IS SADC ON THE RIGHT PATH TOWARDS THE MONETARY UNION? AN EMPIRICAL EVIDENCE OF THE DEGREE OF CONVERGENCE OF INFLATION AND EXCHANGE RATES

By

Nalla Diawara

THESIS

Submitted to
KDI School of Public Policy and Management
In Partial fulfillment of the requirements
for the degree of

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Committee in charge:

Professor Jin Soo LEE, Supervisor

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ABSTRACT

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Using time varying technique, and updated data on inflation and exchange rate, we analyzed if SADC is converging on this specific variables and thus if is progressing toward the materialization of the monetary union in 2016.The sample comprised monthly data from 1990 to 2012, and the results show that even though the region is showing some progress, there is no evidence of convergence of these variables between the member states. This is explained by the low level of integration in the region associated with the differences in the structure and level of development among the member states and the problem of overlapping membership to different RECs of most of the member states.

To my Parents,

Amara Diawara and Cacilda Alfredo Zango

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TO YOU ALL, THE DESERVED REVERENCE

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I. INTRODUCTION

Regional economic integration was one of the options that countries both developed and developing found to improve and promote economic growth and development, and to face the challenges of a world that is becoming more globalized.

The European Union represents one of the most successfully experiences of regional integration that last for more than 50 years, and is being source of inspiration and learning for the other regions trying to follow its steps. A "linear model of integration describes integration in terms of successively deeper levels. It starts with a Free Trade Area (FTA) and then a Customs Union with its free trade behind a common external tariff. This is followed by a Common Market that adds the free flow of factors of production to a customs union and finally an Economic Union, which adds fiscal and monetary integration to a common market." (CCBG 2002, 10-11).

In this study we want to concentrate on the further south of the African continent, where 15 countries, namely, Angola, Botswana, Republic Democratic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe, form one of the African Regional Economic Communities (REC), the Southern Africa Development Community (SADC), which in 2002 the region signed a Memorandum of Understanding on Macroeconomic Convergence Program (MCP).

The present study analysis the implementation of the SADC MCP and evaluates and measures how the region is performing, assuming that it's intend to establish a monetary union by 2016.

We will do so, looking for two monetary variables, namely inflation rate and exchange rate. The variables of analysis were chosen for two reasons; first inflation is the variable that its

target achievement is challenging most of SADC members and Exchange rate is highly influenced by inflation movements, and, second, availability of data and period length for most of the countries of the sample.

Besides this introductory chapter, the documents includes a literature review in chapter two, the model used and it results are presented in the third chapter, while the conclusion and recommendations are in chapter four. In the fifth and last chapter is the reference list.

1.1. Problem Statement

This study surges as the follow up of the findings and recommendations of previous studies both on the assessment of the MEC in SADC, and the feasibility of the Monetary Union in SADC forecasted to be in place in 2016. A first study[1], conclude that SADC wasn't ready for macroeconomic convergence and that could even be counterproductive because it was exposed to asymmetrical external shocks. However, in 2009, an initial SADC MEC performance evaluation[2] observed that part of SADC countries have achieved a good *macroeconomic performance, having some even done better than the 2008 targets despite the 2012 being ambitious.*

Jefferis (2007), when studying the process of monetary integration in the SADC region, concluded that there is a core convergence group comprising the Common Monetary Area (CMA) countries – South Africa, Lesotho, Namibia and Swaziland, plus Botswana, Mauritius, Mozambique and Tanzania whose macroeconomic performance satisfies some of the criteria for monetary union. The remain SADC countries – Angola, DRC, Malawi, Zambia and Zimbabwe

[1] CCBG (2002);
[2] Burgess 2009

make up a “non-converging” group that cannot yet be considered potential candidates for monetary union.

“The success of any ongoing efforts for achieving such a form of integration depends on the degree of economic convergence of national economies. A high degree of macroeconomic convergence would mean that both external and domestic shocks were affecting all members in a similar fashion and that the union-wide, common set of policies would, therefore, be appropriate.” (Jayaraman et al, 2007, 506)

“While macroeconomic convergence is an important component of the process of monetary union, there is scope for debate about how much convergence has to occur prior to the union take place, and how much can follow afterwards. With regard to macroeconomic indicators that are primarily monetary in nature such as inflation, interest rate and exchange rate, there are strong arguments that convergence should come prior to monetary union otherwise convergence will force, abruptly, as the union takes effect.” (Jefferis, 2007, 89)

On the current SADC MEC indicators, the only monetary one, is inflation and recent evaluations, indicated that this one of the variable that most members might attain.

Additional, even though the exchange rate is not part of the SADC MEC targets, we intend to explore the implications of the macroeconomic convergence on exchange rate policies, because on one hand it will impact the level of foreign exchange reserves, sources of government revenues, the depth of financial markets; on the other hand stabilization of exchange rate represents one of the main features of a monetary union, that once set cannot be changed. So if exchange rate is not stabilized in advance the transition process can prove disastrous.

1.2. Thesis Statement

Main Claim

According, Carmignani (2005) for a group of countries have high degree of convergence, they should have:

- Large volumes of intra-regional trade;
- Cross-country symmetry of shocks; and
- Common institutional attributes and economic policies.

Differently from what the theory foresees, "the SADC macroeconomic convergence initiative is not designed specifically to the process of monetary union; instead, it reflects a broader objective of achieving macroeconomic stabilization in the region as a whole. However, (…) macroeconomic convergence is an important prerequisite for a monetary union to be feasible." (Jefferis, 2007, 95)

"High degree of convergence would mean that both external and domestic shocks were affecting all member countries in a similar fashion and that a union-wide, common set of policies would therefore, be appropriate." (Jayaraman et al, 2007, 506)

"There are two aspects of convergence: nominal and real. They cover exchange rate, growth and inflation. In the absence of a high degree of convergence in these spheres, the cost of any premature integration could be disastrous." (Jayaraman et al, 2007, 506)

1.3. Objectives

General Objective

The objective of this study is investigate whether SADC members Countries as whole or the subgroups according its level of developments, presents any economic convergence and whether there exists any case at present for a monetary union.

Specific Objectives

- Discuss the term “macroeconomic convergence”;
- Identify the advantages and disadvantage of a monetary union;
- Describe the actual situation of SADC countries towards the monetary union; and
- Assess the degree of convergence of inflation and exchange rates of SADC region.

1.4. Statement of Significance

The issue of macroeconomic convergence program in different regional economic communities in Africa, including in SADC, have been topic of many academic work. Previous studies looked to the convergence of SADC, different variables like GDP per capita, inflation, Output, and so on. This study analyzes the degree of convergence of SADC and afterwards of a subgroup of countries with some institutional and economic similarities.

There is consensus on the need of the macroeconomic convergence happens before the monetary union takes place, but the debate on the degree of convergence before and after, persists. In this study we will assume the position that there are macroeconomic indicators that “are primarily monetary in nature, such as inflation, interest rate and exchange rates” which should converge before the monetary union takes place.

