Currency Unions and International Integration: Evidence from the CFA and the ECCU

David Fielding* and Kalvinder Shields**

Third Draft: November 2001

Address for correspondence:

Department of Economics, University of Leicester,

Leicester LE1 7RH, England

E-mail: DJF14@LE.AC.UK

Telephone: ++116-252-3909

Abstract

In this paper we develop a model to identify real exchange rate and output shocks in the African CFA Franc Zone and in Dollar-pegging Caribbean countries (including members of the East Caribbean Currency Union). These two groups of countries each comprise states using several different local currencies: on the one hand the BCEAO-CFA Franc and the BEAC-CFA Franc (both pegged to the Euro), on the other the ECCU Dollar and other national Dollar-pegged currencies. The purpose of the analysis is to distinguish the effect of monetary union on macroeconomic integration from the effect of pegging to a common OECD currency.

Keywords: Currency Unions, International Integration

JEL Classification: F15, F33

* Department of Economics, University of Leicester.

** Department of Economics University of Melbourne.

Currency Unions and International Integration: Evidence from the CFA and the ECCU

1. Introduction

Over the last decade, many countries have chosen to adopt "hard" exchange rate pegs, or to become part of an international monetary union (Ghosh *et al.*, 1995). These changes have renewed academic interest in the impact of the exchange rate regime and monetary union on international macroeconomic integration. Papers such as Artis and Zhang (1995), Christodoulakis *et al.* (1995), Fatas (1996) and Boone (1997) examine the impact of exchange rate pegs on the magnitude of business cycle correlations. These studies on the magnitude of the correlation of shocks run parallel to a literature on the impact of exchange rate regimes on the persistence of asymmetric shocks, and in particular on the persistence of deviations from PPP (for example, Lothian and Taylor, 1996, Papell, 1997 and Engel and Rogers, 2001). Evidence on the impact of complete monetary union is necessarily more limited – given the small number of countries that have adhered to a monetary union for any length of time – but Rose and Engel (2000) look at their impact on business cycle correlations and trade.

In general, the evidence confirms the conjecture (as in for example Obstfeld and Rogoff, 1996) that sharing a common currency, or alternatively adopting a hard exchange rate peg with one's main trading partner, reduces international transactions costs and exchange rate risk (promoting greater trade and hence also greater business cycle synchronicity) and insulates partner countries from speculative bubbles that lead to temporary and unnecessary fluctuations in the real exchange rate.

However, none of these papers directly addresses the question of whether the impact of full monetary union on macroeconomic integration differs from that of adopting a hard peg. This is of potential policy importance, because for some countries the administrative or political costs of joining a monetary union may be prohibitively high. If adopting a hard peg is a close macroeconomic substitute to complete monetary integration, the benefits of such integration are likely to be available to a wider range of nation states.

Indeed, existing empirical papers provide very ambiguous evidence about the role of hard pegs versus the role of currency unions. Apart of the Europe-specific papers (none of which provides direct evidence on the impact of full monetary union, given the short time the EMU has been in existence), a substantial part of the international evidence relies on the inclusion of observations from the world's two long-lasting trans-national common currency areas: the CFA Franc Zone in Africa and the East Caribbean Currency Union (ECCU). In panel and cross-section studies, these areas provide the bulk of observations for *both* fixed exchange rate regimes *and* monetary unions.[1]

Using these currency areas as the basis for empirical evidence leaves to one side a potentially important point. The integration benefits to a small open economy from adhering to a currency union might arise not so much from the shared currency as from the common peg. Thus, for example, the increased integration between Puerto Rico and the Bahamas resulting from their dollarization, or between St. Lucia and Dominica resulting from their use of the ECCU Dollar, may be no greater than their integration with Barbados (which maintains a conventional peg against the US Dollar) resulting from the common peg. The existing results from francophone countries are even more ambiguous. Typically, the CFA has been treated as a single currency union, when in fact it comprises three quite separate currencies, each issued by a different central bank and *separately* pegged to the French Franc (and now to the Euro). So, for example, Togo and Gabon have been treated as members of the same currency union, but Togo and Mayotte have not. In fact, all three countries use different currencies, each exchangeable with the others at a fixed rate.

This paper will address these ambiguities by looking at the degree of macroeconomic integration between countries in two areas of the world. First, we will examine pair-wise measures of integration between the nations of the CFA, all of which use one currency or another called the CFA Franc and pegged to the French Franc / Euro. Some of the pairs are made up of economies within the same monetary union, and others are cross-union pairings. Second, we will look at the same measures for a group of Caribbean countries, all of which use currencies pegged to the US Dollar. Some are members of the ECCU, some have dollarized national currencies and others maintain conventional independent pegs.

[1] For example, the data set employed by Rose and Engel (2000) includes 256 pairs of countries identified as sharing a currency, of which 120 are CFA or ECCU pairs. A further 116 are US Dollar or French Franc pairs.

The purpose of the comparisons is to see whether adhering to a common currency delivers a degree of integration over-and-above that resulting from adherence to a common peg. Some of the theoretical explanations for greater integration are based on currency transactions costs, and suggest that integration arises from full monetary union, rather than from a common peg. Others are based on exchange rate volatility and exchange risk, and suggest that (credible) adherence to a common peg might suffice. All of the countries in our sample have maintained a fixed peg since achieving political independence, so the credibility of their pegs is not in question.[2]

The degree of integration between two countries will be measured in terms of the similarity of shocks to real output and the real exchange rate, and the similarity of the economies' responses to these shocks. (An alternative measure is the volume of bilateral trade. However, Yeats (1990) shows that African bilateral trade statistics are extremely unreliable.) The countries that will appear in our analysis are introduced in the next section. The following section discusses the economic and econometric framework that will be used for identifying output and real exchange rate innovations. The aim is to estimate a model based on realistic assumptions about the structure of the small open economies that form our sample, a structure rather different than that of the typical OECD economy.

2. Monetary Union in Africa and the Caribbean

2.1 The CFA Franc Zone

The CFA evolved from the monetary institutions of the last phase of French colonial Africa. It comprises three monetary areas, each with its own currency and central bank: the West African Economic and Monetary Union, using currency issued by the Central Bank of West African States (BCEAO); the Central African Economic Area, using currency issued by the Bank of Central African States (BEAC); and the island state of Comoros. Each currency is exchangeable for the French Franc at a rate of 100:1 (and now at the equivalent Euro rate). The only legal tender in each country is the currency issued by its central bank, and foreign currency (including other CFA currency) is not widely used as a unit of account or medium of exchange. Large exchanges of one CFA

[2] Even if the marginal effect of a common currency over a common peg is negligible, some countries might be able to adhere credibly to a peg only within a monetary union, because of the political fragility of domestic monetary institutions. So monetary union can still be a significant factor in international integration, even if the only economic consequences of monetary union are those arising from the common peg. The political economy of monetary union is, however, beyond the scope of this paper.

currency for another (or of CFA Francs for Euros) must be conducted through the central bank and are subject to taxation, so intra-CFA currency transactions costs are not negligible (Vizy, 1989).

The countries that make up the CFA, and their basic economic structure, are summarised in Tables 1-2. The boundaries between the different monetary areas have a geographical and historical basis, and each of the two monetary unions (the BCEAO and BEAC regions) comprises a wide range of economies. The BCEAO 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 BEAC 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).

[Tables 1-2 here]

In this paper we will identify output and real exchange rate shocks to those 12 of the 15 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.[3] 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 BCEAO-BEAC border, conditional on other, exogenous economic characteristics.

2.2 The ECCU and other Dollar-pegging Caribbean countries

The East Caribbean Currency Union is made up of eight island economies. Adequate data are available for the analysis of macroeconomic shocks in six of these: Antigua and Barbuda (*atg*), Dominica (*dma*), Grenada (*grd*), St. Kitts and Nevis (*ktn*), St. Lucia (*lca*) and St. Vincent and the Grenadines (*vct*).[4] Members share a single central bank issuing the ECCU Dollar, pegged to the US Dollar at a fixed rate. Proximity to the USA and a

[3] The three countries lacking adequate data are Guinea-Bissau in the BCEAO region, Equatorial Guinea in the BEAC region and Comoros. The first two of these are in any case late arrivals to the CFA.
[4] The two other ECCU members are Aruba and Montserrat.

large amount of tourism mean that US Dollars also circulate in these countries, and the central bank does not try to operate an independent monetary stabilization policy. However, the use of the ECCU Dollar as a unit of account and as a medium of exchange by all of the (sizeable) public sectors institutions across the islands ensures that the domestic private sector must deal largely in the local currency. The ECCU-US$ exchange rate has remained fixed for many years, but re-pegging is not impossible. Indeed, the currency was originally pegged to UK Sterling. In this sense, membership of the ECCU does not entail a currency union with the USA.

Many other Caribbean countries have maintained a peg against the US Dollar at one time or another. However, there are just two sizeable economies that have maintained a peg from independence through to the 21st century: the Bahamas (*bhs*), and Barbados (*brb*), plus two Central American economies: Belize (*blz*) and Panama (*pan*). In the case of the Bahamas and Panama, the fact that the peg has been retained for so long is a result of geo-political factors,[5] and the two countries are completely dollarized. Barbados and Belize have maintained conventional fixed pegs against the US Dollar. 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 the ECCU than we do between ECCU countries and the other four Dollar peggers, conditional on other, exogenous economic characteristics.

Note that we will not be looking at the degree of integration between each of the small open economies and the large economy issuing the anchor currency. Our identification of the macroeconomic shocks will be based on the assumption that foreign prices are exogenous, an assumption valid only for a small open economy.

3. Identifying Shocks to the RER and Output in Small Open Economies

3.1 Preview

In this section we describe the economic and econometric basis for the identification of macroeconomic shocks to each of the countries in our analysis. There exist already several time-series papers on the identification and cross-country comparison of macroeconomic shocks that use the method of Blanchard and Quah (1989) in order to identify these shocks. Examples are Bayoumi and Eichengreen (1996) and Funke

[5] Panama shared a land border with the USA until the latter ceded the Canal Zone in 2000; the Bahamas are only a few miles from the coast of Florida.

