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# COLLECTIVE PEGGING TO A SINGLE CURRENCY: THE WEST AFRICAN MONETARY UNION

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# Collective Pegging to a Single Currency: The West African Monetary Union

## ABSTRACT

The paper presents a model of a monetary union designed to illuminate monetary and exchange rate policy in the West African Monetary Union (UMOA). Emphasis is placed on the interaction of the members of UMOA with each other, through the common central bank, and on their interaction with France and the rest of the world. As a consequence, the structure of the national economies depends essentially on their size. The relative size of the partners is reflected in the source and type of disturbances as well as in the trade pattern: large countries are not affected by disturbances originating in small countries. Small countries are affected by all external disturbances. The collective nature of the pegging becomes important because the small countries are taken to be of equal size.

Using a four-country, two-tier macroeconomic model, it is shown that the pseudo-exchange rate union with the large partner has no effect on the real exchange rates of the small countries but affect their price levels, whereas a full monetary union requires in principle a transfer whose allocation between the two small countries by their common central bank may have real effects. This transfer is precisely provided by the large country, as guarantor of the fixed exchange rate arrangement. When both small countries are in surplus, there is a reverse transfer to the large country, with no monetary consequences. In line with the findings of the model, evidence is provided on monetary allocations in UMOA and on the real exchange rates of its major members, as compared to other African countries.

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## Introduction

In the present international monetary system, there is a large number of countries who peg their exchange rates in some way, and a fair number of small countries who peg to a single currency. Few countries, however are members of exchange-rate unions whereby exchange rates are collectively pegged to a single currency.

Even fewer countries establish a full monetary union, with an union-wide central bank. In fact, until the transformation of the East Caribbean Currency Authority into a central bank in October 1983, the closest example was provided by the West African Monetary Union (known by its French acronym UMOA), whose members have agreed to fix their bilateral exchange rates against the French franc.

Perhaps paradoxically, there exists a considerable analytic literature on monetary unions. It emerged during the sixties, in connection with the celebrated controversy about the relative desirability of fixed and flexible exchange rates, and was revived with the creation of the European Monetary System in 1979.[1]

There is a general agreement that the key factors on which the impact of a union depends are, first, the sources and types of economic disturbances giving rise to exchange rate fluctuations, second, the trade patterns of the country joining the union, and, third, wage and price behavior at home and abroad. As Marston (1984) states, the conditions under which a fixed exchange rate regime is superior to floating according to some social welfare criterion involve a complicated weighting of these key factors, making generalizations difficult.

The present paper presents a model of a monetary union designed to illuminate monetary and exchange rate policy in the West African Monetary Union. Emphasis is placed on the interaction of the members of UMOA with each other, through the common central bank, and on their interaction with France and the rest of the world. As a consequence, the structure of the national economies is highly stylized. Indeed, size is the major structural characteristic of a country.

The relative size of the partners is of course reflected in the source and type of disturbances as well as in the trade pattern. While the model can also account for real and nominal wage rigidities, the focus is on the first two key factors mentioned earlier. In the model, therefore, large countries (such as France) are not affected by disturbances originating in small countries but small countries (such as the members of UMOA) are affected by large countries' domestic disturbances. The collective nature of the pegging becomes important because the small countries are taken to be of equal size.

The paper is divided into two parts. A four-country macroeconomic model is presented in part A. The set-up is such that one of two large countries establishes what Corden (1972) would call a pseudo-exchange rate union with two small countries, which in turn form a full monetary union, with their own central bank. The effect on monetary and real disturbances originating inside and outside the union is analyzed.

It is shown that the pseudo-exchange rate union with the large partner has no effect on the real exchange rates of the small countries but affect their price levels, whereas a full monetary union requires in principle a transfer whose allocation between the two small countries may have real effects. This transfer is precisely provided by the large

country, as guarantor of the fixed exchange rate arrangement. Due to size, the converse is not true. When both small countries are in surplus, there is a reverse transfer to the large country, with no monetary consequences.

Part B characterizes the West African Monetary Union, in line with the findings of the model. Evidence is provided on monetary allocations within the union and on the real exchange rates of its members, as compared to other African countries.

## A. Collective pegging to a single currency

### I. A two-tier, four country model

The model consists of standard aggregate demand and aggregate supply relationships, with trade and capital movements linking national economies.[2] Account is taken of the unequal size of the potential partners by modelling two pairs of identical economies, large and small. These are two identical large economies whose bilateral exchange rate floats freely and two identical small economies who decide on whether they will float or fix their exchange rate with one of the large countries. In so doing, they also allow the union-wide central bank to decide on monetary allocations.

Due to the difference in size between the partners in the union, only the distribution of money between the two small countries is endogenously determined. Even there, it can be modified by the allocation of a monetary transfer from the large partner. There is a pseudo-exchange rate union between one of the large countries and the two

small countries but full monetary integration between the two small countries.

Each national economy is highly stylized, and the focus of the model is on the interaction of the members of the monetary union, two small countries labelled country one (viz. Senegal) and country two (viz. Ivory Coast), who take as given the member of the pseudo-exchange rate union, labelled country star (viz. France) and the country outside the union, labelled country double-star (viz. the United States). The model is therefore recursive.

When the French franc devalued against the dollar under the Bretton-Woods system (1958 and 1969 during the sample period) it also devalued against most of the European currencies, and the same holds for the Smithsonian revaluation of 1971. Similarly, there were several recent devaluations of the French franc against the Ecu. These are ignored in the theoretical analysis. For simplicity, we refer to France rather than the EMS as country star.

A more accurate procedure would be to specify a three - (rather than two -) tier structure. If the two large countries are the U.S. and Germany (as a proxy for the EMS), and France is treated as a small country, the recursiveness of the model is preserved. The structure of the monetary union between two (very) small countries would allow them to trade with France and the two large countries, or at least one of them (the U.S.), but not with each other. This would again preserve the recursiveness of the model but there would be two exogenous exchange rates, the franc-dollar rate and the franc-Ecu rate shocking the (very) small economies. In order to illustrate the interaction between France

and the West African Monetary Union, though, a three-tier structure would be too cumbersome.

The four national economies are described by conventional aggregate relationships. Demand for domestic output (the IS curve) is a function of foreign outputs, relative prices or the real exchange rate, and the real interest rate and it can also be changed by an exogenous demand disturbance. Demand for real balances (the LM curve) is a function of domestic output and the nominal interest rate, as a measure of the return differential. By eliminating the nominal interest rate, we obtain an aggregate demand curve which relates domestic output to the real exchange rate, to foreign output and to the exogenous demand and monetary disturbances. A real depreciation increases the demand for domestic output along conventional foreign trade multiplier lines.

The supply of domestic output is derived from labor market equilibrium, where the supply of labor by workers responds to the wage deflated by a consumer price index and the demand for labor by firms responds to the wage deflated by price of the domestic good. Eliminating the nominal wage, we obtain an aggregate supply curve relating domestic output to the real exchange rate and an exogenous supply disturbance, which can be interpreted as an increase in the productivity of labor. A real depreciation lowers the supply of domestic output because it raises the product wage. Prices change as a proportion of the difference between demand and supply, so that a Philipps curve allowing for real wage rigidity is featured.

The model is closed by the assumption that domestic and foreign assets are perfect substitutes, so that interest rates are equalized in the stationary state. This determines recursively the real exchange rate

and the price of domestic output, in terms of the exogenous real and monetary disturbances respectively. Then, under flexible exchange rates, the nominal exchange rate is given by monetary disturbances, whereas, under fixed rates, the nominal money stock is determined endogenously.

Size does not affect the interest-rate elasticities of money demand and aggregate demand, which are common to all four countries, and the other parameters are identical between the pairs of large and small countries. In particular the two small countries' steady-state money stocks are the same. These assumptions could be somewhat relaxed but an analytical solution does require a strong symmetry between economic structures.[3]

The assumptions of labor market equilibrium and of perfect substitutability between domestic and foreign assets are particularly strong. Nevertheless, the case of an infinitely elastic supply of labor has often been used in the context of developing countries. The exchange rate union, on the other hand, does rule out some special risks attached to small countries' assets, making the perfect substitutability assumption slightly more palatable but the comparison with a perfectly flexible exchange rate regime less appropriate.

The model is used to assess the effect of fixing the bilateral exchange rates of the two small countries with one of the large countries. Under price flexibility, the exchange rate regime has no effect on the real exchange rate, since the effect on the nominal exchange rate and the price level offset each other. Nevertheless, a monetary union between one of the large countries and the two small countries may require a transfer from the large partner to offset internal and external disturbances. To that extent, the union allows the small countries'

central bank to enforce an asymmetric monetary allocation rule. Then prices will not be adjusted to the nominal exchange rate and the real exchange rate will also have to change as a consequence of the price rigidity.

