Does Macroeconomic Convergence Lead to Growth?

The Case of Africa

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REVISED VERSION

I. Introduction

It is evident from the income convergence analysis that there is very little evidence that the countries in the various RECs are converging, except in UEMOA. However, with some more stringent testing that is founded on economic growth theories, very slow pace of convergence of the per capita incomes could be seen. The implication of the limited speed of the per capita incomes convergence is that unless there was a major structural shift, it will take at least more than half a century for most RECs economies to converge and thus attain one of the expected outcomes of regional integration initiatives in Africa. Where poor countries in the continent are able to attain levels of development that overcome the disparities in per capita incomes. Clearly, from the analysis to this point, it is evident that the integration policies would have to address the lack or this slow pace of convergence in per capita incomes.

But what is the evidence on the macroeconomic convergence front? The different RECs are faced with the reality that it cannot be able to achieve economic union status unless there is clear and sustainable macroeconomic convergence. In this sub-section, results are presented on the status of macroeconomic convergence in the different RECs under study. We have looked at the two main or primary criteria for macroeconomic convergence namely inflation for monetary policy and budget balance for fiscal balance. Monetary and fiscal policies in the different RECs are the key instruments that are at the disposal of the governments to steer their economies towards an economically integrated area. The macroeconomic anchors that indicate the movement towards attaining the macroeconomic convergence criteria include among other indicators inflation, fiscal balance, current account balance, and real exchange rate.

The objective of this paper is to assess if there is any macroeconomic convergence in the African RECs and investigate if this macroeconomic convergence leads to any growth path. This paper provides empirical evidence on the progress and prospects of the African

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integration process by assessing the level and rate of convergence of the macroeconomic and financial components in Africa. The macroeconomic component of integration relates to three complementary dimensions of convergence. First, it is anticipated that true integration cannot take place unless economies of participating countries in an integration area deal with economic shocks harmoniously. Second, and possibly one of the most important objectives of integration attempts in Africa, is to work towards the convergence of per capita incomes among the economies of participating countries. Consequently, a major emphasis of this paper will be to assess whether there is evidence of convergence of per capita incomes across the integrating countries in each of the RECs under study. The results from various formal tests[1] that are applied to test for income and macroeconomic convergence for selected African RECs are discussed.

The paper is structured as follow; In the second section, the results from the analysis of the convergence of macroeconomic stability indicators for various RECs are reported. The methodology for analyzing macroeconomic convergence as outlined in Appendix 1 and is the same as that employed for the income convergence analysis in as far as it involves sigma tests, unit root tests and cointegration analysis. Evidence of macroeconomic convergence in the selected indicators of convergence could be an indication that policy coordination in the RECs is achieving desired macroeconomic outcomes. From that perspective we first look at the monetary policy (section 2), and then the fiscal policy (Section 3). This would provide the necessary foundation for moving the REC through the various phases of integration towards monetary unions as argued in optimal currency area theories. The results on monetary and fiscal policy outcomes are captured by inflation and fiscal balance as a proportion of GDP. Section 4 concludes this article.

II. Macroeconomic convergence: Monetary Policy

In investigating macroeconomic convergence in the different RECs, inflation was used to analyze convergence in monetary policy. Monetary policy is the central bank process of managing money supply to achieve specific goals—such as constraining inflation, maintaining an exchange rate, achieving full employment or economic growth. The results involving convergence in monetary policy from sigma tests, unit root test and cointegration analysis are presented in Appendices 2, 3 and 4, respectively.

a. Convergence in SADC

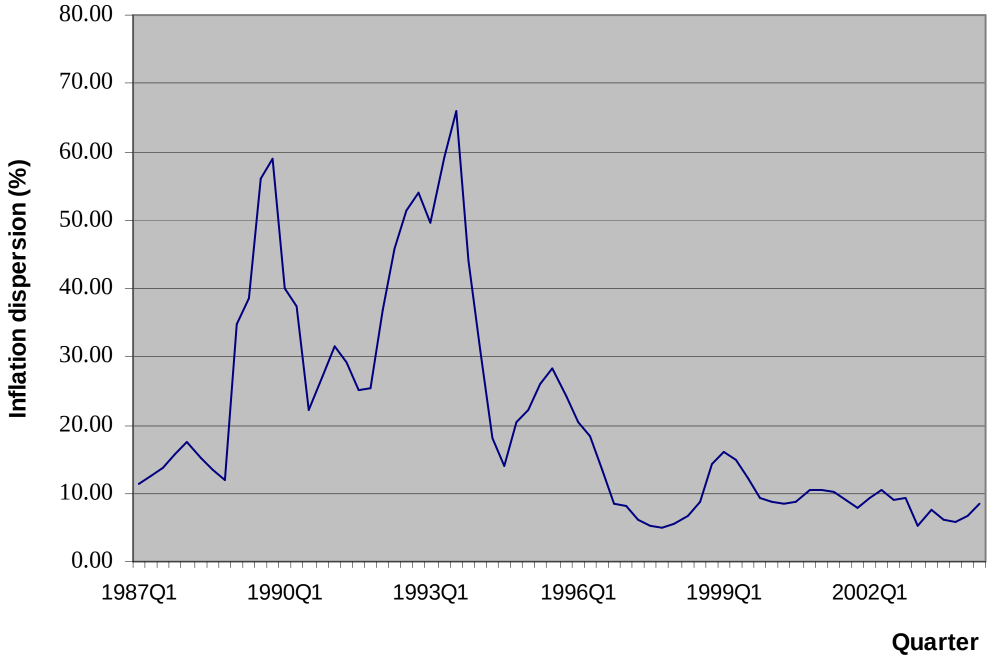
Figure 2.1 shows the plot of the standard deviation of inflation within the SADC countries[2] from 1987Q1 to 2004Q2. Looking at the figure, the variability in inflation among the SADC countries, in general, has decreased over time, although the variation started with a low figure in the first quarter of 1987 and ended in a slightly lower figure in the fourth quarter of 2004. In between, particularly in the first half of the 90s, the variability is

[2] This particular set includes Botswana, Lesotho, Madagascar, Malawi, Mauritius, Namibia, South Africa, Swaziland, Tanzania and Zambia. Other SADC countries such as Angola, Mozambique and Zimbabwe do not have sufficient data to be included in the analysis from 1987Q1 to 2004Q2. D. R. Congo was eliminated from the analysis due to its erratic and highly volatile inflation values. Also, in some quarters its inflation values are extremely high. For example in 1994Q3, inflation is 73,529%.

inflation is high and volatile reaching a maximum of around 66 % in quarter four of 1993. The dispersion in inflation reached the lowest point of 5 % in the fourth quarter of 1997. The variability of inflation from that reference period to the second quarter of 2004 is relatively low and stable. This shows somehow a tendency among SADC countries to have convergence in macroeconomic policy particularly in monetary policy.

As in the income convergence, different statistical tests were also undertaken to establish whether there is a robust convergence. First, the result of convergence test from the sigma test (Appendix 2) showed a significant negative coefficient of time when the standard deviation of inflation was regressed with time. This indicates a tendency of monetary policy convergence among SADC countries over time. Next, the unit root test was applied to each country data set and more than half of the countries in the set (Madagascar, Malawi, Namibia, Swaziland and Tanzania and Zambia) rejected the presence of unit root, which imply their convergence to the regional inflation mean (see Appendix 3, Table A3-1). The result, however, from pooled unit root test, showed that countries as a group have a tendency to converge to the regional mean value. The presence of unit root was rejected and these imply convergence to the regional inflation mean. SADC countries therefore show some evidence of convergence in their inflation, an indication of possible coordination with the desired results in monetary policies. Indeed, further analysis carried out to establish whether there is co-movement in the inflation rates of the SADC member countries through the cointegration analysis. Six countries were included in the test namely: Botswana, Lesotho, Mauritius, South African, Tanzania and Zambia. The results of the cointegration tests showed that there is only partial convergence of monetary policies in SADC countries.

