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**Impact of Common Currency Membership on West African Countries'
Enhanced Economic Growth**

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Abstract

In spite of their current high growth episode, the level of financing of West African economies is too low to ensure sustainable long term economic growth. Their domestic savings are insufficient and their access to foreign borrowing from official creditors is also low. For most countries foreign indebtedness from private creditors is non-existent because of their poor credit risk ratings. Given their inability to improve their sovereign risk profile in the short to medium term, participation in a broad common currency union (CCU) can be the only means to achieve significant reduction in sovereign credit risk and borrow from international private creditors, the largest source of global finance.

With the theoretical model of Contingent Claims Analysis (CCA), it is shown that West African countries can combine their foreign reserves and, through a facility of mutual insurance against adverse debt service outcomes, increase the expected level of net foreign assets available for external debt service, and possibly lower its volatility. The simulation model of the CCA shows that, as members of a CCU, West African economies can benefit from a lower credit risk score that translates into easier access to private creditor lending than in the absence of CCU membership. Once a suitable level of risk is attained, borrower countries can raise their level of indebtedness without changing their risk profile provided the level of foreign reserves available to service their debt increases commensurately.

Key words: Regional integration, Common currency union, Africa's economic development, Africa's external debt, Contingent claims analysis

JEL classification: O110: Macroeconomic Analyses of Economic Development

1. Introduction

Over the last few years, the West African sub-region has experienced an episode of high economic growth that seems likely to continue in the near future. While its performance has been rather satisfactory, it did not equal the achievements recorded by leading emerging economies such as China and India during their high growth periods.¹ Furthermore, in spite of relative consistency in the economic outcome of the recent past, it is not certain how long this upturn will be sustained or what could fuel it in the long run. It can be argued that, in the current absence of significant increases in productivity and international competitiveness, West Africa's economic growth is largely fueled by price increases in export commodities and favorable global demand, two factors that are prone to variability and beyond the control of developing countries in general, and West Africa in particular. Then, how to secure long term economic growth of West African countries in the context of their low level of development, relative marginalization from world markets and severely limiting poor capacity to finance their economies?

After years of attempts at economic development at the national level without much success, West African countries have undertaken a strategy of regional integration, the key feature of which is establishment of a common currency that aims to include all fifteen countries of the sub-region, members of the Economic Community of West African States (ECOWAS). Can a common currency union contribute to economic growth of its members? Frankel (2004) cites the benefits of a fixed exchange rate regime, which characterizes a common currency arrangement, as follows. The fixed exchange rate regimes i) provides a nominal anchor for monetary policy and represents a credible commitment to fight inflation; ii) promotes trade and investment by reducing speculative bubbles; iii) prevents competitive devaluation and iv) avoids speculative bubbles in exchange rates.² Lee and Barro (2011) add that a developing country stands to gain from a fixed exchange rate regime through membership in a common currency union with increased access to long term international financing because it would be able to borrow on better terms due to lower prospects of devaluation and lower expected domestic inflation. The current paper argues that better access to foreign long term financing can also be achieved thanks to a common currency union through a specific arrangement on foreign reserve management.

The purpose of the study is to show that in spite of their current high growth episode, West African countries have a record of historically low growth performance characterized by low investment, low savings rates and very modest access to international sources of credit caused by their poor credit ratings. But, this situation can be improved if they become members of a common currency union that gives them

¹ According to IMF's Regional Economic Outlook for Sub-Saharan Africa, April 2014, Table AS1, the Economic Community of West African States (ECOWAS) recorded real GDP growth rates of 6.8%, 6.8% and 6.1% for 2011, 2012 and 2013 respectively. Its growth rate is expected to reach 6.7% or both 2014 and 2015. By comparison, according to the World Bank's World Development Indicators, the annual growth rate of China's GDP was 10% in 2003 and 2004, 11.3% in 2005, 12.7% in 2006 and 14.2% in 2007. Over the same period, India recorded 7.9% in 2003 and 2004, 9.3% in 2005 and 2006 and 9.8% in 2007.

² Barro and Lee (2011), page. 13.

access to additional foreign reserves and enhances their capacity to service their sovereign debt obligations.

The paper is organized as follows. In the next section, the current situation of West African countries is portrayed through the triple lens of their poor record of economic growth over the last half century and over any shorter sub-period except for the last few years, their limited capacity to finance their economies with domestic savings or international borrowing, and their inability to access international debt markets because of their disqualifying low credit ratings.