## II. Flexible exchange rates

### 1. The two large economies

Assuming perfect foresight about prices and exchange rates, the model of the two large economies consists of the following set of equations:

$$y^* = \nu y^{**} + a\theta^* - b(i^* - \dot{p}_c^*) + u_A^*$$

(1) IS equations

$$y^{**} = \nu y^* - a\theta^* - b(i^{**} - \dot{p}_c^{**}) + u_A^{**}$$

(2) $\theta^* = e + p^{**} - p^*$ real exchange rate

(3) $p_c^* = p^* + \beta\theta^*$ consumer price indexes

(4) $p_c^{**} = p^{**} - \beta\theta^*$

$$u_m^* - p^* = y^* - ci^*$$

(5) LM equations

$$u_m^{**} - p^{**} = y^{**} - ci^{**}$$

(6) $\dot{p}^* = \gamma[y^* + k\beta\theta^* - u_\pi^*]$

Price adjustment rules

$$\dot{p}^{**} = \gamma[y^{**} - k\beta\theta^* - u_\pi^{**}]$$

(7) $i^* = i^{**} + \dot{e}$ interest parity

where $y^j$ is the real output of country j j=*,**

$p^j$ is the price of the output of country j

e is the price of the double starred currency in units of the starred currency

$i^j$ is the nominal interest rate in country j

$u_A^j$ is a demand disturbance in country j

$u_\pi^j$ is a supply disturbance in country j

$u_m^j$ is a monetary disturbance in country j

$\nu$ is the (common) foreign output multiplier

a is a (common) term involving trade elasticities divided by the multiplier

b is the (common)real interest semi-elasticity of aggregate demand

c is the (common)interest semi-elasticity of money demand

$\beta$ is the (common)share of foreign goods in the consumer price indexes

$\gamma$ is the (common)speed of adjustment of domestic prices

and k is the (common) real exchange rate elasticity of aggregate supply

We concentrate here on the stationary state solution of the model.[4] The real exchange rate is obtained from the difference in the cyclical positions of the two countries whereas the interest rate is obtained by their sum. In other words, relative disturbances are channeled through the exchange rate and global disturbances through the interest rate:

$$\theta^* = -\frac{u_*^d}{H_*} \tag{8}$$

$$(9) \qquad i^{*} = i^{**} = \frac{u^{s}_{*}}{b}$$

where $H_{*} = a + k\beta(1 + \nu)$

$u^{d}_{*} = {}^{*}u^{d}_{A} - (1 + \nu){}^{*}u^{d}_{\pi}$ is a composite relative real disturbance

$u^{s}_{*} = {}^{*}u^{s}_{A} - (1 - \nu){}^{*}u^{s}_{\pi}$ is a composite global real disturbance

$$ {}^{*}u^{d}_{i} = \frac{u^{*}_{i} - u^{**}_{i}}{2} \qquad i = A, \pi$$

and $$ {}^{*}u^{s}_{i} = \frac{u^{*}_{i} + u^{**}_{i}}{2}$$

Note that, given $\theta^{*}$, we obtain $y^{*}$ and $y^{**}$ by equating to zero the right-hand side of (6) and we get the price of domestic output from (5):

$$(10) \qquad p^{**} = -y^{**} + \frac{1}{\phi} u^{s}_{*} + u^{**}_{m} = -k\beta\theta^{*} - u^{**}_{\pi} + \frac{1}{\phi} u^{s}_{*} + u^{**}_{m}$$

where $\phi = b/c$

Given prices and the real exchange rate, the nominal exchange rate is also determined:

$$(11) \qquad e = (1 + 2k\beta)\theta^{*} + 2{}^{*}u^{d}_{m} - 2{}^{*}u^{d}_{\pi}$$

where $$ {}^{*}u^{d}_{m} = \frac{u^{*}_{m} - u^{**}_{m}}{2}$$

Let us now consider the effect of the disturbances in turn. Monetary disturbances have no effect on the real exchange rate and offsetting one-to-one effects on the nominal exchange rate and on the own price

level. An increase in the demand for the good of the starred country, $u^*_A > 0$, appreciates the real exchange rate by $\frac{1}{2}H_*$. The size of this multiplier is smaller the larger the demand elasticities, a and $\nu$, and the larger the supply elasticity k weighted by the share of traded goods in the price index, $\beta$.

Note that, according to (11), the effect of a change in the real exchange rate on the nominal exchange rate is augmented by $2k\beta$ because of the effect of aggregate demand expansion in country star in raising prices in country double star. The real appreciation of the domestic currency is always less than the nominal appreciation.

Looking at demand expansion in country double star, it increases the price level there by one half of $(1/\phi) - (k\beta/H_*)$ so that the nominal exchange rate depreciates by more, with the factor given by the effect of real on nominal exchange rate change, $1 + 2k\beta$. The effect of supply or productivity disturbances is also stronger on the nominal exchange rate, the difference being proportional to the trade elasticities.

Equally distributed demand, supply or monetary disturbances (such that $*u^d_i = 0$) leave the exchange rates unchanged ($\theta^* = e = 0$). The size of the effect on the price level of the supply shock differs from the one of the demand shock, by a factor of $1 + \phi - \nu$:

$$(12) \qquad p^{**} = \frac{1}{\phi}\left[\bar{u}_A - (1 + \phi - \nu)\,\bar{u}_\pi\right] + \bar{u}_m$$

where $\bar{u}_i = u^*_i = u^{**}_i \quad i = A, \pi, m.$

Negatively correlated real disturbances (such that $*u^d_i = u^*_i$) leave interest rates unchanged ($i = i^* = 0$). They have no effect on the price level when there are no supply effects ($k = u^i_\pi = 0$):

$$(13) \qquad p^{**} = \frac{1}{H_*}[k\beta\, u_A^* - a\, u_\pi^*] + u_m^{**}$$

where $u_i^* = - u_i^{**} \quad i = A, \pi$

We can thus simplify the structure of the large economies by ruling out supply effects. If, in addition, their monetary policies are perfectly correlated ($u_m^d = 0$) and there are only relative demand disturbances ($u_A^s = 0$), the nominal and real exchange rates are the same and they will be the only channel of external disturbances to the small countries. The solution in this "superkeynesian" case is simply:

$$(14) \qquad e = - \frac{u_A^*}{a}$$

## 2. The two small economies

The model of the small economies consists of the same relationships as the large economies. Care is taken, though, to distinguish trade with the two foreign countries, one of which, the starred one, will turn out to be a partner in the exchange rate union. We present the model of what we will call the domestic economy in log-linear form, expressed again as deviation from steady-state (the Appendix contains the derivation). It will be easy to modify it when we consider the other (identical) small country, which will be the partner in the monetary union.

$$(15) \qquad y = (a^*+a^{**})\theta - a^*\theta^* + \nu^* y^* + \nu^{**} y^{**} - b(i - \dot{p}_c) \qquad \text{IS equation}$$

$$(16) \qquad \theta = e^{**} + p^{**} - p \qquad \text{real exchange rate}$$

$$(17) \qquad p_c = p + (1 - \alpha)\theta - \alpha_* \theta^* \qquad \text{consumer price index}$$

(18) $u_m - p = y - ci$ LM equation

(19) $\dot{p} = \gamma[y - h\alpha_* \theta^* + h(1 - \alpha)\theta - u_\pi]$ price adjustment rule

(20) $i = i^* + \dot{e}^*$ interest parity

(21) $e^* = e^{**} - e$ triangular arbitrage

Concentrating again on a particular solution to the model (with $\dot{p}_c = \dot{p} = \dot{e}^* = 0$), we solve for the real exchange rate $\theta$ as a function of the foreign real exchange rate $\theta^*$ and the common interest rate $i^*$, supply disturbances in the two large countries and domestic disturbances:

(22) $$H\theta = [\tilde{a}^* + (\nu^* - \nu^{**})k\beta]\theta^* + bi^* + \nu^* u_\pi^* + \nu^{**} u_\pi^{**} - u_A + u_\pi$$

where $\tilde{a}^j = a^j + h\alpha_j \qquad j = *, **$

and $H = \tilde{a}^* + \tilde{a}^{**}$

The role of trade patterns is apparent. Indeed, when trade multipliers are the same ($\nu^* = \nu^{**} = \nu/2$), (22) simplifies to:

(23) $$H\theta = \tilde{a}^*\theta^* + {}^*u_A^s - {}^*u_\pi^s - u_A + u_\pi$$

Even in this special case, global disturbances abroad affect the small countries' real exchange rate unless they are the same as domestic disturbances ($u_i = u_i^* = u_i^{**}$, $i = A, \pi$).

Using the right-hand-side of (19) into (18), we get an expression for the price of domestic output in the same form as (10) above:

$$(24) \qquad p = h[(1 - \alpha)\theta - \alpha_* \theta^*] + \frac{u^s_*}{\phi} - u_\pi + u_m$$

Substituting for $\theta$, we get in the strongly symmetric case of equation (23):

$$(25) \qquad p = \frac{hA^*}{H}\, \theta^* + \frac{u^s_*}{\phi} + \chi(^*u^s_A - {}^*u^s_\pi) - \chi u_A - (1 - \chi)\, u_\pi + u_m$$

where $A^* = a^*\alpha_{**} - a^{**}\alpha_*$

and $\chi = h(1 - \alpha)/H$

If there is no difference between the relative shares of foreign output in the domestic price index and the relative trade elasticities, then $A^* = 0$. This is the case, emphasized by Marston (1984), of "balanced" sensitivities. Then, with equal real disturbances at home and abroad, the effect of a supply shock differs from the effect of a demand shock by the same factor $1 + \phi - \nu$ as in (12) above.

