Why doesn't Regional Integration Improve Income Convergence in Africa?*

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Abstract:

This paper investigates why regional integration does not improve income convergence in Africa, despite the common goal of more open and freer trade. Based on empirical analysis using African countries data, the paper presents the evidence that there has been little progress in income convergence in Africa. The paper shows that despite the importance of regional integration there has been limited progress and prospects of the African integration process are not as promising as would be expected for such an important pillar in Africa's development agenda.

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I. Introduction

The purposes of regional integration in Africa are to promote political and economic cooperation. ECA (2006) in its seminal works assessing regional integration in Africa identified the various objectives driving African countries to join regional economic communities (RECs) within the continent. While these objectives are varied from country to country, and the weight ascribed to each also being variable across countries, the growth goal is key to each REC member. Thus, the desire to generate income growth dynamics through integration is not only common across the countries, but also the weight prescribed to it tends to be significant. It is therefore not a surprise that theoretical and empirical discourses present regional integration as a possible catalyst for income convergence. The idea of catch-up, which has been widely studied, presumes that cooperation that takes place between states in a regional integration framework would enable poor countries reach the level of incomes already attained by the richer countries that they are cooperating with. Europe is a good example and a realistic case study of how this cooperation in a regional integration framework has enabled once poor European states to become developed economies. The recent enlargement to reach 27 EU member countries and the clamour by new potential members is informed by the rapid growth experienced post-membership by countries such as Spain. In Africa, despite some progress of integration, the income convergence is still very low, as this paper shows.

This paper investigates why regional integration does not improve income convergence in Africa, despite the common goal of more open and freer trade. The paper discusses the link between the low-income convergence and the growth performance on the one hand and the little progress in regional integration process. Based on empirical analysis using African countries data, the paper presents the evidence that there has been little progress in income convergence in Africa. The paper shows that despite the importance of regional integration there has been limited progress and prospects of the African integration process are not as promising as would be expected for such an important pillar in Africa's development agenda.

The empirical basis for these observations rests on econometric analysis assessing the level and rate of convergence of the income convergence in African RECs. The empirical analysis is premised on the fact that one of the most important objective of integration attempts in Africa is to work towards the convergence of per capita incomes among the economies of countries participating in the integration efforts. With the efforts aimed at attaining convergence of per capita incomes at a higher equilibrium point. Consequently, a major emphasis of the paper is to assess any evidence of catching-up of per capita incomes across the integrating countries in each of the RECs under study.

As a contribution to the policy debate on African integration, and drawing on its empirical evidence, the paper argues that the limited progress in income convergence witnessed in Africa's regional integration processes is a result of weak growth performance. Therefore, in

order to have a strong basis for this link, the paper will present the general economic growth performance over the entire period that integration efforts have been in place in Africa. It follows this presentation with more REC-specific analysis of growth performance for each of the RECs selected. The paper firmly argues that in each of these RECs, the economic growth performance is such that besides the convergence being expected to take a long period of time, it will also likely be achieved at a lower equilibrium given that the richer economies in each of the RECs are also poor performers and smaller.

The paper further demonstrates that there is also a second explanation as to why regional integration does not improve income convergence in Africa. This second link is based in regional integration itself, whereby little progress has been made. Based on weak intra-REC trade flows; concentrated FDI flows; and weak intra-REC infrastructure.

This paper is structured as follow: Section 2 revisits the empirical evidence of income convergence in the context of the so-called conditional beta convergence. The section brings together studies and the various points of view on regional integration and income convergence. Section 3 then presents the empirical models used to estimate the income convergence in the various African RECs, and the realized results. Section 4 and 5 then relate the slow convergence results to the overall economic growth on the one hand and trade, foreign direct investments and infrastructure in Africa on the other. Section 6 concludes.

II. The Regional Integration and Income Convergence Hypothesis

a. Empirical evidences of income convergence

The intensive debate on whether or not poor nations grow faster than the rich ones started in the late 1980s. This was sparked by the empirical evidence of income convergence provided by Baumol (1986). Baumol found a strong inverse relationship between the initial labour productivity of the 16 rich industrial countries and their growth rates in 1870-1979 periods[1]. He then concluded that this is an evidence of income convergence, that is poor nations grow faster than the rich ones. However, De Long (1988) criticized this result and supposed that the conclusion of convergence was based on selection bias by including only few countries with high level of income and where data is readily available for that particular period. Delong's investigation of convergence including a wider group of countries failed to show any convergence at all. These studies attracted more debate in the literature and empirical results showed mixed results. The disparity in empirical results is believed to be due mainly to the different concepts and methodologies used in the different studies as argued in Darlauf (1995).

More evidences on income convergence, however, were provided by classic studies like Dowrick and Nguyen (1989), Barro and Sala-i-Martin (1991), Mankiw et al. (1992) and Islam (1995). Dowrick and Nguyen study established a significant evidence of convergence within the OECD countries in the postwar period. They found that this evidence of convergence is robust even when controlling for potential bias due to cyclical differences, different measures of purchasing power parity, potential errors in the backward projection of income levels, and sample selection biases. On the other hand, Barro and Sala-i-Martin (1991) found an ample evidence of convergence across states and regions within a country implying that poorer

regions within a country tend to grow faster than richer ones. This result was based on the per capita gross domestic product of the various states of America and from the different regions of seven European countries. Similarly, in their studies, Mankiw et al. (1992) provided strong evidence that supports income convergence hypothesis in the so-called homogenous group of countries such as the OECD countries. Moreover, Islam (1995) confirmed this evidence even by using a different econometric methodology using panel data. Further results from Caselli et al. (1996), which also improved on the econometric methodology, support the evidence of income convergence.

Generally, in many empirical studies, however, it is established that income convergence does not occur in a wider group of countries that are heterogeneous. Income convergence is likely to occur as the empirical studies have shown in a more homogenous group of countries, hence, the existence of convergence clubs.

b. Regional Integration, Growth and Income Convergence

There has also been empirical evidence of income convergence from different group of countries that form regional integration. It is therefore believed that regional integration not only promotes trade and economic cooperation but also is good for countries growth and development. Empirical studies suggest that regional integration has significant positive effect on growth (see for example Henrekson et al. 1997) and therefore it may be possible for poorer countries to catch up with the richer ones within the region. There are several explanations believed as to why regional integration is beneficial to a country's economic growth. Firstly, regional integration encourages capital and labor mobility within the region, which may lead to increase in output and labor productivity in the region. Secondly, trade agreements in some form of FTA or Customs Union benefits all countries involved through the increased volume of commodity traded within the region. Thirdly, regional integration helps diffusion of technology by the exchange of goods, ideas and knowledge which may lead the firms to develop technologies that are innovative on a global scale and not only new to the domestic market (Rivera-Batiz et al, 1991).

Regional integration and economic cooperation apparently benefited countries in European Community, East Asia and some countries in Latin America. Sohn and Lee (2006) found not only there is conventional beta-convergence among countries that established FTAs but also found that the trade liberalizing countries exhibit an accelerated income convergence in the sample of eight FTAs. For European countries, the empirical evidences of income convergence are found for example in Mankiw et al. (1992), Ben-David (1993) and Bunyaratavej et al. (2005). Ben-David examined the episodes of major postwar trade liberalization within specific groups of countries and found a strong link between the timing of trade reform and income convergence among countries (see also Ben-David 1996; and Ben-David and Kimhi 2004). Furthermore, European integration has resulted in significant growth improvements on its member countries more likely through technology transfer mechanism (Henrekson et al. 1997; and Okko 2003).

In East Asia, Sato and Zhang (2006) observed that its remarkable sustained economic growth was accompanied by the outward looking, export-oriented development strategy and its

spontaneous and rapid regional integration. The East Asian integration, however, is more of market driven phenomena and has occurred in the absence of formal institutional framework. Sato and Zhang (2006) found that the East Asian countries exhibit some business cycles synchronization and co-movements in real output variables in both short run and the long run, which may be interpreted as an implication of convergence in output. The income convergence in the ASEAN[2] and East Asian countries were supported by Heng and Siang (1999) and Njuguna and Rambaldi (2001).

Finally, a clear sign of productivity convergence was also found in the Mersocur[3] countries (Camarero et al. 2006). Camarero et al. explained that this evidence of productivity convergence is mainly the result from higher integration of the economies, through increased trade flows among the member countries. Similarly, Holmes (2005)[4] found a strong evidence of convergence among the member countries of the Central American Common Market (CACM)[5] in Latin America.

Although there seems to be much compelling evidence that regional integration leads to income convergence, some studies found contrary evidence and believe that there is no systematic relationship between trade openness and convergence. Among the most cited recent studies are Rodriguez and Rodrik (1999), Slaughter (2001) and Baldwin (2003). For example, Slaughter (2001), using a sample of developed countries and LDCs, finds no strong, systematic link between trade liberalization and income convergence. In contrast to the results of accelerated convergence among samples of FTAs presented in Sohn and Lee (2006), Slaughter suggests that if there is anything trade seems to have caused income divergence. On the other hand, Rodriguez and Rodrik examined and identified the weaknesses of some prominent empirical studies on the relationship between trade barriers and economic growth. They observed that it is relatively easy to come up with cases of regions of the world which have diverged or converged in ways unrelated to trade policy (Rodriguez and Rodrik 1999, p.35) and therefore casts doubts on whether there is a systematic relationship between trade liberalization and convergence (see also Milanovic 2006). Baldwin (2003) concluded that one must take caution in attributing any single economic policy, such as lowering of trade barriers, as being a sufficient government action for accelerating the rate of economic growth.

c. Measuring Income Convergence

Absolute and Conditional Convergence

The prediction of convergence across countries has been used as the main tests of the validity of the neoclassical growth model. Moreover, estimates of the speed of convergence across economies were thought to provide information on the key parameters of growth theory, that is the share of capital in the production function. However, the direct test of the so-called "beta convergence" where poor countries with little capital will grow faster than the rich ones with large capital stocks, failed to support the presence of convergence and therefore seen as an evidence against the neoclassical model (see Sala-i-Martin 1996 for exposition).

Sala-i-Martin (1996), however, argued that the neoclassical model prediction of convergence depends on the main assumption that "the only difference across countries lies in their initial

levels of capital". In reality, however, economies may differ in their levels of technology, their propensities to save, or their population growth rates. If different economies have different technological and behavioral parameters, then they will have different steady states. Therefore, an appropriate test of convergence is the so-called "conditional beta-convergence" instead of the absolute beta-convergence, since the prediction that poor economies should grow faster than the rich ones only holds if all economies converge to the same steady state. The conditional beta-convergence allows testing of convergence among countries with different steady states. One way to do this test is to hold constant the steady state of each economy by introducing a vector of other explanatory variables in the equation (Barro and Sala-i-Martin 1992; and Mankiw et al. 1992).

