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Reserve Pooling in the Eastern Caribbean Currency Union and the CFA Franc Zone: A Comparative Analysis

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Abstract

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The paper presents a comparison of the gains from the pooling of reserves, and hence reserve variability, in the Eastern Caribbean Currency Union (ECCU) and the CFA franc zone. The results indicate that countries within the ECCU area have achieved greater balance of payments protection than the CFA zone countries from the pooling of reserves. Unanticipated changes in the terms of trade lowered reserves in the CFA relative to the ECCU, which may reflect a greater reliance on primary commodities in the CFA compared with services in the ECCU.

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Contents   Page

I. INTRODUCTION

The theory of optimum currency areas (OCA) was once ridiculed as "primarily a scholastic discussion which contributes little to the practical problems of exchange rate policy and monetary reform" (Ishiyama, 1975). The viability of OCA was recently called into question with the 50 percent devaluation of the (CFA) franc in 1994.[2] However, the allure of OCA has re-emerged with the advent of the European Monetary Union (EMU) and the recent creation of the Euro currency in 1999. The choice of exchange rate regime, exposure to external shocks and the criteria for the establishment of an OCA become important factors in the establishment of such a currency arrangement.[3] In the case of EMU, the existence of a common currency was foreseen to foster intra-regional trade and to endogenize the OCA conditions. Frankel and Rose (1998) argue that countries need not satisfy the conditions for a currency union ex-ante as the establishment of a single currency may well create these conditions ex-post.

The Eastern Caribbean Currency Union (ECCU) and the West and Central African Monetary Unions chose to peg their currencies to the U.S. dollar and French franc, respectively.[4] By so doing, inflation rates reflect those of the major country to which the domestic currency is pegged. The only comparative study of their respective monetary policies is given by Nascimento (1994). Allechi and Niamkey (1994) explored the gains from pooling of reserves for the CFA.

The scarce literature on the structure and performance of these two monetary unions motivated the study presented here. This study undertook four tasks: (1) explore the gains from pooling of reserves in the ECCU and CFA; (2) measure the level of reserves members of these monetary unions would have to hold in an independent state relative to pooling reserves; (3) examine the role of institutional arrangements in reserve management; and (4) measure the impact of

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[2] CFA stands for Communauté Financière Africaine in the Central African Economic and Monetary Community and Coopération Financière Africaine in the West African Economic and Monetary Union.

[3] The criteria include: (1) the extent of trade among members; (2) similarity in economic structures and commonness of shocks; (3) flexible factor mobility; and (4) existence of fiscal transfers.

[4] The ECCU is comprised of the following independent countries; Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia, and St. Vincent, and two British dependent territories, Anguilla and Montserrat. The WAEMU consists of Benin, Burkina Faso, Côte d'Ivoire, Senegal, Togo, Niger, Guinea Bissau, and Mali, and these countries are governed by a common central bank, the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO). Cameroon, Congo, Gabon, Central African Republic, Equatorial Guinea and Chad form the CAEMC and are governed by the Banque des Etats de l'Afrique Centrale (BEAC).

unanticipated changes in the terms of trade on reserves. The optimal level and variability of reserve pooling, gains from non-pooling and the choice between reserve accumulation and capital formation are examined as well. A case for continued membership of the currency union could be made if member countries gain a greater degree of balance of payment protection in the monetary union than they would have enjoyed independently. Other indirect benefits include those derived from a stable currency, which may contribute to lower external costs of borrowing as well as lower variability in inflation.

The paper is organized as follows: Section II looks at the institutional framework for pooling reserves in the ECCU. As far as possible, a comparison will be made between the institutional framework governing the operations of the reserve pool in the ECCU with that of the West and Central African Monetary unions (CFA franc zone). Section III explores the theory of reserve pooling, while section IV discusses the comparative results between the two currency areas. In doing so, the concept of hypothetical reserves is introduced with a view to estimate the level of reserves countries would have to hold assuming no reserve pooling, and pertinent methodological issues regarding the approach used are discussed briefly. In section V some issues of reserve management in the respective currency areas are presented. Finally, some concluding remarks are made in section VI.

II. Institutional Framework

A. ECCU[5]

In the ECCU, although commercial banks are not obligated to surrender their foreign exchange earnings to the Eastern Caribbean Central Bank (ECCB), they nonetheless submit their foreign exchange to:

(i)   maintain settlement balances with the central bank to settle transactions abroad; and

(ii)   take advantage of interest bearing facilities at the central bank in accounts that must be funded by foreign currency.

The ECCB does not allocate foreign reserves to any particular country or bank because the only meaningful balance of payments in a currency union is at the aggregate level.[6] Nevertheless, with the introduction in 1986 of coding of banknotes by country of origin, it became possible to

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[5] For a more detailed account of the institutional framework of the ECCU/ECCB see "The Eastern Caribbean Currency Union: Institutions , Performance and Policy Issues" Occasional Paper 195/2000.

[6] The ECCB is the monetary authority of the Eastern Caribbean Currency Union.

prepare separate balance of payment accounts for ECCU member countries using the concept of imputed foreign reserves for each country. The formula for calculating imputed reserves is based on the following identity:

$$NFA_i = RM_i - NDA_i \qquad (1)$$

where, NFA_i is net foreign assets, RM_i is reserve money, and NDA_i, net domestic assets for country i.[7]

The fundamental constraint is fiscal in that any agent in any country can access the pool as long as he/she has local currency resources. This policy focus is reflected in the ECCB agreement, which limits the extent of domestic liquidity the bank can create at two levels. First, the ECCB is required to maintain a minimum foreign exchange cover equivalent to 60 percent of demand liabilities.

This implies that the ECCB cannot in the aggregate lend governments and banks more than 40 percent of demand liabilities. The second constraint is that under section 40(1) of the ECCB Agreement, temporary advances to meet seasonal needs, and holdings of treasury bills issued by member governments are limited to 5 percent and 10 percent of each government's recurrent revenue respectively. Additionally, the holding of securities other than treasury bills in respect of all governments may not exceed 15 percent of currency in circulation and other demand liabilities. Once governments have exhausted their credit allocation, they must then seek residual financing from commercial banks and/or nonbanks. However, they tend to seek this residual financing before limits are exhausted.

In determining its annual credit limit, the central bank takes into account the existing level of net foreign assets, demand liabilities at the beginning of the fiscal year and the statutory requirement of 60 percent foreign asset cover but after deducting a margin of 30 percent of credit allocated to finance governments for contingency lending to banks. Credit is allocated to each government based on the ratio of its recurrent revenues to total revenues for all members. Governments are free to draw on their allocation at anytime to finance budget deficits, and the central bank advises them on the appropriate mix of treasury bills and long-term securities.

A careful analysis of these arrangements suggests that each member government has an individual credit allocation at the ECCB, which cannot be extended upon exhaustion. Therefore, there is no spillover effect in regards to member's demand for credit.

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[7] RM_i can only be calculated as currency is issued to banks in country i and generally will not coincide with currency held there. Notes move freely among the islands leading to discrepancies between currency issued and currency held.

B. CFA Franc Zone

The CFA franc zone comprises two regions: the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CAEMC). France guarantees convertibility of the CFA franc through an operations account that each of the central banks holds at the French treasury. In return for the guarantee, the CFA franc zone must allow France to participate in the decision-making process within the currency arrangements. In instances when the operations accounts of the BEAC are in deficit, the statutes of the BEAC prescribe a reduction in net domestic credit when the central bank's position in the operations account is negative.

