Does West Africa Form an Optimum Currency Area? A Generalized PPP Approach*

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Abstract

This paper investigates the optimality of setting up a common currency area in West Africa by using a generalized purchasing power parity (GPPP) model. The Johansen method of multivariate cointegration shows that not only the existing CFA franc zone but also the emerging West African Monetary Zone (WAMZ) separately satisfy conditions for a common currency area, given the existence of common long–run trends in their real exchange rates. However, little evidence is found to substantiate such conditions for the entire West African region. The paper also analyzes the long–term sustainability of adopting a common currency basket in West Africa by using an alternative version of the GPPP model and estimating the endogenous weights of the euro and the US dollar as the anchor currencies. It finds that the weights are quite different between the CFA zone and the WAMZ, confirming the finding from the first part of the paper, namely, that these two sub–regions when combined do not constitute a sustainable common currency area.

Keywords: Generalized Purchasing Power Parity, Cointegration, Common Currency, and West Africa.

JEL classification codes: F31, F36, O55.

I. Introduction

The introduction of the euro as a common currency in Europe has confirmed the growth–enhancing effects of monetary integration, prompting various groups of countries in Africa to begin to consider the adoption of a common currency (Figure 1)[1]. But does it really make economic sense for these groups of countries to have a common currency? This paper focuses on West Africa and considers the optimality of setting up a common currency area by appealing to the theory of optimal currency area.

In West Africa, there already exists a Francophone monetary union, namely the West African Economic and Monetary Union (WAEMU), which is a western part of the larger CFA franc zone. The CFA franc zone has a long history of maintaining a fixed exchange rate to the French franc (now the

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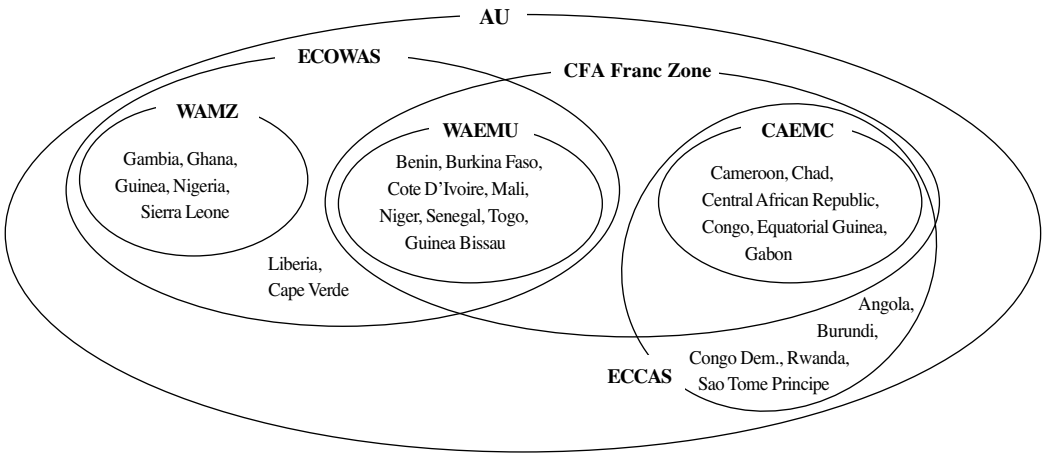
[1] These groups in West and Central Africa overlap with each other to some extent.

Figure 1. Regional Integration in West and Central Africa



WAEMU: West African Economic and Monetary Union
CAEMC: Central African Economic and Monetary Community
WAMZ: West African Monetary Zone
ECOWAS: Economic Community of West African States
ECCAS: Economic Community of Central African States
AU: African Union

euro). The convertibility of its currency has been guaranteed by France since 1945, with the result that the zone has experienced lower inflation and greater fiscal discipline than the neighboring African countries. On the other hand, the rest of West Africa (consisting mostly of Anglophone countries) has adopted a more flexible exchange rate regime and has been characterized by exchange–rate instability, financial fragility and high inflation over the past 40 years.

Both sets of these countries belong to the Economic Community of West African States (ECOWAS), which was established to deepen monetary cooperation and economic integration in West Africa through the removal of barriers to trade and factor mobility. The protocol of the ECOWAS Monetary Cooperation Program in 1987 set forth the establishment of a second monetary union for the non–CFA countries, to be called the West African Monetary Zone (WAMZ), by December 2003; the protocol further specified, as the ultimate goal, the unification of the two monetary unions as a single common currency area.

When this happens, the WAEMU will abandon the CFA franc in favor of the second regional currency, the eco, whose exchange regime with respect to the euro and the US dollar has not yet been specified. The establishment of WAMZ, however, was postponed first to July 2005 and then again to December 2009, because of the failure by member countries to achieve the required macroeconomic convergence criteria. At the present stage, it is doubtful whether WAMZ will come into being by the end of 2009 as planned (see Nnanna, 2007).

In analyzing the optimality of a common currency for West Africa, we apply a generalized purchasing power parity (GPPP) framework within the context of optimal currency area (OCA) theory. In this regard, Frankel and Rose (1998) noted the endogeneity of OCA criteria, namely, that

Table 1. Intra and Extra–Regional Trade Shares in West Africa

	ECOWAS				ECOWAS	
	CFA Franc Zone					
	WAEMU		CAEMC		WAMZ	
	1980–93	1994–2006	1980–93	1994–2006	1980–93	1994–2006
WAEMU	8.7%	10.2%	1.2%	1.3%	2.0%	3.8%
CAEMC	1.2%	1.3%	2.3%	1.9%	0.3%	0.8%
WAMZ	6.3%	9.8%	1.1%	1.9%	2.2%	2.6%
EU	53.1%	43.7%	60.4%	39.3%	52.0%	31.9%
USA	5.5 (13.9)%	4.8 (17.7)%	17.7 (19.2)%	23.9 (35.1)%	23.0 (25.6)%	27.3 (34.4)%
ROW	16.7%	17.3%	15.8%	20.5%	18.0%	26.5%

Source: IMF Direction of Trade Statistics (IMF, 2007a). The numbers in the parentheses refer to the de facto dollar zone consisting of the USA, China, and oil exporting countries. ROW means Rest of the World.

monetary integration tends to boost intra–regional trade flows and cause output correlations to increase and production structures to become more similar. The West African countries, however, do not trade with each other very much but rather tend to trade more with the advanced countries, such as the United States and the EU member countries (Table 1)[2]. This may mean that a common currency has not promoted intra–regional trade as much as the endogeneity postulate would suggest, though a fixed exchange rate with the French franc or the euro can certainly be considered to have contributed to closer trade ties with Europe.

The paper is organized as follows. Section II provides a brief overview of the ongoing monetary integration process in West Africa. Section III discusses theoretical and empirical aspects of the GPPP model, explains the data resources, and provides an answer to the question: Does the CFA franc zone or the WAMZ separately form an optimum currency area? Section IV examines the optimality of creating a common currency area for both sets of countries by estimating the endogenous weights of the euro and the US dollar as anchor currencies. Finally, Section V presents concluding remarks.