Suppose that *absolute* convergence holds for a group of countries i = 1, 2,…, N, a standard growth equation is given as (Barro & Sala-i-Matin, 1995):

$$\log(y_{it}) = a + (1-b)\log(y_{i,t-1}) + v_{it} \qquad (2.1)$$

where y_{it} is the income of the ith country, a and b are constants, with 0 < b <1, v_{it} is a disturbance term and t is time index. The condition b > 0 implies absolute convergence since the annual growth rate, $\log(y_{it} / y_{it-1})$, is inversely related to $\log(y_{it-1})$.

If the group of economies has different steady state positions, a vector of explanatory variables is added to equation (3.1). The conventional equation of growth model, which uses panel data, is given as (e.g. Islam 1995)[11]:

$$\log(y_{it}) = \eta_i + \beta\log(y_{i,t-1}) + \sum_{j=1}^{k}\pi_j \log(x_{it}^j) + \xi_t + u_{it} \qquad (2.2)$$

where y_{it} = per capita income

$\beta = e^{-\lambda\tau}$, λ = rate of convergence, τ = period

x_{it}^j = control/explanatory variables, j = 1, 2,…k

η_i = country-specific effect

ξ_t = period-specific constant

u_{it} = disturbance term

The group of countries is said to be experiencing conditional growth convergence if the condition, $0 < \beta < 1$, holds.

Sigma Convergence

An alternative measure of income convergence is the so-called "sigma convergence" or "σ-convergence". Sigma convergence states that the dispersion of real per capita income across a group of economies tends to fall over time. In other words, a group of economies are

converging in the sense of sigma, σ (standard deviation) if $\sigma_{t+T} < \sigma_t$, where σ_t is the time *t* standard deviation of $\log(y_{i,t})$ across i.

The concept of β-convergence and σ-convergence are not related. Barro and Sala-i-Martin (1995) showed that even if absolute convergence holds, the dispersion of per capita income does not necessarily tend to decline over time. The reason why the two concepts of convergence may not always show up together is that they capture two different aspects of the world. The σ-convergence relates to whether or not the cross-country distribution of world income shrinks over time while β-convergence, on the other hand, relates to the mobility of different individual economies within the given distribution of world income (see Sala-i-Martin 1996).

A formal test of sigma convergence to see whether income dispersion declines over time is to regress σ with the time trend. Convergence in per capita income holds if the coefficient of time is significantly negative.

Stochastic Convergence and Common Trends in Output

The definition of stochastic convergence is based on the concepts of unit roots and cointegration in time series econometrics. This notion of convergence was introduced by Bernard and Darlauf (1995) in their study of income convergence in the context of stochastic environment. In general, stochastic convergence tests whether the long-run forecasts of output differences tend to zero over time. If the output differences series is a mean zero stationary process then this definition of convergence will be satisfied. In order for countries i and j to converge, their outputs must be cointegrated with cointegrating vector [1, -1].

Bernard and Darlauf suggest that if countries do not converge in the strict sense of the above definition, they might still respond to the same long-run driving processes, that is, they may face the same permanent shocks with different long run weights. Countries i = 1, 2,…, N contain a single common trend if the long-term forecasts of output are proportional at a fixed time. In other words, countries i and j have a common trend if their output series are cointegrated with cointegrating vector [1, -α].

The Johansen multivariate tests of cointegration may be used to test for stochastic convergence assuming the output vector process has a finite-vector autoregressive representation as:

$$\Delta Y_t = \Pi_0 + \Pi Y_{t-1} + \Pi_1 \Delta Y_{t-1} + \ldots + \Pi_p \Delta Y_{t-p} + \varepsilon_t \qquad (2.3)$$

where Y_t = vector of per capita incomes

Π = matrix of coefficients

ε = disturbance term

In equation (2.3), the main interest is the rank of Π which is related to the number of cointegrating vectors. If the rank(Π) = N, then Y_t is a stationary process. If the rank(Π) is 0

< r < N, there are r cointegrating vectors for the individual series in Y_t and thus the group of countries is being driven by (N – r) common shocks. If the rank(Π) = 0, there are N stochastic trends and the long-run output levels are not related across countries. For individual output series to converge, there must be (N – 1) cointegrating vectors of the form (1, -1) or one common long-run trend.

III. The Income Convergence in African RECs: Limited Progress

Studies of income convergence for the African continent are few and so far there are very few that are specific to the continent's regional integration initiatives, that is, the various African regional economic communities (RECs). The results from the few income convergence studies for Africa at large, however, is also mixed. The earlier study of Ghura and Hadjimichael (1995) found that there is evidence of conditional convergence of per capital income in the group of 29 Sub-Saharan African countries during the 1981-92 period. However, the evidence was characterized by a slow income convergence of two percent per annum, which usually exemplified a diverse group of countries. On the other hand, using time series stochastic convergence, McCoskey (2002) showed that income disparity in the region at large did not show any tendency to fall overtime. McCoskey claimed that the lack of convergence in Sub-Saharan Africa might be due to the huge intra and inter-regional differences among the countries considered.

This study investigates income convergence in African RECs using the three notions of convergence discussed above. In particular, this study will examine whether income convergence has occurred in the different regional communities in Africa that form regional integration. It is believed that regional integration promotes trade and free movement of labor and capital and thus, has positive effect on growth. Therefore, as in other regions of the world, an income convergence is expected to occur in the African RECs, where poor countries grow faster than the rich countries. The various RECs included in the study are the Southern African Development Community[6] (SADC), Common Market for Eastern and Southern Africa[7] (COMESA), Economic Community of West African States[8] (ECOWAS), Central African Monetary and Economic Community (CEMAC)[9], West African Economic and Monetary Union[10] (UEMOA).

a. Absolute and Conditional Beta-convergence

The first notion of convergence considered in this study is the beta-convergence as discussed above. This study adopts the procedure described in Caselli et al. (1996) in estimating the relationship described in equation (2.2). Caselli et al. used a generalized method of moments (GMM) to address simultaneously the problems of correlated individual effect and endogenous explanatory variables that result to inconsistent estimates, which characterized many growth studies.

Following Caselli et al., the differenced version of equation (2.2) was estimated thereby eliminating the country-specific effects. Both the levels and the first differences of the

dependent variables and the explanatory variables are used as instruments described in Yasar et al. (2005). For each REC, a panel data was used consisting of four observations for each country that is, five-year non-overlapping average from 1981-2000 period. Using the set-up of five-year spans is believed to be less influenced by business cycle fluctuations and less likely to be serially correlated than they would be in an annual data (Islam 1995). Moreover, the time-specific effects may also have minimal effects and thus may not be relevant.

For the estimation of conditional convergence this study limits its explanatory variables to the ones included in the standard growth model that is, x_1 is savings (as proportion of GDP) and x_2 is the sum of population growth rate (n), rate of labor-augmenting technological progress (g) and the rate of depreciation of physical capital (δ). As in most studies of growth convergence, $g + \delta$ is assumed to be equal to 0.05. The restricted version of the model, where the coefficient of savings is theoretically equal and with opposite sign of the growth rates variable, is also estimated. Table 3.1 shows the estimated results for the absolute and conditional beta-convergence coefficients among the various African RECs. Table 3.2 indicates the estimated length of time to eliminate half (50%) of the initial income gap and how long will it take to close those income gaps. Due to lack of sufficient observations, beta-convergence was not estimated for CEMAC and UEMOA.

Southern African Development Community (SADC)

The regression results for beta-convergence indicate some evidence of income convergence among the 14 SADC countries. The coefficients of the lag of income (beta-coefficients) in all equations are significantly positive and less than unity. However, the coefficients of the control variables, π_1 for savings and π_2 for growth rates, are not significant. The result gives a convergence rate of 19 percent for absolute convergence and 17 percent for conditional convergence both from the unrestricted and restricted equations. According to the absolute convergence results, this would mean that it will take four years[12] to eliminate half of the initial income gap among the SADC countries but it would take at least 24 years to close these income gaps (Table 3.2). On the other hand, results from conditional convergence also imply four years to do away with the half of initial income gap among the SADC countries and at least 27 years to catch up.

An interesting result with the SADC countries is that the rate of convergence obtained under the conditional income convergence criteria is close to the absolute rate of convergence. This means that whichever way one was to look at it, whether SADC countries are converging to a unique steady state or each of the economies is converging to its own steady state, it would take roughly the same time.

Common Market for Eastern and Southern Africa (COMESA)

The results from Table 3.1 also show some evidence of income convergence for 17 (out of 20) COMESA countries included in the study. Djibouti, Eritrea and Uganda are not included in the study due to insufficient data. The estimated results for COMESA countries show a slightly higher convergence than the 14 countries in SADC. The beta coefficients in all equations are positive and less than unity. However, the beta-coefficients in the conditional convergence equations are only weakly significant. Again, the coefficients of savings and the

growth rates are not significant. The results imply 22 % rate of absolute convergence, 28 % rate of convergence from the unrestricted conditional convergence model and 22 % rate of convergence from the restricted model. For both absolute and conditional convergence, these results means that it will take three years to eliminate half of the initial income gap among the member countries but it would take at least 21 years for the income gap to disappear.

Table 3.1: Estimated results for income convergence among African RECS.

Estimated Equations	SADC	COMESA	ECOWAS
A. Absolute Convergence			
β	0.391***	0.341**	--
	(2.89)	(2.39)	
Implied λ	0.188	0.216	--
R^2	0.35	0.25	--
B. Conditional Convergence (Unrestricted)			
β	0.424**	0.278*	0.701***
	(2.78)	(1.81)	(2.80)
π_1	0.128	0.066	0.304**
	(1.12)	(0.58)	(2.36)
π_2	0.148	0.275	0.088
	(0.82)	(1.53)	(0.46)
Implied λ	0.172	0.256	0.071
R^2	0.47	0.55	0.61
B. Conditional Convergence (Restricted)			
β	0.421**	0.326*	0.585*
	(2.63)	(1.78)	(2.05)
$\pi_1 - \pi_2$	0.032	-0.050	0.229
	(0.41)	(-0.53)	(1.59)
Implied λ	0.173	0.224	0.107
R^2	0.35	0.27	0.42
Wald-test for restrictions (p-value)	0.29	0.19	0.06
No of countries included	14	17	15
No of observations	56	68	60

Note: Values in parentheses are t-statistics. (--) means estimates are not economically plausible.
***Significant at 1%; **significant at 5%; *significant at 10%.