When foreign real disturbances are perfectly negatively correlated and $A^* = 0$, the price of domestic output is a function of domestic disturbances alone and output is given by a $\chi$-weighted average of demand and supply disturbances:

$$(26) \qquad y = \chi u_A + (1 - \chi)\, u_\pi$$

Similarly, the real exchange rate can be written as:

$$(27) \qquad \theta = \zeta\theta^* - \frac{1}{H}(u_A - u_\pi)$$

where $\zeta = \tilde{a}^*/H = \alpha_*/(1 - \alpha)$ when $A^* = 0$

To solve for the nominal exchange rate of the small country with the numeraire currency, use the definition of the real exchange rate. It is obtained by adding $\theta$ and p in (25) and (27) and subtracting p** in (10). In the absence of supply and interest rate effects in the large countries, we get:

$$(28) \qquad e^{**} = \zeta e - U + u_m$$

where $U = \xi u_A + (1 - \xi) u_\pi$

and $\xi = [1 + h(1 - \alpha)]/H$

To sum up the results under flexible exchange rates, monetary disturbances have no effect on the real exchange rate and only domestic monetary disturbances ($u_m$) have an effect on the price of domestic output (the effect is one-to-one as before). An increase in the demand for domestic output ($u_A > 0$) appreciates the real exchange rate and an increase in labor productivity ($u_\pi > 0$) depreciates it by the same amount 1/H.

In the two-country model, the effect was not symmetric because account had to be taken of the output repercussion on the foreign country, which is zero for the small open economy. Thus the depreciation was larger than the appreciation by $\nu/2H_*$.

Another difference refers to the unambiguously negative effect of demand expansion on the domestic price level. Since the fall in prices

induces a real depreciation, the nominal exchange rate has to appreciate by more than the real rate.

The effect of the supply shock on prices is also unambiguously negative but the nominal exchange rate will only depreciate if the trade elasticities are small ($a^* + a^{**} < 1$ or equivalently $\xi > 1$), because in that case the fall in prices is less than the real depreciation.

## III Fixed exchange rates

Before investigating the effect of alternative monetary arrangements, it is useful to define the effective exchange rate of the domestic economy, a weighted average of the exchange rates of the two partners, with the weights given by the respective shares in the foreign component of the consumer price index, that is by $\zeta$.

$$(29) \qquad E_e = \zeta e^* + (1 - \zeta)\, e^{**} = e^{**} - \zeta e$$

The second equation is obtained by triangular arbitrage. Taking it into account, it is seen from (28) that, in this simplified setting, the effective exchange rate is only a function of domestic disturbances. If the home country fixes its exchange rate with country star $e^* = 0$ and $e^{**} = e$. We thus have the effective exchange rate under the union, denoted by a tilde:

$$(30) \qquad E_{\tilde{e}} = (1 - \zeta)\, e$$

The effective exchange rate under the union appears in the expression for the exchange rate with the potential partner, obtained from (28) by triangular arbitrage. Recalling that $u_m^* = u_m^{**} = \bar{u}_m$ by assumption, we get:

$$(31) \qquad e^* = -(1 - \zeta)\, e - U + u_m - \bar{u}_m$$

Under the union, (31) becomes an equation for the endogenous money stock of the home country, denoted by m:

$$(32) \qquad m = \tilde{E}_e + U + \bar{u}_m$$

Due to the difference in size between the two partners, however, the money stock of country star continues to be policy determined and there is no problem of monetary allocation between the two partners. Thus $\bar{u}_m$ can be interpreted as an exogenous increase in the union-wide money stock, which will increase the domestic money stock one-to-one since there is no induced depreciation of the exchange rate of country star.

Associated with the money stock under the union, there is a price of domestic output, denoted by a tilde. From (25), in the absence of global real disturbances and when sensitivities are balanced, we get:

$$(33) \qquad \tilde{p} = -y + m$$

It is clear from (26) and (27) that since y and $\theta$ are given by real domestic disturbances, the difference between the fixed and flexible

exchange rate solutions is matched by the difference in money stocks and prices:

$$(34) \qquad e^{**} - e = u_m - m = p - \tilde{p}$$

Equation (34) shows that if the fixed exchange rate is lower than the one prevailing before the agreement, the money stock and the price of domestic output will fall by the same amount. The fall in the money stock is brought about by a capital outflow which would increase in magnitude if the government attempted to increase the supply of domestic assets to the public. Since real output does not change, the real money stock remains fixed and the fall in money balances is transmitted to prices. Only by increasing demand for real output could the government enforce a different nominal income. Alternatively, as well will see, the loss in reserves can be offset by a transfer from abroad.

In general, the price of domestic output has to be different from its equilibrium level for the real exchange rate to be different under the union. For example, domestic prices may be rigid downward.

Consider thus a price level $p_T$ which, under the union, gives a real exchange rate $\theta^T$. Then, the difference in real exchange rates is given by:

$$(35) \qquad \theta^T - \theta = e - e^{**} + p - p_T = \tilde{p} - p_T$$

The difference in the price prevailing in the two situations can be decomposed further into the difference in real outputs and in money

stocks. The latter, in turn, can derive from an increase in the foreign money stock:

$$(36) \qquad \tilde{p} - p_T = m - u_T - y + y_T$$
$$= -\frac{1}{H} u_A^T - \bar{u}_m^T$$

where $\theta = 0$ under the "neutral" union (i.e. $u_A = u_\pi = 0$).

A demand expansion $u_A^T$, perhaps in the form of fiscal expansion, appreciates the real exchange rate by 1/H, whereas a monetary transfer from abroad, has a one-to-one effect.

When account is taken of the induced real appreciation, the demand expansion increases output by $\chi < 1$. Given monetary policy, this expansion would reduce prices by the same amount it expands output so that the nominal appreciation would be given by $\chi + 1/H = \xi$. Ruling out the exchange rate change and the fall in prices requires therefore an increase in the money stock by the same factor $\xi$, which will be less than one if the trade elasticities are high enough. The real appreciation is therefore accompanied by a rise in prices in the same amount 1/H. In other words, to keep the nominal rate constant, demand expansion must be consistent with the increase in the money stock or $u_A = u_T/\xi$. Of the equivalent rise in nominal income, a proportion $\chi/\xi$ goes to real output expansion and the remainder $(1 - \chi)/\xi$ goes to the rise in prices and fall in the real exchange rate.

In sum, the effects of a fixed exchange rate regime are confined to nominal variables unless there is a price rigidity, an induced demand for domestic output, as a consequence of fiscal expansion, or a transfer from abroad. The latter possibility becomes quite relevant when there is a

monetary union involving the two small countries, henceforth indexed 1 and 2.

## V. Two-tier monetary unions

### 1. A monetary union of two small countries

If country one fixes its exchange rate with country two, we will have $e_1^* = e_2^*$ in equation (31). Unlike the previous case, we must keep track of the monetary allocation. In fact, any exogenous increase in the union-wide money stock - denoted by t - will be allocated between the two partners in proportion to their steady-state shares (assumed to be equal).

$$\tilde{m}_1 = t + U^d \tag{37}$$

$$\tilde{m}_2 = t - U^d \tag{38}$$

$$e^* = t - (1 - \zeta)e - U^s \tag{39}$$

where t is the increase in the union wide-money stock;

$$U^d = \frac{U^1 - U^2}{2}$$

and

$$U^s = \frac{U^1 + U^2}{2}$$

Given the unchanged real exchange rates, equations (37) through (39) are the solution of the exchange-rate union between two small countries.

If $t = 0$, the money stocks are unchanged when demand and supply disturbances are perfectly correlated ($U^d = 0$). In that case, the exchange rate with country star appreciates by $U^s = U^1$.

## 2. A three-country monetary union

In general, fixing the exchange rate with country star requires an increase in the union-wide money stock given by making $e^* = 0$ in (39). If real disturbances are exogenous, the transfer must adjust. Denoting this endogenous monetary transfer from abroad by a tilde, we get:

$$(40) \qquad \tilde{t} = {}_{E}\tilde{e} + U^s$$

According to equation (40), a depreciation of the franc against the dollar requires an increase in $\tilde{t}$ which is larger the higher the consumption share of goods from country double star relative to goods from country star (the lower $\zeta$). On the other hand, a union-wide demand expansion requires an increase in $\tilde{t}$ which is larger the larger the consumption share of non-union relative to union goods (the lower $\alpha$).

We interpret the endogenous increase in the union-wide money stock ($\tilde{t} > 0$) as a transfer from the large partner which guarantees the fixed exchange rate agreement. While t could be zero in equation (37) through (39), $\tilde{t}$ will generally be non-zero in (40).

Conversely, the transfer may remain exogenous if expenditure is adjusted by fiscal policy in both countries such that (with $u_{\pi}^{i} = 0$):

$$(40') \qquad \tilde{u}_A^s = (t - {}_{E}\tilde{e})/\xi$$

union-wide demand or supply disturbances and no external real disturbances either, so that $U^i = e = 0$.