2. Current economic situation of West African economies

2.1. Historical economic growth performance of ECOWAS countries

Table 1 displays the statistics on growth of real per capita gross domestic product (GDP) for ECOWAS countries. The statistics are reported for various periods ending in 2012, namely 5 years (since 2008), 10 years (since 2003), 20 years (since 2003) and since independence of most West African countries, i.e.52 years (since 1961). The means and coefficients of variation of per capita GDP growth are shown separately for member countries of Union Economique et Monétaire Ouest-Africaine (UEMOA) and non-UEMOA members. Statistics for countries that became independent after 1961 –Cape Verde, Guinea Bissau and The Gambia- have been adjusted. The average growth of real per capita GDP for all countries is 0.99% over the entire 52-year period, which represents an accumulated increase of 66.9%. The breakdown shows that non-UEMOA economies experienced an increase of 114.7%, which is 3.33 times faster than for members of UEMOA countries that posted 34.4%. In other words, over more than half a century UEMOA countries improved the per capita GDP of their residents by slightly more than one third. Two countries of UEMOA stand out by their decline over the 52 year-period; Senegal suffered a decline of 5.6% while Niger reported a drop of 66.6%.

In contrast, Cape Verde, has recorded a 711% increase in its per capita GDP since it gained independence in 1975. Between 1961 and 2012, Brazil posted a cumulated real per capita growth rate of 243.24%, India 404.18 % and China 2,945%. For ECOWAS countries the average growth rates are very similar over the 10-year and 20-year periods ending in 2012, UEMOA and non-UEMOA economies showing comparable degrees of consistency over time despite the 3.3 to 1 ratio in their respective average per capita GDP growth rates. Two countries, Côte d'Ivoire and Guinea Bissau, recorded negative growth rates during these two periods -10 years and 20 years - mostly caused by their internal civil unrest. The two groups of countries saw their best performance during the five-year period 2008-2012, and recorded slight convergence towards Brazil, India and China that experienced a decline in their respective growth rates in view of the 10-year period 2003-2012 compared to the 5-year period 2008-2012.

One of the most striking features of ECOWAS economies is their high level of volatility. Considering the 10-year period (2003-2012), the 20-year period (1993-2012) and the 52 year-year period (1961-2012) the coefficient of variation is abnormally high for most of the countries, especially when compared to the same statistics for the three emerging countries, Brazil, India and China. This historical high volatility makes prediction of future national income very difficult and point estimation very uncertain. Therefore, the

overall average performance of ECOWAS countries can be deemed rather modest and its volatility incommensurately high compared to the three main emerging countries of the last half-century.

Table 1. Growth of Real Per Capita GDP of ECOWAS and Selected Emerging Countries (in %)

Country Name	Mean 2008-12	Mean 2003-12	C.V 2003-12	Mean 1993-2012	C. V. 1993-2012	Mean 1961-2012	C.V. 1961-2012
UEMOA	5 years	10 years	10 years	20 years	20 years	52 years	52 years
Benin	0.90	0.63	155.25	1.10	110.18	0.75	390.53
Burkina Faso	3.05	3.13	67.98	2.91	82.68	1.91	161.61
Cote d'Ivoire	0.61	-0.04	-7899.74	-0.18	-1814.73	0.23	2147.91
Guinea-Bissau	-0.03	-0.77	-636.90	-0.82	-957.37	0.20	3686.62
Mali	0.36	1.41	169.01	1.68	178.66	1.36	356.63
Niger	2.13	1.08	324.37	0.37	922.50	-0.78	-728.80
Senegal	0.28	1.29	118.52	0.93	207.31	-0.11	-3247.81
Togo	1.37	0.82	164.00	0.53	1142.89	0.97	602.07
Average	1.08	0.94		0.81		0.57	
NON-UEMOA							
Cabo Verde	3.46	5.62	67.34	7.11	60.50	5.82	72.73
Gambia, The	0.70	0.52	685.01	0.26	1255.82	0.58	601.03
Ghana	6.12	4.66	62.51	3.18	80.44	0.89	498.12
Guinea	0.23	0.14	985.69	0.66	224.54	0.42	391.42
Liberia	7.13	1.86	687.05	7.76	323.75	0.39	4876.71
Nigeria	3.61	6.62	122.49	3.40	197.03	1.55	534.14
Sierra Leone	4.96	3.91	85.86	2.01	324.92	0.69	810.89
Average	3.74	3.33		3.48		1.48	
Average all countries	2.33	2.06		2.06		0.99	
Brazil	2.28	2.55	94.14	1.94	112.54	2.40	158.78