Table 3.2 Estimated Length of Time (years) for Absolute and Conditional Convergence.

Gap/Period	SADC	COMESA	ECOWAS
a. Absolute			
50 %	4	3	--
99 %	24	21	--
b. Conditional (Restricted)			
50 %	4	3	7
99 %	27	21	43

Source: Authors' Calculations.

Economic Community for West African States (ECOWAS)

Like SADC and COMESA, the results show some evidence of convergence for ECOWAS countries. The estimation results show that the beta-coefficients in the conditional convergence model are significantly greater than zero but less than one, which is the requirement for income convergence. It is also noted that the coefficient of ratio of savings to GDP (π_1) is positive and highly significant. For ECOWAS group, however, the results for absolute convergence are not economically plausible.

The rate of conditional convergence for ECOWAS countries is much lower than SADC and COMESA. The rate of conditional convergence for the unrestricted model is 9 % and 11 % for the restricted model (Table 3.1). These results would mean seven years to cut half of the initial income gap among the members of ECOWAS and it will take at least 43 years to close almost all the gap in income among the member countries.

Annual growth rates vs. initial income

The robustness of the results for absolute and conditional convergence may be compared by assessing the growth behavior relative to the initial income of the countries in each RECs under study. As a rule, if there were convergence in income, one would expect to confirm that the countries with low initial per capita income are growing faster than the countries with higher initial per capita income. The plots of the average annual growth rates against the log of initial per capita incomes of the respective RECs countries are presented in Appendix A. The expectation, if there were convergence, would be to see a clear possibility of fitting a negatively sloped line in the group of countries' plots.

For SADC countries the negative slope or the inverse relationship between the growth in per capita income and the initial income is somewhat hard to establish with certainty. However, there seems to be a tendency for some poor countries to grow faster than the rich ones. Looking closely at Figure A.1, it is evident that some countries with initially low per capita incomes, namely, Mozambique, Lesotho and Swaziland are growing faster than Angola,

Namibia, South Africa, Zambia, and Zimbabwe whose incomes were initially high. Malawi is also growing faster than Congo Democratic Republic, Madagascar and Zambia whose initial incomes were higher. Botswana, and Mauritius are the exceptions. These two countries happen to have started with high income in 1980 (but below South Africa) and have sustained higher economic growth than the other countries in SADC.

Figure A.2 shows the plot of the log of the 1981 per capita income of COMESA countries against their average annual growth in 1981-2003. Again, the negatively sloped line is not very obvious. For most countries, the differences in growth are not large. Countries like Burundi, Comoros, Ethiopia, Kenya, Madagascar, Malawi, Rwanda and Zambia concentrate in the same area of low-income growth. The Democratic Republic of Congo is even showing an average annual growth of below zero. The countries with initial low per capita income are not growing any faster than those whose per capita income were initially high such as Angola, Egypt, Namibia, Mauritius and Seychelles. However, the economic growth in Angola, Namibia, Seychelles and Zimbabwe has slowed down. Only countries like Sudan and Swaziland are growing significantly higher than Angola, Namibia, Seychelles and Zimbabwe whose per capita income were initially high. Egypt and Mauritius may be seen as an exception where it started with higher per capita income but sustaining higher growth than rest of the COMESA countries. Hence, the results of relative faster convergence in COMESA may be due to low-income growth in most of its member countries.

In the ECOWAS countries, there is also a tendency of several countries like Benin, Burkina Faso, Gambia, Ghana, Mali, Nigeria, Senegal and Togo to grow at almost similar level (Figure A.3). Although, Benin, Gambia, Senegal, Nigeria and Togo have higher initial per capita income level than the others. It may be observed that income growth in Cote d'Ivoire, which is the richest in ECOWAS in terms of initial per income in 1980, has slowed down. Moreover, Liberia and Sierra Leone, which have relatively high initial incomes, have also slowed down in growth and are below zero. Cape Verde is one country in ECOWAS, which has relatively high income and was able to sustain it over time. Limited per capita income convergence is therefore apparent.

Figure A.4 plots the relationship between the initial per capita incomes in 1985 and the average annual growth in 1985-2003 of the CEMAC countries. In the figure, if Equatorial Guinea is to be eliminated in the plot, a negative sloping line may fit the data points. If there were convergence, Chad and Gabon were the main drivers. Chad that is originally poorest in 1985 is growing faster than Cameroon, Congo and Gabon whose initial incomes are relatively higher. Gabon, which is the richest in 1985, has slower income growth. It may also be observed that Cameroon has slightly higher growth than Congo whose income was higher in 1985.

Finally, the countries in UEMOA are more compact in terms of their economic growth and income (Figure A.5). There seems to be an apparent convergence in income in this REC where countries with low initial per capita incomes are growing faster than those with high initial per capita incomes. A negative sloping line may pass through Burkina Faso, Mali and Togo and Côte d'Ivoire. All other countries in UEMOA are growing faster than Côte d'Ivoire, which has the highest initial per capita income in 1980. Hence, there seems to be an obvious income convergence happening among UEMOA countries, although this was not statistically tested

b. Dispersion in per capita income in RECs

By looking at the dispersion of income within each REC, one can make an observation whether the disparity of income among the member countries has tendency to fall over time. Here, the dispersion is measured by the income deviation (standard deviation) of each country from the regional mean or average. If there were convergence within each REC, the expectation would be that the standard deviation or the dispersion of the per capita incomes would be reducing over time. Table 3.3 shows the computed standard deviations of per capita incomes in each REC from 1980-2003. Moreover, a plot of these sets of standard deviations against time is shown in Figure 3.1.

More formally, a regression of income standard deviation with time trend was estimated for each REC. The results are presented in the Appendix B.

SADC

Contrary to the expectations of income convergence, Table 3.3 and Figure 3.1 tell a different story of convergence among the member countries of SADC. According to the results income disparity among the SADC countries is increasing rather than decreasing over time. This implies no income convergence is occurring among the SADC countries in terms of their income distribution. In 1980, SADC per capita standard deviation is US$ 976 but in 2003 this standard deviation has increased to US$ 1,425—a clear divergence in income. Figure 3.1 provides the visual for this divergence in income from 1985 up to 2003. The sigma test of convergence through the regression of the standard deviation with time (Appendix B) also confirmed that there is divergence in per capita income in the group. The coefficient of the time trend is found to be positive, although not statistically significant.

Table 3.3 Standard Deviation of Per Capita Income (In constant US$, 2000=100) among RECs.

RECs	1980	1985	1990	1995	2000	2003
SADC	975.9	932.9	1042.4	1116.8	1286.9	1425.1
COMESA	-	1082.9	1372.7	1514.0	1904.9	1777.7
ECOWAS	219.7	217.3	210.8	244.9	286.9	299.2
CEMAC	1895.4	1786.7	1622.5	1644.0	1563.6	1531.9
UEMOA	253.8	208.5	179.4	160.2	173.7	159.6

Source: Authors' calculation.

COMESA

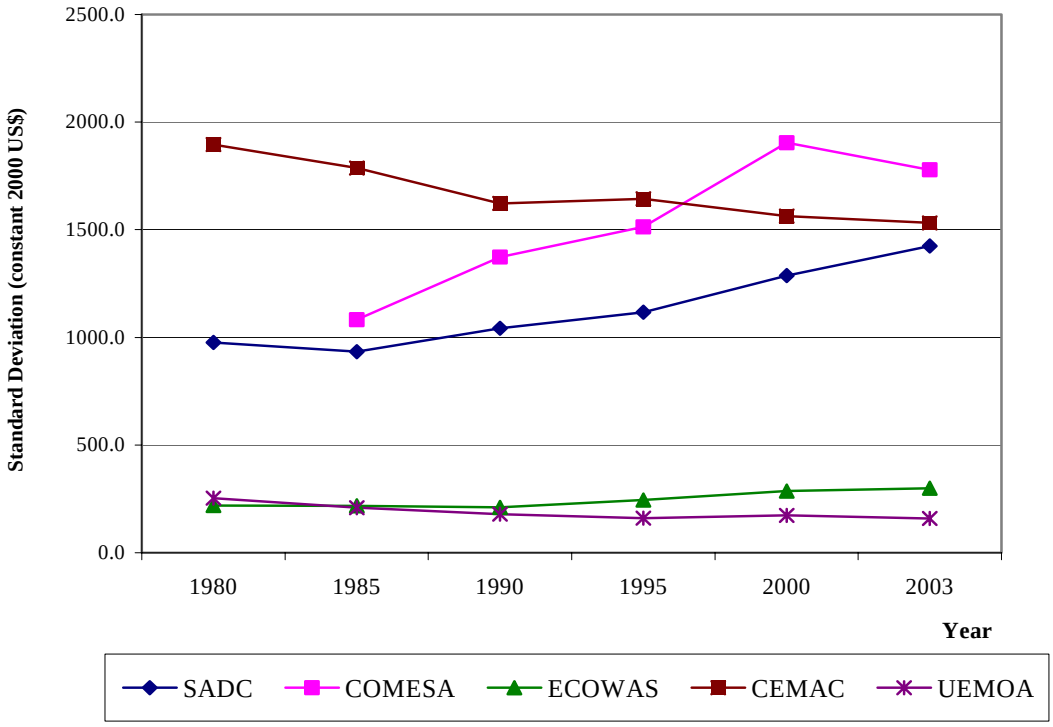
Similar to the case of SADC countries, the income disparity among COMESA countries remains high and increasing. Table 3.3 showed that in 1985 the per capita income standard deviation among COMESA countries is US$1,083 and this increased to US$1,778 in 2003 (see

also Figure 3.1). Clearly, the shape of the income distribution in the COMESA countries became wider over time. The disparity of income in COMESA becomes the highest among African RECs under study in 2003. Hence, there is more evidence of divergence in per capita income in COMESA rather than convergence. The sigma test also confirmed this result with the positive and highly significant coefficient of the time trend (see Appendix B).