The net position of the two zones in the operations account was positive until 1980 as the negative position of the BCEAO was offset by the positive position of the BEAC (Medhora, 1992a). Collectively, the external reserves CFA franc zone have been a small proportion of France's (less than 10 percent). All exports receipts must be exchanged for CFA francs with a local bank which in turn surrenders the foreign bill of payment to the BCEAO and BEAC. Before the CFA zone can avail itself of the facility, members must first contribute all of their own reserves. The respective central banks are also empowered to use all funds maintained abroad by both private and public institutions.

In order to prevent excessive recourse to central bank financing of budget deficits, both central banks have incorporated two monetary rules in their respective agreements. Both central banks restrict outstanding credit to governments to 20 percent of fiscal revenues of the previous year. In the case of the BCEAO, this rule was in effect until 1998, when member states decided to freeze the ceiling for 1999 at the corresponding level of 1997 fiscal revenues, with a view to gradually bringing the stock of advances down to zero by end-2001. Moreover, the limit is statutory advances to the treasuries and is defined in the BCEAO as 20 percent of the previous year's tax revenue and in the BEAC as 20 percent of the previous year's budgetary revenue. Although simple, it must be noted that the first rule does not take into account all sources of central bank credit to public entities that can relieve fiscal pressures. The second rule states that gross foreign assets for each central bank must be maintained above 20 percent of sight liabilities.[8] Moreover, the application of the first rule has not always been strict as some countries have had outstanding credit above the ceiling. Amounts exceeding the prescribed ceiling, however, require approval of the Conseil d'Administration.

The institutional framework in the CFA franc zone makes it possible for member states to use pooled reserves in counterpart of local currency. Within these arrangements, fiscal imbalances of member countries, unless funded by other members within the pool, can result in a decline in the foreign assets of the respective central banks.

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[8] Sight liabilities include notes and coins, sight deposits of banks, financial institutions and the treasury, and foreign currency liabilities.

As a counterpart to the guarantee of the French treasury, each central bank is obliged to maintain 65 percent of its official reserves in the operations account. In the first instance, each country draws down on its own account of pooled and unpooled reserves. Once these are fully drawn down, the other countries' pooled reserves may be used. In essence, there is no statutory limit on a member country's use of another's reserves. A crisis management scheme takes over when the BCEAO or the BEAC reserves fall below the prescribed threshold, not when the reserves of individual countries are exhausted.

It should be noted that the foundation for reserve pooling differ somewhat between the two monetary unions. The issue of full convertibility of the CFA franc through the French guarantee of the operations account, minimizes to a large extent some of the short term risks associated with current payments. Nevertheless, in both regions, the issue of a common currency, complimented by a common history and culture has fostered economic and monetary integration. However, as will be demonstrated later, in the case of the CFA franc zone, the French guarantee would not have been sufficient to preserve the value of the currency in the face of adverse terms of trade shocks without the necessary fiscal adjustment to constrain aggregate demand.

III. THEORETICAL FRAMEWORK

The theoretical approach to reserve pooling taken in this study is based on the framework of Dodsworth (1992).[9] This framework is a modification of the theory of clubs developed earlier by Buchanan (1965) and Ng (1975). The gist of the theory of clubs is that if the utilization patterns of two clubs are not highly positively correlated, then the membership of both clubs could be better off by sharing each others facilities so as to even out crowding. The model assumes each country within an institutionalized regional group is faced in each time period (t) with a level of external payments (D_t). These payments are met from current receipts from abroad (C_t) when $D_t < C_t$ and from a contingency reserve fund (R) if $D_t > C_t$. The size of the reserve fund depends on some measure of dispersion of (D_t) above (C_t), and on a risk factor (W) that reflects the probability (Pr) of illiquidity.

The risk factor is defined as follows:

$$W = \Pr[\sum_{t=1}^{n} D_t > (\sum_{t=1}^{n} C_t + R)] \tag{2}$$

If the time horizon, (n), is held constant, then a trade off curve can be drawn between reserves held and the risk factor (W) because the choice of any two of the three variables R, W or n determines the third. The specification of this trade off curve will depend on the degree of preference or risk aversion. The trade off curve will be convex to the origin, asymptotic to the R

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[9] The optimization approach to reserve pooling, though very attractive, was not used in this paper largely because of the inherent difficulties in defining a cost function for reserves.

axis and intersecting the w axis. If the distribution of $(D_t - C_t)$ in the reserve pooling situation is symmetric, then the trade off curve will cut the w axis at 0.5.[10]

A number of important points emerge from Dodsworth's analysis:

(1) Benefits from reserve pooling arrangements depend not only on precautionary reasons for holding reserves but also on the differences in the risk preferences of the members;

(2) The choice of common risk factor affects the savings in reserves. If a conservative scheme is adopted that does not require an increase in the risk factor of any member, then the reserve savings element will be reduced. This situation is more likely if a wide divergence in attitudes towards risk, is combined with greater correlation between member's usage patterns; and

(3) The size of the reserve saving will be affected by the cost sharing scheme. Cost sharing schemes should be inclined towards requiring the more risk adverse members of the group to contribute more than a proportionate share to the fund.

Two additional benefits of holding reserves are:

(1) Countries are able to acquire goods and services from abroad in the case of national emergencies; and

(2) Reserves may be used to signal a country's financial strength thereby increasing acceptability of public/private financial instruments. They may lower borrowing costs on international capital markets.

A third benefit of holding reserves is:

(3) The precautionary demand for reserves if countries are predisposed to negative shocks. Lack of access to international capital markets in bad times may necessitate holding a higher level of reserves.

Although the model by Dodsworth provides a useful reference for analyzing reserve pooling in the ECCU and the CFA franc zone, there are some inherent limitations. One such limitation is the model's is its exclusive focus on the variability of payments and the risk of illiquidity. The model assumes implicitly that future deficits/surpluses of member states will be unaffected by the existence of the regional reserve pool.

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[10] See appendix for graphical illustration.

A. Gains From Reserve Pooling

The pooling of reserves offers participating countries two possible sources of gain. The first of these is access to increased reserve holdings while the second is a possible reduction in reserve variability. Dodsworth (1992) and Medhora (1992) utilized a notion of coverage in a way, which incorporates these two sources of gain. Coverage is defined as the ratio of reserve holdings to their variability. According to this formulation, coverage will increase if there is an increase in access to reserves or a decrease in reserve variability. Dodsworth (1992) and Medhora (1992) defined coverage in country i as:

$$C_i = \frac{PR_i}{Var(PR_i)} \tag{3}$$

where PR_i is the average level of reserves during a time period and $VAR\ (PR_i)$ is their variability during the same time period (for each country).

In the case of a reserve pool, $PR = \Sigma PR_i$. It is important to note that coverage under reserve pooling is higher than that in the independent state if the variability of the pool is lower than that of each country's individual reserves, or if the increased access to reserves outweighs the higher variability of the pool. In the case of a partial pool, equation (7) becomes:

$$C_i = \frac{(R_i + \sum_{j \neq i} \rho R_j)}{VAR(R_i + \sum_{j \neq i} \rho R_j)} \tag{4}$$

where ρ is the degree of pooling $0 < \rho < 1$ and R_i is the total reserves of country i. That is, with partial pooling, country i's total access to reserves equals all its own reserves plus the partially pooled reserves of all other members of the pool. In a 100 percent pooling scheme (i.e. $\rho = 1$) equation (4) reduces to equation (3) because $\Sigma R_i = PR$.