II. Monetary Integration in West Africa

Since the collapse of the Bretton Woods regime and the adoption of a floating exchange rate system by the advanced countries in 1973, African countries have experimented with various types of exchange rate arrangements, ranging from a peg to a single currency to independent floating. At present, Africa has two common currency areas, that is, the CFA franc zone and the common monetary area of Southern Africa. The experiences of these areas and the introduction of the euro convinced the other African countries of the potential benefits of a common currency in securing low

[2] The total values of bilateral trade between two countries (in millions of US dollars) are taken from the IMF, *Direction of Trade Statistics* (see IMF, 2007a).

inflation and promoting a single market for goods, which can attract foreign direct investment and thus contribute to economic growth.

Under the Abuja Treaty of 1991, an African Economic Community was established by the Organization of African Unity (now the African Union) with the objective of making a single monetary zone for Africa by 2028. According to the treaty, Africa's each region must create its own regional common currency in early stages. At the final stage, all regional common currencies are set to merge into a single common currency for Africa. In 1999, the Sirte Declaration called for accelerating the establishment of a single monetary zone for the entire continent[3]. In what follows, we highlight the following three aspects of the monetary integration process: the choice of anchor currency, currency convertibility, and macroeconomic convergence.

In West Africa, the ECOWAS was established in 1975 in order to remove barriers to trade and factor mobility and to promote economic cooperation. The ECOWAS comprises sixteen countries: eight WAEMU members, five WAMZ members, and three others (Cape Verde, Liberia and Mauritania)[4]. The ultimate goal of the ECOWAS is to create a single common currency in entire West Africa. The timing of introducing a single common currency for the ECOWAS, however, is viewed as somewhat unrealistic. First, existing economic research does not provide conclusive evidence that the ECOWAS satisfies the OCA criteria (see Fielding and Shields, 2003; and Sugimoto, 2007). Second, the choice of anchor currency is not obvious. The WAEMU uses the CFA franc pegged to the euro, while each WAMZ member country at the moment commits itself to maintaining its exchange rate within a margin of ±15% against the US dollar. Ultimately, the WAMZ will use the eco, but its anchor currency (whether the euro, the US dollar or a basket) has not yet been determined.

Some members of the ECOWAS belong also to the WAEMU, a western part of the larger CFA franc zone. The WAEMU consists of eight countries, namely: Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, Togo, and Guinea Bissau[5]. All of them except Guinea Bissau are former French colonies, so their CFA (la Communauté Financière Africaine) franc has been pegged to the French franc (now the euro) since 1948. The eastern part of the CFA franc zone, the Central African Economic and Monetary Community (CAEMC), includes six member countries, namely: Cameroon, Central African Republic, Chad, Republic of Congo, Gabon, and Equatorial Guinea[6]. Their own CFA (la Coopération Financière en Afrique centrale) franc has also been pegged to the French franc at exactly the same parity.

The anchor country, France, provides financial support to the CFA zone. In particular, the full convertibility of the CFA franc with the euro is guaranteed through a special operation account at the French Treasury. This operation account guarantees the access of the CFA zone members to automatic external financing, if necessary, and allows them to smooth out external transactions. Veyrune (2007)

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[3] In 2003, the Association of African Central Bank Governors declared that a single currency for Africa would be established by 2021.

[4] Mauritania, the only Arab member of the WAEMU, left the CFA franc zone in 1973 and also the ECOWAS in 2000.

[5] Mali and Guinea Bissau (a former Portuguese colony) joined the WAEMU in 1984 and 1997, respectively.

[6] Equatorial Guinea (a former Spanish colony) joined the CAEMC in 1985.

points out that French support makes monetary policy in the CFA zone more autonomous than would be the case under a currency board. Veyrune (2007) also presents evidence that the maximum costs to France of administering such a system have been 3% of central government revenue and 1.3% of GDP (with a median of 0.8%) for 1956–2005. After all, French financial support for the CFA zone has not seriously damaged the French economy and has been regarded as a kind of foreign aid.

Other members of the ECOWAS belong to the WAMZ. The WAMZ consists of five countries, namely: the Gambia, Ghana, Guinea, Nigeria and Sierra Leone[7]. All but Guinea are former British colonies and adopted a flexible exchange rate regime after their independence. At the present stage, the countries' exchange rates continue to be market determined and remain within the band of the WAMZ Exchange Rate Mechanism (ERM). These countries, however, do not enjoy the financial support of an external power to guarantee the convertibility of their currencies. In principle, a currency is convertible to the extent that the sovereign issuer has sufficient reserves for imports. One of the WAMZ convergence criteria requires each member country to maintain sufficient reserves to cover over 3 months of imports, but this level of reserves is hardly a substitute for the French support enjoyed by the CFA zone[8]. It is estimated that, if Ghana and Nigeria were included in the CFA zone, the potential costs to the French Treasury would have been 7.4% (the median) for 1956–2005 (see Veyrune, 2007). Higher potential costs will be an obstacle to enlarging the CFA zone. The inherent difficulty of choosing an appropriate anchor currency for the ECOWAS is obvious.

For West Africa, the choice of anchor currency may be more important than having a common currency, to the extent that the region has strong trade links with advanced countries (Table 1). At the same time, intra–regional trade shares in 1994–2006 were higher than in 1980–93 for both the WAEMU and the WAMZ, suggesting the possibility that a common currency, if adopted, may promote further intra–regional trade among the zone members. Even so, the intra–regional trade share of the WAEMU (10.2%) remains low relative to the share of trade with EU countries (43.7%). In the WAMZ, the intra–regional trade share (3.8%) is negligible compared with the share of trade with EU countries (31.9%) and United States (27.3%). By inference, the euro can serve as an exchange rate stabilization anchor to promote external trade for the WAEMU, while a currency basket of the euro and the US dollar might better serve such a purpose for the WAMZ (see more on this point in Section IV).

Finally, as to macroeconomic convergence, the WAEMU members complied more strictly with the convergence criteria in 2006 than they did in 1995, the year following the CFA franc devaluation of 1994 (Table 2). On the other hand, for the WAMZ, the convergence criteria were far from being met in 2006 despite some improvement in recent years. Indeed, all members except the Gambia failed to satisfy one of the primary criteria regarding inflation (i.e., of no more than 5 %). Again, all except Ghana failed to satisfy one of the secondary criteria regarding fiscal policy (i.e., tax revenues of at

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[7] Despite its initial intentions, Liberia did not participate in the WAMZ because of civil war.

