

Macroeconomic Interdependence and Integration in Africa

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September 2007

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Abstract

There is a renewed interest in the debate on integration in Africa since the creation of the Africa Union in 2002. This study investigates the feasibility of a full-fledge union in Africa from an economic standpoint. Towards this goal, we examine both the contemporaneous and dynamic relations in the short- and long-run among six key macro variables- consumer price level, gross domestic product, consumption, investment, trade flows and government expenditures- in eight African countries. In the quarterly data from 1976 to 2005, we observe the existence of common trends in real output, price level, private consumption, government consumption, investment and trade flows among these eight countries. In addition, we also note that there exist common cycles in real output, investment and trade flows for these countries. These two critical findings indicate the existence of some macroeconomic interdependence among these countries. Thus, the chances for success of integration in Africa driven by these eight countries are appreciable.

Keywords: *Common Trend, Common Cycle, Cointegration, Africa.*

JEL Classification: *F15, E32, O55, C32, C52*

Macroeconomic Interdependence and Integration in Africa

1. Introduction

Macroeconomic interdependence has been defined in the 1960s as the “sensitivity of economic behavior in one country to developments in another” (Tollison and Willet, 1973). The presence of this interdependence can be argued as a rationale for creation of Regional Trade Agreements (RTAs). Crawford and Fiorentino (2005) report that 43 new RTAs were notified to the WTO between January 2004 and February 2005 alone. Furthermore, the secretariat of the WTO reports that by May 2003, over 265 RTAs have been notified to the WTO¹. It’s worth mentioning that 190 of these 265 RTAs are currently active and only 3 WTO member countries- Macau China, Mongolia, and Chinese Taipei- are not involved in any RTA. The most advanced form of RTA is the European Union (EU). In addition, the EU combined with the European Free Trade Association (EFTA) make Europe the most concentrated continent in terms of RTAs (Crawford and Fiorentino, 2005). Outside Europe, countries in all parts of the world have also formed RTAs. However, the African continent does not have a long history with RTAs with only five currently active RTAs.

African countries need to adopt policies that will create sustained economic growth to alleviate its problems of malnutrition, unemployment, inadequate health and education systems. Moreover, increased economic or regional integration will greatly decrease the potential risk for outbreak of war or political tensions among countries. Schiff and Winters (1998) show that trade can bring about peace. However, in order to engage into an economic cooperation framework

¹ Retrieved on May 18, 2005 on www.wto.org. Discussion paper “Regionalism: friends or rivals?”

careful studies must be conducted to understand the co-movements of the key macro-economic variables².

Africa's growth has not been uniform across the continent. As a matter of fact, humanitarian crisis in the Darfur region, famine in Niger, high level of corruption and political turmoil in Côte d'Ivoire and in Democratic Republic of Congo, and continued political crisis in Zimbabwe continue to undermine the development efforts in many parts of Africa.

Notwithstanding, there are some positive signs as well. For instance, inflation reached an all-time low, from the African standpoint, at 7.9 per cent despite high oil prices in 2004. Moreover, better fiscal and monetary policies are implemented as they are preconditions for debt reduction by multinational organizations and bilateral partners. In order to increase economic cooperation and to form a better performing RTA, we need to have a rigorous analysis about macroeconomic interdependence in these countries.

In this study, we investigate the co-movements or interdependence of six key macroeconomic variables in the long and short-run for eight African countries. The macro-variables considered are: price level (CPI); gross domestic product (GDP); consumption;

² The study of macroeconomic interdependence is not new. Mundell (1961) pioneered the optimal currency area theory (OCA)² that suggests conditions that need to be met for two or more countries for a successful monetary union (see McKinnon, 1963; Kenen, 1969). The more symmetric the shocks are, the more mobile and flexible the factor markets are, the higher the similarities and the intra-trade level are, the larger will be the chances of success in forming a monetary union. The formation of the EU has offered the ideal framework for scholars to test the OCA theory (see Bayoumi and Eichengreen, 1997; Kim and Chow, 2003). Macroeconomic interdependence has been crucial for the integration of financial markets as well (see Kodres and Pritsker, 2002; Sharma and Wongbangpo 2002). Selover (1999) focused his interest on the international transmission of business cycles in Asia. He studied the co-movements of business cycles between the Asian countries of Indonesia, Malaysia, Philippines, Singapore and Thailand, on the one hand, and among these countries and their key trading partners- the United States, Australia, Japan and the European Union- on the other hand and found supporting evidence of the existence of a single business cycle in Asia. Selover (2004) also examined the relationship between business cycles between Korea and Japan and found little impact of Japanese business cycles on Korean business cycles. Cubadda (2001) makes a general study of common cycles and common seasonal features of times series using U.K. data while Anderson and Moazzami (2003) shed light on the long-term and short-term movements of Canadian dollar exchange rate with respect to the US dollar. Hernandez (2004) examined the common cycles between the US and Mexico and found strong evidence that there were both common cycle and common trend between the Mexican and the US economies.