ECOWAS

The income distribution in ECOWAS countries is much narrower than SADC and COMESA as shown by its smaller per capita income standard deviation (Table 3.3). The average income disparity in ECOWAS started to decline in 1985 and 1990, but it picked up an upward trend again in 1995 up to 2003. The sigma test on ECOWAS income dispersion also showed a significant positive trend, which implies some divergence rather than convergence in income (see Appendix B).

Figure 3.1. Plot of Standard Deviation of Per Capita Income among African RECs



CEMAC

The income disparity among CEMAC countries in 1980 is the highest among the African RECs under study (Figure 3.1). However, this disparity is declining over time but remains remarkably high. In 1980, the CEMAC per capita income standard deviation is USD 1895 but it reduces to USD 1532 in 2003, an indication that income disparity is somewhat declining over time (Table 3.3). The sigma test on the income standard deviation regressed on time

showed a negative coefficient showing a prospect of income convergence among the CEMAC countries. However, this coefficient is not statistically significant (see Appendix B).

UEMOA

The plot of income dispersion across UEMOA countries shows a very strong tendency for income convergence. Figure 3.1 indicates a generally decreasing trend in the income deviation of UEMOA countries over time. Moreover, the income disparity in UEMOA is the lowest among the African RECs and much smaller in magnitude. The UEMOA's per capita standard deviation reduces to USD 160 in 2003 from USD 254 in 1980. The result of the sigma test showed that the coefficient of the time trend is negative and weakly significant reaffirming the tendency income convergence among UEMOA countries.

c. Stochastic Income Convergence

Income convergence in the African RECs is also investigated using the concept of stochastic convergence. In this context, income convergence holds if the differences in incomes tend to zero over time. In other words, if the income differences series is a mean zero stationary process then convergence is evident.

As mentioned earlier, the Johansen multivariate cointegration tests were used to investigate convergence since the number of cointegrating vectors is directly related to the presence or absence of convergence. Firstly, the income variables in each RECs were tested for stationarity. Only those series that are I(1) are included in the cointegration tests[13]. For cointegration tests, each income series has 24 observations, covering a period from 1980 to 2003.

The results of stationary tests showed that all income variables in SADC are I(1) or nonstationary, except Malawi and South Africa, which rejected the presence of unit root at 5 % significant level. Due to insufficient number of observations, however, the countries cannot be analyzed as one group. Therefore, an alternative is to group SADC countries into SACU and non-SACU countries. The SACU countries in this analysis include Botswana, Lesotho, Namibia and Swaziland. The cointegration tests using both the trace and maximum eigenvalues statistics showed no cointegration among the SACU countries, which implies that the incomes are not related across countries and therefore there is no evidence of stochastic convergence (See Appendix C).

Similarly, for the non-SACU countries namely, Angola, DR Congo, Madagascar, Mauritius, Mozambique, Zambia and Zimbabwe, there is also no strong evidence of convergence. However, the cointegration tests showed that this group of countries is driven by (N – 4) common stochastic trends.

In ECOWAS countries, all income variables except Nigeria rejected the presence of unit root at 5 % significant level. Again, to analyze the stochastic income convergence in ECOWAS, the countries were divided into UEMOA and non-UEMOA countries. The non-UEMOA countries are Cape Verde, Gambia, Ghana, Liberia and Sierra Leone. For both UEMOA and non-UEMOA countries, the cointegration tests showed no evidence of stochastic income

convergence. Both groups of countries are being driven by more than one long-run common trend.

In case of CEMAC, the presence of unit root was only rejected for the income series in Cameroon. As in the other RECs, there was no evidence of stochastic per capita income convergence found in CEMAC countries.

IV. Slow convergence in African RECs due to weak growth associated with low growth in factor intensities and low TFP

Based on the empirical evidence from among the African RECs; there is very little evidence of income convergence in spite of integration being expected to enable the African countries to hasten the convergence in their per capita income. The previous section has clearly indicated that there is only limited income convergences that are found in beta-convergence at best, and that a significant amount of time will be required in each of the RECs for complete convergence to be attained. What then explains this slow speed towards income convergence in African RECs?

Sachs and Werner (1996) alluded to the possibility that little convergence among African countries is due to their slow growth. They went further to argue that this is due to the lack of and a result of limited investment, which provides only slow accumulation of capital. Empirical studies have showed that Africa's productive activity depends more on labour rather than capital and total factor productivity. Africa lacks technology to push growth. This is in line with Baumol (1986) observation that the poorer less developed countries have benefited to a relatively small degree from the public good properties of the innovations and investments of other nations partly due to product mix and education. Baumol also noted that a less developed country that produces no cars for instance, cannot benefit from the invention and adoption of a better car-producing robot in Japan, (although such a country does benefit to a lesser degree from new textile and rice-growing technology), nor can it benefit from the factor-price equalization effect of the accompanying Japanese investments, since it cannot shift labor force out of its (nonexistent) auto industry as the factor-equalization theorem's logic requires. Lack of education and the associated skill's prevent both the presence of high-tech industries and the effective imitation (adoption) of the Japanese innovation.

In this section, weak growth is discussed as one possible explanation for the slow income convergence in Africa. But the slow growth is dependent on the evolution of factor intensities and contribution of total factor productivity (TFP). In explaining the income convergence in the OECD countries, Dowrick and Nguyen (1989) investigated extensively what might explain convergence by looking at the growth in the factor intensities and catch-up in total factor productivity of member countries. Although, Dowrick and Nguyen, found a compelling evidence that convergence in OECD is driven by technology catch up, in this study, we similarly argue that it is the lack of capital and employment deepening and low TFP that have slowed down convergence in the African countries despite the benefits of strong positive growth that are expected from regional integration. Using the growth accounting results from Ben Hammouda et al. (2006), this paper demonstrates that in each of the African RECs, there

have been low capital and employment deepening and low growth in the TFP resulting in weak output growth and which might go to explain the lack of progress in income convergence.

The growth accounting results for each of the RECs under study are presented in the Appendix D. The empirical results in the previous section indicated some progress in CEMAC and UEMOA but very limited progress in the other three RECs. Generally, there has been positive contribution of factor accumulation in the growth of output in most of CEMAC countries. But there is no dominance by any of the two factors across the sub-region. In the Central African Republic for instance, the labour intensity contributed more than capital deepening. On the other hand, in the Republic of Congo, until the last half of the 1990s, capital deepening contributed more to growth than labour. But for our purposes in this paper, it is not the share of the contribution that matter, but the trend of the contribution, as a proxy for changing factor intensities. In this perspective, it is evident that across the CEMAC countries, there has been stagnation in the contribution of labour to income growth, implying lack of any labour deepening. Capital deepening is also not prominent in the sub-region. Except for Equatorial Guinea where there is significant contribution of capital, in the other countries, there is sort of stagnation in capital deepening. There is clearly lack of a distinct positive trend from early years to the most present period, which would be reminiscent of capital deepening.

What then can one deduce regarding the factor intensities in CEMAC with respect to their role in growth and by extension income convergence? The first observation is that labour productivity on its own has not improved in a way that as the years of integration efforts passed it contributed more to income growth. As such, lack of improvement in labour productivity could have limited the sub-region's income convergence. The second observation is that the stagnation and in most cases very small role in the contribution of capital is synonymous to lack of investments at the country and regional level. This then leaves what role TFP could have played. Unfortunately, in CEMAC, in no member country was a positive TFP contribution realized over the period covered in this analysis. And the result that the contribution of TFP was negative for most CEMAC countries in the 1990s, a period when integration efforts were meant to be intensive, further strengthens the notion that weak growth factors have played a major role in the lack of convergence of incomes in the REC. Except for Equatorial Guinea, all the other CEMAC countries registered a deterioration in the contribution of TFP in output growth, in spite of the regional integration process. As a result, CEMAC growth has remained weak and has failed to catalyse reasonable convergence in the REC's per capita incomes.

In COMESA where incomes have also not converged, it is evident that the factor intensities have not played the role they would have been expected to play. Across the countries in this REC, there have been mixed results in terms of the contributions of labour and capital. Contribution of labour has improved only in one-quarter of the members (Madagascar, Namibia, Rwanda and Swaziland). In the other member countries, contribution of labour to income growth has either remained stagnant or deteriorated as in the cases of DRC Congo, Malawi, Mauritius, Sudan, Ethiopia and Sudan. Labour productivity has therefore failed to be a catalyst for income convergence in the REC. A similar observation can be made for the capital deepening with majority of the COMESA countries having failed to register improvements in the contribution of capital to growth. This means capital accumulation, an

important contributor to output growth has not been catalytic in inducing income convergence in COMESA. As a result, COMESA countries have on average experienced weak growth insufficient to accelerate the rate of income convergence. Poor contribution of TFP in the growth of the COMESA countries has meant that no meaningful income convergence could occur. Except for Malawi, Mauritius and Uganda, all the other COMESA countries more or less experienced a negative role of TFP in their output growth.

ECOWAS countries appear to have depended mainly on labour to drive their growth. However, the accumulation and productivity of this labour has remained the same over the years and across the countries. This is despite of half of the ECOWAS countries being members of UEMOA, which was seen to have registered some limited progress towards income convergence. In fact, there has been no change in the growth dynamics of ECOWAS and the structure of the contributions of the two factors has remained the same. This implies that there have been little investments that would have been expected to contribute to factor accumulation. Lack of structural shift in the rate of factor accumulation explains the failure of the REC to experience factor intensity driven growth of a significant nature. This is further confirmed by the clear result showing that for a significant number of countries in ECOWAS, including Cape Verde, The Gambia, Liberia, and Sierra Leone, the contribution of capital has a negative sloping trend line. Even though, one would expect from an integration process that is working to support sustainable higher output growth and narrow the income gaps, to see the small and poor economies deepen their capital. Unfortunately, as the factor intensities of these small countries show, this has not been the case in ECOWAS. Neither has this been helped by the lack of capital deepening in the region's largest economy; Nigeria, whose growth attributed to capital accumulation, appears to have been on a declining trend.

Segregating UEMOA countries from the rest of ECOWAS, empirical analysis, especially through the absolute convergence measure shows that income for this REC has been converging, albeit at a low equilibrium. The results for UEMOA are instructive of the challenges of regional integration in that while income convergence is a desired outcome in terms of aiding policy coordination, convergence at a low level of income is not an optimal outcome that RECs in Africa would desire. It is therefore evident that there could be other factors that could be driving income convergence in UEMOA, since labour contribution and capital deepening results are not any different for this REC when compared with the other RECs in the continent. And this explanation could be the contribution of TFP. On average, the contribution of the TFP to growth in GDP in UEMOA countries has been positive when compared to the non-UEMOA ECOWAS countries. The output growth in Benin, Burkina Faso, Guinea Bissau and Senegal, all members of UEMOA benefited from a positive contribution of TFP.