China	8.72	9.87	17.54	9.34	20.47	6.79	101.95
India	5.43	6.33	31.07	5.15	42.05	3.16	102.61

Source: World Bank, World Development Indicators, Online, May 2014

Table 2 reports the main sources of finance in 2012 of ECOWAS countries and three key emerging economies, Brazil, China and India. It shows that 5 countries, Benin, Guinea Bissau, Liberia, Niger and Togo, have no public and publicly-guaranteed (PPG) debt loaned by international private creditors. Burkina Faso, The Gambia, Guinea and Mali have insignificant PPG debt funded by private creditors. Only three countries, Côte d'Ivoire, Nigeria and Senegal have private non-guaranteed debt (PNG) and their respective stock of PNG debt is rather low compared to the stock of PPG debt. In comparison, the stock of debt from private creditors, whether PPG or PNG, represents a higher percentage of total debt for Brazil, China and India. In other words, sovereign borrowing from private sources plays an important role in the emerging economies, which underscores the important contribution of international credit markets to developing countries' growth strategy. In the absence of significant borrowing from international private creditors, ECOWAS countries face a difficult challenge in sustainably financing their economic growth.

Most of them also have very low Gross Fixed Capital Formation to Gross Domestic Product (GFCF/GDP) ratios and even lower Savings to Gross National Income (Savings/GNI) ratios. These two statics give evidence that ECOWAS countries invest little and save little, which may help explain their historically modest per capita growth record.

Table 2. Main Sources of Finance of ECOWAS and Selected Emerging Economies in 2012

Country	PPG Total Debt Stock in Mln \$		PNG Debt Stock in Mln \$	GFCF / GDP in %	Savings / GNI in %
	Official Creditors	Private Creditors			
Benin	1,303.6	0	0	17.6	13.1
Burkina Faso	2,192.0	12.7	0	16.7	15.6
Cape Verde	1,123.6	118.2	0	46.7	22.8
Côte d'Ivoire	5,808.7	128.6	2,490.2	10.1	13.3
The Gambia	386.2	9.6	0	19.2	12.6
Ghana	5,979.3	2,627.1	0	29.0	9.1
Guinea	830.3	12.0	0	15.0	-7.2
Guinea Bissau	213.4	0	0	7.5	N.A
Liberia	208.3	0	0	25.4	32.9
Mali	2,793.4	3.5	0	22.2	8.9
Niger	2,078.6	0	0	33.8	N.A
Nigeria	6,151.6	500.0	850.0	8.2	N.A
Senegal	3,694.6	356.6	265.5	23.0	22.0
Sierra Leone	623.7	209.6	0	40.3	9.9
Togo	450.0	0	0	18.6	12.3
Brazil	38,959.4	77,668.9	286,829.9	18.1	15.0
China	64,463.5	4,539.9	159,670.5	46.8	51.4
India	78,026.4	41,405.8	160,203.9	30.4	30.7

Source: World Bank, World Development Indicators, Online, May 2014

Table 3 reports sovereign credit ratings of a number of West African countries published by the three major international rating agencies, Standard and Poor (S&P), Moody's and Fitch as of April 2014. While S&P has ratings for six countries, Moody's and Fitch rated three countries with only Ghana and Nigeria covered by all agencies. For each of the rating agencies, no West African country reaches the minimum rating required to constitute investment grade sovereign. In other words, West African countries cannot access private sovereign debt markets, which constitutes a significant hurdle to international finance for their development. This situation does not preclude the possibility of international borrowing from official creditors although, as can be seen in Table 2, this source is insufficient for the development needs of West African countries. Table 2 also confirms the poor ratings in Table 3 because only Cote d'Ivoire, Nigeria and Senegal have stocks of private non-guaranteed debt and the amounts are very low.

In summary, although West African countries have reached rates of growth of their per capita GDP in the last few years, the historical record over the last half century shows a different picture characterized by low economic growth and a high degree of volatility. Non-UEMOA countries seem to perform significantly better than UEMOA countries. Most West African countries have modest levels of investment and the majority does not save enough for their investments. West African governments have low levels of international indebtedness from official as well as private sources while their private sectors have no access to international private debt markets and when they do, the amounts borrowed are insignificant. These countries have sovereign credit ratings that are so low, few of them are actually rated by the international agencies, that they do not constitute investment grade sovereigns and therefore cannot access private international debt markets.