The question in this study is whether SADC Monetary Union is attainable. The analysis is conducted recognizing that, first, macroeconomic convergence is part of the process for monetary union; and second, SADC already took the decision to converge, so, what are the conditions that the region has to meet in order to successfully reach and sustain convergence in the region.

We found in the literature, specific studies on convergence pattern of SADC subgroups which are part of other RECs, namely SADC, EAC and COMESA. This study bring one new aspect which is combining different criteria, like level of income[3] (low income and Middle income countries), political stability, economic and institutional similarities (HIPIC countries), forming a SADC subgroup composed by Angola, Malawi, Mozambique, Tanzania e Zambia, and analyzed what its MEC convergence pattern and prospects.

There are a lot of previous studies covering the issue of feasibility of SADC MCP, and monetary union, using different variables and methodology, varying from theoretical to empiric analysis. According the variables and technique used the finds may differ, but, in general most studies, particularly on the feasibility of monetary union concluded that the region will not able to materialize it in the agreed timeline. However, most of the revised studies were conducted some time ago some even before the region have started the implementation of its regional economic integration.

This study will add value in the discussion of the feasibility of SADC´s monetary union because, first, is conducted after 2012, the second reference year of the SADC MCP permitting the inclusion of much more recent data and developments that the region faced; second, application of different methodology from the previous one, and third and most important, will perform analysis for the whole group and sub-groups formed based on income level and political stability.

[3] Based on 2011 World Bank Countries classification

1.5. Background Information on SADC

Southern Africa Development Community (SADC) - History, Objectives and Goals

Cooperation amongst SADC member states started in April 1980 as the Southern African Development Coordinating Conference (SADCC) of nine member countries that focused on common regional (mainly infrastructure) projects intended to reduce economic dependence on Apartheid in South Africa by forging member states links and mobilizing resources. The SADCC had a Summit of Heads of State or Government, Council of Ministers, a Standing Committee of Officials and the Secretariat. Different sectors were decentralized to each member state. As Namibia and South Africa gained political independence in the early 1990s, SADCC was transformed into an institution that goes beyond mere cooperation – the Southern Africa Development Community (SADC) and began to pursue regional economic integration and development. Membership also grew from nine (9) to Fifteen (15). The key objectives of SADC are to promote equitable, self-sustaining economic growth and socio-economic development with a view to alleviating poverty; cultivate common cultural, social and political values, as well as maintain democracy, peace, security and stability; achieve complementarities, and sustainable environmental and resource utilization.

1.5.1 SADC's Regional Economic Integration Plan

In the Regional Indicative Strategic Development Plan Development (RISDP), approved in 2003 are defined the objectives, activities and policies relevant to the achievement of a complete economic integration of SADC. RISDP established a roadmap for deepening regional integration over a 15-year period, outlining a number of targets and milestones to be met along the way, namely:

- Free Trade Area by 2008,
- Customs Union by 2010[4],
- Monetary Union by 2016, and
- Single Currency by 2018.

Under its Plan of economic integration SADC established a Macroeconomic Convergence Program (MCP) through a Memorandum of Understanding (MoU) on Macroeconomic Convergence (MEC) that was signed and entered in force in august 2002, and represents the key legal framework for macroeconomic convergence targets which is part of the preparation of the financial market integration. The MoU on MEC "sets out modalities, principles, institutional arrangements, monitoring and surveillance mechanisms, indicators/criteria, data requirements, and monetary and fiscal policy cooperation parameters for the member countries. The MOU is premised on the recognition by member countries of the need for financial and economic stability, soundness of institutional structures and policy frameworks." (Maruping, 2005, 140-141).

Under chapter 4, priorities of intervention areas of RISP (2003), on the area of Trade, Economic Liberalization and Development, we have de following targets:

[4] According the RISDP, the SADC Customs Union was supposed to be launched in 2010, but the Summit decided to postpone to 2012.

Table 1: Trade, Economic Liberation and Development Targets for SADC

Indicators	2008	2012	2018
Target 5: Macroceonomic Convergence on			
Inflation rate	< 10	< 5	< 3
Ratio of budget deficit to GDP	< 5	< 3	< 3
Nominal Value of public and publicly guaranteed debt to GDP	< 60	< 60	< 60
Target 6: Other Financial Indicators			
External reserves/import cover	3	6	6
Central Bank credit to Government	10	5	5
Savings to GDP	25	30	35
Domestic Investment to GDP	30	30	30
Gradual interconnection of payments and clearing system in SADC by 2008			
Achieve currency convertibility by 2008			
Finalise the legal and regulatory framework for dual and cross listing on the regional stock exchanges by 2008			
Liberalising exchange controls: Current account transactions between Member States by 2006 and the capital account by 2010			
Increase the share of credit accessed by women and SMEs to at least 5% of total private sector credit by 2008			
Target: 7 The establishment of a SADC monetary union by 2016			
Finalize preparation of institutional, administrative and legal framework for setting up a SADC Central Bank by 2016			
Launch a regional currency for the SADC Monetary Union by 2018			

In SADC the Macroeconomic Convergence Program has its legal base on Chapter Three of the SADC Finance and Investment Protocol (FIP) and its Annex 2 where at the Preamble of the latest is stated that the members states are convinced that "regional economic integration and macroeconomic stability are preconditions to sustainable economic growth and for the creation of a monetary union in the Region."

The membership of SADC is not homogenous. Institutional constraints have also limited the extent to which various political level commitments have been implemented and monitored in terms of concrete programs of action. There are still significant disparities among many

member states in terms of income levels and distribution; macroeconomic performance notably fiscal deficits and public debt as percentages of GDP thus leading to high rates of inflation; financial sector development and stability; human resources; infrastructure development; as well as peace, security and governance.

II. LITERATURE REVIEW

2.1 Defining Macroeconomic Convergence

Most of material reviewed neither clarify the concept of MEC, nor did it only in the specific context of respective study. That's why we think is a good opportunity to present a short discussion on the concept of MEC based in previous literature and clearly states what should be the understanding of MEC in this particular study. MEC can be defined both in general economic and empirical (based on statistics and econometrics to test it) terms.

2.1.1 Theoretical Definition

According the definition´s article of Annex 2 of FIP, "macroeconomic convergence means the convergence by State Parties to low and stable levels of inflation, sustainable budget deficits, public and publicly guaranteed debt, and current account balances." We can easily see that the definition is very specific for the purpose of the annex, but there isn´t any indication about the direction (level) of each indicator which might have been a good approach in the sense that gives some flexibility to the region when setting the respective targets for each variable. This position is corroborated by CCBG (2001) when stating that "Macroeconomic convergence, per definition, need not imply greater macroeconomic stability in the region. It is possible to

converge at, for example, higher and growing levels of the budget deficit, inflation and external balance."