Studies on the demand for international reserves have typically assumed that reserves are held both to meet international payments as well as for precautionary reasons to face unexpected payment difficulties, (Heller, 1966; Hamada and Ueda, 1977; and Frankel, 1981). These studies assumed the demand for reserves to be a stable function of country size, the degree of openness of the a country, the variability of payments and the opportunity costs of holding reserves. Country size has typically been measured using income and is expected to be positively related to reserves. The openness of a country, as reflected by its propensity to import, has an ambiguous impact on the demand for reserves. Heller (1966) asserts that in the hypothetical absence of reserves, any temporary deficit in the balance of payments would have to be corrected by means of a reduction in aggregate expenditure. The required adjustment is smaller the higher the propensity to import. This implies a negative relationship between reserves and the propensity to import. Frenkel (1977) argued that the propensity to import reflects the economy's openness and thus measures its vulnerability to external shocks. In this case the demand for reserves should be positively related to the import propensity. In order to account for the adjustment between actual and desired reserves a partial adjustment process is assumed

in this study, (Mathieson and Lizondo, 1987). In most empirical studies of the demand for international reserves, the opportunity cost of holding reserves (usually measured by the domestic interest rate) was found not to be significant (Heller and Khan, 1978, and Saidi, 1981).

In studies by Edwards (1984), Heller (1966), and Frenkel (1981), it was assumed that the higher the variability of external payments the higher the level of reserves a country would desire to hold. This is particularly relevant the more predisposed the country is to negative external shocks. In this case the sign of the coefficient on the variability measure is postulated to be positive. However, in this study we focus on the unexpected portion of external disturbances to measure its impact on the desired level of reserves. The coefficient of the unanticipated portion of terms of trade is expected to be negative.

The following equation summaries the dynamics of desired reserves outlined in the theoretical section:

$$RES_t = \gamma(RES_t^* - RES_{t-1}) + \lambda(Z_t - Z_t^*) \tag{5}$$

where RES_t^* refers to desired reserves, RES_t is actual reserves held at period t and Z_t represents a vector of right hand side variables which include income and the propensity to import. This partial adjustment specification has been used in previous studies (Bilson and Frenkel, 1979, Edwards, 1984).

B. Data Issues

The above model was estimated with reserves to GDP (RES_t) as the dependent variable regressed on the average propensity to import ($AVPIMP_t$) or imports to GDP, per capita GDP ($PCAPGDP_t$), the spread between French treasury bill rate and the CFA central banks' discount rate (SPRD), and the lagged dependent variable (RES_{t-1}) as independent variables. All variables are measured in logarithmic value whose coefficients are estimated using instrumental variables. The choice on instruments were U.S. and French interest rates, terms of trade, lagged average propensity to import and lagged per capita income. The spread between French treasury bill rate and the discount rate was used for the CFA. Alternatively, several measures of the variability of the terms of trade as these affect the ability of countries to meet payments were used in ascertaining their impact on reserve accumulation. In particular an attempt was made to determine how the unanticipated component of the terms of trade affected reserves.

Data for the analysis covering the period 1980–1997 were obtained from IMF *IFS*. Congo and Equatorial Guinea were excluded from the analysis for CAEMC due to gaps in the data. The standard deviation and the coefficient of variation indicate the pattern of reserve variability for member countries. The coefficient of variation corrects for the influence of extreme values on the estimates, therefore both measures will be used to examine reserve variability in the ECCU and the CFA franc zone. Reserve variations are analyzed for the sub-periods 1980–89 and 1990–97 and for the whole period 1980–1997. Reserve holdings of the monetary authority are examined.

IV. RESULTS AND DISCUSSION

A. Reserve Variability

When the standard deviation is used as a measure of reserve variability of the monetary authority, St. Lucia, Antigua and Barbuda, and St. Kitts and Nevis record the highest variability in reserves for the period 1980–1997 (see Table 1). Both measures of reserve variability indicate that Anguilla and Montserrat record the lowest variability in the imputed reserves at the central bank over the period 1980–1997. This finding is consistent with lower than average variability in tourism revenue and merchandise export revenue in Montserrat and Anguilla during the period 1980 to 1997.

The high variability of reserves in Antigua and Barbuda may be associated with very high variability of tourism revenue in that country, perhaps related to the effects of hurricanes. The high variability of reserves in St. Lucia is consistent with high variability in banana export and tourism revenue. With the exception of St. Vincent and the Grenadines, all the countries in the ECCU recorded higher variability in reserves during the 1980s when compared to the 1990s. The higher variability of reserves of countries in the ECCU area during the 1980s may be due to high volatility of the visible trade balance during that period.

The standard deviation indicates that within the CFA franc zone Côte d'Ivoire and Cameroon record the highest variability of reserves for the period 1980–1997 (Table 2). This finding is consistent with the high degree of variability which revenue from service exports from Cameroon and Côte d'Ivoire demonstrates during the period under consideration. The coefficient of variation of reserves from the central bank points to Benin, Mali and Gabon as high reserve variability countries. With the exception of Gabon and Niger all the countries of the CFA franc zone recorded higher variability of reserves during the 1990s when compared to the 1980s. This is consistent with the worsening of the terms of trade during the 1990s.

B. Degree of Pooling

Using equations 3 and 4 coverage ratios using various pooling configurations ranging from a zero pool state to a 100 percent pool are computed for individual countries. All ECCU countries enjoy much higher coverage under a full pool than under a partial pool. Reserves of the monetary authority indicate that Montserrat had the highest level while St. Lucia enjoys the lowest coverage under a 65 and 70 percent pool for the period 1980–1997 (Table 3). Montserrat's high coverage may be due to the fact that its reserves with the monetary authority, although low, show very little variability. In contrast, St. Lucia and Antigua and Barbuda's mean reserves are high over the period and reflect high reserve variations due to general tight liquidity conditions in these economies.

During 1980–89 all the countries enjoyed more coverage under the various pooling configurations than they did under a zero pool state (Table 4). Montserrat, Grenada, and St. Kitts and Nevis gained the highest levels of coverage under a 70 percent pool for example. Grenada also recorded high average reserves and low variability of reserves. St. Kitts and Nevis and Montserrat also record very low reserve variability.

St. Vincent and the Grenadines had a high level of coverage in a no pool state during the 1990s. Under a 70 percent pool, St. Vincent and the Grenadines, Montserrat, and Anguilla attained highest coverage during the 1990s (Table 5). It must be noted that with the exception of St. Lucia and St. Vincent and the Grenadines, all other countries achieved higher coverage during the period of the 1980s.

When the CFA franc zone was examined as a block the countries achieved much lower coverage ratios than the ECCU area for the entire period under consideration (Table 6). Also, all countries enjoyed more coverage under a pooling arrangement. Under a 70 percent pool Senegal, Niger and Chad achieved highest coverage. These three countries all recorded lower than average reserve variability for the period under consideration. Niger and Chad also recorded mean reserves that are higher than the average level of reserves.

When WAEMU was examined as a block, Niger attained the highest coverage for the period 1980 to 1997. This may be due to low reserve variability and higher than average level of reserves. This result is consistent with Medhora (1992b) which concluded that Niger had low variability of reserves for the period 1974 to 1990. Senegal achieved a higher level of coverage in a no pool state than under any pooling configuration. Although Senegal has a low level of reserves, it also records low reserve variability. Côte d'Ivoire had the lowest level of coverage under a 70 percent pool. This may be as a result of its very low level of reserves and high level of reserve variability. The members of WAEMU enjoyed much higher coverage under a 70 percent pool during the 1980s when compared to the 1990s (Tables 7 and 8).