We analyze next how the allocation of the transfer can have real effects.

## 4. A monetary allocation rule

If the union-wide central bank allocates the transfer in (40) according to (37) and (38), the full monetary union will have no real effects. This is easy to verify by eliminating $t = \tilde{t}$.

Consider now a monetary allocation rule whereby money increases in each country, denoted earlier as $u_T^i$, are based on a share $\omega$ of the sum of the equilibrium money stock increases. The percentage change in each money stock is given by $2\omega\tilde{t}$ when the two small countries are identical in steady-state:

$$u_T^1 = 2\omega\tilde{t}$$

(41)

$$u_T^2 = 2(1 - \omega)\tilde{t}$$

Using equations (40) and (41) in (35), we obtain:

$$\theta_1^T = \theta_1 + (1 - 2\omega)\, E\tilde{e} + (1 - \omega)U^1 - \omega U^2$$

(42)

$$\theta_2^T = \theta_2 - (1 - 2\omega)\, E\tilde{e} - (1 - \omega)U^1 + \omega U^2$$

The effects of various disturbances on $\theta_1^T$ are collected in Table 1. Since the gaps are of the same magnitude and of opposite sign (if $\theta_1^T > \theta_1$ then $\theta_2^T < \theta_2$), the results for country two are easy to obtain. Thus, in

Table 1

Effect of Disturbances
on the Real Exchange Rate of Country One ($\theta_1^T$)

| | | j=A | j=π | both |
|---|---|---|---|---|
| | | demand | supply | |
| 1. | Foreign (e) | $\frac{\alpha_{*} + \alpha_{**}(1-2\omega)}{1 - \alpha}$ | n.a. | n.a. |
| 2. | Domestic ($u_j^1$) | $\chi - \omega\xi$ | $1 - \chi - \omega(1 - \xi)$ | $1-\omega$ |
| 3. | Partner ($u_j^2$) | $-\omega\xi$ | $-\omega(1 - \xi)$ | $-\omega$ |
| 4. | Union-wide | | | |
| 4.1 | Global ($u_j^1=u_j^2$) | $\chi - 2\omega\xi$ | $1 - \chi - 2\omega(1 - \xi)$ | $1-2\omega$ |
| 4.2 | Distribution ($u_j^1=-u_j^2$) | $\chi$ | $1 - \chi$ | 1 |

the first column, first row, we see that the effect of a depreciation of the franc-dollar rate is ambiguous when $\omega > \frac{1}{2}$. It will be a real depreciation in the small countries if trade is sufficiently biased toward France. When $\omega = \frac{1}{2}$, the effect is the same as under flexible exchange rates.

The first column, second row shows that demand expansion in country one has an ambiguous effect on the real exchange rate, unless the whole transfer goes to country two ($\omega = 0$), in which case the effect will be positive. The condition for a negative effect will be weaker than $\omega > \frac{1}{2}$ if the supply elasticity is high enough, i.e., if $h(1 - \alpha) > 1$. When the whole transfer goes to the expanding country ($\omega = 1$), the effect is the same as in equation (27) above.

The effect of demand expansion in country two is a real appreciation in country one and the same is true of a productivity improvement if trade elasticities are high enough ($\xi < 1$). As shown in the third row, both effects are dampened by $\omega$, so that they vanish when the whole transfer goes to country two ($\omega = 0$). The effect of a domestic productivity improvement is an unambiguous real depreciation, so that a harvest failure ($u_{\pi}^{1} < 0$) causes the real exchange rate to fall. When the whole transfer goes to country one ($\omega = 1$), the effect is again the same as in equation (27).

As shown in the fourth rows, the effect of union-wide global disturbances are the same as in (27) when $\omega = \frac{1}{2}$. On the contrary, inversely correlated disturbances are independent of $\omega$ and always have an effect given by $\chi$. In general, the real exchange rate gap can be avoided by suitable choice of $\omega$. For example if $U^1 > U^2$, then $\omega > \frac{1}{2}$ for $\theta_i^T = \theta_i$.

The model described above shows how a monetary allocation rule induces a change in the real exchange rates of the members of a monetary union. This implies that there is also a pseudo-exchange-rate union which includes, aside from the members of the monetary union, a large country ready to ensure the fixed-exchange rate agreement by transferring real resources to the union. While the transfer is the counterpart of the administrative monetary allocation rule, we showed under what conditions a fixed exchange rate arrangement could have real effects.

Due to the size difference, an increase in the large partner's money stock could also imply a change in the real exchange rate of the small partner, to the extent that the price level was different from the one at which the exchange rate was pegged. Similarly, the real effects of demand expansion could be interpreted in terms of a fiscal expansion induced by the union, as long as the large partner is willing to transfer real resources and therefore increase real money balances.

Nevertheless, the focus of the analysis was on the allocation of a given transfer between the two small countries, because this is an important feature in the recent experience of the West African Monetary Union. The major implication of the model was therefore that change in the real exchange rate of the small partners are to be expected when the allocation of a given transfer is different from the one implied by the assumed equality of the steady-state monetary shares of the two small countries. Needless to say, much more work needs to be done in order to reflect the structural characteristics of their economies.

## B. The West African Monetary Union (UMOA)

### I. The Franc Zone

Established in the mid-forties between France and its colonies, the Franc zone survived their independence in the early sixties and the move to generalized floating in the early seventies.

Summing up the African monetary experience of the Bretton-Woods era, Mundell (1972) writes: "The French and the English economic traditions in monetary theory and history are different. At the risk of gross oversimplification (...) the French tradition has stressed the passive nature of monetary policy and the importance of exchange stability with convertibility (within the franc area); stability was achieved at the expense of institutional development and monetary experience. The British countries by opting for monetary independence have sacrificed stability, but gained experience and better developed monetary institutions. The simplest test of this is the extent of development of money substitutes" (p. 93).

He goes on to present indicators of financial intermediation for eleven "rich countries" and 33 African countries, classified into "Franc Africa", "Sterling Africa", "North Africa" and "Central East Africa". His figures show that, in 1968, the median propensity to hold cash was 21% in OECD countries, 33% in the "Sterling" category, 47% in the Franc category and 45% in the remaining two.

Table 2 provides evidence along the same lines for the United States and France, as rich countries, Kenya, a Sterling Africa country, several countries of Franc Africa, Barbados, a member of the East Caribbean

Table 2

Indicators of Financial Intermediation (%)

| | (1) Propensity to hold near-money | | | (2) Propensity to hold cash | | |
|---|---|---|---|---|---|---|
| | 1962 | 1972 | 1982 | 1962 | 1972 | 1982 |
| 1. Rich countries | | | | | | |
| United States | 60 | 71 | 80 | 8 | 6 | 6 |
| France | 36 | 60 | 70 | 25 | 11 | 6 |
| 2. Sterling Africa | | | | | | |
| Kenya | 29* | 30 | 37 | 21* | 21 | 18 |
| 3. Franc Africa | | | | | | |
| Cameroon | 7 | 18 | 36 | 52 | 38 | 27 |
| Ivory Coast | 8 | 17 | 30 | 56 | 42 | 33 |
| Senegal | 3 | 9 | 28 | 51 | 39 | 32 |
| Mauritania | 3 | 8 | 26 | 49 | 40 | 31 |
| Madagascar | 2 | 19 | 21** | 55 | 39 | 31** |
| Mali | 3 | 3 | 6 | 61 | 59 | 62 |
| 4. Other | | | | | | |
| Barbados | 57* | 71 | 70 | 13* | 10 | 13 |
| Sudan | 6 | 13 | 18 | 50 | 45 | 32 |

Notes: *1966; **1979

Source: International Monetary Fund, International Financial Statistics (IFS)
(1) Line 35 } over lines 34 + 35 (M2)
(2) Line 14a }
unless otherwise noted

France (1) Lines 35 + 65a } over lines 54 + 56a (M3)
(2) Line 14a

US (1) Lines 59mcb - 59 mab } over line 59 mcb (M3)
(2) Line 14a

Currency Area, and Sudan.[5] The figures for 1962 and 1972 confirm the lower development of money substitutes in Franc Africa.

The Franc Zone changed considerably over the last forty years. Upon independence, it was adapted through the creation of common central banks for the former French colonies of West, Central and East Africa. In particular, Benin, Ivory Coast, Mauritania, Niger, Senegal, Togo and Upper Volta created UMOA, managed by the Central Bank of the West African States (known by its French acronym BCEAO) whereas Cameroon, Central Africa, Chad, Congo and Gabon established the union of the members of the Bank of Central African States. The members of these two monetary unions signed an agreement of monetary cooperation with France whereby the exchange rate between the French franc and the franc of African Financial Cooperation (CFA) was fixed, foreign exchange reserves were pooled and exchange controls were common to the whole zone. Most importantly, an "operations account" at the French Treasury guaranteed the convertibility of the CFA and provided a channel for monetary transfers between France and UMOA.

While Mali participated in the UMOA negotiations, it refused to sign the agreement and left the Franc zone in 1962. The justification was consistent with Mundell's view of the British tradition: monetary sovereignty, Mali argued, was an essential instrument of development. Monetary stability was a less pressing consideration.

