	**-0.0556**	0.0026	0.0132	0.1080	-2.129	**0.0154**
LSO	0.0209	0.0070	0.0266	0.1107	0.5013	0.2912
BWA	0.0330	0.0054	0.0200	0.1100	0.9087	0.1711
MDG	-0.0473	0.0045	0.0188	0.1089	-1.406	0.0749
MWI	**-0.0405**	0.0047	0.0199	0.1095	-1.175	**0.0401**
MUS	0.0146	0.0077	0.0238	0.1109	0.3407	0.3632
MOZ	**-0.0595**	0.0045	0.0187	0.1076	-1.772	**0.0314**
NAM	0.0344	0.0037	0.0158	0.1099	1.1213	0.1251
SYC	0.0025	0.0040	0.0131	0.1111	0.0800	0.4801
ZAF	**-0.0518**	0.0017	0.0129	0.1084	-2.334	**0.0094**
SWZ	**0.0972**	0.0061	0.0228	0.1017	2.5073	**0.0054**
TZA	-0.0389	0.0037	0.0163	0.1096	-1.271	0.0885
ZMB	-0.0422	0.0060	0.0158	0.1093	-1.131	0.1251
ZWE	0.0055	0.0028	0.0127	0.1111	-0.203	0.4013

Source: author, computed from sample data

Note:The figures in bold show significant p-values at 5 percent level of significance and hence the null hypotheses in equation 4.8 in the methodology section is rejected which implies asymmetry in the series.

Furthermore, seven of the most important economies in the region have negative symmetrical business cycles. Negative symmetry implies that the time series falls rapidly, but rises very slowly. This indicates that for the most important SADC members, economic recovery happens far slower than the preceding downswing. It also indicates that expansionary policy measures may be inadequate or that policy harmonisation and bilateral/multilateral co-operation among the member states are weak. The business cycles of member countries must at least co-move closely together in order to have a single currency and monetary union. We explore this issue in detail in the next section.

4.5.2 Results from bilateral co-movement

The coefficient of determination measures the intensity of co-movements in real GDP across SADC countries. The value of the coefficient of determination lies between zero and one; when its value is higher than the average value of 0.5 it implies that there is a higher degree of co-movement between countries under study. In other words, a value higher than 0.5 indicate that member countries' business cycle exhibit synchronisation. The coefficients of determination reported in Table 4.3 are obtained by using equation (4.3) above.

Coefficients of determination are additive unlike the correlation coefficients. The regional mean of the determination coefficients is 0.04 with a standard deviation of 0.06. There seems to be a general lack of co-movement in logs real GDP for SADC countries. Seychelles, Namibia, Madagascar, Mauritius, Malawi, and Botswana have average coefficients of determination below the regional mean; the rest of the SADC countries have average coefficients of determination above the regional mean. However, this value does not confirm that those countries can form any sensible monetary union in near future. This result is in line with the findings by Carmignani (2010) for CEMAC countries in which the corrected concordance index is barely above zero, which shows a lack of concordance of the cyclical phases across these countries.

Table 4. 3: Coefficients of Determination as a Measure of Cyclical Co-movements

Row name	AGO	LSO	BWA	MDG	MWI	MRT	SYC	MOZ	NAM	ZAF	SWZ	TZA	ZMB	ZWE	DRC
AGO	1														
LSO	0.002	1													
BWA	0.048	0.001	1												
MDG	0.000	0.000	0.001	1											
MWI	0.058	0.002	0.005	0.040	1										
MRT	0.010	0.082	0.001	0.046	0.007	1									
SYC	0.005	0.214	0.002	0.028	0.001	0.028	1								
MOZ	0.038	0.024	0.019	0.005	0.008	0.059	0.031	1							
NAM	0.044	0.059	0.034	0.000	0.004	0.045	0.004	0.003	1						
ZAF	0.228	0.019	0.030	0.024	0.001	0.111	0.055	0.218	0.037	1					
SWZ	0.021	0.101	0.036	0.039	0.005	0.119	0.016	0.049	0.104	0.135	1				
TZA	0.029	0.052	0.023	0.000	0.110	0.021	0.000	0.117	0.078	0.028	0.025	1			
ZMB	0.001	0.003	0.012	0.002	0.064	0.032	0.023	0.146	0.000	0.122	0.047	0.116	1		
ZWE	0.073	0.049	0.007	0.008	0.033	0.008	0.063	0.261	0.008	0.110	0.024	0.011	0.063	1	
DRC	0.266	0.001	0.037	0.000	0.001	0.002	0.020	0.058	0.046	0.189	0.009	0.002	0.004	0.071	1

Source: author, computed from sample data

The results reported in Table 4.4, are computed by using equation (4.4) in the methodology section by taking the R^2 values from Table 4.3. Results in column 2 of Table 4.4, are computed by the summation of the R^2 of SADC country *'i'* with the rest of the countries included in the sample minus one (i.e. R^2 equals to one when country *'i'* regressed with its own real GDP), after regressing the log GDP of country *'i'* with each of the other countries in the sample individually. The values in column three are computed in the same way as those in column two, except that values in column three are computed using the summation of the R^2 of SADC country '*i*' with the rest of non-SADC countries minus one. Column 4 reports the relative intensity of SADC country 'i' with the rest of SADC member countries by dividing entries in column three by respective entries in column two (see equation 4.17). Dividing the sum of the R^2 of all SADC-to-SADC country regressions by the sum of all SADC-to-non-SADC countries, gives the relative intensity of co-movement. A value of one means that the strength of the co-movement of a SADC country relative to the rest of SADC countries is just as strong as the strength of the co-movement of a SADC country relative to all non-SADC countries. If the value in column 4 is > 1, it means that the SADC country's business cycles co-move more closely with other SADC countries. Conversely, if the value in column 4 is < 1, the SADC country's business cycles co-moves more closely with non-SADC countries (Non-SADC trade partners) compared to SADC countries.

Table 4.4 compares the relative intensity indexes of co-movement in the business cycles of pairs of *SADC-SADC* versus *SADC-Trade Partner* countries. Among SADC countries, Mozambique, Zimbabwe, Zambia, Seychelles, Swaziland, Tanzania, Mauritius, and DRC show a relatively strong intensity in the co-movement of real GDP compared to the rest of SADC members (see the last column of Table 4.4). Note that the values in bold in Table 4.4, show countries with strong relative intensity of co-movement with SADC members. However, nearly half of the member states have more significant co-movement with their major trade partner countries than with member states.

Therefore, this finding confirms the finding of Carmignani (2010) that concludes:

> *Countries must strengthen policy harmonisation and political connectivity in order to activate the channels through which business cycles can become more synchronised and hence maximize the benefits from the envisaged monetary integration in the region.*

These findings are in agreement with the findings in this chapter.

Table 4.4: Comparison of SADC countries' ratio of relative intensity of co-movements
(RICM) and that of major trade partners

Country Code	Relative Intensity of Co-movements (RICM)		
	Total all	SADC all	SADC relative intensity
AGO	2.922757	0.820042	0.389992
BWA	1.881879	0.254965	0.156717
DRC	1.410106	0.706682	**1.00463**
LSO	1.326669	0.534191	0.674077
MDG	1.498395	0.148454	0.109971
MUS	0.58334	0.381326	**1.887621**
MWI	0.712644	0.332029	0.872347
MOZ	1.33429	1.101481	**4.731282**
NAM	1.194135	0.433222	0.569344
SWZ	0.978067	0.611418	**1.667587**
SYC	0.857648	0.466165	**1.190766**
ZAF	3.50578	1.197229	0.518606
TZA	1.068255	0.630444	**1.43999**
ZMB	0.901105	0.608246	**2.076927**
ZWE	1.319048	0.965	**2.725618**

Source: author, computed from sample data

4.6 Conclusion

In this chapter I analysed the symmetry of business cycles in SADC as a first test to ascertain if these countries are affected similarly by shocks and if the paths to economic recovery are similar. The results give a rough idea of whether these countries would benefit from a uniform economic policy. The results from the Triples test confirm 10 out of 15 member states exhibit structural symmetry. Only five of fifteen SADC countries have asymmetric business cycles; the DRC, Malawi, Mozambique, South Africa and Swaziland all have negative asymmetric business cycles for the period (1970-2010).

However, I am more concerned with the co-movement of business cycles among potential members of a monetary union. The reason is that even if two members have symmetric business cycles, these cycles may not move together; that is, the one may lead the other, making it risky to adopt a single currency and a single monetary policy. When we consider evidence from bilateral co-movements using the coefficients of determination the result shows a general lack of co-movements in the business cycles of SADC countries. Mozambique, Zimbabwe, Zambia, Seychelles, Swaziland, Tanzania, Mauritius, and DRC, however, have relatively strong intensities in the co-movement of their business cycles when compared with the rest of SADC members, making them a potential OCA.

The overall results confirm that only some SADC member countries could potentially form a monetary union in the region based on traditional OCA theory. In light of the experience of EMU where just five countries would able to create the havoc in the entire union, the findings from all the combined three tests confirm that there is not sufficient real business cycle convergence among all member states for the entry into the monetary union. Thus, a common monetary policy will not be optimal for all countries in the region, especially in the short run. These findings are in line with that of Carmignani (2010, P.39) in his study for CEMAC countries and other studies reviewed in this chapter.

However, these results do not give a pessimistic future on the proposed monetary union initiative in the SADC region. Many studies explicitly show that among the EMU countries,

Greece and the rest of the PIIGS displayed patterns in the level of economic activity that are considerably different to developments in the other economies in the region. The crisis in the euro zone may have been avoided if the PIIGS had complied with the traditional OCA criteria prior to accession to the EMU. However, when we infer lessons from EMU in the context of SADC in line with structural asymmetry of business cycles, we should acknowledge that other factors that may have contributed to the EU crises may have been present.

SADC could learn from the EMU experiences to strengthen policy harmonisation and coordination for business cycles to become more synchronised as a precondition to monetary union. Without doing so, SADC countries face the same risk as the PIIGS, having to contend with a fixed exchange rate and monetary policy with which to defend their own economies against adverse external shocks.

CHAPTER 5

ASSESSMENT OF MONETARY UNION IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY: EVIDENCE FROM PANEL COINTEGRATION AND UNIT ROOT TESTS
(ESSAY II)

5.1 Abstract

In this chapter I investigate the likelihood of a proposed monetary union in the Southern African Development Community (SADC) from the view point of the Generalised Purchasing Power Parity (GPPP) hypothesis and optimum currency area (OCA) theory. The Johansen's multivariate co-integration technique, panel unit root tests, Pedroni's residual cointegration test and error correction based panel co-integration tests are performed. The findings from this study confirm that GPPP holds among SADC member countries included in this study on account of cointegartion and stationarity in real exchange rate series. South African rand normalised long run beta coefficients of all the real exchange rates are below one except in the case of Mauritian rupee and all bear negative signs except in the case of Angolan New Kwanza and Mauritian rupee. This evidence is considered as supportive of monetary union in the region except for Angola and Mauritius. However, the absolute magnitudes of the short run adjustment coefficients of SADC countries' real exchange rates are low and bear positive signs in some cases. This finding implies that the observed slow speed of adjustment for (log) real exchange rate of SADC member states might constrain the effectiveness of stabilization policies in the wake of external shocks, rendering SADC countries vulnerable to macroeconomic instability in the region. This result has important policy implications for the proposed monetary union in SADC.

5.2 Introduction

The Southern African Development Community (SADC) is the largest regional economic grouping in sub Saharan Africa (SSA) (Burgess, 2009). SADC's regional economic integration agenda is outlined in its Regional Indicative Strategic Development Plan (RISDP) and adopted by member states in 2003. The RISDP plans for deepening regional integration over a 15-year period including the creation of a free trade area by 2008, a customs union by 2010, a monetary union by 2016, and a single currency by 2018.

Countless research papers on economic integration, specifically relating to monetary integration and OCA theory, have been inspired by the imminent formation of various monetary unions across the globe and the formation in recent years of the European Union (EU). There is a sense of urgency in getting research results to policy makers to avoid a repeat of the EU financial crises. However, recent research results are mixed about the economic and political feasibility of monetary integration in the SADC region and other regional economic communities in Africa. The chief aim of this paper is to test generalised purchasing power parity (GPPP) in SADC as measure of real convergence, in terms of OCA criterion, towards monetary union in the region.

The most important macroeconomic variable behind GPPP is the real exchange rate and its determinant factors. Stability of exchange rates along with other macro variables in the economy of potential currency union members, relative to other members, is a requirement for a group of countries to constitute an OCA and hence of adopt a single currency. I shed light on the long run relationship among these variables for SADC constituent economies to answer the question of whether SADC economies constitute a potential OCA. However, due to data limitations, some countries are not included in the analysis. Assessing OCA theory in the context of SADC and the lessons and practices from other regional integration initiatives on

the continent will contribute to empirical evidence towards the AU's agenda of economic integration in the context of SADC.

Studies carried out to test the validity of the PPP theory in the sub Saharan Africa (SSA) context fail to reject the null hypothesis of a unit root (Table 5.1). This means that the real exchange rate series do not display mean-reverting behaviour in the long run. In some cases the results are not conclusive. To the best of my knowledge, this study is the first to test the GPPP hypothesis in SADC with a view of identifying countries in the region that may qualify as an OCA and may safely enter into a monetary union.

Table 5.1: Summary of PPP /GPPP Studies in SSA

Study	Sample period	Number of countries	Empirical Approach	Main findings
Olayungbo (2011)	1980 to 2005	16 selected sub-Saharan African countries	Panel unit-root tests	Failed to support evidence of PPP in the selected SSA
Chang et al. (2010)	1994 (M12)-2008(M7)	15 COMESA & SADC countries	Panel SURADF[13] tests	Univariate unit root and panel-based unit root tests all fail to support the PPP throughout 15 countries. However, using panel SURADF test they find PPP holds true for three countries only.
Mokoena et al. (2008)[14]		10 SADC countries, excluding: the	Joint tests of nonlinearity and stationarity,	Nonlinear behaviour provides statistical evidence in support

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[13]Seemingly Unrelated Regressions Augmented Dickey-Fuller.

[14] This paper neither focus on the topics of optimal currency areas in the context of SADC nor does it concern itself with issues of macroeconomic convergence, which would typically include budget deficit ratios, inflation rates, public debt ratios, external balance, exchange rates and interest rates. In the context of PPP analysis, this study only seeks to identify dollar-based mean reversion in the SADC.

		DRC, Lesotho, Namibia, and Zimbabwe	and Bayesian unit root tests	of a smooth transition mean reverting behaviour in 4 out of 10 real exchange rates.
Mkenda (2001)	1981(q2) to 1998(q4).	The 3 East African Community countries	GPPP-cointegration test	GPPP method supports the formation of a currency union in the region
Krichene (1998)	1979(1)-1996(12)	5 East African countries: Burundi, Kenya, Rwanda, Tanzania, and Uganda	cointegration model	Rejected the null hypothesis of unit root, hencesupporting absolute PPP in the cases of Burundi and Kenya, Burundi and Rwanda and Kenya and Rwanda.
Nagayasu (1998)	1981-94	16 African countries	Panel cointegration	Confirmed the [15]semi-strong form of long-run PPP, however, the test for unit root and cointegration in individual countries showed that PPP is invalid.

Source: own synthesis

5.3 Exchange Rate Regimes in SADC

Exchange rate stability lays a foundation for a common monetary area or sharing of a single currency. If the real exchange rate variability is low and currencies are stable, then the chances of adopting a single currency for integrating into a monetary union is high (Nokaneng,2009). Joining a monetary union and accepting a common currency has benefits and costs. For

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[15]The semi-strong form of PPP only requires a symmetry restriction on prices, unlike the strong form that requires parameter and homogeneity restrictions (Nagayasu, 1998).

example, a small open economy has the biggest potential gain from joining a larger currency area in order to reduce transactions costs, but it may also be most vulnerable to external shocks and hence has the most to lose from giving up a flexible exchange rate as a macro policy instrument. Countries with more variable exchange rates are subject to larger asymmetric shocks. Those with more stable rates suffer the greatest reduction in the transaction value of the domestic currency when their exchange rates vary, due to their small size and dependence on trade. While asymmetric shocks increase exchange rate variability by magnifying exchange market pressure (by disturbing underlying market conditions, in other words), small size and trade dependence reduce exchange rate variability by prompting intervention (Bayoumi and Eichengreen, 1998).

Three approaches have been widely used in the determination of the long run equilibrium real exchange rate (Daboh, 2008): *the purchasing power parity (PPP) approach, the macroeconomic balance approach and the behavioural equilibrium exchange rate approach*. However, the focus here is on PPP. This is because the PPP approach measures the real exchange rate as the price of foreign goods relative to that of domestic goods, where both prices are in the same currency. That is, PPP defines the real exchange rate as the nominal exchange rate adjusted for the relative price levels of the foreign and domestic economy.

Prior studies establish that the real exchange rate has a unit root, in other words real exchange rates are non-stationary. Thus, the PPP hypothesis does not hold. However, the generalized PPP hypothesis (GPPP) addresses these problems adequately. This method is discussed fully in next section.

It is important to note that, we did not find evidence of countries' exchange rate regimes being given any consideration in the literature testing for OCA based on PPP and GPPP. I believe that when potential members of OCA countries belong to different exchange rate regimes, this might have an impact on the speed of real exchange rate adjustment by different exchange rate regime countries, when exposed to similar shocks.

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Pooling real exchange rates from countries with different exchange rate mechanisms may therefore underestimate GPPP. We do not expect there to be any major variations in the long run. However, one might expect there to be some impact in the short run adjustments and volatility. Table 5.2 summaries SADC countries exchange rate regimes. When I consider the exchange rate regimes in the region, most of the countries either have independently floating or managed floating exchange rate regimes. The rest are pegged to the South African rand which is independently floating. Therefore, we can safely take a broad view that the exchange rate regimes in the region are inherently uniform.

Table 5.2: SADC Currencies and Exchange Rate Regimes since 2004

Country	Currency	Exchange Rate Regime
Angola	New Kwanza	Managed floating
Botswana	Pula	Conventional fixed peg to a basket
DRC	Franc Congolais	Independently floating.
Lesotho	Loti	Conventional fixed peg to ZAR
Malawi	Kwacha	Independently floating
Madagascar	Malagasy ariary	Independently floating
Mauritius	Mauritian rupee	Managed floating
Mozambique	Metical	Managed floating
Namibia	Namibian dollar	Conventional fixed peg to ZAR
Seychelles	Seychelles rupee	Conventional fixed peg to ZAR
South Africa	Rand	Independently floating
Swaziland	Lilangeni	Conventional fixed peg to ZAR
Tanzania	Tanzanian Shilling	Independently floating
Zambia	Kwacha	Managed floating
Zimbabwe	Zimbabwe dollar	Managed floating

Source: SADC Central Banks (various issues)

5.4 The Relevance of GPPP in OCA Theory

The PPP theory of OCA is based on the law of one price that states:

...in the absence of trade barriers, such as transportation costs, transaction costs and tariffs, competition will equalize the price of an identically traded good across countries, when the prices are expressed in the same currency.(Taylor & Taylor, 2004).