Cameroon and Chad had the highest coverage when CAEMC was examined as a block. Chad had low reserve variability and high mean reserves for the period under consideration. However, Cameroon recorded the lowest level of reserves and high reserve variability. This is consistent with the fact that Cameroon recorded the highest variability in export revenue, and is third after, Côte d'Ivoire and Gabon, in terms of variability of revenue from exports of goods. CAEMC also experienced greater balance of payments protection during the 1980s when compared to the 1990s.

The differences in economic structure of exports may in part explain some of the differences in coverage between the CFA franc zone and the ECCU. Within the CAEMC, Chad relies heavily on cotton exports while, Gabon, Equitorial Guinea, Congo and the Cameroon depend on petroleum exports. In the case of the oil exporters, the price of oil fell drastically from historical levels of US$37 per barrel in 1980 to a low US$18 per barrel by in 1989 due in part to unraveling of the Oil Exporting Countries (OPEC) cartel arrangement. Oil prices recovered partially during the Gulf War in 1990–91 to around $23 per barrel and by end-1997 were US$19 per barrel.[11] Consequently, the terms of trade deteriorated dramatically during most of

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[11] These oil prices are based on the average of U.K. Brent, Dubai and West Texas Intermediate. West Texas Intermediate prices are typically US$3–4 higher than the two other prices.

the 1980's and 1990's. Cashin and Pattillo (2000) found adverse shocks to the terms of trade for the petroleum exporters of CAEMC to be very persistent. Within WAEMU, Côte d'Ivoire and Benin received between 20–49 percent of export earnings from cocoa and cotton respectively. Mali earned 10–19 percent of export receipts from gold and 20–49 percent from fish. Cashin and Pattillo (2000) also found that shocks to the terms of trade to members of WAEMU were not as persistent as compared to those to members of CAEMC. The terms of trade in WAEMU worsened during the second half of the 1980's and between 1990–97 with the exception of 1994 and 1995 (Clément et al., 1996 and Hernández-Catá et al., 1998). The deterioration in the terms of trade, rising labor costs, combined with an appreciation of the French franc against the U.S. dollar, led to a deterioration of the regions competitive position (Hernández-Catá et al., 1998). Some of the ECCU countries by comparison, also faced a high degree of primary commodity export concentration. Dominica, St. Lucia, and St. Vincent and the Grenadines during the 1990's share of banana exports revenue to revenue from total exports of goods averaged 40 percent, 49.4 percent and 38.5 percent respectively. St. Kitts and Nevis whose primary commodity export is sugar, averaged 29 percent of revenue from exports of goods during the same period. At the level of the currency union, receipts from exports of goods averaged 25.6 percent of total receipts from goods and services during the 1990s. These receipts however, have declined from a high of 34 percent in 1990 to 21 percent by end-1997, reflecting in part the worsening of the terms of trade and the increased importance of service exports.

C. Hypothetical Reserves

To understand the beneficial impact of pooling one needs to ascertain the level of reserves each country would have had to hold in an independent state to enjoy the level of coverage afforded by a pooling of reserves. This level of coverage is represented by the concept of hypothetical reserves and is computed using Medhora's (1992b) methodology in the following manner by rearranging equation (3) and solving for desired level of reserves. This yields:

$$HR_i = C_i * VAR(R_i) \tag{6}$$

where HR_i, is the level of hypothetical reserves, C_i refers to the level of coverage, and VAR (R_i) represents reserve variability. In the case of the ECCU countries reserves were proxied using the imputed reserves or NFA derived from equation 1 as the difference between reserve money (RM) and net domestic assets (NDA). In order to use this measure, we verified that the main component of RM, currency outside banks as a percentage of GDP was in line with comparator fixed exchange rate countries in the Caribbean Community (CARICOM).[12] For the period of analysis the mean currency to GDP for ECCU countries was comparable to those for Barbados and Belize but not for the Bahamas.[13] The other components of RM, statutory reserves were

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[12] Currency to GDP is highly correlated with the degree of economic activity based on the transactions demand for money.

[13] Average currency to GDP for Barbados was 5.5 percent, Belize 5.3 percent and Bahamas 2.6 percent. The result for Bahamas represented the high co-circulation of U.S. and Bahamian

based on banking regulation while bankers fixed deposits depended on the willingness of commercial banks to place these deposits with the monetary authorities. NDA reflected, advances to individual member governments and the holdings of their securities.

During the period 1980–1997 the level of hypothetical reserves indicated that Dominica, Anguilla. Montserrat and St. Kitts and Nevis earn more than 100 percent increase in reserves from a 20 percent pooling arrangement for example (Table 9). It is noteworthy that hypothetical reserves increase with the degree of pooling. This result is not surprising as Dominica and St. Kitts and Nevis are characterized by relatively high levels of reserve variability and lower than average level of mean reserves. Anguilla and Montserrat are characterized by very low level of mean reserves and low reserve variability. Belonging to the pool therefore would confer on Monsterrat and Anguilla the double benefit of increased access to reserves plus lower variability. Grenada and St. Vincent and the Grenadines incur smaller benefits (68 percent and 52 percent respectively) from the pooling arrangement due to higher than average levels of mean reserves and low reserve variability. Antigua and Barbuda and St. Lucia also obtain benefits from the pooling arrangement due to the very high level of mean reserves but lower than those of other ECCU members.

An examination of hypothetical reserves for the 1980–89 sub-period shows the gains range from 51.5 percent in Grenada to 158.5 percent in Dominica (Table 10). Dominica enjoyed the greatest benefit on account of low level of own reserves and moderate own reserve variability. Grenada, St. Lucia, and St. Vincent and the Grenadines record lower gains. Despite moderate levels of reserves, Grenada had low levels of mean reserve variability and the increased access to reserves was not sufficient to compensate it for accepting higher variability in the pool. A look at the final sub-period 1990–97 reveals the gain range from negative 16.7 percent in St. Vincent and the Grenadines to 78.5 percent in Grenada (Table 11). St. Vincent and the Grenadines, with a high level of own reserves and very low own reserve variability, could not benefit from increased access to reserves in the pool. With low level of own reserves and low own reserve variability, the increased access to reserves did not confer significant benefits on Montserrat during that sub-period.

Hypothetical reserves for countries in the CFA franc zone reveal that most countries experienced losses from the pooling arrangement for the period 1980–97 (Table 12). Among the West African countries Benin, benefits most (133 percent) from a 20 percent pooling arrangement. This may be due to its very high level of own reserve variability as measured by the coefficient of variation. All countries in CAEMC incur losses over the period 1980 to 1997 with the exception of Chad and Gabon. In CAEMC, over the period 1980–89 all countries incur gains with the exception of Cameroon (Table 13). Cameroon incurs sizable losses due to its high level of own reserves and high reserve variability. Within WAEMU, Niger is the only country that gains from the pooling arrangement during the period 1980–89.

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dollars and the higher use of credit and debit cards for transactions purposes. ECCU countries average currency to GDP ranged from 5.1 to 6.4 percent.

Some important points emerge from this analysis. First, countries that are likely to gain the most are those which display relatively low levels of mean reserve availability coupled with high levels of variability. Secondly, pooling will not deliver equal reserve gain to all member states and therefore, there is likely to be some asymmetry in the distribution of gains.

D. Regression Results

The demand for reserves in both the ECCU and CFA franc zone possessed a comparable amount of inertia between actual and desired reserves, taking approximately two to three years for 75 percent of the adjustment to take place (model 1, Table 15). The CFA franc zone had a higher propensity to import with a long run elasticity of 0.88 compared to 0.75 for the ECCU. The income variables in both equations were, however, not significant. A dummy variable to capture the effects of the 1994 devaluation in the CFA franc zone was of expected sign but not significant. The lagged spread between the French treasury bill and the CFA franc discount was of expected sign but not significant.