Table 3. Sovereign Credit Risk Ratings of ECOWAS Countries

ISO code	Country	S&P Rating	S&P Outlook	Moody's rating	Moody's Outlook	Fitch Rating	Fitch Outlook
BF	Burkina Faso	B	STA				
BJ	Benin	B	NEG				
CV	Cape Verde	B+	STA			B+	STA
GH	Ghana	B	STA	B1	STA	B+	NEG
NG	Nigeria	BB-	STA	Ba3	STA	BB-	STA
SN	Senegal	B+	NEG	B1	STA		
	Minimum Investment grade rating	BBB -		Baa3		BBB -	
	Date: 2 April 2014						
Source:	https://docs.google.com/a/mail.wbs.ac.uk/spreadsheet/ccc?key=0AonYZs4MzIZbdDdpVmxmVXp mUTJCcm0yYTV2UWpHOVE#gid=20						
	http://www.theguardian.com/news/datablog/2010/apr/30/credit-ratings-country-fitch-moodys-standard#data						

The foregoing analysis underscores the limited capacity of West African countries to achieve long term economic growth without access to international debt finance. Yet, their current sovereign credit ratings show that their level of riskiness disqualifies them from private international debt markets. One of the remedies to this situation that can be explored is whether regional integration through creation of a common currency union can alter the risk profile of individual countries and make them eligible as investment grade sovereigns. The link between currency union membership and improved solvency is established through access to higher levels of financial resources available for service of international debt service obligations made possible by the common currency arrangement. In the next section a model of risk assessment and pricing of sovereign debt is presented for a single country that is not a member of a common currency union. An equilibrium relationship is established between the country's level and variability of its foreign reserves on the one hand, and the probability of default or debt service stress and value of the foreign debt on the other hand. The following section examines the case of the country when it is a member of a common currency union with specific arrangements with respect to management of its pooled foreign reserves.

3. Contingent claims approach to risk assessment and pricing of sovereign debt

Assessing sovereign country risk and pricing it have been at the forefront of the literature on international credit markets. Several authors have modelled sovereign default risk and proposed methods of pricing it. See Cohen (1991 and 1993), Duffee (1999), KMV Corporation (2002), Duffee et Al. (2003), Arellano (2008), Borensztein and Panizza (2008) and Hilscher and Nosbuch (2010). One specific approach, the contingent claims analysis, seems appropriate for assessment of the riskiness of sovereign debt of developing countries. It is based on the pricing of options proposed by Black and Scholes (1973) and Merton (1973 and 1974) and has been developed by Grossman and Van Huyck (1985), Gray, Merton and Bodie (2007 and 2008), Gapen et Al. (2008), Hubner and Sibille (2011) and Jobst and Gray (2013).

Gray, Merton and Bodie (2007) present a simple model of the balance sheet approach to the contingent claims risk assessment and pricing of sovereign debt. They portray the economy of the borrower country as a combined balance sheet of Government and monetary authorities. Assets of the balance sheet include i) Foreign reserves, ii) Net fiscal asset and iii) Other public assets. The Foreign reserves consist of the public sector's net international reserves. Net fiscal assets are the difference between the present value of taxes and revenues on the one hand and the present value of non-discretionary expenditures on the other hand. Other public assets include equity in public enterprises, value of the public sector's monopoly on the issue of money and other financial and non-financial assets.

The liabilities included in the country's balance sheet comprise i) Base money, ii) Local currency debt, iii) Foreign currency debt and iv) Guarantees. Base money consists of currency in circulation and bank reserves. Local currency debt is owed to domestic creditors outside Government and monetary authorities. Foreign currency debt is sovereign and denominated in foreign currency and owed to foreigners. Guarantees are extended by Government to domestic financial and non-financial entities.

Gray et al. define a distress barrier as the present value of the promised payment related to sovereign debt denominated in foreign currency and propose to measure it as the country's short term debt plus one-half of long term debt plus interest payment up to time t . Distress or default occurs when the country's sovereign assets fall below the distress barrier, which may happen considering that the country's foreign assets are stochastic. Therefore the country's debt is risky.

The borrower country's balance sheet can be written as follows: Assets = Equity + Risky Debt, or

$$A(t) = J(t) + D(t) \quad (1)$$

$A(t)$ is the value of assets at time t

$J(t)$ is the value of the country's equity at time t and

$D(t)$ is the country's risky debt at time t .

