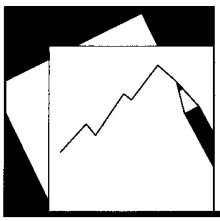
WP/08/214



IMF Working Paper

The Eastern Caribbean Central Bank: Challenges to an Effective Lender of Last Resort

Mario Dehesa and Pablo Druck

INTERNATIONAL MONETARY FUND

 WP/08/214

IMF Working Paper

Western Hemisphere Department

The Eastern Caribbean Central Bank: Challenges to an Effective Lender of Last Resort

Prepared by Mario Dehesa and Pablo Druck[1]

Authorized for distribution by Paul Cashin

September 2008

Abstract

The paper analyzes the challenges for the Eastern Caribbean Central Bank (ECCB) to be an effective lender of last resort (LOLR) as part of a modern banking crisis resolution framework. The main results from the theoretical model of the ECCB's institutional arrangement are that the majority of currency union members may veto emergency lending in the case of a member-specific shock, as such lending may endanger the stability of the currency board (by lowering the central bank's international reserves, thus raising devaluation risk). However, in the presence of contagion across countries, all currency union members have a vested interest in liquidity supply from the central bank. A key policy recommendation is that currency union members need a stronger fiscal position to continue to access international financial markets and sustain the exchange rate peg.

JEL Classification Numbers: C72, E58, O54
Keywords: Lender of last resort; liquidity assistance; exchange rate risk; veto power; ECCB
Authors' E-Mail Addresses: mdehesa@imf.org , pdruck@imf.org

[1] The authors are grateful to Paul Cashin, Benedict Clements, Catherine Pattillo, Alain Ize, Sir Dwight Venner, Wendell Samuel and participants in the First ECCB/IMF Research Policy Review Seminar (held at the Eastern Caribbean Central Bank), for helpful comments.

Contents Page

I. INTRODUCTION

The impact of a banking crisis on an economy is far reaching. Once a banking crisis starts, its negative effects spread quickly throughout the economy, impairing the payments system, shrinking the credit market, and depressing banking deposits in both solvent and insolvent banks (Hoelscher and Quintyn, 2003). To contain the effects of a banking crisis, governments usually step in with costly support programs to avoid further deterioration of the economy.

To protect their economies from a banking crisis, countries have developed tool kits known as "Banking Crisis Resolution Frameworks." Comprehensive banking crisis resolution frameworks include three main pillars: (i) a legal framework that allows closure of banks in bankruptcy; (ii) an exit strategy for insolvent institutions; and (iii) a lender of last resort (LOLR) facility (Schinasi, 2006).

This paper analyzes the challenges faced by the Eastern Caribbean Central Bank (ECCB) in conducting an effective LOLR role. These challenges are analyzed from two perspectives. The first considers constraints imposed by the resources of a central bank under a quasi-currency board arrangement. In this setting, the ECCB's potential to finance a LOLR facility is bounded by the liquidity supply from international capital markets, and/or by the trade-off between using its excess international reserve holdings and protecting the fixed exchange rate regime. Second, the ECCB's ability to act as a LOLR is constrained by its institutional architecture, as its decision-making body in the ECCB (the Monetary Council), formed by one representative from each member country, could block the use of any LOLR facility. For example, suppose that one member needs to use the LOLR facility and that extending the requested liquidity assistance increases pressure on the exchange rate, placing the sustainability of the quasi-currency board at higher risk. What would be the reaction of currency union members? Would they accommodate the currency risk by approving the LOLR facility knowing its potential risks, or might they block emergency lending to help sustain the currency board?

A simple model is presented in order to examine the effects of the ECCB's institutional arrangement on the administration of a potential LOLR facility. The model focuses on a two-country framework, where the countries share a central bank to pool their international reserves and a common currency. The model highlights the incentives for free-rider behavior arising from the specific institutional arrangement underpinning the Eastern Caribbean Currency Union (ECCU). The sequence for free-rider behavior occurs as follows: (i) the central bank grants credit to the country where banks need liquidity; (ii) the central bank's international reserves decline as the money market returns to equilibrium; (iii) devaluation risk rises with an increasing probability that the currency board becomes unsustainable; and consequently (iv) interest rates increase in both liquidity-supported and nonliquidity-supported countries. As a result, while one country benefits from emergency lending, domestic interest rates and exchange rate risks increase in both countries. To contain this free-rider behavior, the ECCB's institutional arrangement allows members to block extensive liquidity assistance, introduced in

the model of this paper as veto power. Later, the model is extended to address the possibility of contagion between the two countries.