Variability in payments measured by log changes in the terms of trade (DTOT) did not significantly affect reserves in the case on the ECCU. A possible explanation is that receipts from export of goods account have declined over the period due to loss of preferential access to a number of markets. By end-1997 exports of goods amounted to 22 percent of exports of goods and services in the ECCU. A similar result was found by Williams et al. (1999) using impulse response functions in analyzing the impact of banana price shocks on the reserves of the ECCU. Banana exports make up the majority of exports of goods from ECCU countries. Cashin et al. (1999) also found that the half life for bananas was less than one year suggesting these shocks are predominantly temporary.

In the case of the CFA zone (model 2), log changes in the terms of trade were negatively related to reserves speaking to the vulnerability due to the reliance on commodity exports (Cashin et al. 2000). An examination of asymmetries in these changes revealed that positive values did not increase reserves suggesting there has been a preponderance of negative changes in the case of the CFA zone. Moreover, variability in the terms of trade as measured by its unanticipated changes (model 3) and the variance of these anticipated changes had a strongly negative impact on reserves, (model 5). Cashin et al (2000) also found that nine of the CFA countries used in this study had half lives to terms of trade shocks that lasted up to six years over the period 1960–1996.[14] Three countries, primarily oil exporters, had terms of trade shocks that were very persistent. Therefore, countries that have low level of reserves and face persistent terms of trade shocks would benefit disproportionately from the pooling arrangement.

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[14] Benin, Mali, and Togo had terms of trade shocks with a half life less than two years, Burkina Faso, Central African Republic, and Niger between two–four years, Senegal between four–six years and Cameroon, Côte d'Ivoire, and Gabon infinity.

V. RESERVE MANAGEMENT

The analysis shows that the member countries of the ECCU have gained significantly from the pooling arrangement. By contrast, most of the countries within the CFA franc zone have experienced losses from reserve pooling arrangements. In a monetary union where it is not possible to monetize fiscal deficits, governments may be inclined to borrow domestically or externally.[15] This section examines the institutional arrangements of the ECCU and the CFA franc zone with a view to discerning whether they have contributed to the promotion of fiscal discipline in these currency areas.

During the 1980s some members of the ECCU borrowed externally to finance capital and developmental programs. This borrowing, was for the most part, concessional with grant elements. During the period 1987 to 1991, the average cost of debt ranged from 2.9 percent to 4.1 percent. In 1987, the cost of debt ranged from 1 percent for Dominica to 10 percent for Antigua and Barbuda. With the exception of Antigua and Barbuda, the cost of debt was below 4 percent for all the ECCU member territories up until 1989. The grant element associated with loans approved for ECCU territories was also highest during the period 1987 to 1992.

Countries, therefore, focused on the accumulation of reserves for future use, while they borrowed at concessional rates to finance developmental projects. It, therefore, constituted prudent reserve management strategy to accumulate reserves and use debt to finance capital and developmental projects because the cost of debt was lower than the return on reserves during the period 1987 to 1991. The LIBOR and the U.S. treasury bill rate are used to indicate the return on reserves as ECCU reserve management policy is to invest in low risk financial instruments. Assuming the cost of managing reserves and the cost of project implementation were zero, data for 1987–1991 show that the return on reserves was greater than the weighted average cost of debt for the ECCU for the period 1987 to 1991 and the spreads between the cost of debt and the return on reserves ranged from 1.36 percent in 1991 to 4.4 percent in 1989.

From 1992 onward (with the exception of 1995), the return on reserves has been less than or equal to the cost of debt. In addition, the cost of debt has increased over the years since some of the countries have been graduated and can no longer access concessional loans. The grant element of the external loans declined substantially from 1991 onward. The average grant element decreased from 52 percent in 1992 to 36 percent in 1997. The level of concessional debt has also declined over the period under consideration. For the period 1988 to1997, concessional debt as a percentage of total debt of the ECCU declined from 98.7 percent in 1988 to 74.7 percent in 1997. Countries, therefore, need to reassess their reserve and debt management strategy in light of the increasing cost of debt, the reduction in grants and foreign aid and the graduation from access to concessional funding. In the reassessment of the reserve management strategy, the ECCU may need to consider strategies that are likely to increase the return on reserves.

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[15] See: David Stasavage. *The CFA Franc Zone and Fiscal Discipline,* Journal of African Economies, Vol 6 (1):132–67, 1997.

For the period 1989 to 1996 the countries within the CFA franc zone benefited from higher returns on reserves than the cost of debt accumulation. Thus, the reserve management policy of these countries focused on the accumulation of debt to finance developmental projects, while they invested their reserves. However, the external debt service payments and the disbursed outstanding debt of these countries became unmanageable during the 1980's and most of these countries benefited from concessional debt rescheduling from Paris Club creditors.[16] It should be noted that concessional rescheduling further reduces the cost of debt accumulation.

Using LIBOR to measure the return on reserves for the CFA franc zone, the data for 1989–96 show that the average return on reserves has been consistently higher than the cost of debt. The return on reserves as measured by the LIBOR was higher than the cost of debt for the periods 1989 to 1991 and 1994 to 1996. This may be due to the fact that the cost of debt has been significantly low throughout the period due to concessional rescheduling.

While the average rate of return as measured by the LIBOR has been the same for the ECCU and the CFA franc zone, the weighted average cost of debt during 1989–96 for countries within the ECCU was 5.5 percent compared to 3.5 percent for the CFA franc zone. In addition, the average return on reserves when measured by the U.S. Treasury Bill and the French Treasury bill rate is much higher for the CFA franc zone (8.1 percent) when compared to the ECCU (5.3 percent). These results are inconsistent with the fact that most CFA franc zone countries have incurred losses from the reserves pooling arrangement. This anomaly may be due to differences in the institutional framework.

Two institutional factors contribute to some members in the CFA franc zone using more resources from the pool than they contribute. First, the French treasury's guarantee of the central banks' operations account relieves them of having to monitor their reserve position and credit creation using the fiscal borrowing and sight liabilities rules. Second, the fact that each country has unrestricted access to the pooled reserves of other members makes governments more inclined to monetize budget deficits. Countries are also less inclined to monitor their balance of payments situation. This feature of the arrangement is one of institutional problems in the formation of clubs that attempts to mitigate the costs of bargaining among members. In essence, it allows for an upper and lower limit within which bargaining in the form of access to the common pool of reserves can occur. Not all countries will have a high level of own reserves and low reserve variability. To avoid the dilemma of persistent use of the common reserve by any country for a long time, a gross reserve target is set for each country based on the balance of payments and other factors such as debt service payments to ensure that its level of own reserves are greater than or equal to 20 percent sight liabilities rule. However, in practice some countries facing persistent shocks never contributed substantially to the pool of reserves.

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[16] Gabon and Congo were the only countries in the CFA franc zone that did not benefit from concessional rescheduling.

By statute, credit to governments is restricted to 20 percent of the stock of advances in the previous year. However, Stasavage (1997) argues that in practice there has been much circumvention of the fiscal borrowing rule. Governments also by applying moral suasion to encourage commercial and development banks to provide financing for specific projects were able to relieve fiscal pressures in many instances. In addition, Stasavage argues that in the case of BCEAO, several states had exceeded their ceiling for direct borrowing.