investment; government expenditure and trade flows. We divide Africa into four regions and picked two largest economies from each region, i.e., Egypt and Algeria from Northern Africa, Nigeria and Côte d'Ivoire from Western Africa, Kenya and Cameroon from Eastern and Central Africa, and South Africa and Angola from the Southern African region. Together, these eight countries (AFR-8, hereafter) out of 53 countries of Africa represent over 62 percent of the continent's GDP in 2003. Apart from Horvath and Grabowski³ (1997), to the best of our knowledge we do not find any study related to African economic integration⁴. We attempt to fill this gap. Not all African countries are alike and so is our choice of eight countries. Some are resource rich (for example Nigeria), while others are agriculture based (for example Kenya). It would be very interesting to see how these diverse groups of economies grow together.

In order to examine macroeconomic interdependence among these eight countries first (as a naïve method) we examine the correlation among these variables. Next, to investigate the dynamic behavior among the macro variables of the eight countries, we investigate the short run and long run co-movements in eight-price levels; in eight-gross domestic products; in eight-consumptions; in eight-investments; in eight-trade flows and in eight-government expenditures following Johansen (1988, 1991) and Johansen and Juselius (1990) and Vahid and Engle (1993). Note that some shocks are short-lived or transitory and only affect macro variables for a short period of time. On the other hand, other shocks are persistent (stay for a long time) and affect these variables for a long period of time. In the literature (see Engle and Kozicki, 1993, Engle and Issler, 1993 and Vahid and Engle 1993) these short-run co-movements are called common

³ They investigated the feasibility of integration in Africa but from a different approach using Mundell's optimal currency area theory.

⁴ Similar studies have been conducted for Western Europe (Horvath and Sharma, 1998), Latin America and the Caribbean (Engle and Issler, 1993; Grabowski and Horvath, 1999; Hecq, 2005) and the Indian Sub-continent (Sharma and Horvath, 1997).

cycles (serial correlation common feature) and long-run co-movements are called trends. Engle and Kozicki (1993) proposed the test-statistics to test for the number of common cycles among stationary variables. On the other hand, Vahid and Engle (1993) proposed the test statistics to test for the serial correlation common feature, i.e. number of common cycles, in a set of non-stationary and co-integrated variables. We find that among these eight countries there exists common trends in all the variables considered here. In addition, we also observe common cycles in real outputs, investments and trade flows. These two findings indicate the existence of strong macroeconomic interdependence among these countries and thus an economic cooperation (formation of RTA) would be beneficial.

This paper is organized as follows. A brief background of eight African economies considered here is given in Section 2. Section 3 discusses the methodology, and data is discussed in Section 4. Results are presented in Section 5 and some concluding remarks are made in Section 6.

2. Economic background

Economic integration in Africa will be a hard-to-reach goal, yet not unattainable. Although, it's been widely recorded that Africa has achieved an eight-year high of 5.1 per cent growth rate in 2004, this growth has not been uniform across the continent. As a matter of fact, humanitarian crisis in the Darfur region, high level of corruption, ongoing political dissensions in Côte d'Ivoire and in Democratic Republic of Congo, as well as continued political crisis in Zimbabwe continue to plague and undermine economic development in many parts of Africa. Nonetheless, the prospects for the continent economic development remain favorable and there are many positive signs that support such a fact. For instance, inflation reached an all-time low,

from the African experience standpoint, at 7.9 per cent despite high oil prices in 2004. Moreover, economic decision-makers have implemented prudent and sounder fiscal and monetary policies in order to appear to multinational organizations and bilateral partners as a good candidate for debt reduction. OECD (Organization of Economic Co-operation and Development) experts are confident that this trend will continue or even get better. The adhesion of African countries to the development platform designed by the NEPAD (New Partnership for Africa's Development) is another fact that contributes to this optimism.

The non-uniformity of economic performance in Africa mentioned at the beginning of this section makes it more realistic to approach the integration of Africa from four regional blocs of countries rather than from the fifty-three countries that comprise it. The four African regions- Northern, Western, Eastern and Central, and Southern regions- considered in this study present a different picture as far as economic performance is concerned. As a matter of fact, the Central and Eastern regions have experienced the best performances in Africa with an increase in real GDP of 14.4 and 6.8 per cent, respectively, in 2004. In this region, the two countries of interest in this study, namely Kenya and Cameroon, represent the two leading economies. Kenya has introduced structural reforms since the 1990s to diversify the economy, appeal to investors (both domestic and international) and reduce its dependency on the agriculture sector. The financial sector has a large number of micro-finance institutions that provide services to individuals and to small and medium-sized enterprises (SMEs) as well. There are roughly 4,000 Saving and Credit Co-operative Societies (SACCOs) established in both rural and urban areas. Moreover, the country has a noticeable SME sector that contribute 18 per cent of total GDP in 2003 and employ about 3.2 millions people (African Economic Outlook, 2004/05). However, the financial sector is underperforming essentially because of a high-level of Non-Performing loans combined with