The general idea behind PPP is that a unit of currency should be able to buy the same basket of goods in two countries so that there is parity in the purchasing power of currency across the two economies. There are two versions of the PPP theory: *absolute and relative. The absolute purchasing power parity* holds when the purchasing power of a unit of currency is exactly equal in the domestic economy and in a foreign economy, once it is converted into foreign currency at the market exchange rate. However, this version of PPP is unlikely to hold, and hence it is common to test the r*elative* PPP, which holds when the percentage change in the exchange rates over a given period just offset the differences in inflation rates in the countries concerned over the same period (Taylor and Taylor, 2004).

PPP theory is commonly regarded as one of the major pillars of international trade and finance theory. It has attracted considerable interest in the literature in the past and recently (Lau et al., 2011). However, puzzles associated with PPP and exchange rate economics make the theory debatable and without universal consensus (Taylor & Taylor, 2004; Mokoena, et al., 2009). Many recent studies which take advantage of econometric techniques, confirm the positive contribution the theory has had. Furthermore, methodological improvements in addressing the limitations in the PPP theory are well documented (Christopoulos & Leon-Ledesma, 2010; Lau et al., 2011). Recently in a panel of 15 OECD countries using new panel root tests, which account for cross sectional interdependence among countries, finds that these panels produce

more support for PPP theory using PPI indexes that represent a higher proportion of tradable goods (Snaith, 2012).

The failure of traditional PPP theory in explaining bilateral exchange rate behaviour does not rule out the possibility of the existence of a stationary relationship between real exchange rates in multi-country settings. When PPP fails, GPPP can be used to test whether a stationary relationship exists within a panel of countries which potentially constitute the OCA. This alternative view of using the GPPP hypothesis was developed by Enders and Hurn (1994).

The idea behind GPPP is traditional PPP can fail because the fundamental macroeconomic variables determining real exchange rates, including national income, terms of trade and government consumption, etc. are non-stationary, and thus real exchange rates themselves tend to be non-stationary. Although bilateral real exchange rates are generally non-stationary, GPPP hypothesizes that bilateral real exchange rates can exhibit common stochastic trends, if the fundamental macroeconomic determinants that affect real exchange rates are sufficiently interrelated. Therefore, the importance of the innovation of GPPP lies in the fact that it establishes a linkage among macroeconomic variables, real exchange rates and the concept of PPP (Gao, 2007).

Enders and Hurn (1994) first used the GPPP approach to assess the suitability of forming a currency union. If two countries qualify for the creation of a currency union, then the fundamental macroeconomic variables in the two countries must move together. In the context of GPPP, the fundamentals that drive real exchange rate will exhibit common stochastic trends. Within the currency area, therefore, there should at least be one linear combination of various bilateral real exchange rates that is stationary. Bilateral exchange rates are affected through both market conditions and intervention. Indeed, OCA theory helps explain the behaviour of bilateral exchange rates on the same grounds that decisions are taken whether or not to form a currency union. Such links arise because shocks to the foreign exchange market

reflect OCA-related factors. When the shocks they experience are similar, the countries' bilateral exchange rates are stable.

Therefore, GPPP postulates that the real exchange rates between the two countries comprising the domain of a currency area should be co-integrated. GPPP is also relevant in a multi-country setting. In such a setting, a currency area is such that the fundamentals that drive the real exchange rates will exhibit common stochastic trends. Thus, real exchange rates in the currency area will also share common stochastic movements. Within the currency area, therefore, there should at least one, at most n-1, linear combination of various bilateral real exchange rates that is stationary.

5.5 Data and Methodology
5.5.1   Data

I use a sample of 11 SADC member countries. Four member states of SADC namely the DRC, Lesotho, Namibia, and Zimbabwe are not included in this study due to data limitations. Monthly data for the period January 1995 to August 2012 is used in this study. All data relating to consumer price indices (CPI) (based on 2005=100) and nominal exchange rates relative to the US dollar are taken from the IMF International Financial Statistics. Each of the consumer price index and nominal exchange rate series are transformed into natural logarithms before the econometric analysis.

The PPP approach measures the real exchange rate as the price of foreign goods relative to that of domestic goods, where both prices are in the same currencies. That is, the PPP approach defines the real exchange rate as the nominal exchange rate adjusted for the relative price levels of the foreign and domestic economy. In its simplest form, under the assumption of purchasing power parity, the PPP-based real exchange rate (RER) is the nominal exchange rate (NER) multiplied by the relative prices of trading countries i.e.

$$RER = NER \frac{P*}{P} \qquad (5.1)$$

where P* and P are the foreign and domestic prices respectively.

Alternatively, we can express equation (5.1) in logarithmic form (in the most standard definition (Chinn, 2006)) such that the series of interest for country 'i' at time 't', is given by the following equation:

$$r_{i,t} = s_{i,t} + p_{us,t}^* - p_{i,t} \qquad (5.2)$$

where $r_{i,t}$ is the logarithm of the RER against the US dollar, $s_{i,t}$ is the logarithm of the NER against the US dollar, and $p_{us,t}^*$ and $p_{i,t}$ respectively, are the logarithms of consumer price indices in the US and country 'i'. Using equation (5.2) we compute the RER series for the countries included in this study.

Table 5.3 presents the descriptive statistics of SADC RER series. Graphical illustrations of logarithm of SADC RER series are depicted in Figure 5.1. The graphs of RER exhibit the random walk nature i.e. non stationary series. However, the residuals series are stationary.

Table 5.3: Descriptive Statistics and Normality Test of SADC (Log) Real Exchange Rate

Country	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Angola	4.460	4.479	5.627	1.966	0.551	-0.867	5.800	95.768***
Botswana	1.714	1.696	2.129	1.493	0.143	0.743	2.945	19.527***
Madagascar	7.438	7.453	7.894	7.171	0.152	0.114	2.155	6.767**
Malawi	4.629	4.680	5.107	4.083	0.215	-0.910	3.432	30.886***
Mauritius	3.300	3.335	3.492	3.093	0.111	-0.262	1.833	14.453***
Mozambique	3.118	3.104	3.457	2.874	0.146	0.559	2.463	13.603***
South Africa	1.909	1.884	2.528	1.592	0.193	0.975	3.992	42.273***
Seychelles	1.798	1.733	2.263	1.558	0.158	1.054	3.212	39.619***
Swaziland	1.949	1.911	2.580	1.581	0.207	0.832	3.416	25.979***
Tanzania	6.911	6.937	7.161	6.635	0.118	-0.470	2.462	10.357***
Zambia	8.476	8.601	9.066	7.904	0.316	-0.284	1.481	23.240***

Source: Computed from sample data (1995m1-2012m8)

*Note: ** and*** indicate significance at 5% and 1% levels, respectively. In all the cases the null hypothesis of normality is rejected.*

Fig 5.1: Graphical illustration of (Log) Real Exchange Rates-SADC Countries in the sample, 1995:1-2012:8

a)   (Log) RER-at Level
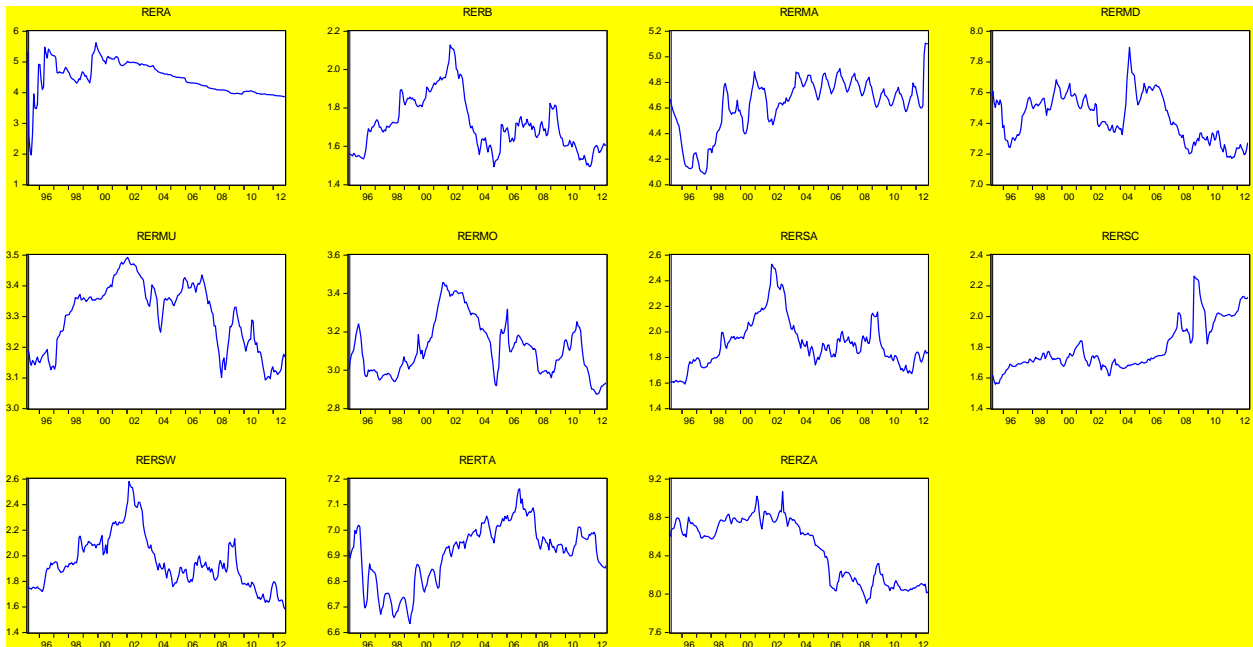
b) RER-Residuals
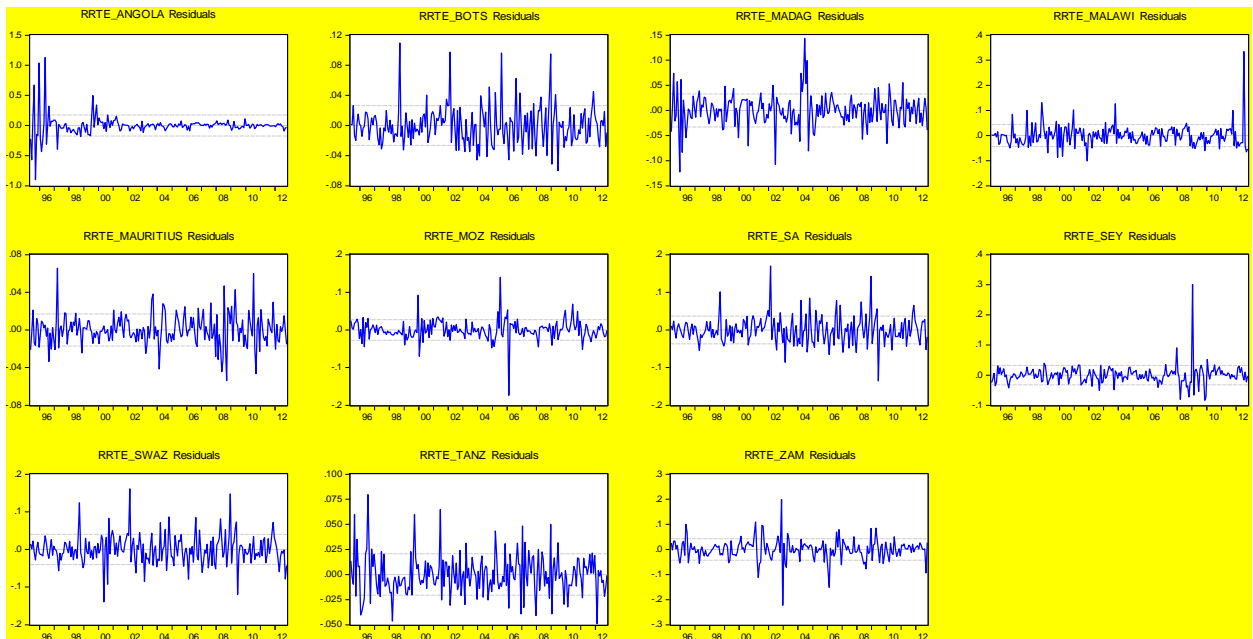
Source: own estimation

5.5.2 Methodology

5.5.2.1 Methodology on cointegration

A time series of RER $\{r_t\}$ is stationary if the following relation holds true under the assumption of linearity:

$$r_t = \alpha + \beta\, r_{t-1} + \varepsilon_t \,, 0 < \beta < 1 \tag{5.3}$$

When β=1, equation (5.3) becomes a unit root process. It means the process does not allow the system to come back to equilibrium which limits the usefulness of PPP as a tool to assess the monetary integration.

However, the GPPP hypothesis can be used under such conditions for the reasons discussed in section two. GPPP can be described as follows assuming an n-country world; an m-country ($m \leq n$) currency area exists such that a long-run equilibrium relationship exists between the m-1 bilateral exchange rates, of the form (Enders & Hurn, 1994; Wilson & Choy, 2007; Beirne, 2008):

$$r_{12t} = \alpha + \beta_{13t} r_{13t} + \beta_{14t} r_{14t} + \ldots + \beta_{1mt} r_{1mt} + \varepsilon_t \tag{5.4}$$

where r_{i1t} is the log of the bilateral RER in period t between country 1 and country i ; α is the intercept term ; β_{i1t}'s are the parameters of the cointegrating vector, which represent the degree of co-movement of the RERs; and is ε_t a stationary stochastic disturbance term.

Equation (5.4) is the spill-over effect due to real shock in country i that are transmitted to other economies that have high degrees of economic interdependence with country i (Beirne, 2008).

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GPPP holds when at least one linear combination of bilateral RERs is observed. The existence of linear combinations implies that output shocks have a symmetrical effect on the RERs in a given area (Ogawa & Kawasaki, 2001; Beirne, 2008). Mathematically,

$$r_{i0t} = \sum \beta_j r_{j0,t} + \varepsilon_{GPPP,t} \tag{5.5}$$

where the residual term, $\varepsilon_{GPPP,t}$, is stationary.

We adopt the Johansen (1996) multivariate maximum likelihood estimation (MMLE)[16] procedure because it assumes all variables to be endogenous and does not require the choice of a dependent variable. The Johansen method tests the restrictions imposed by co-integration of the unrestricted Vector Auto Regression (VAR) involving the series.

To test whether the $n-1$ set of countries form an OCA, following Beirne (2008) the VAR (k) is set up in the following matrix notation.

$$z_t = A_1 z_{t-1} + \ldots + A_k z_{t-k} + \varepsilon_t \qquad \varepsilon_t \sim IN(0,\Sigma) \tag{5.6}$$

where z_t is the log of the RER in the form of (n×1) and A_i represents a matrix of parameters (n×n).

In line with the Vector Error Correction Model (VECM), we can rewrite Equation (6) as follows (in first-difference form):

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[16] The principle of *maximum likelihood estimation* (MLE), originally developed by R. A. Fisher in the 1920s, states that the desired probability distribution be the one that makes the observed data most likely, which is obtained by seeking the value of the parameter vector that maximizes the likelihood function.

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \ldots + \Gamma_k \Delta z_{t-k+1} + \Pi z_{t-k} + \varepsilon_t \qquad (5.7)$$

where short run information is given by Γ_i which represents - $(I - A_1 - \ldots - A_i), (i = 1, \ldots, k-1)$, and long run information is provided by Π which represents $-(I - A_1 - \ldots - A_k)$. Thus the hypothesis to be tested is given by:

$$H_1(r): \Pi = \alpha . \beta' \qquad (5.8)$$

where, α is the loading matrix known as the adjustment parameter in VECM and the reduced rank where, r is the number of co-integrating relationships.

Granger's representation theorem indicates that if the coefficient matrix Π has a reduced rank $r < n-1$, there exists $(n-1) \times r$ matrices α and β each with rank r such that $\Pi = \alpha . \beta'$ and $\beta' . z_t \sim I(0)$.

Finally, the Johansen method estimates the matrix from an unrestricted VAR and tests whether we can reject hypothesis 1 (equation 5.8) on the reduced rank of Π. When the matrix is stable, there is a long-run relationship among $n-1$ real exchange rates whose countries can form an OCA (Sugimoto, 2008).

To test the hypothesis in equation (5.8) using the Johansen co-integration procedure, we can have two specific test statistics; one relating to the trace[17] test and the other to the maximum Eigen-value test. Both tests yield the number of co-integrating vectors in the system. The null

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[17]Both trace and maximum eigenvalue tests are likelihood ratio type tests, however, both operate under different assumptions regarding the deterministic part of the data generation process. The trace test tends to have more distorted sizes whereas their power in some situations superior to that of the maximum eigenvalue tests (Lutvephol, 2000).

hypothesis is that there are at most 'r' co-integrating vectors, i.e. $(0 \leq r \leq n)$. The trace test statistics is computed as follows:

$$\lambda_{trace} = -N\sum_{i} = r+1^{n} \ln(1-\lambda_{i})$$ (5.9)

Where λ_{i} are the (n-r) smallest squared canonical correlations of z_{t-1} with respect to Δz_t, corrected for lagged differences and N is the sample size.

The maximum Eigen-value test is computed as follows:

$$\lambda_{max} = -N\ln(1-\lambda_{N+1})$$ (5.10)

With the maximum Eigen-value test, the null hypothesis is that there are 'r' co-integrating vectors against the alternative that r+1 exist. Thus, rejection of the hypothesis implies that a maximum of 'r' co-integrating vectors exist.

5.5.2.2 Methodology on panel unit root tests

Panel unit root tests are superior to time series unit root tests. Therefore, we use panel unit root tests as found in Im, Pesaran and Shin (IPS) (2003) and Levin Lin and Chu (LLC) (2002). From equation (4) we have the following panel unit root regression:

$$\Delta q_{i,t} = \alpha_i + \beta_i q_{i,t-1} + \sum_{j=1}^{wij} \delta_{i,j} \Delta q_{i,t-j} + \varepsilon_{i,t} \quad ,i=1,\ldots,N, \text{and } t=1$$ (5.11)

LLC (2002) test

The LLC test examines:

H_0: $\beta_1=\beta_2=...=\beta_N=0$ Against H_1: $\beta_i<0$, for some i

H_0 and H_1 are the null and the alternative hypothesis respectively, where the appropriate lag order w_{ij} from equation (5) must be determined. The conventional t-statistics for testing $\beta_i=0$ is:

$$t_{\beta i} = \frac{\hat{\rho}}{\widehat{\delta}(\widehat{\rho})} \qquad (5.12)$$

The IPS adjusted t-statistics is expressed as:

$$t_{\beta i}^* = \frac{t_{\beta i} - NTS\widehat{N}\alpha^{-2}STD\left(\hat{\hat{\sigma}}\right)\mu^* M\breve{T}}{\widehat{\delta}(\widehat{\rho})M\widehat{T}} \qquad (5.13)$$

IPS (2003) test

IPS panel unit root test is used in addition to Levin and Lin test, because IPS allows for a high degree of heterogeneity across the countries of the panel. The IPS test also examines:

H_0: $\beta_1=\beta_2=...=\beta_N=0$ Against H_1: $\beta_i<0$, for some i

The IPS statistics is: $CIPS(N,T) = \frac{1}{N}\sum_{i=1}^{N} t_i(N,T)$ where $t_i(N,T)$ is the crossectionally augmented ADF statistics (CADF) for the ith cross section. Similarly, the standardised IPS t-bar statistics is given by:

$$t_{ips} = \frac{\sqrt{N}(t-1)/N\sum_{t=1}^{N}\overline{E}[t_i,t]\beta_i = 0}{\sqrt{N-1\sum_{t=1}^{N}VAR[t_i,t]\beta_i = 0}} \qquad (5.14)$$

5.6 Empirical Results and Discussions

Prior to co-integration and panel unit root tests analysis, one traditionally carries out conventional[18] unit root tests. In this study I performed the following four unit root tests; the Dickey–Fuller test with generalised least squares (DF-GLS) , the augmented Dickey Fuller (ADF) test, Philipps−Perron (PP), the test proposed by Ng and Perron (NG-MZ$_\alpha$) (2001), and the Kwiatkowski-Philips-Schmidt-Shin (KPSS) test. See the results of unit root tests Table 5.4.