Maruping (2005) shares similar view, but put it in terms of reasons for seeking macroeconomic convergence which "entails the setting of lower and/or upper limits for selected macroeconomic variables, is usually underpinned by the desire to guide certain key aspects of future economic and financial policy and its management among the member countries concerned."

On the other hand, Carmignami (2005), handle the MEC issue in terms of Macroeconomic policy variables. In his view, to foster economic integration in a region, the countries involved need to convergence in terms of their macroeconomic policies (fiscal and monetary), and thus can be done through establishment of a criteria for MEC.

2.1.2. Empirical Definition

Empirically, convergence can be defined through different methods or models to measure it. "Convergence is signaled by a decline in the standard deviation over time. A decrease in the percentage of countries falling in the tails of the distribution also indicates convergence."[5] Carmignani (2005) also presents the two concepts of the evidence of MEC in time-series of monetary variables, first introduced in Hafer and Kutan (1994) and Westbook (1998), that "Two series converge when they share a common stochastic trend."[6] And second by Monteuga-Gomez, (2002) that "Convergence between two series takes place when their time-varying difference dies over time."[7]

[5] Carmignami (2005, 218)
[6] Carmignami (2005)
[7] ib

2.2 Macroeconomic Convergence in Different RECS

Previous studies tried to measure the level of MEC programs in different RECs.

Maruping (2005, 132) systematized the conditions for effective convergence as listed below:

- Efficient and non-distortionary markets for products and factors of production, including free movement of capital and notably labor;
- Effective compensatory financing arrangements to make the domestic costs of adjustment affordable, and equitably share the costs and benefits of integration, and fully incorporate the effects of exogenous shocks such as adverse weather, terms of trade, disease, and external financing shocks including debt relief;
- Proper timing and sequencing as well as consensus-based choice of a convergence anchor (whether rigid or flexible benchmarks and criteria);
- Enabling policies that reduce risks;
- Development and retention of expertise;
- Focus on smaller sub-groupings for greater success, with provision for variable geometry and variable/multi-speed arrangements.

According Maruping (2005), MEC have some advantages for the countries involved either individually or collectively, that can be macroeconomic stability which represents a key and pre-conditions for achieving strong and sustainable economic growth. Maruping (2005) , also does a good job identifying some lessons and challenges for macroeconomic convergence, namely (i) membership overlapping issue; (ii) slow ratification of protocols and reluctant implementation of agreed plans – for instance in the case of SADC not all the member countries already ratified the FIP[8] which represents the instrument of operationalization of the MEC; (iii) socio-economic

[8] Countries which already ratified FIP

policy divergence; and (iv) limited national and regional capacities - both human and institutional.

Kocenda (2001), did a empirical study to assess the MEC criteria of Central and Eastern European transition economies, and found that in general the countries where converging but the results differed for some variables with real output converging at highest degree while inflation at the slowest pace; and for group of countries which belongs to the Baltic states[9] recording the highest degree and most homogenous level of convergence. He attributed this results to two main reasons, "First, international trade within the Central European Free Trade Area framework serves as a natural means of coordinating economic development. Second, the prospective accession to the European Union serves as an institutional means of coordination in order to satisfy a set of pre-accession criteria. […] common institutional features and economic policies tend to correlate with this higher degree of convergence. This finding is in line with the neoclassical growth theory that supports the occurrence of convergence among similar countries." (Kocenda 2001, 22-23).

The variables that are showing convergence in the different RECs MEC Criteria vary widely, in COMESA was found a "convergence in the degree of central bank financing of government deficit and (…) of inflation and money growth, at least for a sub-sample of countries in the region." (Camargnani 2005, 219; 227). But no evidence of convergence inflation and little support for convergence in exchange rate, for the West Africa Monetary Zone (WAMZ). (Adam et al. 2010, 31)

When analyzing the dynamic Macroeconomic convergence in the West Africa Monetary one, Adam et al (2010) observed that the exchange rate, interest rate and inflation rate have a role to play to minimize the effect to shocks, so that "high degree of convergence of key

[9] Estonia, Latvia, and Lithuania.

macroeconomic indicators would render the aspiring region suitable candidate for currency union. If there is no convergence in any key indicators, a common set of policies would prove disastrous." (Adam et al. 2010, 39)

Drábek (2005) identified the issues in the system that are preventing a more successful convergence of macroeconomic indicators, namely (i) *product and factor market, they need to be efficient; (ii) compensatory mechanism to finance the adjustment cost; and* (iii) t*iming and sequencing of macroeconomic convergence, it should be established a* speed and sequence of convergence that is realistic.

2.3 Macroeconomic Convergence Program in SADC

Rightly in the year which the Memorandum of Understanding (MoU) on MEC Program in SADC, McCarthy& Du Plessis (2001)[10] prepared a study for the Committee of Central Banks Governors (CCBG), on the performance of indicators as external debt to GDP ratio, the budget deficit as a percentage of GDP, growth of broad money supply (M2), CPI inflation rates, interest rate spreads, and current account deficits, and the overall impression gained was one of divergence during the 1990s and not convergence.

Thus, at that time the CCBG concludes that "in a region like SADC, which is exposed to asymmetrical external shocks, convergence can in fact be counterproductive." Their main argument is that MEC policy is not a sufficient condition to guarantee macroeconomic stability and the actual level of development of most of the SADC countries, requires that "Policies must be designed to address national development needs and since circumstances may differ, policies many times have to diverge….[mainly in occurrence] of asymmetrical external shocks in the region." (CCBG Report 2001, 19)

[10] Cited by the report of CCBG

As pointed by Jefferis (2007), the issue of how much convergence should occur before the monetary union takes place is being a source of debate.

Hansohm and Shilimela (nd) observed that "in general, macroeconomic convergence has been more evident within SACU countries, and with exception of Mauritius, it remained low for the rest of SADC countries." The conclusion was under the analysis of the tendency of four MEC variables, inflation, budget deficit, Public debt, savings and domestic investment ratios to GDP.