The SADC sub-region empirical results indicated that rather than convergence in incomes being realized, divergence is taking place in absolute sense. A close examination of the sources of growth in this REC indicates that there has been no structural change in the rate of contribution of the factor intensities. This in itself is telling given the theoretical and empirical evidence that developing countries can maximize growth from factor accumulation and achieve more rapid rates if they can exploit innovation. This observation notwithstanding, it is important to highlight that individual success stories as in the case of Botswana have served to up the ante in the race towards income convergence. Botswana's growth is an exception in that not only did the country realize sustained capital deepening, but its growth rate has also

been significant. Furthermore, capital deepening has played a proportionately larger role in the output growth than in other countries in SADC. In the remaining SADC countries, other than Namibia, they have all had their output growth driven by labour, yet labour productivity has not changed in a significantly sufficient manner to have an impact on the rate of growth especially in the poorer economies in the REC. Moreover, in some of the SADC countries, there has been negative contribution of capital to output as indicated for DRC Congo and Zambia.

And like in the other RECs, SADC has also witnessed weak output growth. The low growth has therefore failed to contribute towards income convergence in the REC. Among the SADC countries, Botswana, Madagascar, Malawi and Mauritius realized reasonable positive contribution of TFP to growth. Unfortunately, this might have played more into the divergence of the per capita incomes, driven by Botswana and Mauritius while the weak growth in the other SADC countries made this more prominent.

What can be generalized from the above analysis with respect of factor intensities role in the income convergence patterns of African RECs? In all the RECs, there have been few countries that have experienced a consistent positive contribution of TFP in their growth. It is also evident from the analysis that none of the African RECs studied has been able to register significant structural change in the contributions of factor intensities to output growth at individual countries level that would have enabled the poor countries' incomes to converge to those with higher incomes. Coupling the weak factor intensities and low TFP, it is not surprising that output growth at individual country level and across the RECs in general have remained weak.

V. Little Progress in Regional Integration

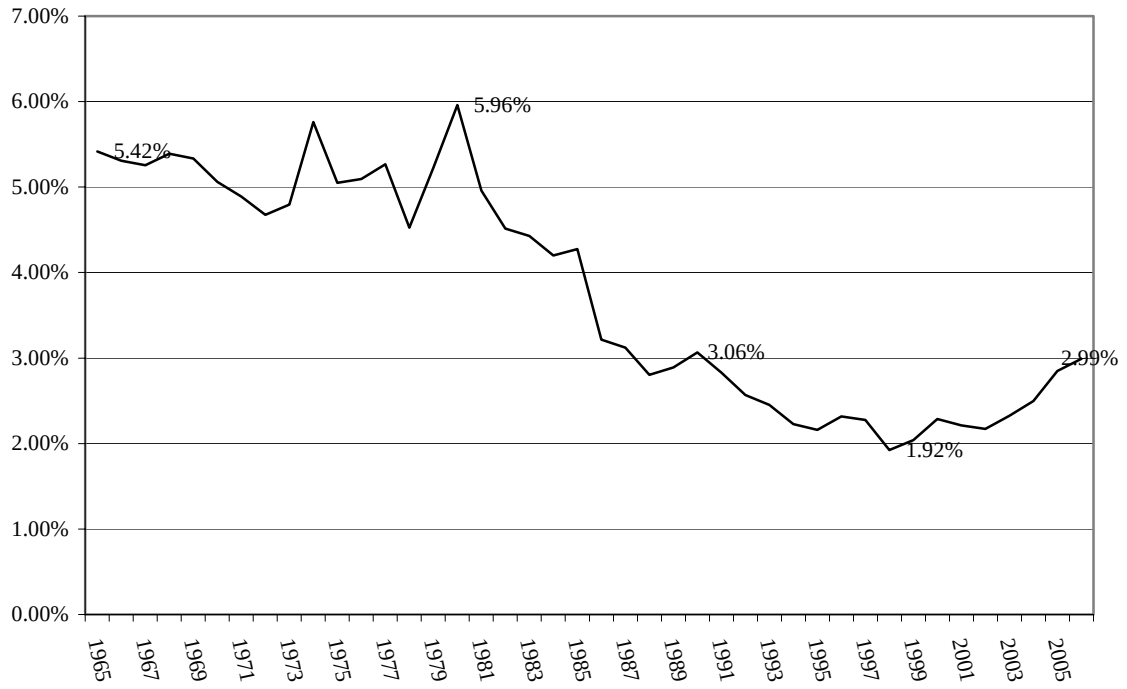
a. Weakness of intra-African Trade

Africa's share in World exports has only been rising marginally and remains close to historic lows. As exemplified in Table 5.1, Africa's share of world total exports reached around 3 percent in 2006. Albeit, somewhat higher than its lowest record in 1998 of about 2 percent. Nonetheless, this figure remains way below the level of the 60's and 70's of about 5 percent. Africa remains a marginal player in world trade.

Unfortunately, African regional trade integration also remains low. Table 5.2 shows that intra-African trade accounted for just less than 10 percent of the continent's total export. Between 1996 and 2005, Africa's world exports have grown faster than the trade within the continent. CEMAC appears to be the least integrated among the African RECs, where their export to the rest of the world grows much faster than its trade within the region. West Africa (ECOWAS), Southern Africa (SADC) and East Africa (COMESA) are somewhat more integrated since there is only marginal difference between the growth of their total world exports and their intra-regional export trade. In ECOWAS, its exports to the rest of the world and its intra-region export trade grew at a similar rate. UEMOA, a custom union and monetary union of eight Western African states performed better both in terms of integration with more than 12 percent of intra-regional trade and a relatively higher growth of intra-regional export trade.

However, even for UEMOA, the level of intra-regional trade is much lower compared to other regions (over 70% within the European Union).

Table 5.1. Africa's share of total world export (per cent)



Unfortunately, the intra-African regional trade is dominated by only few countries, which trade few commodities. In Sub-Saharan Africa (excluding South Africa), for example, only five countries –namely: Côte d'Ivoire, Ghana, Kenya, Nigeria and Zimbabwe provide about three-quarters of all intra-African exports. The export commodities being traded within the intra-Africa region are basically of primary products in nature. Petroleum alone accounts for more than 30 per cent of this exchange, while cotton, live animals, maize and cocoa add another 18 per cent. To a lesser extent, fresh fish, vegetables, tea and sugar are also traded within the region. Manufactured goods account for only about 15 per cent of the intra-African export trade as noted in the 2007 Economic Report on Africa (ECA 2007). In order to foster diversification and enterprise development, as well as regional stability, African countries need to step up their efforts in favor of regional trade integration. Tariffs have to be effectively minimized if not eliminated in the areas where it is well pronounced. Other barriers, such as deficient physical and institutional infrastructures also need to be reviewed.

Table 5.2. Intra African Trade

	Africa (All Regions)	CEMAC	COMESA	ECOWAS	SADC	UEMOA
Average share of intra-regional trade (1996-2005), in percent	9.56	1.56	6.01	9.17	10.17	12.32
Average annual intra-regional export growth (1996-2005), in percent	9.0	7.0	11.0	13.0	7.0	10.0
Average annual growth of total exports (1996-2005), in percent	12.0	17.0	14.0	13.0	9.0	8.0

Source: UNCTAD Handbook of Statistics

b. Weakness of FDI

Many African countries have already done a lot of efforts to create a more business-friendly environment to promote local investment as well as foreign direct investment. Moreover, these countries have made impressive progress towards improving domestic economic and political stability. Foreign direct investment (FDI) in Africa, which makes an important contribution to the economic development of the continent, has only increased modestly in the recent years. Indeed, as indicated in Table 5.3, the region's inflows of FDI are remarkably lower than most developing countries particularly from East Asia and Latin America regions. However, it should be noted that in 2005 there was a big boost in FDI flows to the Sub-Saharan Africa. Net inward FDI flows to the Sub-Saharan Africa reached an all-time high of 17.6 billion dollars.

According to UNCTAD (2006), the rapid increase in FDI flows to the region was due to high commodity prices and rising corporate profits. As in the previous years, a large percentage of FDI inflows to the sub-region in 2005 went only to a few countries. South Africa tops the list with inflows of 6.3 billion dollars, followed by Nigeria and Sudan. In North Africa, the main recipients of FDI are Egypt and Morocco. The large FDI inflow to South Africa was due largely to the acquisition of a bank (ABSA) in South Africa by Barclays Bank, United Kingdom, of about 5 billion dollars. It is also interesting to note that FDI inflows into Sub-Saharan Africa in 2005 were mainly invested in the oil and gas sector, although there were few investments in services, particularly in the banking sector. As in the previous years, Sub-Saharan Africa continues to face difficulties in attracting significant FDI inflows into the manufacturing sector, reflecting largely the lack of diversification of their production structures, low human capital base, and poor infrastructure. (Ben Hammouda and Osakwe 2007).

Table 5.3: Net Inward Foreign Direct Investment Across Regions (US$, Billions)

Group	1997	1998	1999	2000	2001	2002	2003	2004	2005
All developing countries	168.7	172.4	183.3	168.8	176.9	160.3	161.6	211.5	237.5
East Asia and Pacific	62.1	57.8	50.8	44.3	48.5	57.2	59.8	64.6	65.3
Europe and Central Asia	24.6	27.4	29.8	30.2	32.7	34.9	35.9	62.4	75.6
Latin America and the Caribbean	66.7	74.1	88.3	79.3	71.1	48.2	41.1	60.8	61.4
Middle East and North Africa	2.1	2.7	2.4	4.1	3.4	3.7	5.6	5.3	9.1
South Asia	4.9	3.5	3.1	4.4	6.1	6.7	5.6	7.2	8.4
Sub-Saharan Africa	8.3	6.9	9.0	6.5	15.0	9.5	13.6	11.3	17.6
Angola	0.4	1.1	2.5	0.9	2.1	1.7	3.5	1.4	1.5
South Africa	3.8	0.6	1.5	1.0	7.3	0.7	0.8	0.6	6.3

Source: *Global Development Finance* (2006)

VI. Conclusion

This paper investigates why regional integration does not improve income convergence in Africa. This paper discussed basic fundamental issues that may have accounted to the slow income convergence in the African RECs. Firstly, the slow convergence is generally associated with the slow output growth in many African countries. This weak growth in output is further dependent on the slow accumulation of factors of production and low total factor productivity (TFP). The paper demonstrated that in general, most African countries fail to acquire higher capital and deepen employment. Moreover, the contribution of TFP to production is low (in most cases, negative), characterizing inefficient production technology.