Table 5.4: Univariate Unit Root Tests of SADC (Log) Real Exchange Rate Series

(Log) Real Exchange Rate Series	DF(GLSd etrended)	ADF (Level)	PP (GLSdetrended)	MZ_α (GLS detrended)	KPSS (Trend Stationary)
Angola	-0.770(8)	-1.477(8)	-0.523(8)	-0.298(8)	0.239(14)***
Botswana	-1.350(2)	-2.090(8)	-3.712(2)	-3.685(2)	0.236(10)***
Madagascar	-1.699(1)	-2.428(1)	-6.703(1)	-6.665(1)	0.233(11)***
Malawi	-1.699(5)	-1.510(5)	-5.085(5)	-5.051(5)	0.217(13)***
Mauritius	-1.166(7)	-1.5348(7)	-2.967(7)	-2.949(7)	0.316(14)***
Mozambique	-1.532(7)	-1.481(7)	-4.321(7)	-4.293(7)	0.223(14)***
South Africa	-0.995(2)	-2.404(8)	-2.184(2)	-2.158(2)	0.237(14)***
Seychelles	-0.653(1)	-1.235(5)	-1.2801(1)	-2.076(1)	0.254(14)**
Swaziland	-1.215(3)	-1.420(8)	-3.309(2)	-3.283(3)	0.233(14)***
Tanzania	-1.122(8)	-1.299(6)	-2.269(8)	-2.296(8)	0.229(12)***
Zambia	-0.578(1)	-0.441(8)	-1.280(1)	-1.272(1)	0.242(14)***

Source: own Computed from sample data (1995m1-2012m8)

Note:

(1) For ADF we used one-sided (lower tail) test of H_0: Non-stationary vs. H_1: Stationary and 1%, 5%, 10% critical values (T=100) = -3.510 -2.890 -2.580, respectively. 5% Crtical Value for ADF, PP, MZ_α and DF-GLS test is -8.350.

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[18] Conventional unit root tests are carried out just to follow the traditional way doing econometric analysis. However, in this section my focus is on panel unit root tests.

(2) Figures in parentheses are optimal lag lengths selected by appropriate lag criteria. For KPSS test maximum lag of 14 is chosen by Schwert criterion and the autocovariances weighted by Bartlett kernel. Critical values for **Ho:** real exchange rate is trend stationary are: 10%:**0.119**, 5%:**0.146**, and 1%:**0.216**.

(3) Note that all the conventional unit root tests in Table 5.4 show that SADC (log) real exchange rate series contains unit root.

5.6.1 Cointegration Test Results

5.6.1.1 Johansen's test for cointegration

The co-integration rank is determined by assessing the Trace and Maximum Eigen-value test statistics. As shown in Table 5.5 the Trace statistics indicate three cointegrating relationships while the Maximum Eigen-value shows one cointegrating equation at the 1% level. The Eigen-values in Table 5.5 are less than unity which implies that the system as a whole is stable and the co-integration results are reliable (Chiemeke, 2010). Given these findings there are more than one co-integrating vector for SADC (log) real exchange rate in support of GPPP hypothesis in the SADC region for the sample period. To supplement the result presented in Table 3 we also carried out the Pedroni (Engle-Granger-based) residual cointegration test for the series of real exchange rate (RER), nominal exchange rate (NER) and CPI. The Pedroni cointegration test is robust enough to allow for heterogeneous dynamics across individual members of the panel (Pedroni, 2005). The findings in Table 5.6 are in support of the findings in Table 5.5 (For methodological aspects of the Pedroni cointegration test see Pedroni, 2004). The results shown in Table 5.6 further strengthen the assertion of cointegration in the RER series in the SADC region by rejecting the null hypothesis of no integration in all of the statistics.

Table 5.5: GPPP Test using Johansen multivariate co-integration test on SADC (Log) RER
(*Base currency =US$*)
Sample (adjusted): 1995M08 2012M10
Null hypothesis: no integration
Included observations: 207 after adjustments
Trend assumption: Linear deterministic trend
Series: *RERSA RERA RERB RERMA RERMD RERMU RERMO RERSC RERSW RERTA RERZA*
Lags interval (in first differences): 1 to 4

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	1 % Critical Value	Max-Eigen Statistic	1 % Critical Value
None***	0.418328	**395.8688**	293.44	**112.1628**	75.95
r≤ 1***	0.268538	**283.7060**	247.18	64.73099	69.09
r≤ 2***	0.248888	**218.9750**	204.95	59.24356	62.80
r≤ 3	0.190979	159.7314	168.36	43.86950	57.69
r≤ 4	0.152646	115.8619	133.57	34.28672	51.57
r≤ 5	0.125896	81.57520	103.18	27.85303	45.10
r≤ 6	0.090721	53.72216	76.07	19.68641	38.77
r≤ 7	0.070556	34.03575	54.46	15.14602	32.24
r≤ 8	0.047670	18.88973	35.65	10.11057	25.52
r≤ 9	0.030071	8.779158	20.04	6.320142	18.63
r≤ 10	0.011809	2.459016	6.65	2.459016	6.65
Note: *** denotes rejection of the null hypothesis.		*Trace test indicates 3 cointegrating equations at the 1% level.*		*Max-Eigen test indicates 1 cointegrating equation at the 1% level.*	

Source: own estimation

Table 5.6: Pedroni Residual Cointegration Test Result

Series: lnRER lnNER lnCPI				
Sample: 1995M03 2012M10				
Included observations: 2332				
Cross-sections included: 11				
Null Hypothesis: No cointegration				
Trend assumption: Deterministic intercept and trend				
User-specified lag length: 1				
Newey-West automatic bandwidth selection and Bartlett kernel				
(within-dimension)	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	12.73971	0.0000	10.60199	0.0000
Panel rho-Statistic	-3.523916	0.0002	-3.389909	0.0003
Panel PP-Statistic	-2.947256	0.0016	-2.840992	0.0022
Panel ADF-Statistic	-7.917885	0.0000	-7.861144	0.0000
(between-dimension)				
Group rho-Statistic	-2.129851	0.0166		
Group PP-Statistic	-2.305456	0.0106		
Group ADF-Statistic	-8.001912	0.0000		

Source: own estimation

Note: *The null hypothesis of 'no cointegration' is rejected in all the seven statistics as shown above.*

5.6.1.2 *Speed of short run adjustment and long run elasticity coefficients*

The alpha (α) coefficients in Table 5.7 provide the estimates of the short run adjustment of each of the real exchange rates towards the long run equilibrium. The alpha coefficients of SADC countries in Table 5.7 are all below one and the standard errors of the estimation are very low. These are good indications of RER stability in the region. However, all the coefficients are positive except in the case of the Angolan new kwanza, Mauritian rupee, Seychelles rupee, and Zambian kwacha. The coefficients can be interpreted as a measure of how quickly each of the RERs converges to GPPP (Beirne, 2008). Considering the absolute magnitude of the alpha coefficient in Table 5, the Angolan new kwanza has highest value of -0.94 which implies that the (log) RER of the Angolan new kwanza expressed against the dollar adjusts at the rate of 94% per month towards the long run equilibrium whereas the Zambian kwacha adjusts at a rate of -0.0088 or only 0.88% per month towards the long run equilibrium. The rest of the coefficients can also be interpreted likewise.

The absolute magnitude of the adjustment coefficients of SADC countries' real exchange rate is low. The lower the absolute magnitude of the 'α' coefficient, the slower becomes the speed of adjustment towards long run equilibrium. This finding implies that the observed slow speed of adjustment for (log) real exchange rate of SADC member states might constrain the effectiveness of stabilization policies in the wake of external shocks, rendering SADC countries vulnerable to macroeconomic instability in the region. Though the magnitudes of the alpha coefficients are low, they are all significantly different from zero at 1 percent level of significance. Therefore, the problem of weak exogeneity [19] is has not observed for the countries included in this study during the study period.

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[19] An economic variable tends to be weakly exogenous if its speed of adjustment coefficient is not statistically different from zero (Harris, 1995). Such a variable has no explanatory power with respect to the long run coefficients.

Table 5.7: (Log) Real Exchange Rate Series Short-run Adjustment Coefficients (α)

RER series	Adjustment coefficients (α)	Standard Error
D(South African rand)	0.016662	0.03318
D(Angolan new kwanza)	-0.941522	0.12886
D(Botswana pula)	0.037468	0.02376
D(Malawian kwacha)	0.086315	0.03880
D(Malagasy ariary (MGA))	0.107311	0.02685
D(Mauritian rupee)	-0.024887	0.01444
D(Mozambique metical)	0.042243	0.02391
D(Seychelles rupee)	-0.016641	0.05774
D(Swazi lilangeni)	0.016270	0.03557
D(Tanzanian shilling)	0.022810	0.01770
D(Zambian kwacha)	-0.008818	0.03676

Source: Own estimation

The beta (β) coefficient in Table 5.8 reflects the interrelationships among SADC real exchange rates in terms of the log run elasticities. The real exchange rates based on the South African rand expressed against dollar is used to obtain the normalized equations in Table 5.8. When using the South African RER to obtain the normalised cointegrating equations, the results of adjustment coefficients (α) and long run coefficients (β) become much better than using other currencies in the region. The results are statistically significant at the 1 percent level of significance for the bilateral real exchange rates. The sign and the magnitude of the parameters of the co-integrating vectors of countries in the sample reflect common policy connections and coordination that exist among member countries (Beirne, 2008). The magnitude of the beta coefficients of all the real exchange rates are below one except in the case of Mauritius and they all bear negative sign except in the case of Angola and Mauritius. We can take this evidence as supportive of monetary union in the region excluding Angola and Mauritius. These two countries may exhibit asymmetry in response to external shocks, disqualifying

them from a SADC OCA. The interpretation goes with Table 5.8. Thus, a 1 percent increase in the real exchange rate of the South African rand per US dollar (i.e. a devaluation of rand) will induce a 0.818%, 0.137%, 0.558%, 0.387%, 0.083%, 0.779% , 0.445% and 0.156% decrease in the real exchange rates of the currencies of Botswana, Malawi, Madagascar, Mozambique, Seychelles, Swaziland, Tanzania, and Zambia per US dollar, respectively.

Table 5.8: SADC (Log) Real Exchange Rate Normalised long run Cointegrating
Equations (β- Coefficients)

RER series (1 Cointegrating Equation: Log likelihood 4852.518)	Normalised Long run Cointegrating Equations (β- Coefficients)	Standard Error
South African rand	1.000	
Angolan new kwanza	0.160	0.031
Botswana pula	-0.818	0.345
Malawian kwacha	-0.137	0.075
Malagasy ariary (MGA)	-0.558	0.154
Mauritian rupee	1.616	0.252
Mozambique metical	-0.387	0.131
Seychelles rupee	-0.083	0.135
Swazi lilangeni	-0.779	0.273
Tanzanian shilling	-0.445	0.177
Zambian kwacha	-0.156	0.087

Source: Own estimation

5.7 Panel Unit Root Test Results

Our panel unit root test results are subject to inclusion or exclusion of a time trend. The optimal lag lengths are chosen using the Schwarz Information Criteria (SBIC) (see Table 5.9).

Table 5.9: LAG Selection Criteria

Selection-order criteria Sample:1995:5-2012:8 Number of observation=208								
Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-257.16				0.02449	2.50154	2.521	2.54998
1	1134.54	2783.4	9	0.000	4.1E-09	-10.7937	-10.7158	-10.6011
2	1186.12	103.16	9	0.000	2.7E-09	-11.2031	-11.0669	-10.8662*
3	1205.91	39.568	9	0.000	2.5E-09	-11.3068	-11.1122*	-10.8254
4	1219.27	26.719*	9	0.002	2.4E-09*	-11.3487*	-11.0957	-10.7229
Endogenous: ln_ realexrte								
Exogenous: -cons								

Source: Own estimation

Table 5.9 & 5.10, present panel unit root tests according to the LLC and IPS respectively. The LLC panel unit root test rejects the null hypothesis of a unit root at the 1 percent level of significance when a time trend is included in the estimation (Table 5.9). The LLC panel unit root test also rejects the null hypothesis of a unit root in the panel at a 10 percent level of significance when a time trend is not included.

The IPS unit root test result shows that the panel of (log) RER series is stationary at 1 percent level of significance only when the time trend is included in the analysis; otherwise it is unit root (Table 5.10). From these two panel unit root tests, we can safely generalise that the panel

of real exchange rates is stationary. Hence, there is GPPP when the whole panel of SADC countries is considered jointly and when the time trend is included in the panel analysis. The other two variables in this study, the panel series of the logarithm of nominal exchange rate and CPI are also stationary with and without the trend. These results are not reported here.

Table 5.9: Levin-Lin-Chu panel unit root test for SADC (Log) RER Series

t-statistics			p-value	
	Without time Trend	With time Trend	Without time Trend	With time Trend
Unadjusted t	**-6.5519**	**-8.7189**		
Adjusted t*	**-1.5314**	**-3.6077**	**0.0628**	**0.0002**

Notes:
 	
Ho: Panels contain unit roots   AR parameter: Common
 	
H$_1$: Panels are stationary   Panel means: Included
               Number of panels   = 11
               Number of periods   = 212
 	
Asymptotics :   N/T $\rightarrow$ 0
 	
 LR variance: Bartlett kernel, 19.00 lags average (chosen by LLC)				

    Source: Computed from sample data (1995m1-2012m8)

Table 5.10: Im-Pesaran-Shin panel unit root test for SADC (Log) RER series

t-statistics			p-value		Fixed-N Exact Critical Values		
	Without time trend	With time trend	Without time trend	With time trend	1%	5%	10%
t-bar	**-1.5066**	**-2.1323**					
t-tilde-bar	**-1.4935**	**-2.1063**	**0.5265**	**0.0086**	**-2.040**	**-1.890**	**-1.810**
z-t-tilde-bar	**0.0665**	**-2.3823**					
Notes: Ho: Panels contain unit rootsAR parameter: Panel-specific H$_1$: Some panels are stationary Panel means: Included Number of panels =11 Number of periods =212 Asymptotics : T,N $\rightarrow \infty$ sequentially							

Source: Computed from sample data (1995m1-2012m8)

I also carried out Pesaran's cross-sectional augmented Dickey Fuller (CADF) test to supplement the robustness of IPS test. The Pesaran's CADF test also rejects the null hypothesis of *'all series are non-stationary'* at 5 percent level of significance, supporting the results obtained by the LLC and IPS panel unit root tests.

Table 5.11: Pesaran CADF Test for (log) Real Exchange Rate

t-bar test, N,T=(11,212)				Obs. = 2277	
Augmented by 4 lags (average)					
Ho: All series are non-stationary					
H$_1$: Some panels are stationary					
t-bar	cv10	cv5	cv1	Z[t-bar]	p-value
-2.312	-2.150	-2.250	-2.430	-1.924	0.027**
Note:					
Cross-sectional average in first period extracted and extreme t-values truncated					
Deterministics chosen: constant					

5.8 Robustness Check

Lastly, the error correction based co-integration tests for the panel of SADC (log) RER series is computed to check the robustness of the results (Table 5.12).

In these tests there are two statistics; *group mean statistics* (i.e. G_α and G_τ) and the *panel statistics* (i.e. P_α and P_τ). This test rejects the null hypothesis of no co-integration for the panel as the whole at the 1 percent level of significance. However, with the group mean statistics we fail to reject the null hypothesis. This implies that there is no co-integration for at least one of the cross-sectional units. This result is in line with our normalised co-integrating equations' long run coefficients reported in Table 5.8. It is important to again emphasise that, the panel tests have the highest power since they are based on pooled least square estimators of the co-integration coefficients (Persyn & Westerlund, 2008).

Table 5.12: ECM Panel Cointegration Test for the panel of SADC (log) RER series

Results for H_0: no cointegration with 11series and 3 covariates					
Statistics		Value	z-value	p-value	Remark
Group mean	G_τ	0.080	5.796	1.000	*There is no cointegartion for at least one of the cross-sectional units.*
	G_α	0.000	4.148	1.000	
Panel	P_τ	-14.956	-8.079	**0.000**	*There is strong cointegtaion for the panel as the whole.*
	P_α	96.902	-48.648	**0.000**	

Source: Computed from sample data (1995m1-2012m8)

5.9 Conclusion

In this chapter the objective was to establish whether SADC countries form an OCA by using the GPPP framework. For the analysis the Johansen multivariate co-integration technique, LLC and IPS panel unit root tests and error correction based panel co-integration tests were used. A panel of the logarithm of SADC real exchange rates, nominal exchange rates, CPI, and CPI of the US as a base country for the period of 1995 to 2012 are employed in the analysis.

Consistent with the previous studies in developing regions across the globe, all the conventional unit root tests confirm that the panel series in this study have unit roots. We also employed panel unit root tests for RER series which confirmed stationarity with a high level of significance with a time trend included in the estimation. Johansen's multivariate co-integration test has two specific test statistics: the *trace* and the *maximum Eigen-value*. In this paper the trace statistics indicate the existence of three co-integrating relationship among SADC real exchange rates while the maximum Eigen-value shows one cointegration relationship. The Eigen-values obtained in the analysis of these two statistics are less than unity which implies that the systems of equations are stable and hence the results from the estimations are reliable. Therefore, the conclusion from these findings implies that GPPP holds in the SADC region.

In addition to Johansen's co-integration analysis, Pedroni's residual cointegration test and error correction based panel co-integration tests are also performed. Both tests confirm that there are cointegrating relationships among SADC real exchange rate series. However, the absolute magnitudes of the short run adjustment coefficients of SADC countries' real exchange rates are low. The lower the absolute magnitude of the alpha coefficient, the slower becomes the speed of adjustment towards long run equilibrium. This finding implies that the

observed slow speed of adjustment for (log) real exchange rate of SADC member states might constrain the effectiveness of stabilization policies in the wake of external shocks, rendering SADC countries vulnerable to macroeconomic instability in the region. However, the magnitude of the long run beta coefficients of all the real exchange rates are below one except in the case of Mauritius and they all bear negative sign except in the case of Angola and Mauritius. We can take this evidence as supportive of monetary union in the region excluding Angola and Mauritius. These two countries may exhibit asymmetry in response to external shocks, disqualifying them from a SADC-OCA. Similar findings are reported by Zerihun et al. (2014) that states that not all countries in SADC conform to OCA criteria judged by both asymmetrical business cycles and weak co-movements in business cycles.