Figure 2.1 Dispersion (standard deviation) of inflation across SADC countries, 1987Q1-2004Q2.



b. Convergence in COMESA

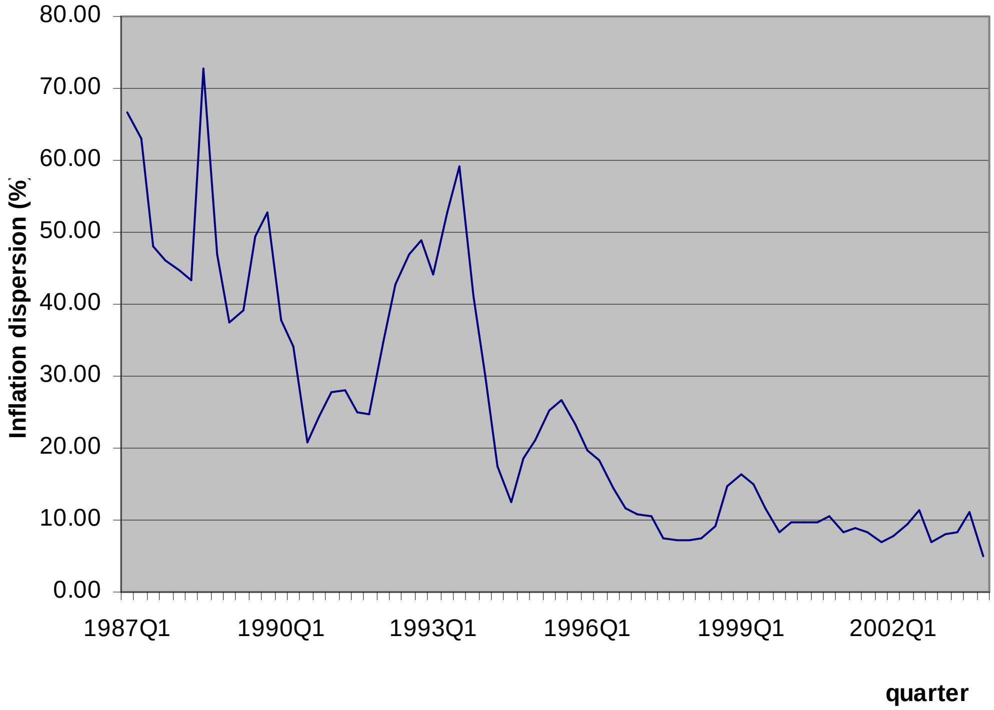
Figure 2.2 shows the plot of the standard deviation of inflation across COMESA countries[3] from 1987Q1 to 2002Q1. In this figure, the general decreasing trend in the variation of inflation across COMESA countries is very obvious. The figure shows the tendency of convergence in the inflation values within COMESA, indicating the realization of some convergence in monetary policies. The standard deviation across COMESA declined to around five percent in quarter four of 2003 from a high of 67 % in quarter one of 1987. Although from 1987 to 1995, the variability of the inflation within COMESA is highly volatile. From 1996 onwards, the variation in the inflation values within the COMESA countries are relatively low and stable.

The tendency of monetary convergence within COMESA is supported by the sigma test on the standard deviation of inflation. The test gave a negative significant coefficient of time implying that the differences in inflation within the COMESA region are diminishing over time (see Appendix 2). The unit root test on the pooled data also supports convergence on monetary policy as the results reject the presence of unit root. However, on individual country basis, only few countries namely: Egypt, Kenya, Malawi, Namibia, Swaziland and Zambia, supports the convergence in monetary policy. And lastly, on the cointegration test, only four countries were included in the analysis— the countries that do not reject the presence of unit root. The cointegration test performed on these four countries (Burundi,

[3] The countries included in the analysis are Burundi, Egypt, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Swaziland, Uganda and Zambia. Other COMESA countries such as Angola, Djibouti, Sudan and Zimbabwe do not have sufficient data. Eritrea and Comoros do not have inflation data from the source while DRC was eliminated due to volatile and extremely high inflation levels.

Egypt, Mauritius and Uganda) showed that only at most two of these countries are showing co-movements.

Figure 2.2 Dispersion (standard deviation) of Inflation across COMESA countries, 1987Q1-2003Q4



c. Convergence in ECOWAS

The plot of the dispersion in the inflation series (1988Q3-2004Q4) among the ECOWAS countries[4] is shown in Figure 3.3. In the figure, a similar behavior with SADC and COMESA may be observed within the ECOWAS countries that is, a generally decreasing variation in inflation is observed. However, the standard deviation is generally more volatile from 1988Q3 to 1998Q3 with a maximum point of 37 %. The variability in inflation became narrow and stable in the late 90s up to 2004Q4 and fluctuates only within the range of 5 % to 12 %.

The sigma test supports the tendency of a monetary policy convergence within the ECOWAS countries (see Appendix 2). The result showed a significant negative coefficient of time, indicating that the differences of inflation within the ECOWAS are diminishing over time. The convergence in monetary policy within ECOWAS is further supported by the unit root test using the pooled panel data set, which implies that as a group the countries in ECOWAS are converging to the regional inflation mean (see

[4] The countries included are Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Benin, Guinea and Liberia do not have sufficient data on quarterly inflation.

Appendix 3, Table A3-6). On the basis of the results of the individual unit root test, most of the countries in ECOWAS also reflect their tendency to convergence into the regional mean (see Appendix 3, Table A3-3). Only three countries namely Cape Verde, Senegal and Togo did not reject the presence of unit root.

Lastly, the cointegration analysis included only four countries. These countries are Cape Verde, Guinea Bissau, Sierra Leone and Togo. The result of the cointegration test indicates only at most one co-movement among them.

d. Convergence in CEMAC

Figure 3.4 shows the plot of the standard deviation of inflation from 1984Q2 to 2002Q2 within the CEMAC countries[5]. In this region, it is interesting to note that the dispersion in inflation is relatively low and stable compared to the other RECs under study. The variability of inflation within CEMAC fluctuates only between the highest point of 16 % and lowest point of 1.40 %. Apparently, CEMAC has a higher possibility of the realization of the REC objective of having convergence in the monetary policy.

The sigma test also support the tendency of convergence in the monetary policy within CEMAC (see Appendix 2), as the coefficient of time is significantly having a negative trend, that is the differences in inflation within CEMAC is decreasing over time. The unit root tests both on the pooled data and individual countries also confirmed that there is a tendency within CEMAC to have monetary policy convergence. The cointegration test for CEMAC countries was not conducted since all countries rejected the presence of unit root in the actual level of inflation.

Figure 2.3 Dispersion (standard deviation) of Inflation across ECOWAS countries, 1988Q3-2004Q4

[5] The countries included are Cameroon, Central African Republic, Chad and Gabon. Republic of Congo and Equatorial Guinea do not have sufficient data.