Based on the contingent claims approach the equity can be considered as an implicit call option on the assets with an exercise price that is equal to the promised payments, B, that will mature in T-t periods. The risky debt can be considered as a risk-free debt minus a guarantee against default which is equal to a put option on the assets with an exercise price equal to B. Therefore,

Risky debt = Default-free Debt – Debt guarantee and

$$D(t) = B e^{-r(T-t)} - P(t) \quad (2)$$

Where P(t) is the value of the debt guarantee.

Assuming t=0, Black and Scholes's formula for the value of a call option (the equity) gives

$$J = AN(d_1) - B e^{-rT} N(d_2) \quad (3)$$

$$d_1 = \frac{\ln\left(\frac{A}{B}\right) + \left(r + \frac{\sigma^2}{2}\right) T}{\sigma\sqrt{T}} \quad (4)$$

$$d_2 = d_1 - \sigma\sqrt{T} \quad (5)$$

,

r is the risk-free rate

σ is the asset return volatility

$N(d)$ is the cumulative probability of the standard normal density function below d

The "risk-neutral" or "risk-adjusted" default probability is $N(-d_2)$.

The formula for the "delta" of the put option is $N(d_1) - 1$.

The yield to maturity on the risky debt, y , is defined by:

$$D = B e^{-yT} \quad (6)$$

$$y = \frac{\ln (B/D)}{\tau} \quad (7)$$

And the credit spread is: $s = y - r$ (8)

The value of assets at time (t)

Gray et al. depict the process of asset return as follows:

$$dA/A = \mu_A dt + \sigma_A \varepsilon \sqrt{t}, \quad (9)$$

where μ_A is the drift rate or asset return on A,

σ_A is the volatility of the return on asset A.

ε is a normally distributed random variable with zero mean and unit variance.

As indicated earlier, default occurs when assets, A, fall to or below the promised payments, B_t . Therefore, the probability of default is the probability that $A_t \leq B_t$ which is :

$$(\text{Prob}(A_t \leq B_t) = \text{Prob}(A_0 \exp[(\mu_A - \sigma_A^2/2)t + \sigma_A \varepsilon \sqrt{t}] \leq B_t) = \text{Prob}(\varepsilon \leq -d_{2,\mu}). \quad (10)$$

Considering that $\varepsilon: N(0,1)$, the “actual” probability of default is $N(-d_{2,\mu})$, where

$$d_{2,\mu} = \frac{\ln(A_0/B_t) + (\mu_A - \sigma_A^2/2)t}{\sigma_A \sqrt{t}} \quad (11)$$

Two variables in (11) are of key interest with respect to the determination of a borrower country’s sovereign risk. Asset A is expected to increase by μ_A . If μ_A increases, it increases $d_{2,\mu}$, and lowers the probability of default $N(-d_{2,\mu})$. A higher level of volatility, σ_A , lowers the numerator in (11), increases the denominator and results in a lower probability of default. In summary, the riskiness of a borrower country’s sovereign debt can result from a higher level of the assets with which it services its debt or from lower volatility of the return on the assets.