The results of the model suggest that:

- If the ECCB has limited access to foreign currency to maintain adequate levels of international reserves or has a constrained capacity to sterilize additional liquidity, then use of the LOLR facility would increase exchange rate risk. Hence, the ECCB may not have the capacity to act as a LOLR while protecting the fixed exchange rate.

- In the case of a country-specific shock, the unaffected country may have an incentive to use its veto power and block the central bank emergency lending requested by the country where banks need liquidity. In this instance, the ECCB would be prevented from acting as a LOLR.

- However, when both countries face an adverse shock, from either a common shock or contagion, they may weaken their veto power and may agree to extend the LOLR to the currency union's members. Since increased central bank credit creates pressures on the exchange rate, the ECCB acts as a LOLR but at heightened risk to sustainability of the exchange rate arrangement.

- The model implies that countries facing country-specific shocks should strengthen their fiscal balances so that they can access international capital markets on their own in order to provide liquidity support to banks. However, in the case of a generalized shock, veto power may not be enough to prevent the central bank from extending credit to country members. Currency union members need therefore to improve their creditworthiness to continue to tap international capital markets and sustain the fixed exchange rate arrangement.

II. THE LOLR FACILITY AND ITS MONETARY EFFECTS

A LOLR plays a crucial role in providing liquidity in times of financial distress. A LOLR can be defined as "the discretionary provision of liquidity to financial institutions by the central bank in reaction to an adverse shock which causes an abnormal increase in demand for liquidity which cannot be met from an alternative source" (Freixas et. al. 1999). Conventional wisdom is that in a banking crisis the central bank should lend freely, at a penalty rate, and on good collateral.[2] These rules suggest that an efficient interbank market could be enough to ensure banks' access to liquidity. However, in a crisis the interbank market may not work

[2] In many developing countries additional requirements are needed to reduce moral hazard and protect the LOLR from undue political pressure, including well designed lending procedures, clearly laid out authority and accountability (He, 2000).

adequately, due to asymmetric information about the banks' actual situation, opening the possibility of a market failure (Freixas et. al., 2003). In this case, a bank supervisory authority could be in a better position relative to other market players to assess each bank's financial situation, and the merits of requests for liquidity support. In the case of the ECCU, the ECCB is also the regulatory entity and is the only market player that has access to detailed information on the financial position of individual banks. Moreover, in the ECCU area, banks have limited room to meet liquidity needs in times of financial distress because the formal interbank market is small and the securities market is thin.

However, the LOLR function is controversial because it creates moral hazard, as with any form of insurance. A LOLR may encourage banks to take additional risks and may reduce the monitoring of banks by creditors (Garcia and Plautz, 1988). This paper does not assess competing views on the LOLR, and focuses only on understanding the challenges faced by the ECCB in conducting an effective LOLR facility.

Liquidity assistance creates an excess supply of money, raising the question of how the money market returns to equilibrium. The adjustment mechanism depends critically on the exchange rate regime, the availability of external financing and the level of securities market development. In a fixed exchange rate regime, excess liquidity provided by the central bank leads to a loss of international reserves and potentially to a currency crisis (Krugman, 1979; Flood and Marion, 1999), unless it is financed by foreign credit (Fischer, 1999) or neutralized through open-market operations. Successful sterilization of liquidity support requires the availability of necessary instruments, and deep and liquid money and securities markets (He, 2000; Laurens, 2005).

In a country with a flexible exchange rate regime and well-developed securities markets, the money market could return to equilibrium through a combination of interest rate and exchange rate adjustments. Open-market operations by the central bank may absorb excess liquidity or distribute part of the adjustment to exchange rate variations without loss of international reserves. However, even with adequate monetary instruments and well-developed securities and foreign exchange markets, sterilization of emergency lending support may result in significant volatility of interest rates (He, 2000).

A currency board arrangement imposes tight constraints on liquidity assistance to troubled banks. The sustainability of the exchange rate peg depends on the backing of base money by international reserves. The ECCB oversees a currency board in a multi-country setting. The ECCB-specific institutional arrangement sets tight constraints on the LOLR function. Under the *ECCB Act (1983)*, external reserves must be held at not less than 60 percent of demand

liabilities.[3] Hence, the central bank would need extra resources to finance their LOLR facility without reducing its international reserve holdings below a legal threshold or below a higher threshold set for precautionary reasons.