In general the study concludes that the GPPP hypothesis holds for SADC economies given the stationary panel of RER series and cointegrating relationships amongst the system of RERs. This implies that the region is potentially an OCA that could proceed with monetary integration. However, the slow speed of adjustment towards long run equilibrium sounds a warning for the possible ineffectiveness of policy to defend these countries against external shocks. We recommend that policy makers should not focus only on the dynamics of RER in the SADC region and consider alongside this result more OCA criteria for meaningful policy formulation as SADC moves toward monetary union.

CHAPTER 6

NON-LINEAR APPROACHES IN TESTINGPURCHASING POWER PARITY OF SADC ECONOMIES TOWARDS MONETARY UNION
(ESSAY III)

6.1 Abstract

Real exchange rate series should be stationary for the theory of purchasing power parity to hold. However, conventional unit root tests in SADC real exchange rates confirm the existence of unit root. Such deficiencies in the investigation of the dynamics of real exchange rate in the region, calls for other methods. Hence, I use two nonlinearity tests: the nonparametric test developed by Brock, Dechert, and Scheinkman known as BDS test and Fourier stationarity test to investigate the non-linearity of real exchange rates in SADC.

The BDS test detects the (iid) assumption of the time series used in the analysis. The Fourier approximation mimics a wide variety of breaks and other types of nonlinearities. Both tests confirm the nonlinear nature of real exchange series of SADC economies. Furthermore, the results from Fourier stationarity test come out in support of SADC as an OCA.

6.2 Introduction

The goal of the regional integration agenda in southern Africa is to create a fully integrated internationally competitive region to ensure economic growth and poverty reduction. The region faces a number of challenges achieving this goal, however, according to the African Development Bank (AfDB, 2011); the region is well positioned to take advantage of them.

The success of the integration process depends on stable economies in terms of inflation rates, interest rates, exchange rates, and levels of employment, among other factors (UNECA, 2010). Member states should consider regional integration as part of their broader strategic development objectives. In meeting these strategic objectives, it is important to understand: *(1)* the impact of regional economic integration on the economies concerned and even more importantly, *(2)* the unintended consequences of monetary integration. SADC has a monetary integration agenda and therefore there is much interest in studying OCA criteria in SADC.

OCA theory is one possible approach for analysing monetary unions. OCA theory dates back to 1961 with Mundell's (1961) seminal article setting out the theoretical foundations of the theory. Following Mundell's works, McKinnon (1963), Kenen (1969) and other economists made great contributions to refine the theory.

According to OCA theory, if PPP holds, one of the criteria of OCA theory is met and there is some potential that countries may form an OCA and therefore move toward full monetary integration.

Literature on PPP in SADC is very limited. Usually PPP is studied by exploring the time series properties of real exchange rates. The vast majority of studies are based on linear tests for mean-reversion in real exchange rates such as the Engle-Granger and Johansen co-integration tests. Real exchange rate time series is stationary and non-linear, as is common to many macroeconomic variables in the literature (Arghyrou & Gregoriou, 2007). However, the

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implicit assumption of linearity of real exchange rates has made the majority of existing empirical literature on long-run PPP behaviour inconclusive and/or inconsistent. Given this gap in the literature, I investigate if nonlinearities are present in SADC real exchange rate time series. The objective is to assess the validity of PPP theory for SADC member countries as an optimal currency area (OCA) criterion towards monetary integration in the SADC region.

For an empirical approach, I first use the BDS test (named after Brock, Dechert, and Scheinkman) to test for non-linearity of the real exchange rate series. In Su et al.'s (2012) study, the real exchange rate series in 20 selected African countries were of low frequency and often exhibited structural breaks. Su et al. (2012) additionally employed the Fourier stationarity test for the analysis of real exchange rate dynamics. In such cases, flexible Fourier tests are more suitable (Enders and Lee, 2009 and 2012, and Pascalu, 2010). Likewise, I additionally use the flexible Fourier stationarity test proposed by Becker et al., (2006) to confirm nonlinearity and test for PPP.

Here the contribution is the use of the flexible Fourier stationary test to test the validity of long-run purchasing power parity (PPP) in a sample of SADC economies. To the best of my knowledge, this thesis is the first to utilize the BDS test and flexible Fourier stationary test to test for long-run PPP in SADC economies. The BDS test detects the independent and identically distributed *(iid)* assumption of the time series used in the analysis, while the Fourier approximation mimics a wide variety of breaks and other types of nonlinearities.

6.3 PPP Hypothesis and OCA Theory

Here I present a brief theoretical review on three interrelated theories; exchange rate theory, PPP hypothesis, and OCA theory in the context of monetary integration. These areas of research are complimentary and have seen a revival following the experience of the European Monetary Union (EMU), which is perceived to have been beneficial for its members (Dellas & Tavlas, 2009).

Given the experience of EMU, the degree of real convergence should be one of the criteria to be satisfied by prospective entrants prior to entry into the euro area (Buiter, 2008). The degree of real convergence also determines the choice of exchange rate regime. PPP of the real exchange rate, as a real convergence criterion for OCA, is supposed to hold among the countries aspiring to form a monetary union.

PPP is based on the law of one price which implies that exchange rates should equalize the national price levels of different countries in terms of a common currency (Taylor, 2003). According to PPP, any change in relative national price levels between two countries should lead to a corresponding adjustment in their bilateral nominal exchange rate. This suggests that variations in the real exchange rate represent deviations from PPP. Consequently, one avenue for investigating the empirical validity of PPP is to examine the characteristics of the real exchange rate. In particular, since PPP implies the mean reversion of real exchange rates or their tendency to eventually return to PPP-determined levels in response to any disturbance, whether real exchange rates are stationary or non-stationary, becomes an issue of central significance. Stationary real exchange rates imply mean reversion and thus provide empirical support for PPP, (Taylor et al., 2001).

There are two strands, linear and nonlinear, in the theory of time series dynamic properties of real exchange rates. Recent studies have focused on exploring the nonlinear behaviour of real exchange rates (Aksoy & Ledesma, 2007; McMillan 2007; Mokoena 2009). The literature further identifies major factors that lead to the nonlinear nature of real exchange rate series, such as, transaction costs in various markets and policy intervention or the actions of market agents in financial speculation and arbitrage behaviour (McMillan, 2007).

The investigation of nonlinearities and asymmetries in macroeconomic behaviour constitutes an increasingly popular area of empirical research (Holmes, 2004). A prior study by Mokoena *et al*., (2009), using SADC real exchange rates, argued that non-linear approaches to exchange rate adjustments are likely to provide a firmer basis for inference and stronger support for the

PPP in the long term in the region. However, Mokoena *et al*. (2009) did not make any inference about monetary integration in the SADC region. These findings motivate our analysis and hence we expect PPP will be valid for most of member countries of SADC. Analysis in this chapter will potentially be endowed with sound policy implications towards the formation of an OCA in the SADC region.

Table 6.1: Developments of PPP Hypothesis over time

Time Horizon	References/Group of researchers	Methodology used	Major findings
Late 1980's and early 1990's	(Taylor, 1988; Karfakis and Moschos, 1989; Kim, 1990; Patel, 1990 and Bleaney, 1991),	Co-integration between nominal exchange rate and price levels	The results were some positive and some negative
Early 1990's	(Frankel & Rose, 1996; Papell & Theodoridis, 1998; O'Connell, 1998; Fleissig & Strauss, 2000; and Ho, 2002),	Panel unit root techniques	Only Ho, (2002) found evidence of PPP and others did not. However, more recent studies using second generation of panel unit test found evidence for PPP.
Studies since 2000s	(Taylor *et al*., 2001; Chortareas *et al*., 2002; Kilian & Taylor, 2003; Chortareas & Kapetanios, 2003 and Sarno et al., 2004) Marcela et al. (2003), Narayan (2005, 2006)	Nonlinear unit root techniques	Most of them found evidence of stationarity in favour of PPP

Source: author (synthesis of literature review)

The purchasing power parity (PPP) hypothesis has been explored extensively in the recent literature using recent advances in the field of applied econometrics that pay explicit attention to the integration and co-integration properties of the variables. Based on the law of one price, PPP asserts that relative goods prices are not affected by exchange rates − or, equivalently, that exchange rate changes will be proportional to relative inflation. This relationship is

important: firstly, it has been a cornerstone of exchange rate models in international economics and has policy implications; it provides a benchmark exchange rate and hence has some practical appeal for policymakers and exchange rate arbitrageurs.

If the real exchange rate is found stationary by using unit root test with structural break(s), then the effects of shocks such as real and monetary shocks that cause deviations around a mean value or deterministic trend are only temporary. Then, PPP is valid in the long run with reference to OCA theory.

6.4   Data and Methodology

6.4.1   Data

In the previous chapter I used linear method to test GPPP in SADC. In this chapter I use non-linear approaches in testing PPP of SADC economies towards monetary union. The statinarity tests are done in chapter five for the same data set employed in this chapter too. Common model specifications employed in previous chapter also apply in this chapter as well.

From an earlier paper (chapter 5), recall that Zambia has the highest mean real exchange rate followed by Madagascar and Tanzania, whereas Botswana has the lowest followed by Seychelles and South Africa (Table 5.1). All the exchange rates of the countries are symmetrically distributed around the mean since the measures of *skewness* for each country is close to zero. However, the Jarque-Bera test shows that the (log) real exchange rate series of SADC countries are not normally distributed. This normality test is significant for all countries in the sample at a 1 percent level of significance, except for Madagascar which is significant at the 5 percent level. This motivates further test for nonlinearity. The present focus is not to examine nonlinearity versus non-normality in real exchange rate dynamics. As discussed in next section, I use the BDS test to make inferences about nonlinearity from the non-normality

test. For the details on nonlinearity versus non-normality in real exchange rate dynamics see (Arghyrou & Gregoriou 2008)[20].

6.4.2 Methodology

Many nonlinear models investigate the dynamic behaviour of real exchange rates. Exponential smooth transition autoregressive (ESTAR) models, threshold autoregressive (TAR) models, smooth transition autoregressive (STAR) models, and Markov switching models (MS) are the most widely used for this purpose. In this study, I use of the BDS nonlinearity test to test for nonlinearity of the real exchange rate series and Fourier unit root tests to make inferences about the suitability of SADC member states to form a monetary union, based on whether or not there is PPP.

6.4.2.1 BDS- Nonparametric Test of Nonlinearity

The motivation for the BDS test goes with the **'**independent and identically distributed' (*iid*) assumption in time series data. To detect this assumption, non-parametric tests like BDS are more appropriate than parametric tests. It is generally believed that a non-parametric model provides a more robust approach to statistical inference because it is more likely to approximately capture the true underlying structure (Delegado & Robinson, 1992; Yatchew, 1998; Epstein & Scheider, 2003).

Following Belaire & Coutreras (2002), let Y_t be a univariate real exchange rate series that is *iid* from some distribution. Also, define

$$P_A = \Pr(|Y_t - Y_s| < \varepsilon) \tag{6.1}$$

---

[20]For further inspection of nonlinear dynamics of real exchange rate series of SADC countries, see the graphical illustration of the logarithm of RER and fitted nonlinearities for the SADC countries included in this study in appendix of this chapter.

as the probability that two points are within a distance 'ε'of each other. Further we can define:

$$P_B = \Pr(|Y_t - Y_s| < \varepsilon, |Y_{t-1} - Y_{s-1}| < \varepsilon) \tag{6.2}$$

Equation 3 holds true, as the probability of a history of the two observations being within ε of each other. By the independence of Y_t, the two events contained in the event B are independent and therefore $P_B = P_A^2$. One can estimate P_A and P_B and also $P_B - P_A^2$, which has an expected value of zero under the null hypothesis. To estimate the probability that the m length vectors are within 'ε', define:

$$c_{m,n}(\varepsilon) = \frac{2}{(n-m+1)(n-m)} \sum_{s=m}^{n} \sum_{t=s+1}^{n} \prod_{j=0}^{m-1} I_\varepsilon(Y_{s-j}, Y_{t-j}) \tag{6.3}$$

where

$$I_\varepsilon(Y_{s-j}, Y_{t-j}) = \begin{cases} 1 & \text{if } |Y_{t-1} - Y_{s-1}| < \varepsilon \\ 0 & \text{otherwise} \end{cases} \tag{6.4}$$

Here 'n' is the sample size and m is the so-called embedding dimension. Under the null of *iid*,

$$E(C_{m,n}(\varepsilon)) = (E(C_{1,n}(\varepsilon)))^m \tag{6.5}$$

Brock et al. (1996) show that, given an embedding dimension, m, and a value of the radius, ε, the BDS statistic is given as:

$$w_{m,n}(\varepsilon) = \sqrt{n-m+1} \frac{c_{m,n}(\varepsilon) - c_{1,n-m+1}^m(\varepsilon)}{\sigma_{m,n}(\varepsilon)} \tag{6.6}$$

It is asymptotically distributed as N (0, 1). This formula uses the square root of the consistent estimator

$$\sigma^2{}_{m,n}(\varepsilon) = 4\left[k^m + 2\sum_{j=1}^{m-1} k^{m-j} c^{2j} + (m-1)^2 c^{2m} - m^2 k c^{2m-2} \right] \tag{6.7}$$

where

$$c = c_{1,n}(\varepsilon)$$

$$k = k_n(\varepsilon) = \frac{6}{n(n-1)(n-2)} \sum_{t=1}^{n} \sum_{s=t+1}^{n} \sum_{r=s+1}^{n} h_\varepsilon(Y_t, Y_s, Y_r) \tag{6.8}$$

$$h_\varepsilon(i,j,k) = \frac{1}{3}\left[I_\varepsilon(i,j) I_\varepsilon(j,k) + I_\varepsilon(i,k) I_\varepsilon(k,j) + I_\varepsilon(j,i) I_\varepsilon(i,k) \right] \tag{6.9}$$

The consistent estimators $c_{1,n}(\varepsilon)$ and $k_n(\varepsilon)$ are in the class of U-statistics and are the most efficient estimators of c and k, respectively (Kanzler, 1999). (See BDS test result in Table 6.1).

6.4.2.2 Stationary test with a Fourier function

Motivations for Fourier Unit Root Test

There have been methodological problems testing the validity of the PPP hypothesis. Firstly, one has to know the exact number and location of the breaks in the series. These are not usually known and therefore need to be estimated. This in turn introduces an undesirable pre-selection bias (see Maddala & Kim, 1998). Secondly, current available tests accounts for only one or two breaks. Thirdly, the use of dummies suggests sharp and sudden changes in the trend or level. However, for low frequency data, it is more likely that structural changes take the form of large swings which cannot be captured well using only dummies. Breaks should therefore be approximated as smooth and gradual processes (Leybourne *et al.,* 1998).

These arguments motivate the use of a recently developed set of unit root and stationarity tests that avoid this problem. Both Becker *et al.* (2006) and Enders and Lee (2009) develop tests that model any structural break of an unknown form as a smooth process via Flexible Fourier transformations. Several authors, including Becker *et al.* (2006), Enders and Lee (2009), and

Pascalau (2010), show that a Fourier approximation can often capture the behaviour of an unknown function even if the function itself is not periodic.

It has been proven that when structural breaks are included for individual countries, the real exchange rate is stationary, implying support for purchasing power parity (Marcela *et al.*, 2003, and Narayan, 2006). A flexible Fourier stationary test was applied to test the validity of long-run PPP in a sample of East Asian countries over the period January 1986 to October 2009 (Chang *et al.*, 2012). The empirical results from this study indicate that PPP does not hold for most of the East Asian countries, with the exception of Indonesia and Japan.

This procedure allows us to study the non-linear mean-reverting behaviour of PPP without having to specify the kind of nonlinear adjustment process. Enders and Lee (2004, 2009) develop their unit root test using the LM principle. The LM has increased power over the DF approach (Pascalau, 2010). Following Enders and Lee (2004, 2009), we consider the following Data Generating Process (DGP):

$$y_t = \alpha_0 + \theta_t + \gamma_1 \sin(2\pi k t / T) + \gamma_2 \cos(2\pi k t / T) + \varepsilon_t \qquad (6.10)$$

$$\varepsilon_t = \beta \varepsilon_{t-1} + u_t \qquad (6.11)$$

$$\Delta y_t = \delta_0 + \delta_1 \sin(2\pi k t / T) + \delta_2 \cos(2\pi k t / T) + v_t \qquad (6.12)$$

where $k(1 \leq k \leq 5)$ is the number of frequencies of the Fourier function, 't' is a trend term, 'T' is the number of usable observations in the regression analysis and $\left[\delta_1 \sin(2\pi k t / T) + \delta_2 \cos(2\pi k t / T)\right]$ captures structural change in the real exchange rate series $\{y_t\}$.

There is non-linearity and unknown breaks if the hypothesis $\delta_1 = \delta_2 = 0$ is rejected, using the F-statistics F (k) of *Table 3* in Enders and Lee (2004). The 'k' in F (k) is the $k_{\min}$ obtained

from regression of equation (6.10) that gives the minimum residual sum of squares (RSS) for different frequencies. The rejection of the above hypothesis is indicative of the presence of structural breaks. If θ=0 (using the τ_{DF} statistics from Table 3 in Enders and Lee 2004), there is a unit root. However, if θ is significantly different from zero, we reject the unit root taking into account nonlinearity and possible structural breaks and therefore the series $\{y_t\}$ is stationary (i.e. exhibit stochastic convergence (Nyong, 2013)). Further details on the methodological aspects of this section can be found in Enders and Lee (2004, 2009). See Fourier unit root test result in Table 6.3.

6.5 Results and Discussion

Univariate unit root tests show that the real exchange rate data of the SADC economies included in this study have a unit root and is non-stationary (real exchange rate series of 11 SADC countries were used, with monthly data from 1995 to 2012 (Section 2)). The BDS test detects the non-validity of the *iid* assumption of the time series used in the analysis, while the Fourier approximation mimics a wide variety of breaks and other types of nonlinearities. If the real exchange rate is found stationary by using the unit root test with structural break(s), the effects of shocks, such as real and monetary shocks that cause deviations around a mean value or deterministic trend, are only temporary. Then, PPP is valid in the long run with reference to OCA theory.

Table 6.2 provides the BDS statistics for all eleven exchange rate series of SADC countries included in the study. The results strongly suggest that the real exchange rate series of all the SADC countries included in this study reject the *iid* null hypothesis at the 1 percent level significance.