Mali's criticism of the Franc zone as a neo-colonial obstacle to "self-centered" development is only one example of a fairly widespread view that the arrangement benefits France.[6] Since the repeated devaluation of the French franc after 1981 and the implementation of tighter area-wide exchange controls, the desirable trend toward trade

diversification away from France seems to have been reversed. As a consequence, the British tradition might now provide an argument for leaving the Franc zone: there will be no monetary stability in UMOA if there is none in France.

This controversy about the costs and benefits of the Franc zone merely illustrates how the volatility of major exchange rates over the last ten years has changed the terms of the Mundellian trade-off between monetary stability and development. Stability relative to one currency means instability relative to other floating currencies, so that fixing "the" exchange rate is no longer an option. The figures for 1982 reported in Table 2 also suggest a blurring of the difference between the French and English monetary traditions. Certainly, the propensity to hold cash remains higher in the former French colonies than in Kenya but, except for Madagascar, the propensity to hold near-money increased much faster in the countries of Franc Africa than it did in Kenya or Sudan.

To the extent that both groups were subject to the global shocks of the seventies, the acceleration of financial development casts the agreements of monetary cooperation with France in a new light. The originality of their design has been emphasized in the work of the Guillaumonts (1984). Rather than a historic relic, the Franc zone represents in their view a conscious choice of monetary and exchange rate policy by sovereign states. Similarly, for Vinay (1980), it is a "unique organization" where "the traditional legalism of French institutions was replaced by a fertile pragmatism".The fact that some former French colonies, such as Madagascar and Mauritania, left the union in 1972 is of course consistent with the idea of choice.[7]

Pragmatism can also be found in the attitude of Mali. Three years after choosing monetary sovereignty, negotiations began for a return to

the Franc zone, and a special arrangement was agreed upon in 1967, whereby the Malian franc was devalued by 50% relative to the CFA. Also, France was to lobby for the accession of Mali to UMOA. The agreement involved two preliminary phases. A one-year fiscal adjustment-cum-liberalization was followed by bilateral cooperation with France along BCEAO lines. The duration of this phase was not specified since full membership for Mali might not be welcome by the other members. This is not surprising in light of its singular monetary underdevelopment, apparent from Table 2, and a persistently negative operations account with France.

Nevertheless, Malian membership in UMOA was agreed upon at Niamey, Niger in October 1983. The third phase was thus completed in 1984. Due to the increasing transfer of resources from France to UMOA, the reversal of Mali's position might be explained by a desire to receive the transfer through UMOA rather than directly from France.

If fixing is impossible in a floating world and a pure float is not a viable - let alone desirable - option for a developing country, an alternative to the institutions of the Franc zone would be for UMOA to collectively peg to a basket of currencies. This was proposed by Nascimento (1984) on the basis of an econometric analysis of the costs and benefits of various exchange rate regimes for the union as a whole. He measures the trade-off between monetary sovereignty and "liquidity" respectively by the loss in reserves associated with an excess supply of money (the offset coefficient) and by the variances of departures from purchasing power parity. According to this operationalization of the Mundellian trade-off, offset coefficients and real exchange rate variability in UMOA are smallest under a basket peg and largest under a crawling peg relative to the French franc.

Both the neglect of the French transfer - which allows the continued sterilization of the loss in reserves - and the assumption of purchasing power parity cast doubt on the applicability of Nascimento's analysis to UMOA, let alone to its persistent deficit members, such as Senegal. All the same, for a given transfer, pegging to a basket allows for the choice of optimal weights. Since it is unlikely for the optimal weight of a particular currency to be one, such a regime would dominate the present arrangement. Similarly, it is unlikely that the rate of crawl be zero, so that a regime where indicators are optimally chosen will also dominate the basket peg.[8] This would make UMOA look like the EMS rather than part of the Franc Zone. The problem for a deficit country in UMOA would then be how to ensure a continued transfer from its surplus partners, if there are any.

## II. Monetary allocations in UMOA

During its first decade, UMOA followed the prudent course cited earlier as being characteristic of the French monetary tradition. From its Paris headquarters, BCEAO managed to keep the composition of the union's money stock (M2) virtually constant. The net foreign assets of the banking system grew almost without interruption and remained at about one third of the money stock, so that domestic assets accounted for the other two thirds (Table 2, column 3). The propensity to hold near-money increased from 4% in 1962 to 13% ten years later (column 4). Finally, as a share of the French money stock, UMOA's money showed a slight increase (column 5).

Table 2

Composition of Money Stock in UMOA

| | Net Foreign Assets | Money (M2) | Ratio (1)/(2) | Ratio Time Deposits/(2) | Share of France |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | (CFAF billion) | | (%) | | |
| 1962 | 31.0 | 88.3 | 35 | 4.3 | 1.2 |
| 1963 | 31.0 | 90.2 | 34 | 4.1 | 1.1 |
| 1964 | 32.2 | 103.1 | 31 | 10.0 | 1.1 |
| 1965 | 43.5 | 103.6 | 40 | 7.8 | 1.0 |
| 1966 | 43.5 | 108.0 | 40 | 8.2 | 1.0 |
| 1967 | 38.8 | 112.1 | 35 | 10.3 | .9 |
| 1968 | 43.8 | 133.6 | 33 | 12.7 | .9 |
| 1969 | 53.7 | 159.6 | 34 | 16.9 | 1.1 |
| 1970 | 79.5 | 185.7 | 43 | 16.1 | 1.1 |
| 1971 | 81.3 | 204.1 | 40 | 16.4 | 1.0 |
| 1972 | 63.7 | 217.0 | 29 | 13.3 | .9 |
| 1973 | 52.9 | 261.0 | 20 | 18.3 | .9 |
| 1974 | 81.0 | 387.2 | 21 | 21.1 | 1.2 |
| 1975 | 30.2 | 437.4 | 7 | 20.9 | 1.2 |
| 1976 | 37.1 | 596.0 | 6 | 21.8 | 1.4 |
| 1977 | 62.8 | 811.7 | 8 | 23.5 | 1.7 |
| 1978 | 38.5 | 941.2 | 4 | 25.4 | 1.7 |
| 1979 | -73.0 | 945.1 | -8 | 22.4 | 1.5 |
| 1980 | -282.0 | 1024.7 | -28 | 23.5 | 1.5 |
| 1981 | -431.1 | 1186.2 | -36 | 25.1 | 1.6 |
| 1982 | -547.5 | 1273.9 | -43 | 27.0 | 1.5 |

Sources: (1) IFS line 31n summed over country pages: excludes long term borrowing (line 36cl) and SDR allocations (included in other items, line 37r).

(2) IFS lines 34 and 35 summed over country pages.

(4) IFS line 35 over (2).

(5) (2) + (3) over IFS lines 34 + 35 for France.

The situation changed in the seventies, but the reversal was obscured by the drastic increases in the reserves of Ivory Coast in 1974 and 1977, largely due to higher world prices for coffee (19% and 20% respectively) and cocoa (56% and 69% respectively). Reserves also jumped for Togo in 1974 due to the rise in the price of phosphates (483%) and, as a share of the union money stock, went from 14% to 27%. At the same time, the institutional reforms allowed greater freedom for BCEAO to conduct monetary policy from its newly established African headquarters.[9]

As shown in Table 3, the negative foreign asset position of the commercial banks overtook the claims of the central bank in 1979 and the operations account of the central bank moved from a claim of CFAF 54.6 million on France in December 1979 to a liability of CFAF 13.2 million in March 1980. The steep increases in the reserves of Togo in 1981 and 1982 were no longer sufficient to offset the declines of the two major partners, Ivory Coast and Senegal. The external liabilities of the banking system increased from 10% of the money stock in December 1979 to 36% in June 1982 and reached 56% in June 1983.

Put in another way, domestic assets increased from 96% of the union money stock in 1978 to 143% in 1982. In the meantime, France's domestic assets fell from 82% to 69% of the money stock in 1980 and increased to 77% in 1981 and 1982. This reflected the loss of foreign exchange reserves associated with the expected devaluations of the franc during these two years (and thus offset the revaluation of existing resources).

The evolution of the shares of UMOA members is summarized in Table 4. Measuring volatility by the coefficient of variation, the Senegalese share in UMOA's money stock was the second most stable, whereas it was the most unstable over the whole period 1962-82. Concentrating on

Table 3

Net Foreign Assets of UMOA
(CFAF billion)

| | (1) Assets of Central Bank | (2) Liabilities of Commercial Banks | (3) (1)-(2) |
|---|---|---|---|
| December | | | |
| 1975 | 66.4 | 44.8 | 19.7 |
| 1976 | 70.2 | 44.0 | 26.2 |
| 1977 | 94.6 | 41.3 | 53.3 |
| 1978 | 125.2 | 90.4 | 34.9 |
| 1979 | 32.5 | 131.5 | -99.0 |
| 1980 | -120.2 | 189.5 | -309.7 |
| 1981 | -237.8 | 190.1 | -427.9 |
| 1982 | -356.8 | 203.6 | -560.5 |
| June | | | |
| 1982 | -260.4 | 174.1 | -434.5 |
| 1983 | -533.0 | 180.3 | -713.3 |

Notes: Total in (3) may not add due to rounding.
Figures in (2), new series since 1979.
June 1983 figure in (3) excludes Benin (data not available).

