Economic Integration in West Africa: Does the CFA Make a Difference?

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Abstract

In this paper we use data from 17 African nations in order to investigate the hypothesis that monetary union – represented in this case by the CFA Franc Zone – augments the extent of macroeconomic integration in developing countries. The paper covers a number of dimensions of integration including the volume of bilateral trade, real exchange rate volatility and the magnitude of cross-country business cycle correlation.

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1. Introduction

Over the last forty years most economies in Sub-Saharan Africa have been characterised by exchange rate instability, financial fragility and high inflation. The continent as a whole is the furthest from achieving the UNDP's Millennium Development Goals, and seems to be diverging from rather than converging on the industrialized world (Easterly and Levine, 1997; World Bank, 2003). Many Sub-Saharan African countries are economically very small, and it is possible that one factor handicapping African economic development is the absence of opportunities to exploit economies of scale in production and trade. For this reason, the promotion of macroeconomic integration in Sub-Saharan Africa is, if anything, even more urgent than elsewhere in the world.

One possible route to greater macroeconomic integration is the formation of monetary unions. In fact, there is a part of Africa – the African Financial Community (CFA) – in which a monetary union has existed for over half a century. At present, the CFA comprises 14 different countries formed into two monetary unions, the West African Economic and Monetary Union (UEMOA) and the Union of Central African States (UDEAC). In each of these two areas there is a single currency and a single central bank.

Many African governments are now entertaining the possibility of emulating or attaching themselves to this zone. Most recently, as documented by Bawumia (2002), the Lomé meeting of ECOWAS heads of state in 1999 set out detailed plans for regional monetary integration among both francophone and anglophone states in West Africa. The ultimate aim envisaged in these plans is a merging of the UEMOA with a yet to be created anglophone monetary union, by as early as 2004. The Gambia, Ghana, Guinea-Conakry, Nigeria and Sierra Leone have agreed to create a Second Monetary Zone by 2003. The institutional characteristics of this zone reflect some of the existing features of the UEMOA: an independent common central bank, no monetary financing for the public sector, pooled forex reserves and a stabilization fund to cushion temporary Balance of Payments shocks.

A widening of monetary union in West Africa could entail two benefits for the new member states. Firstly (and beyond the scope of this paper), the autonomy of a trans-national central bank could make low inflation a time-consistent monetary policy goal. Secondly, the common currency could lead to a greater degree of macroeconomic integration, for reasons outlined below. Some aspects of integration, such as increased trade volumes or lower relative price variability, can reasonably be expected to increase welfare directly. Others, such as a greater degree of business cycle correlation, will mitigate the potential welfare losses resulting from a single monetary policy described by Mundell (1961).

In the light of these policy developments, we will assess the extent to which the existing monetary unions in West Africa and Equatorial Africa have already facilitated a greater degree of macroeconomic integration than could otherwise be expected, conditional on the geographical proximity and production structure of the member states. We focus on this small part of the world for two reasons. First, previous authors have looked at the correlation between exchange rate regimes and macroeconomic integration, but typically in the context of global data sets in which the effects estimated represent global averages. These averages might not reflect the experience of the poorest parts of the globe. Secondly, in our data set we are confident, for reasons given below, that selection for membership of the monetary unions has so far been exogenous to the countries' economic characteristics. (This assumption is much more questionable in global data sets.) So it is reasonable to interpret any difference in the extent of integration within the CFA from the regional average as a product of the CFA institutions themselves. The estimated difference will give us some idea of the magnitude of the increased integration that a wider monetary union might bring.

The following section has two purposes: firstly to survey the ways in which a monetary union might lead to greater macroeconomic integration, and secondly to relate these mechanisms to the institutional characteristics of the existing CFA. This will provide a basis for constructing a model to test the impact that the CFA has had on macroeconomic integration over the last 30 years.

2. Monetary Union and Macroeconomic Integration in Theory and Practice

2.1Theoretical Background

The existing literature suggests at least three aspects of international economic integration that could in principle be affected by membership of a monetary union. A common theme that emerges is that the benefits of a fixed bilateral exchange rate are augmented by full monetary union.

(i) The absence of unanticipated shocks to bilateral nominal exchange rates will reduce the risks involved in international trade. The value of exports (or the cost of imports) in terms of local currency will be easier to predict. There already exists a literature documenting the impact of nominal exchange rate risk on trade; see for example Thursby and Thursby, 1987.[1] A monetary union precludes any nominal exchange rate fluctuations, and should facilitate more trade. Moreover, the use of a common currency will eliminate currency transactions costs in international trade (De Grauwe, 2000), so

[1] However, it is important to acknowledge that in a general equilibrium setting fixed exchange rates do not *necessarily* lead to more trade. See Bacchetta and van Wincoop (2000).

trade volumes ought to increase. This second effect is specific to full monetary union, as opposed to an ordinary fixed exchange rate regime.

(ii) Fixed exchange rates can reduce real exchange rate volatility. If there is any inertia in domestic commodity prices, shocks to the nominal exchange rate will lead to deviations from purchasing power parity. This is a key element of the exchange rate overshooting models that evolved out of Dornbusch (1976). Moreover, a full monetary union could lead to even lower real exchange rate volatility than a fixed exchange rate system. Engel and Rogers (2001) identify a number of factors that determine the degree of real exchange rate volatility between pairs of countries.[2] Nominal exchange rate volatility and physical distance turn out to be important factors, but there is also a substantial "pure" border effect. Controlling for all other factors, the ratio of prices in two regions is more volatile if the regions are located in different countries. Engel and Rogers suggest a number of explanations for this effect. Some of these, including the currency transactions costs mentioned above, but also factors such as international heterogeneity in marketing and distribution systems, the scope for international price discrimination, or "informal" trade barriers, might be reduced if the countries shared a common currency.[3]

(iii) As a consequence of increased trade, the degree of business cycle synchronicity between two countries in a monetary union might be higher, because aggregate demand shocks in one country have more of an impact on the other than they would otherwise; or it might be lower, because increased trade corresponds to increased specialization in types of production subject to different productivity shocks. But an increased volume of bilateral trade is not the only way in which a common currency could affect business cycle synchronicity. For example, if multinational firms have less scope for price discrimination between members of a monetary union (because price differences are more transparent and because the elimination of currency transactions costs facilitates arbitrage in goods), then international productivity shocks are likely to be passed on to local markets in a more uniform way. Papers looking at the relationship between business cycle synchronicity an exchange rate regimes include Artis and Zhang (1995), Christodoulakis *et al.* (1995), Fatas (1996) and Boone (1997).

[2] Related papers on this theme include Lothian and Taylor (1996) and Papell (1997).
[3] For example, traders' lives will be made easier if they only have to hold one type of currency with which to bribe customs officials.

In this paper, we will examine the three dimensions of integration noted above: trade intensity, real exchange rate volatility and business cycle synchronicity. The data set we will use comprises most of the countries of the CFA Franc Zone, plus most of their immediate neighbors with floating exchange rates or adjustable pegs. As we explain below, this gives us the opportunity to examine the effects both of fixed exchange rates *per se* and of full monetary union.

2.2 The CFA Franc Zone: Institutional Background

The CFA evolved from the monetary institutions of the last phase of French colonial Africa. Figure 1 shows a map of the CFA region. The two monetary areas have different currencies. The UEMOA uses currency issued by the Central Bank of West African States (BCEAO); the UDEAC uses currency issued by the Bank of Central African States (BEAC). Somewhat confusingly, both currencies are commonly called the CFA Franc.

The countries that make up the CFA, and their basic economic structure, are summarised in Table 1. The boundaries between the different monetary areas have a geographical and historical basis, and each of the two monetary unions (the UEMOA and UDEAC regions) comprises a wide range of economies, as indicated by the descriptive statistics in Table 2. The UEMOA region includes both semi-industrialised economies with a high export-GDP ratio (such as Cote d'Ivoire and Senegal) and also some of the world's poorest and underdeveloped countries (such as Burkina Faso and Mali). The UDEAC region includes both countries that are equally underdeveloped (Chad, Central African Republic and Equatorial Guinea) and relatively high-income petroleum exporters (Cameroon, Congo Republic and Gabon).