Table 6.2: The BDS test results for the monthly RER series (Fraction of pairs)[21]

	BDS Statistics of SADC Real Exchange Rates – country codes as local currency/USD										
	H_o = independent and identically distributed (*iid*) , is rejected in all cases										
	Country Codes[22]										
m	ANG	BWA	MDG	MWI	MUS	MOZ	ZAF	SYC	SWZ	TZA	ZMB
2	0.169	0.1796	0.1650	0.1779	0.181	0.175	0.176	0.181	0.175	0.174	0.181
3	0.2857	0.3015	0.2745	0.2957	0.303	0.290	0.295	0.302	0.294	0.291	0.304
4	0.3610	0.3827	0.3446	0.3711	0.385	0.364	0.373	0.381	0.375	0.366	0.387
5	0.4114	0.4342	0.3869	0.4177	0.437	0.408	0.423	0.431	0.425	0.411	0.440
6	0.443	0.465	0.4103	0.4444	0.470	0.432	0.452	0.461	0.456	0.435	0.475
$c_1,n(\varepsilon)$	0.7701	0.208	0.243	0.298	0.181	0.217	0.262	0.240	0.293	0.179	0.562
$k_1(\varepsilon)$	3824810	3821906	3831102	3823116	3817066	3814646	3830134	3825536	3821180	3818034	3806902
V-Statistic	0.7033	0.7027	0.7045	0.7030	0.7019	0.701	0.7042	0.7034	0.702	0.702	0.700
	P***<0.001, m=embedding dimension, Included observations (n): 2332										

Source: Computed from sample data (1995m1-2012m8)

The Fourier unit root test results are reported in Table 6.3 with the time paths of SADC countries included in this study. The time paths of all the real exchange rates clearly observe structural shifts in the trend (Appendix A1). Given these findings, the Fourier approximations appear reasonable to use in detecting unit roots in SADC countries:

(1) The third column in Table 3 shows the sum of square of residuals (SSRs). The F-test for SSRs for all the SADC countries included in the study is significant at the 1 percent level of F-test result. This result indicates that a single frequency works best for all of the SADC countries in the study.

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[21] There are other methods as well on the basis of how we select epsilon (ε) like; in the case fraction of pairs, ε is calculated so as to ensure a certain fraction of the total number of pairs of points in the sample lie within of each other. Fixed value: is fixed at a raw value specified in the units as the data series. Standard deviations: is calculated as a multiple of the standard deviation of the series. Fraction of range: is calculated as a fraction of the range (the difference between the maximum and minimum value) of the series. The default is to specify as a fraction of pairs, since this method is most invariant to different distributions of the underlying series.

[22] See Table 1 for the full names of the countries.

(2) The fifth column of Table 6.2 shows that the statistical values are all significant at a 1 percent level of significance. Therefore, both the sine and cosine terms in equation (12) in the methodology section should be included in the estimated model. Thus, the hypothesis $\delta_1 = \delta_2 = 0$ is rejected using F-statistics F (k) of Table 3 in Enders and Lee (2004).

(3) The last column in Table 6.3 reports the results of unit root tests with a nonlinear function based on the estimated frequencies. All the T-statistic values for the 11 SADC member countries are significant at a 1 percent significance level.

Table 6.3: Stationary Test with a Nonlinear Fourier Unit Root Test

Country Code	Obs. (T)	SSRs	$\hat{k}$ Frequency	$F_\mu(\hat{k})$	$\tau_\mu(\hat{k})$
AGO	200	1.295	1	220.18***	-7.033***
BWA	203	0.146	1	446.14***	-2.731***
MDG	210	0.227	1	418.91***	-3.841***
MWI	199	0.311	1	360.60***	-2.731***
MUS	204	0.052	1	554.05***	-1.298***
MOZ	199	0.131	1	446.58***	-3.529***
ZAF	203	0.248	1	392.53***	-3.004***
SYC	200	0.195	1	409.52***	-2.461***
SWZ	203	0.311	1	369.82***	-2.653***
TZA	199	0.058	1	525.94***	-3.085***
ZMB	203	0.349	1	357.99***	-0.410***

Source: Computed from sample data (1995m1-2012m8)

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The Fourier function provides some evidence favouring the long-run validity of PPP for the SADC member countries included in this study. The logarithm of real exchange rate is nonlinear stationary, implying that deviations from the real exchange rate are mean reverting towards the PPP equilibrium. These findings are in line with the findings by Chi-Wei Su *et al.,* 2013, which strongly support PPP equilibrium for 19 African countries. As mentioned by Chi-Wei Su *et al.,* (2013), trade barriers, as well as interventions in the exchange markets, could be behind this nonlinear behaviour.

6.6 Conclusion

An in-depth investigation into the non-linear behaviour of macroeconomic fundamentals like real exchange rates is crucial for the analysis of OCA criteria. Such studies are critical in respect of providing: (1) literature on OCA theory in SADC and (2) empirical evidence to policymakers. The goal of the regional integration agenda in southern Africa is to create a fully integrated internationally competitive region to ensure economic growth and poverty reduction. However, countries in the region need to conform to OCA criteria before forming a monetary union.

The findings confirm that the nonparametric BDS test detects the (*iid*) assumption of the time series. The Fourier approximation mimics a wide variety of breaks and other types of nonlinearities. Both tests confirm the non-linear nature of real exchange series of SADC economies. The result from the Fourier stationarity test further strongly supports an OCA in the region comprising the 11 countries included in the study.

Given the long run dynamics of real exchange rates for the 11 member countries of SADC using the Fourier estimation method, our findings come out in support of the region being an OCA based on the PPP criteria. As suggested by Chang et al. (2009), these 11 SADC countries could use PPP to predict a common exchange rate which would determine whether a

currency is over or under-valued and experiencing differences between domestic and foreign inflation rates. My findings strengthen the findings from the previous two essays that claim potential suitability of member states to constitute a monetary union in the region at some point in future.

CHAPTER 7

EXPLORING EXCHANGE RATE BASED POLICY COORDINATION IN SADC TOWARDS MONETARY UNION

(ESSAY IV)

7.1 Abstract

In this chapter I evaluate 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 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.

7.2 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 OCA conditions face more stable exchange rates (De Grauwe, 2005). In general terms, the RER can play a positive or negative role in the economic performance of national states or groups of countries opting to form monetary union. Stable RER in a regional context requires coordination of the policies affecting the determinants of the RER.

The objective of this chapter 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, I evaluate REER stability in SADC.

Uncoordinated macroeconomic policies in the south-south economic integration policies 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. As discusssed in Chapter 3 of this thesis, most of the member states have performed well meeting the Maasstricht type convergence criteria as shown in Box 7.1. However, moving closer to the convergence targets (Maastricht type criteria)[23] 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 RER determinants and hence the RER.

> **Box 7.1: The Maastricht Treaty (1992) criteria for membership EMU**
> ➢ Long-term interest rate not in excess of 2 percent above the average of the three countries with the lowest inflation rates;
> ➢ Inflation rate not higher than 1.5 percent above the average of the three countries with the lowest inflation rates;
> ➢ No devaluation of its currency in the two years preceding the entrance into the union;
> ➢ Government deficits and debts not exceeding 3 percent and 60 percent of the GDP, respectively.

---

[23]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)

To answer the questions posed and meet the objective stated above I 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.

7.3 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 sector diverse 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 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). I 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.

7.4 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 should suspect the fact 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).

7.5 Data and Descriptive Analysis

In this section I 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 on 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 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 I 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 I include major macroeconomic variables only. Except for the variables with negative values

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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 indicates insufficient policy harmonisation and coordination efforts in the region during the period. To further highlight the result from group statistics I depict brief explanations and graphical illustrations of the variables in the study.

Table 7.1: 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 7.2: 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 7.3: 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 7.4: 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 SADC region 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 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 I used RER as dependent variable. However, in this chapter I use both RER and REER. However, in the analysis of regional groups of countries REER may not work best because of difference in trading partners of member countries. For this reason PMG estimation results obtained from using both variants of exchange rate are discussed in section 7.7. Chinn (2006) shows that exchange rate is the key relative price in international finance; as well as in goods and asset markets. However, different variants of exchange rate and different ways on which exchange rate transmission mechanisms make the study of exchange rate ambiguous. 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 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 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 7.1 shows the correlation among REER series of SADC countries. From Figure 7.1 and appendix B.2 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 7.1: Real Effective Exchange Rate of SADC Countries (1995-2012)
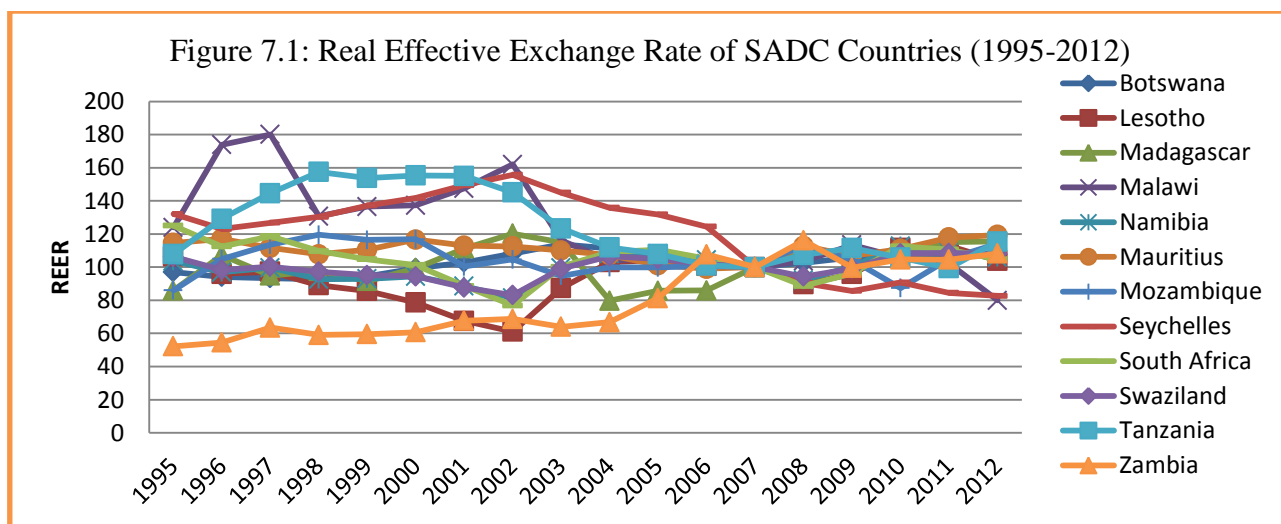
Source: author, estimated from database

Monetary policy

When we look at broad money supply (percent of GDP), the proxy variable for liquidity, in Figure 7.2, 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 7.2: Broad Money as a Perecent of GDP (1995-2012)
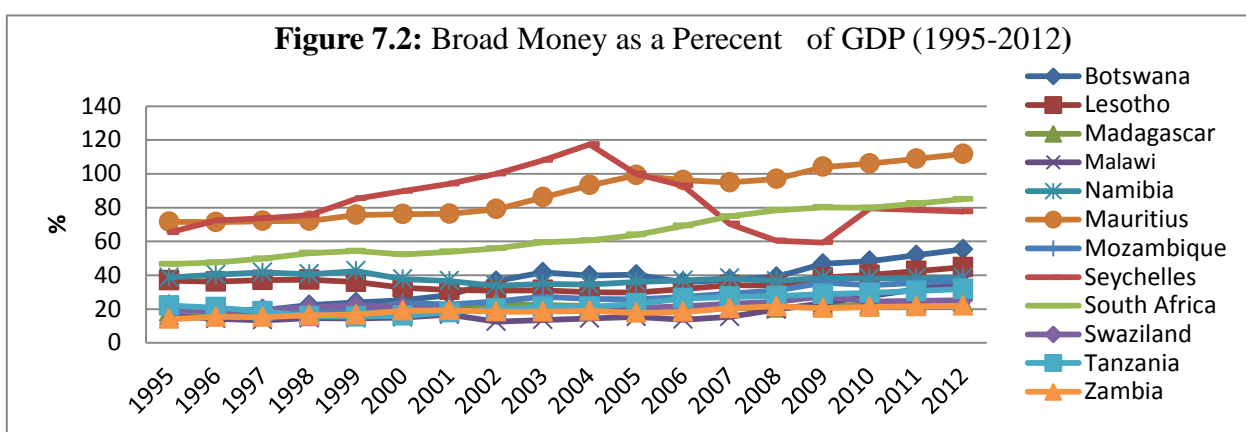
Source: author, estimated from database

Government Expenditure

As shown in Figure 7.3, 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.

Figure 7.3: Government Expenditure (as a Percent of GDP) of SADC Countries (1995-2012)
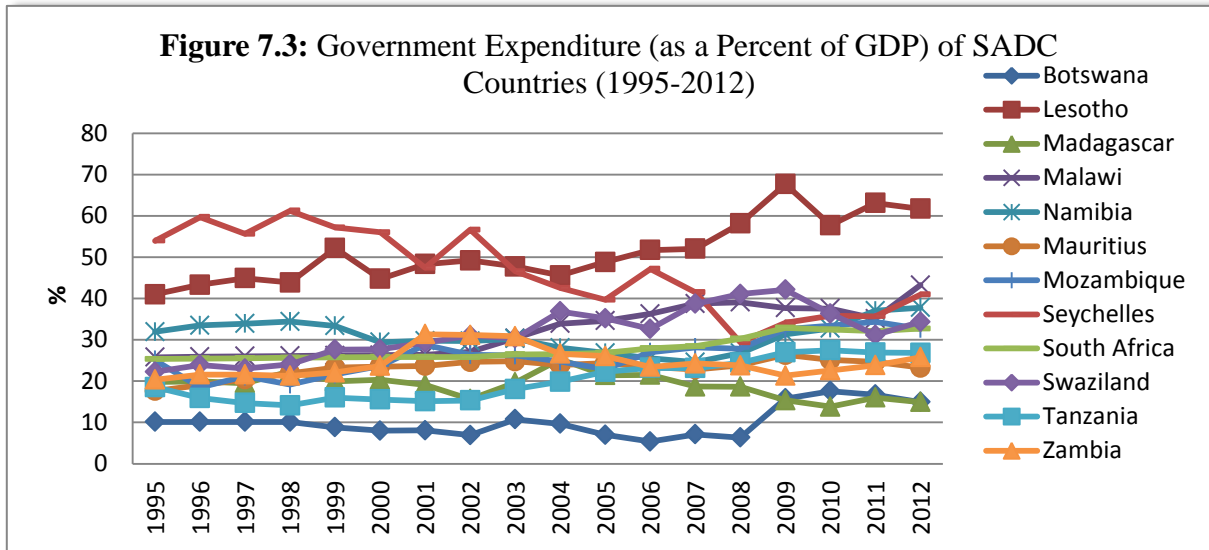
Source: author, estimated from database

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.

7.6 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).

7.6.1   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. The cointegrating relationship among REER series of SADC countries is discussed in Chapter 6. Before proceeding to the modelling exercise, the cross country panels are tested for the presence of a unit root. I 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 7.5 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 7.5: 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, I 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

7.6.2 Methodology on 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:

$$\ln \text{REER} = \alpha_{0,i} + \delta_1 \ln\text{GEXP} + \delta_3 \text{CAB} + \delta_4 \ln\text{LIQ} + \delta_5 \ln\text{OPEN} + \delta_6 \ln\text{TOT} +$$
$$\delta_7 \text{NFA} + \delta_8 \text{TKF} + \delta_9 \text{NKF} + \delta_{10} \ln\text{RESY} \qquad (7.2)$$

where the constant term $\alpha_{0,i}$ 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:

$$\mathrm{Y}_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta_{j=0}^{'} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{7.3}$$

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 I (0) process for all 'i'. Given this conditions 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:

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

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

$\quad$ and $\delta_{ij}^{*} = -\sum_{m=j+1}^{p} \delta_{im} \qquad j = 1,2,...,q-1$ \hfill (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:

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

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:

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

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

7.6.3 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:

$$\log REER_t = \hat{\alpha} + \hat{\beta}'F_t \qquad (7.8)$$

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:

$$\log \tilde{REER}_t = \bar{\alpha} + \hat{\beta}'\tilde{F}_t \qquad (7.9)$$

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.

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

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

7.7 Econometric Results

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 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*[24] 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.

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

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 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 significant amount of depreciation in the REER. Similarly, a 10 percent increase in trade values would lead to a 4.4 percent increase in the REER.

The other three variables have negative point elasticity coefficients implying that positive shocks from these variables have an appreciation effect in 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 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.

I 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)

```
                      POOL MEAN GROUP ESTIMATION RESULT
Panel Variable (i): id                    Number of obs       =        192
Time Variable (t): time                   Number of groups    =         12
                                          Obs per group: min =         16
                                                          avg =       16.0
                                                          max =         16
                                          Log Likelihood      =   258.3874
----------------------------------------------------------------------------
D.lnreal_rte |     Coef.   Std. Err.      z    P>|z|    [95% Conf. Interval]
-------------+--------------------------------------------------------------
ec           |
      lnopen |   -.395469    .0972017   -4.07   0.000   -.5859808   -.2049573
      lngexp |    .178408    .1631695    1.09   0.274   -.1413984    .4982143
        lnm2 |  -1.189833    .2334503   -5.10   0.000   -1.647387    -.732279
      lnresy |   .1918429    .0750204    2.56   0.011    .0448056    .3388803
-------------+--------------------------------------------------------------
SR           |
          ec |  -.2484906    .0549622   -4.52   0.000   -.3562145   -.1407666
             |
      lnopen |
         D1. |   .2594346    .1299576    2.00   0.046    .0047224    .5141468
             |
      lngexp |
         D1. |   .2563283    .1006283    2.55   0.011    .0591004    .4535562
             |
        lnm2 |
         D1. |  -.3083947    .2354526   -1.31   0.190   -.7698734    .1530839
             |
      lnresy |
         D1. |   .1327814    .0485677    2.73   0.006    .0375906    .2279723
             |
       _cons |   1.870766    .4746648    3.94   0.000    .9404404    2.801092
```

```
                        MEAN GROUP ESTIMATION  RESULT

 D.lnreal_rte |     Coef.    Std. Err.      z     P>|z|      [95% Conf. Interval]
--------------+-----------------------------------------------------------------
 ec           |
       lnopen |   .4872897    .6525049    0.75    0.455    -.7915963    1.766176
       lngexp |     1.4345    1.034696    1.39    0.166    -.5934656    3.462466
         lnm2 |  -2.456345    1.435244   -1.71    0.087    -5.269371    .3566808
       lnresy |   .4109235    .2632185    1.56    0.118    -.1049752    .9268223
--------------+-----------------------------------------------------------------
 SR           |
           ec |  -.6094527    .2166409   -2.81    0.005    -1.034061   -.1848443
              |
       lnopen |
          D1. |   .0362724    .1896351    0.19    0.848    -.3354056    .4079504
              |
       lngexp |
          D1. |  -.0609109    .2874424   -0.21    0.832    -.6242877    .5024659
              |
         lnm2 |
          D1. |  -.3854628    .6100163   -0.63    0.527    -1.581073    .8101472
              |
       lnresy |
          D1. |  -.0049435    .1031877   -0.05    0.962    -.2071876    .1973007
              |
        _cons |      1.248    2.477815    0.50    0.614    -3.608429    6.104429
```

Source: author - from estimation result

Considering the results in Table 7.8, I found that all the major macroeconomic policy variables can be used to achieve policy coordination in the region. Trade policy has statistically significant impact in both short run & long run. Fiscal policy has significant impact only in the short run. Monetary policy has significant impact only in the long run. Stock of reserves at year end/GDP (RESY) has statistically significant impact in both short run & 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 seemingly unlikely mean reverting trend at least in the short run. REER misalignment has been in the negative range for

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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.