[8] According to Guidotti (1999), the optimal amount of foreign reserves should be based not only on balance of payments considerations but also on the volume of capital account transactions (see also De Beaufort et al., 2001).

least 20 % of GDP), despite the urgent need to achieve sufficient convergence for the planned introduction of the eco. Of course, the Euro zone started successfully with a few outlier countries

Table 2. Convergence Criteria[1]

(1) CFA Franc Zone (WAEMU + CAEMC)

	CPI inflation rate		Basic fiscal balance (excl. grants) /GDP		Overall debt/GDP	
	1995 (<3%)	2006 (<3%)	1995 (>0%)	2006 (>0%)	1995 (<70%)	2006 (<70%)
Benin	11.4%	3.8%	–0.5%	0.0%	68.6%	14.8%
Burkina Faso	7.6%	2.4%	–0.5%	–3.9%	64.1%	17.1%
Cote D'ivoire	14.6%	2.5%	–2%	–1.9%	188.3%	80.5%
Mali	12.4%	1.5%	0.8%	–0.8%	117.6%	23.9%
Niger	10.8%	0.1%	–6.7%	–2.7%	94.8%	25.6%
Senegal	8.1%	2.1%	0.6%	–3.0%	99.7%	40.5%
Togo	16.5%	2.1%	–5.3%	–0.1%	123%	95.9%
Guinea Bissau	49.1% (1997)	2.0%	–1.0% (1997)	–7.3%	579.6% (1997)	323.8%
Cameroon	6%	5.4%	–2.3%	5.4%	90.3%	20.7%
Cen. Af. Republic	3.8%	6.5%	–2.3%	–1.5%	77.59%	67.9%
Chad	12.4%	5.2%	–2.8%	3.3%	57.4%	26.6%
Congo	0.1%	4.0%	–7.1%	23.7%	262.8%	99.8%
Gabon	2.1%	3.9%	6.5%	9.8%	79.2%	30.4%
Equatorial Guinea	8.8%	7.5%	–5.0%	26.1%	140.1%	1.9%

(2) WAMZ: Primary Criteria

	CPI inflation rate		Budget deficit (excl. grants)/GDP		Central bank financing of fiscal deficit as % of previous year's tax revenue		Gross external reserves (in months of imports)	
	2001 (<10%)	2006 (<5%)	2001 (<5%)	2006 (<4%)	2001 (<10%)	2006 (<10%)	2001 (>3)	2006 (>3)
Gambia	8.1%	1.4%	10%	2.7%	80.7%	0.0%	8.2	4.9
Ghana	21.3%	10.5%	13.2%	11.5%	12.1%	0.0%	1.4	3.8
Guinea	1.1%	39.1%	5.2%	0.8%	0.0%	54.0%	4.4	0.8
Nigeria	16.5%	8.5%	3.2%	–0.6%	0.0%	0.0%	8.9	21.8
Sierra Leone	3.4%	8.3%	16.5%	9.7%	8.9%	13.3%	3.4	5.2

(3) WAMZ: Secondary Criteria

	Tax revenue/GDP		Wage bill/ fiscal revenues		Public investments from domestic receipts		Real interest rate		Nominal exchange rate (+:depreciation/ –:appreciation)	
	2001 (>20%)	2006 (>20%)	2001 (≤ 35%)	2006 (≤ 35%)	2001 (>20%)	2006 (>20%)	2001 (>0)	2006 (>0)	2001 (+/–15%)	2006 (+/–15%)
Gambia	13.9%	18.8%	40.1%	24.2%	6.2%	2.9%	0.1	4.6	12.1%	–9.4%
Ghana	17.2%	21.4%	52.9%	44.9%	16.4%	22.2%	–6.8	–4.1	5.4%	1.1%
Guinea	10.8%	12.7%	35.3%	20.8%	5.5%	12.2%	2.8	–24.4	2.8%	64.6%
Nigeria	19.5%	14.5%	26.4%	20.1%	40.3%	42.0%	4.0	–5.25	3.1%	–7.87%
Sierra Leone	13.4%	10.5%	55.0%	65.3%	6.6%	8.9%	1.4	–0.5	23.2%	13.8%

1. Shaded numbers indicate that the targets are met.

Sources: WAEMU, CAEMC, West African Monetary Institute.

(such as Italy and Greece), but the situation in the WAMZ is more troublesome because Nigeria, a key country with 87% of total regional GDP in 2006, is not fully compliant and hence cannot be expected to play the role Germany had played in the launch of European Economic and Monetary Union (EMU).

III. A Viable Option for West Africa? A Generalized PPP Approach

This section asks whether the existing and emerging currency unions in West Africa satisfy the optimal currency area (OCA) criteria by using the generalized PPP approach[9]. The original version of PPP implies that a bilateral real exchange rate is stationary in the long run. A consensus view in the OCA literature is that countries form an OCA if their bilateral rates remain stationary, because stationarity implies the absence of a need to absorb external shocks through exchange rate adjustment. Several empirical studies, however, suggest that the bilateral real exchange rates in West Africa are non–stationary or stationary with a very slow rate of mean reversion[10]. Deviations from PPP can result if fundamental macroeconomic determinants of real exchange rates (such as income) are non–stationary and are subject to frequent nominal and real shocks. If the fundamental variables are sufficiently interrelated, the bilateral real exchange rates may have common factors despite the otherwise non–stationary properties. For this reason, the standard PPP approach tends to reject the OCA compliance when it in fact holds.

The GPPP approach of Enders and Hurn (1994) is designed to overcome such a problem[11]. This is based on the idea that when two countries have strong economic relationships with one another and experience real symmetric shocks to macroeconomic variables, these variables ought to move together. Even if they experience asymmetric shocks but cooperate with each other for long–run adjustment, they also ought to move together. As a result, their bilateral real exchange rates are driven by similar stochastic trend although they are non–stationary. Intuitively, changes in the bilateral exchange rate would depend on both changes in their own relative price and common relative price changes vis–à–vis other countries from which they import a large number of goods. If the real exchange rates among the member countries of monetary union share common trends, a system of their non–stationary rates may have a common long–run equilibrium path within a currency area. In other words, at least one linear combination of them is stationary in the long run. Thus, GPPP presumes that the countries form an OCA when their real exchange rates are cointegrated.

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[9] The structural VAR approach, a well–known alternative to the GPPP approach, is not suited for our current exercise, which is intended to examine whether an identical currency or currency basket makes sense for a particular geographical area.

[10] Sugimoto (2001) showed that the original version of PPP did not generally hold in the CFA zone countries and that the deviations from PPP were largely caused by asymmetric and more prevalent real shocks increasing the cost of monetary union.

[11] Enders and Hurn (1994) are the pioneers of the GPPP approach. A similar GPPP model has been used by Mkenda (2001) for the East African community and by Grandes (2003) for the rand zone in Southern Africa. Kawasaki and Ogawa (2006) improved the methodology by focusing on the role of the anchor currency.

Methodology

The original version of PPP can be constructed as follows:

$$q_t = e_t + p_t^* - p_t, \tag{1}$$

where q_t and e_t are the natural logarithm of bilateral real and nominal exchange rates; p_t^* and p_t are the natural logarithm of the foreign and domestic price levels, respectively. When individual real exchange rates are non–stationary, simple PPP does not hold for each country. Yet if the fundamental macroeconomic determinants of real exchange rates are highly interrelated, some of them should be stationary or cointegrated. This indicates the presence of GPPP.

It is assumed here that there are n countries comprising the domain of monetary union. Following Enders and Hurn (1994), we describe the relationship between the real exchange rate $(q_{n,it})$ and a set of fundamental variables (x_{it}) for country i as follows:

$$q_{n,it} = x_{it}'\beta_i + \varepsilon_{it} \quad (i = 1, 2, ..., n), \tag{2}$$

where $q_{n,it}$, x_{it}, β_i, and ε_{it} are, respectively, country i's real exchange rate against the currency of country n, a vector of n economic fundamentals, a vector of n coefficients, and an error term. The currency of country n is used as the anchor currency. Any non–stationary variable of vector x_{it} makes $q_{n,it}$ non–stationary, which causes simple PPP to be rejected. However, the variables $q_{n,it}$ and x_{it} on both sides of equation (2) can be cointegrated under certain condition, as explained below.

