

Fiscal Insurance against Exogenous Shocks in the CFA-franc Zone

Laura dos Reis

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Abstract

This paper proposes the implementation of a fiscal insurance scheme for the two currency unions of the CFA-franc zone, the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC). A fiscal insurance mechanism would help to cushion for transitory shocks and at the same time reinforce the monetary union's long-term viability. The paper proposes a basic framework for a fiscal insurance contract of 70 percent of coverage level for shortfalls in cyclical revenues owing to terms-of-trade shocks as a benchmark and then, analyzes different coverage levels and re-payment options in response to incentive problems –i.e. moral hazard and free riding. The paper presents numerical simulations of the initial resources required to implement a group insurance scheme and demonstrate that they would be lower than the required under a self-insurance arrangement. In addition, for particular country cases, each country can be better off under group insurance if the initial fund resources are redistributed in accordance with size and volatility. Finally, the paper analyzes what would be the initial buffer fund needs if the scheme had been implemented in 2003, and also, what could be the role for international organizations together with regional contributions in financing this scheme.

Introduction

This paper proposes the implementation of a fiscal insurance scheme for the two currency unions of the CFA-franc zone¹, the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC). A fiscal insurance scheme is a system of fiscal transfers administered by a supra-national fiscal authority to stabilize volatile fiscal revenues. Member countries would agree to contribute to a buffer fund administered by a centralized fiscal authority. The insurance scheme would consist of a set of rules that determine the amount of net transfers to the fund in accordance with the size and volatility of government's revenues.

Under a currency union, member states cannot pursue independent monetary policy to smooth business cycle fluctuations. A fiscal insurance policy could help accommodate asymmetric and country-specific shocks that are not addressed by the centralized monetary authority. If members of the union coordinate their fiscal policies in such a way that asymmetries in cyclical fluctuations of economic activity or tax revenues are smoothed out by transfers from a buffer fund, potential conflicts in the pursuit of the desired short-run monetary policy can be reduced.

In a monetary union of countries subject to large exogenous shocks, such as the CFA-franc zone, a fiscal insurance mechanism can be of great value for coordinating fiscal policy and for strengthening the commitment to the monetary union. Incentives to

¹ CFA stands for "Communauté Financière Africaine" franc zone. It is divided into two currency unions that use the same currency, the CFA franc. They are the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC). *West African Monetary Union* was established in 1962, and changed into West African Economic and Monetary Union (WAEMU) in January 1994. It has a common central bank, the Central Bank of West African States (Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO). The French acronym is UEMOA (Union Economique et Monétaire de l'Afrique de l'Ouest) and is constituted by eight member countries: Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo. Mali and Guinea Bissau joined the Union on June 1, 1984 and May 2, 1997 respectively. The common currency the franc de la Communauté financière de l'Afrique (CFA franc), is issued by the union's central bank and it has been pegged to the French Frank, since 1948 and since 1999 has been pegged to the euro. The Central African Economic and Customs Union (UDEAC) was founded in 1964. In March 1994 the six UDEAC leaders signed a treaty for the establishment of an *Economic and Monetary Community of Central Africa*, in French Communauté des Etats d'Afrique Central (CEMAC), with the idea to promote sub-regional integration within a monetary union. It consists of six countries: Cameroon, Central African Republic (CAR), Chad, the Republic of Congo, Equatorial Guinea and Gabon. The CEMAC maintained a fixed exchange rate between its currency, the CFA franc, and the French Franc until 1999 when it was replaced by a peg to the euro. It is issued by the Bank of Central African States (Banque des Etats de l'Afrique Centrale, BEAC). French treasury guarantees the currency peg for both regions.

opt out of the union arise during recession for members lacking financing in order to pursue monetary financing or to use monetary policy to accommodate divergences in relative prices. The incentive for such action, which undermines the union, can be reduced if members are able to receive transfers from a common pool of funds.

The ability to conduct countercyclical fiscal transfers in bad times could bring about higher rates of investment and growth as well as facilitate access to financial markets. Better fiscal management would improve market perceptions of a country's fiscal sustainability, leading to more favorable access to international credit markets. Another source of welfare gains would be a reduction in volatility in government responses to shocks as the fiscal insurance system of cross compensation payments would reduce the volatility of the Union's output and fiscal accounts relative to individual member's volatility.

A fiscal insurance scheme could also contribute to more efficient outcomes when there is no ready access to international and regional financial markets. It is important to note that the regional financial sector is small compared to other regions, and that the availability of financial instruments to diversify risk is low. Regional projects, such as a fiscal insurance scheme, could overcome the small size of the financial sector by providing an additional mechanism to diversify risk.

Market failures in the provision of credit arise because of negative externalities, among other things. In the case of the CFA-franc zone, such externalities can take the form of financial instability being transmitted to other members, –for example, when a particular local government cannot service its debt—thus affecting the union's financial stability. In such a case, central bank intervention could impose debt and fiscal deficit targets that can constitute a burden during a recession. In this case, a fiscal insurance scheme can alleviate the burden of complying with fiscal target through better fiscal coordination from a system of fiscal transfers.

Finally, a fiscal insurance scheme that enhances commitment to the union through a self-help arrangement has importance, given the fact that French transfers of foreign aid and the French Treasury guarantee of the currency peg could be reduced in the future. This is because France is now subject to fiscal restraint under the EMU and could eventually be unable to help its former colonies. Also, the growing movement

within African countries for economic integration, especially through the creation of a larger union by the incorporation of non-CFA countries under ECOWAS², raises the issue of whether such a larger union would require additional institutions to promote fiscal discipline. Moreover, the inclusion of non-CFA countries into the union could well result in the loss of financial support from the French Treasury.³

This paper is organized as follows. The first section provides empirical support for the implementation of a fiscal insurance scheme. We investigate the degree of asymmetries in terms of economic structure and shock correlations. These asymmetries are the basis for possible welfare gains through a system of cross-compensations under fiscal insurance. In order to implement this policy, section two presents a basic framework for a fiscal insurance contract of 70 percent of coverage level for shortfalls in cyclical revenues owing to terms-of-trade shocks as a benchmark and then, analyzes different coverage levels (100-50 percent) and re-payment options (flat premium or a credit line) in response to incentive problems –i.e. moral hazard and free riding. Then, in section three we calculate the amount of resources needed for a regional buffer fund as opposed to self-insurance, giving an idea of the gains if a risk-sharing mechanism were implemented. Section four analyses further details of how to implement this policy. In particular, we consider the buffer stock size and financing options if the buffer had been implemented in 2003, and also, what could be the role for international organizations together with regional contributions in financing this scheme. Finally, the last section presents conclusions.

² ECOWAS stands for Economic Community of West African States, and is composed of the eight CFA-franc zone of West African Monetary Union (WAEMU): Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo. Plus seven non-CFA countries: Nigeria, Ghana, Guinea, Liberia, Sierra Leone, Gambia and Cape Verde.

³ “A decision of the European Council on November 23, 1998, requires that France must submit for the Council’s approval any change in the nature or scope of its exchange rate agreements with the CFA franc zone, and neither France nor its EU partners are likely to endorse an expansion of the French Treasury’s guarantee to a much wider set of countries”. (P. Masson and C. Pattillo, 2000)

I. Empirical Evidence for the CFA-franc zone

The CFA-franc zone presents favorable conditions for the implementation of a fiscal insurance scheme. There is limited co-movement in terms of trade shocks and a relative high degree of asymmetries in economic activity. In addition, regional volatility in fiscal revenues and output is lower than that of individual countries. These factors constitute the basis of the welfare gains of the proposed policy.

Terms of trade shocks constitute an important source of volatility, since the region's exports are concentrated in few primary commodities. This is particularly the case for Niger and Guinea-Bissau where a single commodity represents 50 percent or more of their export earnings. Figure 1 in Appendix I shows volatility of terms of trade in CFA-franc zone, relative to sub-Saharan Africa and Latin America. As can be observed volatility is high relative to other regions and has been rising for CFA-franc zone, and in particular for the CEMAC countries. On the other hand, WAEMU has been reducing its volatility.

The degree of co-movement within the CFA-franc zone is not high. This can be observed in Table 1 and 2 in Appendix I. The reason for this in the case of WAEMU is that some primary commodities are common to a number of countries and others are found in only one or two countries (Masson and Patillo, 2001a).

Table 3 and 4 in the Appendix present the degree of asymmetries in the economic structure. The economic structure in the case of WAEMU is mostly concentrated on primary commodities. The agriculture sector share is, on average, for different periods around 40 percent of GDP (Table 3), while the industry sector only represents 18 percent of GDP. In contrast, CEMAC is mostly composed of oil producers. However, the industry sector share is relatively high. CEMAC share in industry is around 36 percent of GDP while the agriculture share is on average 27 percent of GDP (Table 4). The share in services is 45 percent and 36 of GDP for WAEMU and CEMAC respectively.