However, some modern currency boards created institutional arrangements to provide some room for liquidity assistance. The institutional design of some modern currency boards—a group that included in the early 2000s Argentina, Bosnia and Herzegovina, Bulgaria, Estonia, Lithuania and Hong Kong—addresses specifically the fundamental tension between the scope for lender of last resort operations and the tight rules inherent to a currency board arrangement to anchor exchange rate credibility (Wolf and others, 2008).[4] Some modern currency boards created a dedicated "Issue Department" (or "Currency Board account") within the central bank, with responsibility for the backing of base money by international reserves. Other departments such as the "Banking Department" and the "Banking Supervision Department" have the responsibility to reduce the likelihood of a financial crisis through prudential and regulatory frameworks. In some cases, such as in Bulgaria, excess reserves above the backing ratio are explicitly set aside within the Banking Department to support solvent but illiquid banks.

The governance of currency boards has also been strengthened. To further safeguard the integrity of the issue department and the backing ratio, some modern currency boards aim to minimize concerns about the political influence of the current government through long, nonrenewable, and staggered terms of governors (Wolf and others, 2008).

Foreign credit could be used to fund the LOLR facility. Long-term foreign credit lines would allow the ECCB to address the liquidity needs of banks without increasing short-term foreign exchange rate risk, as the gross backing ratio of international reserves to base money would remain unchanged.[5]

---

[3] In practice the ECCB backing ratio expanded from around 83 percent in 1983 to fluctuate at over 95 percent since 1995. Despite the quasi-currency board arrangement, the ECCB is permitted to provide credit to its members under specified limits and within the reserve cover requirement (IMF, 2004, 2008).

[4] In the early 2000s, out of a group of six modern currency board arrangements (CBAs), only Bosnia and Herzegovina explicitly ruled out a LOLR facility. Hong Kong, Argentina and Bulgaria had provisions that explicitly collateralized emergency lending, up to the excess foreign reserves available. Estonia and Lithuania had no formal provisions but may provide support on a case by case basis (Ho, 2002).

[5] Article 24 of the *Eastern Caribbean Central Bank Agreement Act 1983* does not specify if the external reserve to cover demand liabilities refers to a gross or net concept. To compute the backing ratio, some CBAs like Bulgaria and Lithuania use a gross concept of foreign assets that does not take into account the central bank's long-term external obligations coming, for instance, from the IMF and/or the World Bank.

III. THE ECCB'S INSTITUTIONAL ARCHITECTURE

The ECCB's institutional arrangement has a specific characteristic that constrains its policy-decision process.[6] Eight representatives of the ECCU countries and territories comprise the Monetary Council, the highest decision-making authority in the ECCB. In this setting, any policy decision that could potentially affect regional asset prices could trigger a dispute between winners and losers among the ECCB Council's members. The Monetary Council has the power to approve most policy decisions by simple majority, given a quorum of at least five members. However, some policies, particularly those that could affect the sustainability of the currency union, require unanimous vote. Decision-making powers of the ECCB are vested in a Board of Directors—comprised by the Governor, the Deputy Governor, and one appointed Director by each participating government—which is responsible for policy implementation and general administration of the ECCB.[7]

Given the ECCB's decision-making structure, a policy that benefits a group of members while harming others could be vetoed by the Monetary Council. For example, suppose that one of the members needs ECCB liquidity assistance. If this assistance is large enough to put in danger the sustainability of the currency union, the other members may have strong incentives to vote against the proposed policy. Formally, the theoretical model set out in the next section introduces this characteristic as a veto power. It implies that there would be some instances where the affected group of countries would be able to block a policy proposal from other members via their veto power.

The use of veto power to protect the status quo has been well documented in the political economy literature. In particular, Persson and Tabellini (2002) show that the status quo stability increases with the number of veto powers. Hence, as the number of players with veto power increases, the possibility of changing the status quo declines.

IV. THE MODEL

The model is set in a two-country framework, where both countries pool their international reserves in a shared central bank**.** The model assumes a simple utility function to assess the benefits and costs of the central bank's liquidity assistance. In the utility function L, shown in equation (1), liquidity assistance from the ECCB, x, benefits each member country as measured

[6] By law the ECCB is required to maintain a minimum foreign exchange cover of 60 percent of demand liabilities. The remaining 40 percent "excess" foreign reserves over demand liabilities could be lent to banks or member governments. Credit to individual member governments is restricted to their share in total regional recurrent revenue. Beyond their individual credit allocation potential, member governments must seek residual financing from commercial banks or abroad (van Beek, 2000; Williams, 2001).