Each of the two currencies is exchangeable for the French Franc at a rate of 100:1 (and now at the equivalent Euro rate). The French Treasury is obliged to exchange CFA Francs for Euros at this fixed rate,[4] and there are rules limiting CFA government borrowing that are intended to prevent the African countries from abusing France's guarantee of convertibility. However, France is not part of the CFA, and the only legal tender in each CFA country is the currency issued by its central bank. Foreign currency (including other CFA currency) is not used as a unit of account or medium of exchange. Commercial banks do not typically offer customers foreign currency deposit facilities, and foreign currency deposits are a negligibly small fraction of total deposits. The exchange of one CFA currency for another (or of CFA Francs for Euros) must be conducted through the central bank and, and is subject to taxation, so intra-CFA currency transactions costs are not negligible (Vizy, 1989).

[4] In effect, France pegs the Euro to the CFA currencies. Monetary policy in the CFA is constrained not by the need to maintain an exchange rate peg, but by (very lax) rules limiting domestic credit creation.

[Figure 1 and Tables 1-2 here]

The composition of the two monetary unions is a consequence of the French colonial organisation, and is therefore exogenous to contemporary economic characteristics. The current grouping into two currency areas dates from 1955 (seven years before full political independence, at which point the countries were self-governing French overseas territories), and arises from the distinction between French West Africa and French Equatorial Africa in the colonial period. As can be seen from the map, this division is based on the physical geography of the region. The only point of physical contact between the UEMOA and the UDEAC is the Chad-Niger border, which lies in the Sahara Desert far from any major centers of population. Further south, the two areas are separated by Nigeria, a former British colony that has no part in the CFA. The CFA comprises those Sub-Saharan African countries occupied by France at the end of WW1.[5] There have been just two exits from the CFA, neither of which is likely to have been correlated with the countries' economic characteristics. In 1958, at the institution of the Fifth French Republic, all overseas territories participated in a referendum on the new constitution. Guinea-Conakry, which happened to have a socialist government at the time, was the only colony to reject this constitution, and severed all political and financial links with France. In 1973, after full independence, Mauritania (the only Arab country in the area) also exited the CFA, preferring to pursue an identity as a North African Arab state.[6] There have also been just two entries: Equatorial Guinea and Guinea-Bissau. These countries were, respectively, Spanish and Portugese colonies; they are surrounded by, respectively, UDEAC and UEMOA nations, and joined the appropriate monetary union in 1985 and 1997. The only other countries surrounded by the CFA (Gambia, Ghana, Liberia, Nigeria and Sierra Leone) are all anglophone. All but Liberia were British colonies, and up until now it has been made clear that they are not welcome to join the francophone monetary area.

So, if we look across the region depicted in Figure 1, we can see (i) pairs of countries sharing a single country (any two members of the UEMOA, or any two members of the UDEAC), (ii) pairs of countries with different currencies but a bilateral exchange rate that has been fixed for many decades (pairs made up of one UEMOA country and one UDEAC country), and (iii) pairs of countries for which the bilateral exchange rate has been variable (pairs in which at least one country is outside the CFA). The division between the two monetary unions within the CFA, and therefore the distinction between (i) and (ii), has been exogenous to economic characteristics. So also has membership of the CFA as a whole. If we assume (not implausibly) that the countries left outside the CFA with their own individual currencies have not been endowed with the political institutions necessary for a hard

[5] Excepting Djibouti, which is thousands of miles away in the Horn of Africa.

exchange rate peg to be a viable option, then the distinction between (i-ii) and (iii) has also been exogenous. So, using data from these countries relating to the three dimensions of integration outlined above, we have the opportunity to examine both the effects of a fixed exchange rate and the effects of a single currency on macroeconomic integration between pairs of countries in West Africa and Equatorial Africa.[7]

3. Testing the Impact of the CFA on Macroeconomic Integration

In this section we focus on those 12 of the 14 members of the CFA for which adequate macroeconomic data are available: Benin (designated *ben* in the tables), Cote d'Ivoire (*civ*), Mali (*mli*), Niger (*ner*), Senegal (*sen*) and Togo (*tgo*) in the BCEAO area and Cameroon (*cam*), Central African Republic (*car*), Chad (*tcd*), Congo Republic (*cgo*) and Gabon (*gab*) in the BEAC region.[8] We will examine various aspects of macroeconomic integration among these countries and their non-CFA neighbors. There are five non-CFA countries in West Africa for which adequate data exist: The Gambia (*gam*), Ghana (*gha*), Mauritania (*mau*), Nigeria (*nga*) and Sierra Leone (*sle*).[9] Four of these are ECOWAS countries that might form part of an expanded monetary union in the very near future. The fifth (Mauritania) is a former CFA member that might conceivably rejoin the UEMOA at a later date.

One aim will be to identify the extent to which CFA membership has entailed a greater degree of integration (variously defined) than could otherwise have been expected. However, we will also make a distinction between the impact of common CFA membership and the impact of membership of the same monetary area (the UEMOA or the UDEAC). If sharing a common currency delivers an additional degree of integration over-and-above that arising from the common currency peg, then we should see a greater degree of integration within each of the two monetary unions than we do across the UEMOA-UDEAC border, conditional on other, exogenous economic characteristics.

Our basic methodology is similar to that of Rose and Engel (2000), but with different dependent variables and a different data set. The extent of macroeconomic integration between two countries might depend on a variety of factors other than their currency institutions. So our

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[6] Over the period covered by the empirical model in the next section, these two countries have lain outside the CFA.

[7] We ought to comment briefly on the reasons for restricting our geographical scope to just one part of Africa. Firstly, the immediate policy relevance of our results is to the ECOWAS the CFA (two overlapping sets of countries), where the creation of a single monetary union is more than a remote possibility. Secondly, the distance between countries turns out to be an important factor for some of our integration measures. Within that part of Africa to which we restrict ourselves, distance effects are approximately linear. We suspect that this would not be true with a wider geographical scope, and our model already contains several non-linear effects. Including more countries would necessitate a more general functional form and – with limited data – more fragile results.

[8] The two countries lacking adequate data are Guinea-Bissau in the UEMOA region and Equatorial Guinea in the UDEAC region. National Accounts data for these countries exist for only a short time.

[9] The non-CFA countries in Figure 1 for which data are missing are Guinea-Conakry and Liberia.

approach is to construct a fixed-effects regression for different measures of integration in any two countries i and j, conditional on both a common currency dummy (ifs_{ij}) for country pairs within the UEMOA or within the UDEAC, a CFA membership dummy (iff_{ij}) for pairs with one country in the UEMOA and one in the UDEAC, and a set of exogenous conditioning variables.[10]

In the empirical section that follows we will employ several different measures of integration. The first is the total value of bilateral trade between two countries, in millions of dollars (T_{ij}). The T_{ij} figures used are taken from IMF *DOTS* for 1997. This corresponds to integration concept (i) in Section 2. T_{ij} ought to be higher in countries between which there is a nominal exchange rate peg, and even higher in those sharing the same currency.

The second, in the spirit of Engel and Rogers (2001), is a measure based on the real exchange rate. We will look at the extent to which prices in two countries are correlated. This corresponds to integration concept (ii) in Section 2. However, our focus will not be on an unconditional measure of real exchange rate correlation. In the short run, prices could vary in response to a wide variety of macroeconomic factors. For example, in the CFA the two different central banks can each pursue an active monetary policy. Interest parity with France does not hold in the short run, and the differential between each central bank's base rate and that of the European Central Bank varies over time; so does the differential between the interest rates in the two parts of the CFA. The Euro-CFA Franc peg is guaranteed by the French Treasury, so short-run monetary policy in the CFA is not constrained by the need to maintain the peg. Idiosyncratic innovations in monetary policy could generate price deviations. Two countries in different currency areas might exhibit a large degree of heterogeneity in the movement of their real exchange rates not because using different currencies creates underlying structural asymmetries, but just because the two monetary authorities are following different policies. Conditioning out the monetary shocks might give a more informative indicator of the degree of underlying macroeconomic integration. Similarly, two countries might exhibit a high degree of real exchange rate correlation just because their terms of trade or productivity shocks are highly correlated, rather than because of anything to do with the factors outlined in concept (ii) in the previous section.