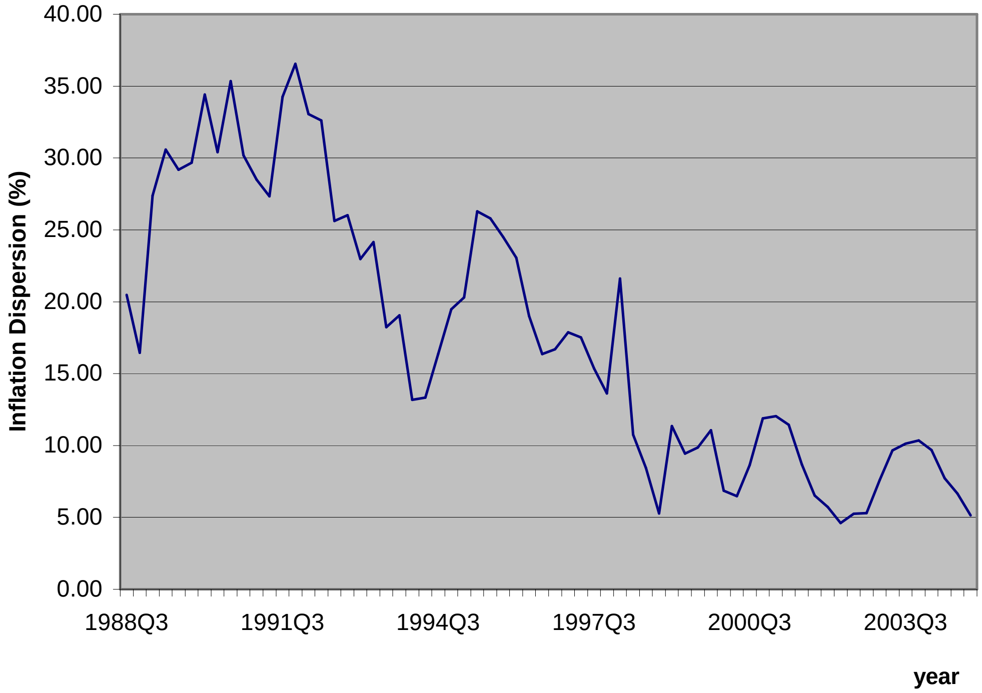
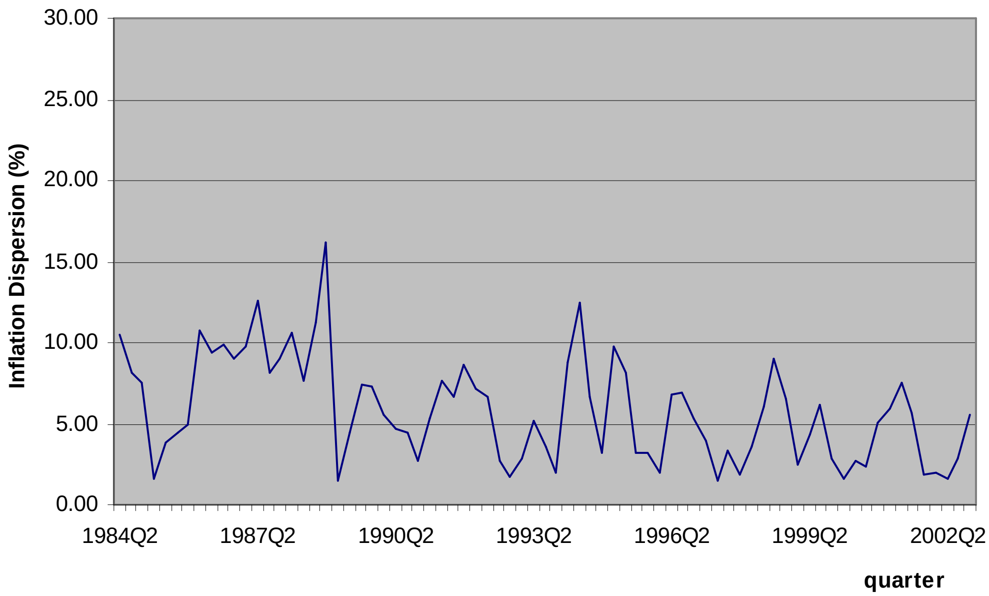


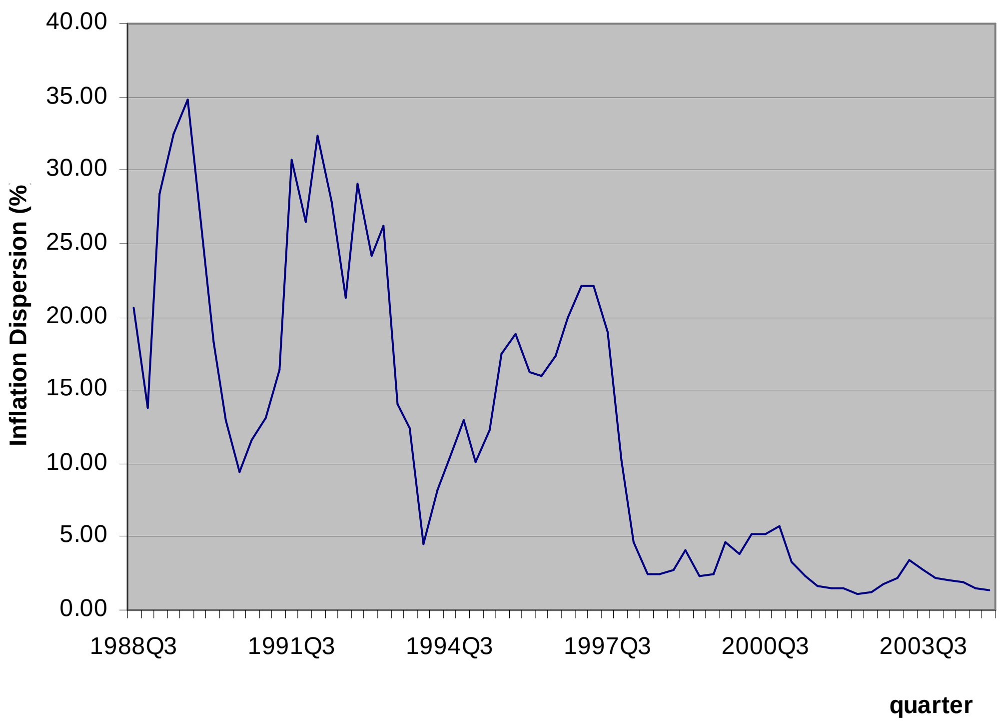
Figure 2.4 Dispersion (standard deviation) of Inflation across CEMAC countries, 1984Q2-2002Q4



e. Convergence in UEMOA

Figure 3.5 shows the plot of the standard deviation of inflation from 1988Q3 to 2004Q4 within the UEMOA countries[6]. From the figure, it may be observed that as in most RECs under study, the dispersion of inflation within UEMOA is highly volatile and unstable in the earlier period of the study that is from 1988Q3 to 1997Q4. However, the variability in UEMOA is relatively lower compared to SADC and COMESA but about a similar level with ECOWAS. From late 90s up to 2004Q4, the variability in inflation within CEMAC has decreased remarkably fluctuating only within the range of 1.4 % to about 5.1%. This observation is a clear evidence of monetary policy convergence within UEMOA countries. Again, this evidence is supported by the sigma test resulting to a significant negative trend in standard deviation over time. The unit root tests on both pooled panel data and on individual countries also confirmed the evidence of monetary convergence in UEMOA, as the results indicates convergence to their regional mean. Lastly, only two countries were included in the cointegration test and the result is not conclusive as it failed to reject any of the hypothesis statements.

