Monetary Union in West Africa:

Who Might Gain, Who Might Lose and Why?

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Abstract

We develop a model in which governments' financing needs exceed the socially optimal level because public resources are diverted to serve the narrow interests of the group in power. From a social welfare perspective, this results in undue pressure on the central bank to extract seigniorage. Monetary policy also suffers from an expansive bias due to the authorities' inability to precommit to price stability. Such a conjecture about the fiscal-monetary policy mix appears quite relevant in Africa, with deep implications for the incentives of fiscally heterogeneous countries to form a currency union. We calibrate the model to data for West Africa and use it to assess proposed ECOWAS monetary unions. Fiscal heterogeneity indeed appears critical in shaping regional currency blocs that would be mutually beneficial for all their members. In particular, Nigeria's membership in the configurations currently envisaged would not be in the interests of other ECOWAS countries, unless it were accompanied by effective containment on Nigeria's financing needs.

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INTRODUCTION

The elimination of national currencies and their replacement by a common regional currency continues to be a topical subject. It has inspired much research, mainly in the European context, but other regions are now considering the advisability of such a project. The reasons for doing so range from wanting to promote regional solidarity and integration to a fear that independent national currencies may be subject to destabilizing speculation. One example is a project to create a common currency – the *eco* – among 13 countries of West Africa. This project has the particularity that the region already includes a monetary union, the West African Economic and Monetary Union (WAEMU),[2] and those countries that are not members of it propose to create a second monetary zone (the West African Monetary Zone, or WAMZ) by July 2005, with the intention of subsequently merging it with WAEMU.[3] Figure 1 shows the overlapping membership of the CFA franc zone, ECOWAS, and WAMZ.

In this paper, we analyze the main costs and benefits of the proposed monetary unions in West Africa using a simple theoretical framework[4] calibrated to reflect some of the region's key economic and political features. The analysis encompasses traditional "Optimum Currency Area" (OCA) arguments as well as the role of commitment problems in macroeconomic policy, placing a special emphasis on the distortions generated by politically motivated decision makers. More specifically, we assume that governments in power tend to channel public resources toward socially useless activities and that they are ineffective at raising sufficient tax revenues. With politically

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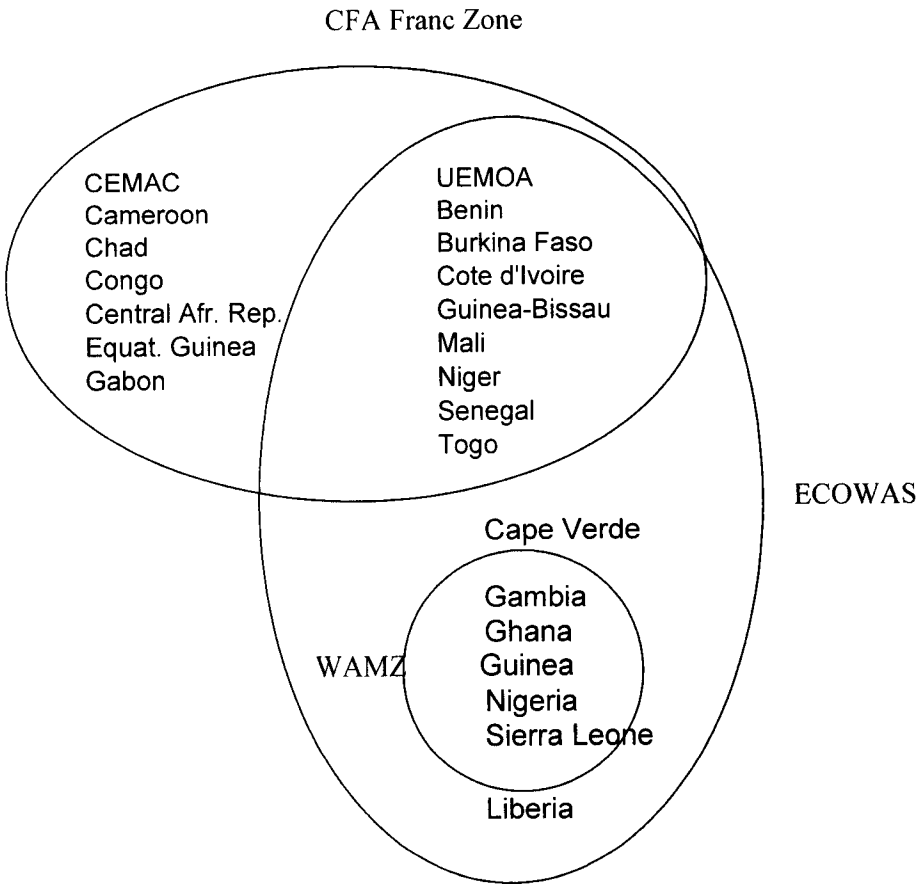
[2] WAEMU, which is part of the CFA franc zone, has 8 members, namely Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo.

[3] These countries are among the 15 countries forming the Economic Community of West African States (ECOWAS). The 5 countries participating in the WAMZ project currently have their own independent currencies: The Gambia, Ghana, Guinea, Nigeria, and Sierra Leone. In addition to these 5 and the 8 WAEMU countries, ECOWAS has two other members: Liberia, which has so far declined to participate in the project, and Cape Verde, whose currency is linked to the euro.

[4] It draws on a theoretical model presented in Debrun (2003).

dependent central banks, such distortions affect monetary policy through the authorities' incentive to extract seigniorage. Differences in fiscal distortions affect incentives for countries to join a given monetary union, and the willingness of existing members to accept new entrants. This aspect is arguably of considerably greater importance in Africa than in Europe, and we present some evidence below on the extent of fiscal distortions.

Figure 1. Membership of CFA Franc Zone and ECOWAS



We consider only the direct effect of monetary unification, not the possible use of supranational institutions to establish anti-inflationary credibility, for instance through an external guarantee of a peg to a hard currency. In the model, net gains or losses from joining a monetary union depend on the correlation of shocks to the terms of trade (TOT)

of members of the union, the political distortions affecting fiscal policy, and the degree of economic integration between them. We calibrate the model to data for West African countries, and examine the desirability of forming a monetary union, either among all the ECOWAS countries,[5] or among a subset of them. Since the parameters cannot be precisely pinned down, a sensitivity analysis is undertaken in order to see if the results about the feasibility of monetary unions are robust in the face of plausible variations of the parameters.

It needs to be recognized, of course, that there may be other incentives to join a monetary union, such as the desire to foster regional integration, for example through trade creation. In addition, the peg of the CFA franc to the euro, and the guarantee of convertibility provided by the French treasury, gives an extra element of stability to the existing WAEMU zone that would presumably not be extended to a greater West-African currency. We do not attempt to model this in the present paper, but we discuss below how initiatives to form a wider monetary union might affect its stability.

The second section of the paper summarizes the theoretical model while Section III describes its calibration. The simulation results are presented and discussed in Section IV. Section V concludes.

THE MODEL

This section summarizes the key features of the theoretical model supporting the simulations.[6] We keep the model as simple as possible and rely on the mainstream literature on European monetary integration, in particular Beetsma and Bovenberg (1998, 1999) and Martin (1995). The relevance of that strand of literature for our exercise is two-fold. First, it emphasizes the

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[5] Guinea-Bissau and Liberia are not considered because of data availability problems, and because the former has only been a member of WAEMU since 1997 and the latter is not participant in the WAMZ project. Cape Verde is not considered either, since it is not a participant in WAMZ and its interest in the wider ECOWAS currency union is unclear.

[6] See Debrun (2003) for systematic comparisons with the relevant literature. A Technical Appendix with the key derivations is available from the authors upon request. For a survey of the recent literature on monetary and fiscal policies in a currency union, see Beetsma and Debrun (2004).

role of commitment problems in macroeconomic policy, an aspect that is particularly relevant in Africa, where credible institutional fixes (i.e. central bank independence and fiscal rules) are harder to implement than in other regions. Second, it is based on straightforward extensions of the highly flexible Barro-Gordon (1983) framework, which allows for neat analytical solutions while, at the same time, addressing the interaction between monetary and fiscal policies and international policy coordination. This approach is well suited to shed light on regional efforts to build a multilateral monetary union similar to the one envisaged in Western Africa. The present multilateral focus sharply contrasts with the treatment of currency unions proposed by Alesina and Barro (2002) who view monetary integration as a process of dollarization in which inflation-prone countries adopt "hard" currencies in a *bilateral* "client-anchor" relationship. Another key difference is that Alesina and Barro (2002) emphasize the induced increase in bilateral trade among the members of a currency union, a dimension that is admittedly less relevant in the African context (see Section III).