Likewise, Maleleka (2007), in a report where he analyzed two particular sub-groups of countries of SADC namely, Southern African Customs Union (SACU) [11] and Common Monetary Area (CMA)[12] concluded that for the four primary targets "CMA and SACU countries have on average been stable and shown resilience in macroeconomic management. But this did not result in output convergence." (11) And there is divergence in policy and in output between the countries members of the two sub-groups and the rest of SADC members and thus is driven by "lack of comprehensive undertaking of factors that drive growth in respective countries, (…)[and, by] differences in underlying disturbance factors. This indicates that while the countries may generally be stable due to the anchor role played by South Africa, the countries may not be highly integrated because of the underlying structural differences." (1)

Analyzing the economic prerequisites and implications of monetary union in SADC, using inflation, interest rate and exchange rate, Jefferis (2007), concluded that:

"There is a core 'convergence' group comprising the CMA countries – South Africa, Lesotho, Namibia and Swaziland – plus Botswana, Mauritius, Mozambique and Tanzania whose macroeconomic performance satisfies some of the criteria for monetary union. The remaining

[11] SACU members are: South Africa, Lesotho, Malawi, Botswana and Swaziland.
[12] CMA Members are the SACU one, excluding Botswana

SADC countries – Angola, DRC, Malawi, Zambia and Zimbabwe – make up a 'nonconverging' group that cannot yet be considered potential candidates for monetary union. However, even within the convergence group, countries remain far from satisfying the other prerequisites for monetary union, including significant intra-regional trade, and full capital and labour mobility. " (Jefferis 2007,83)

Agbeyegbe (2008), using the same variables (exchange rate and inflation) that we will be looking at, in this study, but using a different methodology – the time varying parameters, also analyzed the feasibility of the SADC monetary union, had concluded that was no-convergence, so at that time, "the chances of SADC member countries satisfying some form of Maastricht-type criteria is quite low."(150)

Using econometric techniques to realize a statistical analysis of the macroeconomic performance of Botwsana, Namibia and Zambia, Ogbokor and Chakanhga (2011) found that there was fair favorable economic performance by Botswana and Namibia during 1990 and 2007 while Zambia had an unfavorable economic performance from 1990 until late 2002. But, what really brought our attention to this study was the finding that "each country had a different variable that determined its economic performance better than the other did. Policies put in place to ensure that the set targets are being achieved are not as efficient yet as the impact of the MoU and its policies are yet to be felt." They recommended further research on all the indicators to allow policy implementers to recognize what the main focus should be in achieving regional integration and other SADC objectives.

2.4 Monetary Union

A monetary union is part of a broad objective of monetary integration process which basically represents a greater harmonisation and linking of monetary and exchange rate policies, involving the following stages:

Table 2: Degree of Monetary Integration

POLICY CHOICES	DEGREE OF MONETARY INTEGRATION			
	None	Weak	Strong	Full
Exchange rate	Floating	Constrained float/crawling peg	Fixed peg	single currency
Capital Market	Exchange(capital Controls possible	Progressive removal of capital controls, Equal treatment across jurisdictions		
Other		Removal of controls on labour mobility, Stricter limits on fiscal deficits and public debt, trade liberalization, stabilization of financial sector and strengthening of supervision		
Monetary policy implications	Unconstrained	constrained by exchange rate targets and capital movements	Co-ordinated movements in interest rates	single central bank and benchmark interest rate

Source: Keith (2007)

2.4.1 Advantages of a Monetary Union

- Elimination of currency conversion costs;
- Reduction of currency transactions costs on products and services as well as costs associated with exchange rate fluctuations;
- Promotion of trade;
- Efficiency gains;
- Improvements in quality and credibility of macroeconomic policymaking; and
- Higher economic growth.

2.4.2 Disadvantages of a Monetary Union

- Possible difficult of having a “one-size-fits-all” monetary policy and choice of appropriate fiscal policy;
- Need of continuing structural reforms;
- Unclear relation between the monetary union and higher growth rates;
- The cost of ceding of monetary and exchange rate policy autonomy, where the range of policy instruments available to national governments is reduced, and there a need for the government find other instruments to adjust in case of economic shocks;
- Need to have common Key policy instruments across a group of countries and those countries should be individually subject to similar shocks;
- Have similar trade structure, which could help facing shocks, since in case of small open economies, as the case of most of SADC countries, they are highly subjected to external shocks; and
- Diversify economies in order to reduce their vulnerability to external shocks

According the optimal Currency Area (OCA) under monetary union arrangements, the countries involved should have additional flexibility of the fiscal policy. But this position is controversial because the usage of fiscal policy to adjust from negative shocks can cause problems of public debt sustainability and budget deficits in one country and can cause negative externalities for the rest members of the union in the cases which additional borrowing and recourse to capital markets cause pressure for the interest rate increases.

III. METHODOLOGY AND DATA

To empirically measure the degree of economic convergence of SADC towards the creation of a monetary union, we follow the methodology used by Jayaraman, *et al* (2007) and Adam, *et al* (2010).

According Hall et al. (1992), cited by Jayaraman et al (2007) and Adam et al. (2010), convergence is an issue related to long-run behavior of a number of time series. The same authors recall the fact that time series of economic data are in general non-stationary, while two time series cannot cointegrate if they are non-stationary. One important caution made by is Hall *et al* (1992) is that testing for cointegration of the series is a necessary condition but not a sufficient to conclude that two variables are converging, as can be shown in the following static linear regression:

$$(\ln X_{RSA} - \ln X_{SADC\,i})t = a + b(\ln X_{RSA} - \ln X_{US})t + \mu_t \qquad (1)$$

Where

$X_{RSA}, X_{SADC_i}, X_{USA}$ – nominal exchange rate or inflation rate of Republic of South Africa, of a given SADC country (i) and of USA, respectively

$\mu(t)$ - error term

$H_0 : b(t) = 0$ Convergence between X_{RSA} *and* X_{SADC_i}

$H_1 : b(t) \neq 0$ No - Convergence between X_{RSA} *and* X_{SADC_i}

$H_1 : b(t) = 1$ Convergence between X_{SADC_i} *and* X_{US}

From the timeframe established for the achievement of the targets, we can see in fact convergence is a process, and this aspect would be better captured measuring empirically,

assuming some dynamic adjustments in the form of time varying parameters. For that, we incorporate dynamic adjustments by formulating a model with time varying parameters.

According Jayaraman *et al* (2007), by applying a Kalman Filter model, we can capture two distinct aspects: (i) the evolution of a set of unobserved variables, the state variables over time; and (ii) a measurement which describes how well the actually observed data are generated from the state variables.

Time varying parameters – Kalman Filter

A Kalman Filter model in this case can be describe by the following state space model:

$$(LnX_{RSA} - \ln X_{SADCi})(t) = a(t) + b(t)(\ln X_{RSA} - \ln X_{US})(t) + \mu(t) \qquad (2)$$

Where,

$$a(t) = a(t)_{-1} + V_{1t} \qquad (3)$$
$$b(t) = b(t)_{-1} + V_{2t} \qquad (4)$$

V_{1t}, V_{2t} - error terms

Hypothesis:

H_0: b(t) $\neq$ 0 $\rightarrow$ **No-convergence** on the fact that relationship between X_{RSA} and X_{SADCi} is affected by the relationship X_{RSA} and X_{US} (Specific alternative)

H_1: a(t) $\neq$0 and b(t) = 0 $\rightarrow$ **Convergence** If X_{RSA} and X_{SADCi} are unaffected by the specific alterative. (General alternative)

3.1 Variables and Data

The data was obtained from the International Financial Statistics database of IMF, CD-Room version, July 2012, for the following variables, frequency, period and countries:

- **Inflation rate (Logarithm of CPI Index):** Monthly data, 1993:7 – 2011:9 (219 observations), for Botswana, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, and Zambia.
- **Exchange rate (Logarithm of SDR per national currency):** Monthly data, 1980:1 – 2011:9 (381observations), for Angola, Botswana, Lesotho, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, and Tanzania.
- Inflation and Exchange rate of United States of America, for correspondent periods.