Table 5 (Appendix I) shows that GDP growth volatility of the union has been lower than that of each individual member for the period 1980-2004. Moreover, Table 6 shows that volatility in growth for each individual country is higher than that of the

aggregate for WAEMU and CEMAC. Also, growth volatility of each country member is higher than that of the other members excluding that country. This is presented in Table 6 where the first column (individual country) is always higher than the second and third columns, implying that no member seems to be overwhelmingly more stable than its partners. As a result the likelihood of countries deciding not to participate to avoid importing volatility from partner countries does not appear very high.

The analysis of volatility in fiscal accounts supports the same conclusions as that in the case of GDP volatility. Table 7 (Appendix I) compares revenue volatility across individual countries in the region for different sample periods and countries (before and after 1994 devaluation). Revenue volatility is lower for WAEMU and CEMAC aggregates than for individual country members.

It is important to emphasize that volatility in fiscal accounts has declined after the 1994 devaluation, owing to the improvement in macroeconomic coordination through greater regional integration since 1994. But recent deterioration and variability in compliance with convergence criteria due to exogenous shocks show the need for additional fiscal mechanism in order to improve regional coordination in fiscal policy.

For example, in the case of WAEMU, in spite of the big reduction in fiscal deficits after 1994, observance of convergence criteria has been uneven. Also, there has been a slowdown in convergence among member states since 1998, in spite of the new convergence criteria established in 1999⁴. External and internal factors are behind the deterioration and greater variability in compliance with fiscal targets since 1998 (See Table 8, Appendix I). External factors such as terms-of-trade shocks have a direct impact in fiscal performance since a high component of tax receipts comes from trade. Internal factors such as the political crisis in Cote d'Ivoire and Togo, have affected growth rates and external financing flows, deteriorating fiscal performance.

⁴ A new Convergence, Stability, Growth and Solidarity Pact was adopted in 1999 to reinforce fiscal convergence among member states. It established first-order and second-order indicators. The primary criteria of the pact are: basic fiscal balance (non-grant revenues minus expenditures excluding foreign-financed investment) must be in equilibrium or surplus; inflation rate should be no more than 3 percent; a ratio of domestic and foreign debt to GDP of less than 70 percent; and no accumulation of domestic and external payments arrears. The secondary criteria consist of: public sector wage bill should not exceed 35 percent of tax revenues, the ratio of domestically financed investment to tax receipts should be over 20 percent, a ratio of tax receipts-to-GDP of over 17 percent, and external current account deficit (excl. grants) of less than 3 percent of GDP. In addition, a penalty mechanism was established including no access to the West African Development Bank and the suspension of all access to central bank financing.

Fiscal policy compliance by CEMAC's members⁵ is affected even more by external factors, in particular oil prices. Five out of six CEMAC's members are oil exporters. These are Cameroon, Chad, The Republic of Congo, Equatorial Guinea and Gabon, while the Central African Republic is the only non-oil producer in the region. As Wiegand (2004) explains, years with negative balance are the ones with low petroleum prices, while in years with record oil prices, no country recorded a negative fiscal balance. In recent years, favorable international oil prices have resulted in an expansion in the money supply with an increase in fiscal revenues and spending, and no oil producer, except Chad, has been in violation of the convergence criterion for the fiscal balance (Table 9).

II. A Fiscal Insurance Proposal for CFA-Franc

Basic Framework

We propose the implementation of a fiscal insurance scheme based on the following elements:

- A buffer fund administered by a centralized fiscal authority that could be managed by the regional central banks.
- A partial insurance coverage contract that provides 70 percent coverage for shortfalls in cyclical revenues owing to terms-of-trade shocks. The fiscal authority is responsible for establishing the share of the shortfalls in revenues attributed to terms-of-trade shocks for each member.
- The initial fund requirements for 70 percent of coverage are 13.2 percent of GDP trend for WAEMU and 18.5 percent of GDP trend for CEMAC.

⁵ CEMAC's fiscal and macroeconomic monitoring is enacted by the Bank of Central African States (BEAC) and the CEMAC's Executive Secretariat and supported by the French treasury. Within each annual surveillance exercise, the CEMAC's Executive Secretariat, evaluates member's compliance with the regional targets in fiscal policy and macroeconomic indicators. The targets are: nonnegative basic fiscal balance (overall balance excluding grants and foreign financed investment); foreign and domestic debt of no more than 70 percent; non-accumulation of domestic and/or external arrears; an annual inflation rate of no more than 3 percent. As explained above, compliance with fiscal targets is highly dependent on oil prices

- The initial fund requirements for this coverage could be financed through regional savings and multilateral donor concessional loans.
- The re-payments to the fund can take the form of a flat premium or a credit line with charges.
- Access to the buffer fund is determined according to the size and volatility of government's revenues.
- Exceptional contributions to the buffer fund can occur if the buffer reaches a minimum threshold level determined by the central authority.

Fiscal Insurance Contracts

The types of contract and the re-payment options depend on the degree of the incentive problems, i.e. moral hazard and free-rider problems. These incentive problems imply the need to specify a partial insurance contract. We propose a partial insurance coverage of 70 percent of the shortfall in cyclical revenues as a benchmark. Alternative levels of coverage are also possible, and considered in the next section.⁶

The net fiscal transfer flows from and into the buffer fund will depend on the re-payment options, which will be related to the initial financing conditions⁷. Two possible re-payment options are:

1. A flat premium.
2. A credit line with charges.

The case of a flat premium, is equivalent to a contract in which the buffer fund charges an actuarially fair premium⁸ at the beginning of each period, and transfers resources to each country in accordance with the ex-post realization of shocks.

⁶ Alternatively to the option of fixing the level of coverage to 70 percent, the centralized fiscal authority can also specify a partial insurance contract with a deductible d and to a maximum coverage N (for example two standard deviations of GDP trend). Positive transfers from the buffer would be made if income shortfalls are greater than d covering up to a maximum of N . In this way, the fiscal authority would transfer $N-d$ resources to the members.

⁷ Alternative financing possibilities are considered in next section.

⁸ This assumes zero profits, such that the expected losses equal the expected revenues.

In the credit line option, re-payments would only take place whenever countries have received financing. As a result, the buffer fund would lend money whenever there is a shortfall in revenues due to a terms-of-trade shock and countries would re-pay with charges. Re-payment charges and time-horizon of the loan would depend on the conditions under which the buffer was constituted. For example, it could take the form of a re-payment in a 3 to 5 year at 2 percent annual charge, that is, similar to multilateral concessional lending.

A credit line might be easier to implement since contributions to the buffer fund are made during the re-payment period in accordance to the individual country credit line (based on size and volatility) and not every year as in the case of a flat premium. This can reduce the administrative burden of charging a flat premium to all countries every year in order to gain access to the funds. In addition, a credit line can reduce the incentives to abuse the scheme since access to the fund will imply a promise to re-pay the loan in a certain period of time (3 or 5 years).

Simulation Analysis

Appendix II describes the simulation exercise and assumptions of the Monte Carlo simulation for different insurance coverage levels. The purpose of the simulation is to estimate the initial amount of buffer fund resources needed to launch a fiscal insurance scheme. The percentage of coverage is calculated as the number of histories that the buffer fund is not depleted out of 100 50-year histories of simulated revenues.

The equilibrium buffer fund required as a share of regional GDP trend in the case of the proposed 70 percent of coverage would be 13.2 percent of GDP trend in the case of WAEMU and 18.5 percent of GDP trend in the case of CEMAC.

The required amounts of initial buffer fund resources for alternative coverage levels are also presented in Table 1 below for comparison purposes. It presents the initial buffer requirements for WAEMU and CEMAC assuming coverage levels between 100 percent (full coverage) and 50 percent.

Table 1. Size of the Initial Buffer Fund: Simulation for Partial Insurance

Coverage ^{/1}	WAEMU	CEMAC
	Bo/GDP (%)	Bo/GDP (%)
100%	40.7	64.7
90%	26.6	34.2
80%	17.8	23.3
70%	13.2	18.5
60%	11.0	15.6
50%	8.2	10.1

^{/1}The percentage of coverage is the number of histories the buffer fund is depleted out of a total of 100 histories.

Note: “Bo/GDP” is the share of the initial period buffer fund over GDP trend.