We consider a static, *n*-good, *n*-country economic area, which is assumed to be small vis-à-vis the rest of the world. Countries differ only by the size of their GDP, the political distortion affecting fiscal policy design, and random supply shocks. We use log-linear specifications where each variable represents a relative deviation from an arbitrary steady state. Variables or parameters indexed by the subscript *i* are country-specific, the other variables or parameters being identical across countries. All parameters are positive.

As in the related literature, a supply function relates (the log of) output (y) to *unexpected* inflation ($\pi_i - \pi_i^e$). Following Alesina and Tabellini (1987) and many subsequent papers, an ad-valorem tax of τ percent on firms' value added reduces output below its full-employment level (standardized to zero). Individual policies also influence neighboring countries, creating a policy coordination problem (Hamada, 1985). To focus on the key difference between autonomy and

participation in a monetary union, we restrict the coordination problem to monetary policy[7] and assume that, under flexible exchange rates, a monetary expansion in a given country has a contractionary impact on the other countries in the region. Hence, noncoordinated monetary policies entail excessive inflation because of mutually fruitless attempts to offset the negative impact of the neighbors' expansion (Hamada, 1985, Canzoneri and Gray, 1985 or Canzoneri and Henderson, 1991). Martin (1995) provides one possible rationale for negative externalities on the supply side,[8] claiming that multinationals established in different countries constantly reshuffle production in favor of plants located in countries with low real wages achieved through loose monetary policies.

Another rationale that may be particularly relevant in Western Africa is the existence of bottlenecks in the supply of conventional intermediate goods traded at the regional level. Those bottlenecks mainly reflect limited local production capacity (as is often the case for cement or refined petroleum products for instance) and inefficient port and transportation infrastructures (a fact that concerns all intermediate goods imported from overseas such as machinery or vehicles). The Technical Appendix formally derives a supply function consistent with the case of an intermediate good imported from overseas at a fixed dollar price. In the short-medium run, inefficient port and transportation infrastructures make the supply of that good imperfectly elastic so that its local currency price reflects not only nominal exchange rate fluctuations vis-à-vis the dollar but also pressure from domestic demand. Hence, an unexpected monetary expansion in one country stimulates the demand by domestic firms, driving up the price of the intermediate good beyond the rate of depreciation. If intra-regional exchange rates do not overshoot, countries that did not engineer the

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[7] For recent discussions of fiscal coordination problems in monetary unions, see for instance Beetsma, Debrun and Klassen (2001), Andersen (2002) or Uhlig (2002) and the references therein.

[8] Multi-country models in the "new open economy macroeconomics" literature tend to emphasize the terms of trade as the international transmission channel of monetary policy. A monetary expansion worsens the terms of trade, creating a positive spillover for neighbouring countries (see e.g., Clarida, Galì and Gertler, 2002 and the references therein). In reality, such effects should only materialize for "large" countries in the trade-theoretic sense and can be deemed negligible for our analysis of a group of small economies whose policy choices do not influence their terms of trade.

same monetary stimulus face higher local currency price for the intermediate good that results in a contraction of their domestic output.

The magnitude of such spillovers depends on the size of the country initiating the monetary expansion and on the importance of formal and informal trade between that country and its neighbors. This explains why we later link our supply-side externality to the intensity of intra-regional trade flows. In practice though, it is very difficult to quantify cross-border spillovers in Western Africa. A recent case study of the regional economic impact of the political crisis in Côte d'Ivoire nevertheless suggests that they might be quite significant for immediate neighbors (see Doré, Anne and Engmann 2003).

In the supply function (1), the externality is captured by parameters $\theta_{i,k}$ representing the marginal effect of a monetary policy action in country *k* on output in country *i*. We also assume that output is subject to a country-specific terms-of-trade shock ε_i, which is zero-mean, non-autocorrelated and with finite variance $\sigma^2_{\varepsilon_i}$.

$$y_i = c\left(\pi_i - \pi_i^e - \tau_i\right) - \sum_{k \neq i, k=1}^{n} \theta_{i,k} c\left(\pi_k - \pi_k^e\right) + \varepsilon_i \ , \ i = 1,\ldots,n \qquad (1)$$

Following Alesina and Tabellini (1987) and most of the subsequent literature, we impose a one-period budget constraint approximated by equation (2).

$$g_i = \mu\pi_i + \tau_i - \delta_i, \ i = 1,\ldots,n \qquad (2)$$

where g_i and τ_i are the ratios of socially beneficial government spending and fiscal revenues to GDP, respectively, and μ is the inflation tax base. The fixed parameter δ_i accounts for country-specific inefficiencies affecting fiscal policy design, such as tax collection costs, the appropriation of tax revenues by corrupt officials, and the allocation of scarce public resources to socially wasteful

projects.[9] In sum, it symbolizes the dead-weight loss of institutional inefficiencies affecting fiscal policy (as a proportion of total output) and therefore comes as a wedge between the actual tax payments made by firms (which distort production – see equation (1)) and seigniorage revenues on the one hand, and the socially useful government spending on the other hand – see equation (3).

To preserve analytical tractability, and in common with much of the related literature, we assume that policymakers maximize utility functions generalizing Barro and Gordon (1983).[10]

$$U_i^G = \frac{1}{2}\left\{ -a\left(\pi_i - \tilde{\pi}(\varepsilon_i)\right)^2 - b\tau_i^2 - \gamma\left(g_i - \tilde{g}_i\right)^2 \right\} + y_i,\ i = 1,...,n \qquad (3)$$

Equation (3) implies that the marginal benefit (cost) of output gain (loss) is constant whereas deviations of inflation, taxes and expenditure from "ideal" levels (denoted by a tilde and assumed to be zero in the case of taxes) are increasingly costly. Since the linearity in y_i precludes output stabilization policies (i.e. the variance of output does not directly matter to policymakers), we follow Muscatelli (1998) and restore an implicit trade-off between the variability of inflation and the variability of output by making the socially desirable inflation rate contingent on supply shocks as follows: $\tilde{\pi}(\varepsilon_i) = -\eta\varepsilon_i$ with $\eta > 0$. A negative (positive) output shock thus incites the policymaker to tolerate positive (negative) inflation.

With autonomous monetary policies, policymakers independently choose effective tax rates τ_i and inflation rates π_i maximizing (3). Policy choices are made simultaneously by all

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[9] Inefficiencies in developing countries' fiscal policy design are well documented (Gupta et al.,1997, 2000; Mauro, 1998; Robinson and Torvik, 2002). Hefeker (2003) adopts a similar specification of fiscal inefficiency. An obvious alternative to our constant total distortion would be to introduce "iceberg costs", thereby assuming a constant *marginal* distortion. However, the fixed cost conjecture has overwhelming advantages in terms of tractability. As the solution of the model with iceberg costs yields similar results, we do not expect the analysis of monetary integration under this assumption to be qualitatively different.

[10] The quasi-linear specification brings about additional algebraic simplifications (see Alesina, Angeloni and Etro, 2001; Muscatelli, 1998; and Debrun, 2001).

governments, taking the neighbors' policies as given (Nash conjecture[11]), which implicitly supposes flexible exchange rates, as illustrated in the Technical Appendix. The optimal, time-consistent policy mix is derived under standard assumptions, that is complete information, rational expectations and the following sequence of events: (*i*) binding nominal wage contracts are signed, (*ii*) shocks are realized and perfectly observed by all, and (*iii*) monetary and fiscal policies are decided. Under monetary autonomy, the time-consistent policy mix (denoted by a star superscript) for any country *i* can be characterized as follows (see the Technical Appendix for details):

$$\pi_i^* = \frac{\gamma\mu b}{\Lambda}\left(\widetilde{g}_i + \delta_i\right) + \frac{(b+\gamma)+\gamma\mu}{\Lambda}c - \frac{a(b+\gamma)\eta}{\Lambda}\varepsilon_i,\ i = 1,...,n \quad , \tag{4}$$

$$\tau_i^* = \frac{\gamma a}{\Lambda}\left(\widetilde{g}_i + \delta_i\right) - \frac{\gamma\mu\ (1+\mu)+a}{\Lambda}c + \frac{a\gamma\mu\eta}{\Lambda}\varepsilon_i, \tag{5}$$

$$g_i^* = \frac{\gamma\left(a+\mu^2 b\right)}{\Lambda}\widetilde{g}_i - \frac{ab}{\Lambda}\delta_i + \frac{b\mu - a}{\Lambda}c - \frac{ab\mu\eta}{\Lambda}\varepsilon_i, \tag{6}$$

or equivalently,

$$g_i^* + \delta_i = \left[\frac{\gamma a + \gamma\mu^2 b}{\Lambda}\right]\left[\widetilde{g}_i + \delta_i\right] + \left[\frac{b\mu - a}{\Lambda}\right]c + \left[\frac{-a\eta\mu b}{\Lambda}\right]\varepsilon_i,$$

$$\text{with } \Lambda = a(b+\gamma) + \gamma\mu^2 b > 0,$$

Key features of the equilibrium are the following. First, the average inflation rate is unambiguously positive, indicating that tax revenues are on average too low to completely finance the socially beneficial expenditure ($\widetilde{g}_i$) and to make up for the institutional dead-weight loss (δ_i). Second, distortionary tax rates (τ_i) increase with the socially desirable amounts of public spending and the institutional dead-weight loss δ_i, and decrease with the marginal effect of policy instruments

[11] The determination of monetary and fiscal policies might also be envisaged as a Stackelberg leadership game in which credible commitments on fiscal policy actions (e.g. through a formal budgetary process) are made *before* monetary policy is chosen (See Beetsma and Bovenberg, 1998 and Beetsma, Debrun and Klaassen, 2001). However, this presupposes a degree of pre-commitment that we deem unlikely in the specific context considered in this paper.