We will use time series because:

- Cross-section generally rejects no-convergence (meaning convergence), while time series, accepted no convergence.
- Cross-section test cannot identify grouping of countries which are converging.

All calculations were performed on E-views.

Limitations

- Difference on countries coverage for both variables;
- Difference of period covered of the two variables; and
- Data shortage for some countries, like Mozambique.

IV. EMPIRAL RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The tables 9 and 10 in ANNEX present the descriptive statistics of inflation and exchange rate of the SADC selected countries and USA. The descriptive shows that the hypothesis of normality cannot be accepted. Both variables are positively skewed in all the countries with exception of Seychelles, which exchange rate are negatively skewed.

Angola and Mozambique show the most volatile exchange rate, while, Zambia and Malawi are the one with highest volatility of their inflation rates.

4.2 Convergence Test

Was conducted a co-integration test because is a necessary condition for testing existence or not of convergence between different series. Applying the Augmented Dickey Fuller (ADF) was found that with exception of Angola´s exchange rate series all other series are non-stationary and integrated of order I (1).

4.2.1 Unit Root Tests

Table 3: Log of Inflation

	Levels		1st Difference	
	ADF Statistics	P-Value	ADF Statistics	P-Value
BWA	18.42406	1.00	-4.20962	0.000
MDG	4.054865	1.00	-8.29023	0.000
MOZ	3.830652	1.00	-4.86255	0.000
MUS	13.00509	1.00	-5.62287	0.000
MWI	2.773397	0.9987	-5.07778	0.000
NAM	2.775934	0.9987	-14.4229	0.000
SWZ	5.470826	1.00	-13.7856	0.000
SYC	2.684783	0.9983	-10.8583	0.000
USA	4.492851	1.00	-7.33041	0.000
TZA	4.286402	1.00	-12.562	0.000
ZAM	4.248561	1.00	-5.29475	0.000
ZFA	7.585978	1.00	-4.25637	0.000

Table 4: Log of Exchange Rate

	Levels		1st Difference	
	ADF Statistics	P-Value	ADF Statistics	P-Value
AGO	-2.727463	0.01	-23.8554	0.000
BWA	2.941048	1.00	-17.5198	0.000
LSO	2.046217	0.99	-17.6805	0.000
MOZ	0.153957	0.73	-20.8275	0.000
NAM	1.639599	0.9756	-14.348	0.000
MUS	3.510088	0.9999	-20.8807	0.000
SWZ	1.673547	0.98	-14.7639	0.000
SYC	0.972109	0.9125	-16.6436	0.000
TZA	3.35667	1.00	-9.57094	0.000
USA	0.12035	0.72	-17.9548	0.000
ZFA	2.046217	0.99	-17.6805	0.000

As Hall et al (1992) observed, “if two non-stationary time series are not co-integrated, then they cannot converge” but testing for co-integration is just a necessary condition but not sufficient.

4.2.2 Co-integration Tests

Table 5: Log of Inflation

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None	387.5430*	239.2354	135.4366*	64.50472
At most 1	252.1064*	197.3709	58.14794*	58.43354
At most 2	193.9585*	159.5297	52.64478*	52.36261
At most 3	141.3137*	125.6154	44.88694	46.23142
At most 4	96.42673*	95.75366	31.70666	40.07757
At most 5	64.72007	69.81889	24.30591	33.87687
At most 6	40.41416	47.85613	20.26849	27.58434
At most 7	20.14567	29.79707	10.98074	21.13162
At most 8	9.164925	15.49471	7.367754	14.26460
At most 9	1.797171	3.841466	1.797171	3.841466

Trace test indicates 5 co-integrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level

Table 6: Log of Exchange Rate

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None	364.3378*	197.3709	115.1371*	58.43354
At most 1	249.2007*	159.5297	95.04105	52.36261
At most 2	154.1596*	125.6154	47.55434*	46.23142
At most 3	106.6053*	95.75366	34.87979	40.07757
At most 4	71.72551*	69.81889	27.29167	33.87687
At most 5	44.43384	47.85613	15.84398	27.58434
At most 6	28.58985	29.79707	14.44005	21.13162
At most 7	14.14981	15.49471	11.90959	14.26460
At most 8	2.240218	3.841466	2.240218	3.841466

Trace test indicates 5 co-integrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level

The Trace and Maximum-Eigen test statistics for inflation and exchange rates give support to the existence of co-integration among the variables, suggesting that the countries may be more readily candidates for monetary union, but are not a sufficient condition.

First we will run the static model expressed above to confirm if there is convergence in the actual situation of the selected SADC member states.

4.2.3 Ordinary Least Squared (OLS) Regression Results - Static Model

The tables 7 and 8 below present the results for the equation

$$(LnX_{RSA} - \ln X_{SADCi})t = a + b(\ln X_{RSA} - X_{US})t + \mu(t) \qquad (1)$$

For testing the following hypothesis:

$H_0 : b(t) = 0$ Convergence between X_{RSA} *and* X_{SADC_i}

$H_1 : b(t) \neq 0$ No - convergence between X_{RSA} *and* X_{SADC_i}

According the results obtained after running the equation above in *E-views* and looking for the values of the *t-statistic*, and comparing with the critical values of 1.714, 2.069 and 2.807, for two-tailed 10 percent, 5 percent and 1 percent respectively, we reject the null hypothesis that b(t) is equal to zero, meaning, that there is no-convergence between the inflation rate levels of any of the countries of SADC member countries included in the sample and of South Africa, as shown in the table 7 below.

Table 7: Inflation Rate

Country	$\hat{a}$	t-stat.	$\hat{b}$	t-stat.	R^2	DW	P-Value
BWA	0.033759	9.716983	-0.60696	-33.9165	0.84	0.030	0.000
MAD	0.10922	13.41665	-1.33449	-31.8255	0.82	0.040	0.000
MOZ	0.117964	10.16568	-1.63322	-27.3241	0.77	0.02	0.000
MUS	-0.00395	-1.965	0.043485	4.204202	0.08	0.05	0.000
MWI	0.287728	15.8542	-3.35647	-35.9054	0.86	0.02	0.000
NAM	-0.06559	-12.3893	0.409343	15.01211	0.51	0.1	0.000
SWZ	0.035534	15.61224	-0.39141	-33.3858	0.84	0.29	0.000
SYC	-0.12516	-12.7441	0.18792	3.714684	0.06	0.02	0.0003
TZA	0.018506	2.249577	-0.77278	-18.2376	0.61	0.06	0.0255
ZAM	0.339737	24.85221	-3.54558	-50.353	0.92	0.01	0.000

T-statistic critical values, 10% = 1.714, 5% = 2.069, 1% = 2.807
***denotes no-rejection of H_0: b(t) = 0 (convergence)**

For the case of the exchange rate, using the level of t-statistic criteria, we could conclude that the results don't give enough evidence to reject the hypothesis that the exchange rate of Namibia and Swaziland exchange rate are converging towards the South African one as the table 8 below reports, the associated to coefficient b(t) of Namibia are significant for 1 percent and 5 percent confidence level. This result is not surprising, because South Africa and Namibia are both members of a Common Monetary Area[13] , the Rand Monetary Area (RMA), under the Southern African Customs Union (SACU) arrangement.