(1995). This involves estimating a reduced form VAR for inflation and output growth, and identifying structural shocks to each variable by imposing a set of restrictions that includes the theory-based assumption that in the long run output shocks can affect inflation but not *vice versa*.

We will adopt the general modelling strategy of Blanchard and Quah in this paper, but within the framework of a different theoretical model. The three key differences can be summarised as follows.

(1) We are looking at small open economies in which the real exchange rate is a key variable, so we need to model the relationship between domestic and foreign prices. Our model is conditioned on foreign price inflation.

(2) We do not assume that output growth is independent of inflation in the long run, because there is evidence from empirical work on growth and investment in LDCs that high inflation can have deleterious consequences for long run growth (Fischer, 1993).[6] This could be either because high inflation is associated with a higher degree of price uncertainty, depressing investment (as in, for example, Green and Villanueva, 1990), or because larger and more frequent price changes increase search costs.

(3) We wish to construct measures the degree of similarity between two countries' shocks that are *conditional* on domestic monetary policy. Two members of the same CFA monetary union might exhibit highly correlated output shocks just because they are subject to a common monetary policy; and two countries from different CFA regions might exhibit asymmetric shocks because of differences in monetary policy. (Because it is the French Treasury that guarantees the CFA–Euro pegs, the central banks of the CFA are free to follow independent short-run monetary policies. For example, central bank discount rates differ across the CFA, and are different from those of the European Central Bank.) Our aim is to identify whether sharing a common currency induces greater integration for any given set of monetary policies, so we need to identify shocks to output growth and inflation *conditional* on monetary policy indicators. In the Caribbean countries, such conditioning makes less sense. In all of the countries we will

---

[6] Bruno and Easterly (1998) contest the link between inflation and long run growth. But in the face of conflicting evidence, we choose not to impose the *a priori* restriction that inflation has no impact on long run growth.

include in our analysis, the US Dollar circulates freely as a medium of exchange alongside the local currency (in a way that the Euro does *not* in the CFA). So there is no rationale for the local central banks to operate an independent monetary policy. For this reason the output and real exchange rate shocks in the CFA will be conditioned on a monetary policy indicator, but the corresponding shocks in the Caribbean will not.

So our aim is to construct a structural VAR representation of the macro-economy of each member of the CFA and of the Caribbean Dollar peggers for which data are available. The estimated innovations in this VAR will be interpreted as macroeconomic shocks. Inference about the degree of similarity between the shocks to two countries will be based on the magnitude of the correlation of the innovations in their respective VARs, and on the degree of similarity in the impact of these innovations on the rest of the economy. We will focus particularly on shocks to domestic prices and output, conditional on domestic monetary policy (in the CFA) and common foreign price shocks. So the VAR needs to include domestic money and foreign prices alongside domestic prices and output. The structural model will be estimated by imposing exactly identifying restrictions on a reduced form VAR. These restrictions will be imposed on the long run equilibrium in the model, in the style of Blanchard and Quah (1989), not on short run coefficients. However, the macroeconomic model we employ is larger than the one used in the traditional Blanchard-Quah framework, and the restrictions embodied in it have a different theoretical motivation.

We begin with a description of the theory, and then relate this to the econometric model to be estimated in the following section.

3.2 The theoretical framework

The theoretical model from which the restrictions are derived is a description of the macroeconomic steady state. The econometric model used for the CFA is slightly larger than the one used for the Caribbean, since it includes also a monetary policy variable. We will describe the more general CFA model first, and then later indicate how the Caribbean model differs. The dependent variables in the model are Dr (real interest rate growth) Dm (nominal money stock growth) Dy (income growth) and Dp (inflation in domestic consumer prices). There is one independent variable, Dp^* (foreign inflation measured in domestic currency units). The relevant "foreign" price index is assumed to be the one in the country issuing the currency that forms the basis of the peg (i.e., France or the USA). In the steady state, the dependent variables in each economy are determined as follows:

$\Delta[m - p] = a_0 + a_1 \cdot \Delta y, \; + a_2 \cdot \Delta r, \; a_1 \neq 0 \neq a_2$	*Money Demand*	(1)
$\Delta p = b_0 + b_1 \cdot \Delta p^*, \; b_1 \neq 0$	*Relative PPP*	(2)
$\Delta y = c_0 + c_1 \cdot \Delta p + c_2 \cdot \Delta r, \; c_1 \leq 0, \; c_2 \leq 0$	*Aggregate Supply*	(3)
$\Delta r = f_0 + f_1 \cdot \Delta y + f_2 \cdot \Delta[p^* - p], \; f_1 \leq 0 \leq f_2$	*Aggregate Demand*	(4)

Equation (1) states that long run real money demand growth (with a reasonably wide definition of money) is a function of real income growth and real interest rate changes. In the steady state, the nominal money stock is assumed to adjust to clear the money market for a given level of nominal money demand, and the monetary authorities do not restrict the formation of bank deposits. This equilibrium condition does not preclude the possibility that in the short run policy-driven monetary shocks (i.e., innovations in Δm) can impact on the other dependent variables in the system.

Equation (2) embodies a weak version of the assumption of relative PPP. We do not assume that domestic and foreign consumer price inflation rates converge in the long run (although this is possible, if $b_0 = [1 - b_1] = 0$). Rather, we assume that if there is any divergence, it is at least at a constant rate. Lowrey (1995) provides evidence for this weak form of relative PPP amongst CFA members, whereas Nuven (1994) is able to reject the hypothesis of strong PPP for most CFA countries. Note that with a fixed nominal exchange rate the foreign price inflation term, Δp^*, is independent of the other variables in the model.

Equation (3) allows the growth of aggregate supply to depend on the growth of aggregate domestic prices, even in the long run. The introduction of the term $c_1 \cdot \Delta p$ is not intended to suggest that there is long run money illusion, or that nominal wages are permanently rigid. Rather, it allows for the possibility that high inflation can have deleterious consequences for long run growth. The coefficient c_2 allows interest rate increases to depress capital stock growth and hence income growth in the long run.

Equation (4) is an inverted aggregate demand curve, in which the growth of aggregate demand depends on the growth of the interest rate (which will affect domestic demand for consumption and investment goods) and real exchange rate appreciation (which will affect net export growth).

The one dependent variable which is difficult to measure in many LDCs is the interest rate, r. The only rate reported consistently throughout the sample period in the CFA and the Caribbean is the official central bank discount rate, which is unlikely to equal the marginal cost of loanable funds. So we do not attempt to model Δr, and instead express equations (3-4) in reduced form:

$$\Delta y = [c_0 + c_2 \cdot \phi_0 + (c_1 - c_2 \cdot \phi_1) \cdot \Delta p + c_2 \cdot \phi_2 \cdot \Delta p^*] / [1 - c_2 \cdot \phi_1] \qquad (5)$$

Since $c_2 \cdot \phi_1 \neq 0$, the denominator of this expression, and therefore the impact of increases in Δp and $\Delta p^* r$ on Δy, are ambiguous. For the same reason $[c_1 - c_2 \cdot \phi_1]$ is ambiguously signed, but $c_2 \cdot \phi_2 \leq 0$; so the effects on Δp and Δp^* on Δy could work in the same or in opposite directions. The "normal" case is when an increase in inflation decreases output growth, because of its efficiency-reducing effects. However, there is also a "perverse" case when both the elasticity of aggregate supply with respect to the interest rate and the slope of the IS curve are greater than unity ($c_2 \cdot \phi_1 > 1$), so the response of long run growth to inflation flips sign.

Since equation (5) is constructed by substituting the aggregate demand curve into the aggregate supply curve, the shocks to output in our model are not to be interpreted as "aggregate demand" or "aggregate supply" shocks. They are more readily interpreted as aggregate "real" (as opposed to price or nominal money) shocks.

Our equation for money demand growth is also expressed in reduced form:

$$\Delta m = a_0 + a_2 \cdot \phi_0 + [a_1 + a_2 \cdot \phi_1] \cdot \Delta y + a_2 \cdot \phi_2 \cdot \Delta p^* + [1 - a_2 \cdot \phi_2] \cdot \Delta p \qquad (6)$$

Implicit in equations (5-6) is the equilibrium adjustment of the real marginal cost of loanable funds. At times domestic monetary authorities in the CFA and in several of the Caribbean countries have controlled nominal lending rates on certain types of loan, so it would be very heroic to assume the equilibrium adjustment of the formal financial sector loan rate. We are rather relying on the assumption that if the formal sector loans market does not clear, there is at the margin a flexible curb market interest rate that adjusts endogenously. The steady state for each economy is described by the values of the parameters in equations (2) and (5-6).

If we estimate the dynamics of the three dependent variables (Δp, Δy, Δm) within a VAR framework for which equations (2) and (5-6) describe the steady state, then there are three long run restrictions to be imposed. These are the absence of Δm in equation (5) and the absence of Dy and Dm in equation (2). These restrictions will be used to identify the system. Note that in this model of a fixed exchange rate economy with relative PPP in the long run, and with a long run aggregate supply function that includes inflation, shocks to inflation will have a long run impact on output, but shocks to output will have no impact on inflation. In this way we differ from other papers that use long run restrictions to identify a macroeconomic model, in which output shocks typically have a long run impact on inflation, but inflation shocks have no impact on output.

We do not impose corresponding short run restrictions on equations (2) and (5). We allow changes in Dm to influence Dy in the short run, because a disequilibrium in the money market might well affect aggregate demand, as consumers respond to excess supply of or demand for money by increasing or reducing their spending. We also allow changes in Dm and Dy to affect Dp in the short run because short run deviations from PPP are possible, and in the short run prices rather than nominal money may adjust to clear the money market in response to changes in Dy or Dm.