(τ_i and π_i) on output (c). Indeed, c measures the marginal output cost of taxes but also the marginal output gain from unexpected inflation, so higher c leads to higher equilibrium inflation, greater seigniorage revenues, and, correspondingly, a lesser reliance on tax revenues. Third, equilibrium government spending increases with the desired public spending level $\widetilde{g}_i$ and decreases with the direct and indirect (output) costs of taxation and inflation. Also, the resources wasted in inefficient tax collection or socially useless projects (δ_i) further reduce the equilibrium level of socially beneficial spending (g_i^*).

In equations (4) and (5), the terms in $\widetilde{g}_i + \delta_i$ characterize the trade-off between the direct relative utility costs of collecting revenues (either through inflation or distortionary taxes) on the one hand, and the need to finance socially useful expenditure *and* to make up for wasted resources, on the other hand. To simplify discussions involving that trade-off, we will hereafter refer to $\widetilde{g}_i + \delta_i$ as government i's *unconstrained financing needs* (UFN). In the same equations, the terms in c capture the typical Barro-Gordon inflation bias and an additional incentive to rely on the inflationary financing stemming from the output cost of distortionary taxation. The inflation bias distorts the ex-ante optimal outcome that would prevail if the policymakers were able to make credible commitments on inflation,[12] and in doing so, relaxes the budget constraint, allowing higher spending and lower taxes which in turn lead to greater output. In other words, the distortion resulting from the lack of commitment shifts the burden of financing expenditure from taxation to inflation.[13]

In a monetary union (MU), monetary policy is decided by a common central bank (CCB) whose actions maximize a GDP-weighted average of individual policymakers' utility functions—see equation (7).

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[12] The "commitment" solution is discussed in Debrun (2003).

[13] See also Alesina and Tabellini (1987).

$$U^{CCB} = \sum_{i=1}^{n} \omega_i U_i^G \tag{7}$$

$$\text{with } \omega_i > 0, \forall i \text{ and } \sum_{i=1}^{n} \omega_i = 1$$

It is crucial at this stage to note that we seek to isolate the "pure" effect of monetary unification on policy outcomes. Therefore, we refrain from considering the delegation of national monetary power to a supranational central bank as an external fix to domestic institutional weaknesses; instead, we assume that the CCB is subject to the same type of political pressures as a national central bank would be. The only difference is that, in a monetary union, individual pressures are diluted according to the relative weight of the country in the joint decision process.

The time consistent policy mix is described by the equations (8) to (10), where a subscript MU stands for monetary union and a subscript A designates cross-country, ω-weighted averages, that is $x_A = \sum_{i=1}^{n} \omega_i x_i$ for $x \in \{ \tilde{g}, \delta, \varepsilon \}$, while

$$\theta_A = \sum_{i \in N} \sum_{j \in N} \omega_i \theta_{i,j} \Big/ \sum_{i \in N} \omega_i$$

where the set N represents the countries in the monetary union and $\theta_{i,i} = 0$. Hence, θ_A captures the extent to which monetary unification leads to internalize the monetary policy externalities prevailing under autonomous policy making.

For simplicity of exposition, we only reproduce here the solution for a monetary union among the n countries.[14] Moreover, to ease comparisons with the case of autonomy, it is useful to introduce the parameter $\Psi_i = \tilde{g}_A / \tilde{g}_i$ which captures the discrepancy between country i's spending objective and the aggregate spending objective considered by the CCB. If different from 1, the common monetary policy fails to achieve the optimal trade-off between tax and monetary financing for country

[14] Debrun (2003) develops the general solution where only a subset of countries would form a monetary union.

i. Finally, we will also assume that $\delta_A/\delta_i = \Psi_i$, which is tantamount to saying that the impact of institutional failures on fiscal policies is strictly proportional to the desired size of the government (as captured by $\tilde{g}_i$). That assumption – supported by the empirical evidence reported in Table 1 – proves convenient in the welfare analysis because it allows expressing the equations of interest in terms of the government's unconstrained financing need (UFN) as a whole.

$$\pi^*_{MU} = \frac{\gamma\mu b}{\Lambda}\left(\tilde{g}_A + \delta_A\right) + \frac{\left(1-\theta_A\right)\left(b+\gamma\right)+\gamma\mu}{\Lambda}c - \frac{a(b+\gamma)\eta}{\Lambda}\varepsilon_A, \tag{8}$$

$$\tau^*_{i,MU} = \left[\frac{a\gamma}{\Lambda} + \frac{\gamma^2\mu^2 b\left[1-\Psi_i\right]}{(b+\gamma)\Lambda}\right]\left(\tilde{g}_i + \delta_i\right) - \frac{\gamma\mu\left(1-\theta_A+\mu\right)+a}{\Lambda}c + \frac{a\gamma\mu\eta}{\Lambda}\varepsilon_A, \tag{9}$$

$$\begin{aligned} g^*_{i,MU} = {} & \left[\frac{\gamma\mu^2 b^2\Psi_i}{(b+\gamma)\Lambda}\right]\left(\tilde{g}_i + \delta_i\right) + \left(b+\gamma\right)^{-1}\left(\gamma\ \tilde{g}_i - b\delta_i\right) \\ & + \frac{\left(1-\theta_A\right)b\mu - a}{\Lambda}c - \frac{ab\mu\eta}{\Lambda}\varepsilon_A \ , \end{aligned} \tag{10}$$

or equivalently,

$$\Leftrightarrow g^*_{i,MU} + \delta_i = \left[\frac{a\gamma(b+\gamma)+\gamma\mu^2 b(b\Psi_i+\gamma)}{(b+\gamma)\Lambda}\right]\left[\tilde{g}_i + \delta_i\right] + \left[\frac{\left(1-\theta_A\right)b\mu - a}{\Lambda}\right]c - \left[\frac{ab\mu\eta}{\Lambda}\right]\varepsilon_i$$

From equation (8), we see that the common monetary policy (inflation rate) depends on the average UFN in the area while it only stabilizes the average supply shock. The properties of the equilibrium policy mix reflect the fact that the gains from monetary unification essentially depend on the ability of the new regime to address the excessive inflation problem and the implications of the latter on fiscal strategies. Specifically, the CCB is able to credibly reduce average inflation with respect to autonomy because it internalizes the adverse external effects of individual monetary expansions. In that sense, monetary unification serves as a partial surrogate to the credible appointment of a conservative central banker. With the CCB now determining seigniorage revenues according to union-wide objectives, policymakers need to adjust national tax and expenditure choices.

Having obtained closed-form solutions for the time-consistent policy mix under autonomy and monetary union, we can derive the net welfare effect of participating in the monetary union against the alternative of autonomous monetary policy. Denoting by E_{-1} mathematical expectations taken before the first stage of the game, the net welfare effect of monetary integration for some country i is defined as follows:

$$\begin{aligned} E_{-1}G_i(n) &\equiv E_{-1}U_i^G\big|_{MU} - E_{-1}U_i^G\big|_{Autonomy} \\ &= \frac{\theta_A(2-\theta_A)(b+\gamma)}{2\Lambda}c^2 \\ &+ \frac{\gamma\mu b(1-\Psi_i)(\tilde{g}_i+\delta_i)}{\Lambda}\left[(1-\theta_A)c - \frac{\gamma\mu b(1-\Psi_i)(\tilde{g}_i+\delta_i)}{2(b+\gamma)}\right], \\ &- \frac{a^2\eta^2(b+\gamma)(1-\omega_i)^2}{2\Lambda}\left[\sigma_{\varepsilon_i}^2 + \sigma_{\bar{\varepsilon}_{-i}}^2 - 2\,\mathrm{cov}(\varepsilon_i, \bar{\varepsilon}_{-i})\right] \end{aligned} \tag{11}$$

where σ_x^2 symbolizes the variance of a random variable x and $\bar{\varepsilon}_{-i} = \sum_{k\neq i}\left(\omega_k \big/ 1-\omega_i\right)\varepsilon_k$ (the GDP-weighted average of supply shocks across the $n-1$ other member states of the monetary union) so that $\varepsilon_{-i} = \omega_i\,\varepsilon_i + (1-\omega_i)\,\bar{\varepsilon}_{-i}$.