For all coverage levels between 100 and 50 percent, CEMAC requires higher initial buffer fund levels than WAEMU. For intermediate level of coverage (between 80 and 60 percent) the difference between the two regions is about 5 percentage points, between 17.8 and 11 percent of GDP trend for WAMU and between 23.3 and 15.6 percent for CEMAC.⁹ In addition, for coverage levels lower than 100 percent the initial fund requirements are substantially lower. For example, for 90 percent coverage, the regional initial funds would have been 26.6 percent of the regional GDP trend in the case of WAEMU, two-thirds of the requirement in the case of full insurance (40.7 percent). For CEMAC, a coverage level of 90 percent requires an initial buffer fund of 34.2 percent, half of the buffer fund requirement in the case of full insurance (64.7 percent).

Welfare Gains

The proposal would have important welfare gains than can be measured as the difference between the initial fund requirements under group insurance (risk-sharing) and the sum of individual requirements under self-insurance.

For the proposal of 70 percentage coverage levels, the savings of a risk-sharing scheme as compared to self-insurance would amount to 8.3 percent of the regional GDP in the case of WAEMU and 9.5 percent in the case of CEMAC (See Table 2 and 3 below).

⁹ Our proposal of 70 percent is only as a benchmark. Further research on the optimal coverage level is needed to take into account countries' preferences for risk.

As Table 2 shows, the results for coverage levels of 90 to 50 percent for the case of risk-sharing [WAEMU(2)] is lower than the sum of individual cases under self-insurance [WAEMU(1)] presenting the overall gains of the proposed policy (ranging between 13.7 and 3.6 percentage points of GDP).

**Table 2. WAEMU Self Insurance and Risk-Sharing:
Simulation for Partial Insurance**

Countries	100%	90%	80%	70%	60%	50%
	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)
1- Self-Insurance						
Benin	75.8	41.9	32.3	25.6	18.8	13.5
Burkina Faso	52.3	22.3	14.2	9.7	5.3	3.2
Côte d'Ivoire	94.7	58.3	46.5	32.0	24.3	18.3
Mali	20.9	13.5	8.3	5.9	4.0	2.8
Niger	51.6	30.5	18.8	15.3	11.4	8.3
Senegal	50.3	29.1	22.0	14.8	10.5	8.1
Togo	52.1	31.7	22.1	15.8	11.3	7.4
WAEMU(1)	68.2	40.3	30.6	21.5	15.8	11.7
2- Risk-Sharing						
WAEMU(2)	40.7	26.6	17.8	13.2	11.0	8.2
Total Difference (WAEMU (2)-(1))	-27.5	-13.7	-12.8	-8.3	-4.8	-3.6

Note: "Bo/GDP" is the share of the initial period buffer fund over GDP trend. "WAEMU(1)" is the weighted aggregate by countries' GDP. "WAEMU(2)" is the buffer fund under pooling revenues.

Table 3 presents the simulation results for CEMAC. The buffer fund for the aggregate in the case of risk-sharing [CEMAC(2)] is for every case lower than the weighted average under self-insurance [CEMAC(1)]. As before, the regional requirements of fund resources under risk-sharing would be lower than the sum of individual cases under self insurance. The difference between risk-sharing and self-insurance in terms of the required initial buffer funds ranges from 12.1 to 8 percentage points of GDP trend.

**Table 3. CEMAC Self Insurance and Risk-Sharing:
Simulation for Partial Insurance**

Countries	100%	90%	80%	70%	60%	50%
	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)	Bo/GDP (%)
1- Self-Insurance						
Cameroon	71.0	36.1	28.4	19.7	15.9	11.2
CAR	19.0	11.6	8.7	6.3	4.5	3.3
Chad	33.8	16.2	11.7	6.0	2.9	1.6
Congo, Rep.	22.2	13.9	8.2	4.7	3.2	2.0
Gabon	127.4	90.3	76.1	67.9	59.6	51.2
CEMAC(1)	73.4	44.0	35.4	28.1	23.6	18.9
2- Risk-Sharing						
CEMAC(2)	64.7	34.2	23.3	18.5	15.6	10.1
Total Difference (CEMAC (2)-(1))	-8.7	-9.8	-12.1	-9.5	-8.0	-8.7

Note: “Bo/GDP” is the share of the initial period buffer fund over GDP trend. “CEMAC(1)” is the weighted aggregate by countries’ GDP. “CEMAC(2)” is the buffer fund under pooling revenues.

This means that on average all countries would benefit from a regional fiscal insurance scheme. But, there are regional variations when we compare individual countries initial fund requirement under self-insurance with the regional aggregates requirements.

For example, in the case of CEMAC Gabon would require initial fund resource of 67.9 percent of GDP trend to cover for 70 percent shortfalls in cyclical revenues, which is higher than the regional 18.5 percent for the same coverage level. And this is also the case for Cameroon. While in the case of the remaining three countries (Chad, Congo and the Central African Republic (CAR)), they would need lower initial resources under self-insurance. This does not mean that only Gabon and Cameroon would benefit from a fiscal insurance scheme but that considerations of size and volatility should be taken into account to determine access to fund resources.

III. Buffer Fund Financing

This section describes further steps required to implement the proposed scheme. In particular, it focuses on what are current regional conditions to finance the buffer fund, what could be the initial fund requirements if the scheme had been implemented in 2003 and what could be the multilaterals’ role in providing financing.

The fact that managing the buffer fund would require coordination at the regional level may argue for a supra-national organization. The regional central banks (BCEAO and BEAC), which are currently coordinating monetary policy and establishing fiscal targets guidelines, may be good candidates to operate this policy. The centralized fiscal authority will have to consider the available mechanisms to finance the initial buffer fund. A list of potential sources of financing are:

1. *Regional contributions.*
2. *Market financing.*
3. *Multilateral Organizations financing.*
4. *Contributions by donor countries.*

Regional contributions through own savings and market financing might be restricted. Market access to finance this scheme can be limited given the current high level of external public debt and the low re-payment capacity of the region. In fact, many of CFA-franc countries are under HIPC¹⁰ initiative and some of them, like Congo and Cote d'Ivoire are still affected by domestic conflict and civil war. As a result, the region would have to rely on their joint monetary resources and/or on the help of international donors in order to raise funds to start this policy. Eventually, a fiscal insurance scheme if started, may improve regional market access as the central banks may be able to issue debt with the buffer fund as collateral, lowering borrowing costs.

It is worth noting that although the financial sector is still small and weak¹¹, there is high liquidity in the banking sector –relative to its size. In particular, gross external assets relative to sight liabilities of the central bank are around 112.7% for WAEMU and 68.1% for CEMAC for the period 2000-02, with a statutory minimum of 20%. External reserves over GDP for the same period are on average 11.8 percent of GDP for WAEMU

¹⁰ HIPC stands for Heavily Indebted Poor Countries. This Initiative was launched in 1996 with the purpose of providing debt relief through the reduction external debt of eligible countries to sustainable levels and the elimination of any debt overhang that might affect growth and investment. Countries from CFA-franc zone that have reached “decision point” -the first stage towards debt relief under HIPC- are: Benin, Burkina Faso, Cameroon, Chad, Guinea-Bissau, Mali, Niger, and Senegal. In addition, Burkina Faso has reached the second stage (“completion point”). Domestic conflict in Cote d'Ivoire has deterred the country from reaching the “decision point” stage.

¹¹ Financial market depth as measured by M2 (money and quasi money) over GDP (2000-02) is around 24.7 percent of GDP in WAEMU and 12.5 percent for CEMAC. The same ratio is around 35.7 percent in Sub-Saharan Africa and 26.7 in Latin America (See Table 11 and Figure 2 in Appendix I for selected financial indicators).

and 4.4 percent for CEMAC. This liquidity can be a source of financing for the buffer fund. The only concern with regional bank lending would be the cost of this type of financing option.

Finally, the fact that international donors can add to countries own savings with concessional lending at lower markets rates would not only increase the amount of resources available to start the scheme but it would also reduce the premium or charges to all countries.

Initial Fund Requirements

Tables 4 presents the initial buffer fund requirements as share of GDP and revenue trend comparing the results obtained for group and self-insurance if the buffer fund had been implemented in 2003 for a coverage level of 70 percent. The resources required are 13.2 percent of the GDP trend for WAEMU and 18.5 percent of the GDP trend for CEMAC. And the initial buffer fund requirements as a share of revenue trend are 65 percent and 86.7 percent for WAEMU and CEMAC respectively.¹²

¹² In Appendix I, Table 10 considers what would have been the amount required under different partial coverage levels if the buffer fund had been implemented in 2003. In this section we only present result for coverage levels of 70 percent since a higher level of insurance would have been very costly for the region. In addition, by providing lower level of coverage, country members would have to make use of their own saving to add to the buffer fund, reducing the incentive problems.