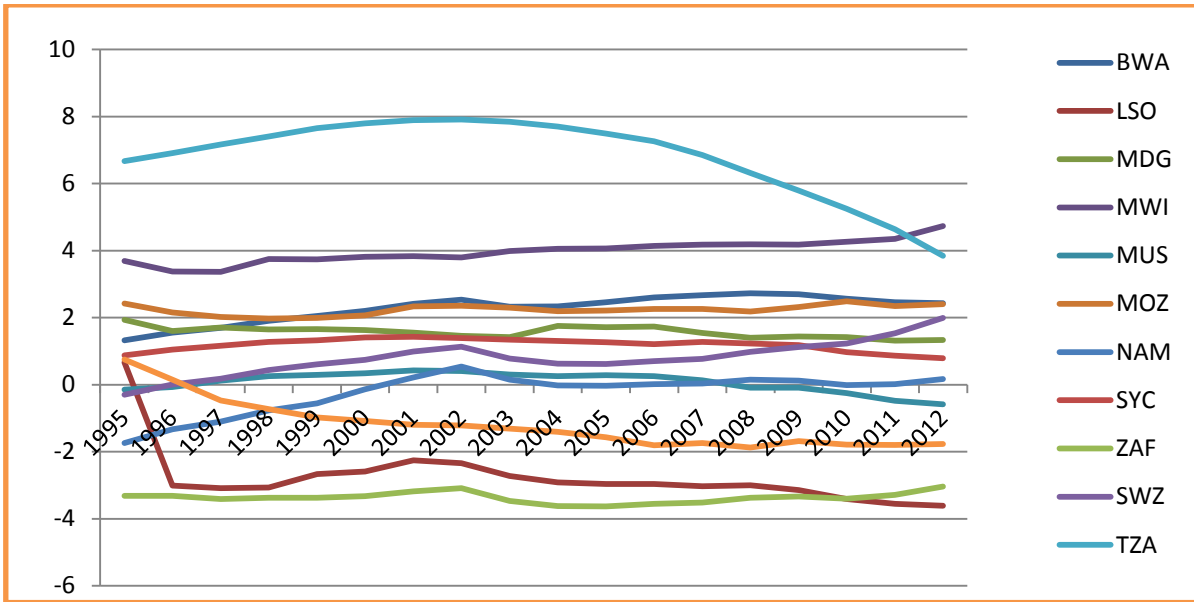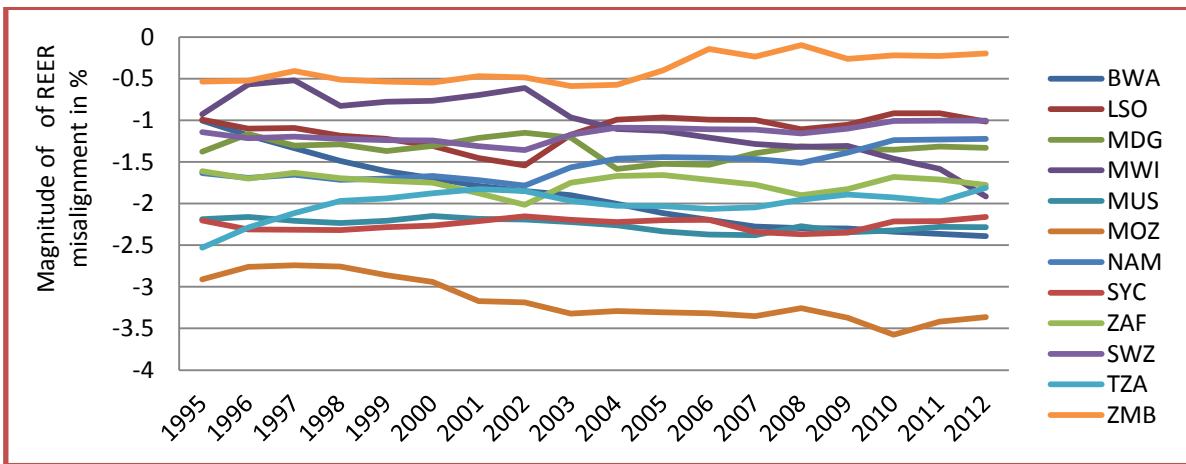Figure 7.4: RER Misalignment Using Heterogenous Intercepts

Figure 7.5: REER Misalignment Using Heterogenous Intercepts

Source: author, estimated from database

However when we evaluate RER misalignment in Figure 7.4, even though there is still persistent RER misalignment in region, its deviation is not as such wider given developing countries standard. This is promising result for further policy coordination in the region.As the findings in this case also confirms persistent misalignment in RER is still an indicative for lower financial deepening and potential tendency to currency crisis in the SADC region.

To answer the research question of whether there is sufficient policy coordination among SADC economies to induce the proposed monetary union in 2018 or not we need to consider our long run estimation result under PMG and the value of RER/EER 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.

7.8 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 I 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 to realise those 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 an indicative for lower financial deepening and higher tendency to 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.

CHAPTER 8

CONCLUSION AND POLICY IMPLICATIONS

8.1   Introduction

This thesis evaluates the feasibility of the proposed SADC monetary union with analytical rigor to establish scientific inputs for policy makers and other stakeholders. Monetary union entails benefits and costs to its constituent countries or regions. The way how countries pursue monetary union, determines the level of benefits and costs.

Generally speaking monetary union is beneficial since it eliminates transactions costs and accounting costs, removes foreign exchange risk, creates a more transparent pricing system and more credible monetary policy, and it is less susceptible to speculative attacks. However, reaping such benefits at the practical level is not easy exercise particularly in the current context of SADC countries. It requires realistic time span, political will, common understandings and awareness, commitment and self-disciplined policy actions from member states and their fellow citizens.

The success stories in monetary integration come largely from European Monetary Union (EMU). Such stories are limited on the African continent. Indeed, African socioeconomic development initiatives, including the African economic integration strategies, have been judged by models and theoretical concepts developed outside Africa.   Such academic applications often create pessimism among stakeholders in the continent and outside, rather than increasing the continental initiatives.

However, regional integration endeavours in Africa can offer significant "win-win" possibilities for regional integration on the continent. To shape up the on-going regional

economic integration initiatives on the continent, there should be awareness creation, economic education, and information campaigns in the process of any existing or proposed monetary union. It is also important to give emphasis on awareness creation not only among the policy makers of member states but also among the citizens of respective countries constituting SADC community. Therefore, member states of economic communities need to work extensively in promoting consciousness of their fellow citizens, in realisation of on-going endeavours towards Pan-African Economic Community (PAEC).

8.2 Conclusion and Policy Implications

The overriding desire for greater economic independence and development is one of the strongest justifications for regional integration of the African continent. Africa's marginal contribution to the world economy is often blamed on weak regional integration (UNECA, 2012). Given this fact, deeper regional integration in Africa is thought of as a way to promote peace, security and stability by forcing a stronger commitment by members to unity within the African Union (AU).

The economic integration in southern African countries is one of the oldest economic integration initiatives in the world; it can be traced back to the Southern African Customs Union (SACU) which was created in 1910 between South Africa and its neighbours. Economic integration in Africa and its regions remains a policy priority area within the African Union. An important part of economic integration is monetary integration, which include integration of financial and banking systems, policy coordination and ultimately the adoption of a common currency. In this study the focus was only on the readiness of monetary integration in the region.

The thesis focuses on:

(1) Assessing the degree of structural symmetry in SADC business cycles and whether GPPP/PPP holds for SADC countries in its linear and non-linear context of using SADC real exchange rates series, as an OCA criteria, and;

(2) Measuring the degree of exchange rate based policy coordination among SADC countries attempting to move their economies towards successful monetary integration.

SADC is adamant that it would conclude monetary union by 2018. SADC cannot afford a repeat of the type of financial and fiscal instability brought about by *ex ante* structural economic differences and asynchronous business cycles as in the European Monetary Union (EMU). Using annual real GDP, as the most comprehensive measure of economic activity, I make use of methodologies like the Triples test to analyse each country's business cycles for symmetry. I then evaluate SADC countries' ratio of relative intensity of co-movements in business cycles with co-SADC country and versus that of major trade partners.

I adopt the Triples test due to its accessibility, superior results and efficiency above many other methods used in the literature to detect symmetry. Furthermore, the Triples test is asymptotically distribution free, which means that the outliers and changes in the variance of the distribution of the time series cannot affect the test. I find that not all countries in SADC conform to OCA criteria judged by both asymmetrical business cycles and weak co-movements in business cycles.

Next I measured the degree of real convergence among SADC real exchange rate series using the Generalized Purchasing Power Parity (GPPP) approach.

The macroeconomic variable behind GPPP is the real exchange rate and its determinant factors. Exchange rate stability along with other macro variables in the economy is fundamental step for adopting a single currency.

Although bilateral real exchange rates are generally non-stationary, GPPP hypothesizes that bilateral real exchange rates can exhibit common stochastic trends if those fundamental variables are sufficiently interrelated. I test this hypothesis with Johansen's (2004) multivariate co-integration technique. A panel of SADC real exchange rates, nominal exchange rates, CPI, and CPI of the US as a base country for the period of 1995 to 2012 are employed in the analysis.

The analysis shows that the trace statistics indicate one co-integrating relationship. The max Eigne value shows that the variables are not co-integrated. In reference to the more powerful trace statistics, there is one co-integrating vector for SADC real exchange rate in support of GPPP for the sample. Recent cross-sectional dependence augmented frameworks of panel unit root tests confirm that the panel of real exchange rates in the study is stationary. Thus there is GPPP in the panel of SADC when the time trend is included in the analysis.

However, the absolute magnitude of the adjustment coefficients of SADC countries' real exchange rate is very low. The lower the absolute magnitude of the 'α' coefficient, the slower the speed of adjustment becomes towards long run equilibrium. Therefore, the observed slow speed of adjustment for real exchange rate of SADC member states might constrain the effectiveness of stabilization policies in the wake of external shocks, rendering SADC countries vulnerable to macroeconomic instability in the region.

I use the error correction based panel co-integration tests for SADC real exchange rate series to improve the robustness of the findings. From these tests, the two statistics, the panel statistics reject the null hypothesis of no co-integration for the panel as the whole at the 1% level of significance; however, the group mean statistics fail to reject the null hypothesis. This implies that there is no co-integration for at least one of the cross-sectional units. In general, weak GPPP holds for the SADC region implying that at the current stage, the level of integration in the region is not promising to form fully flagged monetary union at the proposed time.

I also address methodological problems like the existence of unit roots and random walks in the data employed. These problems are associated with the implicit assumption of linearity of real exchange rates that has made the majority of existing empirical literature on long-run PPP behaviour inconclusive and/or inconsistent. These problems motivate the use of nonlinear methods used in this study, which may better explain the dynamics of real exchange rates in the SADC region.

Therefore, I used two nonlinearity tests: the nonparametric test developed by Brock, Dechert, and Scheinkman - known as the BDS test and the Fourier stationarity test. The BDS non-linearity test detects whether the independent and identically distributed (*iid*) assumption of the time series used in the analysis holds true or not while the Fourier approximation mimics a wide variety of breaks and other types of nonlinearities. Both tests confirm the non-linear nature of real exchange series in SADC. The Fourier stationarity test results further provide strong evidence of an OCA among the 11 SADC countries included in the study: both the *sine* and *cosine* terms in the model specified are significantly different from zero at 1% level of significance. This provides evidence favouring the long-run validity of PPP for the SADC economies. For the countries under this study it is shown that the logarithm of real exchange

rate is nonlinear stationary, implying that deviations of real exchange rate from the mean is mean reverting towards the PPP equilibrium.

Real exchange rate based policy coordination has emerged as an alternative to augment the limitations of OCA theory. Lastly the study assesses the strength of real exchange rate based policy coordination in SADC as a prerequisite toward sensible monetary integration in the region. The quantitative analysis encompasses 12 SADC member states over the period 1995-2012. I used dynamic pooled mean group (PMG) and mean group estimators (MG), real exchange rate equilibrium and misalignment analysis to arrive at robust conclusions.

The PMG is more appealing to use than the standard panel data analysis techniques since it pools long run relationships and short run dynamics between countries forming monetary union. The underlying hypothesis that the study investigates goes with the assertion that countries meeting OCA conditions face more stable exchange rates. However, the study finds that SADC economies are characterised by persistent overvaluation with seemingly unlikely mean reverting trend at least in the short run. As the findings in the paper confirm, persistent overvaluation in the real effective exchange rate (REER) is indicative of weak financial deepening and a higher tendency for currency crisis in the region. This calls for further policy coordination and policy harmonisation in the region as a prerequisite for monetary union.

The thesis makes a contribution to the literature on monetary integration and OCA theory, with specific reference to the SADC region. Although OCA theory is not yet fully developed to grasp the complex dynamics of monetary integrations particularly in the south-south set up, it is still instrumental in providing methods of evaluating monetary integration and provides increasing evidence that economies require a high degree of economic integration and policy

coordination to avoid the risks of destabilization brought on by exogenous shocks, when in a monetary union.

The study concludes that there is overwhelming evidence that real convergence is met to some extent among SADC economies as a group; however, there is a slow pace of integration. By considering findings from all the four essays the study finds that nine SADC countries can potentially constitute SADC-OCA namely; Botswana, Madagascar, Malawi, Mozambique, Seychelles, South Africa, Swaziland, Tanzania and Zambia. Angola and Mauritius disqualified from a SADC-OCA at least for the sample period considered in this study. Lesotho, DRC, and Zimbabwe are not included due to data limitations; otherwise Lesotho could join the qualifying group of countries given long experience with the Common Monetary Area (CMA).

Furthermore, there is a nonlinear relationship between bilateral real exchange rate series in SADC. Moreover, policy coordination in the region is insufficient to form the proposed monetary union within the stipulated time frame. There should be strong policy coordination and public awareness to increase the benefits and decrease costs associated with the proposed monetary union in the region. These measures are the prerequisites before the prime move towards monetary integration in the region to avoid profound consequences as faced by the EMU after the EMU financial crises.

To reap benefits SADC economic integration initiatives, it requires realistic time span, political will, common understandings and awareness, commitment and self-disciplined policy actions from political leaders of member states and their fellow citizens.

8.3 Contribution of the Thesis

There are mounting doubts about the feasibility of monetary integration in the SADC region. However, it is important to evaluate the readiness of SADC members to complete the process of monetary integration in order to inform policy on monetary integration and the adoption of a common currency. In theory, this is mainly done by evaluating monetary integration against OCA (Optimum Currency Area Theory). Only once potential monetary union members have been evaluated to see how the empirics fit the theory (OCA theory), can proper policy conclusions are made.

Existing literature which test OCA criteria in the SADC region focuses on the Common Monetary Area (CMA) also known as the Rand Monetary Area. The literature on other monetary integration initiatives is largely biased towards north-north economic integration, particularly the European Monetary Union (EMU) with little or no emphasis to south-south integration. Thus, the contributions of existing OCA literature have been largely theoretical. In contrast, this thesis makes a notable contribution by incorporating empirical content into the analysis of the proposed monetary union in the SADC.

The main contribution of this thesis lies in its comprehensive empirical investigations of the degree of real convergence towards the proposed monetary union in the region using recent databases. It provides additional source of references by applying methodologies never been applied in the context of SADC. Indeed, many of the latest and more advanced methods found in recent OCA theory literature, have also not been applied to the SADC region. This thesis contributes to the literature by evaluating SADC against OCA criteria not evaluated before and by applying the most recent and advanced methods not applied to SADC countries before. This thesis also contributes towards positive refinement of OCA theory in the context of South-South-Integration (SSI). Thus, the thesis sheds light on the readiness of the proposed monetary union in the region from the real convergence point of view with some policy implications.

8.4 Suggestions for Further Research

Future studies on policy coordination in the SADC region and in SSA ought to:

1. Consider both the stabilizing and destabilizing elements of regional monetary cooperation and integration in the context of different forms of cooperation.

2. Focus on the inter-temporal aspects of fiscal and monetary policy coordination using dynamic game theory articulated to deal with '*Prisoner's Dilemma*' type of problems and credibility issues among SADC member countries.

3. Investigate the relevance of the Lucas Critique which emphasizes the use of fully-specified, optimisation based dynamic stochastic general equilibrium (DSGE) models for policy analysis; that is, to suggest econometric policy advice for SADC countries to join the proposed monetary union.

4. Use sophisticated statistical tools to fill the gap in the literature concerning the interaction between each of the OCA criteria against a background of monetary integration in the region. Such empirical findings will assist to judge whether SADC will function to realise the anticipated benefits from this gigantic regional initiative.

5. As depicted in the conceptual framework of this thesis, I further recommend for qualitative assessments to be carried for the purpose of exploring the perceptions of the stakeholders on the ongoing SADC monetary integration process.