The first line of the right-hand side of (11) is strictly positive, showing the unambiguous benefits from a lower Barro-Gordon inflationary bias. The second line summarizes the effect of cross-country differences in governments' financing needs. The latter is country-specific and ambiguous. It ultimately depends on the sign and magnitude of the discrepancy between an individual government's UFN and the union's average. On the one hand, cross country differences in UFN contribute to decrease individual welfare because the union-wide inflation rate will only by chance coincide with a country's desired trade-off between seigniorage and tax revenues. On the other hand, profligate governments (i.e. with a relatively high UFN, or $\Psi_i < 1$) benefit from the participation of more fiscally conservative partners (i.e. countries with lower UFN, or $\Psi_i > 1$) because the latter impose

some restraint on the CCB, thereby amplifying the reduction in average inflation rate profligate countries expect from monetary unification. Correspondingly, countries with small UFN suffer from the pressure exerted by others on the CCB to produce greater monetary financing , thereby mitigating the gains from CCB's pseudo-conservatism. Also notice that the relative importance of these effects on governments' utility increases when the impact of unification on monetary discipline is smaller – that is when $\left(1-\theta_A^h\right)$ is larger. Net losses due to fiscal heterogeneity may thus more than offset the gains derived from the pseudo-conservatism of the CCB. As the model assumes that the pressure exerted by a country on the CCB is proportional to its size, the joint cross-country distribution of sizes and financing needs should be critical to determine the equilibrium configuration of monetary unions in the region.

The third line of (11) accounts for the suboptimal stabilization of country-specific shocks by the CCB. That term is equal to zero if and only if $\sigma_{\varepsilon_i}^2 = \sigma_{\bar{\varepsilon}_{-i}}^2$ and $corr\left(\varepsilon_i, \bar{\varepsilon}_{-i}\right) = 1$.

Overall, equation (11) indicates that the decision to form a monetary union rests on a trade-off between the benefits of having a supranational currency intrinsically more stable than the national currency and the costs associated with idiosyncrasies.[15] In addition to shock asymmetry, our model emphasizes the differences in the financing needs by governments of potential member states.

CALIBRATION

The model summarized above implies that for any country, the net gains from joining a monetary union depend on: (1) differences in governments' financing needs; (2) the correlation of their shocks with those of other members; and (3) the strength of negative monetary policy externalities (which depends on the intensity of trade linkages). Size differences among countries also

[15] In their study of international unions, Alesina, Angeloni and Etro (2001) also note: "central to the political economy of all unions is the existence of a tension between the heterogeneity of individual countries' preferences and the advantage of taking certain decisions in common."

influence the prospects of particular monetary union configurations. Broadly, the stylized facts on these points in West Africa are as follows. (1) Concerning fiscal policy, WAEMU countries had higher revenue, lower spending, lower deficits (as ratios to GDP) and substantially lower inflation relative to WAMZ countries on average during 1996–2000 (Appendix Table A.1).[16] Our calculation of the fiscal policy distortion discussed below also uses an institutional quality index, which varies substantially across the countries (see Table 1). (2) Terms of trade (TOT) shocks (measured by standard deviations of changes in the TOT) are large, and are typically not well-correlated across the ECOWAS countries (Table A.2), due in large part to differences in commodity exports. In particular, as Nigeria is the only net oil exporter, its TOT changes are negatively correlated on average with those of the rest of the countries. Note also that the correlations tend to be higher for the WAEMU countries among themselves than either the correlation of WAEMU with non-WAEMU countries or the correlations among non-WAEMU countries. (3) Internal trade within the ECOWAS region is relatively small, at a little over 10 percent of the average of exports and imports (Masson and Pattillo, 2001), indicating that the level of the monetary policy externality in the model is relatively low. The WAEMU countries however trade considerably more among themselves than do the WAMZ countries, in part because of the pre-existing monetary union among WAEMU countries and of the inevitably more intense trade flows between coastal and landlocked countries in the WAEMU.[17]

Besides the negative supply-side externality conjectured in the model, negative spillover effects of unexpected inflationary shocks or depreciations on output in neighboring countries may in

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[16] Of course, period averages can conceal large variability. For example, while fiscal performance in WAEMU generally improved in the post-devaluation period 1994–97, there has been marked deterioration since then, partly due to unfavorable terms of trade developments, but also caused by weak policies in several countries (Doré and Masson, 2002). While Nigeria's fiscal position varies substantially with the volatile oil price cycles, the 1996–2000 period is not particularly atypical. Oil prices were in the moderate range, except in 2000 when they were high.

[17] All WAMZ countries have access to sea. As documented in Doré, Anne and Engmann (2003, table 13), the share of imports from Côte d'Ivoire is much larger for its landlocked neighbours than for those having access to sea.

practice also operate through demand-side channels. The latter may be relevant in the case of Nigeria and its neighbors, for example, as Nigeria has substantial parallel trade with the WAEMU countries bordering it. In particular, Nigeria and Niger share a long, porous border over which substantial amounts of livestock, food products, textiles and small manufactures are traded. Depreciations in Nigeria, or other changes in Nigeria's trade and exchange rate policies have significant effects on cross-border trade, real exchange rates on the naira/CFA parallel market, and real incomes in Niger (Dissou and Dorosh, 1998).

There is broad consistency between the model's predictions about the monetary-fiscal policy mix and the experience in Western Africa. The model predicts that after joining a monetary union, countries would have lower inflation, further implying that expenditure would be financed with higher taxes. Some supporting evidence, noted above, comes from the comparison of the WAEMU countries with their WAMZ neighbors which have retained substantial monetary autonomy. Inflation is substantially lower, and revenues higher, in the WAEMU countries (Appendix Table A.1). Although they are each special cases, it is also interesting to look at the inflation experiences of countries that were not continuously part of the CFA franc. These include Mali, which left the franc zone at independence, but rejoined it in 1984; Equatorial Guinea, a former Spanish colony, which joined the Central African currency zone in 1985; and Guinea-Bissau, a former Portuguese colony which joined WAEMU in 1997. For all three countries, Appendix Table A.3 shows that inflation has been dramatically lower in the period after joining the CFA zone relative to a pre-monetary union period beginning in 1970. The comparison is even more stark excluding 1994/95, the two years influenced by the CFA franc devaluation.

To calibrate the model, we need to determine values for parameters related of the supply function (equation (1)), the government budget constraint (equation (2)), and the government utility function (equation (3)). Some of these parameters are country-specific, and others are assumed to be the same for all countries. In this section as well as the next, we discuss the sensitivity of our results to alternative parameterizations.

Looking first at the log-linear supply function (1), we calibrate the term σ_{ε_i} so that it properly reflects the impact of term-of-trade variability on domestic output.[18] It is appropriate to scale the variance of the terms of trade by the degree of openness of the economy, because changes in the trade balance affect output in proportion the importance of trade for the economy[19][20]

One of the potentially important considerations in discussing the costs of monetary unions is the asymmetry of shocks facing participating countries. This asymmetry is measured by the extent to which the correlation matrix of terms of trade shocks (Table A.2) departs from the unit matrix . In fact, as we shall see below, asymmetry of external shocks does not play a great role in the analysis, even when we calculate openness as the sum (not the average) of exports and imports, divided by GDP.

Turning to the externality parameters, the $\theta_{i,k}$'s are calibrated to the data for country *i's* exports to country *k*, scaled by the GDP of country *i*, since we are considering the supply function for country *i*. This matrix is given in Table A.4, and is based on DOT data, taken for 1999 or the most recent year for which data were available. There are many zeros, which may be due to missing data

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[18] Kose and Riezman (2001) provide evidence of the importance of terms of trade shocks for African economies.

[19] Writing the level of output as the sum of domestic demand (DD) and net exports ($p_X X - p_M M$), $Y = DD + p_X X - p_M M$, we see that, if trade is initially balanced, and we normalize the initial price indices to equal unity, it is the case in differential form that

$$\frac{dY}{Y} = \frac{dDD}{Y} + \frac{d(X-M)}{Y} + \frac{X}{Y}\left(\frac{dp_X}{p_X} - \frac{dp_M}{p_M}\right).$$

The last term in parentheses is the change in the terms of trade. If trade is not balanced, then the expression can be written in terms of the average of exports and imports, and a further term in the sum of changes in the price of imports and exports appears, multiplied by the trade balance. We ignore the latter term as being of second order; the standard deviation of the TOT shocks is thus scaled by openness to get the relevant σ_ε (see columns 1–3 of Appendix Table A.2).