**Table 4. WAEMU and CEMAC Initial Fund Requirements, 70 Percent Coverage
(Shares of GDP and Revenue Trend)**

Countries	70%	
	Bo/GDP (%)	Bo/Rev (%)
WAEMU		
1-Self-Insurance		
Benin	25.6	139.0
Burkina Faso	9.7	62.4
Côte d'Ivoire	32.0	138.3
Mali	5.9	32.2
Niger	15.3	107.0
Senegal	14.8	74.4
Togo	15.8	74.4
WAEMU(1)	21.5	103.3
2- Risk-Sharing		
WAEMU(2)	13.2	65.0
CEMAC		
1-Self-Insurance		
Cameroon	19.7	110.4
CAR	6.3	39.9
Chad	6.0	45.6
Congo, Rep.	4.7	19.7
Gabon	67.9	225.6
CEMAC(1)	28.1	119.2
2- Risk-Sharing		
CEMAC	18.5	86.7

In addition, Tables 5 and 6 provide estimates of the initial buffer fund requirements in billions of CFA-francs if the buffer fund had been implemented in 2003. The amount of resources would have been around 2400 billions of CFA-francs in the case of WAEMU or around 4.1 billion dollars (11.1 percent of GDP) and would have been around 2500 billions of CFA-francs for CEMAC, around 4.4 billions dollars (15 percent of GDP).

Table 5 compares the initial buffer fund requirements under self insurance with the requirements under group insurance for WAEMU. Note that there are savings of around CFA-franc 1200 billions in the case of group insurance.

In addition, group insurance is divided into two possible fund redistributions: 1) Uniforms case of 13% of GDP for all and, 2) Weighted redistributions of fund resources. If we compare for each country the case of self-insurance with the two cases of group insurance (uniform (13%) and weighted redistribution) we can see the benefits of each

redistribution method. All countries will benefit from applying the weighted case by size and volatility¹³ since the initial fund requirements are lower than that required under self-insurance, while not all countries can benefit from the 13 percent uniform redistribution. For example, Mali initial requirements would have been around CFA-francs 103.8 billions under the weighted redistribution which is lower than the self-insurance requirement of CFA-franc156.1 billions. In contrast, the lineal case of 13 percent of GDP would have implied resources of CFA francs 315.3 billion, which are higher than the self-insurance requirement.

**Table 5. WAEMU Initial Fund Requirements in 2003
(Billions of CFA-francs)**

Countries	Initial Buffer Fund (Billions CFA-francs)		
	Self-Insurance	Group Insurance (18% of GDP)	Group Insurance (weighted)
Benin	476.5	222.9	316.9
Burkina Faso	305.4	318.2	203.1
Côte d'Ivoire	1810.7	851.3	1204.3
Mali	156.1	315.3	103.8
Niger	209.7	127.4	139.5
Senegal	536.1	468.5	356.6
Togo	98.5	86.1	65.5
WAEMU	3593.1	2389.7	2389.7

In the case of CEMAC, Table 6 compares the initial buffer fund requirements under self insurance (CFA-francs 3513.5 billions) with the requirements under group insurance (CFA-francs 2538.9 billions). As before, if each country has to raise 18 percent of GDP under the lineal case, only Cameroon and Gabon would have benefited, since they are the only ones with lower initial fund requirements under group insurance in the lineal case of 18 percent of GDP. In contrast, if we redistribute the total initial funds for group insurance (CFA-francs 2389.7 billions) in a way that weights countries by size and volatility then, all countries will benefit as the amount needed is always lower than the required under self insurance (Table 6).

¹³ The redistribution by size and volatility of CFA francs 2389.7 billions considers the shares generated from the simulation exercise. The simulation methodology takes into account the size and volatility of each country's fiscal revenues in order to obtain the initial buffer fund requirements for different coverage levels.

**Table 6. CEMAC Initial Fund Requirements in 2003
(Billions of CFA-francs)**

Countries	Initial Buffer Fund (Billions of CFA-francs)		
	Self-Insurance	Group Insurance (18 % of GDP)	Group Insurance (weighted)
Cameroon	1147.7	901.3	829.3
CAR	37.8	82.2	27.3
Chad	107.8	205.0	77.9
Congo, Rep.	123.8	544.7	89.4
Gabon	2096.4	805.7	1514.9
CEMAC	3513.5	2538.9	2538.9

In sum, countries can exploit their negative correlations by reaching lower initial fund requirements as compared to self insurance. In that case, if the buffer fund initial requirement (the uniform redistribution of 13 percent or 18 percent of GDP) is applied to each country, then for some countries self-insurance would be more convenient, while in the case of a redistribution weighted by size and volatility, group insurance is always more beneficial.

Multilaterals' Role in Response to Exogenous Shocks

The World Bank and the International Monetary Fund recognize that to respond to exogenous shocks additional schemes and improvements in current mechanism are needed¹⁴. These institutions have developed financial facilities to respond to these types of shocks¹⁵. In general, low-income countries have not usually had access to donor assistance when faced with terms-of-trade shocks, and have resorted to market borrowing, becoming thereby increasingly indebted. This is because most of donor's assistance had been ad-hoc and often arrives too late. Timely procedures and lack of automatic rules seem to be the problem with current instruments to respond to shocks.

¹⁴ World Bank (2004).

¹⁵ In particular IMF's Compensatory Financing Facility (CFF) provides financing to countries experiencing balance of payment difficulties resulting from exogenous shocks like a decline in export revenues or an increase in certain import costs. The Poverty Reduction and Growth Facility (PRGF) and stand-by arrangements are also used for all types of balance of payment difficulties, including natural disasters and terms-of-trade shocks. The World Bank also provides with lending in the case of natural disasters. For commodity shocks the World Bank does not have a specific instrument or facility but relies on the flexibility on its own standard loans products.

Given these limitations there have been proposals to diversify the productive structure in order to reduce the impact of shocks. Note that the proposed policy of a fiscal insurance mechanism is in fact an implicit way of economic diversification as it will exploit regional asymmetries in a manner similar to economic diversification. However, the advantage of the proposal is that it does not require a complex and costly system of subsidies and political costs.

Moreover, the fact that a supra-national organization, would be managing the buffer fund can also function as an arbiter at the regional level with knowledge to determine when countries have been affected by shocks and as a result qualify to withdraw resources. Conditionality of funds resources provided by multilaterals or international donors would be directed to the regional fiscal authority –as opposed to country members- and would focus only on fiscal and debt sustainability that would be in line with the regional fiscal authority’ interests in managing the fund.

Multilaterals’ funding of initial resources can take place through IDA¹⁶ contributions and regional lending. In particular matching funds would be an interesting mechanism to complement regional funding. If the buffer fund could complement countries own savings with additional donor money this would make it possible to reach a “critical mass” of resources to enable the scheme to operate at an early date and enable the participation of countries that due to low levels of income and high level of debt would not have been able to participate.

IV. Conclusions

A fiscal insurance mechanism would help to cushion for transitory shocks and at the same time reinforce the monetary union’s long-term viability. Additional policy schemes that support self-help in the union like a fiscal insurance scheme can help improve fiscal coordination for CFA-franc zone countries and can be valuable not only due to the fact that it has been difficult for country members to comply with fiscal targets but also, to offset the eventual weakening of the exchange rate backing by the French Treasury.

¹⁶ 11 out of 14 countries from the CFA-franc zone are eligible for IDA funds: Congo, Cameroon, Senegal, Benin, Togo, CAR, Mali, Burkina Faso, Chad, Niger, Guinea-Bissau.

The particular characteristics of the CFA-franc show that volatility in fiscal accounts would be reduced if countries joined a fiscal insurance arrangement because of the possibility of cross-compensations under a risk-sharing scheme. Moreover, since regional fluctuations in terms of trade are not highly correlated, regional asymmetries can be exploited through a system of cross-compensation.

We propose a basic framework of 70 percent coverage level for shortfalls in cyclical revenues owing to terms-of trade shocks as a benchmark to evaluate this policy. In that case, the initial buffer fund requirements would be around 13.2 percent of GDP trend for WAMU and around 18.5 percent of GDP. Depending on the initial buffer fund financing, two options are suggested for fund re-payments, a flat premiums or a credit line with charges. In particular, if the buffer fund can be financed by international donors at lower market rates, this can help in reducing the premium and /or charges for the repayment period.