Figure 2.5 Dispersion (standard deviation) of Inflation across UEMOA countries, 1988Q3-2004Q4



III. Macroeconomic convergence: Fiscal Policy

Another interest in the study is to observe the convergence in the fiscal policies within different RECs. Fiscal policy is the government policy in setting the level of public expenditure and how that expenditure is funded. Convergence in fiscal policy is another

[6] The countries included are Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo. Only Benin is not included due to insufficient data.

measure of macroeconomic convergence. Here, fiscal balance[7] is used as test variable to capture the results for the convergence in the fiscal policies within the different RECs. The different statistical test such as the sigma tests, unit root test and cointegration analysis are presented in Appendices 2, 3 and 4, respectively.

Figures 3.1 – 3.5 show the plots of standard deviation of fiscal balance, 1985-2003, respectively for SADC, COMESA, ECOWAS, CEMAC and UEMOA. In general, the variability in the fiscal balance within each REC that is under study is not too wide, which is an indication of achieving a much faster convergence in fiscal policy. In most cases, the dispersion in the fiscal balance is below 10 %. For most RECs the standard deviation in the fiscal balance reached a maximum of only 15 % except for CEMAC whose highest point is around 24 % at the beginning of the reference period. The dispersion in the fiscal balance in SADC and COMESA reached a low of around three percent at the end of the reference period, that is 2003. This figure is comparatively lower than in ECOWAS, CEMAC and UEMOA, which standard deviation are at four percent, six percent and five percent, respectively.

The sigma tests on the standard deviation of fiscal balance indicate significant negative coefficient of time for SADC and ECOWAS, which implies the tendency of fiscal policy convergence. Although the sigma tests for COMESA, CEMAC and UEMOA do not give a significant negative coefficient, this do not imply that there is no tendency for fiscal policy within these RECS. The reason is that the dispersion in fiscal balance within these RECs is already low and stable. This evidence is supported by the unit root tests performed on the pooled panel and on the individual country. The unit root test performed in each REC reject the presence of unit root, which indicate the evidence of convergence to the regional mean value. Moreover, on the basis of unit root tests on the individual countries, all countries in COMESA, CEMAC and UEMOA reject the presence of unit root, which means that the countries are converging to their respective regional mean value. For SADC and ECOWAS, only one or two countries did not reject the presence of unit root.

Cointegration analysis was not conducted for COMESA, CEMAC and UEMOA. All countries in these RECs rejected the presence of unit root. This indicates that the levels of fiscal balance in all of these countries are relatively stable and have no tendency to fluctuate uncontrollably and to increase steady. For SADC and ECOWAS, cointegration analysis was conducted for only very few countries and there was no co-movements found. It is noted that even for SADC and ECOWAS, most countries have relatively stable values of fiscal balance.

Figure 3.1 Dispersion (standard deviation) of fiscal balance across SADC countries, 1985-2003

[7] Here fiscal balance represents the government deficit/surplus including grants. It represents the net financing requirement of the consolidated government expressed as % of current GDP in national currency (World Bank Africa Database CD-ROM 2004/5).

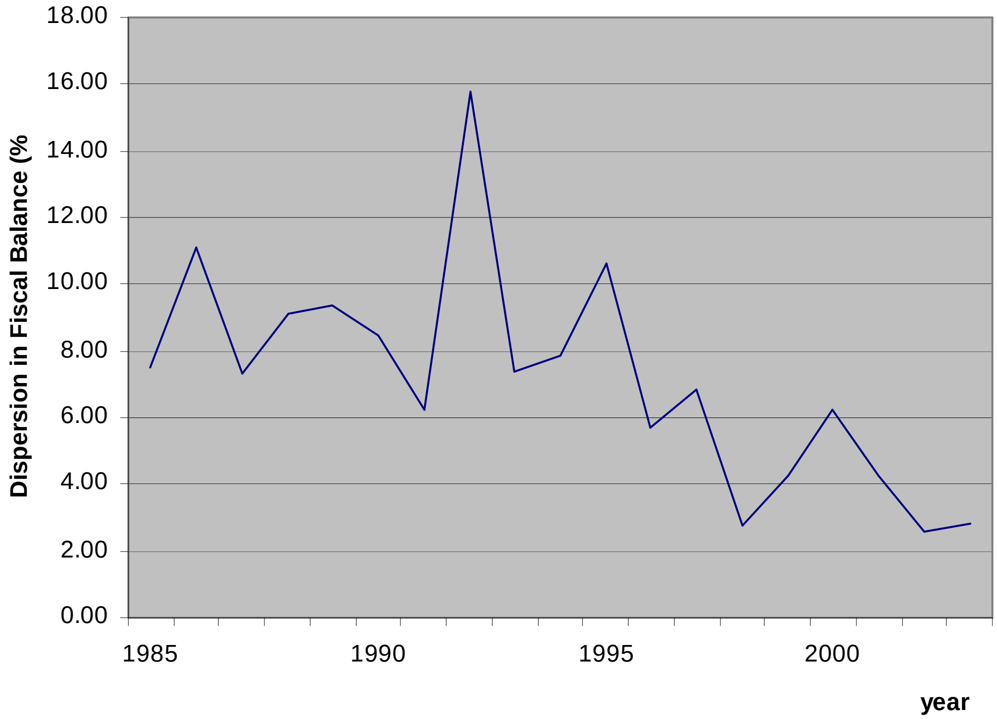


Figure 3.2 Dispersion (standard deviation) of fiscal balance across COMESA countries, 1985-2003

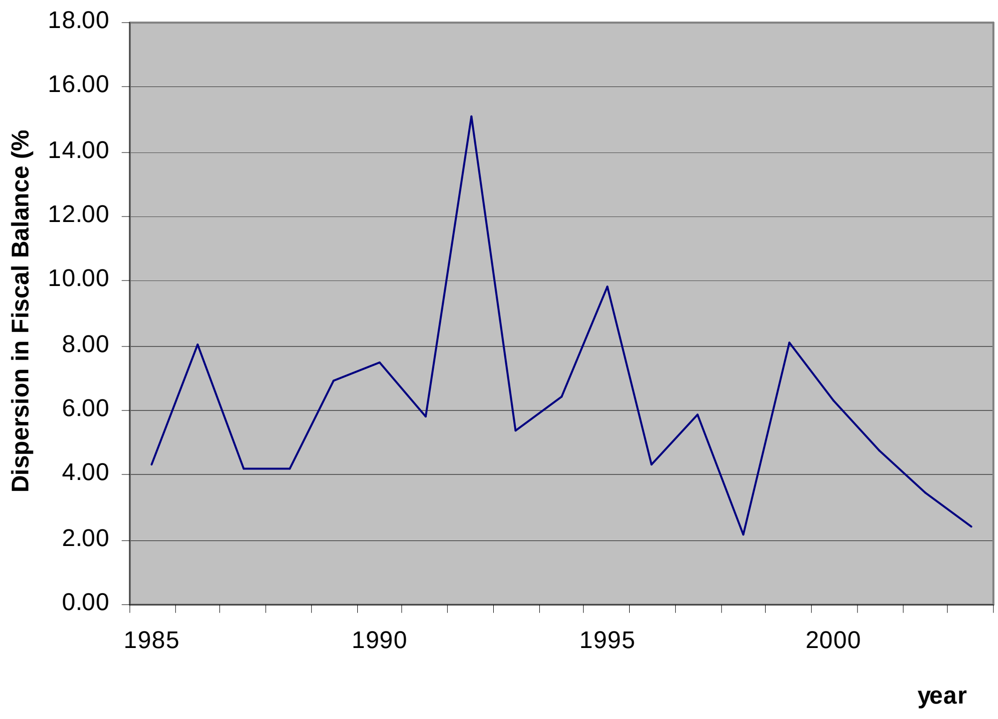


Figure 3.3 Dispersion (standard deviation) of fiscal balance across ECOWAS countries, 1985-2003