There is no long run restriction on the money growth equation, equation (6). We are assuming that in the long run, the nominal value of bank deposits can adjust to satisfy people's demand, and that this demand depends on inflation, income and the interest rate. In the short run, when PPP does not have to hold, it may be that money market equilibrium is achieved (at least partially) by the adjustment of domestic prices. In this case, a shock to the money base could impact on Dm in the short run. This does not mean that Dm can be assumed to be weakly exogenous to Dp and Dy. Central bank decisions about narrow money creation are likely to depend on the current state of the macro-economy: there is evidence for this with respect to Cote d'Ivoire in Fielding (1999). Dm is likely to depend on Dp and Dy in both the short run and the long run, but for different reasons.

In the absence of any short run restrictions in our model, the dynamics of inflation, output growth and money growth can be described by a system of the form:

$$C_{11}(L)\, Dp_t + C_{12}(L)\, Dy_t + C_{13}(L)\, Dm_t + B_{11}(L)\, Dp^*_t = e_{1t} \qquad \text{(2a)}$$

$$C_{21}(L)\, Dp_t + C_{22}(L)\, Dy_t + C_{23}(L)\, Dm_t + B_{21}(L)\, Dp^*_t = e_{2t} \qquad \text{(5a)}$$

$$C_{31}(L)\, Dp_t + C_{32}(L)\, Dy_t + C_{33}(L)\, Dm_t + B_{31}(L)\, Dp^*_t = e_{3t} \qquad \text{(6a)}$$

where equation (xa) corresponds to equation (x) above, the $B_{ij}(L)$ are lag polynomials embodying restrictions to ensure that equations (2) and (5-6) hold in the long run, and the ε_{it} are orthogonal shocks to domestic inflation, output growth and money growth respectively.

We are especially interested in the shocks in equations (2a) and (5a). Equation (2a) captures deviations from relative PPP. That is, it models variations in a country's real exchange rate *vis à vis* the country whose currency is used as the peg (France or the USA). ε_{1t} captures the unanticipated component of such variations. We would expect ε_{1t} to be smaller for our sample of countries than in countries without a peg, though this conjecture will not be tested directly.[7] Our main concern is whether a country's real exchange rate *vis à vis* one of its neighbors exhibits less volatility when the two countries use the same currency rather than just the same peg; i.e., whether the two countries' ε_{1t} shocks are more highly correlated, and whether their dynamic responses to the shocks exhibit greater similarity.

In equation (5a), the output growth shocks ε_{2t} combine shocks to aggregate demand with shocks to aggregate supply, separate identification of the two components being impossible in the absence of appropriate interest rate data. To the extent that ε_{2t} is dominated by productivity shocks, we might expect economies with similar production structures to have a relatively high correlation in ε_{2t}. To the extent that sharing a common currency rather than just a common peg promotes macroeconomic integration, we ought to observe a higher correlation in ε_{2t} when two countries in our sample are in the same monetary union, and greater similarity in the dynamic response to the ε_{2t} shocks. In other words, the two countries' real business cycles ought to exhibit a greater degree of similarity.

3.3 The econometric framework

The identification of the system is based on the methodological framework introduced by Blanchard and Quah (1989), although our macroeconomic model differs from theirs. For each country we estimate a reduced form VAR:

$$X_t = A(L)X_{t-1} + B(L)\Delta p^*_t + e_t = B(L)\Delta p^*_t + (I - A(L))^{-1}e_t \qquad (7)$$

where $A(L)$ is a 3×3 matrix of lag polynomials, $B(L)$ a 3×1 matrix, and X_t denotes the 3×1 vector of stationary variables:

$$X_t = [\Delta p_t, \Delta y_t, \Delta m_t]' \qquad (8)$$

[7] Because when the exchange rate floats we do not have enough restrictions to identify the ε vector.

This three-variable system corresponds to the model represented by equations (2a) and (5a-6a) above. e_t represents the vector of reduced form residuals. We impose no *a priori* restrictions on the reduced form residual covariance matrix. Moreover, the e_t are likely to be correlated across countries, so all the VARs must be estimated simultaneously.

In the absence of any theoretical restrictions the reduced form innovations e_t have no obvious economic interpretation. Such an interpretation will depend on the derivation of an alternative moving average representation to equation (7), which formulates variable movements as a function of past *structural* shocks, ϵ_t:

$$X_t - B(L)\Delta p^*_t = C(L)\epsilon_t \tag{9}$$

where, in terms of the theoretical model represented by equations (2a) and (5a-6a), $C = B^{-1}$ and the matrix ϵ_t contains the structural shocks to each equation in the system. The elements of ϵ_t are mutually uncorrelated. This will allow us to estimate the *cross-country* correlation coefficients for each element of ϵ_t. Moving from equation (7) to equation (9) requires the identification of a non-singular matrix S that links the reduced form and structural innovations, i.e.:

$$e_t = S\epsilon_t \tag{10}$$

where, in terms of equation (9), $S = C(0)$. In an n-variable model identification requires n^2 restrictions: in our case, $n^2 = 9$. Following the Blanchard-Quah framework, we assume that the structural shocks are orthogonal and have unit variance, i.e. $Var(\epsilon_t) = I$. This gives us $(n+1)n/2 = 6$ restrictions. The other restrictions comesfrom the assumption that in the moving average process described in equation (9), which can be written out in full as:

$$X_t - B(L)\Delta p^*_t = \begin{bmatrix} \Delta p_t \\ \Delta y_t \\ \Delta m_t \end{bmatrix} - \begin{bmatrix} B(L)_{11} \\ B(L)_{21} \\ B(L)_{31} \end{bmatrix} \Delta p^*_t = \begin{bmatrix} C(L)_{11} & C(L)_{12} & C(L)_{13} \\ C(L)_{21} & C(L)_{22} & C(L)_{23} \\ C(L)_{31} & C(L)_{32} & C(L)_{33} \end{bmatrix} \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \epsilon_{3t} \end{bmatrix} \tag{11}$$

the $C(L)$ matrix is lower-triangular, i.e., $C_{12} = C_{13} = C_{23} = 0$. These are precisely the restrictions embodied in the long run macroeconomic model described above. The imposition of these restrictions will allow us to recover the structural shocks ϵ_t from the reduced form shocks e_t in the original VAR.[8]

[8] The normalization to unit variances, which is necessary to identify the structural shocks, does put a limit on their informational content: the cross-country correlation coefficients cannot be accompanied by

Equation (11) is designed to identify shocks in the CFA, where only domestic currency circulates freely. In the Caribbean and Central American countries we will look at, US Dollars circulate alongside the domestic currency, and are freely available. In these countries it makes little sense to model the response of macroeconomic variables to the stock domestically issued currency. For this reason the VAR applied to the Caribbean is reduced in dimension:

$$X_t - B(L)\Delta p_t{}^* = \begin{bmatrix} \Delta p_t \\ \Delta y_t \end{bmatrix} - \begin{bmatrix} B(L)_{11} \\ B(L)_{21} \end{bmatrix} \Delta p_t{}^* = \begin{bmatrix} C(L)_{11} & C(L)_{12} \\ C(L)_{21} & C(L)_{22} \end{bmatrix} \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \qquad (12)$$

The single restriction needed to identify e_t (besides $Var(e_t) = I$) is that $C_{12} = 0$. In the next section, we present the results of estimating the VARs in equations (11-12) for each of our African and Caribbean countries.

4. Estimates of Shocks to the RER and Output in the CFA and the Caribbean

4.1 Preview

In this section we will present estimates of cross-country correlations of the structural shocks e_{1t} and e_{2t} for members of the CFA (using equation (11) to identify the shocks in each country) and for ECCU members and their neighbors (using equation (12)). To the extent that adhering to a common currency delivers extra insulation from real exchange rate fluctuations (over-and-above that provided by a common peg), we ought to find that pairs of countries using a common currency exhibit a higher correlation of e_{1t} than pairs using different currencies, and greater similarity in the dynamic response to the e_{1t} shocks. To the extent that adhering to a common currency delivers extra macroeconomic integration, the same ought to be true of the e_{2t} shocks.

In the next two sub-sections, we present descriptive statistics on real exchange rate and output shocks in the CFA and the Caribbean. The last sub-section, we construct formal tests of the hypotheses above.

a comparison of innovation variances. Nevertheless, as Table 3 below shows, the residual variances for each variable in the unrestricted VAR are quite similar across countries. So the variances of the structural shocks that lie behind the innovations in the unrestricted VAR are unlikely to vary enormously across countries.

4.2 Shocks in the CFA

Figures for Dp (the growth rate of the consumer price index), Dy (the growth rate of real GDP at market prices) and Dm (the growth rate of M1) in the CFA countries are taken from the World Bank *World Development Indicators*. The annual data run from 1966 to 1997. French inflation figures (Dp^*) are taken from the same source. ADF tests (not reported) indicate that all the variables are stationary. We use the data to estimate the VAR in equation (11) for each of the 12 countries. Since the reduced-form regression residuals are likely to be correlated across countries, OLS is not an efficient way of estimating the VAR parameters. However, there are not enough observations to estimate the whole (36 × 36) covariance matrix of residuals. So we stack the 12 Dp series and estimate the 12-variable system by SUR, and then do the same for Dy and Dm. Descriptive statistics for resulting regression equations are given in Table 3; the VAR lag order is 2, which minimizes the Schwartz-Bayesian Criterion for the system.[9]

[Table 3 here]

Table 4 shows the sample cross-country correlation coefficients for the estimated structural innovations to Dp (e_{1t}) and Dy (e_{2t}). In the correlation matrix, the Dp correlations are shown below the main diagonal and the Dy correlations above. The e_{1t} are typically very highly correlated across all of the CFA, even across the BCEAO-BEAC border. Most are significantly greater than zero at the 1% level. So, for example, the correlation coefficient for real exchange rate shocks to the Central African Republic (*car*) and Senegal (*sen*) is 97%. When prices in one CFA country deviate from relative PPP with France, prices in other CFA countries are likely to be deviating in the same direction.

[Table 4 here]

We will leave until later the question of whether the correlations within the BCEAO region and within the BEAC region are greater than those across the two currency areas, conditional on each country's economic characteristics. But a cursory glance at Table 4 reveals that some countries have significantly lower correlation coefficients with *all* other CFA members, regardless of the currency they use. As Table 5 indicates, there is a

[9] In the CFA regressions the coefficient on contemporaneous Δp^* is never significant, and only its lags are included in the regressions.