For this reason we will look at the degree of conditional real exchange rate correlation between i and j. Our measure of correlation will be corr(u_i^p, u_j^p); u_i^p is an innovation constructed from the regression:

[10] In other words, $ifs_{ij} = 1$ if *either* ($i \in$ UEMOA and $j \in$ UEMOA) *or* ($i \in$ UDEAC and $j \in$ UDEAC); $ifs_{ij} = 0$ else. $iff_{ij} = 1$ if *either* ($i \in$ UEMOA and $j \in$ UDEAC) *or* ($i \in$ UDEAC and $j \in$ UEMOA); $iff_{ij} = 0$ else.

$$\begin{bmatrix}\Delta p_{it}\\ \Delta y_{it}\\ \Delta m_{it}\end{bmatrix} = \beta(L)\begin{bmatrix}\Delta p_{it-1}\\ \Delta y_{it-1}\\ \Delta m_{it-1}\end{bmatrix} + \alpha(L)\Delta x_{it} + \begin{bmatrix}u^{p}_{it}\\ u^{y}_{it}\\ u^{m}_{it}\end{bmatrix} \tag{1}$$

where p_{it} is the log ratio of domestic prices (measured by the GDP deflator) to import prices (measured by the imports deflator in the National Accounts) for country i in year t. y_{it} is the log of real GDP, m_{it} the log of nominal M1 and x_{it} the log of the terms of trade (measured using export and import deflators in the National Accounts).[11] $\beta(.)$ is a 3×3 and $\alpha(.)$ a 1×3 matrix of lag polynomial operators. The annual data used to construct the variables in the VAR are described in Appendix 1.

This VAR is also used to construct the third measure of integration: the degree of business cycle synchronicity, corresponding to concept (iii) in Section 2. Here we are concerned with the measurement of the extent to which aggregate supply and aggregate demand shocks in one country are passed on to another. Again, we wish to condition on monetary policy: in the long run, money is neutral, but in the short run money shocks can impact on output. So the output shock correlations are measured as corr(u_i^y, u_j^y).

These two correlation measures capture the degree of similarity in observed movements in the real exchange rate and in output at time t, conditional on their own past values, on the past values of M1 (which is probably endogenous to p and y) and on current and past movements in the terms of trade (which is exogenous in a small open economy). However, they do not quite represent correlations in shocks to the real exchange rate and to aggregate output. Equation (1) represents a reduced-form system that corresponds to a structural system in which contemporaneous movements in p, y and m interact with each other. The u_i^p and u_i^m are mixtures of structural shocks to p and y (and to m) in this system. So an alternative way of measuring real exchange rate and output correlations is to impose an identification structure on equation (1) so as to extract the structural shocks ε_i^p and ε_i^y, and then to measure the correlations corr(ε_i^p, ε_j^p) and corr(ε_i^y, ε_j^y).

The identification structure we impose is based on the econometric methodology of Blanchard and Quah (1989), though with a different set of theory-based restrictions from those they use. Let Z_{it} = [Δp_{it} Δy_{it} Δm_{it}]' and u_{it} = [u_{it}^p u_{it}^y u_{it}^m]'. Then equation (1) can be re-written as a moving-average process:

$$Z_{it} - a(L)\Delta x_{it} = (I - \beta(L))^{-1}u_{it} \tag{2}$$

[11] For the CFA countries, M1 is measured as checking deposits at banks located in a certain country, plus currency issued in that country. Currency issued is a proxy for currency in circulation, but the limited data on *billets deplacés* (notes issued in one country that end up in another) suggest that this is a reasonable approximation.

We can compare equation (2) with a moving-average representation of a putative structural model of the form:

$$Z_{it} - a(L)\Delta x_{it} = \gamma(L)\varepsilon_{it} \quad (3)$$

where ε_{it} is a 1×3 vector of innovations to each of the structural equations. Identification the structural model requires the recovery of the 3×3 matrix $\gamma(0)$:

$$u_{it} = \gamma(0)\varepsilon_{it} \quad (4)$$

For this we need $3^2 = 9$ restrictions. Assuming that the three elements of ε_{it} are orthogonal and using a normalization, so that each has a unit variance, gives us 3(3+1)/2 = 6 restrictions, with $Var(\varepsilon_{it}) = I$. The last three restrictions come from the assumption that $\gamma(L)$ is lower-triangular. In other words, we assume that in the long run, conditional on the terms of trade, the growth of the real exchange rate is independent of output and money growth, and output is independent of money growth. The real exchange rate restrictions can be motivated by the assumption that relative PPP holds (at least in growth rates) in the long run, for which there is African evidence in Lowrey (1995). The final restriction is based on the assumption that aggregate supply growth is independent of monetary shocks in the long run.

Altogether, then, we have five integration measures: T_{ij}, u_{ij}^p, u_{ij}^y, ε_{ij}^p and ε_{ij}^y. The following sections discuss how we investigate the possibility that these measures are dependent on whether two countries have a fixed exchange rate or share the same currency, conditional on geographical and economic characteristics.

4. The Impact of the CFA on Trade

Our first set of estimates relates to trade intensity, T_{ij}. The basic form of our trade intensity regression is:

$$T_{ij} = f(D_i, D_j, ifs_{ij}, iff_{ij}, X_{ij}, u_{ij}) \quad (5)$$

where u_{ij} is a residual, and X_{ij} a vector of conditioning variables. D_i is a dummy variable for the i^{th} country. It turns out that country-specific effects have a large part to play in predicting trade intensity, and it might not necessarily be the case that the economic characteristics contained in the X-vector fully capture these effects. In other words, we will allow for unobserved country-specific characteristics to affect the size of T_{ij}. These characteristics might incorporate a range of factors. For example, Rose and van Wincoop (2001) and Anderson and van Wincoop (2001) suggest that it is important to take account of the magnitude of each country's barriers to trade with all its trading partners. This is a factor that is difficult to measure in our sample of countries with very limited fiscal data.

The *X*-vector comprises a number of economic characteristics. To the extent that integration is a function of the volume of bilateral trade flows, the explanatory variables in "gravity" models of international trade will enter into *X*:

(i) The log-product of the two countries' total initial GDP (in US Dollars): $y_i \cdot y_j$

(ii) The log-product of their initial *per capita* GDP (in US Dollars): $y^P{}_i \cdot y^P{}_j$

(iii) A dummy variable for whether the countries share a land border: ifb_{ij}

(iv) The logarithm of the Great Circle distance between their capital cities (in radians): $dist_{ij}$

(v) A dummy variable for whether the two countries have a maritime coastline: ifc_{ij}

Figures for (i-iii) are taken from the World Bank *World Development Indicators*. However, these conditioning variables might also affect the magnitude of macroeconomic integration for other reasons. For example, larger or more developed countries might be less susceptible to speculative behavior that induces unanticipated deviations in the real exchange rate; so real exchange rate volatility might be lower. In this paper, we do not attempt to identify the channels through which the conditioning variables impact on our macroeconomic integration measures.

There are two reasons for suspecting that estimation of the parameters of a linear form of equation (5) by least-squares will be inappropriate. First, many of the T_{ij} observations are equal to zero (all cases where trade is less than \$1mn; see Table 3); so it is likely that a Tobit regression will be more appropriate than the equivalent linear form. Secondly, the ifs_{ij} and iff_{ij} dummies appear in equation (5) in order to capture the possibility that sharing a common currency (or having a fixed exchange rate) reduces transactions costs in international trade, as outlined above. In this sense, they have a role similar to the variables in the equation reflecting the determinants of international transport costs: ifb_{ij}, $dist_{ij}$ and ifc_{ij}. A simple version of equation (5) might treat the four cost variables as linearly separable arguments of *f()*. However, in the light of comments by, for example, Persson (2001), the linearity assumption is questionable. The magnitude of the impact of a common currency (or of a fixed exchange rate) on trade between two countries could depend on the size of transport costs, if only because larger transport costs could increase the size of the currency transactions involved, *ceteris paribus*. But also, the magnitude of informal barriers to trade might depend on the two elements of costs – for transport and for currency transactions – in a more complex way. For this reason, a more appropriate form of equation (5) will include terms interacting ifs_{ij} and iff_{ij} with the other cost variables:

$$\log(T_{ij}) = T_{ij}* \mid \log(T_{ij}) > 0$$
$$T*_{ij} = \theta_i D_i + \theta_j D_j + \beta_1 y_i y_j + \beta_2 y_i^P y_j^P + \eta_1 ifs_{ij} + \eta_2 ifb_{ij} + \eta_3 dist_{ij} + \eta_4 ifc_{ij} \tag{6}$$
$$+ \gamma_1 [ifs_{ij} \cdot ifb_{ij}] + \gamma_2 [ifs_{ij} \cdot dist_{ij}] + \gamma_3 [ifs_{ij} \cdot ifc_{ij}] + \delta_1 [iff_{ij} \cdot dist_{ij}] + \delta_2 [iff_{ij} \cdot ifc_{ij}] + u_{ij}$$

where $T_{ij}*$ is the latent variable in a Tobit regression. The logarithmic transformation is used because the positive values of T_{ij} are approximately log-normally distributed. (There are no negative values of $\log(T_{ij})$, since trade volumes below $1mn. are not reported.) Note that iff_{ij} is not interacted with ifb_{ij} because there is only one case of a land border between a UEMOA country and a UDEAC country (Niger and Chad).