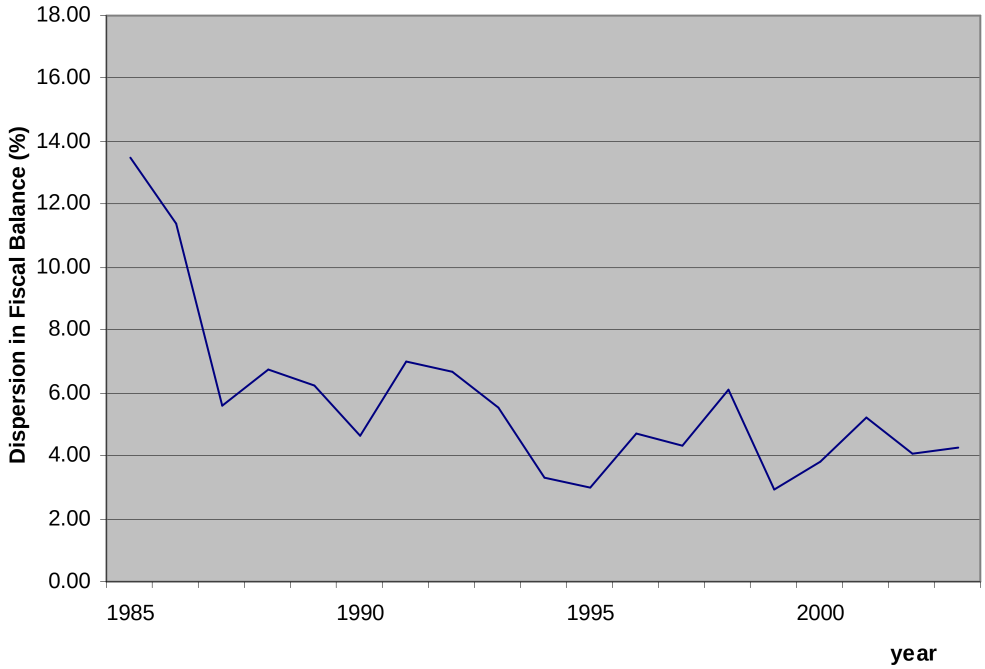


Figure 3.4 Dispersion (standard deviation) of fiscal balance across CEMAC countries, 1985-2003

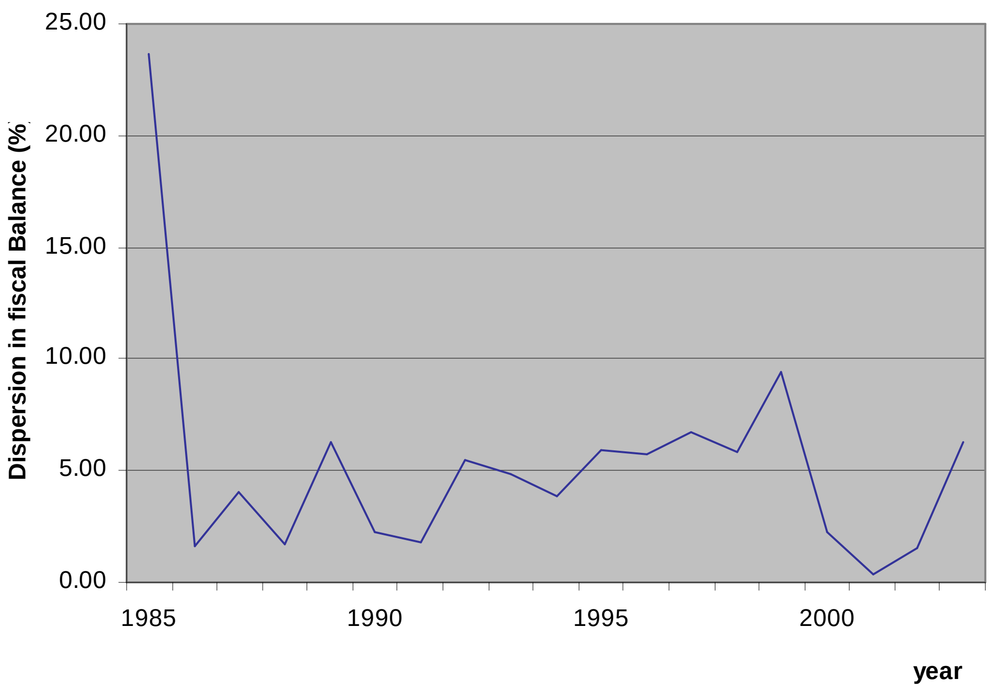
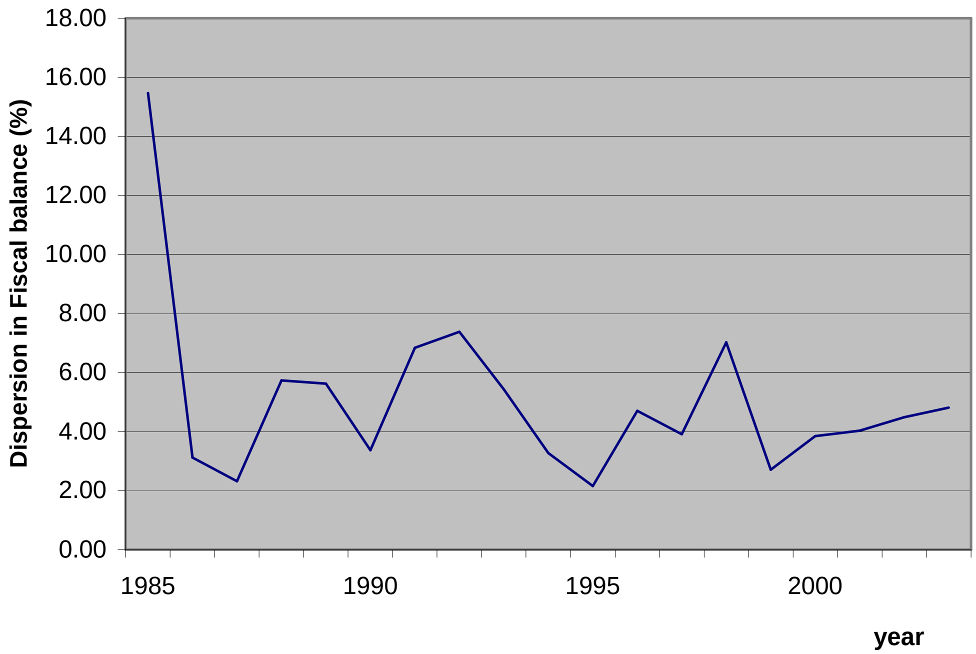


Figure 3.5 Dispersion (standard deviation) of fiscal balance across UEMOA countries, 1985-2003



IV. Concluding remarks

In conclusion, the income convergence analysis shows that there is very little evidence of convergence among countries in the various RECs, except in UEMOA. However, with more stringent testing based on economic growth theories, a very slow pace of convergence of per capita incomes could be seen. At that rate, unless there was a major structural shift, it will take more than half a century for most REC economies to converge and thus attain one of the expected outcomes of regional integration initiatives in Africa. The main contribution of the paper is the comparative analysis among the different regional economic groupings in Africa. Our study shows that the main challenge in terms of regional integration in Africa is the gap between the political commitment and the reality of the process itself. This has an important implication in terms of economic policy on the need to take into account the diversity of the local economic situation in building the regional cooperation initiative.