weak banking supervision and reliable legal framework. This major problem is currently being dealt with as the government in 2004 a major financial sector reform strategy. The success of these reforms will just strengthen the economic development of this country by boosting domestic investment. On the other hand, Cameroon, which is a member of the “CFA zone” whose currency is pegged to the Euro, has a “fairly” developed industry because of targeted government policies since the 1960s. This country has a vibrant service sector (government services, other private services, commerce, hotels and restaurants, transports and communication) which remained the key source of economic growth in 2003 and 2004. For instance, it represented 52 and 53 percent of total GDP in 2003 and 2004, respectively, while the agriculture sector represented a lower 18 per cent in both years. However, Cameroon needs more fiscal discipline if it wants to meet the conditions under the Heavily Indebted Poor Countries (HIPC) initiative for international funding and debt relief.

In the oil-rich northern Africa, Egypt and Algeria are the two driving forces of the economy of the region. Growth prospects in this region are expected to remain strong due to the good health of the Egyptian and Algerian economies. Indeed, both Egypt and Algeria, respectively the second and third largest African economies, grew at 4.5 percent in 2005. Algeria’s GDP per capita of about \$2,450 was almost 3 times the continental average in 2004. This is higher than the GDP per capita of Egypt that hovered around \$1,100 in the same period. With the petroleum sector- and related sector- representing approximately 44 per cent of its economy in 2003, Algeria has benefited from the price hike in the oil-market. Hence, the economy remains vulnerable to price fluctuations in oil and natural gas. Oil production was 1.4 millions barrels per day in 2004 and topped 1.5 millions in 2005. It’s also noteworthy that this is the home country of Sonatrach, the national oil company which was Africa’s largest firm in

2004, with a turnover of \$31.5 billion- against \$18.6 billion in 2003 (African Economic Outlook 2004/2005). Agriculture represented just 10 percent of GDP in 2003 as compared with 16 per cent in Egypt in the same period. Indeed, agriculture still represents a key sector in the Egyptian economy. The business environment is improving as policies are being implemented to boost the development of the private sector. Thus, foreign investment projects are facilitated by the establishment of the General Authority for Free Zones and Investment- a sort of single bureau that expedite the handling of administrative paperwork. Other plans include the improvement of the competitiveness of SMEs that employ 75 percent of workers and account for 80 per cent of GDP.

In the Southern African region, Angola and South Africa are the two dominant economies. This region has experienced a robust economic growth in recent years. This robustness in growth is due to both an increase in oil prices-essentially for Angola- but also due to an increase in the metal (gold, diamond and copper) prices by 16%. South Africa which is the world's leading exporter of gold and Africa's largest economy, is trying to raise its competitiveness and expand its markets by negotiating a trade deal with China that is potential market for South Africa. South Africa remains indeed the main source of outward foreign direct investment in Africa (an estimated \$500 million in 2003). In its bid to become the financial centre of Africa, the country opened its bond and securities exchanges to foreign governments and companies in 2004. As far as Angola is concerned, the economy is largely dominated by the oil and gas sector that represented 49 per cent of total GDP in 2003 and 75 percent of government revenue and 90 percent of exports. Angola has doubled its oil production from 1990 to 2004, i.e., 1 million barrels/day. In 2005, the production in offshore fields was 1.2 millions barrels/day. This trend will continue till 2008 where production is projected to peak at 2.1

million/day. The diamond sector also is the second largest source of export revenues (roughly 10 per cent of total exports). A windfall of revenue due to large increases in both oil and metal prices have raised concerns about the reallocation of resources to build a country that was plagued by a 25 years civil war that ended in 2002. More transparency in the management of oil proceeds is necessary to alleviate the burden of poverty in the country.

Finally, the western African region experienced a sharp slow down in economic growth as the two largest economies are not performing well due to severe political crisis in Côte d'Ivoire on the one hand, and labor unrest in Nigeria on the other. However, perspectives for this region were brighter in 2005 and 2006, despite the existence of risks. Notwithstanding the fact that Nigeria is Africa's largest oil producer (2.33 million barrels/day in 2004), her population remains largely below poverty level (70 percent of population in 2003). Nigeria's banking sector has undergone ambitious reforms that started in 2000 with the introduction of the small and medium industries equity investment scheme (SMIEIS) destined to primarily boost banks' investments in SMEs and in the agricultural sector, which represents 26 percent of total GDP in 2003. Under the SMIEIS banks are required to set aside 10 percent of their profit before tax annually for equity investments in SMEs.