Now, the system of n equations is drawn by

$$\begin{bmatrix} q_{n,1t} \\ q_{n,2t} \\ q_{n,3t} \\ \cdot \\ \cdot \\ q_{n,nt} \end{bmatrix} = \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1n} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2n} \\ \beta_{31} & \beta_{32} & \cdots & \beta_{3n} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \beta_{n1} & \beta_{n2} & \cdots & \beta_{nn} \end{bmatrix} \begin{bmatrix} x_{1t} \\ x_{2t} \\ x_{3t} \\ \cdot \\ \cdot \\ x_{nt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \cdot \\ \cdot \\ \varepsilon_{nt} \end{bmatrix} \tag{3}$$

where elements of x_{it} $(i = 1, 2, 3, ...n)$ are required to be non–stationary, though Liang (1999) pointed out that the inclusion of the stationary element would not statistically affect the cointegrating relationship. In equation (3), as long as the rank of β is smaller than $n-1$, a linear combination of real exchange rates turns out to be stationary[12]. In other words, GPPP holds under the condition that rank $(\beta) < n-1$ if the presence of common trends within the set of economies permits the real exchange rates comprising the domain of monetary union to have a long–run relationship with one another. Thus, on the simple assumption that rank $(\beta) = 1$, the GPPP test can be performed by asking whether there is one cointegration in the following equation:

$$\alpha_1 q_{n,1t} + \alpha_2 q_{n,2t} + \alpha_3 q_{n,3t} + \cdots + \alpha_{n-1} q_{n,n-1t} = 0, \tag{4}$$

where α_i $(i = 1, 2, 3, ... n-1)$ is the parameter of the cointegrating vector. If GPPP holds, the $n-1$

[12] When the rank of β is zero, simple PPP holds for the real exchange rate of every country. When the rank of β is full, there is no cointegrating relationship among the real exchange rates of different countries.

set of countries can be considered to satisfy the OCA criteria.

The two most commonly used tests of cointegration are the residual–based test of Engle and Granger (1987) and the cointegrating rank test of Johansen (1988, 1996) and Johansen and Juselius (1990). This section adopts the Johansen multivariate Maximum Likelihood Estimation (MLE) procedure, because it assumes all variables to be endogenous and does not require the choice of a dependent variable. The Johansen method tests the restrictions imposed by cointegration on the unrestricted Vector Auto Regression (VAR) involving the series. To test whether the $n-1$ set of countries form an OCA, we first set up the VAR as follows:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_k Y_{t-k} + BZ_t + \varepsilon_t \tag{5}$$

$$Y_t' = [q_{n,1t}, q_{n,2t}, q_{n,3t}, q_{n,4t}, \cdots, q_{n,n-1t}]'$$

where Y_t, k, Z_t, and ε_t, respectively, represent an $n-1$ vector of non–stationary endogenous variables (real exchange rates), lag length, deterministic variables, and stationary disturbance terms. According to the Vector Error Correction Model (VECM), we can rewrite the VAR as follows:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + BZ_t + \varepsilon_t \tag{6}$$

$$\Pi = \sum_{i=1}^{k} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{k} A_j$$

$$H_1(r) : \Pi = \upsilon \cdot \alpha' \tag{7}$$

where υ is the loading matrix known as the adjustment parameters in VECM and the reduced rank r is the number of cointegration relationships. Granger's representation theorem indicates that if the coefficient matrix Π has reduced rank $r < n-1$, there exist $(n-1) \times r$ matrices υ and α each with rank r such that $\Pi = \upsilon \cdot \alpha'$ and $\alpha' \cdot Y_t \sim I(0)$. Finally, the Johansen method estimates the matrix Π from an unrestricted VAR and tests whether we can reject hypothesis (7) on the reduced rank of Π. When the matrix Π is stable, there is a long–run relationship among the $n-1$ real exchange rates whose countries can form an OCA.

Testing for GPPP in West Africa

The real exchange rates are calculated by using monthly data for the nominal exchange rates and consumer price indices (CPI) of West African countries. The data, ranging from January 1975 to July 2007, are taken from the IMF, *International Financial Statistics* (IMF, 2007b), AFRISTAT and EUROSTAT. For the pre–1999 euro period, the ECU rate and the GDP–weighted average CPI are substituted for the euro rate and the EU harmonized CPI. Because of lack of data, only five of the eight countries in the WAEMU (Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo) and three of the five countries in the WAMZ (Gambia, Ghana, and Nigeria) are included for tests that involve the entire sample period (January 1975 to July 2007). For tests involving a more recent period of January 1994–July 2007, three countries in the WAEMU (Benin, Mali, and Guinea Bissau), six countries in the CAEMC (Cameroon, Central African Republic, Chad, Congo, Gabon, and Equatorial Guinea), and one country in the WAMZ (Sierra Leone) are also added. In all cases, the euro is used as the

numeraire (base) currency.

In preliminary data analysis, we employed four kinds of unit root tests, namely, Augmented Dickey–Fuller (ADF), Philipps–Perron (PP), Ng–Perron (NP), and Kwiatkowski–Philipps– Schmidt–Shin (KPSS) tests, for the real exchange rates relative to the euro. According to the ADF, PP and NP tests (not formally reported here), all countries have non–stationary real exchange rates in levels except for Benin, but they become stationary in first difference. The KPSS test (again not formally reported here) suggested similar results. There is thus little evidence that simple PPP holds for the West African countries.

It should be noted that the West African countries have experienced significant structural changes over the last three decades, including the launch of the European Monetary System (April 1979), a CFA franc devaluation (January 1994), and the introduction of the euro (January 1999). The sharp decline in the prices of some primary commodities (such as cocoa), the recent rise in oil prices, droughts, and civil war (as in Cote D'Ivoire) can also be potential break points in the real exchange rate for each country. From the methodological point of view, it is best to take these major events into account, as they likely affect the statistical properties of the variables concerned.

Several methodologies are available. For example, Johansen et al. (2000) exploited the VECM with breaks at known times, while Inoue (1999) developed a VECM with breaks at unknown timing. These cointegration rank tests, however, assume that the estimated coefficients of the cointegrating vector remain constant for the entire sample period. Our primary interest, however, concerns whether monetary integration can be seen as a consequence of or a prerequisite for a sustainable currency union. For this purpose, we use the cointegration rank tests of Johansen and Juselius (1990), which allow us to distinguish a pre–structural–change period from a post–structural–change period and to compare the estimated cointegrating coefficients before and after the structural change.

Although many events and developments can be candidates for structural change, the CFA devaluation of January 1994 by far had the greatest impact on the real exchange rates of the CFA member countries[13]. On the other hand, we cannot identify any such drastic event for the real exchange rates of the WAMZ member countries. We therefore perform cointegration tests separately for January 1975–December 1993 and for January 1994–July 2007.