[20] Openness is calculated from exports and imports of goods and services taken either from the *Balance of Payments Yearbook 2001,* the *Direction of Trade Statistics Yearbook 2001* (DOT), or *International Financial Statistics.* Generally, the sources agreed, but in some cases data were missing or a very low ratio suggested data problems, so an alternative source was used.

rather than the absence of trade. Moreover, informal trade is by definition omitted, so we make an ad hoc adjustment for it by increasing all the $\theta_{i,k}$ by 25 percent[21].

Another parameter deriving from the supply function is θ_A, which depends on the composition of the monetary union: it is a GDP weighted average of the trade linkages among the various countries that are included, scaled by the total GDP of the zone. We obtain θ_A=*0.0399* for the WAEMU and θ_A=*0.0591* for the full ECOWAS monetary union. The scale of the externality parameter is critical for the existence of feasible monetary unions. Indeed, absent that feature (that is for $\theta_A = 0$), fiscal heterogeneity would always entail net welfare losses for all countries with relatively low financing needs, as can be seen from setting $\theta_A = 0$ in equation (11) – the first terms on the right-hand side would be zero while the other two terms would be unambiguously negative for all countries with $\Psi_i > 1$. Thus, increasing this parameter by 25 percent has a positive effect on expected utility levels under a monetary union although this ad hoc adjustment in externality parameters turns out to have no qualitative impact on the simulation results.

Second, turning to the government instantaneous budget constraint (equation (2)), data for inflation and government spending and taxes as ratios to GDP are readily available (Table A.1) and allow calculation of μ, the hypothetical tax base on which to apply the inflation tax in order to balance the government's budget. Since the model requires this parameter to be the same for all countries, we calculate it from the average for the 5 non-WAEMU countries in our sample:[22] the deficit (with sign reversed), divided by inflation, provides the estimate: $\mu = 7.64 / 15.23 = .50$. An alternative would

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[21] This adjustment is fairly conservative, in the light of existing estimates of the size of informal trade. As monetary policy externalities are proportional to trade openness, the adjustment increases the benefits from monetary unification, but leaves unchanged the costs of heterogeneity (asymmetric shocks and country-specific fiscal regime).

[22] These countries are the closest to the regime of monetary discretion assumed in the theoretical model.

be to use the money/income ratio, but doing so would hardly be consistent with the no-borrowing constraint of equation (2) and might not capture all the sources of seigniorage.

Third, we have emphasized the effects of political distortions on the design of fiscal policy, assuming that resources were diverted from socially productive ends to benefit private interests. For any amount of socially desirable spending $\tilde{g}_t$, that fiscal wedge increases the government's financing needs by δ_t percent of GDP, resulting in higher inflation and tax rates. As the analysis in the previous section shows, the UFN is the relevant concept to study the equilibrium policy mix in the context of our model.

Estimating UFN is challenging because its components ($\tilde{g}_t$ and δ_t) are unobservable. Taking expenditures on health and education as the best possible proxies for the socially beneficial expenditure entering in g_t, we turn to the data to identify and eventually estimate the systematic *underspending* on those specific items predicted by our theoretical model as being a result of δ_t – see equation (6). In line with a growing literature on the economic impact of institutions (e.g. Mauro, 1998 and Gupta, Davoodi and Tiongson, 2000), our own regressions explaining government expenditure on health and education in a cross-section of African countries (as of 1999) confirm that countries with poor institutions (and therefore more diversion) spend relatively *less* on health and education, than countries with good institutions.

To estimate the extent of resource diversion in the countries of our sample, we compare actual outlays on health and education with the expenditure levels predicted by the empirical equations under the highest possible ranking of our index of institutional quality, implicitly assuming that "perfect" institutions lead to zero diversion[23] (see "no diversion" columns in Table 1). For each sector, resource diversion is thus the difference between the actual and the hypothetical figures.

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[23] Admittedly, perfect institutions are not of this world. The same is probably true for the absence of political distortions in the policymaking process.

Since social (and governments') *objectives* in terms of public spending (that is $\tilde{g}_i$) are unobservable as well, we take *actual* public expenditure as a proxy of the desired level of socially beneficial spending. We thereby assume that the population would ideally like its government to allocate 100 percent of actual outlays on items it deems desirable, which seems both legitimate and plausible. To obtain the UFN, we thus increase actual public spending (our proxy for $\tilde{g}_i$) by a factor $\left(1+\frac{\delta_i^{HE}}{2\left(g_i^{HE}+\delta_i^{HE}\right)}\right)$, which is (one plus half of)[24] the estimated resource diversion in percentage of the no-diversion spending levels (third and fifth columns in Table 1).

Fourth, the utility function parameters are directly borrowed from Debrun, Masson and Pattillo (2002) whose slightly different specification allowed us to calibrate a, b, and γ directly on the basis of observed fiscal data for countries in the region.[25] Appendix I in Debrun, Masson and Pattillo (2002) describes in detail the calibration of utility function parameters *a, b,* and γ as functions of *c*. Normalizing *c=1*, we derived the following baseline values for the other parameters: *a=0.9657, b=9.0759, γ=1.7723.*

Testing sensitivity of the simulations to halving and doubling each of the three parameters in turn, keeping the others constant (see Debrun, Masson and Pattillo, 2002) showed that although the magnitude of the gains differed considerably from the baseline case presented below, signs were preserved in 80 percent of the cases, indicating that incentives to join a monetary union were relatively robust to substantial deviations from the set of baseline parameters.

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[24] We apply only half of the estimated diversion to be conservative in our estimates.

[25] It should be noted however that the welfare effects of monetary unification are identical to those calculated in Debrun, Masson and Pattillo (2002).

Table 1. Expenditure on Priority Sectors: Estimates of the Diversion Effect

	ICRG Institutional Quality Index	Health (1999)		Education (1999)		Diversion in Percent of No Diversion	Government Spending	
		Actual	No Diversion	Actual	No Diversion		Actual 1/	UFN
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				(In percentage of GDP)				
Benin 2/	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	18.5	21.6
Burkina Faso	4.3	1.2	2.6	2.0	2.9	42.2	24.9	30.2
Cote d'Ivoire	5.5	1.2	2.3	5.5	6.2	21.5	20.8	23.0
Gambia, The	5.6	1.6	2.6	2.6	3.2	29.3	24.5	28.1
Ghana	5.6	1.4	2.7	n.a.	n.a.	47.7	28.2	35.0
Guinea	4.6	2.1	3.3	1.6	2.4	35.7	16.4	19.3
Mali	3.4	1.9	3.4	2.2	3.2	38.2	22.8	27.2
Niger	4.0	1.4	2.8	n.a.	n.a.	49.9	16.1	20.1
Nigeria	4.2	0.7	2.4	n.a.	n.a.	70.6	31.4	42.5
Senegal	5.3	2.6	3.6	3.6	4.3	21.6	20.2	22.4
Sierra Leone	3.0	1.0	2.7	1.1	2.2	57.6	20.1	25.9
Togo	3.4	1.1	2.8	4.2	5.2	34.0	19.7	23.0
ECOWAS average	4.4	1.5	2.8	2.8	3.7	40.8	22.0	26.5
WAEMU average	4.7	1.6	2.9	3.5	4.4	34.6	20.4	23.9
WAMZ average	4.6	1.4	2.7	1.7	2.6	48.5	22.8	30.2

Note: The health expenditure regression includes a constant, the log of GDP per capita at PPP (average 1990–97), an index of institutional quality (simple average of ICRG indices for political stability, democratic accountability and corruption, ranging from 0–10, higher numbers indicating better institutions), a dummy identifying countries with HIV/AIDS prevalence rate above 10 percent, life expectancy and infant mortality. The sample consists of 34 African countries and estimates were obtained by OLS. No institutional data were available for Benin. The education expenditure regression includes a constant, the log of GDP per capita at PPP (average 1984–98), illiteracy and an interaction variable between illiteracy and institutional quality (simple average of ICRG indices for political stability, democratic accountability, corruption, rule of law and bureaucratic quality). Here, the sample only consists of 24 African countries due to missing data. Averages across countries are unweighted.

1/ Average over 1996–2000.
2/ For Benin, the spending target is based on WAEMU average diversion.