Source: BCEAO (includes long-term borrowing and SDR allocations which are excluded in the IFS presentation of Table 2).

Table 4

Monetary Shares

in UMOA (%)

Summary Statistics

1973-82

| | Mean | | Coef. var.* | | Correlation | |
|---|---|---|---|---|---|---|
| Ivory Coast | 58 | (54) | 6 | (12) | .33 | (.37) |
| Senegal | 19 | (22) | 8 | (29) | -.72 | (-.37) |
| Togo | 7 | (7) | 14 | (19) | .24 | (.43) |
| Niger | 6 | (6) | 18 | (14) | .26 | (.06) |
| Benin | 5 | (6) | 18 | (14) | -.42 | (-.46) |
| Upper Volta | 5 | (5) | 9 | (12) | -.44 | (-.47) |
| Total/France | 1 | (1) | 17 | (22) | 1.00 | |

Note: numbers in parentheses refer to 1962-82

*standard deviation divided by mean times 100

Source: IFS, lines 34 and 35.

the two larger shares, the share of Ivory Coast has been positively correlated with the share of UMOA in the French money stock whereas the corresponding correlation for Senegal has been negative. During the sixties, the converse was true (-.55 for Ivory Coast and .62 for Senegal). Senegal's allocation was therefore insulated from the decline of the total for the last few years. That on average the insulation was at the expense of Ivory Coast is clear from a negative correlation of .8 between the two monetary allocations (Table 5). The strength of the inverse link between the two economies was even higher in the sixties (for 1962-72 the correlation reached -.99), largely because of the deterioration of the Ivorian external position after 1980.[10] If the French transfer decreases, however, the negative shares correlation will increase again.

The increase in UMOA's money relative to France's has reversed in the last few years, in line with France's emerging reluctance to continuously replenish the operations account. This implies that, in the future, the monetary allocation of the transfer will become a central policy issue for the members of UMOA. The membership of Mali, another structural deficit country, also tightens the constraint on the shares.

## III. Nominal Stability and Real Volatility

Table 6 lists the 1980 trade shares of France, Senegal and the other African countries covered in Table 2 by loosely-defined Ecu and dollar areas. The shares of the Franc zone (including France) and of the United States are also indicated. The non-U.S. members of the dollar area are obtained residually.

Table 5

Correlation of Monetary Allocations

1973-1982

| | Ivory Coast | Senegal | Togo | Niger | Benin |
|---|---|---|---|---|---|
| Senegal | -.76(-.96) | | | | |
| Togo | -.71(.60) | .41(-.76) | | | |
| Niger | -.52(-.24) | -.10(.02) | .52(.20) | | |
| Benin | -.78(-.65) | .60(.51) | .24(-.27) | .24(.21) | |
| Upper Volta | -.82(-.88) | .65(.81) | .27(-.58) | .34(.31) | .84(.66) |

Note: Numbers in parentheses refer to 1962-1982.

Source: Same data as Table 4.

Table 6

Trade Shares by "Currency Area"

(1980, %)

| Imports | ECU | of which Franc Zone | Dollar | of which Franc Zone |
|---|---|---|---|---|
| Senegal (1) | 53 | 37 | 47 | 4 |
| France (1) | 47 | 0 | 53 | 8 |
| Ivory Coast (2) | 52 | 42 | 48 | 7 |
| Cameroon (3) | 51 | 43 | 49 | 5 |
| Mali (3) | 79 | 67 | 21 | 0 |
| Mauritania (5) | 37 | 29 | 70 | 5 |
| Madagascar (3) | 62 | 41 | 38 | 4 |
| Kenya (1) | 31 | 0 | 69 | 17 |
| Sudan (5) | 29 | 5 | 71 | 8 |
| Exports | | | | |
| Senegal | 56 | 46 | 44 | 0 |
| France | 48 | 0 | 52 | 5 |
| Ivory Coast | 63 | 29 | 37 | 9 |
| Cameroon | 53 | 21 | 47 | 29 |
| Mali | 59 | 26 | 41 | 0 |
| Mauritania | 48 | 29 | 52 | 0 |
| Madagascar | 40 | 23 | 60 | 19 |
| Kenya | 34 | 0 | 66 | 4 |
| Sudan | 16 | 5 | 84 | 0 |

Notes: Number in parentheses indicates the minimum share, e.g. for Senegal all partners with 1% share or larger were included in the compu tation. Except for U.S., dollar area is obtained residually. France shares refer to 1981.

Source: International Monetary Fund, Direction of Trade

Ivory Coast, Madagascar and Mali show a lower share for imports from the dollar-area than Senegal. The share of imports from the U.S. is similar to that of Mauritania, Cameroon and Madagascar. The Franc zone export share is highest in Senegal, followed by Mauritania, Mali and Ivory Coast. On the import side, however, Senegal has the lowest share among Franc zone countries. Thus trade diversification increased the dollar-area share in the trade of the Franc zone countries, but the trend has probably been reversed by the franc devaluations of 1981/82 and the associated tightening of exchange controls.[11]

Due to the different trade patterns, there are sizable differences between the nominal effective exchange rate of France, and the ones of the Franc Zone countries. In the seventies, changes in the effective exchange rate of the U.S. dollar have also become an important source of divergence. Taking a 1972 base, the French rate in 1980 (using same year import weights) was 105, whereas the Senegalese rate was 95 and the Ivorian rate was at par. Eliminating the effect of the franc-dollar rate shows a range of variation from 80(91) in 1979-80 to 95(99) in 1976 for France (Ivory Coast) and from 97 in 1973-74 to 105 in 1977 for Senegal. The appreciation of the dollar in the early eighties brings these indices to 102 for France, 107 for Ivory Coast and 117 for Senegal. Similarly, the devaluations of the French franc bring the effective rates to 127, 111 and 101 respectively.

After a decade of experience with flexible exchange rates, the notion that real exchange rates would be stabilized by the offsetting of nominal variations by inflation differentials, very popular in the mid-seventies, has been abandoned even by its most ardent defenders. The failure of purchasing power parity is evident in the substantial

variability of most measures of real effective exchange rates for industrial countries.[12] Data availability precluded the computation of effective exchange rates using more narrowly based indexes than the so-called African consumer price index or even correcting prices for exchange rate changes.[13]

Table 7 compares the experience of African countries during the floating rate period. The lowest nominal changes by far are in Senegal (they rise to about 1/3 for Ivory Coast and Senegal when export weights are used) and the mean nominal appreciation of Mauritania becomes large in absolute value. The evolution of the real rate is even more striking because Senegal and France are the only French-speaking countries to have depreciated in real terms.[14]

Nominal variability increased enormously in Senegal (28 vs. 3 for Ivory Coast). In terms of real variability, Senegal was close to France (6), Mauritania highest (8), and Ivory Coast lowest (4). The mean changes are close in absolute values but the correlation between nominal and real changes is lower in Ivory Coast. Also, the correlation between real rates in the two countries increased to .45 in the seventies. Chart 1 shows a real depreciation of the franc since 1968 and pronounced swings around the upward trend, which are most pronounced when the 1981 weights are used.[15]

It is also evident from Chart 1 that, after 1976, Senegal moved opposite to France, whereas Ivory Coast magnified the French movement. There is a substantial gap between the real rates of the two partners until 1980, as would be expected from the automatic adjustment mechanism of the balance of payments. This suggests that the monetary allocation rule did respond to the economies' external performance, particularly

Table 7

Nominal and Real Exchange Rates

1973-1982

| | Mean (% p.a.) | | Coef. Variation | | Correlations |
|---|---|---|---|---|---|
| | Nominal | Real | Nominal | Real | Nominal & Real |
| Export Weights | | | | | |
| IVORY COAST | .32 | -1.92 | 15.53 | 3.18 | .63 |
| CAMEROON | 1.95 | -.24 | 2.93 | 26.04 | .82 |
| MADAGASCAR | 2.84 | -.96 | 2.41 | 5.78 | .10 |
| MAURITANIA | -1.61 | -.64 | 4.14 | 14.95 | .96 |
| SUDAN | 11.19 | 3.28 | 1.51 | 4.39 | .82 |
| KENYA | -2.08 | -2.41 | 4.97 | 5.36 | .90 |
| SENEGAL | .36 | .84 | 6.66 | 7.83 | .70 |
| FRANCE | 1.70 | .83 | 2.92 | 5.12 | .96 |
| Import Weights | | | | | |
| IVORY COAST | 1.11 | -1.51 | 2.85 | 4.16 | .62 |
| CAMEROON | 1.37 | -.41 | 1.72 | 7.41 | .57 |
| MADAGASCAR | 1.91 | -1.32 | 2.14 | 4.08 | -.19 |
| MAURITANIA | -1.76 | -1.13 | 3.66 | 8.52 | .98 |
| SUDAN | 11.43 | 3.44 | 1.60 | 4.33 | .87 |
| KENYA | 4.26 | .87 | .90 | 5.24 | .33 |
| SENEGAL | .16 | 1.69 | 28.13 | 5.60 | .77 |
| FRANCE | 2.54 | 1.44 | 2.28 | 5.53 | .86 |