[7] Article 7 of the *Eastern Caribbean Central Bank Agreement Act 1983* states that the Board of Directors may request Monetary Council members to vote without meeting on urgent matters, and reach decisions by this method by a simple majority of all the Council members.

by *f(x)*. In the case of a liquidity shock, the country places a higher value in having access to a liquidity line. This effect is measured by the parameter *P*, where *P* = 1 in tranquil times and is higher than 1 during a liquidity crisis. The costs of the liquidity assistance are captured by *h(ε)*, where ε is the devaluation risk that depends positively on the central bank's overall liquidity assistance, $\varepsilon = g(x_t)$ and x_t is the central bank's total liquidity assistance to both countries:[8]

$$L_i = P_i f(x_i) - h(\varepsilon), \quad \text{for country } i, \text{ where } i = 1,2. \tag{1}$$

A country facing a liquidity shock has a strong incentive to request central bank liquidity assistance**.** A country with a troubled bank (*P* higher than 1) will have an incentive to request the central bank's liquidity assistance, as the benefits from liquidity assistance exceed the costs of a higher devaluation risk. In other words, starting from the initial condition $f'(x_0)=h'(\varepsilon_0)$, a liquidity shock will make the country value emergency lending more, $Pf'(x_0)>h'(\varepsilon_0)$, creating strong incentives to request assistance from the central bank until $Pf'(x_1)=h'(\varepsilon_1)$.

Conversely, a country that does not experience a liquidity shock may have an incentive to veto the central bank's liquidity assistance to another country. The utility of the unaffected country declines with the liquidity assistance to the country facing the shock, due to the higher devaluation risk arising from the presence of liquidity assistance. Consequently, the unaffected country may attempt to use its veto power to block liquidity assistance. Equation (2) states that country *i* will exercise its veto power to block the implementation of the policy proposal made by country *j* when that proposal reduces country *i*'s utility below a predetermined threshold α_i, which is defined as a reservation utility level:

$$P_i f_i(x_i) - h_i(\varepsilon) \prec \alpha_i, \qquad \text{for country } i. \tag{2}$$

The complete model is constituted by the following equations:

$$L_1 = P_1 f_1(x_1) - h_1(\varepsilon) + \lambda_2[P_2 f_2(x_2) - h_2(\varepsilon) - \alpha_2] \tag{3}$$

$$L_2 = P_2 f_2(x_2) - h_2(\varepsilon) + \lambda_1[P_1 f_1(x_1) - h_1(\varepsilon) - \alpha_1], \tag{4}$$

where the goal of each country is to maximize its utility function, $P_i f_i(x_i) - h_i(\varepsilon)$, arising from accessing the central bank's liquidity assistance, subject to the other country's veto power, defined by $P_j f_j(x_j) - h_j(\varepsilon) - \alpha_j$.

[8] The model assumes a fixed exchange rate regime, and therefore the liquidity assistance reduces international reserves, and raises the devaluation risk; total liquidity is measured by $x_t = x_1 + x_2$.

The model is solved as a noncooperative game between two players. The solution is found by both countries simultaneously maximizing the utility function to choose the optimal size of liquidity requested from the central bank. The solution maximizes simultaneously the utility functions (3) and (4) with respect to x_1 and x_2. To facilitate the interpretation of the model, the results are derived numerically using well-behaved benefit and cost functions to characterize the utility function. Benefits are specified as $f(x_i) = \sqrt{x_i}$ while the cost related to the exchange rate risk is specified as $h(\varepsilon) = x_t^2$, where $x_t = x_1 + x_2$.

The properties of the model can be further analyzed by solving the model from a "social planner" point of view. In this case, the conceptual entity performing as "social planner" internalizes the cross-country effects of emergency lending on the exchange rate risk, in order to determine the optimal liquidity assistance. Hence, the solution is found by maximizing equation (5) in x_1 and x_2:

$$L_{SP} = P_1 f_1(x_1) - h_1(\varepsilon) + P_2 f_2(x_2) - h_2(\varepsilon). \qquad (5)$$

Given the structure of the ECCU financial system, the model also introduces the possibility of contagion between the two countries. Several ECCU banks are linked to banks located elsewhere in the region either through business links or by common ownership (IMF, 2004, 2008). Contagion is modeled by making P, the parametric measure of the needed liquidity assistance in one country, a function of the value of liquidity assistance in the other country. Formally, P_2 is a function of P_1, that is, $P_2 = z(P_1)$.