IV. SIMULATIONS

Table 2 gives the net gains from a monetary union among existing WAEMU member states for the countries individually, using baseline parameter values. Since the theoretical model assumes that the common central bank follows discretionary strategies, those results ignore the utility value of the particular commitment technology available to the BCEAO—WAEMU's central bank—namely a peg between the CFA franc and the euro guaranteed by the French Treasury. Such an arrangement has specific origins that are quite distinct from the constitution of a monetary union.[26]

Table 2 indicates that participation in a monetary union is better than independent policies (and separate currencies) for all of the WAEMU member states. The magnitude of the gains, which are to be interpreted as permanent log changes in GDP equivalents (see equation 3), are sizeable. It can be seen that the countries with the most profligate fiscal policies (values of Ψ smaller than unity), in particular Burkina Faso and Mali, are the greatest gainers relative to independent monetary policies; while the most fiscally conservative member states—Benin and Niger—post relatively small gains. As illustrated by Table 4 below, this reflects the fact that the traditional pillar of OCA analysis—the requirement of some symmetry in the shocks—is nowhere near as important here as differences in spending propensities in determining net gains from monetary unification. Again, one should keep in mind that this assessment is made under the assumption that the common central bank follows discretionary strategies, and that, unlike the actual situation of the WAEMU countries, the exchange rate of the common currency can adjust to exogenous shocks. Admittedly, the utility impact of shocks would be larger than suggested by Table 4 if the decision to form the monetary union was paired with the decision to adopt an external peg for the region's currency. While fiscally profligate countries benefit from a central bank they perceive as less accommodative, the fiscally conservative

[26] A similar agreement, but not in the context of monetary union, has been extended to Cape Verde by Portugal, to maintain an exchange rate link with the euro.

member states suffer from the excessive monetary financing those less conservative countries manage to extract. This partly explains why Niger finds its participation only marginally beneficial (also due to the effect of the negative correlation of its shocks with the rest of the Union) while Burkina Faso and Mali record above-average gains with respect to monetary autonomy.

Table 2. WAEMU: Net Benefits 1/

Country	ω	Gain Rel. to Indep.	Correlation	Ψ
Benin	0.0824	0.0217	0.6911	1.0939
Burkina	0.0985	0.0793	0.6009	0.7847
Cote d'Ivoire	0.4137	0.0349	0.7737	1.0300
Mali	0.0987	0.0609	0.4905	0.8719
Niger	0.0729	0.0148	-0.3161	1.1780
Senegal	0.1816	0.0310	0.8331	1.0581
Togo	0.0521	0.0346	0.5628	1.0276

1/ a=0.9657,b=9.0759,γ=1.7723,c =1,η=1,μ=0.50,θ_A =0.0399.

Table 3. ECOWAS Monetary Union: Net Benefits for Participants 1/

Country	ω	Gain. Rel. to Indep.	Correlation	Ψ	Gain Rel. to WAEMU
Benin	0.0340	-0.0175	0.2677	1.4922	-0.0392
Burkina	0.0406	0.0425	0.1979	1.0704	-0.0367
Cote d'Ivoire	0.1706	-0.0042	0.0508	1.4051	-0.0390
Mali	0.0407	0.0236	0.1523	1.1893	-0.0373
Niger	0.0301	-0.0242	-0.2465	1.6069	-0.0390
Senegal	0.0749	-0.0075	0.3455	1.4434	-0.0386
Togo	0.0215	-0.0032	0.4255	1.4017	-0.0378
Gambia	0.0061	0.0238	0.2277	1.1499	n.a.
Ghana	0.1078	0.0692	-0.2748	0.9232	n.a.
Guinea	0.0597	-0.0275	0.5914	1.6706	n.a.
Nigeria	0.4037	0.1155	0.9429	0.7594	n.a.
Sierra Leone	0.0104	0.0147	-0.1986	1.2447	n.a.

1/ θ_A =0.0591

Table 3 does a welfare calculation for a monetary union among the full set of ECOWAS countries. The same factors as those cited above explain why Burkina Faso and Mali are the only WAEMU member states that would prefer participation in a full ECOWAS monetary union over independent monetary policies (we will consider below whether this is the relevant comparison) while all but one (Guinea) of the non-WAEMU countries would express the same preference. Unsurprisingly, Guinea has the lowest financing needs (UFN) among non-WAEMU countries and the largest gainer among them, Nigeria, has the largest UFN.

Looking more carefully into the various ways participation in the monetary union may affect governments' utility, we calculate the net loss/gain due to the cross-country differences in the spending objectives (A) and the net loss due to asymmetric shocks (B)—see Table 4. A residual term (C) mainly captures the net gain stemming from the reduced incentives of the CCB to boost output through unexpected inflation.

It can be seen that the disciplinary effect (C) is relatively large for all the countries considered. In contrast, the costs stemming from suboptimal stabilization in the presence of asymmetric shocks (B) are small, representing often less than 10 percent of C. As a consequence, the determining factor in the net gain or loss expected from participation in a greater ECOWAS monetary union is the country's position in the cross-country distribution of financing needs, represented by the value of Ψ_i. In particular, Table 4 shows that the two countries characterized by $\Psi_i < 1$ (Ghana and Nigeria) exhibit a positive A, meaning that they take advantage of sharing a common central bank with more conservative member states. At the other end of the distribution, countries characterized by $\Psi_i \gtrsim 1.4$ (small UFN relative to union's average) appear to lose more from the pressures of their profligate partners on the CCB than they gain from the disciplinary effect of centralized policy making: $|A| > C$. If trade were not scaled up by 25 percent to account for informal trade, then C (and hence also the net gains) would be reduced by about 0.01 for all countries. As can be seen from Table 4,

this would not change the signs of the net gains: most countries, except Nigeria and Ghana, would lose from monetary union, while those countries would be substantial net gainers.

More relevant for WAEMU countries, however, is a comparison of the full ECOWAS monetary union with the utility derived from being members of a smaller monetary union. The last column of Table 3 suggests that all WAEMU countries would record comparable losses from the full ECOWAS monetary union[27]. Of course, that comparison ignores the induced changes in the institutional architecture of the monetary union. In particular, we do not consider the value of the BCEAO's commitment to peg the CFA franc to the euro and in practice, it is unclear whether the CCB of the full ECOWAS could rely on a comparable commitment technology.

Table 4. Decomposition of the Net Gain from a Monetary Union Among ECOWAS Countries Relative to Monetary Autonomy

	Ψ_i	A	B	C	Net Gain/Loss
Benin	1.4922	-0.0730	-0.0068	0.0623	-0.0175
Burkina Faso	1.0704	-0.0142	-0.0022	0.0589	0.0425
Cote d'Ivoire	1.4051	-0.0635	-0.0024	0.0617	-0.0042
Mali	1.1893	-0.0346	-0.0019	0.0601	0.0236
Niger	1.6069	-0.0840	-0.0032	0.0630	-0.0242
Senegal	1.4434	-0.0678	-0.0017	0.0620	-0.0075
Togo	1.4017	-0.0631	-0.0018	0.0617	-0.0032
The Gambia	1.1499	-0.0283	-0.0077	0.0598	0.0238
Ghana	0.9232	0.0176	-0.0055	0.0571	0.0692
Guinea	1.6706	-0.0895	-0.0012	0.0632	-0.0275
Nigeria	0.7594	0.0655	-0.0041	0.0541	0.1155
Sierra Leone	1.2447	-0.0429	-0.0030	0.0606	0.0147

[27] These losses would be increased if no account were taken of informal trade.

Those politically sensitive and economically crucial matters could give additional incentives to WAEMU member states to resist a wider monetary union or to strictly limit its membership. In any case, even a mere extension of the WAEMU that preserved present institutional arrangements would have to be reviewed by France and its European Union partners and it is likely that any risk of a substantial revision of the guarantee currently extended to the BCEAO would undermine the willingness of WAEMU member states to engage in a significant enlargement of the Union. However, such a risk is also an opportunity for WAEMU member states in the sense that it gives them a considerable bargaining power in negotiations with potential entrants. Since our simulations clearly identify disciplinary gains as the key motivation for non-WAEMU countries (except Guinea) to join a greater ECOWAS monetary union, WAEMU countries—as Germany during the negotiation of the Maastricht Treaty[28]—might be in a position to obtain serious institutional guarantees concerning, for instance, safeguards on the statutory independence of the CCB, a monetary policy framework conducive to price stability, and the strict application of entry criteria, including the requirement for fiscal discipline.

We now turn to whether WAMZ would likely be a feasible and durable monetary union on its own. The results in Table 5 indicate that it would not, for the same reasons that the full ECOWAS monetary union was not. All countries except Nigeria would be worse off than if they retained their own monetary policies. Nigeria has both very different terms of trade shocks and less disciplined fiscal policies than some of the other countries that are prospective members of the WAMZ. Given its size, it would dominate the monetary policy of the union, provided the union operated a discretionary monetary policy (rather than being tied to an external anchor through a currency board, for instance).

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[28] Debrun (2001) shows that Germany might have enjoyed a large bargaining power because other countries saw their participation in the European Monetary Union as a surrogate to building credible monetary institutions at home.