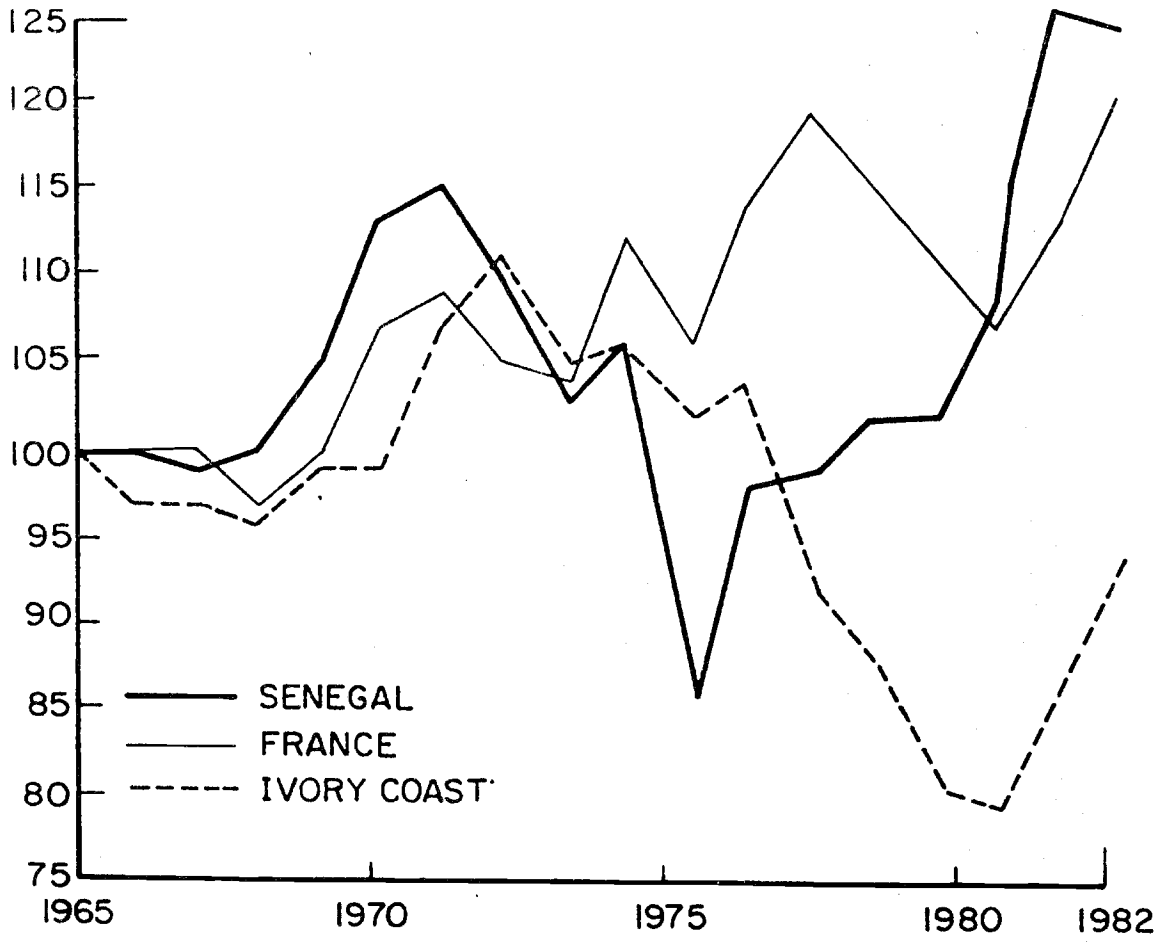
SOURCE: IFS, weights described in Macedo (1983b).

when the total share of UMOA ceased to increase in relation to the French money stock.

The correlation of the relative shares of the two countries in UMOA and the ratio of their real effective exchange rates was rather weak in the period 1965-82 (-.25 using 1980 import shares) and basically disappeared in the 70's (-.05). This was also the case, but to a less extent, of the correlation between money shares and relative consumer prices, which dropped from -.35 to -.05 between the two sample periods.

Chart 1

REAL EFFECTIVE EXCHANGE RATE INDICES
(1980 IMPORT WEIGHTS)



## Conclusion

While there are few monetary unions, there are many models thereof. Most of these models are concerned with the choice of a single country to peg to a single currency. The case analyzed in this paper is even more unusual, since it involves a collection of countries pegging to a single currency. Nevertheless, an effort was made to analyze the workings of a full monetary union which has been in existence for almost forty years.

The theoretical model presented in part A emphasized the interaction of two small and two large countries, and showed under what conditions the monetary union would involve changes in the real exchange rates of its members. A transfer of real resources from the large partner was an especially relevant instance since this is what has happened in the last few years.

Building on the available studies of the institutional structure of UMOA, the process of monetary allocation was described in part B. The drastic deterioration of the net foreign asset position of UMOA in the last five years shows the importance of the French transfer. Over the last twenty years, however, monetary allocation within the union involved a very high negative correlation between the two major partners, Senegal and Ivory Coast. To the extent that the transfer from France disappears, a fixed exchange rate with the French franc will require a restoration of this pattern rather than the growing union-wide deficit which has been observed since 1979.

The comparison of the interaction between exchange rate and relative price changes in Senegal, Ivory Coast and France confirmed the expected failure of purchasing power parity to stabilize the real exchange rate. More surprising - despite the presence in the price index used of

non-traded goods and goods whose price is controlled - was the insulation of (African) consumer price inflation in UMOA from French consumer price inflation. Therefore, UMOA's stable nominal effective rates were accompanied by unstable real effective exchange rates. Since this relative price is weakly positively correlated with the terms of trade, it can be said that the monetary union achieved nominal stability at the expense of the real volatility. The unfortunate consequences of this pattern for resource allocation led Nascimento (1983) to propose a basket peg for UMOA. But his argument ignores the increasing French transfer of the last four years.

The comparison of the real effective exchange rates of Senegal and Ivory Coast with several other African countries confirms the singularity of Senegal's experience. All depreciated in nominal terms, but Senegal achieved a real depreciation during the floating rate period whereas other former French colonies appreciated in real terms. Real exchange variability over the sample period was less pronounced in Madagascar, Mauritania and Sudan.

This suggests that, if the loss of monetary autonomy did not induce a gold-standard type adjustment to external inflation in Senegal (as it did in Ivory Coast before 1980), the reason is to be found in the increase of the union-wide money stock relative to the exogenously determined French money stock in the seventies. More importantly, from 1975 to 1980, if the monetary allocation rule allowed Ivory Coast to drain money from Senegal through the balance of payments it would have induced real appreciation in the former and real depreciation in the latter, as was indeed observed.

As mentioned, the present paper merely scratches the surface of the problem of the choice of an exchange rate regime for the members of UMOA

and for developing countries in general. The model does not capture enough stylized features of the small African economies and much more work needs to be done on characterizing them empirically. Some features of the large industrial economies were also left out, especially the effect of the changes in the franc-Ecu rate.

Finally, the model suggested an exogenous administrative procedure to determine the crucial monetary allocation parameter. Therefore, the effect of the recent threat of reduction in the transfer from France is likely to be increasing conflicts about the monetary allocation rule, making it endogenous. A set-up like the one presented in part A can of course be extended to incorporate some of these conflicts.

# APPENDIX I

## DERIVATION OF A LOG LINEAR MODEL

This appendix derives the log-linear model used in the text for one small country. It can easily be adapted to the large countries. The supply side is an extension of the three-country model in Marston (1984) which introduces domestic supply disturbances and an endogenous labour supply. The wage contract set-up is left out. Supply disturbances are features in the two-country model of Marston (1982). The demand side is adapted from Macedo (1983a).

### 1. Supply

Consider a Cobb-Douglas technology for domestic output, subject to a random productivity disturbance. For a given stock of capital, set to one by choice of units, we have

$$Y = \tilde{U}_{\pi} L^{\lambda} \tag{1}$$

where $Y$ is domestic output

$L$ is employment

$\tilde{U}_{\pi}$ is a supply disturbance

$\lambda$ is the share of labor (a constant)

By marginal productivity pricing, we have:

$$\frac{WL}{PY} = \lambda \tag{2}$$

where W is the wage rate

P is the price of domestic output

Substituting for Y in (2), we get labor demand as a function of the real product wage and the disturbance term:

$$(3) \qquad L^d = [\hat{U}_\pi/(W/P)]^{1/(1-\lambda)}$$

We assume that the supply of is a function of the wage measured in terms of the consumer price index, defined as a geometric average of the domestic currency prices of the goods produced in the three countries:

$$(4) \qquad P_c = P^{\alpha} (P^*E^*)^{\alpha^*} (P^{**}E^{**})^{\alpha^{**}}$$

where $P^*(P^{**})$ is the foreign currency price the good produced in the partner (non-partner) country;

$E^*(E^{**})$ is the price of the partner's (non-partner's) currency in units of domestic currency;

and $\alpha + \alpha_* + \alpha_{**} = 1$

The price of the partner's currency in terms of the non-partner's is determined by triangular arbitrage:

$$(5) \qquad E = E^{**}/E^*$$

Using the definition of the two relevant real exchange rates, we have another expression for $P_c$:

(6) $P_c = P\theta^{(1 - \alpha)}/\theta^{*\alpha^*}$

where $\theta^* = P^{**}E/P^*$

and $\theta = P^{**}E^{**}/P$

According to (6), proportional changes in $P^c$ and P require that the real exchange rate efffects offset each other or $\theta^{*\alpha^*} = \theta^{(1 - \alpha)}$. If the domestic real exchange rate depreciates, the real exchange rate of the partner will have to depreciate by a smaller amount. The larger the bias in trade toward the partner, measured by $\zeta$, the smaller this dampening effect.