“core” group of 8 CFA members (Cote d’Ivoire, Senegal, Togo and Mali in the BCEAO region; Cameroon, Congo Republic, Gabon and the Central African Republic in the BEAC region) whose average e_{1t} correlation coefficient is 92%. If the group is expanded to incorporate the other four CFA members (Benin, Burkina Faso and Niger in the BCAEO region and Chad in the BEAC region), then the average correlation coefficient falls to 76%. In other words, there are substantial country-specific factors affecting the degree of correlation in addition to any effect of sharing a common currency.

[Table 5 here]

Table 4 also lists correlation coefficients for the output shocks e_{2t}. These exhibit rather more heterogeneity than the real exchange rate shocks. As indicated in Table 5, there are two groups of countries within which correlations are positive and reasonably large. These are (i) the BCAEO countries Benin, Burkina Faso, Senegal, Togo, and Niger, plus the BEAC countries Cameroon, Gabon, Central African Republic and Chad; (ii) the BCEAO counties Cote d’Ivoire and Mali, plus the BEAC country Congo Republic. However, all correlations across these two groups are *negative*. Again, country-specific effects play a large role in predicting the size of correlations. It remains to be seen whether membership of the same monetary union has any marginal impact on these correlation coefficients. Moreover, country-specific effects for output shocks differ from country-specific effects for real exchange rate shocks: the membership of the core price groups in Table 5 cuts across the core output groups. This is not inconsistent with possible theoretical explanations for the degree of correlation between output shocks or between real exchange rate shocks. For example, the degree of similarity in real exchange rate shocks might be dominated by the extent of price inertia. (The four real exchange rate “outsiders” are all among the most underdeveloped countries in the CFA; three are in the Sahel.) The degree of similarity in output shocks might be dominated by completely different factors, such as the structure of production. But it does suggest that adherence to a common currency is by no means the only factor driving the size of cross-country correlations in e_{1t} and e_{2t}.

The extent of macroeconomic integration is indicated not only by the size of innovation correlations, but also by the degree of similarity in the response to these innovations. Table 6 provides some information on this aspect of integration by listing the cumulative impulse response statistics for each shock in each country. The first column in the table shows the estimated asymptotic effect on the level of p of a unit shock to equation (2a), i.e., $e_{1t} = 1$. The second shows the effect of the same shock on the level of shock on the level of y, and the third shows the effect of a unit shock to equation (5a) on y.[10] (By assumption, a shock to equation (5a) has no asymptotic effect on the level of p.)

There is no obvious pattern relating the size of the impulse responses to membership of one or other of the monetary unions. For example, in the first column, there are both BCEAO and BEAC countries with relatively small cumulative impulse responses (for example, Mali and Gabon), and both BCEAO and BEAC countries with relatively large responses (for example, Benin and Congo Republic). The middle column, corresponding to the ambiguously signed parameter $c_2 f_2/[1 - c_2 f_1]$ in equation (5), shows positive responses in some of the countries of both monetary unions, and negative responses in others. As with the innovation correlations, country-specific effects appear to dominate any monetary union effect in inducing similarity in dynamic responses to shocks. Moreover Figures 1-3, which depict the cumulative impulse response profiles corresponding to the Table 6 estimates, indicate that there is no obvious pattern distinguishing the dynamic response to shocks in the BCEAO countries from the dynamic response to shocks in the BEAC countries.

[Table 6 and Figures 1-6 here]

4.3 Shocks in the Caribbean

Figures for Dp and Dy in the Caribbean countries are taken from the World Bank *World Development Indicators*. The number of the annual observations available varies from one country to another, with the earliest reported figures in 1960 and the latest in 2000. However, there are at least 30 observations for all 10 countries. US inflation figures (Dp^*) are taken from the same source. ADF tests (not reported) indicate that all of these variables are stationary. We use the data to estimate the VAR in equation (12) for each of the 10 countries. Were we to use SUR to estimate in the VAR, as we did for the CFA countries, the sample size would be quite limited. (Some Caribbean countries' data starts

10 It should be noted as a *caveat* that few of the figures in Table 6 are significantly different from zero: we have quite a small sample.

and ends early; some starts and ends late.) So there is an efficiency trade-off between using SUR and using OLS with different start and end dates in different countries. Here we report results of the second approach, but the results of the first are quite similar. Descriptive statistics for resulting regression equations are given in the bottom part of Table 3; the VAR lag order is 2, which minimizes the Schwartz-Bayesian Criterion for the system.

The bottom part of Table 4 shows the sample cross-country correlation coefficients for the estimated structural innovations to Dp (e_{1t}) and Dy (e_{2t}). In the correlation matrix, the Dp correlations are shown below the main diagonal and the Dy correlations above. The Caribbean e_{1t} correlation coefficients are typically rather smaller than the corresponding CFA ones, even when the sample is restricted to the ECCU countries alone. Overall, this is a more heterogeneous group than the African one. As shown in the bottom half of Table 5, there is a core of 5 countries for which the average real exchange rate innovation correlation is 52%: Antigua, Dominica and Grenada in the ECCU, plus Barbados and Belize outside. Adding in St. Kitts and Panama reduces the average to 38%; adding in the other three countries reduces the average even further. In other words, there is a substantial amount of unanticipated real exchange rate variation across the Caribbean countries, as well as between each country and the USA. Again, country-specific effects appear to be important. Moreover, the degree of correlation of real exchange rate shocks for the ECCU as a whole is substantially less than the corresponding degree of correlation in the CFA area.

These remarks are also true of the estimated output shock correlations. If one excludes Panama, then the average e_{2t} correlation coefficient for the remaining 9 countries is greater than zero, but only 30% of the individual coefficients are statistically significant. Even within the ECCU, there are many pairs of countries with negative or insignificant correlations. Still, we have yet to see whether adhering to the ECCU has a marginally positive impact on the degree of correlation, *ceteris paribus*.

Neither is there an obvious pattern relating the size of the cumulative impulse responses to membership of the ECCU (bottom half of Table 6). In the first column, for example, there are both ECCU and non-ECCU countries with relatively small cumulative impulse responses (for example, Grenada and Belize), and both ECCU and non-ECCU countries with relatively large responses (for example, Antigua and the Bahamas). The middle column, representing the cumulative impact of shocks to the real exchange rate on output, shows positive responses in some of the ECCU and non-ECCU countries, and negative responses in others. As in the CFA, country-specific effects appear to dominate any monetary union effect in inducing similarity in dynamic responses to shocks. Moreover Figures 4-6, which depict the cumulative impulse response profiles corresponding to the Table 6 estimates, indicate that there is no obvious pattern distinguishing the dynamic response to shocks in the ECCU countries from the dynamic response to shocks in the non-ECCU countries.

4.4. Testing for the marginal effect of adhering to a common currency

We will now address directly the question: Is macroeconomic integration within a common currency area (as captured by the observed correlation of structural innovations in output and the real exchange rate) greater than integration among currencies sharing a common peg? In order to do this, we follow a methodology 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 approach is to construct a fixed-effects regression for the correlation between real exchange rate or output innovations in any two countries i and j, conditional on both a common currency dummy ($ifsame_{ij}$) and a set of exogenous conditioning variables (X_{ij}):

$$\ln\left(\frac{1+\sigma_{ij}^{\Delta z}}{1-\sigma_{ij}^{\Delta z}}\right)=\theta_i\cdot D_i+\theta_j\cdot D_j+\alpha\cdot ifsame_{ij}+X'_{ij}\beta+u_{ij};\ z=p,y \qquad (13)$$

where $\sigma_{ij}^{\Delta z}$ is the cross-country correlation between the structural innovations in the z^{th} macroeconomic variable. The logistic transformation is used to ensure that the distribution of the dependent variable is unbounded. u_{ij} is a residual. The t-ratio on the parameter α constitutes a test statistic for the hypothesis that sharing a common currency (rather than just a common peg) makes a difference to the extent of macroeconomic integration.

D_i is a dummy variable for the i^{th} country. As we saw earlier, country-specific effects have a large part to play in predicting the size of cross-country innovation correlations, 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 the innovation correlations.

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): $(y/n)_i \cdot (y/n)_j$

(iii) The log-product of their land surface areas (in km^2): $a_i \cdot a_j$

(iv) A dummy variable for whether the countries share a land border (for the CFA sample only): *ifbord (i,j)*

(v) The logarithm of the Great Circle distance between their capital cities (in radians): *dist(i,j)*

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 their correlation measure $s_{ij}^{\Delta p}$ might be greater. In this paper, we do not attempt to identify the channels through which the conditioning variables impact on our macroeconomic integration measures.

The regression equation (13) is estimated on two samples. The first is made up of the 66 country pairs identified in the matrix in the top half of Table 4, i.e., the pairings of the 12 CFA countries. The second is made up of the 45 country pairs identified in the matrix in the bottom half of Table 4, i.e., the parings of the 10 Caribbean and Central American countries. For each sample there are two regressions, one for $s_{ij}^{\Delta p}$ and one for $s_{ij}^{\Delta y}$. In the CFA sample, $ifsame_{ij} = 1$ in 31 cases (when both countries are in the BCEAO area, or both are in the BEAC area); in the Caribbean sample, $ifsame_{ij} = 1$ in 15 cases (when both countries are ECCU members). The data used to construct the conditioning variable (i-iv) is taken from the World Bank *World Development Indicators*. The regression results are reported in Table 7.

The first part of the table reports the CFA regressions. It turns out that none of the elements of the X-vector is statistically significant at conventional confidence levels,[11] so we report two regressions each for $s_{ij}^{\Delta p}$ and $s_{ij}^{\Delta y}$: one including the *X*-vector and one excluding it. The fixed effects are highly significant, explaining over 80% of the sample variation in $s_{ij}^{\Delta p}$ and over 30% of the sample variation in $s_{ij}^{\Delta y}$. In other words, the country-specific factors that do affect the degree of macroeconomic integration are not strongly correlated with the conventional variables used to explain trade integration.