[Tables 3-4 here]

The regression results are presented in Table 4. For each explanatory variable, the estimated coefficient is reported alongside the corresponding standard error and the resulting t-ratio. The final row in the table reports the estimated residual variance, σ. The table includes two regression equations. The first is the unrestricted equation (6); the second is a more parsimonious form in which some conditioning variable coefficients have been set to zero so as to minimize the Hannon-Quinn Information Criterion. Those coefficients that are statistically significant in the unrestricted equation do not change substantially in the restricted one, so we are reasonably confident that our inferences are robust to the inclusion of nuisance parameters in the model.

The significant coefficients in the regression indicate that whether two countries share a land border, whether they both have a coastline, whether they have a fixed bilateral exchange rate and whether they share a common currency all have a significant impact on trade volumes. Because several of the interaction terms are statistically significant, interpretation of the regression results is easier if we consider their implications for the expected level of trade between different kinds of countries. The lowest level of trade to be expected is when (i) the countries do not have a common land border, and (ii) at least one of them is outside the CFA or (if they are both in the CFA) when they do not share the same currency and at least one has no coastline. There is no significant difference between the trade volumes for these different types of pair. If we normalize on the level of trade to be expected for such country pairs, and set $\log(T_{ij})$ for them equal to zero, then the following levels of $\log(T_{ij})$ are to be expected for other types of pair.[12]

[12] These figures are based on the restricted model coefficients; but the figures from the unrestricted model are very similar.

With a common land border, but with at least one country outside the CFA: $\log(T) = 0.85$
One UEMOA country and one UDEAC country, both with a coastline: $\log(T) = 1.28$
Two countries with a single currency but no common land border: $\log(T) = 1.46$
Two countries with a single currency and a common land border: $\log(T) = 3.74$

All of these figures are significantly different from zero (the base case); the last figure is significantly different from the other three. Geographical proximity makes a substantial difference to trade volumes. In the absence of such proximity, having a fixed exchange rate plus a coastline, or alternatively sharing a single currency – even without a coastline – are at least as good. The transport costs involved in inland trade appear to cancel out the benefits of a fixed exchange rate, but not those of a single currency. Most strikingly, trade between neighboring countries with a single currency is very much higher than for any other type of country pair. Without reliable data on trade between individual districts, it is not possible to say whether the single currency completely eradicates the border effect in trade. Nevertheless, we can say that trade across a land border in a monetary union is very much higher, *ceteris paribus*, than it is across a land border between two countries with no fixed exchange rate.[13]

5. The Impact of the CFA on Real Exchange Rate and Output Correlations

In this section we consider the impact of CFA membership on cross-country correlations in the reduced-form and structural shocks to the real exchange rate and output, u_{ij}^{p}, u_{ij}^{y}, ε_{ij}^{p} and ε_{ij}^{y}. First of all, we estimate the parameters in equation (1-4), using annual data reported in the World Bank *World Development Indicators*. Data are available for all countries at least for the period 1968-99, with the exception of the Central African Republic, where National Accounts data end in 1991. For some countries, data are available from as early as 1963. In all cases, the model parameters (and the resulting pairwise correlations) are estimated on as large a sample as possible. Our main interest is in the shocks implicit in the model, which are depicted in Figures 2-7. Corresponding summary statistics are given in Table 3 above.

[Figures 2-7 here]

It can be seen from the table that in three out of four cases (the exception being ε_{it}^{y}), the unconditional correlations are higher for UEMOA-UDEAC pairs than for pairs with at least one country outside the CFA, and those for single currency pairs are even higher. However, the time-

[13] We can say nothing about the intermediate case of trade across a land border between a UEMOA and a UDEAC country, of which there is only one example.

series model from which these innovations have been constructed conditions only on money and terms of trade shocks. There might also be time-invariant country-specific characteristics that affect the size of the correlations. In the light of the discussion in section 2, we ought also to condition on the distance / transport cost variables used for the trade regression, and also on some measures of the extent of heterogeneity in economic structure. The two measures that we shall use in the regressions reported below are the absolute values of the difference between *i* and *j* in (i) the ratio of agricultural value added to GDP, $|a_i - a_j|$ and (ii) the ratio of industrial value added to GDP, $|d_i - d_j|$. Figures are again taken from *World Development Indicators*. We estimate the impact of the CFA on real exchange rate and output correlations, conditional on these factors, by means of regression equations of the form:

$$\mathrm{f}(\mathrm{corr}(q_i,q_j)) = \phi_1 \cdot ifs_{ij} + \phi_2 \cdot iff_{ij} + \phi_3 \cdot ifb_{ij} + \phi_4 \cdot ifc_{ij} + \phi_5 \cdot dist_{ij} + \phi_6 \cdot |a_i - a_j| + \phi_7 \cdot |d_i - d_j| + v_{ij}^q \quad (7)$$

$$\mathrm{f}(x) = \log(1 + x) - \log(1 - x);\ (q_i,q_j) = \{(u_i^p,u_j^p),\ (u_i^y,u_j^y),\ (\varepsilon_i^p,\varepsilon_j^p),\ (\varepsilon_i^y,\varepsilon_j^y)\}$$

where v_{ij}^q is a residual, and all variables have been orthogonalized with respect to country fixed effects (D_i,D_j). The logistic transformation is used to ensure that the dependent variable distributions are unbounded. Note that this is a linear regression equation; we will see presently that there are no statistically significant non-linearities in the cross-country correlations for the macroeconomic shocks. Note also in figures (2-7) that the 1994 devaluation shows up very markedly in the innovation time series for many of the CFA countries. The regressions reported below use measures of the dependent variables that exclude the 1994 observations, on the grounds that the devaluation was an atypical shock to the CFA macroeconomies that is unlikely to be repeated. If the 1994 observations are included, the stylized facts discussed below are even more marked.

Equation (7) does not include $\log(T_{ij})$ as an explanatory variable. It is possible to include the trade volume measure in the regression, using the explanatory variables in Table 4 as instruments. However, $\log(T_{ij})$ is not statistically significant in any of these IV regressions. This suggests that the impact on CFA membership on real exchange rate and output correlations is through channels other than increased trade.

Tables 5-6 report the regression results. For each of the four correlation measures, the table includes both a restricted and unrestricted version of equation (7). The restricted model allows the omission any variable except the dummy variables ifs_{ij} and iff_{ij}. The unrestricted version minimizes the Akaike Information Criterion, but the restricted version minimizes the Hannon-Quinn Criterion. In any case, the significant coefficients in the unrestricted model are very similar to those in the restricted model, so the choice of model specification does not substantially alter the inferences we make. Because the residuals in each regression are correlated with each other, the OLS estimator for the restricted model differs from the Maximum Likelihood estimator; we report the latter. The summary statistics in table 6 indicate that the regression residuals are normally distributed and homoskedastic. Ramsey RESET tests for the validity of our functional form (testing the significance of powers of v_{ij}^q up to the fourth order in the regression equations) indicate that the linear model is acceptable.

[Tables 5-6 here]

The dummy variables ifs_{ij} and iff_{ij} are significant in three out of four of the regression equations – all except corr(ε_i^y,ε_j^y). In no equation is the coefficient on one dummy significantly different from that on the other; in other words, the impact of CFA membership on these correlations appears to be a consequence of the fixed exchange rate rather than monetary union *per se*.

For the correlations in the reduced-form residuals, corr(u_i^p,u_j^p) and corr(u_i^y,u_j^y), all of the coefficients on the dummy variables are equal to about 0.3. This means that the expected difference between the correlations inside the CFA and those outside the CFA, conditional on other variables in the model, is roughly 0.15. For the real exchange rate correlation, the only other significant variable is the coastline dummy, ifc_{ij}, with a coefficient also equal to about 0.3. The natural interpretation of this effect is that lower transport costs reduce the magnitude of deviations from PPP. In the reduced-form output correlation regression, the distance variable, $dist_{ij}$, and the economic structure variable, $|a_i - a_j|$, are statistically significant, with coefficients equal to –0.12 and –0.55 respectively. In this case the correlation appears to depend not only on transport costs, but also on the degree of similarity with respect to agriculture's share of GDP.