On the other hand, the government has reinforced the banking system's soundness in 2004 by introducing a minimum risk-weighted capital adequacy ratio of 10 percent. As far as Côte d'Ivoire, the second largest economy of the region is concerned, the economy is dominated by agriculture that represented 20 percent of GDP in 2003, and industries represented only 18 percent of GDP in the same period. Indeed, Côte d'Ivoire was the world's largest producer of cocoa in 2004 with 1.45 million tons (or 45 percent of world's market of 3.1 million tons). Coffee is also an important source of export revenue along with cotton, palm oil and rubber. Because of

the ongoing political crisis the country's economy has entered a recession since 2002 with growth rates of -1.6, -1.7, -2 and -1.1 percent respectively from 2002 to 2005. In 2004, the GDP per capita was slightly below the African average of about \$850, and a growth of 1.2 per cent was recorded in 2006 following a small and fragile move towards normalcy. The country has an extraordinary potential for economic development with a well-diversified manufacturing sector, huge reserves of gold and iron estimated at 1.5 billion tons, nickel (439 million), manganese (35 million), oil (100 million barrels) and 1,100 billion cubic meters of natural gas. Overall, the enormous development capacities of these eight countries make them very good candidates to head the economic integration process in Africa as they represent the largest economies in their respective regions. Furthermore, these eight countries weigh about sixty-two percent of Africa's total GDP⁵.

3. Methodology

First, as a descriptive analysis, the correlation among the selected macro-variables are obtained and analyzed. Next, the investigation for the dynamic behavior is conducted by testing each series for unit root using the Augmented-Dickey Fuller (ADF), Dickey-Fuller and Phillips and Perron (PP) tests (Perron, 1988; Phillips and Perron, 1988). Then, to test for the number of common trends, i.e. the number of co-integrating vectors among eight- GDPs; among eight-investments; among eight- price levels; among eight- consumptions; among eight- trade variables and among eight government expenditures the maximum likelihood based λ -max and λ -trace test statistics introduced by Johansen (1988, 1991) are used. Since the methodology for

⁵ As of 2003.

testing unit roots and number of co-integrating vectors are well-known, the details are omitted here.

In order to test for the number of common cycles when the variables are co-integrated we follow the methodology proposed by Vahid and Engle (1993). Let x_t be an $n \times 1$ vector of $I(1)$ variables⁶, then Johansen (1988, 1991) showed that there can exist r ($< n$) linearly independent co-integrating vectors and the collection of these vectors form the $n \times r$ matrix β , where $\beta' x_t$ is $I(0)$. Vahid and Engle (1993) showed that in a set of co-integrated variables, a test for common cycles is in fact a test for the significance of canonical correlations between Δx_t and $(\beta' x_{t-1}, \Delta x_{t-1}, \Delta x_{t-2}, \dots, \Delta x_{t-(m-1)})$, where $(m-1)$ is the lag length chosen in the VAR. Their test statistics based on the likelihood ratio test is given by:

$$C(m-1, s) = -[T - (m-1) - 1] \sum_{i=1}^s \ln(1 - I_i^2),$$

where I_i^2 are the smallest canonical correlations between Δx_t and $(\beta' x_{t-1}, \Delta x_{t-1}, \Delta x_{t-2}, \Delta x_{t-3}, \dots, \Delta x_{t-(m-1)})$ and T is the number of observations. $C(m-1, s)$ asymptotically follows a χ^2 -distribution with $[rs + n(m-1)s + s^2 - ns]$ degrees of freedom. For testing that the canonical correlations between two sets of variables are zero, Rao (1973, p. 556, equation 8C.5.3) proposed an F-approximation to the likelihood ratio statistics which has a better small sample properties than the usual χ^2 -statistics. Rao's approximate F-statistics is also used here. Note that the test proposed by Vahid and Engle (1993) is for the null hypothesis that the dimension of the co-feature space is at least s . If it is found that the dimension of the co-feature space is s , then there exist $(n-s)$ common cycles.

⁶ In our study n is eight.

Finally, we investigate the feasibility of a trend-cycle decomposition. Vahid and Engle (1993) argue that a trend-cycle decomposition of n series in the system is possible only if $n = r + s$, i.e. to decompose these series into common trend and common cycles, one must ensure that the sum of the dimension of the co-feature space and the number of co-integrating vectors is equal to the number of series in the system.

4. Data and Data Sources

We use quarterly data from 1976:1 to 2005:4 on price level measured by the consumer price index (CPI), gross domestic product (GDP) in real terms, private consumption (PVCS), investment (INV), trade flows (TRDFLW), as measured by the sum of imports and exports, and government consumption expenditures (GVCS) for Algeria, Angola, Cameroon, Côte d'Ivoire, Egypt, Kenya, Nigeria, and South Africa from the International Financial Statistics (IFS) and the World Development Indicators (WDI) databases. The choice of the period was motivated by the difficulties to get reliable data for previous time periods (1960-1977) in these countries of Africa.