Appendix 1: Methodology – overall econometric strategy

The econometric strategy reflects the composite definition of convergence that has been provided in the literature. The chapter has considered three main approaches. To fix ideas, let *x* be a generic economic variable, *i* a generic country in the region, *t* a generic point in time (i.e. a year).

Analysis of cross-country dispersion

Define the standard deviation of *x* across countries in the region at time *t* as σ_t. Then one way to assess convergence is to see whether σ decreases over time. A formal test involves estimating the regression:

(1) $\sigma_t = \alpha + \varphi T_t + \varepsilon_t$

where *T* is a time trend, ε is a disturbance, and α and φ is the parameters to be estimated. Convergence requires the estimated φ to be significantly negative. Equation (1) can be estimated by pooled OLS. Henceforth this methodology to test convergence will be referred to as **sigma test** in the same way most of the literature considers it.

Unit root testing

Define the regional average of variable *x* as x_m. Then, define the time varying process $\delta_{it} \equiv x_{it} - x_{mt}$. In practice δ is the time varying difference between *x* in country *i* at time *t* and some regional reference value of *x* at the same time. A second way to assess convergence is to see whether this time varying difference exhibits any tendency to die over time. Formally, this requires estimating the following equation:

(2) $\delta_{it} = \phi \delta_{it-1} + \varepsilon_t$

and test the null hypothesis $H_0 : \phi = 1$. This is a standard test for a unit root. Rejection of the null implies that the series *x* is converging towards the reference value.

The unit root test can be run either country by country or for the pooled panel. In the first case, the test indicates whether each specific country is converging to the reference value. In the second case, the test indicates whether the group as a whole is converging towards the reference value. In this second case it is possible to keep individual heterogeneity into account by specifying the null as $H_0 : \phi_i = 1$ for all *i* against the alternative $H_1 : \phi_i < 1$, *i* =1, 2…M_1; $\phi_i = 1$, *i* = M_1 + 1, M_2 + 2…P (where P is the total number of countries in the region).

Even though it is obvious to define the reference value as the regional average, one can think of different references, i.e. the lowest (or highest, depending whether convergence to the top or to the bottom is desirable) value in the region, the average of the three lowest (or highest) values in the region, the target level established by convergence criteria.

The actual procedures for unit root testing are the DGLS unit root test of Elliot et al. (1996) and the panel unit root test of Im et al. (2003). Henceforth, this approach to testing convergence will be referred to as **unit root test**.

Analysis of cointegration

A third notion of convergence holds that two (or more) series converge if they share a common stochastic trend; that is, if they are cointegrated. Therefore, the test of convergence amounts to testing for cointegration in the equation:

(3) $$x_{i,t} = \beta_0 + \beta_1 x_{-i1,t} + \beta_2 x_{-i2,t} + ... + \beta_k x_{-ik,t} + \varepsilon_t$$

where *–i,n* (*n* = 1….*k*) denotes the countries other than *i* . Of course, equation (3) will include only those countries for which the series *x* is integrated of order 1. The determination of the order of integration will be done using the same DGLS unit root test applied for **unit root test** methodology.

A finding of *p*-1 cointegrating vectors, where *p* is the total number of countries (series) in the equation, will denote *full convergence*. A finding of less than *p*-1 cointegrating vectors will denote *partial convergence*; that is, some of the countries are converging and some are not. If no cointegrating vector is identified, then this will be evidence that countries are not converging at all.

The test of cointegration will follow Johansen (1991). Henceforth, this way of estimating convergence will be referred to as **cointegration test.**

Shocks symmetry and business cycles convergence

This section applies the **cointegration test** to quarterly bilateral real exchange rate data to assess the degree of shocks convergence in the region. Shocks convergence is typically regarded as a necessary condition for a regional to constitute an optimal currency area. Because of limited data availability, other methods for estimating shock convergence (i.e. structural VAR, output detrending) are hardly applicable. The cointegration test applied to the real exchange rates is a valuable alternative.

The rationale for this test follows the G-PPP hypothesis of Enders and Hurn (1994): if the real exchange rates between countries share a common stochastic trend, then it means that their fundamentals co-move and hence that they are affected by somewhat symmetric shocks.

The cointegration test can be integrated by additional quantitative information concerning the depth of trade integration in the region, the correlation of terms of trade across countries and their volatility/dispersion, the degree of flexibility of prices and wages, and the extent of labor mobility across the borders.

Appendix 2. Convergence Tests

Table A2.1: Sigma tests results for macroeconomic variables

Series	SADC	COMESA	ECOWAS	CEMAC	UEMOA
1. Inflation (Quarterly)					
Coeff. of time	-0.429*** (5.445)	-0.759*** (-12.723)	-0.422*** (-13.710)	-0.067*** (-4.420)	-0.410*** (-10.178)
R-squared	0.304	0.710	0.746	0.211	0.618
DW	0.250	0.586	0.567	1.261	0.534
2. Fiscal Balance (Annual)					
Coeff. of time	-0.372*** (-3.437)	-0.121 (0.976)	-0.328*** (-3.898)	-0.234 (-1.117)	-0.179 (-1.490)
R-squared	0.410	0.053	0.472	0.068	0.115
DW	2.295	2.168	1.019	1.493	1.618

***Significant at 1%; **significant at 5%; *significant at 10%

Appendix 3: Unit root tests

Table A3-1: Unit Root Tests for SADC Individual country series deviation from regional mean.

	Inflation (Quarterly: 1987Q1-2004Q2)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Angola	-	-	-2.538**	-
Botswana	-0.960	-1.279	-1.383	-
Congo, D.R.	-	-	-	-
Lesotho	-1.019	-0.991	-4.310***	-
Madagascar	-2.617***	-2.974*	-1.421	-
Malawi	-3.140***	-3.351**	-3.260***	-
Mauritius	-1.487	-2.653	-1.984**	-
Mozambique	-	-	-2.078**	-
Namibia	-3.623***	-3.676**	-2.642**	-
South Africa	-1.128	-1.234	-2.524**	-
Swaziland	-2.235**	-2.429	-	-
Tanzania	-0.509	-4.746***	-1.993**	-
Zambia	-2.176**	-2.511	-3.308***	-
Zimbabwe	-	-	-3.434***	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A3-2: Unit root tests for COMESA individual country series deviation from regional mean.