This paper has provided empirical evidence on what would be the welfare gains if a fiscal insurance arrangement were implemented in the CFA-franc zone, WAEMU and CEMAC monetary unions. The simulation exercise for different levels of coverage show what would have been the welfare gains of the proposed policy in terms of lower buffer fund requirement as opposed to self insurance. Under the proposed benchmark case of a 70 percent level of coverage, saving can be around 8.3 and 9.5 percentage points of GDP for WAEMU and CEMAC respectively.

We evaluate what would have been the initial fund requirements if a buffer fund had been implemented in 2003 through the provision of 70 percent coverage in revenue fluctuations owing to exogenous shock. The amount of resources needed would be around 13.2 percent of GDP trend for WAMU and around 18.5 percent of GDP trend for CEMAC, representing CFA-francs 2389.7 billions (4.1 billions dollars) and CFA-francs 2538.9 billion (4.4 billions dollars) respectively. We demonstrate that the initial resource requirements under group insurance are lower than the total requirements under self insurance. But for particular country cases, each country can be better off under group insurance if the initial fund resources are redistributed in accordance with size and volatility.

The buffer fund financing can range from own savings, to market financing and multilateral support. We emphasize that market access is limited given the low repayment capacity of these economies and the high debt levels. As a result, Multilaterals' support in financing a fiscal insurance scheme, in addition to countries own savings, is important given limited market access and a weak regional financial sector. In particular, current financial schemes support by the World Bank and by the International Monetary Fund to respond to terms-of-trade shocks are not being used by low-income countries due to the lack of timely and predictable procedures. As a result, multilaterals support to the initial financing of a buffer fund would make it possible to reach a "critical mass" of resources to add to the regional savings, enabling the scheme to be made operational at an early date. This will enable the participation of countries that due to low levels of income and high level of debt might have not otherwise been able to participate.

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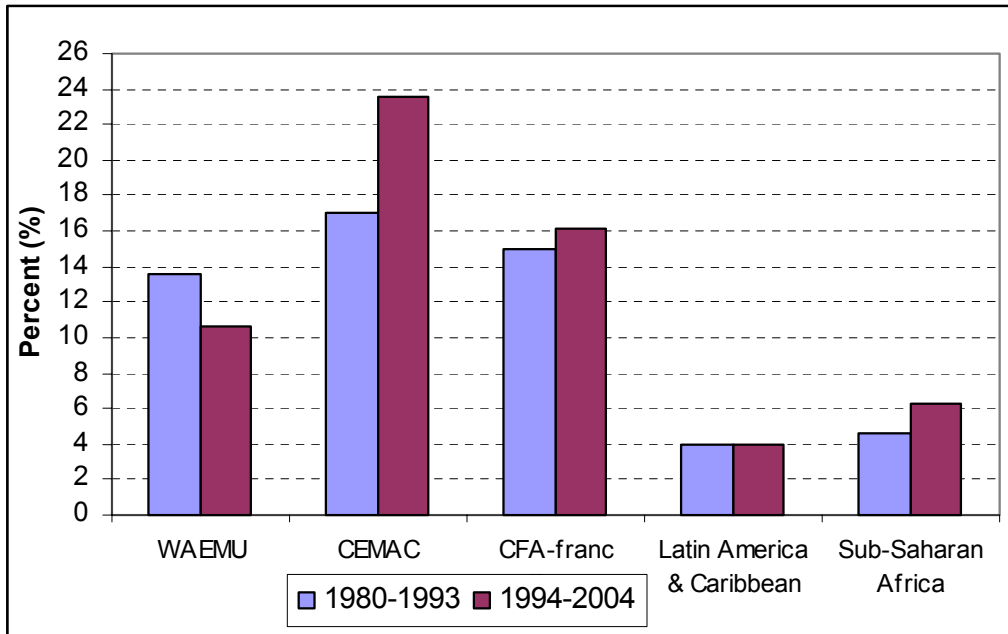
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Appendix I

Figure 1: Terms of Trade Volatility



Source: *World Development Indicators*, April 2004. World Bank.

Table 1. WAEMU and CEMAC: Correlation in Terms of Trade

	Benin	Burkina Faso	Cameroon	CAR	Chad	Congo, Rep.	Cote d'Ivoire	Gabon	Guinea-Bissau	Mali	Niger	Senegal
Benin	1.000											
Burkina Faso	0.019	1.000										
Cameroon	0.378	-0.163	1.000									
CAR	-0.050	0.149	-0.070	1.000								
Chad	0.420	0.219	0.284	0.181	1.000							
Congo, Rep.	0.048	-0.387	0.095	0.143	-0.092	1.000						
Cote d'Ivoire	-0.005	0.042	-0.074	-0.295	-0.155	-0.215	1.000					
Gabon	0.080	0.191	-0.148	0.124	0.514	0.272	-0.333	1.000				
Guinea-Bissau	-0.189	0.223	-0.133	0.083	-0.021	0.269	-0.275	0.277	1.000			
Mali	0.449	0.317	-0.058	0.199	0.156	-0.016	-0.186	0.051	0.013	1.000		
Niger	0.110	0.538	0.260	0.206	0.316	0.140	-0.483	0.259	0.127	0.248	1.000	
Senegal	0.032	0.203	-0.286	0.261	0.086	-0.297	-0.102	-0.087	0.178	0.358	-0.084	1.000
Togo	0.253	0.217	-0.203	-0.170	0.216	-0.354	0.645	-0.216	-0.255	0.086	-0.380	0.109
Equatorial Guinea	-0.114	-0.444	-0.181	-0.278	-0.554	0.580	0.165	-0.362	0.028	-0.363	-0.017	-0.250

	Benin	Burkina Faso	Cote d'Ivoire	Guinea-Bissau	Mali	Niger	Senegal	Togo
Benin	1.000							
Burkina Faso	0.019	1.000						
Cote d'Ivoire	-0.005	0.042	1.000					
Guinea-Bissau	-0.189	0.223	-0.275	1.000				
Mali	0.449	0.317	-0.186	0.013	1.000			
Niger	0.110	0.538	-0.483	0.127	0.248	1.000		
Senegal	0.032	0.203	-0.102	0.178	0.358	-0.084	1.000	
Togo	0.253	0.217	0.645	-0.255	0.086	-0.380	0.109	1.000

	CAR	Cameroon	Chad	Congo	Equatorial Guinea	Gabon
CAR	1.000					
Cameroon	-0.070	1.000				
Chad	0.181	0.284	1.000			
Congo	0.143	0.095	-0.092	1.000		
Equatorial Guinea	-0.278	-0.181	-0.554	0.580	1.000	
Gabon	0.124	-0.148	0.514	0.272	-0.362	1.000

Table 2. CFA-franc Zone: Correlation in Terms of Trade

	Correlation (1980-2002)	
	All CFA-franc Zone	WAEMU
Benin	0.110	0.096
Burkina Faso	0.086	0.223
Cameroon	0.037	-0.052
CAR	-0.098	-0.025
Chad	-0.023	0.184
Congo, Rep.	0.014	0.011
Cote d'Ivoire	0.048	0.099
Gabon	0.025	0.096
		CEMAC
Guinea-Bissau	-0.138	-0.004
Mali	0.097	0.020
Niger	0.095	0.067
Senegal	0.009	0.200
Togo	0.121	-0.159
Equatorial Guinea	-0.004	0.080

Source: World Bank. *World Development Indicators*, April 2004.

Table 3. WAEMU Economic Structure (% of GDP)

	1982	1992	2001	2002
Benin				
Agriculture	32,5	36,0	35,5	35,5
Industry	15,1	13,3	14,4	14,4
Manufacturing	9,1	8,3	9,2	9,1
Services	52,4	50,7	50,0	50,1
Burkina Faso				
Agriculture	32,1	33,5	38,2	37,6
Industry	20,9	22,2	20,7	20,4
Manufacturing	15,5	15,7	14,7	14,5
Services	47,0	44,3	41,1	41,9
Cote d'Ivoire				
Agriculture	24,9	29,0	24,7	25,7
Industry	22,0	22,7	21,4	20,8
Manufacturing	14,7	20,6	18,4	17,6
Services	53,2	48,3	53,9	53,6
Guinea Bissau				
Agriculture	46,8	49,4	56,2	58,1
Industry	14,4	10,7	12,7	12,2
Manufacturing		2,5	10,1	9,4
Services	38,8	39,9	31,1	29,7
Mali				
Agriculture	44,1	46,1	37,8	
Industry	13,7	15,8	26,4	
Manufacturing	6,4	7,5	3,6	
Services	42,2	38,0	35,9	
Niger				
Agriculture	44,3	38,8	40,6	39,9
Industry	17,3	17,9	17,0	16,9
Manufacturing	3,9	6,5	6,6	6,6
Services	38,4	43,4	42,5	43,2
Senegal				
Agriculture	21,7	18,9	17,9	18,2
Industry	15,0	18,8	27,0	28,1
Manufacturing	10,4	12,5	17,7	18,2
Services	63,3	62,2	55,1	53,7
Togo				
Agriculture	27,0	35,3	39,4	40,1
Industry	23,4	23,8	21,1	21,6
Manufacturing	7,4	11,6	9,7	9,3
Services	49,7	41,0	39,4	38,3

Source: The World Bank. Country Statistics.