4. Membership in a common currency union and riskiness of sovereign debt

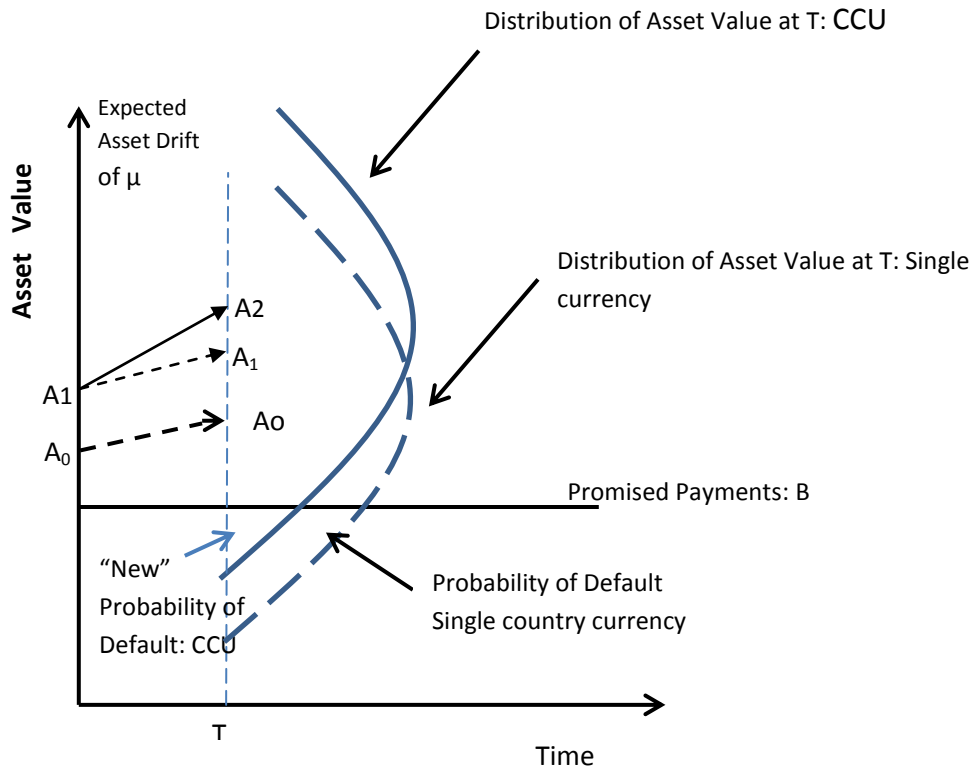
Members of the Economic Community of West African States (ECOWAS) have a regional integration agenda that includes creation of a common currency union (CCU). If implemented the new common currency would replace the West African CFA Franc that is currently used by eight countries that are members of the West African Economic and Monetary Union (WAEMU).³ The ECOWAS CCU could replace the WAEMU but retain one of its key features, the “*Compte d’Opérations*” (*Operations Account*). In accordance with this arrangement each member country would surrender its foreign reserves to the CCU authority, presumably the common central bank, and have accounting of its reserves that would be separate from the reserves of other members. The Operation Account would give the country access to its own foreign reserves, among other things, for its sovereign debt service obligations. It would also make available part of other members’ foreign reserves, for the country to service its foreign debt. In other words, through this arrangement, the member country would increase its capacity to make payments on its sovereign debt by the portion of other members’ reserves that can be accessed as one of the benefits of its membership in the CCU. An additional feature of this arrangement would be subordination of a country’s debt from the CCU authority to sovereign external debt.

Figure 1 portrays the change in a country’s sovereign debt risk level that results from membership in the CCU. Consider a country with its own national currency that borrows externally and promises to make a given payment, B , at time T . It currently has foreign reserves equal to A_0 that have an expected drift, μ , with a growth path depicted by the dotted line $A_0 - A_0$. The distribution of its assets is given by the curved dotted line and the probability of default on its sovereign debt is represented by the area under the horizontal line of promised payments, B , and the curved dotted line. Now if the country is a member of the CCU and has access to a portion of the foreign reserves of the other CCU members, the level of assets that it can use to service its sovereign debt increases from A_0 to A_1 and the level of its assets available at time T follows the growth path $A_1 - A_1$. If it makes more productive use of the foreign debt the growth path could be $A_1 - A_2$.

Considering that the level of promised payments has remained constant, access to additional means of sovereign debt service shifts the distribution to a higher level and results in a new probability of default that is lower than in the case of a country with its own national currency. The new probability of default is depicted by the area under the horizontal line of promised payments and the solid curved line of distribution of asset under the CCU.

³ For the lists of members of ECOWAS and WAEMU see Table 1.

Figure 1: Probability distribution of asset value under CCU and single country currency



Numerical simulation of impact of CCU membership on sovereign debt

The following numerical simulation is aimed at shedding light on the gains that can accrue to a country that is a member of an ECOWAS CCU under the arrangement of common foreign reserves specified above. The main feature of relevance for the simulation model is that member countries can use their own reserves and a portion of the reserves of other member countries to service their sovereign debt thus increasing their capacity for promised payment on external debt service. The model is based on the contingent claims analysis presented above. Its five arguments are the level of assets of the country (A), the level of its promised payment (B), the rate of interest on its sovereign debt (r), time until the expected payment, T, and the volatility of the return on its assets (σ).

A key feature of the model is that the “actual” probability of default is $N(-d_{2,\mu})$, and eq.(11) states that

$$d_{2,\mu} = \frac{\ln(A_0/B_t) + (\mu_A - \sigma_A^2/2)t}{\sigma_A \sqrt{t}}$$

For the sake of simplicity, it is assumed that the rate of return on the country’s assets, μ , is equal to the rate of interest on the loan, r.

Table 4 presents the probability of default on a loan under various combinations of the expected level of assets and the associated volatility of the return on the assets. The country is assumed to commit to a promised payment, B, equal to \$75 to be made in one year (T=1). The succession of higher levels of assets indicates the impact of increasingly higher access to CCU reserves for a given level of the country’s own assets. By the same token, the succession of decreasing levels of volatility, σ , shows the impact of the resulting volatility of the return on the assets to which the country has access under the CCU reserve management arrangement. The main result evidenced by the simulation is that the higher the level of assets, the lower the probability of default. The lower the level of volatility of asset returns, the lower the probability of default. A combination of these two factors accelerates the decrease in the probability of default.