In none of the CFA regressions is the t-ratio on a statistically significant. In no case is there any evidence that belonging to a common currency area enhances macroeconomic integration, over-and-above any effect from adhering to a common peg.

The results for the Caribbean are largely similar to those for the CFA, with the fixed effects playing the dominant role in explaining sample variation in $s_{ij}^{\Delta p}$ and $s_{ij}^{\Delta y}$. They explain over 60% of the variation in $s_{ij}^{\Delta p}$ and over 40% of the variation in $s_{ij}^{\Delta y}$. However, some of the *X*-variables are statistically significant in the $s_{ij}^{\Delta y}$ regression. A 1% increase in the distance between i and j reduces $\left(\frac{1+s_{ij}^{\Delta y}}{1-s_{ij}^{\Delta y}}\right)$ by 0.3%, while a 1% increase in the initial GDP measure increases it by 0.18% and a 1% increase in the country size measure reduces it by 0.04%.

In none of the Caribbean regressions is the t-ratio on a statistically significant. In no case is there any evidence that belonging to a common currency area enhances macroeconomic integration, over-and-above any effect from adhering to a common peg.

It is also possible to estimate the marginal impact of a common currency on the degree of similarity in impulse responses discussed in sections 4.2-4.3. For example, we can regress the absolute cross-country differences in the figures in the first column of Table 6 on the explanatory variables in Table 7. Such regression equations are not reported here; in no case is the *ifsame*(*i,j*) dummy statistically significant.

5. Summary and Conclusion

In this paper we have used a structural VAR model for a small open economy to estimate real exchange rate and output shocks in two areas of the world: the CFA Franc Zone and the Caribbean, including the East Caribbean Currency Union. All of

[11] The *ifbord* dummy does have a significantly positive coefficient if all other X-variables (including *ifsame*) are excluded from the regression.

the countries in our two samples have maintained a pegged exchange rate over the last 40 years (to the French Franc and US Dollar respectively). Some of them share the same currency. The purpose of estimating the structural innovations is to see whether sharing a common currency delivers an extra degree of macroeconomic integration (measured by the size of cross-country innovation correlations), as compared with sharing a common peg.

We have found that innovations are highly correlated, particularly in the CFA area, and this is likely to result at least partly from the fact that all countries maintain a peg against the same OECD currency. However, there is no evidence that sharing a common currency delivers an extra degree of integration. Previous papers have found a substantially greater degree of integration between countries that adhere to the same peg than between countries that do not. The results of this paper suggest that this difference is not primarily a result of sharing a common currency. What matters is a credible, stable peg.

It may be the case that for many countries, institutional constraints mean that the best way of achieving a credible peg is to join a local monetary union. But our results suggest that countries that dollarize or euroize independently, or are able to maintain a conventional peg independently, are not likely to be any less integrated with their pegging partners than if they shared the same central bank.

References

M. Artis and Zhang, W. (1995) "International Business Cycles and the ERM: Is there a European Business Cycle?", CEPR Discussion Paper 1191

L. Boone (1997) "Symmetry and Asymmetry of Supply and Demand Shocks in the European Union: A Dynamic Analysis", CEPII Working Paper 97-03

T. Bayoumi and Eichengreen, B. (1996) "Operationalizing the Theory of Optimal Currency Areas", mimeo, CEPR, London, UK

O. Blanchard and Quah, D. (1989) "Dynamic Effects of Aggregate Demand and Supply Disturbances", *American Economic Review*, 79, P655-73

M. Bruno and Easterly, W. (1998) "Inflation Crises and Long Run Growth", *Journal of Monetary Economics*, 41, 3-26

N. Christodoulakis, Dimelis, S. and Kollintzas, T. (1995) "Comparisons of Business Cycles in the EC: Idiosyncracies and Regularities", *Economica*, 62, 1-27

C. Engel and Rogers, J. (2001) "Deviations from Purchasing Power Parity: Causes and Welfare Costs", *Journal of International Economics*, 55, 29-57

A. Fatas (1996) "EMU: Countries or Regions?", paper presented to the European Economic Association Annual Conference, Istanbul

S. Fischer (1993) "The Role of Macroeconomic Factors in Growth", *Journal of Monetary Economics*, 32, 485-512

L. Goreux (2001 A. Ghosh , Gulde, A-M., Ostry, J. and Wolf, H. (1995) "Currency Boards: The Ultimate Fix?", IMF Working Paper WP/95/121

J. Green and Villanueva, D. (1990) "Private Investment in Developing Countries", *IMF Staff Papers*, 38, 33-58

J. Lothian and Taylor, M. (1996) "Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries", *Journal of Political Economy*, 104, 448-509

M. Lowrey (1995) "France and the CFA: Price and Money Supply Growth Determination", *Journal of African Economies*, 4, 225-42

D. Nuven (1994) "Linkages in the Price Level and Inflation Rate Between CFA Franc Zone Countries and France", IMF Working Paper WPS/94/93-EA, IMF, Washington, DC

M. Obstfeld and Rogoff, K. (1996) *Foundations of International Macroeconomics*: MIT Press, Cambridge, MA

D. Papell (1997) "Searching for Stationarity: Purchasing Power Parity Under the Current Float", *Journal of International Economics*, 43, 313-32

A. Rose and Engel, C. (2000) "Currency Unions and International Integration", NBER Working Paper 7282

M. Vizy (1989) La Zone Franc: CHEAM, Paris, France

Table 1: Summary Statistics

	ben	bfa	civ	sen	tgo	mli	ner	cam	cgo	gab	car	tcd
1987 agriculture value added (% GDP)	33.3	31.5	29.2	21.7	33.5	45.2	36.3	24.8	11.9	11	46.9	33.1
1997 agriculture value added (% GDP)	38.4	31.8	27.3	18.5	42.2	44.0	38.0	42.1	9.5	7.5	54.1	37.4
1987 total external debt (% GDP)	76.4	38.4	134.6	87.6	98.9	94.2	75.1	33.2	145.2	79.8	47.8	27.9
1997 total external debt (% GDP)	75.9	54.5	152.3	81.0	89.2	119.9	88.7	101.9	227	67.5	92.3	54.9
1987 exports (% GDP)	29.3	10.6	33.4	24.1	41.4	16.6	21.5	15.7	41.7	42.7	16.2	15.4
1997 exports (% GDP)	24.9	11.2	46.6	32.8	34.7	25.5	16.2	26.8	77.0	64.0	19.5	18.7
1985 gross investment (% GDP)	12.9	20.9	12.3	12.5	17.6	20.7	12.0	24.7	19.7	26.4	12.5	9.1
1995 gross investment (% GDP)	18.5	27.0	16.0	18.7	14.9	20.6	10.8	16.2	26.0	26.3	9.0	16.3
sample s.d. Δy (%)	4.5	4.0	6.3	3.8	7.4	5.3	9.0	5.7	6.9	9.0	4.2	11.4
sample s.d. Δp (%)	8.0	8.1	6.8	7.9	8.0	10.0	9.1	7.2	7.8	9.0	6.5	8.0
sample s.d. Δm (%)	30.0	9.9	10.5	16.0	34.3	11.1	13.6	13.1	13.7	16.8	13.7	16.8

	atg	dma	grd	ktn	lca	vct	bhs	brb	blz	pan
1985 agriculture value added (% GDP)	5.0	28.0	17.1	9.1	15.2	19.6	2.2	6.2	20.4	8.8
1995 agriculture value added (% GDP)	3.8	20.4	10.1	5.3	10.5	14.1	– –	– –	20.7	8.4
1985 exports (% GDP)	88.6	36.5	43.0	55.4	55.9	73.0	64.8	67.8	48.5	68.6
1995 exports (% GDP)	85.9	46.8	45.4	49.6	67.6	53.1	– –	– –	49.8	100.7
1985 gross investment (% GDP)	– –	28.5	26.6	30.3	21.0	28.0	19.2	15.4	21.6	15.2
1995 gross investment (% GDP)	46.7	32.6	32.1	46.0	19.0	33.2	– –	– –	20.0	30.3
1985 total external debt (% GDP)	– –	55.1	40.7	16.4	10.6	22.0	– –	38.1	56.6	88.1
1995 total external debt (% GDP)	– –	44.6	40.8	24.2	22.6	78.4	– –	34.3	44.0	79.4
sample s.d. Δy (%)	3.56	6.07	5.57	3.61	7.2	5.22	6.84	3.76	1.0	4.46
sample s.d. Δp (%)	3.42	4.57	4.13	4.46	4.81	3.33	2.17	4.32	0.97	4.09

Source: World Bank World Development Indicators 1999. Δy: GDP growth rate; Δp: inflation; Δm: money supply growth rate

Table 2: Monetary Groupings in the CFA and the Caribbean
Countries in italics are excluded from the econometric analysis because of inadequate data.