5. Results

5.1. Correlation Analysis

The correlation coefficients between macro variables of two countries are reported in Table 1. In general, CPI between all the countries is highly correlated except between Algeria and Angola. In the latter case, the correlation is positive and equal to 0.57 while in the former case they are respectively 0.97, 0.94, 0.98, 0.94 and 0.97 for Algeria and Côte d'Ivoire, Algeria and Cameroon, Algeria and Kenya, Algeria and Nigeria, and Algeria and South Africa. More importantly, the correlation between Algeria and Egypt, the two largest economies, deserves

much of our attention. This correlation is very high and positive at 0.97 suggesting that the price level in the two largest economies of Northern Africa almost always move in the same direction at any given point in time. As a matter of fact, CPI is moving in the same direction in all countries and highly correlated as expected. Still in Northern Africa, we find that the correlations of RGDP, investment, private consumption, public consumption and trade flows are respectively 0.76, 0.36, 0.65, 0.68 and 0.64 between Algeria and Egypt. It appears that movements in investment in the two largest economies are poorly correlated at any given point in time as compared to other macro-variables which show stronger correlations.

In the Western region, there is a high positive correlation, 0.91 for the CPI between Côte d'Ivoire and Nigeria the two most important economies. Not surprisingly, we find an extremely high and positive correlation at 0.99 between Côte d'Ivoire and Cameroon. In fact, although the two countries are in different regions of Africa, the currencies they use share the same characteristics and are called C.F.A franc, which was tied to the French franc from its inception till 2001. Since 2001, these currencies are tied to the Euro through the French franc. As a result, inflationary movements in these two countries are quite similar which is confirmed by the high correlation. On the other hand, correlations between Côte d'Ivoire and Nigeria are elevated and positive at 0.71 for both real GDP and investment, while the correlation for trade flows remains lower but significant at 0.67. These figures suggest a relatively high correlation in the movements of real output, investment and trade flows between these two countries at any given point in time. However, we find low correlations between these two countries for private and public consumption which is negative at -0.36 for the latter and 0.13 for the former.

As far as the Central and Eastern region is concerned, we find that the correlation coefficient between Cameroon and Kenya is positive and high at 0.93 for the CPI. This indicates

that movements of CPI in these two countries are highly correlated and in the same direction. Yet, investment, private and public consumption are weakly correlated at any given point in time as shown by their correlation coefficients which are 0.38, 0.28 and 0.23, respectively. On the other hand, the correlation between Cameroon and Kenya for trade flows is relatively stronger at 0.67 as compared to 0.61 which is the correlation of real output for the same countries.

Finally, in the Southern region, Angola and South Africa shows the lowest correlation in CPI of the four regions considered. This coefficient is 0.63. Correlation between these two countries for public consumption is extremely low at 0.04 which certainly suggests that there is hardly a sign of correlation in the movements of public consumption between Angola and South Africa at any given point in time. Similarly, we report a low negative correlation for private consumption equal to -0.14 as well as a low positive correlation for investment at 0.28. Moreover, we find also a low correlation equal to 0.14 and a very high positive correlation of movements in trade flows which is found to be 0.92, as reported in Table 1.

5.2. Common Trend Analysis

First, each series is tested for a unit root. This is necessary for the Johansen and Juselius (1990) co-integration test of co-movements (long-run) among the group of series in the long run. We use Augmented Dickey- Fuller and Phillips-Perron (1988) tests in both log levels and log first differences⁷. For all countries, we find real output non-stationary while the log first difference or economic growth rate is stationary for all countries. In other words, real output is I(1) for all countries. Similarly, inflation is stationary for all countries, which means that price

⁷ For the sake of brevity we do not report these test results but they are available upon request.

levels are $I(1)$ ⁸. Investment and trade flows are also found to be $I(1)$ by both the ADF and PP tests⁹ for all countries excepting Algeria where only the PP tests finds investment to be $I(1)$. Both private and government consumptions are $I(1)$ in all countries with the exception of private consumption in Cameroon .

Next, we examine the long-run dynamics, i.e. the common trends among eight- GDPs; among eight- investments; among eight- price levels; among eight- consumptions; among eight- trade variables and among eight- government expenditures by using the likelihood ratio based λ -max and λ -trace test statistics proposed by Johansen (1988, 1991) and these test statistics are reported in Table 2. As a matter of fact, the existence of at least one co-integration vector among group of variables considered is an evidence of the presence of long-run co-movements among these variables. It's worth mentioning that as a general behavior of economies we have emphasized the discussion on only three variables, i.e. real output, investment, and trade flows. Their attractiveness to foreign and domestic investments as well as their openness (trade flows) are good indicators of how well or not countries are fit to engage in a full-fledge regional or continental economic union

We cannot reject the null hypothesis of six co-integrating vectors at the 5 % significance level in real output. In other words, there exists a common trend in real output in these selected eight African countries¹⁰. Furthermore, an analysis of trade flows and CPI confirm the fact that these eight countries should be considered as a core. As a matter of fact, our results reveal that there are five co-integrating vectors in trade flows for all eight countries, which indicate that

⁸ For Algeria and South Africa, there is stationarity but at the margin.

⁹ Whenever differences are found within different test methods, we give more consideration to Phillip-Perron (PP) test. The legitimate reason is that the countries considered in this study might more or less have experienced some national, or regional, events that could have generated some forms of break into the series spanning from 1976 till 2005.