The sight liabilities rule has also not been closely applied. In the case of the WAEMU, the ratio of gross foreign assets to sight liabilities was below 20 percent for the period 1980 to 1993. Within the CAEMC the ratio fell below 20 percent after 1986. In both instances, the central banks found it difficult to restrict credit and refinancing ceilings to commercial banks.

As noted earlier, the ECCB is required to maintain a minimum foreign exchange cover equivalent to 60 percent of demand liabilities. In practice, the ratio of foreign assets to demand liabilities has never fallen below the statutory limit and has been maintained in excess of 90 percent in recent years. The financing that can be provided to governments and commercial banks is restricted to 40 percent of demand liabilities. However, the ECCB agreement restricts lending to governments to certain percentages of their recurrent revenue depending on the instrument used to create credit.

Two important differences exist between the CFA franc zone and the ECCU area. First, once governments in the ECCU have exhausted their credit allocation they must then seek residual financing from commercial banks and/or nonbanks, that is, they cannot draw on the undisbursed pools of other members. Second, the global amount of credit allocated in any one year has never been taken up in full, though on occasions individual governments have utilized the full amount of their respective limits. In the CFA franc zone, global credit has often been exhausted and thus, the French treasury has had to augment the operations account of the individual central banks.

The absence of an external guarantor forces the ECCB to adhere to the foreign asset rule and maintain high levels of foreign reserves in order to maintain currency credibility. The absence of an external guarantor has also induced the ECCB to adopt prudent reserve management techniques in order to maintain currency credibility.

Within the ECCU it is likely that some countries with fiscal imbalances will seek external financing, as they cannot draw down on the allocated pools of other member countries. Fiscal adjustment therefore becomes especially important in an environment where the cost of debt is increasing, and grants and concessional lending are declining.

Since 1997, both the CAEMC and the WAEMU have put a number of measures in place to achieve greater concordance between monetary and fiscal policy with a view to strengthen the effectiveness and credibility of their economic policies. Policies included macroeconomic policy convergence, regional integration through a common external tariff and a deepening of financial markets.

VI. CONCLUSIONS

This paper addresses four issues: (1) the gains from pooling of reserves in the ECCU and CFA; (2) the level of reserves member of these monetary unions would have to hold independently; (3) the role of institutional arrangements in reserve management; and (4) the impact of unanticipated components of the terms of trade on reserves.

Member countries of the ECCU benefited significantly from the monetary union. CFA franc zone countries enjoy much lower coverage than ECCU member states for the period under consideration. However, for both areas, countries with low levels of own reserves and high reserve variability benefit most from the reserves pooling exercise.

The higher coverage enjoyed by ECCU member countries is the combined outcome of institutional design, absence of an external guarantor and stronger reserve management. The ECCU area must, however, reassess their reserve management strategy, as the opportunity cost of holding reserves is increasing. An evaluation of the likely impact of a change in portfolio mix on the return on reserves should be made in order to inform any changes in the management of reserves.

Both monetary unions had a comparable speed of adjustment between actual and desired reserves. The CFA zone had a larger long run propensity to import relative to the ECCU. Unanticipated changes in the terms of trade had a strongly negative impact on reserves in the CFA zone.

The performance of the CFA franc zone will improve if credit creation is monitored more closely as stated in new initiatives designed to strengthen the adherence to fiscal rules—in particular closer monitoring of the sight liabilities and the fiscal borrowing rules. Second, access to the pooled reserves of other countries should be restricted in order to promote fiscal discipline among countries. Third, the CFA franc zone may need to re-assess the enforcement of its current institutional framework with a view to improving governance mechanisms and adherence to rules on credit ceilings. The deterioration in the terms of trade was not corrected for with an appropriate the degree of fiscal adjustment. Both the WAEMU and CAEMC have taken bold initiatives since 1997 to strengthen the concordance between monetary and fiscal policy with a view to fostering macroeconomic coordination, regional integration and policy credibility to support the common monetary arrangement.

An issue raised by this study but which warrants further analysis is the design of membership rules in monetary unions that constrain the degree of fiscal imprudence of members who contribute least to the pooling arrangement. Another is the role of central bank independence and decision making in multi-state arrangements.

Table 1. Reserves Variability ECCU Monetary Authority 1980–1997

Country	Mean Reserves	Standard Deviation	Coefficient of Variation Reserves	Coefficient of Variation Terms of Trade
Antigua and Barbuda	79.86	44.19	0.55	0.18
Anguilla	26.65	10.44	0.39	n.a.
Dominica	35.37	20.35	0.58	0.07
Grenada	59.58	25.16	0.42	0.15
Montserrat	19.51	5.40	0.28	n.a.
St. Kitts and Nevis	47.69	30.79	0.65	0.14
St. Lucia	95.80	58.60	0.61	0.14
St. Vincent and the Grenadines	58.30	26.98	0.46	0.21

Table 2. Reserves Variability WAEMU and CAEMC Monetary Authority 1980–1997[1]

	Mean Reserves	Standard Deviation	Coefficient of Variation Reserves	Coefficient of Variation Terms of Trade
WAMU				
Benin	15.14	47.23	3.12	0.21
Burkina Faso	67.02	41.04	0.61	0.16
Côte d'Ivoire	-294.51	203.00	-0.69	0.18
Mali	29.55	69.42	2.35	0.10
Niger	19.35	12.73	0.66	0.26
Senegal	-152.96	58.50	-0.38	0.09
Togo	41.60	27.04	0.65	0.21
CAMU				
Cameroon	-109.21	134.17	-1.23	0.32
Central African Republic	29.49	37.62	1.28	0.33
Chad	16.40	17.88	1.09	0.28
Gabon	23.98	49.30	2.06	0.16

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 3. Coverage Ratios ECCU Monetary Authority 1980–1997

	Pool (in percent)					
	None	20	50	65	70	100
Antigua and Barbuda	1.81	2.84	3.91	4.31	4.43	16.18
Anguilla	2.55	5.74	7.38	7.79	7.90	16.18
Dominica	1.74	3.98	5.67	6.19	6.34	16.18
Grenada	2.37	3.99	5.34	5.77	5.90	16.18
Montserrat	3.61	7.47	8.70	8.96	9.02	16.18
St. Kitts and Nevis	1.55	3.16	4.63	5.13	5.27	16.18
St. Lucia	1.63	2.42	3.30	3.64	3.75	16.18
St. Vincent and the Grenadines	2.16	3.29	4.27	4.59	4.68	16.18

Table 4. Coverage Ratios ECCU Monetary Authority 1980–1989

	Pool (in percent)					
	None	20	50	65	70	100
Antigua and Barbuda	1.96	3.17	4.57	5.15	5.32	17.15
Dominica	1.48	3.82	6.17	7.03	7.28	17.15
Grenada	3.97	6.02	7.90	8.54	8.72	17.15
Montserrat	4.04	9.03	11.71	12.41	12.59	17.15
St. Kitts and Nevis	2.30	5.18	7.73	8.58	8.83	17.15
St. Lucia	1.52	2.48	3.66	4.16	4.32	17.15
St. Vincent and the Grenadines	1.89	3.38	5.04	5.70	5.90	17.15

Table 5. Coverage Ratios ECCU Monetary Authority 1990–1997

	Pool (in percent)					
	None	20	50	65	70	100
Antigua and Barbuda	1.27	3.22	5.44	4.62	4.72	14.42
Anguilla	0.73	6.28	13.79	7.96	8.04	14.42
Dominica	1.35	5.18	10.44	6.95	7.05	14.42
Grenada	2.20	3.72	6.95	5.47	5.59	14.42
Montserrat	0.79	7.78	17.53	8.79	8.84	14.42
St. Kitts and Nevis	0.77	3.96	7.48	5.73	5.85	14.42
St. Lucia	1.78	3.16	4.98	4.31	4.40	14.42
St. Vincent and the Grenadines	9.27	7.72	13.28	7.06	7.03	14.42