1. CFA Countries (3 separate currencies)

BCEAO: area	Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo
BEAC area:	Cameroon, C.A.R., Chad, Congo Republic, Equatorial Guinea, Gabon
Separate: FF peg	Comoros

2. Caribbean & Central American Countries (5 separate currencies)

ECCU:	Antigua & Barbuda, Aruba, Dominica, Grenada, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines
Separate: US$ pegs	The Bahamas, Barbados, Belize, Panama

Table 3: Regression Descriptive Statistics

		*D*p eqn.			*D*y eqn.			*D*m eqn.	
Country	R^2	**s**	DW	R^2	**s**	DW	R^2	**s**	DW
Ben	0.01	0.05	1.95	0.32	0.06	2.08	0.42	0.24	2.34
Bfa	0.36	0.03	2.26	0.42	0.06	2.28	0.22	0.09	1.53
Civ	0.30	0.05	1.84	0.35	0.05	1.63	0.22	0.09	1.80
Sen	0.52	0.03	2.13	0.61	0.05	1.93	0.28	0.13	2.24
Tgo	0.08	0.06	1.93	0.55	0.05	1.90	0.33	0.29	2.30
Mli	0.36	0.03	1.84	0.60	0.06	2.08	0.12	0.11	1.63
Ner	0.20	0.08	2.04	0.48	0.06	1.66	0.29	0.11	2.11
Cam	0.46	0.04	1.51	0.45	0.05	1.92	0.46	0.09	2.39
Cgo	0.31	0.06	1.54	0.41	0.04	1.81	0.20	0.11	2.37
Gab	0.30	0.08	2.25	0.75	0.04	1.77	0.58	0.10	2.25
Car	0.03	0.04	1.37	0.64	0.04	2.02	0.08	0.12	1.70
Tcd	0.35	0.10	2.13	0.60	0.04	1.77	0.16	0.16	2.24

		*D*p eqn.			*D*y eqn.	
country	R^2	**s**	DW	R^2	**s**	DW
Atg	0.40	0.039	1.48	0.62	0.042	1.86
Dma	0.54	0.050	2.12	0.31	0.061	1.86
Grd	0.53	0.052	2.30	0.42	0.075	2.14
Ktn	0.52	0.048	1.61	0.35	0.047	2.12
Lca	0.74	0.055	2.27	0.45	0.087	2.08
Vct	0.61	0.039	2.20	0.33	0.062	1.96
Bhs	0.66	0.023	1.81	0.32	0.074	2.00
Brb	0.40	0.059	1.60	0.11	0.047	1.73
Blz	0.29	0.048	1.80	0.14	0.039	1.93
Pan	0.49	0.042	1.90	0.20	0.045	1.99

Table 4: Structural Innovation Correlations
(For Δy above the diagonal and Δp below. *** significantly different from zero at 1%; ** at 5%; * at 10%)

	ben	bfa	sen	tgo	ner	cam	gab	car	tcd	civ	mli	cgo
Ben		0.47***	0.13	0.56***	0.38**	0.52***	0.48***	0.31*	0.28	-0.58***	-0.48***	-0.50***
Bfa	0.74***		0.68***	0.78***	0.76***	0.69***	0.84***	0.54***	0.67***	-0.73***	-0.77***	-0.83***
Sen	0.72***	0.89***		0.58***	0.79***	0.56***	0.63***	0.40***	0.55***	-0.56***	-0.64***	-0.68***
Tgo	0.82***	0.84***	0.91***		0.85***	0.81***	0.90***	0.67***	0.77***	-0.87***	-0.93***	-0.93***
Ner	0.41**	0.47***	0.41**	0.50***		0.76***	0.82***	0.58***	0.65***	-0.80***	-0.83***	-0.90***
Cam	0.75***	0.81***	0.94***	0.89***	0.27		0.87***	0.62***	0.69***	-0.74***	-0.76***	-0.83***
Gab	0.75***	0.87***	0.95***	0.90***	0.39**	0.96***		0.69***	0.75***	-0.82***	-0.88***	-0.93***
Car	0.77***	0.84***	0.97***	0.93***	0.39**	0.95***	0.97***		0.61***	-0.42***	-0.57***	-0.66***
Tcd	0.67***	0.56***	0.56***	0.59***	0.25	0.63***	0.61***	0.60***		-0.61***	-0.79***	-0.80***
Civ	0.82***	0.89***	0.90***	0.90***	0.46***	0.91***	0.92***	0.91***	0.64***		0.86***	0.87***
Mli	0.74***	0.81***	0.92***	0.91***	0.47***	0.89***	0.94***	0.94***	0.66***	0.86***		0.94***
Cgo	0.74***	0.86***	0.94***	0.90***	0.44***	0.91***	0.92***	0.95***	0.69***	0.89***	0.91***	

	atg	dma	grd	ktn	lca	vct	bhs	brb	blz	pan
Atg		0.292	0.375**	0.631***	0.107	0.188	0.086	0.150	0.062	-0.011
Dma	0.681***		0.006	0.234	0.200	0.309*	0.133	-0.034	0.320*	-0.249
Grd	0.248	0.586***		0.229	-0.156	0.328*	0.316*	0.364*	0.055	0.108
Ktn	0.454**	0.321*	0.256		0.332*	-0.036	0.122	0.162	0.248	-0.148
Lca	0.026	0.072	-0.204	0.087		0.220	0.139	0.407**	0.289	-0.291
Vct	0.062	-0.145	0.023	0.235	-0.209		0.132	0.008	0.326**	-0.310*
Bhs	0.202	-0.061	-0.233	0.124	-0.107	0.132		0.283*	0.040	0.117
Brb	0.672***	0.520***	0.503***	0.313**	-0.265	-0.191	0.142		0.006	-0.025
Blz	0.386**	0.483***	0.487***	0.219	-0.190	-0.114	-0.177	0.579***		-0.193
Pan	0.084	0.124	0.239	0.147	-0.176	-0.169	-0.056	0.367*	0.244	

Table 5: Identification of "Core Groups"

The table shows the mean value of cross-country correlations in either price innovations (e_1) or output innovations (e_2) for different "core groups" of countries. Corresponding standard deviations (S.D.) are also shown, along with the percentage of correlations significantly greater than zero (% Sig.).

	Core Group	Mean Corr.	S.D. Corr.	% Sig.
CFA				
Prices Group #1	ben, bfa, civ, sen, tgo, mli, ner, cam, cgo, gab, car, tcd	0.759	0.194	96
Prices Group #2	civ, sen, tgo, mli, cam, cgo, gab, car	0.921	0.026	100
Output Group #1	ben, bfa, sen, tgo, ner, cam, gab, car, tcd	0.629	0.175	100
Output Group #2	civ, mli, cgo	0.890	0.036	100
Caribbean				
Prices Group #1	atg, dma, grd, ktn, brb, blz, pan	0.377	0.174	57
Prices Group #2	atg, dma, grd, brb, blz	0.515	0.123	90
Output Group #1	atg, dma, grd, ktn, lca, vct, bhs, brb, blz	0.191	0.155	31

Table 6: Asymptotic Cumulative Impulse Responses

		p on p	p on y	y on y
BCEAO	ben	2.88	1.13	0.81
	bfa	1.26	0.74	1.14
	civ	1.51	-0.36	0.71
	sen	0.49	-0.12	1.22
	tgo	0.84	-2.56	1.36
	mli	0.76	-0.94	0.98
	ner	2.82	0.86	0.77
BEAC	cam	0.69	1.74	1.67
	cgo	1.18	-1.50	0.61
	gab	0.69	0.75	0.66
	car	0.79	-0.04	0.87
	tcd	0.59	-0.67	2.09
ECCU members	atg	1.62	1.06	2.22
	dma	0.94	-0.53	0.60
	grd	0.64	-0.25	1.24
	ktn	1.13	1.22	0.84
	lca	0.65	-0.24	0.70
	vct	1.59	-0.07	0.92
Others	bhs	1.94	-0.04	1.26
	brb	1.55	-0.42	1.21
	blz	0.77	0.44	1.78
	pan	1.13	0.77	1.36

Table 7: Testing for the Marginal Effects of Adhering to a Common Currency

1. The CFA Zone

Regression #1: dependent variable is $\ln\left(\dfrac{1+s_{ij}^{\Delta p}}{1-s_{ij}^{\Delta p}}\right)$

(The regression also includes country fixed effects.)

(i) including conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
dist(i,j)	-0.1080	0.20860	-0.518	0.6071	0.16826	0.0056
$y_i \cdot y_j$	-0.0715	0.12714	-0.562	0.5765	0.10840	0.0065
$(y/n)_i \cdot (y/n)_j$	-0.3145	0.22194	-1.417	0.1630	0.21850	0.0401
$a_i \cdot a_j$	-0.0679	0.05862	-1.158	0.2525	0.06422	0.0272
ifbord(i,j)	+0.2801	0.18463	+1.517	0.1359	0.20013	0.0457
ifsame(i,j)	-0.1434	0.15473	-0.927	0.3588	0.16332	0.0176

R^2 = 0.898, s = 0.363

(ii) excluding conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
ifsame(i,j)	+0.0996	0.09500	+1.049	0.2991	0.10012	0.0203

R^2 = 0.882, s = 0.371

Regression #2: dependent variable is $\ln\left(\dfrac{1+s_{ij}^{\Delta y}}{1-s_{ij}^{\Delta y}}\right)$

(The regression also includes country fixed effects.)

(i) including conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
dist(i,j)	-0.2660	1.05250	-0.253	0.8016	0.62563	0.0013
$y_i \cdot y_j$	-0.4206	0.64148	-0.656	0.5152	0.56891	0.0089
$(y/n)_i \cdot (y/n)_j$	-1.1146	1.11970	-0.995	0.3245	1.06690	0.0202
$a_i \cdot a_j$	-0.1594	0.29576	-0.539	0.5925	0.20639	0.0060
ifbord(i,j)	+0.4480	0.93153	+0.481	0.6328	0.8533	0.0048
ifsame(i,j)	-0.7664	0.78067	-0.982	0.3312	0.51991	0.0197

R^2 = 0.3678, s = 1.830

(ii) excluding conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
ifsame(i,j)	-0.2994	0.45489	-0.658	0.5132	0.42382	0.0081

R^2 = 0.340, s = 1.778

Table 7 (Continued)

2. The Caribbean & Central America

Regression #1: dependent variable is $\ln\left(\frac{1+s_{ij}^{\Delta p}}{1-s_{ij}^{\Delta p}}\right)$

(The regression also includes country fixed effects.)

(i) including conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
dist(i,j)	+0.0728	0.15336	+0.475	0.6385	0.14036	0.0075
$y_i \cdot y_j$	+0.0448	0.07135	+0.628	0.5347	0.05192	0.0130
$(y/n)_i \cdot (y/n)_j$	-0.2961	0.30666	-0.966	0.3420	0.38348	0.0301
$a_i \cdot a_j$	-0.0058	0.03027	-0.192	0.8488	0.02433	0.0012
ifsame(i,j)	+0.3555	0.42268	+0.841	0.4069	0.3662	0.0230

$R^2 = 0.689$, $s = 0.404$

(ii) excluding conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
ifsame(i,j)	+0.1901	0.24705	+0.769	0.447	0.23673	0.0171

$R^2 = 0.669$, $s = 0.391$

Regression #2: dependent variable is $\ln\left(\frac{1+s_{ij}^{\Delta y}}{1-s_{ij}^{\Delta y}}\right)$

(The regression also includes country fixed effects.)