¹⁰ In different geographic regions researchers find common trends in output (see Hernández (2004) for U.S.A. and Mexico; Engle and Issler (1993) for Latin America; and Horvarth and Sharma (1998) for Western Europe.

trade flows exhibit co-movements in the long-run or common trends. Similarly, when the CPI is considered, we find evidence for the existence of seven co-integrating vectors. This finding means that there are long-run co-movements in CPI between Algeria, Egypt, Côte d'Ivoire, Nigeria, Cameroon, Kenya, Angola and South Africa. These findings for trade flows and CPI bring additional support to the fact that integration in Africa should be built around this core of eight countries. As far as investment, government and private expenditures are concerned, they are all found to be co-integrated. Indeed, when the core of eight countries are considered, λ -trace statistics shows that there are respectively five, six and six co-integrating vectors, while λ -max shows that there are three, two and three co-integrating vectors for investment, government and private expenditures. Hence, these three macro-variables share common trends giving stronger evidence and support to decision-makers in considering a core of eight countries to build an economic integration.

5.3. Common Cycles Analysis

Since all the macro-variables analyzed here have common trends so there are some short-term cycles which move them towards the equilibrium in the long-run. Thus, following Vahid and Engle (1993), we test for the number of common cycles among these macro-variables. For each set of macro-variables, the λ^2 and F-statistics to test for the number of common cycles are reported in Table 3. As noted earlier, here we focus only on three macro-variables, namely real GDP, investment and trade flows since we believe that these variables are instrumental in any prospects of economic integration (monetary or trade arrangements). As far as real GDP is concerned, we note that the dimension of the co-feature space is 7, i.e. $s=7$. Hence, there exist one independent common cycle in real GDPs of eight countries. This finding brings additional support for these countries to initiate policies geared towards the increased cooperation among

them. In case of investment there are 3 independent common cycles since the rank of the co-feature space is 5. Investment is a key macro-variable that essentially determines economic growth in any country. On the other hand, the existence of common cycles in investment means that any policy destined to promoting growth through investment will be efficient and easy to implement. This situation is a good precondition for a successful economic integration (Mundell, 1961). These results indicate that these countries can start establishing a fruitful monetary arrangement as both real GDP and investment share common movements in the short-run and shocks can be dealt with much more efficiently. The dimension of the co-feature space for trade flows is six, which means that there are two common cycles and thus it suggests that a trade agreement can be successful for these countries.

6. Conclusion

This study revisits the ongoing debate of forming an economic union in Africa . Our investigation shows that this goal of integration on a continental scale could be achieved by considering a core of eight countries (the two leading economies in each sub-region), i.e. Algeria, Egypt, Côte d'Ivoire, Nigeria, Cameroon, Kenya, Angola and South Africa- as the driving force of such an integration project. Indeed, this approach proves more realistic than considering all the fifty three countries in the African Continent. We observe the existence of common trends in real outputs, price levels, private consumptions, investments, trade flows and government expenditures among these eight countries. In addition, we also noted that there exist common cycles in real outputs, investments and trade flows among these eight countries. These two findings indicate the existence of some macroeconomic interdependence among these countries. Thus, the chances for success of integration in Africa driven by these eight countries

are appreciable. The two-fold implications of these findings indicate that decision-makers should give much more consideration to this approach by (i) implementing or encouraging the implementation of policies geared toward reinforcing the interdependence of these economies; and further by (ii) increasing coordination of macroeconomic policies among these eight countries. As these steps are taken, a momentum is likely to be generated in each region which will ultimately bring about the continent-wide economic integration strived for.

References

- African Development Bank/Organization of Economic Cooperation and Development (2005), *African Development Outlook (2004/2005)*.
- Anderson, F.J. and Moazzami, B. (2003) "Long-term trend and short-run dynamics of the Canadian dollar: an error correction modeling approach", *Applied Economics*, Vol. 35, pp. 1527-1530.
- Bayoumi, T. and Eichengreen, B. (1997) "Ever closer to heaven? An optimum-currency- area index for European countries", *European Economic Review*, Vol. 41, pp.761-770.
- Cubadda, G. (2001) "Common Features in time series with both deterministic and stochastic seasonality", *Econometric Review*, Vol. 20(2), pp. 201-216.
- Crawford, J.A. and Fiorentino, V.R. (2005) "The Changing Landscape of Regional Trade Agreements", Discussion Paper No. 8, *World Trade Organization*.
- Engle, R.F. and Issler, J.V. (1993) "Common Trends and Common Cycles in Latin America", *Revista Brasileira de Economica*, abr-jun, pag. 47(2), pp.149-76.
- Engle, R.F. and Kozicki, S. (1993) "Testing for Common Features", *Journal of Business and Economics Statistics*, 11, 369-380.
- Grabowski, R. and Horvarth, J. (1999) "Economics Integration in Central America and the Caribbean" *Journal of Economic Development*, Vol. 24, No. 1, pp. 121-132.
- Hecq, A. (2005) "Common Trends and Common Cycles in Latin America: A Two-Step Versus a 'Zigzag' Approach", *Computing in Economics and Finance*, 2005, No. 258.
- Hernandez, J. H. (2004) "Business Cycles in Mexico and the United States: Do They Share Common Movements?" *Journal of Applied Economics*, Vol. VII, No. 2, pp. 303-323.
- Horvath, J. and Grabowski, R. (1997) "Prospects of African Integration in Light of the Theory of Optimum Currency Areas" *Journal of Economic Integration*, Vol. 12(1), pp. 1- 25.
- Horvath, J. and Sharma, S. C. (1998) "Investigations into the Macroeconomic Interdependence of Western Europe: Is there Evidence for Two-Tier Europe?", *Journal of Quantitative Economics*, Vol. 14(2), pp.41-65.
- Johansen, S. (1988) "Statistical Analysis of Cointegrating Vectors" *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-54.
- Johansen, S. and Juselius, K. (1990) "Maximum Likelihood Estimation and Inference on Cointegration.--With application to the Demand for Money", *Oxford Bulletin of Economics and Statistics*, Vol. 52(2), pp. 169-210.