We turn now to the regressions for the structural innovation correlations, corr(ε_i^p,ε_j^p) and corr(ε_i^y,ε_j^y). The CFA dummy coefficients in the corr(ε_i^p,ε_j^p) regression are about twice as big as in the corresponding regression for corr(u_i^p,u_j^p); but the coefficients in the corr(ε_i^y,ε_j^y) regression are insignificantly different from zero. This suggests that the dependency of the reduced-form output correlations on common CFA membership is solely a consequence of the fact that the fixed nominal exchange rate reduces the size of asymmetric shocks to the real exchange rate equations (ε_{it}^p) for each country. In other words, there is strong evidence for the importance of the CFA in terms of integration concept (ii) in section 2 above, but no evidence for the importance of the CFA in terms of integration concept (iii).

6. Summary and Conclusion

In this paper we have explored the factors that determine the degree of macroeconomic integration in West Africa. Our sample of countries includes, but is not restricted to, countries in the two monetary unions that make up the CFA Franc Zone. These two monetary areas share a common peg to the French Franc / Euro. Consequently, when we consider pairwise measures of integration, we have examples of countries sharing a single currency, of countries with different currencies but a hard exchange rate peg, and of countries between whose currencies' bilateral exchange rate has been flexible. Our aim has been to see whether sharing a common currency delivers an extra degree of macroeconomic integration, as compared with sharing a common peg, and whether the peg delivers more integration than do flexible exchange rates. Five indicators of integration are considered, including measures of trade intensity, real exchange rate correlation and business cycle synchronicity.

For a wide variety of measures the exchange rate peg delivers more integration than a flexible exchange rate. The differences are statistically significant and economically substantial. In the case of trade integration (but not in other cases) there is also evidence that a common currency – as opposed to a simple exchange rate peg – makes a difference. In this case, the size of the difference depends on geographical factors reflecting international transportation costs. The extra trade that a common currency delivers is greater among countries that face lower costs. For more distant trading partners the effect of the single currency is smaller (though still statistically significant). The dependency of the effect on transportation costs also applies to the more modest enhancements to international trade associated with a simple exchange rate peg.

Other authors, on the basis of cross-country and panel data spanning the whole world, have claimed that there is evidence for a link between macroeconomic integration and countries' exchange rate regime. We have estimated the magnitude of this effect specifically for West Africa, one of the poorest parts of the world, and found that the effect substantial, though not always linearly separable from other economic characteristics.

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Table 1: Monetary Groupings in the CFA

Countries in italics are excluded from the econometric analysis because of inadequate data.

UEMOA: Benin, Burkina Faso, Cote d'Ivoire, *Guinea-Bissau*, Mali, Niger, Senegal, Togo

UDEAC: Cameroon, C.A.R., Chad, Congo Republic, *Equatorial Guinea*, Gabon

Table 2: Summary Statistics for CFA Countries and Their Neighbors

	Gross National Income ($bn)	per capita GNI ($1000)	agriculture value added / GDP	industry value added / GDP
ben	2.3	0.37	0.38	0.14
bfa	2.4	0.21	0.35	0.17
cam	8.6	0.58	0.44	0.20
car	1.0	0.28	0.55	0.20
civ	9.6	0.60	0.29	0.22
cgo	1.7	0.57	0.05	0.71
gab	3.9	3.19	0.06	0.53
mal	2.5	0.24	0.46	0.17
ner	1.9	0.18	0.39	0.18
sen	4.7	0.49	0.18	0.27
tcd	1.5	0.20	0.39	0.14
tgo	1.3	0.29	0.38	0.22
gam	0.4	0.34	0.38	0.13
gha	6.6	0.34	0.35	0.25
mau	1.0	0.37	0.22	0.31
nga	32.7	0.26	0.30	0.46
sle	0.6	0.13	0.47	0.30

Table 3: Dependent Variable Descriptive Statistics

(i) Trade: T_{ij}

	fraction of obs. > 0	*log mean of obs. > 0*	*log std. dev. of obs. > 0*
1. one country outside CFA	0.40	2.93	0.21
2. UEMOA-UDEAC pairings	0.51	3.15	0.26
3. single currency pairings	0.90	4.13	0.21

(ii) Price and Output Correlations

The reported figures are mean values, with standard deviations in parenthesis.

variable	*one country outside CFA*	*UEMOA-UDEAC pairings*	*single currency pairings*
$f(corr(\varepsilon_i^p,\varepsilon_j^p))$	-0.03 (0.39)	0.17 (0.40)	0.23 (0.44)
$f(corr(\varepsilon_i^y,\varepsilon_j^y))$	0.15 (0.39)	0.15 (0.29)	0.05 (0.38)
$f(corr(u_i^p,u_j^p))$	-0.06 (0.37)	0.16 (0.40)	0.24 (0.49)
$f(corr(u_i^y,u_j^y))$	0.00 (0.47)	0.12 (0.37)	0.16 (0.43)
number of observations	70	35	31

Table 4: Tobit Regression Results for T_{ij}

The regression equation also includes fixed effects.

variable	***coeff.***	***s.e.***	***t ratio***	***prob.***	***coeff.***	***s.e.***	***t ratio***	***prob.***
ifs_{ij}	+1.4569	0.8715	+1.672	0.0975	+1.2026	0.4226	+2.846	0.0053
iff_{ij}	+0.0071	1.0995	+0.007	0.9948				
ifc_{ij}	-0.0847	0.6489	-0.131	0.8964				
ifb_{ij}	+0.6526	0.4599	+1.419	0.1588	+0.8477	0.3699	+2.292	0.0238
$dist_{ij}$	-0.1834	0.2565	-0.715	0.4760				
$y_i.y_j$	-0.0367	0.1272	-0.288	0.7735				
$y^p{}_i.y^p{}_j$	+0.0780	0.1491	+0.523	0.6019				
$ifc.ifs_{ij}$	-0.3721	0.5997	-0.620	0.5363				
$ifc.iff_{ij}$	+1.1674	0.6082	+1.919	0.0576	+1.2760	0.4595	+2.777	0.0064
$ifb.ifs_{ij}$	+1.3907	0.7025	+1.980	0.0503	+1.4323	0.5773	+2.481	0.0146
$dist.ifs_{ij}$	-0.1745	0.5435	-0.321	0.7488				
$dist.iff_{ij}$	+0.0666	0.6989	+0.095	0.9242				
σ	+0.8567	0.0736	+11.65	0.0000	+0.8530	0.0731	+11.67	0.0000
log-lik.	-70.500				-71.358			

Table 5: FIML Regression results for Real Exchange Rate and Output Correlations
All variables have been orthogonalized with respect to fixed effects.

$corr(\varepsilon_i^p, \varepsilon_j^p)$

variable	***coeff.***	***s.e.***	***t ratio***	***prob.***	***Coeff.***	***s.e.***	***t ratio***	***prob.***
ifc_{ij}	+0.0222	0.1636	+0.136	0.8923				
ifb_{ij}	+0.2526	0.1157	+2.183	0.0308	+0.1453	0.0803	+1.811	0.0724
$dist_{ij}$	+0.0743	0.0691	+1.074	0.2847				
$\|a_i-a_j\|$	-0.0137	0.4329	-0.032	0.9749				
$\|d_i-d_j\|$	-0.4174	0.3176	-1.314	0.1911				
ifs_{ij}	+0.5763	0.1702	+3.387	0.0009	+0.5605	0.1659	+3.378	0.0010
iff_{ij}	+0.6029	0.1698	+3.550	0.0005	+0.5939	0.1652	+3.594	0.0005
σ	+0.3687				+0.3691			

$corr(\varepsilon_i^y, \varepsilon_j^y)$

variable	***coeff.***	***s.e.***	***t ratio***	***prob.***	***Coeff.***	***s.e.***	***t ratio***	***prob.***
ifc_{ij}	-0.1582	0.1462	-1.083	0.2607				
ifb_{ij}	-0.0208	0.1034	-0.201	0.7312				
$dist_{ij}$	+0.0044	0.0618	+0.071	0.9349				
$\|a_i-a_j\|$	+0.2959	0.3868	+0.765	0.4457				
$\|d_i-d_j\|$	+0.1305	0.2837	+0.460	0.6465				
ifs_{ij}	-0.1541	0.1520	-1.013	0.3422	-0.1616	0.1467	-1.101	0.2729
iff_{ij}	-0.0212	0.1517	-0.140	0.8361	-0.0497	0.1453	-0.342	0.7330
σ	+0.3294				+0.3283			