In this regard, an ECOWAS monetary union would be more desirable, as Nigeria would have a somewhat smaller weight. As proposed, the WAMZ is only viewed as a way-station toward the full ECOWAS union, and as a way of speeding the transition.

Table 5. WAMZ Monetary Union 1/

Country	ω	Gain Rel. to Indept.	Correlation	Ψ
Gambia	0.0103	-0.0592	0.1298	1.3652
Ghana	0.1833	-0.0121	-0.4325	1.0961
Guinea	0.1016	-0.1138	0.6109	1.9835
Nigeria	0.6870	0.0456	0.9912	0.9016
Sierra Leone	0.0178	-0.0702	-0.3191	1.4778

1/ $\theta_A = 0.0201$

Finally, Table 6 considers whether adding a single country to a monetary union made of WAEMU countries would be incentive compatible both for the entrant and the existing members. In each case, entry is in the interest of the newcomer. However, existing members would only welcome The Gambia or Guinea, although for Sierra Leone, the negative effects on other countries are so small as to be negligible, and hence WAEMU members might not object to admitting Sierra Leone as well. In contrast, Nigeria and to a much lesser extent Ghana would have negative effects on existing members if they joined. When Nigeria is added, each of the other countries' correlations with the union's average shock goes down, while Nigeria's correlation exceeds 0.9. Nigeria's dominance in terms of size would, according to our model, grant it the greatest influence on the union's monetary policy. Through this channel, the large financing needs of Nigeria's government and Nigeria-specific shocks to its terms of trade would have significant negative externalities on other countries. Also, Ghana has the second largest UFN among WAMZ countries, and would have a significant weight in the union's monetary policy.

Table 6. Adding Countries Individually to WAEMU

Country	ω	Gain Rel to Indep.	Correlation	Ψ	Gain Rel. to WAEMU
		Adding The Gambia 1/			
Benin	0.0812	0.0221	0.6808	1.0969	0.0005
Burkina	0.0971	0.0797	0.6058	0.7868	0.0005
Cote d'Ivoire	0.4077	0.0353	0.7735	1.0328	0.0005
Mali	0.0973	0.0614	0.4921	0.8742	0.0005
Niger	0.0719	0.0152	-0.3251	1.1812	0.0005
Senegal	0.1790	0.0315	0.8459	1.0610	0.0005
Togo	0.0513	0.0350	0.5497	1.0304	0.0004
Gambia	0.0145	0.0615	0.4915	0.8452	n.a.
		Adding Ghana 2/			
Benin	0.0653	0.0150	0.6104	1.2022	-0.0066
Burkina	0.0781	0.0729	0.4780	0.8623	-0.0064
Cote d'Ivoire	0.3280	0.0285	0.8416	1.1319	-0.0064
Mali	0.0783	0.0544	0.3691	0.9581	-0.0065
Niger	0.0578	0.0081	-0.1956	1.2945	-0.0067
Senegal	0.1440	0.0243	0.6869	1.1628	-0.0067
Togo	0.0413	0.0278	0.4436	1.1292	-0.0067
Ghana	0.2072	0.1017	0.8466	0.7438	n.a.
		Adding Guinea 3/			
Benin	0.0720	0.0227	0.6335	1.0685	0.0010
Burkina	0.0860	0.0806	0.6426	0.7665	0.0013
Cote d'Ivoire	0.3614	0.0361	0.7206	1.0061	0.0013
Mali	0.0862	0.0623	0.5478	0.8516	0.0014
Niger	0.0637	0.0162	-0.3366	1.1506	0.0015
Senegal	0.1587	0.0324	0.8844	1.0336	0.0014
Togo	0.0455	0.0359	0.5644	1.0337	0.0013
Guinea	0.1265	0.0117	0.2176	1.1963	n.a.
		Adding Nigeria 4/			
Benin	0.0416	-0.0382	0.2246	1.5249	-0.0599
Burkina	0.0498	0.0228	0.1548	1.0938	-0.0564
Cote d'Ivoire	0.2090	-0.0251	-0.0539	1.4358	-0.0599
Mali	0.0499	0.0035	0.1201	1.2153	-0.0574
Niger	0.0369	-0.0453	-0.2394	1.6420	-0.0601
Senegal	0.0918	-0.0282	0.2764	1.4749	-0.0592
Togo	0.0263	-0.0236	0.3939	1.4324	-0.0582
Nigeria	0.4947	0.0996	0.9746	0.7760	n.a.
		Adding Sierra Leone 5/			
Benin	0.0804	0.0208	0.6861	1.0965	-0.0009
Burkina	0.0961	0.0784	0.5931	0.7865	-0.0008
Cote d'Ivoire	0.4035	0.0340	0.7825	1.0325	-0.0008
Mali	0.0963	0.0601	0.4809	0.8739	-0.0008
Niger	0.0711	0.0139	-0.3090	1.1808	-0.0009
Senegal	0.1771	0.0301	0.8245	1.0606	-0.0009
Togo	0.0508	0.0337	0.5622	1.0300	-0.0009
Sierra Leone	0.0247	0.0524	0.5075	0.9147	n.a.

1/ θ_A =0.0408.
2/ θ_A =0.0486.
3/ θ_A =0.0377.
4/ θ_A =0.0445.
5/ θ_A =0.0394.

Still, the negative effect on WAEMU members from adding Nigeria would be considerably larger (about ten times according to our calculations) than the negative effects from adding Ghana.

As suggested earlier, changes in spending propensities at the regional level might substantially affect incentives to form monetary unions and our analysis makes clear that specific efforts aiming at a greater degree of fiscal convergence would contribute to make larger monetary unions more desirable for all member states. One way to foster convergence of fiscal performance on mutually agreed objectives would be through the implementation of regional surveillance. As in the process that led to the creation of the European Monetary Union, membership could be made conditional upon the satisfaction of these fiscal convergence criteria. To illustrate the potential importance of such a mechanism, Table 7 reports the net gains from a full ECOWAS monetary union assuming that Nigeria's UFN is set equal to the average for the remaining 11 countries.

Interestingly enough, for all the WAEMU countries a monetary union under these conditions would be preferred to a narrower union with the same membership as the existing WAEMU, and all the non-WAEMU countries would also benefit relative to monetary autonomy. Of course, the credibility of fiscal arrangements remains an open question, especially after the monetary union has been established and is difficult to reverse. The recent experience in the Euro Area suggests that substantial pressures from politically influential member states to loosen the rules would be hard to resist. But we leave these important institutional issues for future research.

Table 7. ECOWAS Monetary Union: Net Benefits for Participants When Nigeria's Spending Distortion is Equal to Average

Country	ω	Gain Rel to Indep.	Correlation	Ψ	Gain Rel. to WAEMU
Benin	0.0340	0.0278	0.2677	1.1721	0.0061
Burkina	0.0406	0.0853	0.1979	0.8408	0.0060
Cote d'Ivoire	0.1706	0.0407	0.0508	1.1037	0.0059
Mali	0.0407	0.0672	0.1523	0.9342	0.0063
Niger	0.0301	0.0215	-0.2465	1.2622	0.0068
Senegal	0.0749	0.0375	0.3455	1.1338	0.0065
Togo	0.0215	0.0417	0.4255	1.1011	0.0071
Gambia	0.0061	0.0672	0.2277	0.9032	n.a.
Ghana	0.1078	0.1105	-0.2748	0.7252	n.a.
Guinea	0.0597	0.0185	0.5914	1.3123	n.a.
Nigeria	0.4037	0.0540	0.9429	1.0000	n.a.
Sierra Leone	0.0104	0.0587	-0.1986	0.9778	n.a.

V. CONCLUSIONS

We calibrated a model in which negative spillovers from autonomous monetary policy provide incentives for forming a monetary union; these incentives depend on the extent of trade linkages among member countries. The model also includes a fiscal distortion that causes governments to aim for financing that is higher than the socially optimal level in order to channel funds that serve the narrow interests of the group in power or to compensate for revenue losses due to inefficient tax collection. We have argued that this feature, ignored in the literature on monetary union in Europe, is potentially quite important in Africa, and influences both the incentives to join a monetary union and, for existing members, the willingness to accept a new member.

Our simulations bear this out. Using actual data to calibrate the model, we find that differences in government spending propensities are more important than asymmetric shocks in determining net gains and losses from potential monetary unions. The proposed monetary union among all the countries of ECOWAS, though desirable for most of the non-WAEMU countries, is shown not to be incentive compatible for most of the existing WAEMU members in the absence of other institutional

changes or gains not captured in the model. The chief reason is that Nigeria, which would have a preponderant weight in such a union, is estimated to have a high fiscal distortion. This distortion would put pressure on an ECOWAS monetary union's central bank to produce monetary financing, and hence would lower the utility of these countries. An additional, but less important factor, is that Nigeria's terms of trade differ from those of its neighbors, and hence the average shock would have a low, or negative correlation, with other countries' shocks. Even though a monetary union would be in Nigeria's interest, it is difficult to see that all potential members would be willing to proceed with one, despite agreement in principle to do so.