Secondly, the slow convergence in income may also be attributed to the failure of the African RECs to improve intra-regional trade. Aside from the fact that Sub-Saharan Africa has only minimal contribution to the world trade, the intra-Africa trade was also marginal. The regional integration in Africa was not able to increase the volume of commodity traded within

the region. It is also doubtful whether there are some significant mobility of labor and resources within each RECs.

Thirdly, the limited inflow of FDI in the region restraint the accumulation of capital that is essential to output growth. Moreover, the little investment coming into Africa is shared only by few countries. The other countries have to compete with this limited resource.

Given the above constraints, the success of African regional integration and narrowing down the differences in income seems to depend on how the countries in the region would be able to improve trade by opening borders among the neighboring countries, given the region's marginal share in the world trade. Although, formal institutional framework may help in facilitating regional integration, a lesson from the East Asian emerging countries suggests that a spontaneous and rapid regional integration is through market driven phenomena and sustained economic growth.

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Endnotes:

[1] These countries are Australia, United Kingdom, Switzerland, Belgium, Netherlands, Canada, United States, Denmark, Italy, Austria, Germany, Norway, France, Finland, Sweden and Japan.

[2] The members ASEAN countries are Indonesia, Malaysia, Philippines, Singapore and Thailand.

[3] The member countries of Mercosur are Argentina, Brazil, Argentina, Paraguay and Uruguay. These countries started as an FTA in 1991 and later developed into a customs union (CU) in 1995.

[4] Holmes (2005) used an alternative method non-traditional method that is the principal component analysis to investigate convergence.

[5]The CACM was created in 1960 by a treaty between Guatemala, Honduras, Nicaragua, El Sa;vador, and later Costa Rica.

[6]The SADC countries are Angola, Botswana, DR Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[7]The member countries in COMESA are Angola, Burundi, Comoros, DR Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

[8]The ECOWAS countries are Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Bissau Guinea, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

[9]The CEMAC countries are namely: Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon.

[10]The UEMOA countries are Benin, Burkina Faso, Cotê d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo.

[11] This model with Cobb-Douglas technology is derived using a log-linear approximation of the behavior of a country's growth rate in the neighborhood of the steady state that is, $d \ln y_t / dt = \lambda[\ln y^* - \ln y_t]$ where λ is the rate of convergence and y^* is the steady state output (See e.g. Barro & Sala-i-Martin 1995, Ch. 1; and Njuguna 1999, Ch. 2).

[12] The time t for which $\log(y_t)$ is halfway between $\log(y_0)$ and $\log(y^*)$ satisfies the condition $e^{-\lambda t} = ½$ (see Barro and Sala-i-Martin 1995).

[13] The authors were not able to provide results for COMESA countries due to insufficient data.

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Appendix A. Plots of Average Annual Growth Rates VS. Log of Initial Per Capita Income