$Corr(u_i^p, u_j^p)$

Variable	***coeff.***	***s.e.***	***t ratio***	***prob.***	***Coeff.***	***s.e.***	***t ratio***	***prob.***
ifc_{ij}	+0.3187	0.1675	+1.903	0.0593	+0.3290	0.1394	+2.359	0.0198
ifb_{ij}	+0.1522	0.1184	+1.285	0.2011				
$dist_{ij}$	+0.0934	0.0708	+1.320	0.1893				
$\|a_i-a_j\|$	+0.4529	0.4432	+1.022	0.3087				
$\|d_i-d_j\|$	-0.4446	0.3251	-1.368	0.1738				
ifs_{ij}	+0.3666	0.1742	+2.104	0.0373	+0.3753	0.1696	+2.213	0.0286
iff_{ij}	+0.3201	0.1738	+1.842	0.0678	+0.2872	0.1688	+1.702	0.0911
σ	+0.3775				+0.3773			

$corr(u_i^y, u_j^y)$

variable	***coeff.***	***s.e.***	***t ratio***	***prob.***	***Coeff.***	***s.e.***	***t ratio***	***prob.***
ifc_{ij}	+0.0866	0.1737	+0.498	0.6191				
ifb_{ij}	+0.0358	0.1228	+0.292	0.7711				
$dist_{ij}$	-0.0892	0.0734	-1.215	0.2264	-0.1230	0.0508	-2.423	0.0167
$\|a_i-a_j\|$	-0.3560	0.4596	-0.775	0.4400	-0.5478	0.3007	-1.822	0.0707
$\|d_i-d_j\|$	-0.0225	0.3372	-0.067	0.9469				
ifs_{ij}	+0.3261	0.1807	+1.805	0.0734	+0.3394	0.1756	+1.933	0.0554
iff_{ij}	+0.3621	0.1803	+2.008	0.0467	+0.3681	0.1713	+2.149	0.0335
σ	+0.3915				+0.3866			

Table 6: Descriptive Statistics for the Table 5 Regressions

Regression Residual Correlations
(Lower Diagonal: Unrestricted Model; Upper Diagonal: Restricted Model)

	$corr(\varepsilon_i^p,\varepsilon_j^p)$	$corr(\varepsilon_i^y,\varepsilon_j^y)$	$corr(u_i^p,u_j^p)$	$corr(u_i^y,u_j^y)$
$corr(\varepsilon_i^p,\varepsilon_j^p)$		-0.0413	0.51733	0.12617
$corr(\varepsilon_i^y,\varepsilon_j^y)$	-0.02493		0.06562	0.51549
$corr(u_i^p,u_j^p)$	0.50864	0.07109		0.15054
$corr(u_i^y,u_j^y)$	0.12791	0.52277	0.14737	

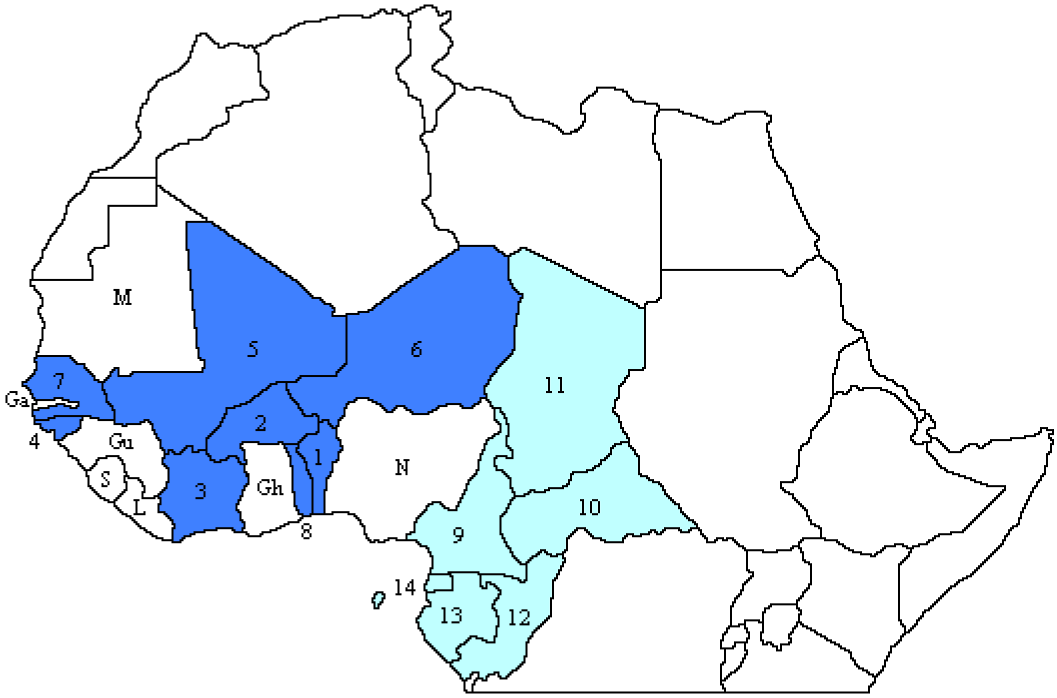
Correlation of Actual and Fitted Values (Unrestricted Model)

equation	$corr(\varepsilon_i^p,\varepsilon_j^p)$	$corr(\varepsilon_i^y,\varepsilon_j^y)$	$corr(u_i^p,u_j^p)$	$corr(u_i^y,u_j^y)$
correlation	0.37398	0.20008	0.31235	0.25606

		Unrestricted Model	*Restricted Model*
log-likelihood		605.93	600.13
Hannan-Quinn Criterion		-8.2553	-8.5445
Akaike Criterion		-8.9107	-8.8254
Residual Normality Test		p = 0.92	p = 0.90
Heteroskedasticity Test		p = 0.52	p = 0.39
R^2(LR)		0.3010	
RESET (order 2)	eq. 1	p = 0.49	
	eq. 2	p = 0.88	
	eq. 3	p = 0.41	
	eq. 4	p = 0.68	
RESET (order 3)	eq. 1	p = 0.46	
	eq. 2	p = 0.93	
	eq. 3	p = 0.61	
	eq. 4	p = 0.32	
RESET(order 4)	eq. 1	p = 0.64	
	eq. 2	p = 0.66	
	eq. 3	p = 0.41	
	eq. 4	p = 0.52	

Figure 1: The CFA Franc Zone and its Neighbors

The dark shaded area is the UEMOA; the light shaded area is the UDEAC.



1 = Benin; 2 = Burkina Faso; 3 = Côte d'Ivoire; 4 = Guinea-Bissau; 5 = Mali; 6 = Niger; 7 = Senegal; 8 = Togo; 9 = Cameroon; 10 = C.A.R.; 11 = Chad; 12 = Congo Republic; 13 = Gabon; 14 = Equatorial Guinea; Ga = Gambia; Gh = Ghana; Gu = Guinea-Conakry; L = Liberia; M = Mauritania; N = Nigeria; S = Sierra Leone