Tables 3–5 show Johansen's two test statistics, namely, the trace statistics and the maximum eigenvalue statistics; the correct lag order was selected for each VECM. The choice of optimal lag length was determined by two alternative information criteria, that is, the Hannan–Quinn criterion and the Akaike Information criterion (subject to a maximum of 12 lags). In all cases, we assumed that the level data in question had no deterministic trend and that the cointegrationg equations had an intercept. The optimal model for each country was identified by the following four tests (the results not formally reported here): (i) AR(4) test to reject the null of autocorrelation of the residuals in each VECM; (ii)

[13] For the CFA member countries, the parity was fixed at 50 CFA francs per French franc from 1948 to 1994, when it was devalued by 50%. Devarajan (1997) estimated that the real exchange rate misalignments of almost all CFA members except the oil–producing countries had been corrected by the devaluation.

Table 3. Johansen Cointegration Tests for Selected Countries: Before and After the Devaluation

(1) WAEMU: Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo

Pre–devaluation sample: January1975–December 1993 (lag =1)				Post–devaluation sample: January 1994–July 2007 (lag =6)			
Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic	Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.147152	82.88871***	36.29160**	H_0: r = 0 *	0.953013	576.0777***	498.4347***
H_0: r = 1 ($\leq$ 1)	0.096698	46.59711	23.18711	H_0: r = 1 ($\leq$ 1) *	0.224208	77.64301***	41.38093***
H_0: r = 2 ($\leq$ 2)	0.047308	23.41000	11.04974	H_0: r = 2 ($\leq$ 2)	0.114482	36.26208**	19.81787
H_0: r = 3 ($\leq$ 3)	0.030348	12.36026	7.026585	H_0: r = 3 ($\leq$ 3)	0.056560	16.44420	9.490199
H_0: r = 4 ($\leq$ 4)	0.023122	5.333674	5.333674	H_0: r = 4 ($\leq$ 4)	0.041765	6.954003	6.954003

Note: 'r' denotes the number of cointegrating vectors; *** and ** denote that the hypothesis is rejected at the 1% and 5% levels.

(2) WAMZ: Gambia, Ghana, and Nigeria

Pre–devaluation sample: January 1975–December 1993 (lag =2)				Post–devaluation sample: January 1994–July 2007 (lag =3)			
Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic	Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0	0.084325	29.45972	20.08533	H_0: r = 0 *	0.136435	34.60177**	23.90987**
H_0: r = 1 ($\leq$ 1)	0.036091	9.374394	8.380999	H_0: r = 1 ($\leq$ 1)	0.056588	10.69189	9.495162
H_0: r = 2 ($\leq$ 2)	0.004348	0.993395	0.993395	H_0: r = 2 ($\leq$ 2)	0.007315	1.196729	1.196729

Note: 'r' denotes the number of cointegrating vectors; *** and ** denote that the hypothesis is rejected at the 1% and 5% levels.

χ^2 test for stationarity to check whether the individual series can be stationary by themselves; (iii) χ^2 test for weak exogeneity for the long–term equilibrium; and (iv) χ^2 tests for long–term exclusion.

Estimation results

First, in Table 3(1), we find only one cointegration relationship among WAEMU members[14] for the pre–devaluation period, but two cointegration relationships for the post–devaluation period[15]. This finding supports the endogeneity view, namely, that economic integration can be seen as a consequence of rather than a prerequisite for a sustainable currency union. In this context, in 1994, the WAEMU established a multilateral surveillance system aimed at ensuring stronger fiscal consolidation among the member countries. In 1999, moreover, the CFA franc was repegged from the French franc to the euro. This change necessitated a strengthening of the zone's convergence criteria in order to maintain continued French financial support (see Table 2(1)). The empirical result suggests that

[14] Because of lack of data and to compare the pre–devaluation and post–devaluation periods, five of the eight countries (Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo) are included in the WAEMU.

[15] We also find two cointegration relationships among WAEMU members for the entire sample period by a different methodology that incorporates a structural break in 1994 (see Johansen et al., 2000). This means that the coefficients of the cointegrating vector remained constant even if a break (the 1994 devaluation) was considered, confirming that the results are robust.

Table 4. Johansen Cointegration Tests for All Countries for the Post–Devaluation Period

(1) WAEMU: Benin, Burkina Faso, Cote D'ivoire, Mali, Niger, Senegal, Togo, and Guinea Bissau

Post–devaluation sample: January 1994–July 2007 (lag =2)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.946343	633.5739***	476.7981***
H_0: r = 1 (≤ 1) *	0.242895	156.7759***	45.35532**
H_0: r = 2 (≤ 2)	0.199605	111.4205**	36.29197
H_0: r = 3 (≤ 3)	0.143894	75.12857	25.32393
H_0: r = 4 (≤ 4)	0.117715	49.80464	20.41423
H_0: r = 5 (≤ 5)	0.092316	29.39041	15.78807
H_0: r = 6 (≤ 6)	0.059762	13.60235	10.04442
H_0: r = 7 (≤ 7)	0.021591	3.557930	3.557930

(2) CAEMC: Cameroon, Central African Republic, Chad, Congo, Gabon, and Equatorial Guinea

Post–devaluation sample: January 1994–July 2007 (lag =3)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.811127	305.9924***	228.3354***
H_0: r = 1 (≤ 1) *	0.234377	77.65697**	36.58793**
H_0: r = 2 (≤ 2)	0.120042	41.06904	17.51971
H_0: r = 3 (≤ 3)	0.093656	23.54934	13.47212
H_0: r = 4 (≤ 4)	0.052813	10.07721	7.433458
H_0: r = 5 (≤ 5)	0.019112	2.643754	2.643754

(3) WAMZ: Gambia, Ghana, Nigeria, and Sierra Leone

Post–devaluation sample: January 1994–July 2007 (lag =1)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.218149	80.55326***	40.11283***
H_0: r = 1 (≤ 1) *	0.168186	40.44043**	30.01591***
H_0: r = 2 (≤ 2)	0.055228	10.42452	9.260382
H_0: r = 3 (≤ 3)	0.007116	1.164136	1.164136

Note: 'r' denotes the number of cointegrating vectors; *** and ** denote that the hypothesis is rejected at the 1% and 5% levels.

greater intra–regional macroeconomic convergence caused GPPP to hold with greater statistical robustness.

Second, in Table 3(2), we cannot find any cointegration relationship among prospective WAMZ members[16] for the pre–devaluation period, but can find at least one cointegration relationship for the post–devaluation period[17]. The presence of at least one cointegration relationship in the latter period implies that the process of convergence toward GPPP in WAMZ started earlier than the actual adoption of the eco, now planned for 2009. This corroborates a similar finding of Lopez and Papell (2004) for the Euro zone based on a different methodology. Moreover, we also find three cointegration relationships among WAEMU–WAMZ members for the entire sample period by the different methodology with breaks at known time (1994 devaluation) exploited by Johansen et al. (2000), even though the number of included member countries is limited for the lack of data (the

[16] For the reasons stated in the preceding footnote, three of the five countries (Gambia, Ghana, and Nigeria) are included in the WAMZ.

[17] Even if the US dollar is instead used as the numeraire currency, similar results are obtained. Moreover, we cannot find any cointegration relationship among WAMZ members for the entire sample period by using the methodology of Johansen et al. (2000).