We are now in a position to express labor supply as a positive function of the real wage, with elasticity n:

(7) $L^S = N_o\ (W/P^c)^n$

Using (6) in (7) we get

(8) $L^S = N_o\ [(W/P)\theta^{*\alpha^*}\theta^{-(1 - \alpha)}]^n$

In equilibrium, demand for labor equals supply of labor except for a frictional unemployment pool. Equating (8) to (34), we obtain the equilibrium product wage as a function of the terms of trade. Denoting logarithmic deviations by lower case letters we get:

(9) $[1+n(1-\lambda)](w - p) = -n(1-\lambda)[\alpha_*\theta^* - (1-\alpha)\theta] + \tilde{u}_\pi$

Using (2) to substitute for L in (1), we get aggregate supply as a function of the product wage, which, upon substitution from (9), yields:

$$(10) \qquad y = -h(1 - \alpha)\theta + h\alpha_{*}\,\theta^{*} + u_{\pi}$$

where $\quad h = \dfrac{\lambda n}{1 + n(1 - \lambda)}$

and $\quad u_{\pi} = \left[\dfrac{1}{1-\lambda} - \dfrac{1}{1+n(1-\lambda)}\right] \tilde{u}_{\pi}$

2. Demand

The demand side is obtained from the open-economy income identity which defines aggregate demand:

$$(11) \qquad Y = A(Y, R, U_A) + \sum_i X^i(Y^i, \frac{E^iP^i}{P}) - \sum_i \frac{E^iP^i}{P} M^i(Y, \frac{E^iP^i}{P})$$

where $A = C + I + G$ is real absorption

$X^i$ ($M^i$) are exports (imports) to (from) country i, i = *, **

R is real interest rate

$U_A$ is a demand disturbance

In (11) the trade balance is expressed in units of the domestic good and the effects of foreign (domestic) income on exports (imports) are to be interpreted in common units, not made explicit to avoid cluttering. To linearize (11), log differentiate, denote again logarithmic deviations by lower case letters and define r = dR, to obtain:

$$(12) \qquad y = \sum_i [a^i(p^i + e^i - p) + \nu^i y^i] - br + u_A$$

where $$a^{*} = \frac{1}{\Delta}\frac{X^{*}}{Y}\left[\frac{M^{*}\theta}{X^{*}\theta^{*}}\left(\eta_{X}^{*} - 1\right) + \eta_{M}^{*}\right]$$

$$a^{**} = \frac{1}{\Delta}\frac{X^{**}}{Y}\left[\frac{M^{**}\theta}{X^{**}}\left(\eta_{X}^{**} - 1\right) + \eta_{M}^{**}\right]$$

$$v^{i} = \frac{1}{\Delta}\frac{Y^{i}}{Y}\frac{\partial X^{i}}{\partial Y^{i}}$$

$$b = \frac{1}{\Delta Y}\frac{\partial A}{\partial R}$$

$$U_{A} = \frac{1}{\Delta}\frac{\partial A}{\partial U_{A}}\,dU_{A}$$

$$\Delta = 1 - \frac{\partial A}{\partial Y} + \sum_{i}\frac{\partial M^{i}}{\partial Y}$$

$$\eta_{Z}^{i} = -\frac{\partial Z^{i}/Z^{i}}{\partial(E^{i}P^{i}/P)/(E^{i}P^{i}/P)} \qquad Z = M,\ X$$

Appendix Table 1

Monetary Shares in UMOA

| | Senegal | Ivory Coast | Other UMOA |
|---|---|---|---|
| 1962 | 41.3 | 36.0 | 22.7 |
| 1963 | 35.4 | 40.3 | 24.3 |
| 1964 | 30.0 | 48.0 | 22.0 |
| 1965 | 29.0 | 47.2 | 23.8 |
| 1966 | 25.7 | 49.9 | 24.4 |
| 1967 | 23.2 | 51.9 | 24.9 |
| 1968 | 22.2 | 54.3 | 23.5 |
| 1969 | 18.6 | 57.6 | 23.8 |
| 1970 | 20.1 | 57.5 | 22.4 |
| 1971 | 18.6 | 57.6 | 23.8 |
| 1972 | 19.7 | 56.6 | 23.7 |
| 1973 | 20.1 | 56.7 | 23.2 |
| 1974 | 20.0 | 57.6 | 22.4 |
| 1975 | 19.7 | 55.9 | 24.4 |
| 1976 | 19.1 | 58.7 | 22.2 |
| 1977 | 16.1 | 64.6 | 19.3 |
| 1978 | 16.9 | 61.8 | 21.3 |
| 1979 | 17.0 | 59.9 | 23.1 |
| 1980 | 17.3 | 56.8 | 25.9 |
| 1981 | 18.3 | 53.9 | 27.8 |
| 1982 | 20.6 | 51.9 | 27.5 |

Source: IFS Lines 34 + 35

Appendix Table 2

Shares of M1 in UMOA

Summary Statistics

1962 - 1982

| | mean (%) | coef. var.* | correlation |
|---|---|---|---|
| Ivory Coast | 51.31 | 13 | .54 |
| Senegal | 23.58 | 27 | -.56 |
| Togo | 6.55 | 20 | .55 |
| Niger | 6.57 | 14 | .07 |
| Benin | 6.07 | 13 | -.48 |
| Upper Volta | 5.92 | 11 | -.61 |
| Memo: Total/France | 1.60 | 31 | 1.00 |

* standard deviation divided by the mean times 100

Source: IFS, line 34.

Appendix Table 3

Correlation of Monetary Allocations

1962-1982

| | Ivory Coast | Senegal | Togo | Niger | Benin |
|---|---|---|---|---|---|
| Senegal | -.96 | | | | |
| Togo | .60 | -.76 | | | |
| Niger | -.24 | .02 | .20 | | |
| Benin | -.65 | .51 | -.27 | .21 | |
| Upper Volta | -.88 | .81 | -.58 | .31 | .66 |

Source: IFS.

## Notes

1. It was surveyed some years ago by Tower and Willet (1976). Since then, there have been contributions by Allen and Kenen (1980), Marston (1980 and 1984), Aoki (1983), Melitz (1984) and Huizinga (1984), among others. On exchange rate policy in developing countries, see Lewis (1977) and Kenen (1978).
2. See Macedo (1983a) for a two-country model along the same lines.
3. It is possible to introduce further asymmetries by marginal changes in the parameters, using the methodology developed by Aoki (1981).
4. The homogeneous solution is in Macedo (1984).
5. The relation of monetary and real integration in Africa is emphasized in Letiche (1971). On the West African experience, see McLenaghan et al. (1982) and Robson (1983). Helleiner (1983) has an assessment of prospects in Africa's relations with the Fund. Note that, since Sudan is in the Middle Eastern Department at the Fund, it is not included in IMF (1968-77).
6. Raffinot (1982) has one of the most systematic attempts at defending this view. It surfaces, however, in Mulumba (1976) - cited almost approvingly by Connolly (1983).
7. Indeed, Allen (1983) reviewed the institutional structure of UMOA as part of the preparation for setting up the East Caribbean Central Bank.
8. See the analysis of Branson and Katseli (1982), and, on the choice of indicators, Branson and Macedo (1982).
9. Bhattia (1982) emphasizes the importance of the 1974 reform in his study of UMOA up to that date. The need for a more active interest rate policy is clear from Leite (1982).

10. Discreetly, the 1980 Report of BCEAO assigns the responsibility of the decline to "un Etat membre de l'Union" (p. 45).

11. The use of export and import shares to measure the relative importance of trading partners' currencies neglects the growing weight of services and interest. In the case of Senegal the current account shares are not too different from the ones reported in Table 7. See Macedo (1983b).

12. Nascimento (1984) and Connolly (1983) assume that purchasing power parity holds between UMOA and EMS (or France).

13. A comparison of the African index with the national output deflator appears in Plane (1983).

14. Plane (1983) computes "synthetic indices of competitiveness" based on ratios of unit values as well as on average market shares. These indexes behave quite differently from the real exchange rates.

15. No real rates are reported for Mali due to the absence of a price index in IFS. Plane (1983) presents such an index and singles it out as showing a clear overvaluation, unlike the other 9 African currencies he studies.

15. Using export weights (not shown) the upward trend is much less noticeable. Also, the figures are quite different for the whole period.

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