[13] Of the members of SACU, only Botswana is not party, which after joining quitted in 1976.

Table 8: Nominal Exchange Rate

Country	$\hat{a}$	t-stat.	$\hat{b}$	t-stat.	R^2	DW	P-Value
AGO	-22.319	-50.510	-11.103	-37.351	0.770	0.020	0.000
BWA	-0.102	-9.478	0.091	12.534	0.290	0.030	0.000
MOZ	-0.593	-4.690	-1.252	-14.733	0.360	0.030	0.000
NAM	-0.006	-2.363	-0.003*	-1.756	0.008	1.630	0.000
MUS	2.251	218.294	0.459	66.198	0.920	0.090	0.000
SYC	1.745	63.396	0.942	50.892	0.870	0.020	0.000
TZA	2.515	40.662	-1.308	-31.441	0.720	0.030	0.000

T-statistic critical values, 10% = 1.714, 5% = 2.069, 1% = 2.807
***denotes no-rejection of H_0: b(t) = 0 (convergence), at 5% of significance**

Using the static model, the figures obtained don't support the existence of convergence between the SADC members countries considered in the sample. But these results are not sufficient for reaching a final conclusion. Before doing so, we will measure the convergence using a dynamic model, applying Kalman Filter method.

4.2.4 Dynamic Model Results – Kalman Filter

Applying a kalman Filter model as expressed in the equation (2) – (4) above, we obtained the series in ANNEX A, which respective visual result is as presented in the figures 1 and 2 below.

Figure 1: State Variables Coefficients B (t) for Exchange Rate

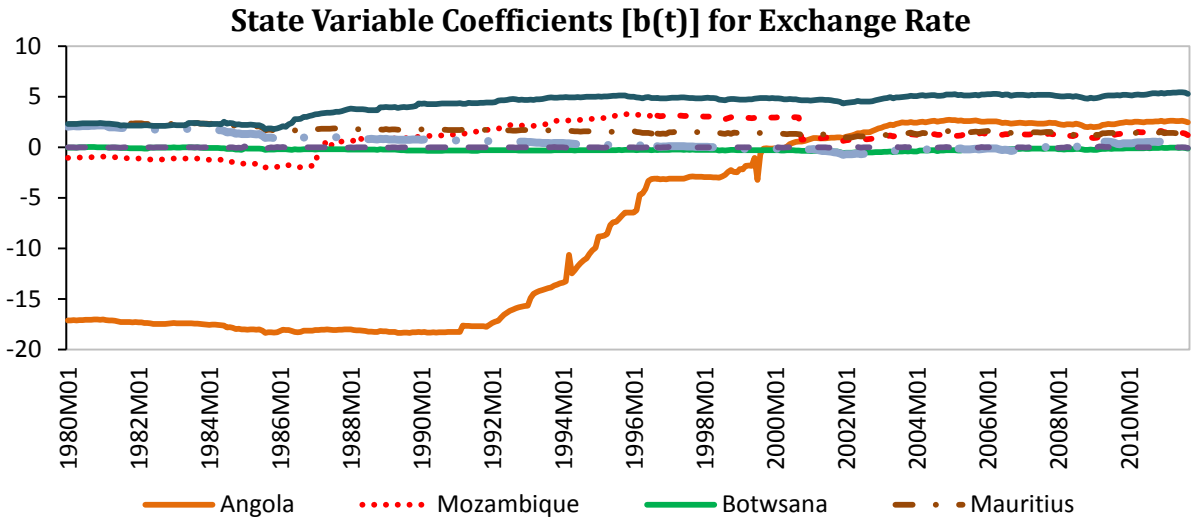
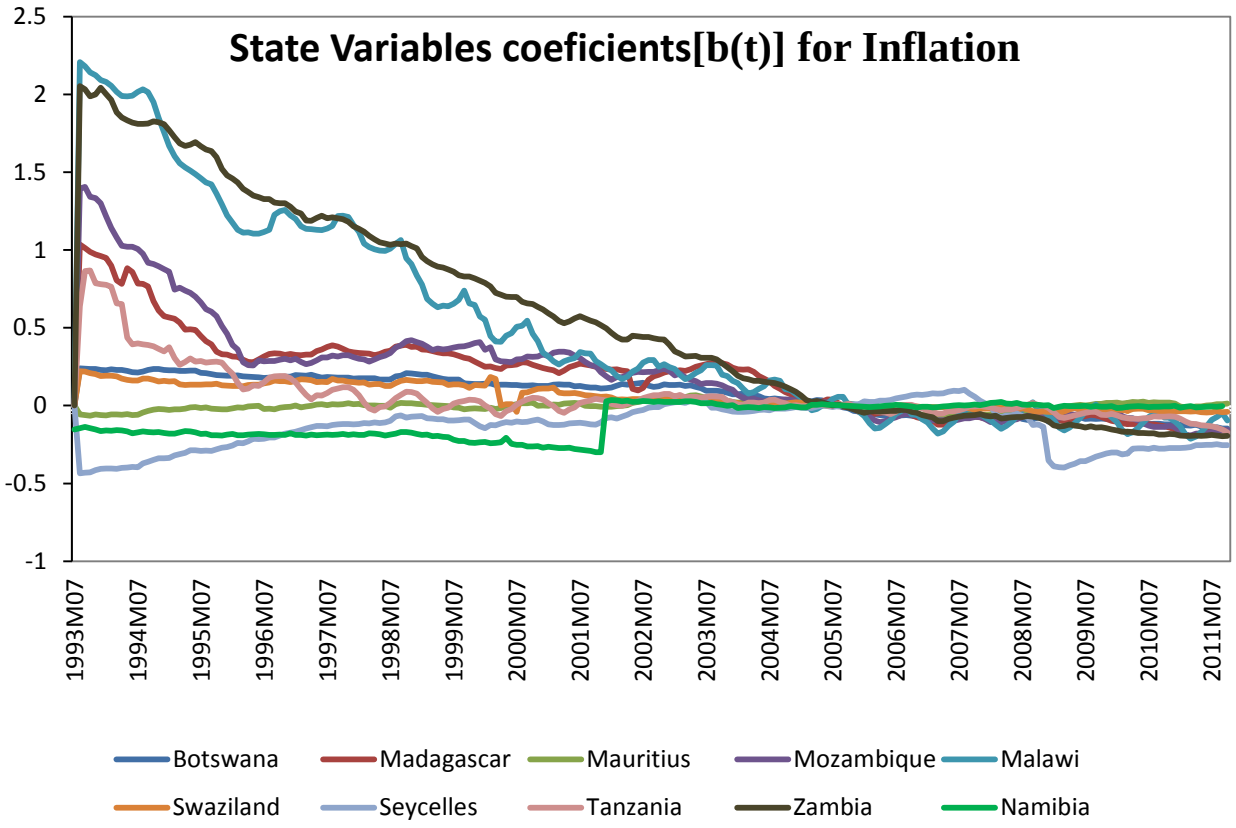


Figure 2: State Variables Coefficients b (t) for inflation



V. CONCLUSIONS

This study analyzed the feasibility of the SADC monetary union program under the current situation. That was done assessing the actual level of convergence of the inflation rate and exchange rate, using both a static and dynamic models.