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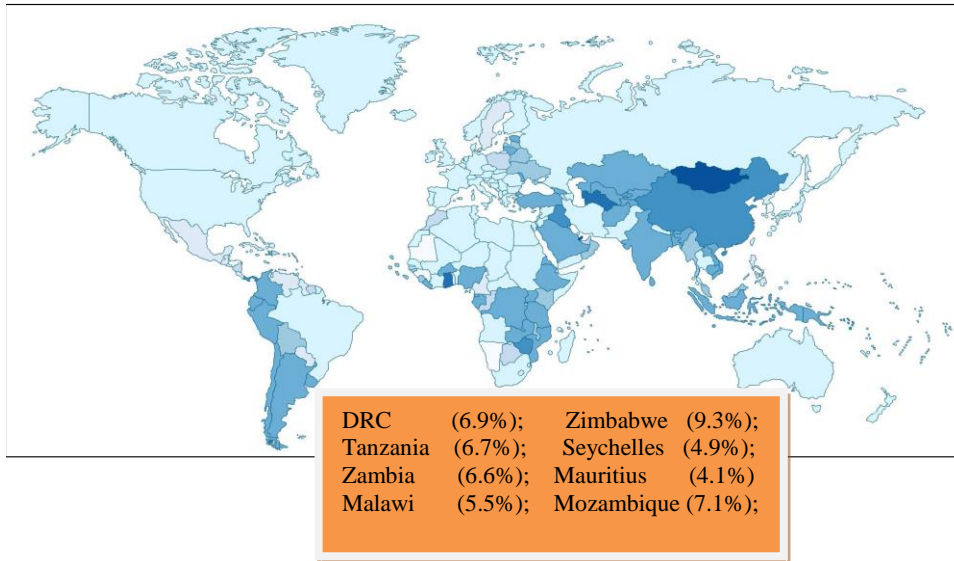
APPENDICES

Appendix A

Appendix A.1: SADC Real Growth Rate

Country	Real Growth Rate			
	2008	**2009**	**2010**	**2011**
Angola	13.8	2.4	3.4	3.4
Botswana	3.1	-4.9	7.2	5.1
DRC	6.2	2.8	7.2	6.9
Lesotho	3.4	2.4	5.6	4.3
Malawi	8.6	7.6	7.1	6
Mauritius	5.1	3.1	4.2	4.1
Mozambique	6.8	6.3	6.8	7.2
Namibia	4.3	-0.4	6.6	3.8
Seychelles	-0.9	0.7	6.2	5
South Africa	3.6	-1.5	2.9	3.1
Swaziland	2.4	1.2	2	1.3
Tanzania	7.4	6	7	6
Zambia	5.7	6.4	7.6	6.5
Zimbabwe	-14.7	5.7	8.1	9.3
SADC Average	**3.91**	**2.70**	**5.85**	5.14
2004 - 2008	**Not less than 7%**			
2009 - 2012	**Not less than 7%**			

Source: SADC RED Papers

Appendix A.2: SADC Economic Growth in 2011

World Economic Growth 2011

DRC	(6.9%);	Zimbabwe	(9.3%);
Tanzania	(6.7%);	Seychelles	(4.9%);
Zambia	(6.6%);	Mauritius	(4.1%)
Malawi	(5.5%);	Mozambique	(7.1%);

Appendix A.3: SADC Fixed Investment in 2011

World Gross Fixed Investment

Tanzania	(26.1%)	Seychelles	(33.8 %)
Zambia	(20.7%)	Mauritius	(24.5%)
Mozambique	(26.9%)	Lesotho	(38.8%)
Botswana	(27.6)	Malawi	(22.7%)
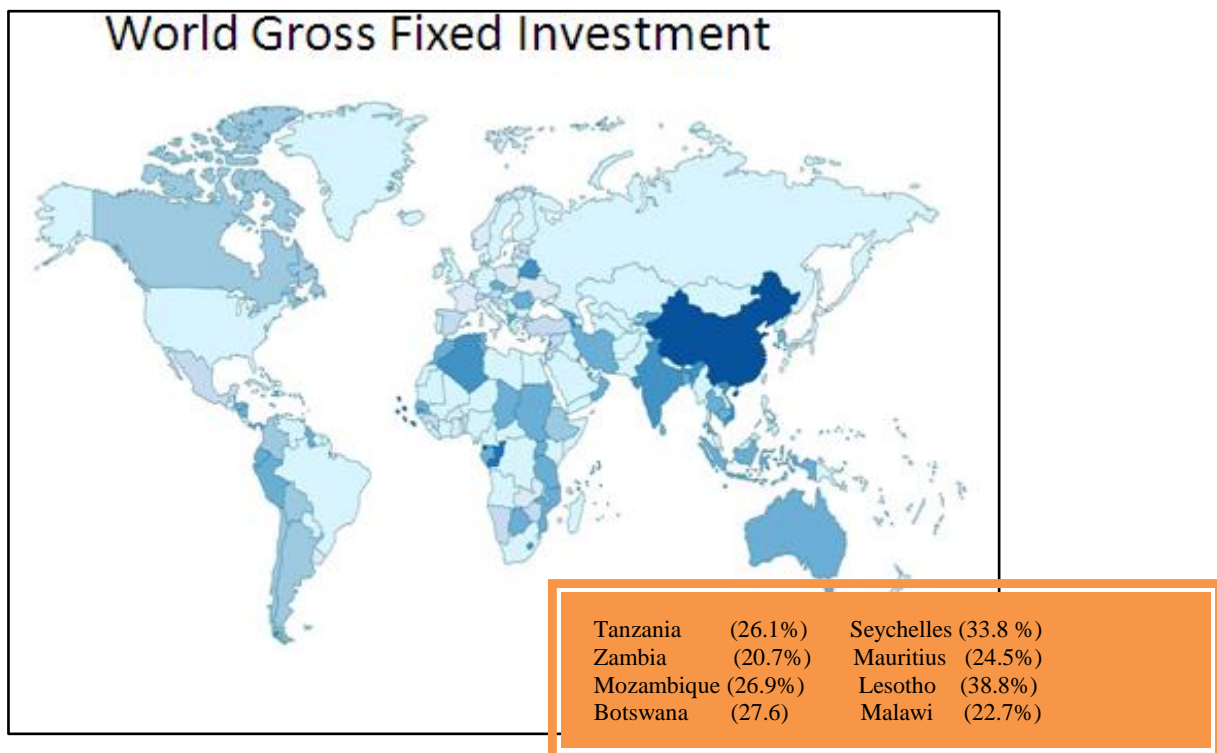
Source: World Bank Development Report (2012)

Appendix B: Extension from Chapter 5

Appendix B.1 Levin-Lin-Chu unit root test result

```
Levin-Lin-Chu unit-root test for ln_exrte
————————————————————————
Ho: Panels contain unit roots          Number of panels =    11
Ha: Panels are stationary              Number of periods =   212

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 19.00 lags average (chosen by LLC)
————————————————————————————————————————
                Statistic      p-value
————————————————————————————————————————
 Unadjusted t     -7.1387
 Adjusted t*      -6.1183        0.0000
————————————————————————————————————————
```

```
Levin-Lin-Chu unit-root test for ln_exrte
————————————————————————
Ho: Panels contain unit roots          Number of panels =    11
Ha: Panels are stationary              Number of periods =   212

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 19.00 lags average (chosen by LLC)
————————————————————————————————————————
                Statistic      p-value
————————————————————————————————————————
 Unadjusted t     -7.7089
 Adjusted t*      -4.2077        0.0000
————————————————————————————————————————
```

```
Levin-Lin-Chu unit-root test for ln_cpi
————————————————————————
Ho: Panels contain unit roots          Number of panels =    11
Ha: Panels are stationary              Number of periods =   212

AR parameter: Common                   Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 19.00 lags average (chosen by LLC)
————————————————————————————————————————
                Statistic      p-value
————————————————————————————————————————
 Unadjusted t     -4.4630
 Adjusted t*      -4.8052        0.0000
————————————————————————————————————————
```

```
Levin-Lin-Chu unit-root test for ln_cpi
─────────────────────────────────────

Ho: Panels contain unit roots            Number of panels  =     11
Ha: Panels are stationary                Number of periods =    212

AR parameter: Common                     Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 19.00 lags average (chosen by LLC)
────────────────────────────────────────────────────────────────────
                   Statistic      p-value
────────────────────────────────────────────────────────────────────
 Unadjusted t       -6.0995
 Adjusted t*        -1.9963        0.0229
────────────────────────────────────────────────────────────────────
```

Appendix B.2: Im-Pesaran-Shin unit-root test

```
Im-Pesaran-Shin unit-root test for ln_exrte
───────────────────────────────────────────
Ho: All panels contain unit roots        Number of panels  =     11
Ha: Some panels are stationary           Number of periods =    212

AR parameter: Panel-specific             Asymptotics: T,N -> Infinity
Panel means:  Included                                   sequentially
Time trend:   Not included

ADF regressions: No lags included
────────────────────────────────────────────────────────────────────
                                         Fixed-N exact critical values
                   Statistic   p-value    1%       5%      10%
────────────────────────────────────────────────────────────────────
 t-bar             -2.4526               -2.040  -1.890   -1.810
 t-tilde-bar       -2.3518
 Z-t-tilde-bar     -3.3632     0.0004
────────────────────────────────────────────────────────────────────
```

```
Im-Pesaran-Shin unit-root test for ln_exrte
───────────────────────────────────────────
Ho: All panels contain unit roots        Number of panels  =     11
Ha: Some panels are stationary           Number of periods =    212

AR parameter: Panel-specific             Asymptotics: T,N -> Infinity
Panel means:  Included                                   sequentially
Time trend:   Included

ADF regressions: No lags included
────────────────────────────────────────────────────────────────────
                                         Fixed-N exact critical values
                   Statistic   p-value    1%       5%      10%
────────────────────────────────────────────────────────────────────
 t-bar             -2.0286               -2.640  -2.510   -2.440
 t-tilde-bar       -1.9714
 Z-t-tilde-bar     -1.8433     0.0326
────────────────────────────────────────────────────────────────────
```

```
Im-Pesaran-Shin unit-root test for ln_cpi
────────────────────────────────────────
Ho: All panels contain unit roots        Number of panels  =     11
Ha: Some panels are stationary           Number of periods =    212

AR parameter: Panel-specific             Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included

ADF regressions: No lags included
                                         ──────────────────────────────
                                            Fixed-N exact critical values
              Statistic      p-value       1%      5%      10%
──────────────────────────────────────────────────────────────────────
  t-bar         -2.1179                    -2.040  -1.890  -1.810
  t-tilde-bar   -1.9831
  Z-t-tilde-bar -1.8899       0.0294
──────────────────────────────────────────────────────────────────────
```

```
Im-Pesaran-Shin unit-root test for ln_cpi
────────────────────────────────────────
Ho: All panels contain unit roots        Number of panels  =     11
Ha: Some panels are stationary           Number of periods =    212

AR parameter: Panel-specific             Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Included

ADF regressions: No lags included
                                         ──────────────────────────────
                                            Fixed-N exact critical values
              Statistic      p-value       1%      5%      10%
──────────────────────────────────────────────────────────────────────
  t-bar         -2.3999                    -2.640  -2.510  -2.440
  t-tilde-bar   -2.3172
  Z-t-tilde-bar -3.2250       0.0006
──────────────────────────────────────────────────────────────────────
```

Appendix C: Extension from Chapter 6

Appendix C.1: Graphical Illustration of the (Log) Real Exchange Rate & Fitted Nonlinearities of 11 SADC Countries
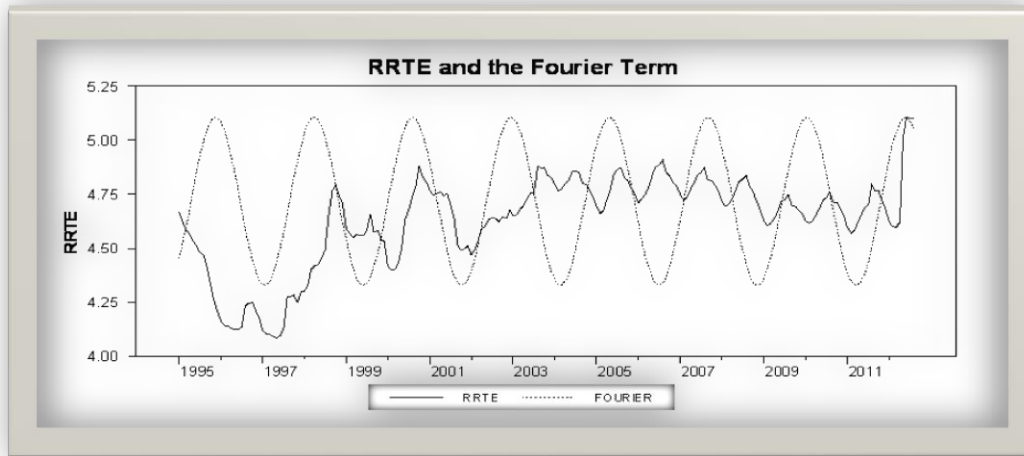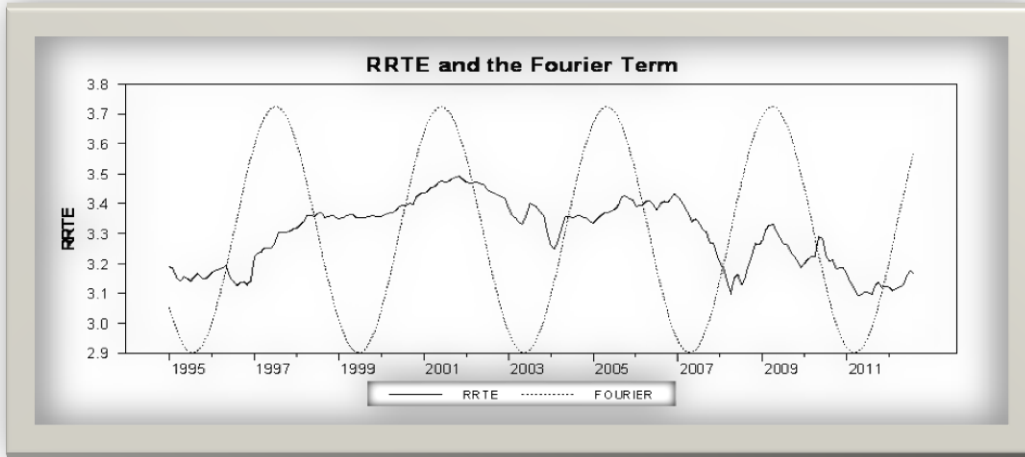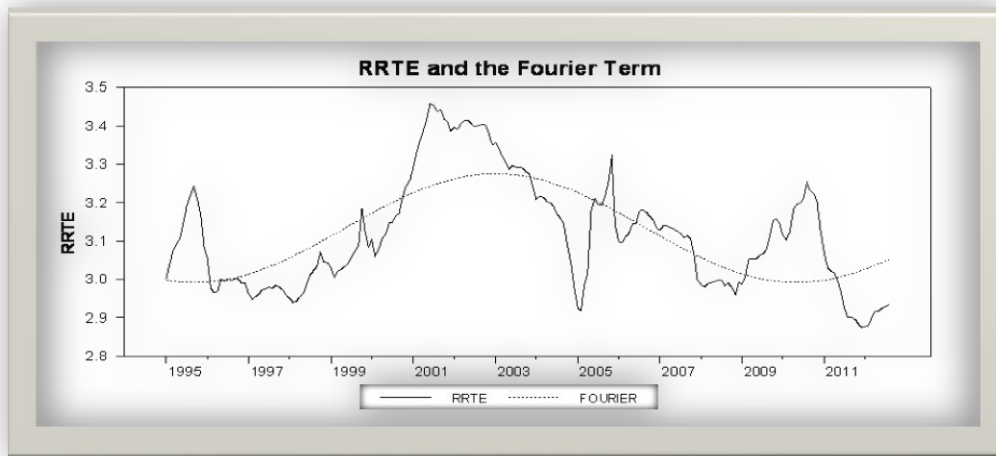
1. Angola
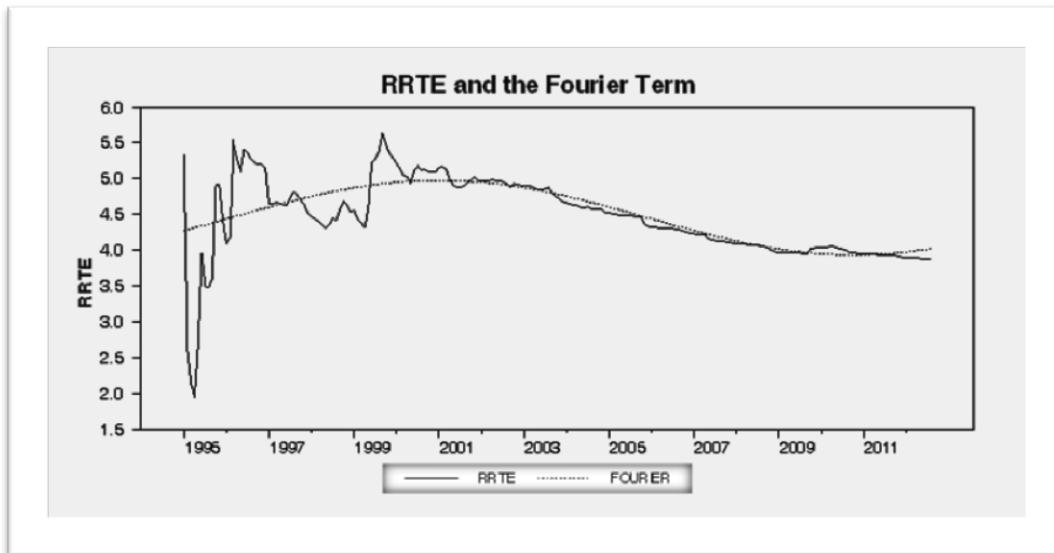
2. Botswana