Table 5. Johansen Cointegration Tests for a Limited Extension of WAEMU

(1) WAEMU (Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo) + Gambia

Pre–devaluation sample: May 1975–Decemer 1993 (lag =1)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.196054	116.2512***	49.75479***
H_0: r = 1 (≤ 1)	0.103403	66.49646	24.88589
H_0: r = 2 (≤ 2)	0.082691	41.61057	19.67888
H_0: r = 3 (≤ 3)	0.046859	21.93169	10.94216
H_0: r = 4 (≤ 4)	0.030269	10.98953	7.008029
H_0: r = 5 (≤ 5)	0.017311	3.981501	3.981501

(2) WAEMU (Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo) + Ghana

Pre–devaluation sample: May 1975–Desember 1993 (lag =1)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.261578	145.5813***	69.13863***
H_0: r = 1 (≤ 1)	0.125231	76.44270	30.50530
H_0: r = 2 (≤ 2)	0.096851	45.93740	23.22593
H_0: r = 3 (≤ 3)	0.038888	22.71147	9.043370
H_0: r = 4 (≤ 4)	0.035647	13.66810	8.275922
H_0: r = 5 (≤ 5)	0.023372	5.392176	5.392176

(3) WAEMU (Burkina Faso, Cote D'ivoire, Niger, Senegal, and Togo) + Nigeria

Pre–devaluation sample: January 1975–December 1993 (lag =2)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0	0.136791	103.7110	33.53838
H_0: r = 1 (≤ 1)	0.125842	70.17257	30.66466
H_0: r = 2 (≤ 2)	0.074279	39.50791	17.59768
H_0: r = 3 (≤ 3)	0.047789	21.91022	11.16475
H_0: r = 4 (≤ 4)	0.031709	10.74548	7.346799
H_0: r = 5 (≤ 5)	0.014796	3.398680	3.398680

Note: 'r' denotes the number of cointegrating vectors; *** and ** denote that the hypothesis is rejected at the 1% and 5% levels.

results not formally reported here). Thus, we cannot rule out the possibility that the ex post facto effect of macroeconomic convergence enhances the likelihood of satisfying the OCA criteria even for the combined CFA–WAMZ zone.

Third, in Table 4(1)–(3) with the inclusion of almost all members in West Africa for the period after the CFA franc devaluation, we find two cointegration relationships each among WAEMU members, among CAEMC members, and among WAMZ members. These results give additional support to the endogeneity view. It appears to be the case that each monetary union can achieve macroeconomic convergence even if new members initially have relatively low economic interdependence.

Fourth, in Table 5(1)–(3), we investigate the possibility of a limited extension of the WAEMU through the addition of a new member. As discussed above, the Gambia, Ghana, and Nigeria were not members of the WAMZ during 1975–1993 though they became members during 1994–2007. It is thus of interest to ask if any one of these countries (as well as the existing members of the WAEMU) would have benefited from their membership in the CFA franc zone. We find that WAEMU members have one cointegration relationship with the Gambia as well as with Ghana. On the other hand, we

cannot find any cointegration relationship between Nigeria and WAEMU members[18]. These results indicate that the Gambia and Ghana can be candidates for membership in the WAEMU, but not Nigeria.

Nigeria is by far the largest economy in WAMZ (accounting for 81.1% of total trade for 1994–2006 and 87.1% of nominal GDP in 2006) and also carries a preponderant weight in the larger West African region (accounting for 46% of total trade and 49.5% of GDP). As such, Nigeria has already played a leading role in the WAMZ over the period of 1994–2006. All things considered, we can conclude that the separate coexistence of the CFA zone and the WAMZ is preferable to the creation of a unified common currency area for the ECOWAS at the present stage. Debrun et al. (2002) came to a similar conclusion, though by a different approach. In arguing that Nigeria's membership in a single ECOWAS monetary union does not benefit other countries, they highlight the country's large fiscal deficits and the fact that Nigeria's trade pattern differs significantly from those of its neighbors. On the other hand, they argue that the possibility of including the Gambia and Ghana, two peripheral countries, in the CFA zone is worth serious consideration.

At present, there are two conflicting public views about the roadmap to monetary integration for potential WAMZ countries: (i) they should participate in the WAMZ on schedule; and (ii) they should skip the WAMZ process and directly join the CFA zone. In an article written by Atafori published in the 19 October 2006 issue of the *Statesman* (Ghana's oldest newspaper), Augustine Gockel, a senior lecturer in Economics at the University of Ghana, explained that Ghana and Nigeria should join the CFA zone because they are surrounded by and trade with the CFA member countries[19]. Table 1 also shows that the WAMZ–WAEMU bizonal trade has expanded more quickly than the intra–WAMZ trade and that the volume of such bizonal trade is now larger than the volume of intra–WAMZ trade during the post–devaluation period[20]. Although the WAMZ members may thus find it advantageous to join the CFA zone, the existing WAEMU members may not find the countries as attractive partners[21]. An enlargement of the CFA zone, moreover, might create anxiety about the continued financial support of the French Treasury.

It may be of interest to perform cointegration tests for different subsets of countries, for example, by using the grouping proposed by Bénassy–Quéré and Coupet (2005) based on the concept of "economic proximity." Their cluster analysis suggests five country groups within Africa: (i) Benin, Burkina Faso, Mali and Togo, with a relatively small share of trade with the EU markets and a low debt service ratio; (ii) Cote d'Ivoire, the Gambia and Senegal, with a relatively high output diversification or a relatively low share of the primary sector; (iii) Cameroon, Central African Republic and Chad, with a large share of trade with the EU markets; (iv) Ghana, Guinea Bissau, Niger

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[18] We find that WAEMU members had four cointegration relationships with the Gambia, two cointegration relationships with Ghana, and barely one cointegration relationship with Nigeria during the post–devaluation period.

[19] Ghana trades more with her Francophone neighbors, especially Togo, than with the other WAMZ members.

[20] The WAMZ intra–zone trade share is 2.2% for 1980–1993 and 2.6% for 1994–2006. The WAMZ– WAEMU bizonal trade share is 2% for 1980–1993 and 3.8% for 1994–2006.

[21] Masson and Pattillo (2005) used a different approach to conclude that these countries are not attractive partners to the existing members.

and Sierra Leone, with a large share of primary commodities and a high debt service ratio; and (v) Congo, Gabon and Nigeria, a group of oil–exporting countries.

It turns out that, except for the fifth group, we find at least one cointegration relationship among the members of each country group (results not formally reported here). All things considered, the first and second groups have more incentives to strengthen intra–zone trade through monetary integration than the other groups. On the other hand, to the extent that these countries may have a fear of floating, the other groups of countries have incentives to stabilize their exchange rates against the euro (the third and fourth groups) or against the US dollar (the fifth group). The lack of a cointegration relationship for the fifth group may to some degree be an artifact of the use of the euro as the numeraire in cointegration tests. Because these oil–exporting countries do not actively engage in intra–regional trade, their paramount concern might be exchange rate stability against the US dollar rather than the adoption of a common currency for the region.

IV. Euro or Dollar? The Choice of Anchor Currency

The previous section used the euro as the numeraire currency for cointegration tests and concluded that the coexistence of the CFA zone and the WAMZ was preferable to the creation of a unified common currency zone for the ECOWAS at the present stage. However, the economic benefits of a common currency for the ECOWAS cannot necessarily be precluded if the endogeneity view holds true[22].