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly 1987Q1-2003Q4)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Angola	-	-	-2.613**	-
Burundi	-1.196	-2.379	-3.189***	-
Comoros	-	-	-5.245***	-
DRC	-	-	-	-
Egypt	-3.135***	-3.201**	-	-
Ethiopia	-0.667	-2.386	-2.749***	-
Kenya	-2.579**	-3.496**	-3.063***	-
Madagascar	-1.476	-2.275	-1.726*	-
Malawi	-2.532**	-3.262**	-3.404***	-
Mauritius	-1.536	-3.504**	-2.064**	-
Namibia	-3.003***	-3.937***	-2.974***	-
Rwanda	-1.576	-3.524**	-	-
Seychelles	-0.262	-2.567	-	-
Sudan	-	-	-	-
Swaziland	-1.901**	-3.756***	-	-
Uganda	-0.084	-0.774	-2.808***	

Zambia	-2.113**	-2.419	-3.212***	-
Zimbabwe	-	-	-2.336**	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A3-3: Unit Root Tests for ECOWAS Individual country series deviation from regional mean.

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]					
	Per Capita Income (Annual: 1980-2003)		Inflation (Quarterly:1988Q3-2004Q4)		Fiscal Balance[b] (Annual:1985-2002)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Benin	-0.189	-	-	-	-	-
Burkina Faso	-0.921	-	-2.646**	-4.393***	-	-
Cape Verde	1.816	-	-1.085	-1.935	-3.29***	-
Cote d'Ivoire	-0.789	-	-2.151**	-3.543**	-1.86*	-
Gambia	-1.693*	-	-1.831*	-2.473	-1.03	-
Ghana	-1.495	-	-4.179***	-4.256***	-1.99**	-
Guinea-Bissau	-1.188	-	-1.623*	-3.973***	4.120***	-
Guinea	-	-	-	-	-	-
Liberia	-0.682	-	-	-	-	-
Mali	-0.424	-	-1.861*	-2.421	-3.96***	-
Niger	-0.968	-	-2.010**	-4.239***	-3.68***	-
Nigeria	-1.750*	-	-2.762***	-3.224**	-	-
Senegal	-1.608*	-	-1.096	-4.622***	-5.06***	-
Sierra Leone	-0.118	-	-1.882*	-2.306	-2.37**	-
Togo	-2.079**	-	-1.420	-2.412	-2.61**	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A3-4: Unit Root Tests for CEMAC Individual country series deviation from regional mean.

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly: 1984Q2-2002Q4)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Cameroon	-3.405***	-4.668***	-4.320***	-
CAR	-2.301**	-3.444**	-	-
Chad	-2.813***	-3.432**	-	-
Congo, Rep	-	-	-2.932***	-
Eq. Guinea	-	-	-	-
Gabon	-5.326***	-4.839***	-3.177***	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A3-5: Unit Root Tests for UEMOA Individual country series deviation from regional mean.

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly: 1988Q3-2004Q4)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend + Intercept	Intercept	Trend + Intercept
Benin	-	-	-	-
Burkina Faso	-2.281**	-3.986***	-	-
Côte d'Ivoire	-2.036**	-2.969*	-3.188***	-
Guinea Bissau	-1.489	-3.787***	-3.978***	-
Mali	-2.087**	-3.835***	-2.659**	-
Niger	-0.868	-3.074*	-4.037***	-
Senegal	-1.810*	-3.249***	-3.921***	-
Togo	-2.811***	-3.914***	-2.670**	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A3-6. Unit Root test results on pooled observations (series deviation from regional mean)

Series	Im, Pesaran and Shin W-Stat (Ind'l unit root process) [a]				
	SADC	COMESA	ECOWAS	CEMAC	UEMOA
1. Inflation					
Intercept	-2.498*** (0.006)	-5.668*** (0.000)	-3.253*** (0.000)	-7.090*** (0.000)	-3.113*** (0.001)
Intercept + Trend	-4.616*** (0.000)	-5.005*** (0.000)	-5.938*** (0.000)	-7.381*** (0.000)	-5.693*** (0.000)
2. Fiscal Balance					
Intercept	-4.260*** (0.000)	-4.921*** (0.000)	-6.410*** (0.000)	-10.192*** (0.000)	-6.547*** (0.000)
Intercept + Trend	-3.746*** (0.000)	-6.219*** (0.000)	-4.930*** (0.000)	-8.335*** (0.000)	-8.054*** (0.000)

[a] Automatic selection of lag length based on Schwarz Information Criterion.
Values in the parentheses are probabilities.
***Significant at 1%; **significant at 5%; *significant at 10%

APPENDIX 4. COINTEGRATION TEST

Table A4-1: Cointegration test on SADC countries:

a. Unit root test on actual values

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly: 1987Q1-2004Q2)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Angola	-	-	-2.604**	-
Botswana	-1.286	-1.732	-1.560	-
Congo, D.R.	-	-	-	-
Lesotho	-1.437	-1.283	-2.792***	-
Madagascar	-2.122**	-2.191	-2.283**	-
Malawi	-3.331***	-3.490**	-3.563***	-
Mauritius	-1.327	-1.821	-1.680*	-
Mozambique	-	-	-2.080**	-
Namibia	-4.246***	-4.160***	-2.051**	-
South Africa	0.642	-2.444	-1.654*	-
Swaziland	-3.504***	-3.997***	-	-
Tanzania	-1.075	-2.515	-2.299**	-
Zambia	-2.056	-2.434	-3.712***	-
Zimbabwe	-	-	-3.706***	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10%
See MacKinnon (1996) for asymptotic critical values.

Table A4-1a: Cointegration analysis on per capita income of SADC countries[8]

a. SACU

Included observations: 22 after adjustments
Trend assumption: Linear deterministic trend
Series: BOTSWANA LESOTHO NAMIBIA SWAZILAND
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.615491	45.02579	47.85613	0.0900
At most 1	0.503526	23.99843	29.79707	0.2005
At most 2	0.304201	8.593487	15.49471	0.4043
At most 3	0.027533	0.614220	3.841466	0.4332

[8] Cointegration analysis on per capita income for all SADC countries is not possible due to insufficient data. Therefore, we use the sub-group of SACU and non-SACU countries.

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

b. Non-SACU

Included observations: 22 after adjustments
Trend assumption: Linear deterministic trend
Series: ANGOLA DRC MADAGASCAR MAURITIUS MOZAMBIQUE ZAMBIA ZIMBABWE
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.999605	372.9000	125.6154	0.0000
At most 1 *	0.987230	200.4701	95.75366	0.0000
At most 2 *	0.859424	104.5354	69.81889	0.0000
At most 3 *	0.767418	61.37130	47.85613	0.0017
At most 4	0.495655	29.28405	29.79707	0.0572
At most 5	0.440905	14.22516	15.49471	0.0770
At most 6	0.063085	1.433578	3.841466	0.2312

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-1b: Cointegration analysis on inflation of SADC countries

Included observations: 67 after adjustments
Trend assumption: Linear deterministic trend
Series: BOTSWANA LESOTHO MAURITIUS SER01 TANZANIA ZAMBIA
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.467772	125.5677	95.75366	0.0001
At most 1 *	0.391108	83.31191	69.81889	0.0029
At most 2 *	0.319774	50.07220	47.85613	0.0305
At most 3	0.225815	24.25512	29.79707	0.1899
At most 4	0.095763	7.106877	15.49471	0.5652
At most 5	0.005394	0.362394	3.841466	0.5472

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-1c: Cointegration analysis on fiscal balance of SADC countries

Included observations: 17 after adjustments
Trend assumption: Linear deterministic trend
Series: BOTSWANA MAURITIUS S_AFRICA
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.554320	21.82771	29.79707	0.3082
At most 1	0.273232	8.089105	15.49471	0.4559
At most 2	0.145024	2.663597	3.841466	0.1027