Table 4. CEMAC Economic Structure (% of GDP)

	1982	1992	2001	2002
Cameroon				
Agriculture	28.7	27.3	42.4	45.5
Industry	32.1	25.8	17.7	17.9
Manufacturing	12.1	14.3	9.3	9.1
Services	39.2	47	39.9	36.6
C.A.R.				
Agriculture	41.7	46.1	55.4	54.8
Industry	13.1	20.7	20.9	21.6
Manufacturing	7.7	11	...	...
Services	45.2	33.2	23.7	23.6
Chad				
Agriculture	39.5	35.3	35.8	35.8
Industry	12.4	13.4	17.5	17.5
Manufacturing		10.6	13.1	13.1
Services	48.2	51.2	46.7	46.7
Congo, Rep. of				
Agriculture	7.9	11.5	5.9	6.1
Industry	52.6	35.5	65.2	65.6
Manufacturing	4.8	7.9	4.1	5.2
Services	39.6	53	28.9	28.4
Eq. Guinea				
Agriculture	...	51.1	8.5	...
Industry	...	19.5	87	...
Manufacturing	...	1.7		...
Services	...	29.4	4.6	...
Gabon				
Agriculture	6.1	8.2	7.6	7.6
Industry	60.6	43.3	50.6	46.4
Manufacturing	4.3	6.9	4.9	4.7
Services	33.2	48.4	41.7	46

Source: The World Bank. Country Statistics.

**Table 5. GDP Growth and Volatility in WAEMU and CEMAC
(in percent)**

Countries	GDP Growth	GDP Volatility
	1980-2004	1980-2004
Benin	3,39	2,59
Burkina Faso	4,90	3,69
Cote d'Ivoire	1,37	3,10
Guinea Bisseau	1,41	7,02
Mali	3,96	5,65
Niger	1,62	5,46
Senegal	3,32	3,91
Togo	1,62	5,71
WAEMU	2,29	2,53
Cameroon	2,96	5,65
CAR	1,35	5,68
Chad	6,60	8,90
Congo, Rep.	3,73	6,14
Equatorial Guinea	13,41	18,14
Gabon	1,80	5,87
CEMAC	3,03	3,50

Source: IMF, *World Economic Outlook*. September, 2004

**Table 6. GDP Volatility WAEMU and CEMAC 1980-2004
(in percent)**

Country	Individual Country	WAEMU (All Eight)	WAEMU-1 (All Seven)
Benin	2.59	2.53	2.61
Burkina Faso	3.69	2.53	2.53
Cote d'Ivoire	3.10	2.53	3.03
Guinea Bisseau	7.02	2.53	2.56
Mali	5.65	2.53	2.51
Niger	5.46	2.53	2.43
Senegal	3.91	2.53	2.70
Togo	5.71	2.53	2.55

Country	Individual Country	CEMAC (All Six)	CEMAC-1 (All Five)
Cameroon	5.65	3.50	4.33
CAR	5.68	3.50	3.55
Chad	8.90	3.50	3.56
Congo	6.14	3.50	3.85
Equatorial	18.14	3.50	3.46
Gabon	5.87	3.50	4.35

Source: IMF, *World Economic Outlook*. September, 2004

**Table 7. Revenue Volatility in WAEMU and CEMAC
(in percent)**

Countries	1980-2004	1980-1993	1994-2004
Benin	11,1	13,7	6,6
Burkina Faso	8,6	9,2	8,3
Cote d'Ivoire	13,3	13,8	11,5
Guinea Bissau	72,5	32,8	95,0
Mali	11,0	12,9	8,8
Niger	12,0	10,2	10,4
Senegal	7,1	7,3	6,0
Togo	18,2	19,2	13,7
WAEMU	8,7	9,4	5,0
Cameroon	18,3	20,3	16,0
CAR	23,2	24,7	22,5
Chad	28,2	29,0	27,4
Congo, Rep.	18,9	9,2	26,8
Equatorial Guinea	39,4	24,3	43,0
Gabon	19,4	18,8	20,4
CEMAC	13,6	13,4	13,6
CFA	8,4	8,9	7,0

Source: IMF.

Table 8. WAEMU Convergence Criteria (1995-2001)

Basic Fiscal Balance >=0	1995	1996	1997	1998	1999	2000	2001
Benin	-0.8	1.4	1.5	3.8	2.8	1.9	0.4
Burkina Faso	8.6	0.6	0.1	-0.3	-0.4	-1.6	-2.9
Cote d'Ivoire	-1.2	0.5	-0.6	-0.3	-1.5	-0.3	1.1
Guinea Bisseau	-2.8	-5.3	-1.0	-16.3	-8.6	-17.2	-11.7
Mali	0.1	2.2	1.0	1.2	0.1	-0.7	-2.0
Niger	-3.7	-1.7	-3.0	-3.3	-4.8	-0.7	-3.4
Senegal	-0.1	1.7	2.7	2.6	1.7	1.2	-0.8
Togo	-4.3	-2.5	-1.7	-4.0	-2.0	-3.1	-0.4
WAEMU	-0.3	0.6	0.1	0.0	-0.7	-0.5	-0.9
Std Dev	4.0	2.6	1.8	6.3	3.7	6.1	4.0

GDP growth and TOT changes	1995	1996	1997	1998	1999	2000	2001
GDP growth (%)	5.8	7.1	5.5	5.4	2.5	-0.2	3.3
TOT changes (%)	6.8	-4.3	-3.4	1.9	-2.8	-7.4	4.0

Source: IMF, *Country Report No 03/70*. March 03. WB, *World Development Indicators* April 2004

Table 9. CEMAC Convergence Criteria (1995-2001)

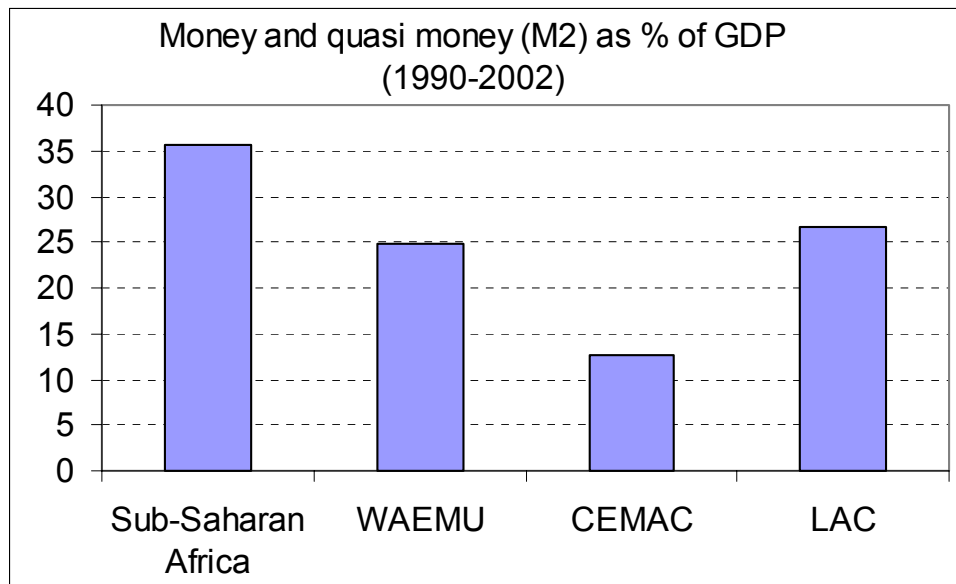
Basic Fiscal Balance >=0	1995	1996	1997	1998	1999	2000	2001
Cameroon	-2.1	-0.9	-0.2	-0.6	0.6	2.7	2.6
Republic of Congo	-7.1	-6.9	-5.9	-15.9	-0.6	7.2	8.9
Equatorial Guinea	-5.1	-5.3	3.0	-0.5	3.7	9.0	14.6
Gabon	6.5	6.2	11.1	-1.3	4.3	13.9	7.7
WEO oil price(in U.S. dollars per barrel)	17.2	20.4	19.3	13.1	18.0	28.2	24.3

Source: IMF, *Working Paper 04/8*

Table 10. Initial Fund Resources: Partial Insurance Coverage, 2003.