Table 6. Coverage Ratios WAEMU and CAEMC Monetary Authority 1980–1997[1]

	Pool (in percent)					
	None	20	50	65	70	100
WAEMU						
Benin	0.32	0.58	1.14	1.29	1.33	2.06
Burkina Faso	1.63	0.02	0.96	1.21	1.28	2.06
Côte d'Ivoire	1.45	1.26	1.06	0.97	0.95	2.06
Mali	0.43	0.33	0.90	1.08	1.13	2.06
Niger	1.52	1.00	1.61	1.73	1.76	2.06
Senegal	2.61	2.08	1.71	1.60	1.57	2.06
Togo	1.54	0.40	1.24	1.44	1.49	2.06
CAEMC						
Cameroon	0.81	0.65	0.44	0.36	0.33	0.59
Central African Republic	0.78	0.31	0.07	0.19	0.22	0.59
Chad	0.92	0.17	0.22	0.32	0.35	0.59
Gabon	0.50	0.19	0.10	0.19	0.22	0.59

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 7. Coverage Ratios WAEMU and CAEMC Monetary Authority 1980–1989[1]

	Pool (in percent)					
	None	20	50	65	70	100
WAEMU						
Benin	1.36	2.68	3.12	3.21	3.24	3.53
Burkina Faso	1.50	1.12	2.36	2.67	2.75	3.53
Côte d'Ivoire	3.24	2.80	2.36	2.20	2.15	3.53
Mali	1.06	2.47	2.99	3.11	3.14	3.53
Niger	1.32	2.01	2.96	3.15	3.20	3.53
Senegal	3.71	3.74	3.76	3.77	3.77	3.53
Togo	2.18	1.00	2.38	2.71	2.80	3.53
CAEMC						
Cameroon	0.16	1.26	2.04	2.27	2.34	3.53
Central African Republic	0.92	2.72	3.33	3.44	3.47	3.53
Chad	0.69	2.55	3.23	3.36	3.39	3.53
Gabon	0.55	0.73	1.72	2.02	2.10	3.53

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 8. Coverage Ratios WAEMU and CAEMC Monetary Authority 1990–1997[1]

	Pool (in percent)					
	None	20	50	65	70	100
WAEMU						
Benin	2.23	0.34	0.58	0.81	0.87	1.33
Burkina Faso	3.75	0.99	0.34	0.67	0.76	1.33
Côte d'Ivoire	0.81	0.70	0.58	0.52	0.51	1.33
Mali	1.56	0.50	0.30	0.54	0.61	1.33
Niger	1.73	0.41	0.99	1.11	1.14	1.33
Senegal	2.06	1.88	1.74	1.70	1.68	1.33
Togo	1.06	0.14	0.75	0.90	0.94	1.33
CAEMC						
Cameroon	2.73	2.02	1.38	1.16	1.10	1.33
Central African Republic	1.42	0.23	0.52	0.72	0.78	1.33
Chad	1.56	0.21	0.86	1.01	1.05	1.33
Gabon	0.72	0.29	0.80	0.93	0.96	1.33

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 9. Hypothetical Reserves ECCU Monetary Authority 1980–1997

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
Antigua and Barbuda	125.66	172.94	190.51	195.71	714.96	79.86	45.80	57.35
Anguilla	59.90	76.99	81.31	82.45	168.88	26.65	33.25	124.74
Dominica	80.97	115.44	125.97	128.90	329.17	35.37	45.60	128.93
Grenada	100.29	134.29	145.30	148.42	407.09	59.58	40.71	68.32
Monsterrat	40.33	46.97	48.38	48.74	87.38	19.51	20.83	106.76
St. Kitts and Nevis	97.37	142.52	157.93	162.37	498.11	47.69	49.68	104.18
St. Lucia	141.81	193.24	213.48	219.60	948.04	95.80	46.00	48.02
St. Vincent and the Grenadines	88.83	115.12	123.80	126.27	436.42	58.30	30.54	52.38

Table 10. Hypothetical Reserves ECCU Monetary Authority 1980–1989

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
Antigua and Barbuda	78.49	113.30	127.44	131.77	424.87	48.67	29.83	61.29
Dominica	54.62	88.24	100.49	104.09	245.27	21.13	33.49	158.51
Grenada	66.72	87.49	94.62	96.67	190.08	44.04	22.69	51.52
Montserrat	35.83	46.50	49.26	49.99	68.11	16.05	19.78	123.26
St. Kitts and Nevis	52.48	78.29	86.94	89.42	173.78	23.26	29.22	125.64
St. Lucia	81.45	120.38	136.90	142.04	563.95	49.92	31.53	63.17
St. Vincent and the Grenadines	70.63	105.45	119.18	123.33	358.81	39.57	31.06	78.49

Table 11. Hypothetical Reserves ECCU Monetary Authority 1990–1997

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
Antigua and Barbuda	162.15	274.09	232.58	237.92	726.22	139.29	22.86	16.41
Anguilla	62.64	137.65	79.39	80.19	143.90	49.04	13.60	27.74
Dominica	92.85	187.24	124.66	126.45	258.56	63.25	29.60	46.79
Grenada	128.03	239.02	188.20	192.31	496.00	71.74	56.29	78.46
Monsterrat	40.70	91.67	45.98	46.20	75.39	36.77	3.93	10.69
St. Kitts and Nevis	122.52	231.21	177.25	180.87	445.91	118.24	4.28	3.62
St. Lucia	187.20	294.68	254.91	260.26	853.48	160.13	27.07	16.91
St. Vincent and the Grenadines	68.05	117.04	62.20	61.94	127.10	81.70	-13.65	-16.71

Table 12. Hypothetical Reserves WAEMU and CAEMC Monetary Authority 1980–1997[1]

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
WAEMU								
Benin	35.33	71.59	82.36	85.34	134.07	15.14	20.19	133.38
Burkina Faso	6.14	54.85	68.76	72.55	116.48	67.02	-60.88	-90.84
Côte d'Ivoire	270.99	242.83	231.17	227.57	576.18	-294.51	565.50	-192.01
Mali	30.24	81.76	98.77	103.62	197.05	29.55	0.69	2.33
Niger	18.10	29.26	31.59	32.18	36.13	19.35	-1.25	-6.46
Senegal	159.66	165.01	166.70	167.18	166.04	-152.96	312.62	-204.38
Togo	16.78	46.97	54.62	56.64	76.74	41.60	-24.82	-59.66
CAEMC								
Cameroon	130.23	153.04	161.82	164.45	380.82	-109.21	239.44	-219.26
Central African Republic	25.37	60.15	69.83	72.45	106.79	29.49	-4.11	-13.95
Chad	23.12	38.42	41.89	42.78	50.75	16.40	6.73	41.02
Gabon	30.80	71.02	83.12	86.47	139.94	23.98	6.82	28.42

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 13. Hypothetical Reserves WAEMU and CAEMC Monetary Authority 1980–1989[1]