Table 1 summarizes the results of the model using the numerical solution. It is assumed that the original shock starts in country 1. To read the table, each scenario includes the following information: (i) if country 1 faces a shock, $P_1 > 1$; (ii) if contagion occurs to country 2, both P_1 and P_2 are bigger than 1; (iii) if a country exercises its veto power, the heading of the column reads "veto," and "no veto" otherwise; and (iv) a country defines its reservation utility level as $\alpha = 0.10$.

Table 1 evaluates liquidity assistance in the presence of a shock, in the case where the unaffected country exercises its veto power, in the case of contagion, and where there is veto power in the presence of contagion, as follows:

- Effect of a shock. Compare columns "no shock/no veto" with "shock/no veto": Country 1 receives liquidity assistance from the central bank after experiencing a shock (domestic credit x_1 increases from 0.25 to 0.96). The exchange rate risk increases ($h(\varepsilon)$ rises from 0.25 to 1.04), so country 2 reduces its own use of the domestic credit of the central bank (x_2 declines from 0.25 to 0.06) to ameliorate the cost created by the higher exchange rate risk. The utility for country 1, L_1, is highly positive due to the high value it gives to credit (P_1 rises from 1 to 4) while L_2, the utility for country 2, declines from 0.25 to -0.80, due to the higher devaluation risk. *Hence, the central bank will honor the*

request of country 1 for liquidity assistance, but at a cost of higher devaluation risk for both countries.

- Effect of veto. Compare columns "shock/no veto" with "shock/veto": Country 2, using its veto power, limits the amount of the emergency liquidity that the central bank provides to country 1 despite the shock experienced by this country (central bank credit x to country 1 declines from 0.96 to 0.39). By restricting the access to emergency liquidity, country 2 controls the exchange rate risk ($h(\varepsilon)$ declines from 1.04 to 0.33). The key feature is that if country 2 has the possibility of a veto, it will exercise it when its utility reaches its predetermined lower limit. *Hence, the central bank may not support the request of country 1 for liquidity assistance.*

Table 1. Numerical Simulation of the Liquidity Assistance Model, (Two Countries)

		Non Cooperative Game				
	(1)	(2)	(3)	(4)	(5)	(6)
	Social Planner	No shock No Veto	Shock No Veto	Shock Veto	Shock-No Veto Contagion	Shock-Veto Contagion
Domestic credit country 1, x_1	0.16	0.25	0.96	0.39	0.86	0.70
Domestic credit country 2, x_2	0.16	0.25	0.06	0.19	0.22	0.27
Total credit, $x_t = x_1 + x_2$	0.31	0.50	1.02	0.58	1.08	0.97
Exchange rate risk, $h(\varepsilon)$	0.10	0.25	1.04	0.33	1.16	0.93
Utility country 1, L_1	0.30	0.25	2.88	2.16	2.55	2.41
Utility country 2, L_2	0.30	0.25	-0.80	0.10	-0.23	0.10
Shock country 1, P_1	1	1	4	4	4	4
Shock country 2, P_2	1	1	1	1	2	2

Source: Authors' calculations.

- Social Planner vs. noncooperative game. Compare the column "social planner" with "no shock/no veto." Countries end up better off under the "social planner" setting than under the noncooperative game setting, because the social planner internalizes the cross-country effects created when the central bank grants credit to anyone country. Specifically, countries reach a higher utility under the social planner case (L_1=L_2=0.30) compared to the "no shock/no veto" case in the noncooperative game (L_1=L_2=0.25), due to the lower cost associated with devaluation risk under the "social planner" (($h(\varepsilon)$=0.10) relative the "no shock/no veto" case in the noncooperative game ($h(\varepsilon)$=0.25). The exchange rate risk diminishes as less credit from the central bank is granted to each country under the "social planner" (x_1=x_2=0.16) than under the "no shock/no veto" case (x_1=x_2=0.25). *Although countries would prefer the social planner solution, this equilibrium would be difficult to reach in general because once a country is hit by a liquidity shock, its government face strong political pressure to request liquidity assistance to avoid a potential full-fledged economic crisis, thereby disregarding the externalities caused to other countries in terms of heightened exchange rate risk.* Henceforth, the paper will focus only in solutions set as noncooperative games.