Initial Buffer Fund (Billions of CFA-francs)	Coverage				
	90%	80%	70%	60%	50%
WAEMU	4825.8	3223.3	2389.7	2003.1	1481.2
CEMAC	4685.4	3191.9	2538.9	2134.8	1388.1

Figure 2. Financial Depth. CFA-franc Zone and other regions (1990-2002)



Source: The World Bank, *World Development Indicators*, April 2004.

Table 11. Selected Financial Indicators (1990-2002)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Reserves (As percentage of GDP)													
Benin	3.5	10.2	11.4	11.6	17.3	9.9	11.8	11.7	11.2	16.7	20.1	24.2	22.8
Burkina Faso	9.6	11.0	10.1	11.9	11.0	13.0	11.7	12.7	12.1	9.9	9.2	9.3	9.8
Cameroon	0.2	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	3.9	6.4
Central African Republic	8.0	7.3	7.0	8.7	24.6	20.8	23.0	18.4	14.2	13.1	13.9	12.3	11.7
Chad	7.9	7.5	4.8	2.7	6.4	9.9	10.1	8.7	6.9	6.2	8.0	7.3	10.9
Congo, Rep.	0.2	0.2	0.1	0.0	2.8	2.8	3.6	2.6	0.0	1.7	6.9	2.5	1.0
Côte d'Ivoire	0.0	0.1	0.1	0.0	2.5	4.8	5.0	5.3	6.7	5.0	6.3	9.5	15.9
Equatorial Guinea	0.5	7.3	8.7	0.3	0.3	0.0	0.2	1.0	0.2	0.4	1.8	4.0	4.1
Gabon	4.6	6.1	1.3	0.0	4.2	3.0	4.4	5.3	0.3	0.4	3.7	0.2	2.8
Guinea-Bissau	7.0	5.7	7.8	6.0	7.8	8.0	4.3	12.6	17.4	15.7	31.0	34.7	50.5
Mali	6.9	11.5	10.7	11.6	10.3	11.5	15.1	15.1	13.4	12.0	14.3	11.6	18.1
Niger	9.0	8.7	9.6	8.6	7.1	5.0	3.9	2.9	2.6	1.9	4.5	5.5	6.2
Senegal	0.2	0.2	0.2	0.1	4.9	6.1	6.2	8.8	9.2	8.5	8.8	9.7	12.6
Togo	20.4	21.3	15.1	11.2	8.5	8.5	5.4	7.0	7.4	7.7	11.4	9.5	13.9
Total Africa (WEO)	4.2	5.0	4.3	4.9	6.4	6.4	7.3	9.8	9.7	9.8	12.5	15.0	16.1
CFA countries	3.3	4.0	3.2	2.9	5.0	5.6	5.8	6.1	5.8	5.2	7.1	7.8	10.8
WAEMU	4.1	5.2	4.8	4.7	6.4	7.2	7.3	8.1	8.5	7.7	9.4	10.9	15.0
CAEMC	2.4	2.6	1.2	0.7	3.2	3.3	3.7	3.3	1.5	1.5	4.3	3.5	5.3
M2 (As percentage of GDP)													
Benin	23.7	26.6	28.5	29.1	25.4	24.9	23.4	22.8	20.9	22.6	26.8	29.3	27.7
Burkina Faso	18.1	17.6	18.3	19.0	18.9	21.0	20.6	21.5	21.5	20.8	20.3	19.2	18.1
Cameroon	22.8	22.9	21.5	18.2	18.1	16.2	13.5	12.9	13.7	14.4	15.9	17.1	18.8
Central African Republic	15.6	15.3	15.4	16.6	19.0	21.0	22.5	20.7	17.3	15.9	16.2	15.6	14.7
Chad	14.8	13.4	14.0	13.8	8.4	10.9	12.9	13.3	10.7	11.0	11.3	11.1	12.1
Congo, Rep.	20.3	21.4	21.2	19.3	14.4	15.1	13.2	14.2	16.4	13.3	11.9	14.5	13.1
Cote d'Ivoire	29.1	28.6	28.5	26.6	22.1	24.0	23.5	22.6	22.0	21.9	22.0	22.1	26.0
Equatorial Guinea	16.2	9.7	9.4	8.8	7.9	11.8	10.6	5.9	7.2	5.2	4.4	4.5	5.5
Gabon	17.5	19.5	18.6	15.6	12.1	13.8	13.3	14.0	17.0	16.9	13.9	17.2	16.8
Guinea-Bissau	39.5	25.9	11.9	12.7	14.5	14.0	13.1	17.5	29.4	26.9	34.7	46.6	55.2
Mali	21.0	21.1	20.5	21.6	20.8	20.0	21.3	22.9	23.0	22.8	22.4	23.2	23.7
Niger	20.2	19.5	19.6	19.2	14.4	14.0	12.7	10.4	7.3	7.0	7.7	8.4	9.0
Togo	34.5	35.9	33.5	35.6	25.4	27.8	25.8	22.0	23.6	23.5	26.5	26.3	24.6
Sub-Saharan Africa	32.8	33.6	34.3	33.1	33.4	33.9	32.7	34.1	35.5	35.9	35.4	35.8	36.0
CFA countries	22.6	21.3	20.1	19.7	17.0	18.0	17.4	17.0	17.7	17.1	18.0	19.6	20.4
WAEMU	26.6	25.0	23.0	23.4	20.2	20.8	20.1	19.9	21.1	20.8	22.9	25.0	26.3
CAEMC	17.9	17.0	16.7	15.4	13.3	14.8	14.3	13.5	13.7	12.8	12.2	13.3	13.5
External Public Debt/GDP													
Benin	47.7	53.7	51.6	57.5	87.8	71.1	70.0	73.7	69.4	69.1	74.6	75.5	69.3
Burkina Faso	19.6	24.2	25.9	31.4	50.6	45.2	44.4	49.4	46.4	51.9	61.7	49.6	52.2
Cameroon	38.0	49.0	54.2	63.6	107.2	83.3	77.6	73.8	77.0	76.7	69.6	66.8	54.6
Central African Republic	41.9	51.4	50.9	61.2	91.4	74.5	83.8	88.4	83.6	73.4	77.0	88.2	92.4
Chad	20.9	25.6	28.2	34.6	54.8	48.2	48.8	46.4	45.6	67.4	76.3	54.1	46.1
Congo, Rep. of	117.2	116.2	109.2	143.8	238.5	221.6	178.7	195.4	235.7	207.7	140.7	152.2	165.9
Côte d'Ivoire	96.2	107.4	105.5	112.9	140.8	88.8	76.9	66.9	64.6	67.8	81.2	79.7	61.9
Equatorial Guinea	160.6	172.7	143.5	163.7	207.8	142.1	101.3	47.4	54.8	37.1	22.0	16.4	13.0
Gabon	49.3	56.9	49.5	55.9	81.5	76.2	68.6	69.4	82.8	77.7	62.5	63.9	65.5
Guinea-Bissau	274.2	298.9	360.3	341.8	360.6	357.1	319.1	334.8	445.8	352.5	369.7	408.4	410.7
Mali	71.9	76.1	78.7	82.8	117.1	97.5	102.1	109.0	100.3	98.7	99.2	71.3	58.4
Niger	49.6	56.9	50.8	55.1	101.9	84.6	76.6	85.5	77.9	79.4	94.3	91.6	80.7
Senegal	49.8	51.8	54.7	62.8	85.4	76.4	79.8	75.7	77.7	73.7	70.0	65.9	65.4
Togo	65.1	69.1	63.8	84.1	114.9	90.6	81.0	77.9	91.9	76.5	117.7	109.4	112.2
Total Africa (WEO)	41.7	43.2	45.2	48.7	55.6	51.8	49.6	45.2	48.2	47.5	45.2	44.7	43.7
Sub-Saharan Africa	42.2	43.8	48.0	52.5	58.7	52.8	50.4	45.2	49.1	49.2	47.5	48.0	46.4
CFA countries	60.6	67.5	67.8	77.2	112.4	88.9	81.7	79.6	80.7	80.3	80.6	75.8	68.2
WAEMU	68.9	75.7	75.0	83.0	113.5	84.3	78.6	75.9	73.8	73.8	83.8	77.7	68.0
CEMAC	50.2	57.8	58.6	69.9	111.1	95.8	86.1	84.7	92.1	90.3	76.7	73.4	68.6
Real interest rate (%)													
Benin	14.2	15.2	13.0	..	..	..	..	..	..	..	..	..	..
Burkina Faso	14.4	20.4	16.6	..	..	..	..	..	..	..	..	..	..
Cote d'Ivoire	21.5	15.2	16.8	..	..	..	..	..	..	..	..	..	..
Guinea-Bissau	11.9	-12.4	-8.9	9.7	10.6	-8.2	9.0	..	..	..	..	..	..
Mali	10.6	13.7	14.5	..	..	..	..	..	..	..	..	..	..
Niger	17.9	22.3	15.5	..	..	..	..	..	..	..	..	..	..
Togo	12.6	13.0	13.8	..	..	..	..	..	..	..	..	..	..
Cameroon	16.6	14.1	19.3	15.1	5.8	-0.9	15.7	18.8	20.6	20.7	20.6	17.2	17.2
Central African Republic	15.9	20.1	15.0	21.6	-4.3	5.2	19.8	20.4	20.8	20.6	19.1	17.2	16.3
Chad	9.7	14.6	35.2	19.0	-18.1	6.6	9.3	18.7	10.7	32.1	15.4	7.2	13.8
Congo, Rep.	19.7	19.9	19.6	18.8	-14.1	13.3	3.4	16.3	49.1	-6.1	-16.5	40.3	18.8
Equatorial Guinea	21.5	14.1	17.7	18.3	-23.8	13.1	-2.7	-4.7	60.7	-13.6	-21.1	30.2	15.9
Gabon	2.7	33.3	17.3	16.2	-20.0	16.7	8.1	19.6	44.8	16.4	-5.0	36.7	11.4
Sub-Saharan Africa	-1.4	1.7	2.1	-0.2	-3.8	-3.5	..	..	..	..	..	..	..
CFA countries	13.4	14.7	14.8	14.8	-8.5	5.3	8.9	14.8	34.5	11.7	2.1	24.8	15.6
WAEMU	14.7	12.5	11.6	9.7	10.6	-8.2	9.0	..	..	..	..	..	..
CEMAC	14.4	19.3	20.7	18.2	-12.4	9.0	8.9	14.8	34.5	11.7	2.1	24.8	15.6