First studies concluded that the SADC member as a whole are not converging in most of their macroeconomic variables, like inflation, GDP growth, interest rate, exchange rate. Thus the monetary union was unfeasible, mainly because their economies are heterogeneous and they face the problem of overlapping membership to different RECs.

Using the Static Model, in a sample of 10 SADC member countries, out of 15, due to data availability, in the case of inflation rate, the results show that there no-convergence between any of the countries towards the South African one. For the exchange rate, the results demonstrates that Namibia and Zambia Exchange rate present a level of convergence towards the South Africa one, but this can be explained by the fact of this three countries be part of a REC which is already in monetary union.

We recognize that the results are not conclusive, but we believe that they represent a continuation and consolidation of the finding of previous studies, and in this sense a source of information for the policy makers involved in the process of regional integration.

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VII. ANNEX

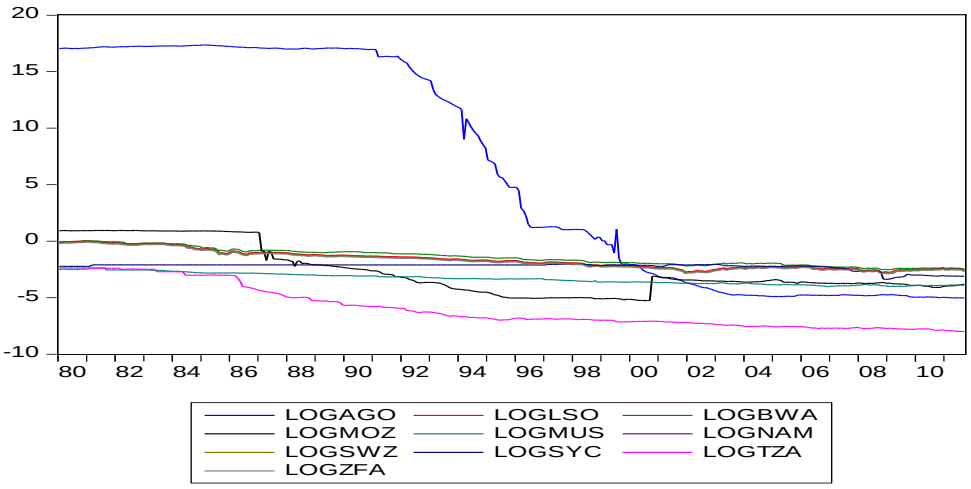
Table 9: Descriptive Statistics of SADC and USA Exchange Rates

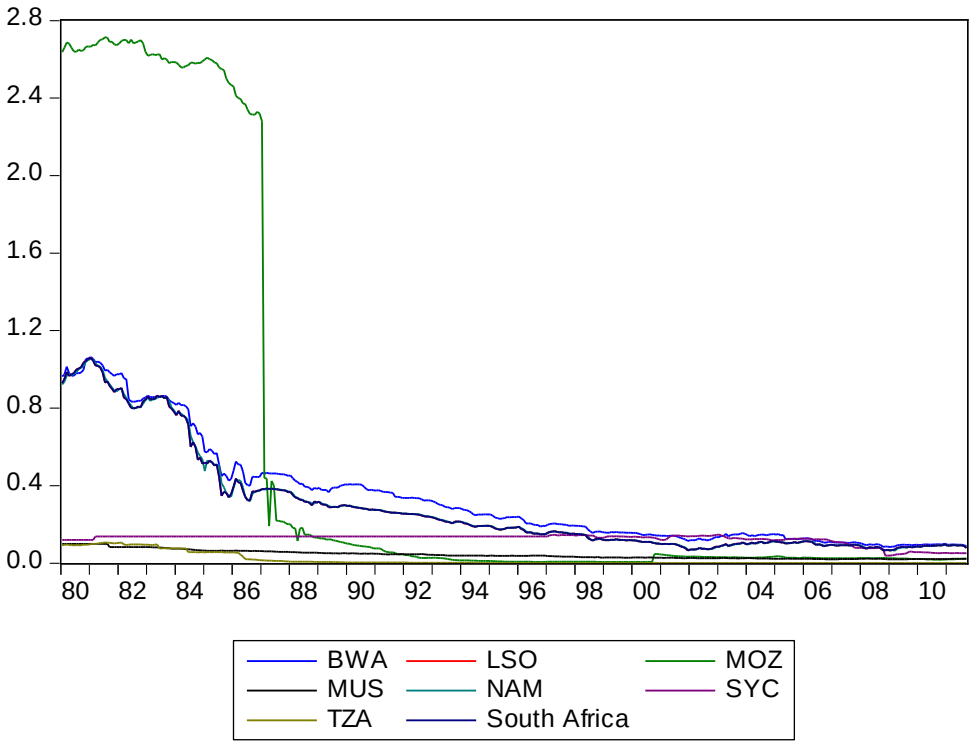
	AGO	BWA	LSO	MOZ	NAM	MUS	SWZ	SYC	TZA	USA	ZFA
Mean	10374840	0.338229	0.288973	0.611858	0.289996	0.043793	0.290044	0.125070	0.018290	0.750177	0.288973
Median	118.2780	0.231846	0.176372	0.030215	0.176388	0.038214	0.176388	0.138227	0.001199	0.729474	0.176372
Maximum	34721300	1.062790	1.058850	2.713760	1.053840	0.100000	1.053840	0.147018	0.106355	1.042300	1.058850
Minimum	0.006671	0.083303	0.065101	0.005501	0.064392	0.019359	0.064392	0.039140	0.000387	0.608090	0.065101
Std. Dev.	13426888	0.274434	0.271354	1.062463	0.272038	0.022560	0.272082	0.026955	0.032951	0.095543	0.271354
Skewness	0.623591	1.283461	1.536633	1.329658	1.520966	0.988015	1.520151	-2.040698	1.686271	1.071090	1.536633
Kurtosis	1.514845	3.500614	4.122904	2.794103	4.066304	3.034939	4.063177	5.801657	4.169320	3.546910	4.122904
Jarque-Bera	59.70827	108.5803	169.9557	112.9403	164.9469	62.00645	164.6839	389.0497	202.2689	77.59771	169.9557
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	381	381	381	381	381	381	381	381	381	381	381