- Johansen, S. (1991) "Estimations and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, Vol. 59, pp. 1551-80.
- Kenen, P. (1969) "The Theory of Optimum Currency Areas: An Eclectic View, (in Mundell, R.A. and Swoboda, A.K. eds.) *Monetary Problems of the International Economy* (University of Chicago Press, Chicago, IL), pp.41-60.
- Kim, Y. and Chow, K.H. (2003) "Optimum currency area in Europe: an alternative assessment", *Economics Letters*, Vol. 81, pp.297-304.
- Kodres, L.E. & Pritsker, M. (2002) "A rational expectation model of financial contagion", *Journal of Finance*, Vol. 57, 769-799.
- McKinnon, R. (1963) "Optimum Currency Areas" *American Economic Review*, Vol. 53, pp. 717-725.
- Mundell, R.A. (1961) "A Theory of Optimum Currency Areas", *American Economic Review*, Vol. 51, 657-665.
- Perron, P. (1988). "Trends and Random Walks in Macroeconomic Time Series: Further Evidence from a New Approach." *Journal of Economic Dynamic and Control*, Vol. 12, pp. 297-332.
- Phillips, P. C. B and Perron, P. (1988) "Testing for a Unit Root in Time Series Regression", *Biometrika*, Vol. 75(2), pp. 335-46.
- Rao, C. R. (1973) *Linear Statistical Inference and its Applications*, John Wiley and Sons, New York.
- Schiff, M. and Winters, A. (1998). "Regional Integration as Diplomacy." World Bank, *Economic Review*, Vol. 12(2), pp. 271-295.
- Selover, D.D. (1999) "International Transmission and Business Cycles Transmission in ASEAN", *Journal of the Japanese and the International Studies*, Vol. 13(3), pp. 230-253.
- Selover, D. D. (2004) "International co-movements and business cycle transmission between Korea and Japan", *Journal of the Japanese and International Economics*, Vol. 18, pp.57-83.
- Sharma, S. C. and Horvath, J. (1997) "Macroeconomic Interdependence and Integration in the Indian Sub-continent", *Journal of Quantitative Economics*, Vol.13(1), pp.37-59.
- Sharma, S.C. and Wongbangpo, P. (2002) "Long-term trends and cycles in ASEAN stock markets", *Review of Financial Economics*, Vol. 11, pp. 299-315.

Tollison, R.D. & Willet, D.T. (1973) "International Integration and the Interdependence of Economics Variables", *International Organization*, Vol. 27, No. 2, pp. 255-71.

Vahid, F. and Engle, R.F. (1993) "Common trends and common cycles", *Journal of Applied Econometrics*, Vol. 8, pp. 341-360.

Table 1. Correlations (Cont'd)

Consumption								
ALG	1	0.14	0.573	0.557	0.651	0.569	-0.052	0.294
ANG		1	-0.269	0.103	-0.365	-0.318	-0.491	-0.144
CIV			1	0.401	0.614	0.828	0.131	0.508
CMR				1	0.496	0.281	-0.158	-0.483
EGY					1	0.665	0.095	0.156
KEN						1	0.439	0.473
NGR							1	0.102
SAF								1
Government Expenditure								
ALG	1	0.233	0.659	0.66	0.688	0.635	-0.428	0.633
ANG		1	0.177	0.734	-0.13	-0.009	-0.402	0.046
CIV			1	0.483	0.408	0.754	-0.366	0.704
CMR				1	0.257	0.232	-0.643	0.287
EGY					1	0.562	-0.384	0.383
KEN						1	-0.112	0.765
NGR							1	-0.404
SAF								1
Trade Flows								
ALG	1	0.847	0.848	0.77	0.645	0.668	0.5	0.869
ANG		1	0.892	0.805	0.687	0.784	0.588	0.92
CIV			1	0.804	0.556	0.784	0.673	0.897
CMR				1	0.757	0.679	0.387	0.82
EGY					1	0.696	0.373	0.755
KEN						1	0.838	0.905
NGR							1	0.695
SAF								1