To illustrate, if the level of assets increases from \$100 to \$150, the probability of default is reduced by two thirds (from 33.5% to 10.8%) under a volatility of 50%, by 81% under a volatility of 40% and by 93.9% if volatility is 30%. At a volatility of 20% the probability is equal to zero if assets reach \$150. The reduction in the probability of default is also quite significant as the level of volatility decreases for a given level of assets. Even for a level of assets as low as \$100, the probability of default is halved when volatility decreases from 50% to 20% and is equal to zero for a volatility of 10%. Very high levels of assets or very low levels of volatility are of insignificant marginal impact because the probability of default reaches zero for the combination of assets equal to \$150 and volatility equal to 30%. It takes more extreme values of assets or volatility to yield a probability equal or close to zero when they are considered individually. The policy implication is that if facing market parameters described above, a borrower country benefits from a 50% increase in its capacity to service its sovereign debt and through the diversification effect of the pooled CCU

reserves to which it has access, faces volatility of these assets equal to 20%, the resulting probability of default of its external debt is zero and it becomes a risk-free borrower.

Table 4. Probability of Default on Sovereign Debt under Selected Levels of Assets and volatility

(Assuming $B = \$75$, $T = 1$)

Volatility (σ)	\$100	\$125	\$150	\$175	\$200	\$225	\$250	\$300
50%	33.5%	19.2%	10.8%	6.1%	3.5%	2.0%	1.2%	0.4%
40%	26.0%	11.5%	4.9%	2.1%	0.9%	0.4%	0.2%	0.0%
30%	16.5%	4.3%	1.0%	0.2%	0.1%	0.0%	0.0%	0.0%
20%	5.6%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: Author's calculations.

Table 5 displays the value of the sovereign loan of the country for a promised payment of \$75 and a time to maturity of one year for various combinations of asset value and volatility. In other words it indicates the amount of money the country can raise under these parameters. Considering that, as shown in Table 4, the higher the level of asset value or the lower the level of volatility, the lower the probability of default, Table 5 gives the value of the loan assigned to each of the asset level-volatility combinations. Higher levels of assets command a higher loan value and lower volatility has the same effect. The maximum value of the loan, \$71.34, corresponds to a probability of default of zero in Table 4. Table 5 also shows that the highest value of the loan is reached with the combination of assets equal to \$150 and volatility equal to 20%. For a country with an initial combination of assets equal to \$100 and volatility equal to 50%, this represents a gain in loan value of \$6.18 or 9.5%. Significantly higher levels of assets or lower levels of volatility have no marginal impact on the value of the loan, especially when the two parameters are considered individually. In policy terms, the results of Table 5 show that, for a given set of market parameters, as the level of assets to which the borrower country has access increases thanks to the CCU reserve arrangement, it will be able to raise more money from lenders for a given level of promised payment. The same effect is also true if, thanks to the CCU arrangement, the volatility of the assets decreases thanks to the effect of diversification on asset returns that is a possible result of the pooling of reserves.

Table 5. Value of Sovereign Debt under Selected Levels of Assets and Volatility
 (Assuming $B = \$75$, $T = 1$)

Volatility (σ)	\$100	\$125	\$150	\$175	\$200	\$225	\$250	\$300
50%	\$65.16	\$68.30	\$69.81	\$70.55	\$70.92	\$71.11	\$71.21	\$71.30
40%	\$67.63	\$69.98	\$70.84	\$71.15	\$71.27	\$71.31	\$71.33	\$71.34
30%	\$69.70	\$71.01	\$71.28	\$71.33	\$71.34	\$71.34	\$71.34	\$71.34
20%	\$71.03	\$71.33	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34
10%	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34
5%	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34	\$71.34

Source: Author's calculations.