(i) including conditioning variables

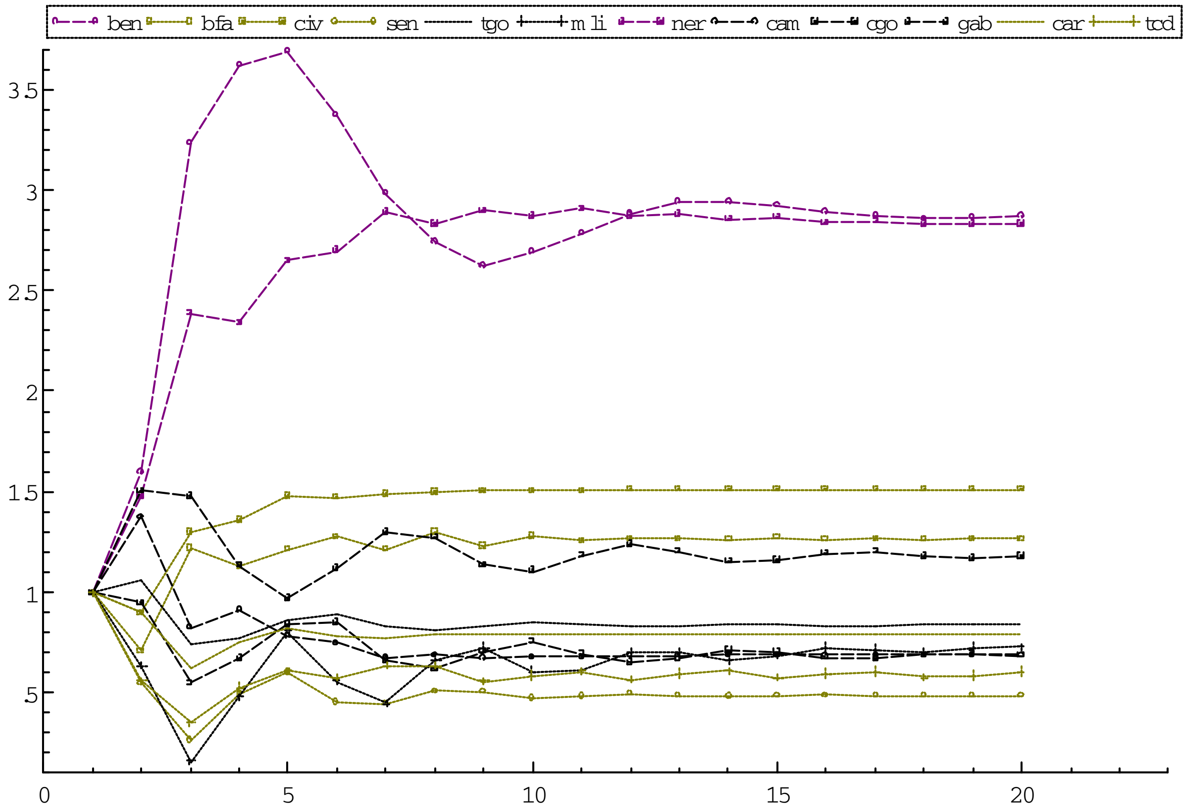
variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
dist(i,j)	-0.3045	0.12242	-2.488	0.019	0.13015	0.1710
$y_i \cdot y_j$	+0.1803	0.05695	+3.166	0.004	0.04155	0.2504
$(y/n)_i \cdot (y/n)_j$	-0.3208	0.24479	-1.310	0.200	0.19968	0.0541
$a_i \cdot a_j$	-0.0439	0.02416	-1.815	0.080	0.02000	0.0990
ifsame(i,j)	-0.5267	0.33740	-1.561	0.129	0.28981	0.0751

$R^2 = 0.602$, $s = 0.322$

(ii) excluding conditioning variables

variable	coefficient	std. error	t-value	probability	H.C.S.E.	Partial R^2
ifsame(i,j)	+0.1288	0.23123	+0.557	0.5811	0.21773	0.009

$R^2 = 0.419$, $s = 0.366$



Figure+ 1: CFA Cumulative Impulse Responses: p on p

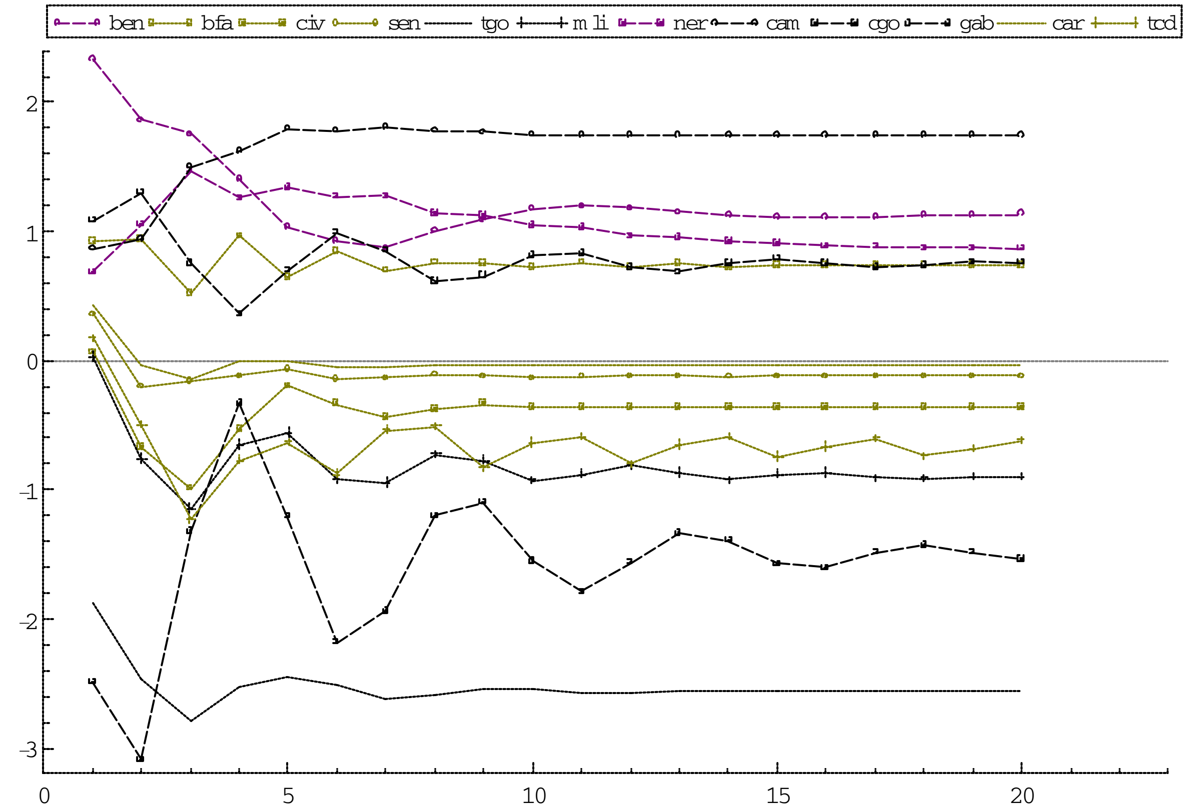


Figure 2: CFA Cumulative Impulse Responses: p on y

+ The profiles chart the cumulative effect of a unit shock to the Dp equation (equation (2a)) or to the Dy equation (equation (5a)) on p and y. The horizontal axes measure years after the initial shock.