ALG: Algeria, ANG: Angola, CIV: Cote d'Ivoire, CMR: Cameroon, EGY: Egipt, KEN: Kenia, NGR: Nigeria
SAF: South Africa,

Table 2. Johansen's Cointegration Tests

Variables	H0	Eigen values	?-trace	?-max
RGDP	r = 0	0.927716	650.3049	210.1718
	r = 1	0.919538	440.1332	201.5979
	r = 2	0.732754	238.5353	105.5669
	r = 3	0.569019	132.9684	67.33528
	r = 4	0.343836	65.6331	33.70759
	r = 5	0.275182	31.92551	25.74676
	r = 6	0.063801	6.178745	5.274193
INV	r = 0	0.496656	254.1649	78.25878
	r = 1	0.409796	175.9061	60.11077
	r = 2	0.324634	115.7953	44.74502
	r = 3	0.20012	71.05032	25.45548
	r = 4	0.188252	45.59484	23.77641
	r = 5	0.097092	21.81843	11.6434
CPI	r = 0	0.476809	243.8944	60.89407
	r = 1	0.35616	183.0003	41.38868
	r = 2	0.334825	141.6116	38.32428
	r = 3	0.29993	103.2874	33.51803
	r = 4	0.256507	69.76933	27.86116
	r = 5	0.228019	41.90816	24.32677
	r = 6	0.166263	17.58139	17.09267
	r = 7	0.005186	0.488725	0.488725
GVEX	r = 0	0.367311	215.1985	52.18642
	r = 1	0.340112	163.0121	47.38804
	r = 2	0.263301	115.6241	34.83567
	r = 3	0.233456	80.78839	30.30844
	r = 4	0.185807	50.47996	23.43359
	r = 5	0.123802	27.04637	15.06663
	r = 6	0.067243	11.97974	7.935579
CS	r = 0	0.477492	239.5676	68.80617
	r = 1	0.356951	170.7614	46.80262
	r = 2	0.341128	123.9588	44.22602
	r = 3	0.248507	79.73281	30.28344
	r = 4	0.197858	49.44937	23.36983
	r = 5	0.153475	26.07954	17.66129
	r = 6	0.076272	8.418254	8.409753
TRDFLW	r = 0	0.607579	326.0468	107.5734
	r = 1	0.444144	218.4734	67.53328
	r = 2	0.405051	150.9401	59.71709
	r = 3	0.309912	91.22305	42.6577
	r = 4	0.240976	48.56535	31.70801
	r = 5	0.075672	16.85734	9.049191

<u>5% Critical values:</u>	<u>?-trace</u>	<u>?-max</u>
r = 0	143.6691	48.8772
r = 1	111.7805	42.77219
r = 2	83.93712	36.63019
r = 3	60.06141	30.43961
r = 4	40.17493	24.15921
r = 5	24.27596	17.7973
r = 6	12.3209	11.2248
r = 7	4.129906	4.129906

*All lags p are determined
using the AIC*

RGDP: Real GDP; INV: Investment ; CPI: Consumer Price Index;
GVEX: Government Spending; CS: Consumption; TRDFLW: Trade Flows.

Table 3: Common Feature Tests

Ho	λ_2	Chi Sq. Statistics	F Statistics	p-values
Real GDP				
s=1	0.590078	41.82	5.83	0.0001
s=2	0.512043	75.48	4.92	0.0001
s=3	0.378087	97.76	3.96	0.0001
s=4	0.271569	112.62	3.29	0.0001
s=5	0.191955	122.62	2.76	0.0004
s=6	0.104115	127.786	2.15	0.0259
s=7	0.057442	130.55	1.74	0.1421
s=8	0.003712	89.07	0.41	0.5234
Investment				
s=1	0.511033	36.04	3.99	0.0001
s=2	0.411943	62.79	3.25	0.0001
s=3	0.310548	81.52	2.57	0.0001
s=4	0.220866	94.10	1.93	0.0001
s=5	0.082436	98.43	1.23	0.2452
s=6	0.063502	101.74	1.12	0.3465
s=7	0.024827	103.00	0.72	0.5804
s=8	0.001037	103.05	0.11	0.736
Trade Flows				
s=1	0.606525	46.99	5.09	0.0001
s=2	0.517904	83.75	3.93	0.0001
s=3	0.301058	101.79	2.71	0.0001
s=4	0.190669	112.45	2.18	0.001
s=5	0.140764	120.09	1.88	0.0213
s=6	0.091146	124.90	1.44	0.1719
s=7	0.020853	125.97	0.58	0.6745
s=8	0.000247	125.98	0.03	0.8692

s is the dimension of the co-feature space

m is the lag length of VAR system in first difference