The last question of the study is: how much more can a country borrow as a result of its membership in a CCU. In other words, with respect to the probability of default on the country's debt to what extent can an increase in the level of assets made possible by membership in the CCU counterbalance an increase in the promised payment that would result from a higher level of sovereign debt? Consider a country that benefits from a \$25 increase in its level of assets and wishes to increase its debt so that its promised payment also increases by \$25. Table 6 displays the resulting probabilities of default for various scenarios of \$25 changes for A, from \$100 to \$125, \$125 to \$150, \$150 to \$175, and so on. For the \$25 increase in promised payment the following scenarios are considered: \$50 to \$75, \$55 to \$80, \$60 to \$85 and \$65 to \$90. For an initial value of asset of \$100, raising B from \$65 to \$90 would increase the probability of default from 15.8% to 42.5%, a difference of 26.7%. If on the other hand, for a promised payment of \$65 the level of assets is raised from \$100 to \$125, the probability of default is reduced from 15.8% to 5.9%, which amounts to a reduction of only 9.9%.

These results are consistent for all combinations of \$25 increases in A and \$25 increases in B. However, as the initial risk level of the country diminishes, i.e. for lower initial values of B and higher initial values of A, the changes in A and in B result in lower differences in probabilities of default because intrinsically both initial values are associated with lower probabilities of default in the first place. Another way to illustrate the results obtained above is to compare probabilities of default that are identical although associated with different scenarios. The probability of default of 11.5% applies to a loan with a promised payment of \$60 and a level of assets of \$100. It also applies to a promised payment of \$90 and a level of assets of \$150. So to maintain the same probability of default a country would need to increase its level of assets by \$50 (from \$100 to \$150) to compensate for an increase of \$30 (from \$60 to \$90) in its promised payment. The policy implication for the results of Table 6 are that a country can benefit from membership in a CCU by increasing its sovereign debt capacity but in a limited fashion unless it can access significantly larger levels of assets as the level of debt increases which can, beyond a certain level, be prohibitively costly for the CCU. However moderate increases in a country's indebtedness as a result of CCU membership can provide a reliable economic gain.

Table 6. Probability of Default on Sovereign Debt under Selected Levels of Assets and Promised Payment
 (Assuming $\sigma = 40\%$, $T = 1$)

Prom. Paymt (B)	\$100	\$125	\$150	\$175	\$200	\$225	\$250	\$300
\$60	11.5%	3.9%	1.3%	0.5%	0.2%	0.1%	0.0%	0.0%
\$65	15.8%	5.9%	2.2%	0.8%	0.3%	0.1%	0.1%	0.0%
\$70	20.7%	8.5%	3.4%	1.3%	0.5%	0.2%	0.1%	0.0%
\$75	26.0%	11.5%	4.9%	2.1%	0.9%	0.4%	0.2%	0.0%
\$80	31.5%	14.9%	6.7%	3.0%	1.3%	0.6%	0.3%	0.0%
\$85	37.0%	18.7%	8.9%	4.2%	2.0%	0.9%	0.4%	0.1%
\$90	42.5%	22.8%	11.5%	5.6%	2.7%	1.3%	0.7%	0.2%

Source: Author's calculations.

Conclusion

The historical record shows that between 1961 and 2012 and over shorter periods since they became politically independent, West African countries have had modest rates of growth of their per capita GDP. They marked a slight improvement in the last few years. Compared to emerging economies such as Brazil, China and India, they have invested and saved modestly and enjoyed limited access to international public lenders and private credit markets. Their limited capacity to borrow internationally can be largely explained by their poor sovereign credit ratings that do not qualify them as investment grade sovereigns. Therefore, their challenge in the short to medium term is to enhance their risk profile and gain access to private international credit market to finance their development efforts. The paper has investigated this possibility and a mechanism through which this could be achieved, namely membership in a common currency union.

The contingent claims approach to assessment and pricing of sovereign debt risk is used to show that if West African countries become members of a common currency union that allows them to use part of the pooled foreign reserves in addition to their own national reserves, they increase the level of assets that can be used to service their sovereign debt thus reducing the probability of default and consequently the riskiness of their debt. A similar effect could also be achieved if the variability of the return on those assets results from the pooling of the reserves. With the help of a numerical simulation, it is shown that the probability of default on the sovereign loan decreases if membership in a common currency union results in an increase in the level of assets or a decrease of their volatility. If the two effects are combined, the debtor country can reach a risk-free status at moderate levels of improvement of the two unlike the case of improvement in one variable only.

The benefits from common currency membership also translate into higher pricing of the sovereign loan and higher proceeds for the borrower country if the arrangement for foreign reserve management gives access to a higher level of assets or causes reduction in the volatility of the assets. The model also shows that membership in the common currency union enhances the capacity of the country to borrow internationally if the level of assets increases, but only moderately because as the level of promised payment on the debt increases as the result of higher debt levels, significantly higher levels of assets are needed to keep the probability of default constant.

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