At present, whereas the anchor currency in the CFA zone is the euro, the de facto anchor currency in WAMZ is the US dollar. In the future, the WAMZ will use the eco, but its anchor currency, whether the euro, the US dollar or a basket, has not yet been determined. Moreover, as explained in the previous section, some of the potential WAMZ members would have benefited not only from participating in the WAMZ but also from joining the CFA zone directly.

Under these circumstances, the adoption of a single anchor currency, though in some cases optimal in its own right, may not contribute to real effective exchange rate stability. This means that, if anything, the WAMZ should adopt a common basket of currencies, presumably the euro and the US dollar. But what should be the weights of the euro and the dollar in such a basket? This section first examines what weights would contribute to real effective exchange rate stability by using an alternative version of the GPPP model that includes the anchor country.

The second part of the section then considers the usefulness of trade–based weights as substitutes for such optimal weights. Given the practical difficulty of obtaining optimal weights, a pragmatic approach to adopting a common currency basket in West Africa may well be to use simple trade–based weights, which can be obtained with relative ease. But how would such a trade–weighted basket (consisting of the euro and the dollar) perform in term of achieving effective exchange rate stability? Thus, we estimate the “endogenous” weights of a common basket for the WAEMU or the CAEMC,

[22] Yehoue (2005) suggested, from the view point of trade dependence, that the best anchor for an African Monetary Union would be the euro.

and compare them with the "exogenous" trade–based weights in order to see how closely they are substitutable.

Methodology

In estimating the endogenous weights of the euro and the US dollar, we follow the methodology of Kawasaki and Ogawa (2006). Denoting the real exchange rate by $q_{n,it}$, where n refers to the anchor currency (the euro, the dollar or the basket), i refers to the country in question, and t is a time subscript, we can transform country i's real exchange rate against the currency basket as follows:

$$q_{CB,i} = \gamma \cdot q_{US,i} + (1-\gamma) \cdot q_{EU,i} \quad (0 \le \gamma \le 1), \tag{8}$$

where γ is the weight of the US dollar. By substituting equation (8) into equation (4), we obtain the following equation:

$$\sum_{i=1}^{n-1} \alpha_i \cdot q_{CB,i} = \alpha_1 \cdot \{\gamma \cdot q_{US,1} + (1-\gamma) \cdot q_{EU,1}\} + \alpha_2 \cdot \{\gamma \cdot q_{US,2} + (1-\gamma) \cdot q_{EU,2}\} + \cdots + \alpha_{n-1} \cdot \{\gamma \cdot q_{US,n-1} + (1-\gamma) \cdot q_{EU,n-1}\} = 0.$$

This equation can be rewritten as follows:

$$\alpha_1 \cdot \{\gamma \cdot (q_{US,1} - q_{EU,1}) + q_{EU,1}\} + \alpha_2 \cdot \{\gamma \cdot (q_{US,2} - q_{EU,2}) + q_{EU,2}\} + \cdots + \alpha_{n-1} \cdot \{\gamma \cdot (q_{US,n-1} - q_{EU,n-1}) + q_{EU,n-1}\} = 0.$$

After some substitution and rearranging, we obtain the following equation:

$$\alpha_1 \cdot q_{EU,1} + \alpha_2 \cdot q_{EU,2} + \cdots + \alpha_{n-1} \cdot q_{EU,n-1} + \gamma \cdot (\alpha_1 + \alpha_2 + \cdots + \alpha_{n-1}) \cdot q_{US,EU} = 0, \tag{9}$$

where $q_{US,EU}$ is the EU's real exchange rate against the US dollar. Accordingly, we set up the n dimensional VECM of equation (6), where the endogenous variables are

$$Y' = [q_{EU,1},\ q_{EU,2},\ q_{EU,3},\ q_{EU,4}, \cdots q_{EU,n-1}, q_{US,EU}]'.$$

When GPPP holds within the group in question, the real exchange rates are cointegrated with an unique cointegrating vector in the form of equation (9) in the case of rank =1. By the Johansen method, we estimate the cointegrating vector $\alpha'^{*} = [\alpha_1^*,\ \alpha_2^*,\ \alpha_3^*, \cdots \alpha_{n-1}^*,\ \alpha_n^*]$ where α_i^* $(i = 1,2,3,\cdots n-1)$ and α_n^* are the estimated variable of α_i $(i = 1,2,3,\cdots n-1)$ and $\gamma \cdot (\alpha_1 + \alpha_2 + \cdots + \alpha_{n-1})$. Lastly, the estimated optimal weight of the US dollar can be obtained as follows:

$$\gamma^* = \frac{\alpha_n^*}{(\alpha_1^* + \alpha_2^* + \cdots \alpha_{n-1}^*)}.$$

This means that the estimated optimal weight of the euro is $1 - \gamma^*$.

Although the focus of this section is on a common currency basket, we also explore the optimality of adopting a single anchor currency by testing the significance of the coefficient α_n^* by the Johansen method. If the hypothesis of $\alpha_n^* = 0$ cannot be rejected, a common currency pegged to the euro alone is preferable to a common currency basket. On the other hand, if the hypothesis of $\alpha_n^* = 1$ cannot be rejected, a common currency pegged to the US dollar alone is preferable.

Table 6. Johansen Cointegration Tests for the Choice of Anchor Currency for WAMZ (Gambia, Ghana, Nigeria, Sierra Leone) + United States

Post–devaluation sample: January 1994–July 2007 (lag =1)

Null hypothesis	Eigenvalue	Trace statistic	Max–Eigen statistic
H_0: r = 0 *	0.284527	130.6987***	54.57428***
H_0: r = 1 ($\leq$ 1) *	0.208910	76.12439***	38.19801***
H_0: r = 2 ($\leq$ 2) *	0.156701	37.92638**	27.78069***
H_0: r = 3 ($\leq$ 3)	0.049619	10.14569	8.295394
H_0: r = 4 ($\leq$ 4)	0.011287	1.850295	1.850295

Notes: 'r' denotes the number of cointegrating vectors; *** and ** denote that the hypothesis is rejected at the 1% and 5% levels.

Estimating the endogenous weights of the euro and the US dollar

Table 6 reports the results of Johansen cointegration tests for the period of 1994–2007. First, in Table 6(1), we find three cointegration relationships among WAMZ members and the United States. Table 7(3) further shows that the estimated weights of the euro and the US dollar are 41% and 59%, respectively[23]. These findings indicate that an almost equally–weighted basket consisting of the euro and the US dollar may well be a viable option. At any rate, the current de facto dollar peg arrangement does not make sense for the WAMZ in terms of stabilizing the real effective exchange rates, although this does not mean that joining the CFA zone makes sense either. At least for now, it is difficult to find a common currency that is optimal for both the WAMZ and the CFA franc zone.

Next, we compare the endogenous weights with the trade–based exogenous weights[24]. Looking at Table 7(1) in the case of the WAEMU, we find that the estimated weights are 88% for the euro and 12% for the US dollar[25]. These are contrasted to the exogenous weights (trade shares) of 90.1% for the euro and 9.9% for the US dollar for the period of 1994–2006[26]. The endogenous weights roughly correspond to the exogenous weights. Looking at Table 7(3) in the case of the WAMZ, the estimated weights of the euro and the US dollar are 41% and 59%. These endogenous weights roughly correspond to the exogenous weights calculated by the trade shares (53.9% for the euro and 46.1% for the US dollar) during the same period.