- Effect of contagion. Compare columns "shock/no veto" with "shock/no veto/contagion." Contagion weakens the veto power because both countries will benefit from the central bank's liquidity assistance. Now that country 2 is also affected by contagion, it will be willing to bear the costs associated with the devaluation risk in order to have access to the central bank's credit line. Consequently, the central bank's total liquidity assistance increases from 1.02 to 1.08. Due to contagion, country 2 is also requesting the central bank's emergency lending, and as a result ends up with negative utility (L_2 = -0.23) that is nonetheless higher than when compared with the "shock/no veto" case (L_2 = -0.80). *Hence, in the case of contagion, both countries receive more central bank liquidity assistance, but at the cost of a higher devaluation risk.*

- Effect of a veto in the presence of contagion. Compare columns " shock/no veto/contagion " with "shock/veto/contagion." Country 1 scales down its access to the central bank's liquidity assistance because country 2 exercises its veto power to protect its utility level. However, country 2, facing contagion from country 1, softens its constraints relative to the case of no contagion to allow both countries to have greater access to the central bank's liquidity assistance (x_t = 0.97 compared with x_t = 0.58 in the case of "shock/veto"). *Hence, both countries benefit from the central bank's liquidity assistance in the presence of contagion, but with some limitation because country 2 exercises its veto power; devaluation risk is higher compared to the case of no contagion.*

Box 1. The CFA Franc Arrangement[9]

The CFA franc zone comprises two regions with two distinct currencies that are only legal tender in their respective zones, but are commonly referred interchangeably as the CFA franc: the West African Economic and Monetary Union (WAEMU)[10] with the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO)[11] as central bank, and the Central African Economic and Monetary Community (CEMAC) with Banque des Etats de l'Afrique Centrale (BEAC) as central bank. Since 1945 the exchange rate has changed only once in each region—in 1994 by 50 percent.

The strength of the monetary union arrangement arises in large measure from the support provided by the French Treasury, which is represented on the Board of Directors of the two central banks, but the monetary union's financial sustainability depends on its members' fiscal stance. The key CFA franc zone principles are: (i) fixed parity against the French franc (now the Euro) but adjustable after consultation with the French government (see below) and the unanimous vote of all members countries within each region; (ii) the guarantee of convertibility of the CFA franc into Euro by the French Treasury; and (iii) pooling of exchange rate reserves within each region. The convertibility guarantee is made operational through an operations account of the central bank with the French Treasury, which may have a positive or negative (as in the 1980s) balance. Deficits on the operations account are covered by the French Treasury, effectively giving the franc zone states an overdraft facility.

The key principles are supported by statues of the central banks that require them to: (i) maintain at least 65 percent of their foreign assets in the operations account with the French treasury (scheduled to decline to 50 percent in CEMAC in 2009, as done in WAEMU after 2005); (ii) provide for exchange cover at least 20 percent of their sight deposits—if this requirement is missed for three consecutive months, a central bank Board meeting is convened to adopt remedial measures; and (iii) impose a cap on accumulated credit extended to each member country of 20 percent of the previous year's public sector revenue. In addition, administrative restrictions limit capital outflows.

The 1994 experience shows that the convertibility guarantee does not rule out exchange rate adjustment. The events that led to the 1994 devaluation can be traced back to the mid-1980s, when franc zone countries had to cope with adverse terms of trade shocks, the appreciation of the French franc vis-à-vis the U.S. dollar (which is the denomination currency for international commodity purchases), and expansionary public sector policies to sustain growth, including borrowing from the central bank by state-controlled banks. Expansionary fiscal policies in member countries of each region financed with borrowing from the central banks, proved to be inconsistent with exchange rate stability. Despite foreign support including substantial aid, structural balance of payments deficits cannot avoid an eventual macroeconomic adjustment as no financing source can provide indefinite support. In the framework of this paper the pre-1994 situation resembles case 3 of "shock no veto" analyzed in Table 1. The external shocks suffered by these monetary unions led country members to resort to central bank financing at the cost of increasing the exchange rate risk. The adjustment process entailed a shift to case 4 of "shock veto" of Table 1, as France limited ("vetoed") indefinite liquidity assistance.

[9] This box draws on Clement (1996), the Africa Research Group (2001), van den Boogaerde and Tsangarides (2005), and Yehoue (2007).