Sources: The World Bank, *World Development Indicators* April 2004. IMF, *World Economic Outlook*, 2004.

APPENDIX II

Monte Carlo Simulation

This appendix explains in detail the Monte Carlo simulation used to estimate the initial buffer size for both full and partial insurance. To measure the size of the required buffer, 100 50-year histories of revenues were generated for the member countries in WAEMU and CEMAC¹⁷.

First, to estimate the relationship among member's countries fiscal revenues, a first-order vector auto-regression (VAR) was run with the original cyclical revenues for the period 1980-2003, as follows:

$$(1) R_{t,i} = \alpha + \beta R_{t-1,i} + \varepsilon_{t,i} \quad \text{where } i=1 \dots 5 \text{ economies}$$

The coefficients α and β capture the relationship among the five member countries and ε is the observed or reduced form residual. Following Sims (1980) equation (1) can be re-expressed as a reduced form equation that comes from a structural VAR:

$$(2) R_{t,i} = B^{-1}\Gamma_0 + B^{-1}\Gamma_1 R_{t-1,i} + B^{-1}\mu_{t,i}$$

Where,

$$\mu \sim N(0, 1)$$

$$B^{-1}\Gamma_0 = \alpha$$

$$B^{-1}\Gamma_1 = \beta$$

$$B^{-1}\mu_{t,i} = \varepsilon_{t,i}$$

Matrix B^{-1} is the Cholesky factorization matrix

From equations (1) and (2), note that ε is the observed or reduced form residual and μ is the unobserved structural innovation.

Second, to generate five thousand new revenue variables the estimated coefficients (α and β) from (1) are used in periods of fifty years and assuming that the initial period revenues are zero ($R_0 = 0$). In addition, five thousand new random variables ε are needed to get the new revenues variables recursively from (1). In order to get ε , five thousand random numbers μ are generated for each of the economies.¹⁸ Using the Cholesky factorization matrix (B^{-1}), the observed errors (ε) are recovered as follows:

¹⁷ Guinea Bissau was not included in WAEMU since it joined the union in 1997. Equatorial Guinea was not included in CEMAC owing to data unavailability for 1980-2003.

¹⁸ These random numbers are drawn from a standard normal cumulative distribution. In order to obtain the original values, we calculate the inverse of the cumulative distribution.

$$(3) \varepsilon_{t,i} = B^{-1} \mu_{t,i}$$

Finally, using the 100 50-year histories of revenues and the buffer accumulation identity (see below), the initial buffer depends on what type of insurance is provided. Two options are considered:

1. **Full Insurance:** B_0 is such that in every period $B_t > 0$ for 100 50-year histories and for all t .
2. **Partial Insurance:** B_0 is such that for specific t and depending on the level of coverage it becomes $B_t < 0$. That is, sometimes the buffer is depleted (“bust”), provided that there is no full insurance. Thus, the buffer coverage will be equal to:

$$\% \text{ Coverage} = \frac{\# \text{ number of histories where } B_t > 0}{\# \text{ of histories}(100)} * 100$$

Simulation Exercise Assumptions and Methodology:

1. We assume that the economies are in a balanced growth path with constant long-term real growth rates of GDP; fiscal revenues and expenditures are assumed over the long run.
2. The centralized fiscal authority will only cover for transitory shocks; only cyclical changes in revenues will be considered.
3. To determine permanent and transitory components in revenues and expenditures we compute a linear trend on the logarithm of real revenues and expenditures.¹⁹ The trend in revenues sets the basis for the calculation of the permanent sustainable path of expenditures for each country, which is the path of the expenditures that the centralized fiscal authority guarantees to each member considering all expenditure targets for the following period as the position of the revenue trend.
4. A Monte Carlo simulation of 100 50-year histories of fiscal revenues observations is generated to test the performance of the insurance scheme for different random shocks and assuming full insurance and partial insurance.

¹⁹ An alternative method would be to filter the data using the Hodrik-Prescott (HP) filter. But the H-P filter has two limitations that make it difficult to apply: First, the position of the trend in the last portion of the sample changes as the sample size grows over time, which implies a large degree of uncertainty in the last points of the trend estimate. Second, the trend estimate is very sensitive to the weight parameter. A linear trend is more stable since all the observations in the sample have equal weight whereas HP gives a relatively larger weight to the last observation.

5. Rules for net transfers: total fiscal revenues in excess of the expenditure trend target are transferred to the centralized fiscal authority. If revenues are below the expenditure target, financing is provided by the fiscal authority.
6. The Initial buffer fund level is determined as a percentage of Revenue trend and also as a percentage of GDP trend. In the case of full insurance, it is calculated by iterations as the minimum initial buffer level such that it is never depleted in the 100 histories. In the case of partial insurance, the buffer remains positive all times between 90 and 50 of the simulated revenue trajectories out of 100 histories, which represent 90 percent and 50 percent coverage, respectively.
7. The Law for the dynamic evolution of the buffer stock in real terms as share of the aggregate (WAEMU, CEMAC) revenue trend:

$$(1) B_{t+1} = (1+r)B_t + Cyc Rev$$

Rewriting (1) we obtain the following identities,

$$(1.b) \frac{B_{t+1}}{RevTrend_t} = (1+r) \frac{B_t}{RevTrend_t} + \frac{Cyc Rev}{RevTrend_t} :$$

$$(1.c) b_{t+1}(1+g) = b_t(1+i) + cycrev_t \quad t = 0, \dots, 50 \text{ (100 histories)}$$

Where,

- b_t is the share of the buffer stock over aggregate revenue trend.
- $cycrev_t$ is the share of the aggregate revenues over aggregate revenue trend. This variable has mean zero.
- $(1+i)$ real interest rate (3%).
- $(1+g)$ real growth in WAEMU and CEMAC revenue trend.

Solving (2) forward for T iterations,

$$(3) b_T = \left(\frac{1+r}{1+g}\right)^T b_0 + \left(\frac{1}{1+g}\right) \sum_{t=0}^{T-1} \left(\frac{1+r}{1+g}\right)^{T-t-1} cycrev_t$$

And multiplying (2) by $\left(\frac{1+r}{1+g}\right)^{-T}$, taking the limit as $T \rightarrow \infty$, and imposing the

transversality condition: $Lim_{T \rightarrow \infty} b_T \left(\frac{1+r}{1+g}\right)^{-T} = 0$

The initial buffer (b_0) as share of revenue trend converges to:

$$(3) b_0 = - \left(\frac{1}{1+g}\right) \sum_{t=0}^{\infty} \left(\frac{1+g}{1+r}\right)^{t+1} cycrev_t$$