3. Madagascar

4. Malawi

175

5. Mauritius

RRTE and the Fourier Term

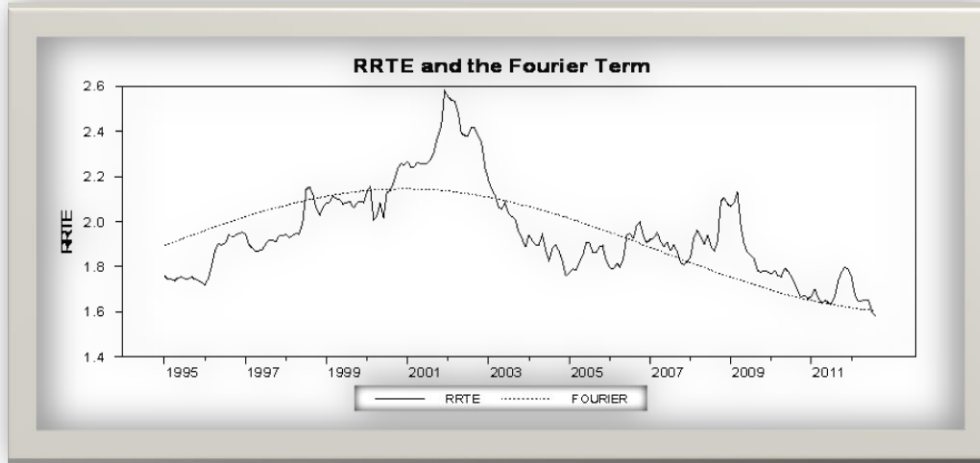## 6. Mozambique

RRTE and the Fourier Term
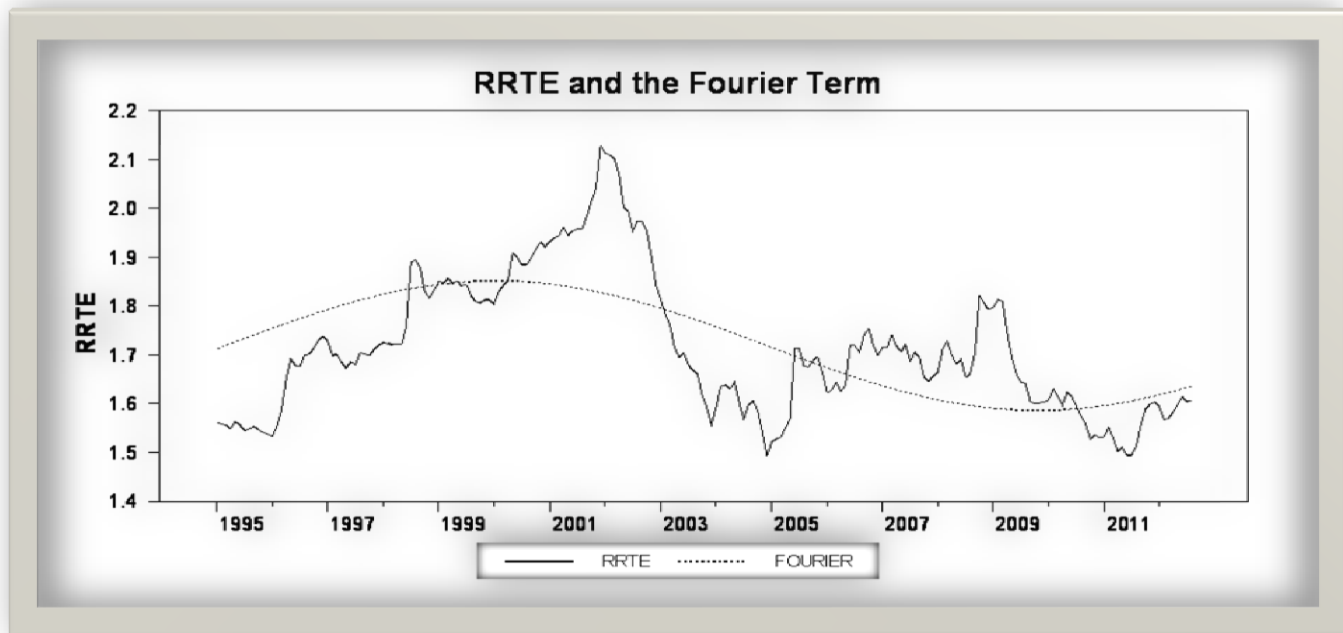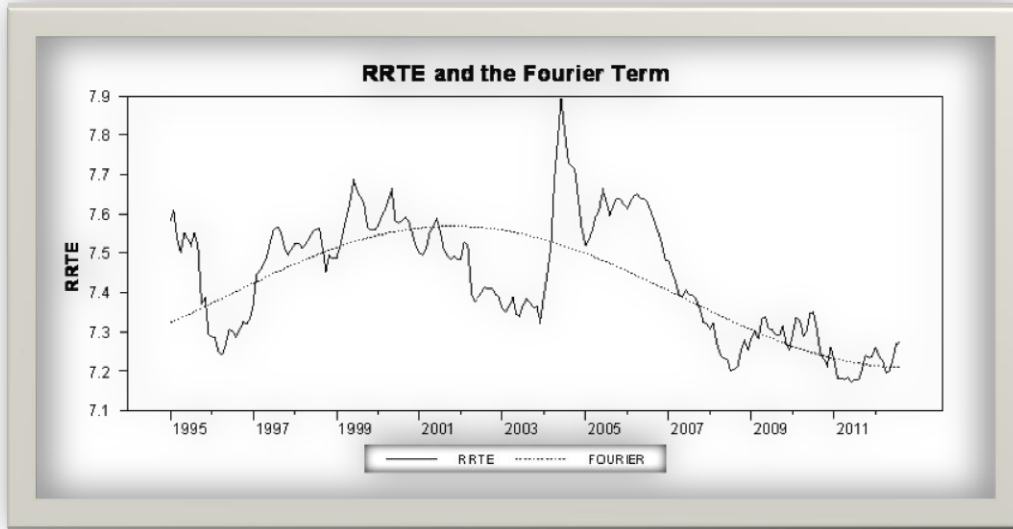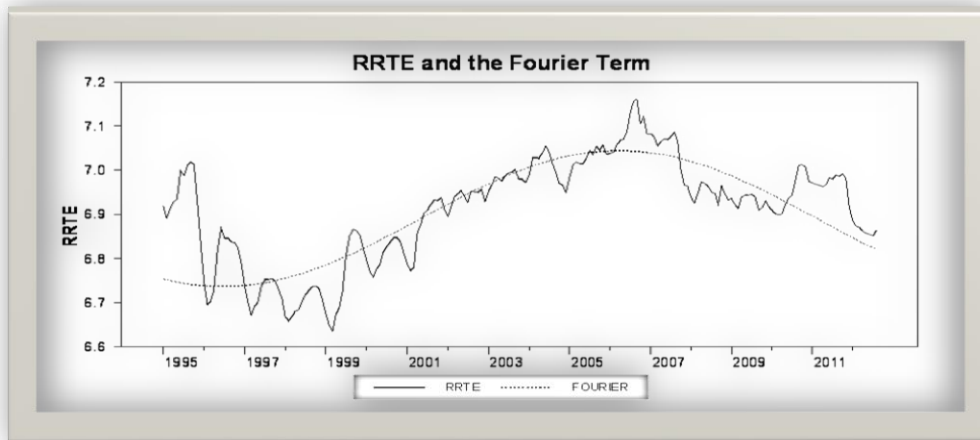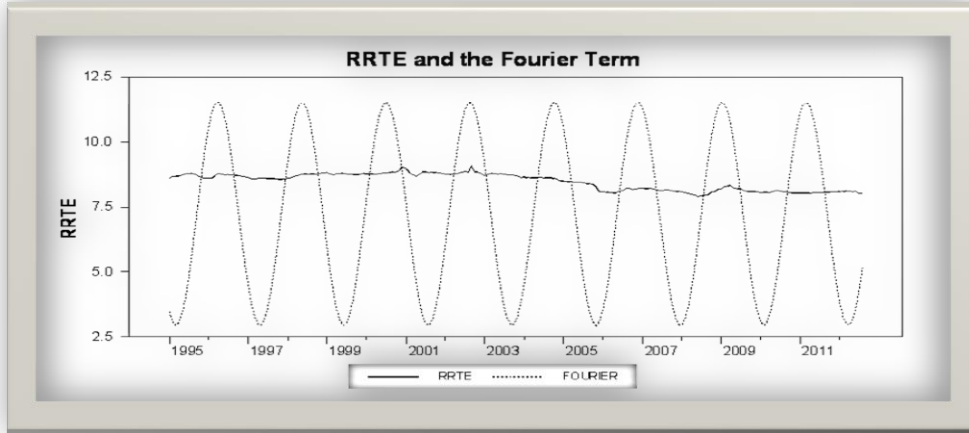
7. South Africa
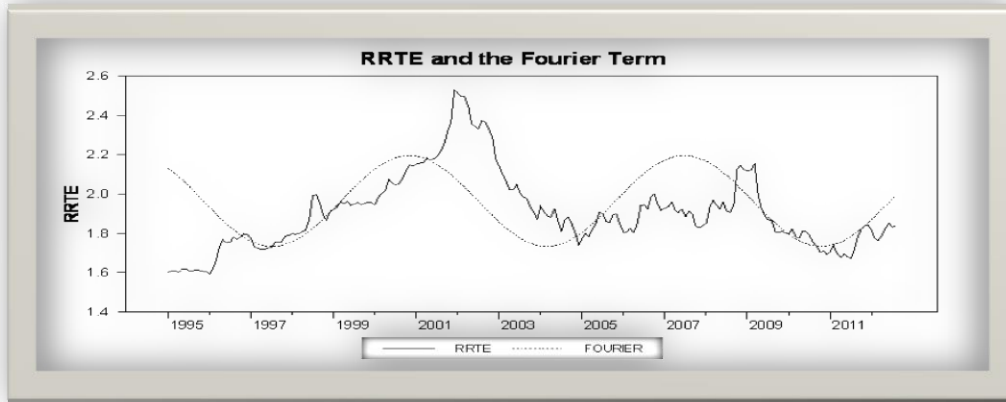
8. Seychelles
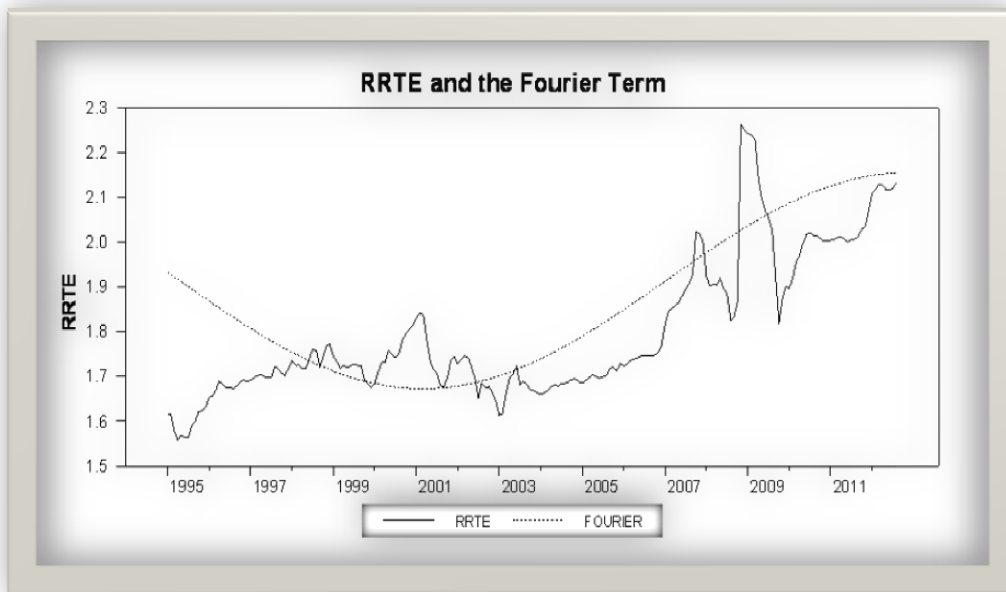
9. Swaziland

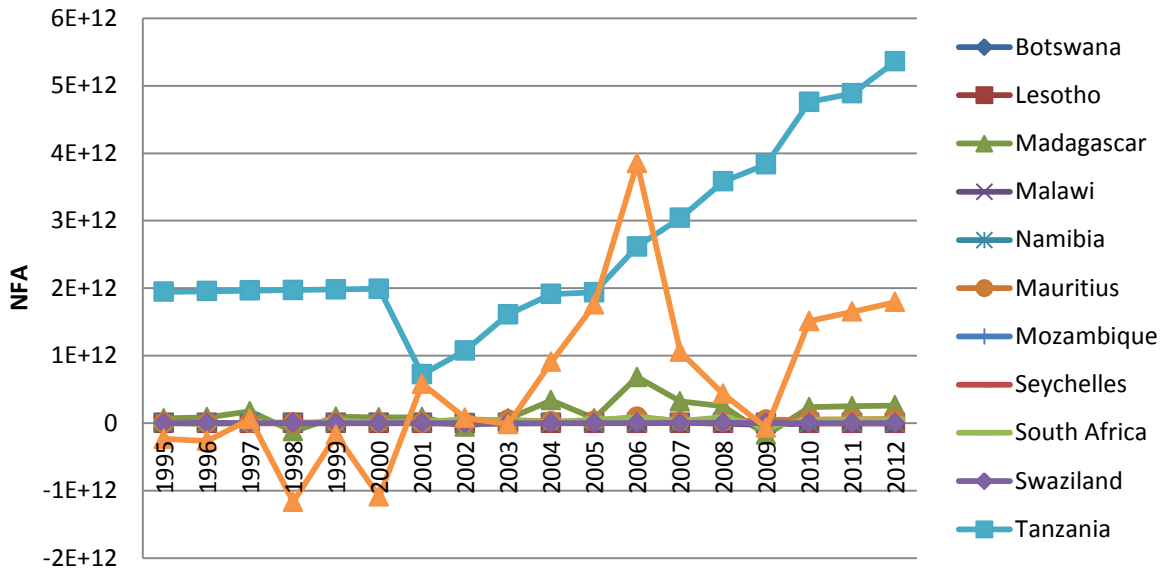## 10. Tanzania

11. Zambia

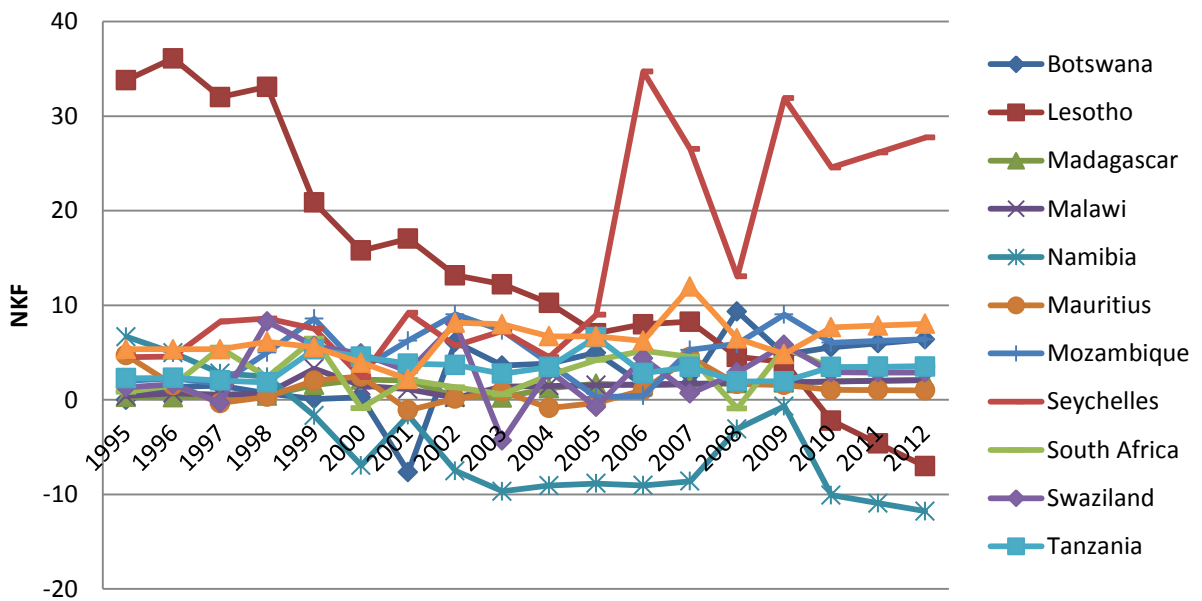# Appendix D: Extensions from Chapter 7

Appendix D.1**:** Graphical Illustrations of Capital Flow Variables
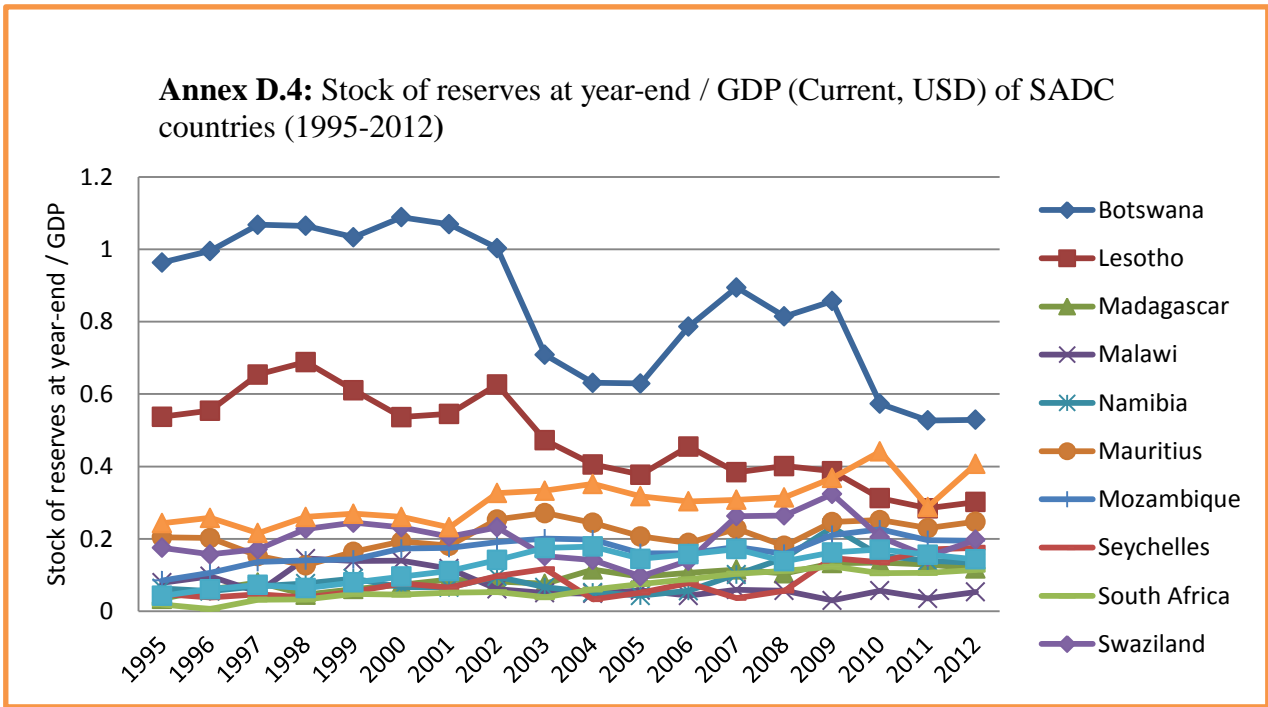

Annex D.1: Terms of trade of SADC countries (1995-2012)
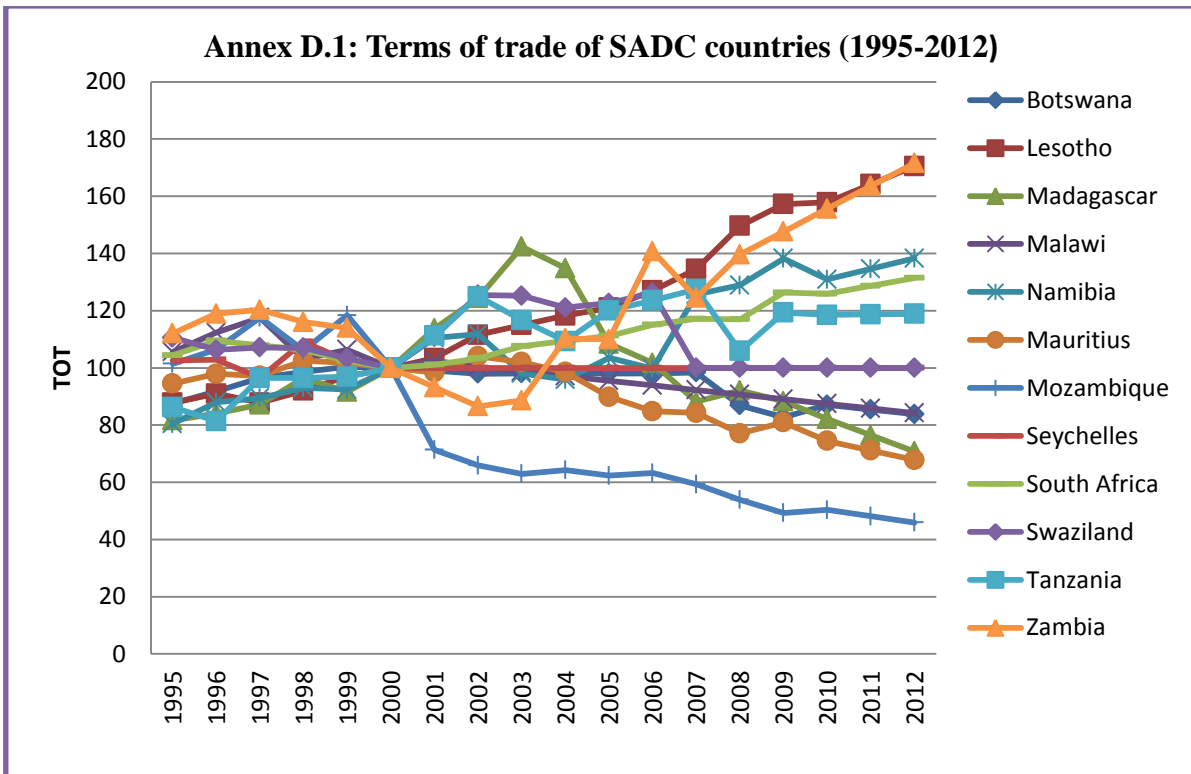
Annex D.2: Net foreign assets of SADC countries (1995-2012)

Annex D.3: Net capital flows/GDP (Current,USD) of SADC countries (1995-2012)

Annex D.4: Stock of reserves at year-end / GDP (Current, USD) of SADC countries (1995-2012**)**

Source: computed from sample data

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