Table 10: Descriptive Statistics of SADC and USA Inflation Rates

	BWA	MDG	MOZ	MUS	MWI	NAM	SWZ	SYC	USA	TZA	ZAM	ZFA
Mean	88.98517	83.52828	83.13738	92.12662	75.27703	98.56077	88.40132	105.5704	93.78899	89.86937	73.26267	91.59531
Median	80.91510	73.19500	73.48260	88.08530	71.92540	97.10370	87.30270	92.85380	92.52830	86.36060	59.25080	91.32220
Maximum	172.0780	174.3050	174.0010	146.5750	176.9150	149.0330	154.7390	193.9230	116.1800	176.3040	180.5170	148.4980
Minimum	38.01120	17.14390	11.88700	51.09970	5.313350	55.78170	38.69800	73.63800	73.94070	20.41710	6.196030	48.27810
Std. Dev.	38.10435	43.51810	44.26949	28.34815	50.98439	24.01443	33.21404	38.41628	12.37745	36.52364	54.56656	28.24613
Skewness	0.569760	0.518093	0.382149	0.392137	0.257502	0.320953	0.371992	1.410444	0.159823	0.271994	0.461556	0.361244
Kurtosis	2.136258	2.127789	2.073440	1.932671	1.775924	2.406127	1.988367	3.490006	1.750522	2.464218	1.876347	2.081766
Jarque-Bera	18.65660	16.73918	13.16432	16.00779	16.09277	6.978139	14.38932	74.80230	15.17824	5.319736	19.29693	12.45691
Probability	0.000089	0.000232	0.001385	0.000334	0.000320	0.030529	0.000751	0.000000	0.000506	0.069957	0.000065	0.001972
Observations	219	219	219	219	219	219	219	219	219	219	219	219

Exchange Rate





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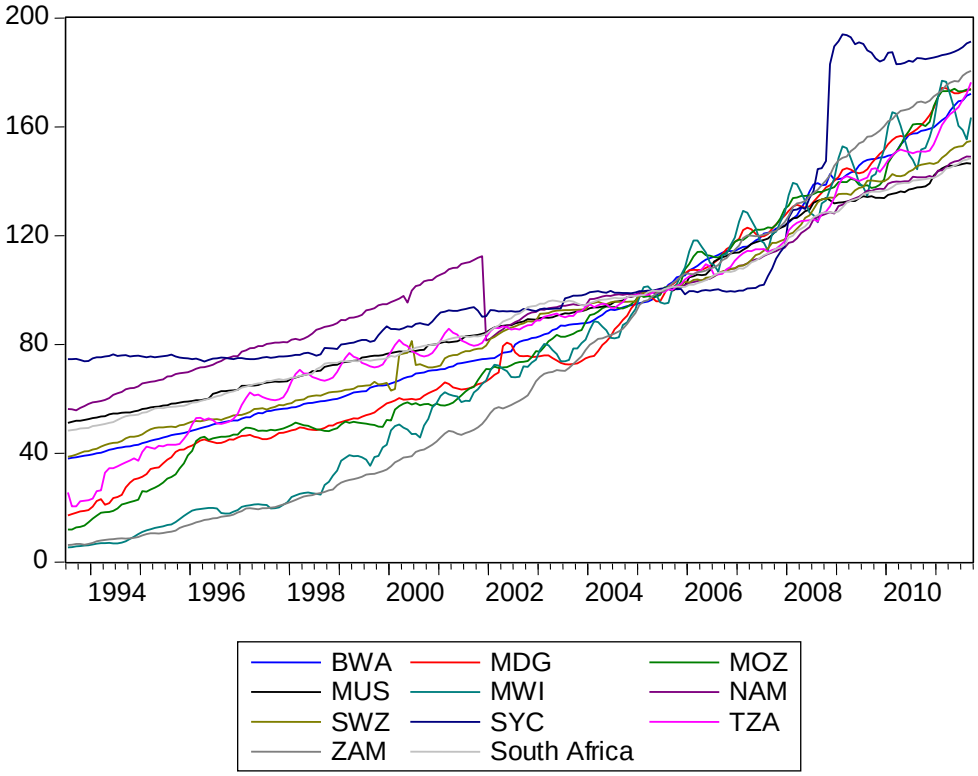
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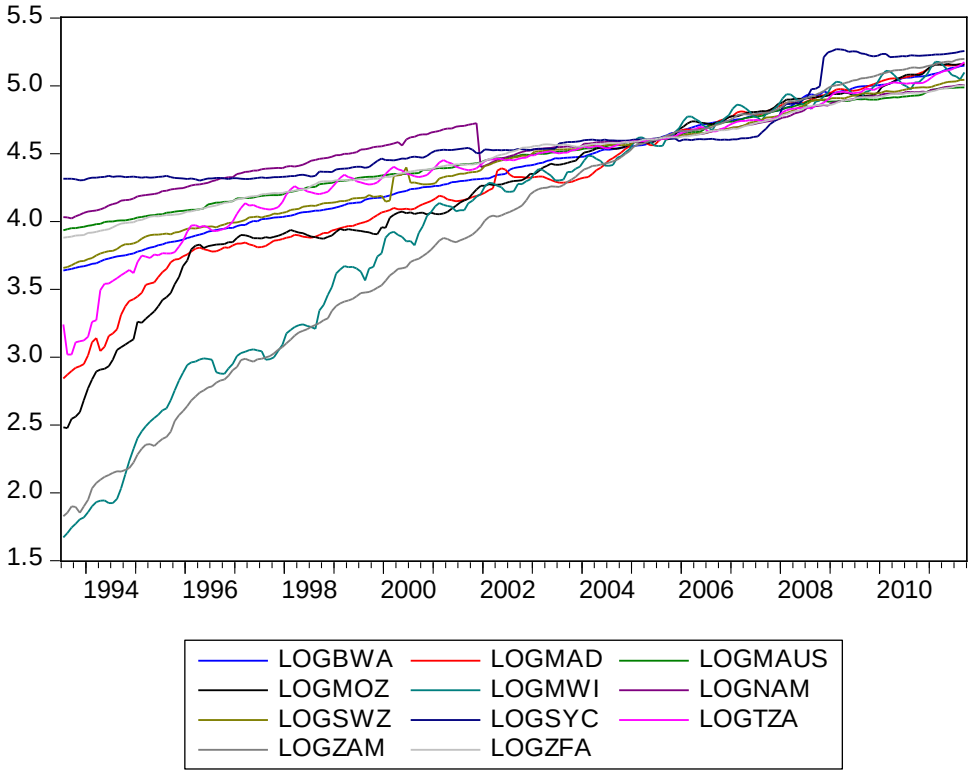
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