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-2: Cointegration test on COMESA countries

a. Unit root tests on Actual Values

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly 1987Q1-2003Q4)		Fiscal Balance[b] (Annual: 1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Angola	-	-	-2.602**	-
Burundi	-1.197	-1.589	-3.357***	-
Comoros	-	-	-4.745***	-
DRC	-4.611***	-4.665***	-	-
Egypt	0.159	-2.14	-	-
Ethiopia	-2.217**	-2.517	-3.025***	-
Kenya	-2.909***	-3.127**	-2.806***	-
Madagascar	-2.066**	-2.143	-2.283**	-
Malawi	-3.309***	-3.486**	-3.686***	-
Mauritius	-1.305	-1.866	-1.684*	-
Namibia	-4.175***	-3.203**	-2.054**	-
Rwanda	-3.406***	-3.525**	-	-
Seychelles	-3.118***	-2.493	-	-
Sudan	-	-	-	-
Swaziland	-3.606***	-4.001***	-	-

Uganda	-0.054	-0.840	-4.171***	
Zambia	-2.040**	-2.411**	-3.529***	-
Zimbabwe	-	-	-2.992***	-

[a]Automatic selection of lag length (maxlag=4 (annual series);=11(quarterly series) based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10%

Table A4-2b: Cointegration analysis on inflation of COMESA countries

Included observations: 66 after adjustments
Trend assumption: Linear deterministic trend
Series: BURUNDI EGYPT MAURITIUS UGANDA
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.415465	66.92641	47.85613	0.0003
At most 1 *	0.240070	31.48844	29.79707	0.0316
At most 2	0.115791	13.36950	15.49471	0.1019
At most 3 *	0.076428	5.247421	3.841466	0.0220

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Note: The test is not possible for fiscal balance as all the series rejected the presence of unit root.

Table A4-3: Cointegration Tests for ECOWAS countries

a. Unit root tests on actual values

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly:1988Q3-2004Q4)		Fiscal Balance[b] (Annual:1985-2002)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Benin	-		-	-
Burkina Faso	-3.886***		-	-
Cape Verde	-1.185		-3.40***	-
Cote d'Ivoire	-3.526***		-1.41	-
Gambia the	-2.034**		-2.09**	-
Ghana	-3.856***		-2.11**	-
Guinea-Bissau	-1.395		-4.09***	-
Guinea	-		-	-
Liberia	-		-	-
Mali	-2.913***		-1.86*	-
Niger	-3.012***		-3.34***	-
Nigeria	-2.219**		-	-
Senegal	-2.853***		-4.02***	-
Sierra Leone	-1.804*		-2.13**	-
Togo	-1.864*		-2.274**	-

[a] Automatic selection of lag length based on Schwarz Information Criterion.
[b] Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A4-3b: Cointegration analysis on Inflation of ECOWAS countries

Included observations: 63 after adjustments
Trend assumption: Linear deterministic trend
Series: CAPE_VERDE GUINEABISS S_LEONE TOGO
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.353902	55.22179	47.85613	0.0087
At most 1	0.270783	27.70317	29.79707	0.0856
At most 2	0.093787	7.808803	15.49471	0.4861
At most 3	0.025147	1.604498	3.841466	0.2053

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-3c: Cointegration analysis on fiscal balance of ECOWAS countries

Included observations: 17 after adjustments
Trend assumption: Linear deterministic trend
Series: CIV MALI
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.471591	12.71034	15.49471	0.1259
At most 1	0.103971	1.866303	3.841466	0.1719

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-4: Cointegration results for CEMAC countries

a. Unit Root test on actual values

Country	Elliot-Rothenberg-Stock DF-GLS test-statistics[a]	
	Inflation (Quarterly: 1984Q2-2002Q4)	**Fiscal Balance**[b] (Annual:1985-2003)
	Intercept	Intercept
Cameroon	-2.311**	-2.180**
CAR	-3.624***	-
Chad	-1.759*	-
Congo	-	-2.802***
Gabon	-3.718***	-3.330***

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Note: No cointegration test for inflation and fiscal balance series. The presence of unit root is rejected in all countries except Chad (based on 5% critical value).

Table A4-5: Cointegration Tests for UEMOA countries

a. Unit Root test on actual values

Country	Elliot-Rothenberg-Stock DF-GLS test-Statistics[a]			
	Inflation (Quarterly: 1984Q2-2002Q4)		Fiscal Balance[b] (Annual:1985-2003)	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Benin	-	-	-	-
Burkina Faso	-3.887***	-3.897***	-	-
Côte d'Ivoire	-3.526***	-3.558**	-1.408	-
Guinea Bissau	-1.395	-4.572***	-4.090***	-
Mali	-2.913***	-3.268**	-1.858*	-
Niger	-3.012***	-3.236**	-3.316***	-
Senegal	-2.853***	-2.998*	-4.020***	-
Togo	-1.870*	-1.974	-2.275**	-

[a]Automatic selection of lag length based on Schwarz Information Criterion.
[b]Test critical values were calculated for 20 observations and may not be accurate for this particular series.
(-) means insufficient data.
***Significant at 1%; **significant at 5%; *significant at 10% . See MacKinnon (1996) for asymptotic critical values.

Table A4-5b. Cointegration analysis on the inflation series of UEMOA coutries

Included observations: 63 after adjustments
Trend assumption: Linear deterministic trend
Series: GUINEA_B TOGO
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.192736	17.43531	15.49471	0.0252
At most 1 *	0.060724	3.946693	3.841466	0.0470

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table A4-5c. Cointegration analysis on fiscal balance series of UEMOA countries

Included observations: 17 after adjustments
Trend assumption: Linear deterministic trend
Series: CIV MALI

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.473307	12.74771	15.49471	0.1244
At most 1	0.103026	1.848381	3.841466	0.1740

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

APPENDIX 6: List of countries under different RECs

I. Common Market for East and Southern Africa (COMESA)

1. Angola
2. Burundi
3. Comoros
4. Democratic Republic of Congo (DRC)
5. Djibouti
6. Egypt
7. Eritrea
8. Ethiopia
9. Kenya
10. Madagascar
11. Malawi
12. Mauritius
13. Namibia
14. Rwanda
15. Seychelles
16. Sudan
17. Swaziland
18. Uganda
19. Zambia
20. Zimbabwe

II. Economic Community of West African States (ECOWAS)

1. Benin
2. Burkina Faso
3. Cape Verde
4. Cote d'Ivoire
5. Gambia
6. Ghana
7. Bissau Guinea
8. Guinea
9. Liberia
10. Mali
11. Niger
12. Nigeria
13. Senegal
14. Sierra Leone
15. Togo

III. Southern African Development Community (SADC)

1. Angola
2. Botswana
3. DR Congo
4. Lesotho
5. Madagascar
6. Malawi
7. Mauritius
8. Mozambique
9. Namibia
10. South Africa
11. Swaziland
12. Tanzania
13. Zambia
14. Zimbabwe

IV. Central African Monetary and Economic Community (CEMAC)

1. Cameroon
2. Central Africa Republic
3. Chad
4. Congo
5. Equatorial Guinea
6. Gabon

V. West African Economic and Monetary Union (UEMOA)

1. Benin
2. Burkina Faso
3. Cote d'Ivoire
4. Bissau Guinea
5. Mali
6. Niger
7. Senegal
8. Togo