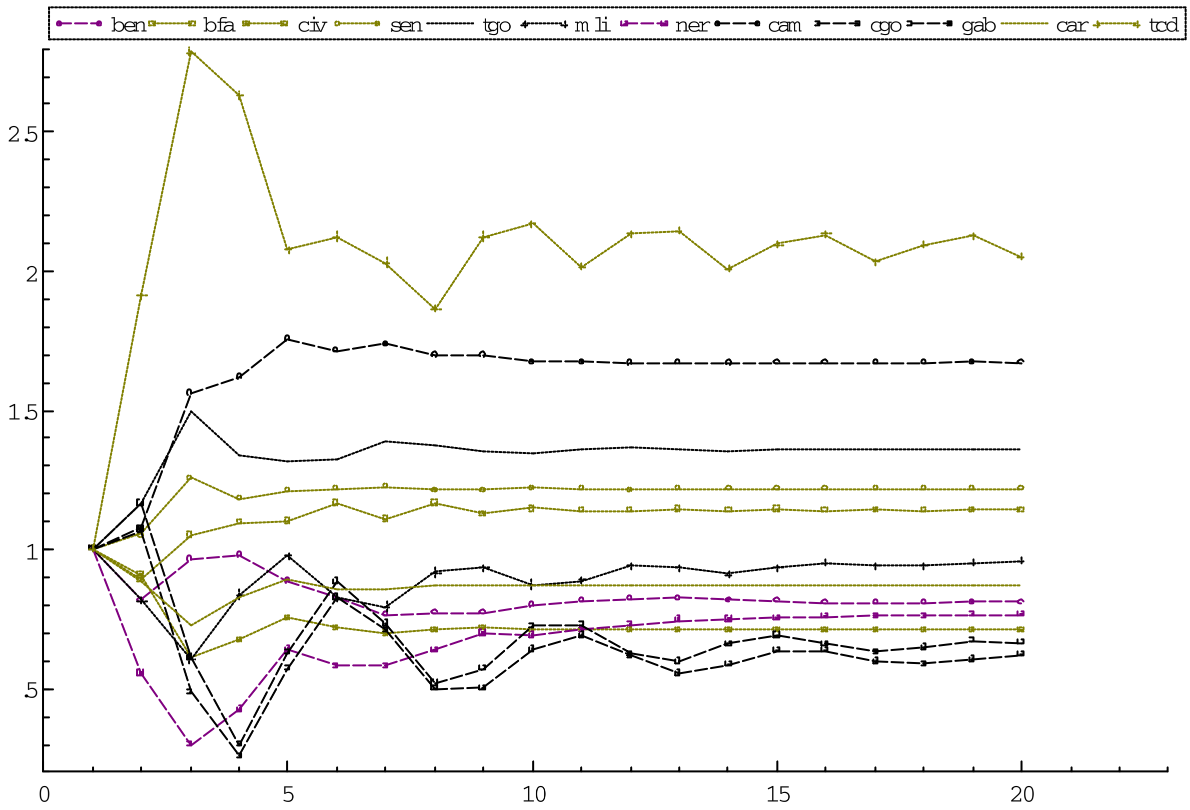


Figure 3: CFA Cumulative Impulse Responses: y on y

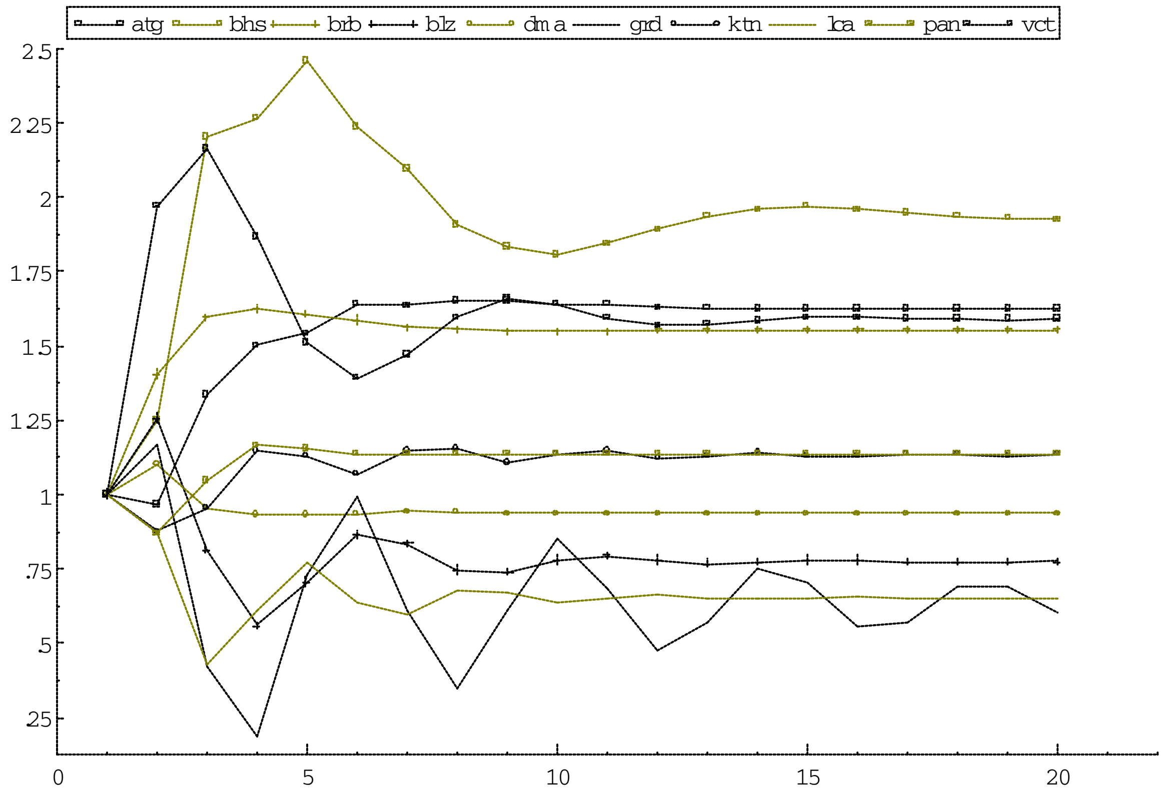


Figure 4: Caribbean Cumulative Impulse Responses: p on p

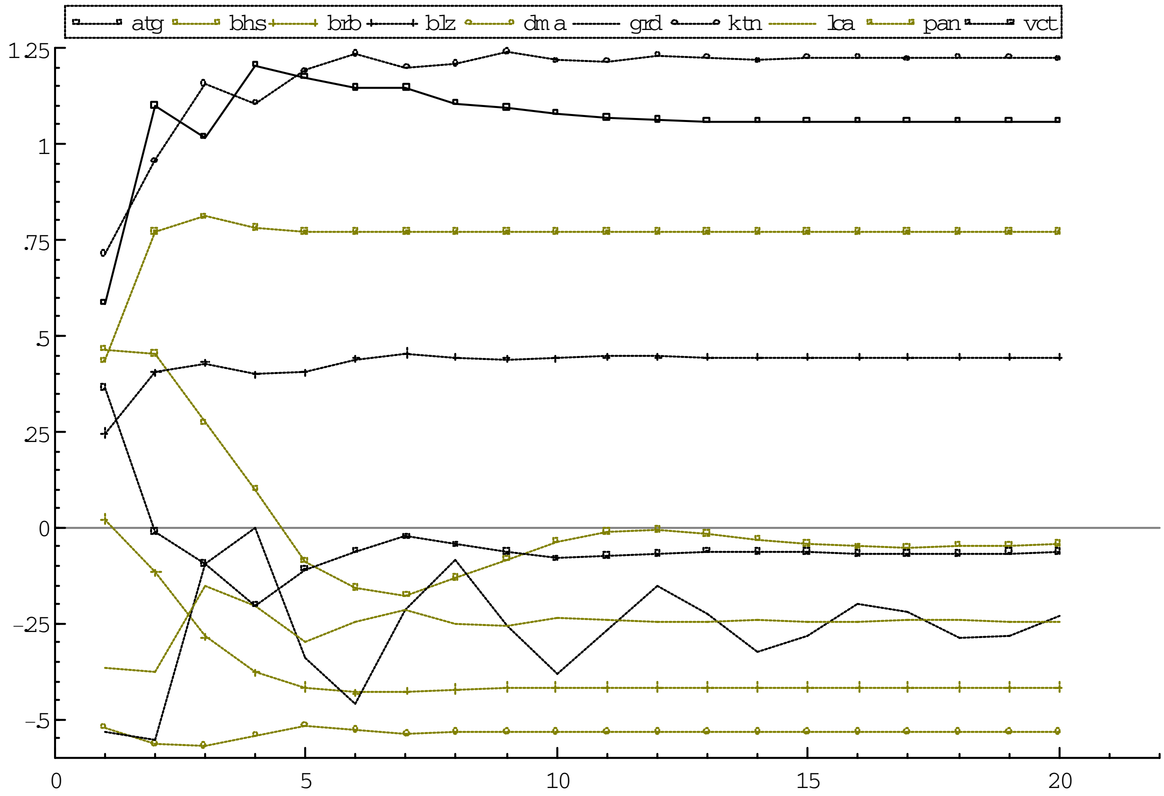


Figure 5: Caribbean Cumulative Impulse Responses: p on y

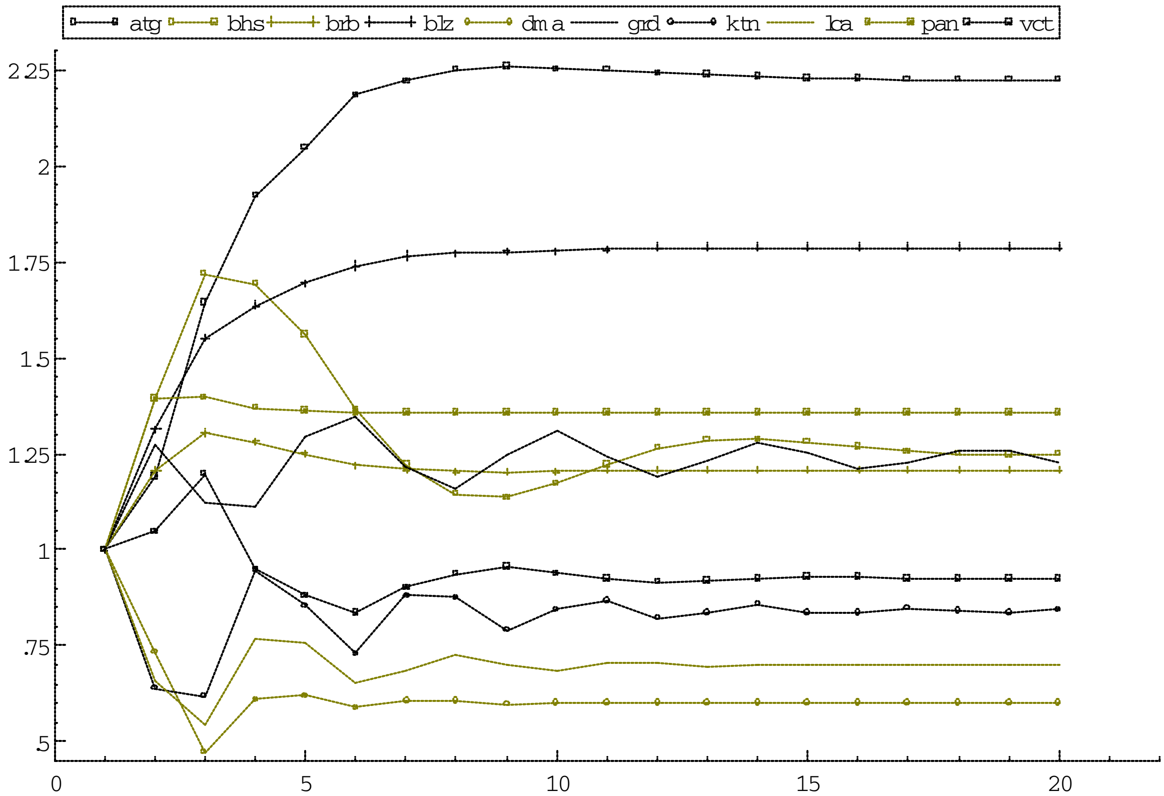


Figure 6: Caribbean Cumulative Impulse Responses: y on y