In contrast, the membership of the other non-WAEMU countries individually would not pose the same problems, and the model suggests that in most cases they would increase the welfare of existing WAEMU countries as well as that of the prospective new members.

The problem of disparities in financing needs for the formation of a monetary union, and for its ongoing monetary policy, suggests that regional surveillance mechanisms could contribute to a greater degree of convergence in fiscal policies. If Nigeria's financing needs were equal to the average for the other countries, a full-ECOWAS monetary union would be incentive compatible for all countries. While the design of such regional surveillance is outside the scope of this paper, we conclude that lack of fiscal convergence, not the low level of regional trade or the asymmetry of shocks, is the primary obstacle to the creation of a well-functioning and acceptable monetary union in West Africa.

APPENDIX

Western Africa: Selected Data

Table A1. Government Spending, Revenue, Deficits and Inflation 1996–2000, and GDP shares

	Revenue/GDP	Spending/GDP	Deficit/GDP[1]	Inflation[2]	Shares of GDP, ω^3
WAEMU:					41.23%
Benin	18.87	18.45	0.43	3.73	3.40%
Burkina Faso	21.15	24.91	-3.76	2.43	4.06%
Cote D Ivoire	18.69	20.75	-2.06	2.89	17.06%
Mali	20.21	22.8	-2.59	1.72	4.07%
Niger	13.09	16.08	-2.98	2.67	3.01%
Senegal	19.88	20.19	-0.3	1.41	7.49%
Togo	15.66	19.69	-4.03	3.15	2.15%
Average	18.22	20.41	-2.19	2.57	
WAMZ:					58.77%
Gambia, The	19.88	24.49	-4.61	1.93	0.61%
Ghana	19.45	28.24	-8.78	25.33	10.78%
Guinea	13.79	16.40	-2.61	-----	5.97%
Nigeria	17.47	31.43	-13.96	12.27	40.37%
Sierra Leone	11.88	20.14	-8.26	21.37	1.04%
Average	16.49	24.14	-7.64	15.23	
ECOWAS average	17.50	21.96	-4.46	7.17	
SSA average					
WAEMU-WAMZ	1.73	-3.73	5.45	-12.66	

Source: International Financial Statistics

[1/] if negative

[2/] in percent

[3/] Based on 1998 figures for GDP in U.S. $.

Table A2. Openness, Standard Deviation and Correlation of Terms of Trade Shocks

	Openness[1]	Standard Deviation of TOT shocks		Correlation of Terms of Trade Shocks											
		Unscaled	Scaled	Benin	Burkina Faso	Cote d'Ivoire	Mali	Niger	Senegal	Togo	Gambia, The	Ghana	Guinea	Nigeria	Sierra Leone
Benin	61%	0.178	0.109		0.56 *	0.22	0.43 **	-0.03	0.46 **	0.28	0.14	0.33	-0.19	0.07	0.19
Burkina Faso	43%	0.072	0.031	0.56 *		0.06	0.94 *	-0.02	0.57 *	0.11	0.37	0.16	0.26	0.02	0.06
Cote d'Ivoire	82%	0.063	0.052	0.22	0.06		-0.01	-0.40 **	0.59 *	0.52 *	0.36	0.75 *	-0.16	-0.23	0.65 *
Mali	63%	0.051	0.032	0.43 **	0.94 *	-0.01		-0.06	0.48 *	0.07	0.26	0.08	0.32	0.01	-0.05
Niger	47%	0.064	0.03	-0.03	-0.02	-0.40 **	-0.06		-0.57 *	-0.41 **	-0.31	0.05	-0.13	-0.17	0.06
Senegal	67%	0.065	0.043	0.46 **	0.57 *	0.59 *	0.48 *	-0.57 *		0.49 *	0.62 *	0.28	0.33	0.09	0.15
Togo	76%	0.081	0.062	0.28	0.11	0.52 *	0.07	-0.41 **	0.49 *		0.03	0.14	0.07	0.27	0.26
Gambia, The	154%	0.186	0.286	0.14	0.37	0.36	0.26	-0.31	0.62 *	0.03		0.17	0.54 *	0.06	0.17
Ghana	62%	0.111	0.069	0.33	0.16	0.75 *	0.08	0.05	0.28	0.14	0.17		-0.41	-0.54 *	0.62 *
Guinea	39%	0.073	0.029	-0.19	0.26	-0.16	0.32	-0.13	0.33	0.07	0.54 *	-0.41		0.59 *	-0.44
Nigeria	71%	0.215	0.152	0.07	0.02	-0.23	0.01	-0.17	0.09	0.27	0.06	-0.54 *	0.59 *		-0.38
Sierra Leone	45%	0.063	0.028	0.19	0.06	0.65 *	-0.05	0.06	0.15	0.26	0.17	0.62 *	-0.44	-0.38	
Average All				0.19	0.24	0.18	0.19	-0.15	0.27	0.14	0.19	0.13	0.06	-0.02	0.10
Average WAEMU				0.32	0.37	0.16	0.31	-0.25	0.34	0.17	0.21	0.26	0.07	0.01	0.19
Average Non-WAEMU				0.08	0.13	0.20	0.09	-0.07	0.21	0.11	0.16	-0.03	0.05	-0.05	0.00

Source: Calculated from the Terms of Trade Index (1987=100,US$-based), World Tables (World Bank). Openness calculated from Balance of Payments Yearbook 2001, Direction of Trade Statistics 2001, and International Financial Statistics.

(*) Significant at 5% level.

(**) Significant at 10% level.

1/ Calculated as the sum of exports and imports as a percent of GDP.

Table A3. Inflation in 3 Late-Joiners of the CFA franc zone

	Year Country Joined Monetary Union (MU)	Average Inflation in pre-MU period 1/	Average Inflation in post-MU period 2/	Average Inflation in post-MU period (w/o 1994/5)
Mali	1984	11.8	2.9	0.9
Equatorial Guinea	1985	21.4	4.1	1.1
Guinea-Bissau	1997	38.3	4.4	

Source: IMF World Economic Outlook (WEO) database.

1/ From 1970 until year country joined the CFA franc zone.
2/ From year after country joined CFA franc zone until 2001.

Appendix Table A4. Theta(i, k): Importance of Inflation Surprises in Country at Top for Country at Left 1/

	Benin	Burkina	Cote d'Ivoire	Mali	Niger	Senegal	Togo	UEMOA	Gambia	Ghana	Guinea	Nigeria	Sierra Leone	WAMZ
Benin	0.0000	0.0004	0.0000	0.0004	0.0021	0.0004	0.0004	0.0039	0.0000	0.0000	0.0000	0.0004	0.0000	0.0004
Burkina 1/	0.0004	0.0000	0.0072	0.0011	0.0011	0.0000	0.0011	0.0108	0.0000	0.0022	0.0000	0.0000	0.0000	0.0022
Cote d'Ivoire	0.0037	0.0110	0.0000	0.0195	0.0034	0.0124	0.0075	0.0576	0.0010	0.0115	0.0045	0.0034	0.0008	0.0212
Mali	0.0000	0.0007	0.0011	0.0000	0.0004	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0011	0.0000	0.0011
Niger	0.0019	0.0005	0.0015	0.0000	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0369	0.0000	0.0369
Senegal	0.0047	0.0010	0.0029	0.0105	0.0002	0.0000	0.0012	0.0205	0.0043	0.0008	0.0021	0.0004	0.0004	0.0080
Togo	0.0333	0.0068	0.0014	0.0020	0.0048	0.0000	0.0000	0.0483	0.0000	0.0116	0.0000	0.0272	0.0000	0.0387
Total UEMOA	0.0043	0.0052	0.0015	0.0102	0.0020	0.0052	0.0035	0.0319	0.0012	0.0057	0.0023	0.0057	0.0004	0.0153
Gambia	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ghana	0.0033	0.0008	0.0003	0.0000	0.0008	0.0004	0.0382	0.0438	0.0001	0.0000	0.0000	0.0106	0.0000	0.0107
Guinea	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0000	0.0022	0.0000	0.0000	0.0000	0.0017	0.0000	0.0017
Nigeria	0.0004	0.0006	0.0217	0.0000	0.0009	0.0097	0.0002	0.0335	0.0000	0.0197	0.0001	0.0000	0.0005	0.0203
Sierra Leone	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total WAMZ	0.0008	0.0006	0.0152	0.0000	0.0008	0.0067	0.0071	0.0313	0.0000	0.0135	0.0001	0.0021	0.0003	0.0161

1/ Calculated as exports of i to k, divided by GDP of i.

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