Referring to Table 7(2) in the case of CAEMC, we further note that the endogenous weights are

[23] In the case of the WAMZ, the weights have expected signs only for the first cointegrating vector, but not for the second and third vectors. Thus, the weights are calculated only for the first vector. We rejected the hypothesis of $\alpha_n^* = 0$ for the first cointegrating vector.

[24] We can find two cointegration relationships among WAEMU members and the United States, and two cointegration relationships among CAEMC members and the United States (the results not formally reported here). These results mean that the WAEMU or CAEMC members can form a common currency area with a common currency basket of the euro and the US dollar.

[25] The weights should be greater than zero and smaller than unity. In the case of the WAEMU, the weights have expected signs only for the second cointegrating vector, but not for the first. Thus, the weights are calculated only for the second vector. We rejected the hypothesis of $\alpha_n^* = 0$ in the case of the second cointegrating vector.

[26] The larger endogenous weight of the euro is not surprising, given the existing exchange rate arrangement. In addition, some CAEMC members (such as Cameroon, Central African Republic, and Chad) rely heavily on the EU markets.

Table 7. Johansen Cointegration Tests: Estimated Cointegration Coefficients

(1) WAEMU (Benin, Burkina Faso, Cote D'ivoire, Mali, Niger, Senegal, Togo, and Guinea Bissau) + United States

	Benin	Burkina Faso	Cote D'ivoire	Mali	Niger	Senegal	Togo	Guinea Bissau	USA
r = 1	5.611210	–19.44090	–10.91187	6.416040	5.041422	–17.83101	4.892646	–0.173267	0.408492
r = 2***	0.618731	–17.17182	–10.92459	–28.69022	53.95379	3.831497	23.91690	–4.061044	2.532748

Endogenous weights: Euro 88%, US Dollar 12% ←→ Exogenous weights: Euro 90.1%, US Dollar 9.9%

(2) CAEMC (Cameroon, Central African Republic, Chad, Congo, Gabon, and Equatorial Guinea) + United States

	Cameroon	Central African Republic	Chad	Congo	Gabon	Equatorial Guinea	USA
r = 1***	–19.53797	7.466620	1.318424	3.613379	–19.62450	–2.539123	–0.975835
r = 2	–87.46525	0.490185	3.614051	13.52435	54.04832	19.30574	–7.681903

Endogenous weights: Euro 97%, US Dollar 3% ←→ Exogenous weights: Euro 62.2%, US Dollar 37.8%

(3) WAMZ (Gambia, Ghana, Nigeria, and Sierra Leone) + United States

	Gambia	Ghana	Nigeria	Sierra Leone	USA
r = 1***	5.556982	–5.250661	0.661122	–10.67462	–5.725591
r = 2	–2.709403	–6.435159	1.613576	5.743999	6.955262
r = 3	0.764990	4.512991	–0.882854	–4.072893	2.876687

Endogenous weights: Euro 41%, US Dollar 59% ←→ Exogenous weights: Euro 53.9%, US Dollar 46.1%

97% for the euro and 3% for the US dollar[27]. In contrast to WAEMU and WAMZ, the endogenous weights of the euro and the US dollar in CAEMC differ significantly from the trade–based weights (62.2% for the euro and 37.8% for the US dollar) during the same period. This may be explained by the greater diversity of CAEMC countries. For example, the oil–exporting countries (such as Congo and Gabon) trade heavily with the US dollar area[28]. The trade weights, however, may approach the endogenous weights in the future. First, the world's principal oil–exporting countries may begin to invoice their trade in a basket of currencies because of the recent and prospective weakening of the US dollar (given the correction triggered by the US subprime crisis as well as the expected unwinding of global imbalances)[29]. Second, as a long–term trend, the euro may be emerging as a major international reserve currency, to become equal in status to, if not to take the place of, the US dollar (see Papaioannou et al., 2006).

Finally, the same table shows that the weights are quite different between the CFA zone and the

[27] In the case of the CAEMC, the weights have expected signs only for the first cointegrating vector, but not for the second. Thus, the weights are calculated only for the first vector. We rejected the hypothesis of $\alpha_n^* = 0$ for the first cointegrating vector.

[28] If the US dollar area is defined to include China and all oil exporting countries whose currencies are pegged to the US dollar, the trade–based exogenous weights are 52.8% for the euro and 47.2% for the dollar.

[29] OPEC members have recently expressed such interest because a depreciating dollar would not only make crude oil prices higher (in dollar terms) but also erode the value of their dollar reserves.

WAMZ, confirming what we found in section III, namely, that these two sub–regions when combined do not constitute a sustainable common currency area. At the same time, these "endogenous" weights do not diverge extensively from the respective zones' trade–based weights. To this extent, we conclude that the trade–based weights can be used as a pragmatic means of agreeing on a common currency basket.

V. Conclusion

The paper had two objectives. The first was to investigate the optimality of setting up a common currency area in West Africa by using a generalized PPP (GPPP) model. The results from Johansen's cointegration tests show that (i) the existing WAEMU formed an optimal currency area (OCA) for the full sample period of 1975–2007; (ii) the emerging WAMZ formed an OCA only for the more recent period of 1994–2007; (iii) the WAEMU, combined with either Gambia or Ghana, formed an OCA for the earlier period of 1975–1993; and (iv) the WAEMU, combined with Nigeria, did not form an OCA for the same period.

The results (i) and (ii) above suggest the possibility that exchange rate stability, either de jure or de facto, promotes trade among the zone of stability. This is consistent with the idea of endogeneity first suggested by Frankel and Rose (1998). The result (i) further underscores that the process of convergence toward GPPP already started among the WAMZ members even before the formal adoption of the common currency (eco) planned for 2009, suggesting that the countries have begun to conduct economic policies in such a way as to achieve the stated convergence criteria. This means that, if such convergence continues over time, it begins to make more economic sense to adopt a common currency for the ECOWAS (the combined CFA franc and WAMZ area). At the present stage, however, the coexistence of CFA franc zone and the WAMZ appears to make more sense.

Second, another objective of the paper was to analyze the possibility for creating a common currency basket for West Africa by estimating the endogenous weights of the euro and US dollar that would make the member countries' bilateral exchange rates stable. Setting up a common currency area in West Africa requires a common anchor currency, but one group of potential members (the CFA zone) has the euro as the anchor currency and the other group (the WAMZ) has the US dollar. If the estimated weights of the major currencies are similar across the two sets of countries, a mutually acceptable currency basket could be found as the anchor currency for the whole region. Our empirical results, however, did not support such a view.

For the WAEMU, we found that the weights were 88% for the euro and 12% for the US dollar. Likewise for the CAEMC, the weights were 97 % for the euro and 3% for the US dollar. For these CFA zone countries, a continued peg to the euro seems to be the right policy. In contrast, for WANZ, the weights were found to be 41 % for the euro and 59% for the US dollar. While the WAMZ's de facto dollar peg arrangement does not make sense, nor does it make sense for these countries to join the CFA zone.

If the West African countries are determined to set up a common currency area, it is advisable to

adopt policies that would facilitate the economic integration of the CFA franc zone with the WAMZ, and to choose the right anchor for the common currency in such a way as to maximize the extent of real effective exchange rate stability for all member countries.

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