[10] Includes Benin, Burkina, Cote d' Ivoire, Mali, Niger, Senegal and Togo.

[11] Cameroon, Central African Republic, Congo, Gabon, Equatorial Guinea, and Chad.

Box 1. The CFA Franc Arrangement (Concluded)

Structural adjustment programs encouraged by multilateral institutions followed the 1994 devaluation, including by the introduction of fiscal targets to support each monetary union. The list of fiscal indicators centered on the primary surplus, domestic and external arrears, the wage bill, and investment financed by domestic resources. The combination of structural reforms and stricter rules to access central bank credit, including penalty rates applied to advances to the treasuries above the ceiling, has strengthened both monetary unions.

Since 1998 France has been subject to limits on its fiscal deficits—and thus cannot inject unlimited amounts of liquidity to support the CFA franc— and the European Union has to be consulted on any change of parity. By 2004 external reserves in each monetary union were at their highest level in a decade, and more than covered reserve money or short-term debt.

Access to international capital markets

Accessing international capital markets improves the utility of both liquidity-constrained and unconstrained countries. Access to the international capital market is represented by the term *c* in equation (6), with its respective interest rate *i*. Accordingly, this amount increases the availability of credit for the country experiencing the shock *f (x+c)*, but does not affect the devaluation risk because it does not create a disequilibrium between central bank international reserves and base money. The extended model is determined by the following equations:

$$L_1 = P_1 f_1(x_1 + c) - h_1(\varepsilon) - ic + \lambda_2[f_2(x_2) - h_2(\varepsilon) - \alpha_2] + \lambda_3 c \quad (6)$$

$$L_2 = P_2 f_2(x_2) - h_2(\varepsilon) + \lambda_1[f_1(x_1) - h_1(\varepsilon) - \alpha_1]. \quad (7)$$

Table 2 shows the results of the numerical solution based on the extended model:

- Effect of a foreign credit line. This exercise compares the results of columns "no contagion/no veto" with "no contagion/veto/FCL." In the case of "no contagion/veto/FCL," country 2 exercises its veto power to protect its utility. Country 1 reacts by borrowing from the capital markets (*c* rises from 0 to 0.44) and simultaneously reduces its borrowing from the central bank (x_1 falls from 0.96 to 0.39). Hence, the total amount of credit remains constant at 1.02. The key outcome is that the foreign credit allows a reduction in the exchange rate risk (*h(ε)* declines from 1.04 to 0.33). As a result, the combined utility level rises (L_1+L_2 = 2.45) and surpasses the utility level reached when the currency union has to rely exclusively on the veto power of country 2 to control the exchange rate risk (as shown in the column of "no contagion/veto" (L_1+L_2 = 2.26). *This case suggests that countries should have a solid fiscal position. The troubled country knows that the unaffected country may block its request for central bank liquidity assistance and therefore will depend on its own resources to address the liquidity challenge. A solid fiscal position for the troubled country would allow it to access international capital markets to provide liquidity to its financial sector.*

- Effect of foreign credit line in the presence of contagion. This exercise compares the results of columns "contagion/veto/FCL" with "no contagion/veto/FCL." Contagion gives incentives to both countries to request the central bank's liquidity assistance, and to tolerate a higher devaluation risk ($x_t = x_1+x_2+c$ increases from 1.02 to 1.10 while $h(\varepsilon)$ increases from 0.33 to 0.93). However, with easier accessibility to domestic resources countries have less incentive to borrow from international capital markets (c amounts to 0.13 in column "contagion/veto/FCL" which is lower than 0.44 in column "no contagion/veto/FCL"). The higher devaluation risk arises from larger reliance on domestic resources, and the marginal use of foreign credit to address a liquidity shock. *The implication is that the currency union's institutional arrangement of the veto power may not be enough to protect the currency union from exchange rate pressures in the case of a shock with contagion.*

Table 2. Liquidity Assistance Model—Including Foreign Credit Line (FCL), (Two Countries)

	No Contagion			Contagion		
	No Veto	Veto	Veto-FCL	No Veto	Veto	Veto–FCL
Domestic credit country 1, x_1	0.96	0.39	0.39	0.86	0.70	0.70
Domestic credit country 2, x_2	0.06	0.19	0.19	0.22	0.27	0.27
Foreign credit country 1, c	0	0	0.44	0	0	0.13
Total credit, $x_t = x_1+x_2+c$	1.02	0.58	1.02	1.08	0.97	1.10
Exchange rate risk, $h(\varepsilon)$	1.04	0.33	0.33	1.16	0.93	0.93
Utility country 1, L_1	2.88	2.16	2.35	2.55	2.41	2.72
Utility country 2, L_2	-0.80	0.10	0.10	-0.23	0.10	0.10
Total utility, L_1+L_2	2.08	2.26	2.45	2.32	2.41	2.82
Shock country 1, P_1	4	4	4	4	4	4
Shock country 2, P_2	1	1	1	2	2	2

Source: Authors' calculations.