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
WAEMU								
Benin	42.68	49.61	51.10	51.48	56.23	-21.62	64.30	-297.44
Burkina Faso	29.37	61.87	69.82	71.90	92.48	39.26	-9.90	-25.21
Côte d'Ivoire	309.05	260.72	243.25	238.12	390.61	-357.80	666.85	-186.38
Mali	46.02	55.75	57.92	58.48	65.82	-19.80	65.82	-332.47
Niger	26.61	39.13	41.72	42.37	46.76	17.51	9.11	52.02
Senegal	178.21	179.19	179.47	179.55	168.45	-176.77	354.98	-200.81
Togo	23.21	55.19	62.76	64.72	81.79	50.35	-27.15	-53.91
CEMAC								
Cameroon	63.98	103.68	115.40	118.62	179.34	-7.93	71.90	-907.27
Central African Republic	19.34	23.67	24.47	24.66	25.15	6.58	12.76	194.08
Chad	23.27	29.42	30.60	30.89	32.21	6.32	16.95	268.07
Gabon	43.44	101.88	119.90	124.92	209.78	32.75	10.69	32.64

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 14. Hypothetical Reserves WAEMU and CAEMC Monetary Authority 1990–1997[1]

| | Pool (in percent) | | | | | Mean | | |
	20	50	65	70	100	Reserves	Difference	Percent Gain/Loss
WAEMU								
Benin	9.23	15.99	22.22	23.86	36.54	61.09	-51.86	-84.89
Burkina Faso	26.81	9.34	18.25	20.58	36.15	101.71	-74.89	-73.63
Côte d'Ivoire	188.20	154.57	140.29	135.84	356.76	-215.40	403.60	-187.37
Mali	29.53	17.35	31.72	35.72	78.17	91.23	-61.70	-67.63
Niger	5.18	12.44	13.92	14.29	16.74	21.66	-16.48	-76.07
Senegal	112.22	103.81	101.22	100.50	79.68	-123.18	235.40	-191.10
Togo	4.15	21.74	26.15	27.32	38.68	30.66	-26.51	-86.47
CEMAC								
Cameroon	174.41	118.99	100.16	94.74	115.04	-235.81	410.21	-173.96
Central African Republic	9.35	21.25	29.73	32.03	54.77	58.13	-48.78	-83.91
Chad	3.92	16.02	18.72	19.41	24.73	28.99	-25.07	-86.47
Gabon	8.45	23.59	27.41	28.42	39.33	21.18	-12.73	-60.10

1/ Congo and Equatorial Guinea excluded from CAEMC due to gaps in data.

Table 15. Demand for Reserves ECCU and CFA Franc Zone

	ECCU Instrumental Variable Estimation					CFA Instrumental Variable Estimation				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Constant	-1.16 (-2.78)	-1.17 (-2.83)	-1.16 (-2.87)	-1.16 (-2.77)	-1.12 (-2.19)	-0.84 (-2.01)	-0.83 (-1.99)	-0.74 (-1.39)	-0.82 (-1.97)	-0.79 (-1.51)
AVPIMP	-0.33 (-2.84)	-0.34 (-2.93)	-0.37 (-3.0)	-0.34 (-2.94)	-0.34 (-2.87)	0.31 (1.90)	0.34 (1.8)	0.59 (1.92)	0.24 (0.9)	0.46 (1.85)
PCAPGDP	0.002 (0.04)	0.003 (0.06)	0.001 (0.03)	0.001 (0.03)	0.001 (0.01)	-0.03 (-0.48)	-0.04 (-0.45)	-0.03 (-0.45)	-0.03 (-0.46)	-0.04 (-0.69)
RES(t-1)	0.56 (4.62)	0.56 (4.60)	0.56 (4.6)	0.56 (4.6)	0.57 (4.4)	0.56 (5.1)	0.56 (5.1)	0.50 (3.6)	0.56 (5.1)	0.43 (2.9)
DLTOT	-	0.07 (0.38)	-	-	-	-	-0.33 (-5.38)	-	0.39 (4.5)	-
DUMMY			-	-	-	-0.16 (-0.45)	-0.15 (-0.40)	-0.09 (-0.27)	-0.18 (-0.6)	-0.11 (-0.36)
SPRD$_{t-1}$						-0.18 (-0.05)	-0.06 (-0.01)	-0.06 (-0.01)	-0.06 (-0.01)	-1.5 (-0.31)
TOTVAR1		0.24 (0.62)	-	-		-	-	-	-	-
TOTVAR2		-	0.07 (0.16)	-		-	-	-0.43 (-2.17)	-	-
SHIFT				-					-0.76 (-5.2)	-
TOTVAR3				-0.27 (-0.11)						
TOTVAR4										-0.27 (-3.88)
Adj. R^2	0.45	0.36	0.36	0.36	0.36	0.45	0.41	0.24	0.50	0.24
No. of obs.	101	101	101	101	101	187	187	187	187	187
S.E. of Regression	0.28	0.28	0.28	0.28	0.28	0.88	0.92	1.04	0.84	1.04

Note: t-statistics in parentheses. AVPIMP is the ratio of imports to GDP in logs. PCAPGDP is per capita GDP in logs and RES(-1) is lagged reserves to GDP in logs. DUMMY represents the 1994 devaluation of the CFA franc. DLTOT is defined as the growth rate in the terms of trade. SPRD$_{t-1}$ denotes the spread between French treasury bill and the CFA franc zone discount rate. TOTVAR1 is defined as the residuals from a regression of log terms of trade on constant and trend for each country. TOTVAR2 is defined as the residuals from a regression of log terms of trade on a constant and lagged log terms of trade. SHIFT is defined as the product of a dummy variable and the growth rate of the terms of trade (DLTOT). The dummy variable assumes a value of 1 for all positive values in growth rate of the terms of trade, zero elsewhere. TOTVAR3 is the variance of TOTVAR1 and TOTVAR4 is the variance of TOTVAR2.

Trade-Off Between Reserves and Risk

Identical preferences among members is assumed in this two country case so that each country holds reserves Rab and faces a risk factor Wab. Summing vertically over reserves held yields a composite trade-off curve T_2 which can be compared with the possibilities available under a pooling system T_3. MN represents the savings in terms of reserves from the pooling arrangement while MP a decrease in the risk factor (Figure 1). The substitution effect is thought to outweigh the income effect favoring a lower level of risk, hence MN will tend to overstate actual savings in reserves and understate the true benefits of the pooling arrangement at M^*.

Figure 1. Trade-off Curves Between Reserves and Risk Factor.
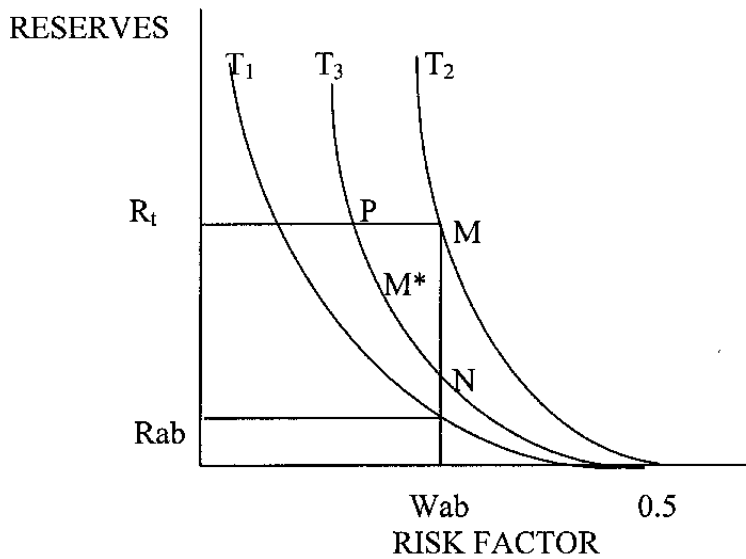
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