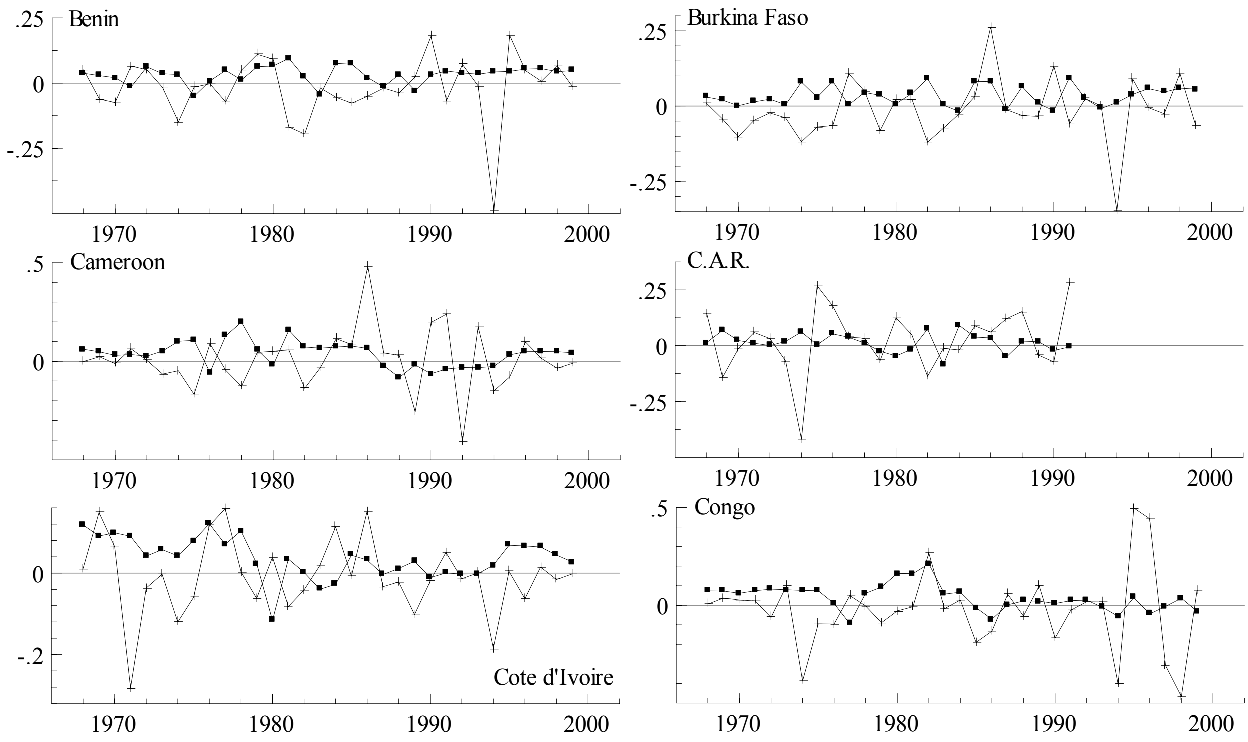


Figure 2: u_{it}^{p} (+) and u_{it}^{y} (■) time series

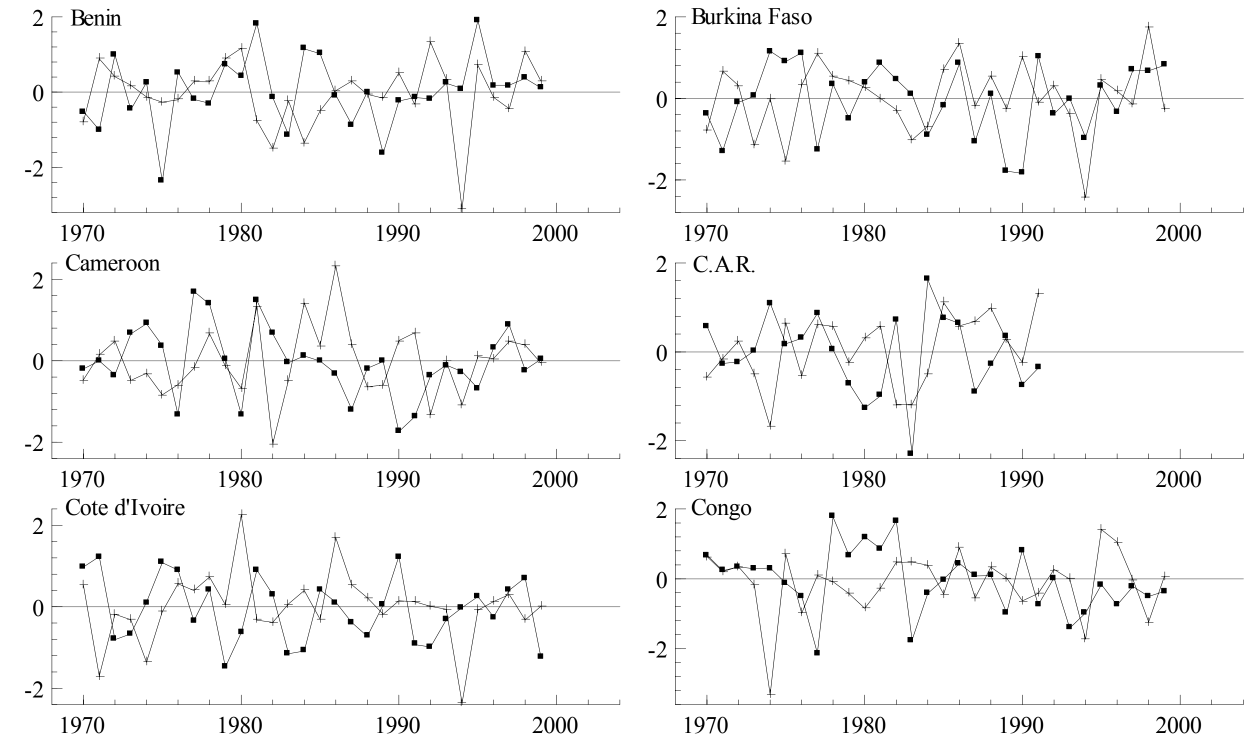


Figure 3: ε_{it}^{p} (+) and ε_{it}^{y} (■) time series

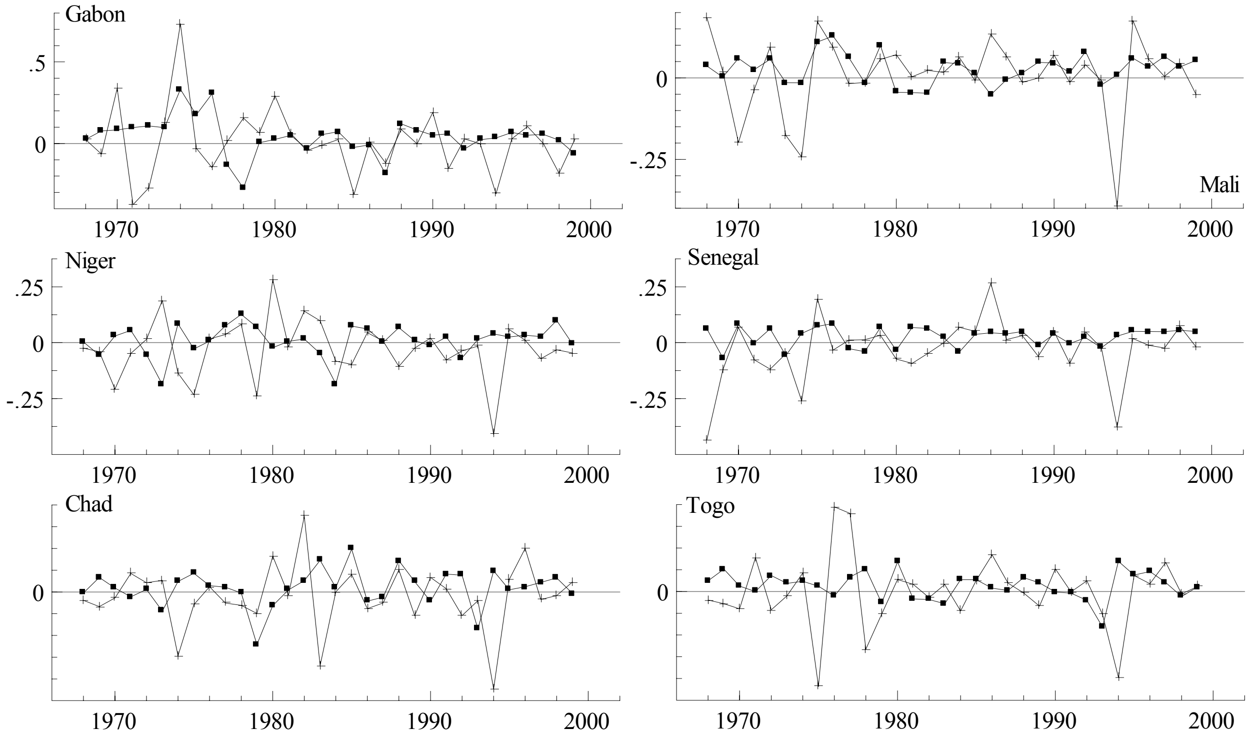


Figure 4: u_{it}^p (+) and u_{it}^y (■) time series