Figure A.1 Convergence of per capita income across SADC countries, 1980-2003

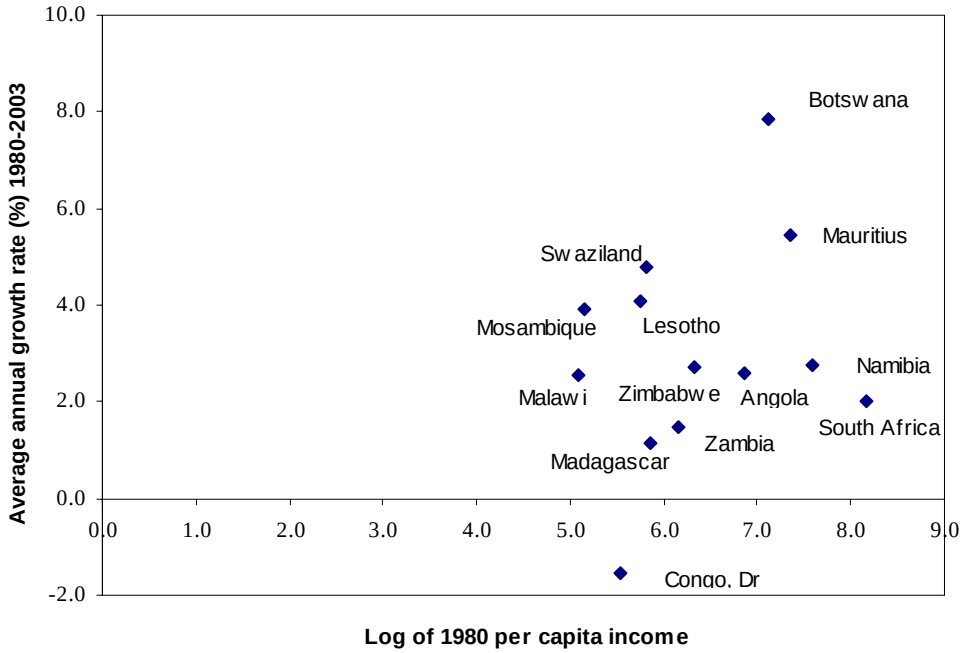


Figure A.2 Convergence of per capita income across COMESA countries, 1981-2003

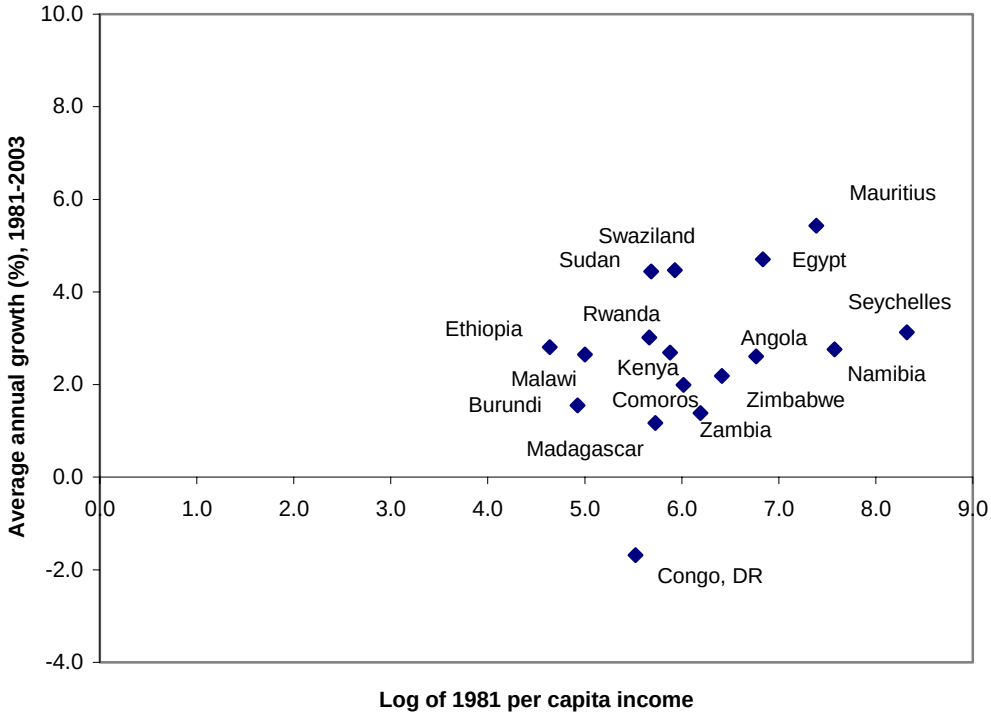


Figure A.3 Convergence of per capita income across ECOWAS countries, 1980-2003

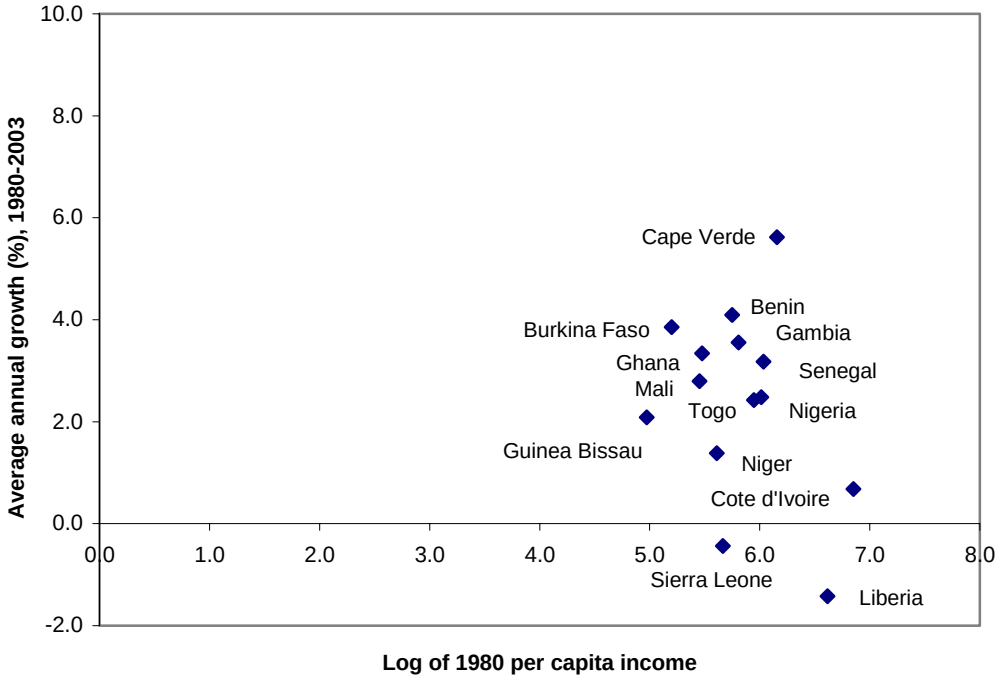


Figure A.4 Convergence of per capita income across CEMAC countries, 1985-2003

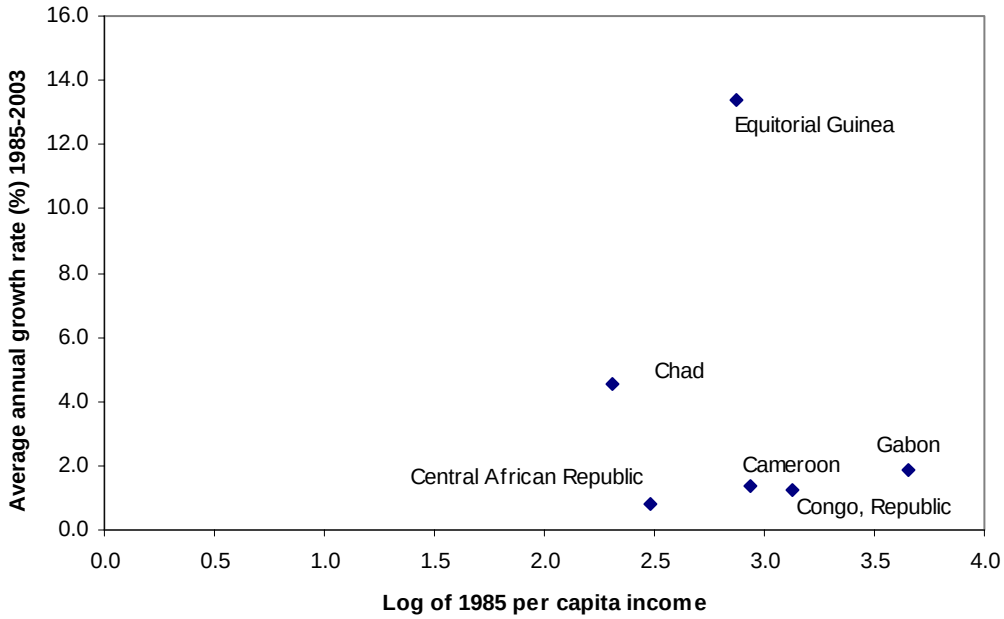
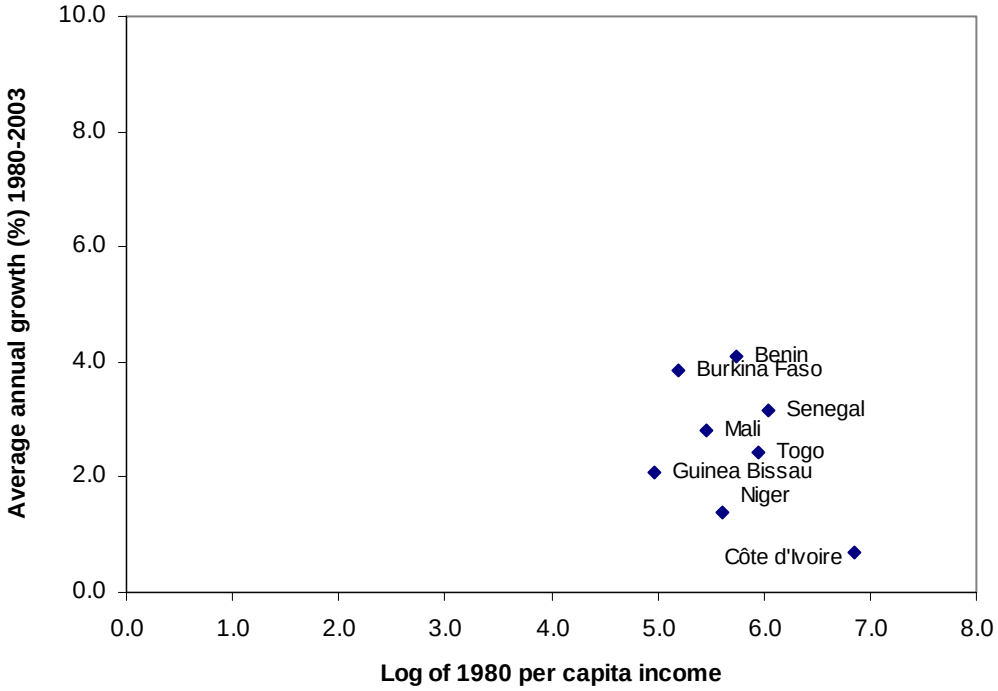


Figure A.5 Convergence of per capita income across UEMOA countries, 1980-2003



Appendix B

Table B.1 Sigma tests results for per capita income variables

	SADC	COMESA	ECOWAS	CEMAC	UEMOA
1. Per Capita Income (Annual)					
Coeff. of time (t-value)	56.53 (0.94)	47.25*** (11.27)	10.13* (1.85)	-8.79 (-1.16)	-1.93* (-1.65)
R-squared	0.98	0.98	0.98	0.53	0.95
DW	1.97	1.79	1.38	1.82	1.91

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

Source: Authors' calculations.

Appendix C. Cointegrating Analysis on Per Capita Incomes.

a.1 SADC (SACU)

Sample (adjusted): 1982 2003
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

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.615491	21.02736	27.58434	0.2746
At most 1	0.503526	15.40495	21.13162	0.2615
At most 2	0.304201	7.979267	14.26460	0.3808
At most 3	0.027533	0.614220	3.841466	0.4332

Max-eigenvalue 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

a.2 SADC (Non-SACU)

Sample (adjusted): 1982 2003
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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.999605	172.4299	46.23142	0.0000
At most 1 *	0.987230	95.93474	40.07757	0.0000
At most 2 *	0.859424	43.16410	33.87687	0.0030
At most 3 *	0.767418	32.08725	27.58434	0.0123

At most 4	0.495655	15.05889	21.13162	0.2848
At most 5	0.440905	12.79158	14.26460	0.0843
At most 6	0.063085	1.433578	3.841466	0.2312

Max-eigenvalue 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

b.1 ECOWAS (UEMOA)

Sample (adjusted): 1981 2003
Included observations: 23 after adjustments
Trend assumption: Linear deterministic trend
Series: BENIN BURKINA CIV GUINEAB MALI NIGER SENEGAL TOGO
Lags interval (in first differences):

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.964887	227.1531	159.5297	0.0000
At most 1 *	0.919343	150.1218	125.6154	0.0007
At most 2	0.681521	92.21814	95.75366	0.0854
At most 3	0.643296	65.90156	69.81889	0.0987
At most 4	0.559100	42.19201	47.85613	0.1534
At most 5	0.408370	23.35645	29.79707	0.2290
At most 6	0.350540	11.28434	15.49471	0.1946
At most 7	0.057302	1.357225	3.841466	0.2440

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.964887	77.03137	52.36261	0.0000
At most 1 *	0.919343	57.90363	46.23142	0.0019
At most 2	0.681521	26.31658	40.07757	0.6808
At most 3	0.643296	23.70955	33.87687	0.4769
At most 4	0.559100	18.83556	27.58434	0.4273

At most 5	0.408370	12.07211	21.13162	0.5405
At most 6	0.350540	9.927119	14.26460	0.2168
At most 7	0.057302	1.357225	3.841466	0.2440

Max-eigenvalue 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

b.2 ECOWAS (Non-UEMOA)

Sample (adjusted): 1982 2003
Included observations: 22 after adjustments
Trend assumption: Linear deterministic trend
Series: CAPE_VERDE GAMBIA GHANA LIBERIA SIERRA_LEONE
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 *	0.880785	106.8239	69.81889	0.0000
At most 1 *	0.810073	60.03376	47.85613	0.0024
At most 2	0.507118	23.48927	29.79707	0.2229
At most 3	0.286009	7.924574	15.49471	0.4735
At most 4	0.023053	0.513098	3.841466	0.4738

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.880785	46.79016	33.87687	0.0009
At most 1 *	0.810073	36.54450	27.58434	0.0027
At most 2	0.507118	15.56469	21.13162	0.2513
At most 3	0.286009	7.411476	14.26460	0.4417
At most 4	0.023053	0.513098	3.841466	0.4738

Max-eigenvalue 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

C. CEMAC

Sample (adjusted): 1982 2003
Included observations: 22 after adjustments
Trend assumption: Linear deterministic trend
Series: CENTRAL_AFRICAN_REPUBLIC CHAD CONGO GABON
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 *	0.831461	80.38502	47.85613	0.0000
At most 1 *	0.685324	41.21210	29.79707	0.0016
At most 2 *	0.430591	15.77547	15.49471	0.0454
At most 3	0.142651	3.386020	3.841466	0.0657

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.831461	39.17293	27.58434	0.0011
At most 1 *	0.685324	25.43663	21.13162	0.0116
At most 2	0.430591	12.38945	14.26460	0.0969
At most 3	0.142651	3.386020	3.841466	0.0657

Max-eigenvalue 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

APPENDIX D. Contribution of Output and Factors to Growth

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
CEMAC					
Cameroon	1981-1985	9.40	1.48	4.94	2.99
	1986-1990	-2.22	1.56	1.57	-5.35
	1991-1995	-1.86	1.79	-0.27	-3.38
	1996-2000	4.75	1.56	0.03	3.16
CAR	1981-1985	2.29	1.27	-0.42	1.44
	1986-1990	0.04	0.86	0.29	-1.12
	1991-1995	1.09	1.45	0.12	-0.49
	1996-2000	0.40	1.59	-0.31	-0.88
Chad	1981-1985	9.18	1.46	-0.12	7.84
	1986-1990	1.94	1.40	2.10	-1.56
	1991-1995	2.36	1.72	1.10	-0.46
	1996-2000	2.28	1.97	2.45	-2.14
Congo Republic	1981-1985	10.57	1.93	2.62	6.03
	1986-1990	-0.26	1.98	2.06	-4.30
	1991-1995	0.70	1.86	2.34	-3.50
	1996-2000	2.52	1.95	0.91	-0.34
Equatorial Guinea	1981-1985	..	4.16	3.28	..
	1986-1990	1.36	1.21	1.03	-0.88
	1991-1995	7.05	1.39	5.08	0.58
	1996-2000	35.74	1.61	11.42	22.72
Gabon	1981-1985	2.56	1.46	1.33	-0.24
	1986-1990	1.73	1.50	0.06	0.16
	1991-1995	3.13	1.49	0.09	1.55
	1996-2000	1.76	1.10	0.69	-0.02
COMESA					
Burundi	1981-1985	5.35	1.57	3.76	0.03
	1986-1990	3.73	1.59	1.88	0.25
	1991-1995	-2.23	1.33	1.03	-4.59
	1996-2000	-1.02	1.55	1.58	-4.15
Comoros	1981-1985	4.29	1.42	2.30	0.58
	1986-1990	1.62	1.51	1.52	-1.41
	1991-1995	0.89	1.73	1.44	-2.27
	1996-2000	0.97	1.71	0.00	-0.74
DRC Congo	1981-1985	1.86	1.46	1.63	-1.22

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
	1986-1990	0.01	1.57	0.71	-2.27
	1991-1995	-7.12	2.05	-1.83	-7.33
	1996-2000	-3.93	0.80	-1.89	-2.85
Ethiopia	1981-1985	..	1.67	1.20	..
	1986-1990	5.32	2.00	1.78	1.54
	1991-1995	1.53	0.99	0.61	-0.07
	1996-2000	5.27	1.36	1.76	2.15
Kenya	1981-1985	2.53	2.31	0.86	-0.64
	1986-1990	5.64	2.10	1.07	2.47
	1991-1995	1.61	2.14	0.86	-1.39
	1996-2000	1.79	1.90	1.01	-1.11
Madagascar	1981-1985	-1.55	1.38	-0.36	-2.58
	1986-1990	2.75	1.47	0.64	0.64
	1991-1995	-0.28	1.60	0.27	-2.15
	1996-2000	3.84	2.02	1.89	-0.08
Malawi	1981-1985	2.17	1.82	0.21	0.14
	1986-1990	2.32	1.83	-0.02	0.51
	1991-1995	3.52	0.78	-0.07	2.81
	1996-2000	3.92	1.28	-0.92	3.56
Mauritius	1981-1985	4.33	1.51	1.09	1.73
	1986-1990	7.39	1.31	2.66	3.42
	1991-1995	5.13	1.08	3.05	0.99
	1996-2000	5.27	1.01	2.55	1.70
Namibia	1981-1985	-0.19	1.15	1.34	-2.69
	1986-1990	2.68	2.33	0.48	-0.13
	1991-1995	4.96	1.83	1.50	1.62
	1996-2000	3.48	1.70	1.81	-0.03
Rwanda	1981-1985	2.68	2.10	3.82	-3.24
	1986-1990	1.50	1.81	1.98	-2.29
	1991-1995	-3.96	-1.48	0.61	-3.09
	1996-2000	9.80	4.32	0.94	4.54
Swaziland	1981-1985	2.61	1.61	4.26	-3.27
	1986-1990	11.15	1.62	3.32	6.21
	1991-1995	2.83	2.45	2.28	-1.90
	1996-2000	3.30	2.23	-0.77	1.84
Uganda	1981-1985	..	1.47	..	..

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
	1986-1990	5.09	2.10	0.28	2.72
	1991-1995	7.05	1.69	0.88	4.47
	1996-2000	6.49	1.42	2.18	2.90
Zambia	1981-1985	0.53	1.78	-0.70	-0.55
	1986-1990	1.64	1.71	-0.94	0.86
	1991-1995	-1.28	1.77	-1.37	-1.69
	1996-2000	2.84	1.64	-0.94	2.14
Zimbabwe	1981-1985	4.36	2.55	-0.07	1.88
	1986-1990	4.60	2.34	0.67	1.59
	1991-1995	1.39	1.33	1.79	-1.73
	1996-2000	2.07	1.18	0.27	0.62
ECOWAS					
Benin	1981-1985	4.66	1.44	2.73	0.50
(UEMOA)	1986-1990	0.89	1.55	1.86	-2.52
	1991-1995	4.25	1.76	2.36	0.13
	1996-2000	5.34	1.72	2.81	0.81
Burkina Faso	1981-1985	4.18	1.19	0.58	2.41
(UEMOA)	1986-1990	2.64	1.12	0.77	0.75
	1991-1995	3.84	1.14	0.73	1.97
	1996-2000	4.32	1.21	1.80	1.31
Côte d'Ivoire	1981-1985	0.32	1.96	1.34	-2.98
(UEMOA)	1986-1990	1.18	1.84	0.71	-1.37
	1991-1995	1.51	2.50	0.22	-1.21
	1996-2000	3.46	1.81	1.32	0.33
Guinea-Bissau	1981-1985	6.45	1.15	0.51	4.79
(UEMOA)	1986-1990	3.78	1.32	0.48	1.98
	1991-1995	3.18	1.76	0.48	0.95
	1996-2000	1.06	1.64	-0.65	0.07
Mali	1981-1985	-2.25	1.26	0.54	-4.05
(UEMOA)	1986-1990	3.86	1.52	3.66	-1.31
	1991-1995	2.99	1.30	2.16	-0.48
	1996-2000	3.88	1.37	1.66	0.85
Niger	1981-1985	-2.32	1.77	0.45	-4.54
(UEMOA)	1986-1990	2.60	1.78	-0.18	1.00
	1991-1995	0.81	1.78	-0.83	-0.14
	1996-2000	2.92	1.98	0.20	0.75

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
Senegal	1981-1985	3.23	1.56	-0.01	1.68
(UEMOA)	1986-1990	3.22	1.56	0.28	1.37
	1991-1995	1.53	1.55	0.71	-0.74
	1996-2000	5.30	1.50	1.59	2.21
Togo	1981-1985	-0.24	1.80	0.11	-2.15
(UEMOA)	1986-1990	2.51	1.59	0.92	0.00
	1991-1995	0.61	1.23	-0.46	-0.16
	1996-2000	2.29	2.02	0.27	0.00
Cape Verde	1981-1985	..	1.71	7.18	..
	1986-1990	3.50	1.97	2.66	-1.12
	1991-1995	5.23	2.07	2.10	1.07
	1996-2000	6.40	2.22	0.56	3.62
Gambia, The	1981-1985	3.23	1.87	3.99	-2.62
	1986-1990	4.10	2.50	1.02	0.57
	1991-1995	2.11	2.36	1.33	-1.59
	1996-2000	4.80	1.88	1.33	1.60
Ghana	1981-1985	-0.25	2.12	0.19	-2.57
	1986-1990	4.81	1.69	7.37	-4.25
	1991-1995	4.28	1.73	5.37	-2.82
	1996-2000	4.32	1.54	2.73	0.05
Guinea	1981-1985	..	1.07	..	..
	1986-1990	..	1.46	1.80	..
	1991-1995	3.74	1.40	2.15	0.19
	1996-2000	4.18	1.29	2.70	0.19
Liberia	1981-1985	-1.88	1.70	-0.28	-3.30
	1986-1990	-1.79	1.59	-1.24	-2.15
	1991-1995	-1.51	1.45	-1.72	-1.24
	1996-2000	-1.53	1.30	-1.98	-0.85
Nigeria	1981-1985	-2.75	1.70	2.83	-7.29
	1986-1990	5.42	1.55	0.85	3.02
	1991-1995	2.50	1.66	1.59	-0.75
	1996-2000	2.84	1.64	0.14	1.05
Sierra Leone	1981-1985	0.87	1.03	0.94	-1.10
	1986-1990	1.09	1.13	-0.26	0.23
	1991-1995	-5.05	1.44	-1.07	-5.42
	1996-2000	-3.33	1.37	-1.34	-3.35

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
SADC					
Angola	1981-1985	..	1.68	2.04	..
	1986-1990	3.28	1.11	0.35	1.82
	1991-1995	-3.78	1.61	1.67	-7.06
	1996-2000	6.46	1.61	3.14	1.72
Botswana	1981-1985	10.01	2.18	4.01	3.82
	1986-1990	11.87	2.04	5.35	4.47
	1991-1995	4.07	2.08	3.31	-1.33
	1996-2000	6.28	1.51	2.86	1.91
Congo, Dem. Rep. of	1981-1985	1.86	1.46	1.63	-1.22
	1986-1990	0.01	1.57	0.71	-2.27
	1991-1995	-7.12	2.05	-1.83	-7.33
	1996-2000	-3.93	0.80	-1.89	-2.85
Lesotho	1981-1985	3.16	1.22	4.26	-2.32
	1986-1990	5.86	0.79	3.61	1.45
	1991-1995	3.96	0.80	4.33	-1.17
	1996-2000	3.01	0.78	2.40	-0.17
Madagascar	1981-1985	-1.55	1.38	-0.36	-2.58
	1986-1990	2.75	1.47	0.64	0.64
	1991-1995	-0.28	1.60	0.27	-2.15
	1996-2000	3.84	2.02	1.89	-0.08
Malawi	1981-1985	2.17	1.82	0.21	0.14
	1986-1990	2.32	1.83	-0.02	0.51
	1991-1995	3.52	0.78	-0.07	2.81
	1996-2000	3.92	1.28	-0.92	3.56
Mauritius	1981-1985	4.33	1.51	1.09	1.73
	1986-1990	7.39	1.31	2.66	3.42
	1991-1995	5.13	1.08	3.05	0.99
	1996-2000	5.27	1.01	2.55	1.70
Mozambique	1981-1985	-4.62	1.12	1.12	-6.86
	1986-1990	5.62	0.27	1.65	3.70
	1991-1995	3.46	1.17	1.72	0.57
	1996-2000	7.98	1.31	3.55	3.12
Namibia	1981-1985	-0.19	1.15	1.34	-2.69
	1986-1990	2.68	2.33	0.48	-0.13
	1991-1995	4.96	1.83	1.50	1.62

COUNTRIES	Years	Growth in GDP	Contribution of Labour	Contribution of Capital	Contribution of Growth in Total Factor Productivity
	1996-2000	3.48	1.70	1.81	-0.03
South Africa	1981-1985	0.91	1.74	1.42	-2.25
	1986-1990	1.81	1.62	0.30	-0.11
	1991-1995	0.89	1.44	0.18	-0.73
	1996-2000	2.65	1.63	0.70	0.32
Swaziland	1981-1985	2.61	1.61	4.26	-3.27
	1986-1990	11.15	1.62	3.32	6.21
	1991-1995	2.83	2.45	2.28	-1.90
	1996-2000	3.30	2.23	-0.77	1.84
Tanzania	1981-1985	..	2.00	1.18	..
	1986-1990	..	1.97	1.86	..
	1991-1995	1.80	1.82	2.56	-2.58
	1996-2000	4.22	1.59	1.06	1.57
Zambia	1981-1985	0.53	1.78	-0.70	-0.55
	1986-1990	1.64	1.71	-0.94	0.86
	1991-1995	-1.28	1.77	-1.37	-1.69
	1996-2000	2.84	1.64	-0.94	2.14
Zimbabwe	1981-1985	4.36	2.55	-0.07	1.88
	1986-1990	4.60	2.34	0.67	1.59
	1991-1995	1.39	1.33	1.79	-1.73
	1996-2000	2.07	1.18	0.27	0.62

Source: Ben Hammouda et al. (2006)