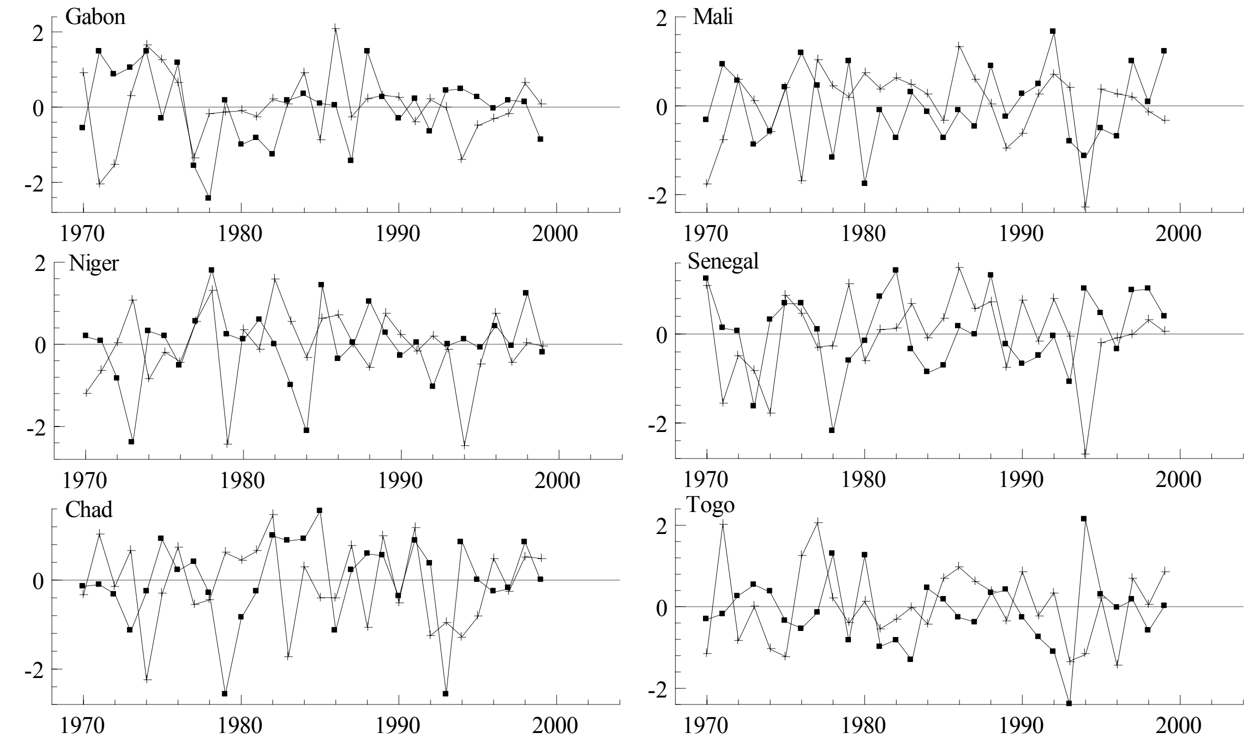


Figure 5: ε_{it}^p (+) and ε_{it}^y (■) time series

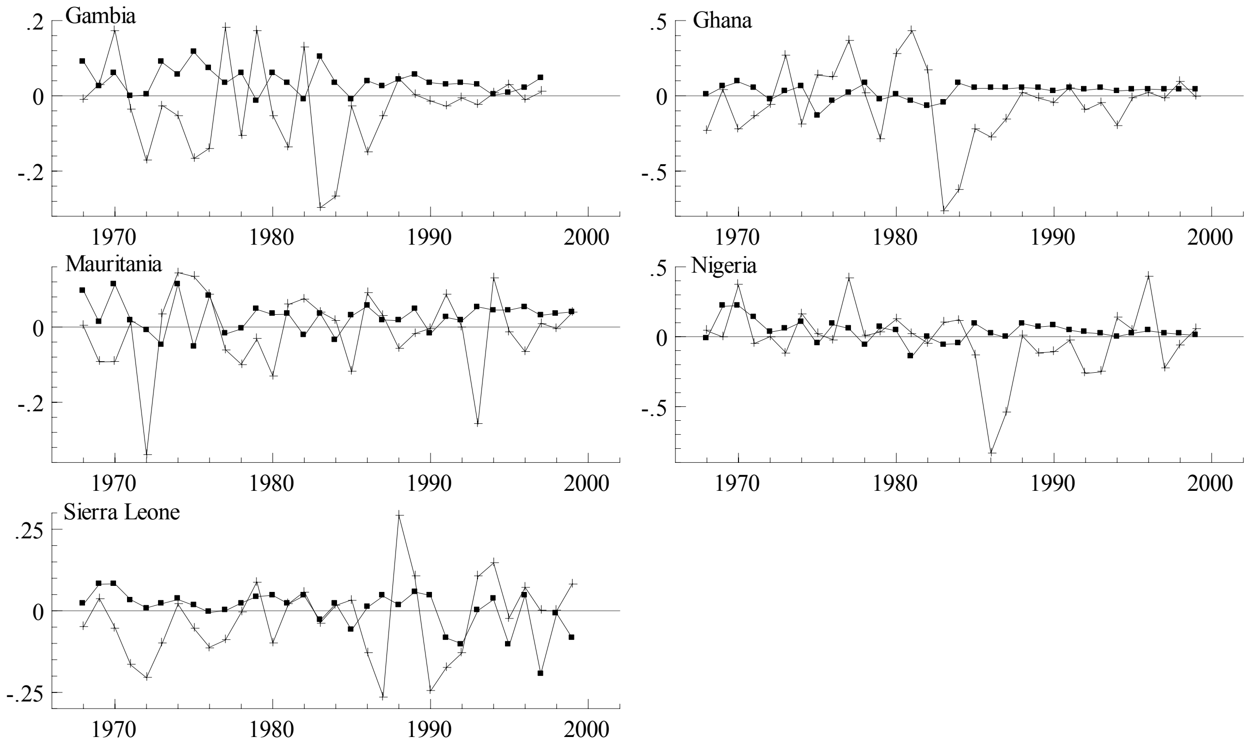


Figure 6: u_{it}^{p} (+) and u_{it}^{y} (■) time series

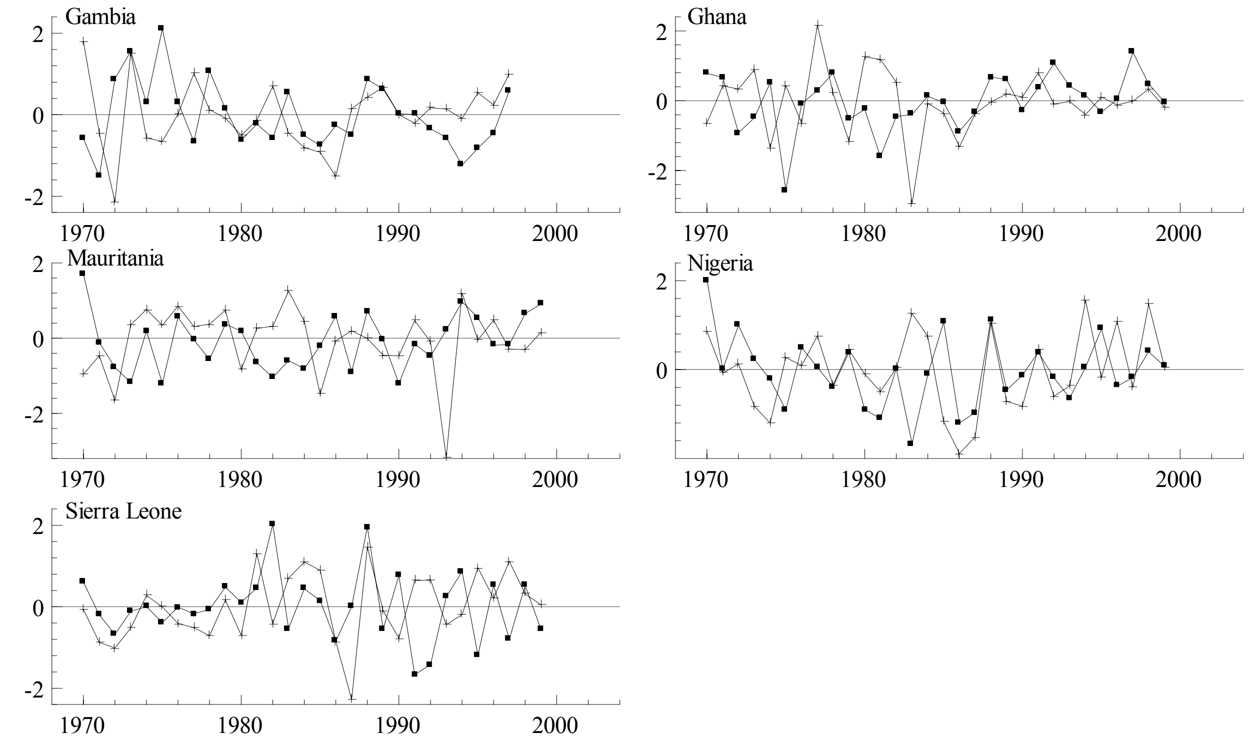


Figure 7: ε_{it}^{p} (+) and ε_{it}^{y} (■) time series