V. CONCLUSIONS

This paper analyzes the challenges for the ECCB to be an effective LOLR as part of a modern banking crisis resolution framework. A simple model is presented in order to examine the effects of the ECCB's institutional arrangement on the administration of a potential LOLR facility. The model focuses on a two-country framework, where the countries share a central bank to pool their international reserves and a common currency. The model produces the following results:

- Exchange rate risk may prevent liquidity assistance where two countries pool their international reserves in a common central bank. A country that experiences a shock seeks emergency liquidity from the central bank, and in so doing is willing to tolerate

higher exchange rate risk. The higher exchange rate risk (which arises from lower international reserves following provision of liquidity assistance) automatically spreads to the other country. However, higher devaluation risk may be unacceptable to the other country, and it vetoes the possibility of granting emergency credit to the troubled country. The veto power is exercised when the utility of the unaffected country falls below the reservation utility level.

- In the case of contagion, common banking problems weaken the opposition to blocking liquidity assistance. As the unaffected country softens its veto power, the central bank may provide emergency liquidity assistance to both countries, despite the heightened exchange rate risk.

- A stronger fiscal position enables liquidity assistance in the case of a country-specific shock as well as in the case of contagion. In both cases, access to foreign credit support depends on fiscal sustainability. However the rationale for foreign credit support is different. In a country-specific shock the need for foreign credit arises because the unaffected country in a currency union exercises its veto power and blocks the provision of emergency liquidity by the central bank. The troubled country has to resolve the crisis using its own resources and therefore needs to strengthen its fiscal balances. In the case of contagion the sustainability of the exchange rate of the currency union depends on accessing foreign credit. Accordingly, currency union members have an incentive to increase their creditworthiness by strengthening their fiscal positions.

- In the case of the ECCB, the model implies that unaffected Eastern Caribbean Currency Union members may veto emergency lending where a member faces a country-specific shock, because the requested lending may jeopardize the stability of the currency board. Nevertheless, in the presence of contagion across countries, all currency union members have a vested interest in liquidity supply from the central bank. Consequently, a key policy recommendation is that Eastern Caribbean Currency Union members need a stronger fiscal position to continue to access international financial markets and support the sustainability of the fixed exchange rate arrangement.

REFERENCES

Africa Research Group, 2001, *Growing Up with the Umbilical Cord Attached. Developments in the African Franc Zone 1994–2001,* Foreign and Commonwealth Office, London September 2001.

Camilleri, M., 2004, "An Institutional Framework for Comparing Emerging Market Currency Boards," IMF Working Paper WP/04/180 (Washington, D.C.: International Monetary Fund).

Clément, J.A.P., J. Mueller, S. Cossé, and J. Le Dem, 1996, *Aftermath of the CFA Franc Devaluation*, IMF Occasional Paper No.138 (Washington, D.C.: International Monetary Fund).

Fischer, S., 1999, "On the Need for an International Lender of Last Resort," *Journal of Economic Perspectives*, Vol. 13, pp. 85–104.

Freixas, X., C. Giannini, G. Hoggarth, and F. Soussa, 1999, "Lender of Last Resort: A Review of the Literature," *Financial Stability Review*, Vol. 7, pp. 151–67.

Freixas, X., B. Parigi, and J.C. Rochet, 2003, "The Lender of Last Resort: A 21st Century Approach," Working Paper No. 298 (Frankfurt: European Central Bank).

Flood, R., and N. Marion, 1999, "Perspectives on the Recent Currency Crisis Literature," *International Journal of Finance and Economics*, Vol. 4, pp. 1–26.

Garcia, G., and E. Plautz, 1988, *The Federal Reserve. Lender of Last Resort*, (Cambridge: Ballinger Publishing Company).

He, D., 2000, "Emergency Liquidity Support Facilities," IMF Working Paper WP/00/79 (Washington, D.C.: International Monetary Fund).

Ho, C., 2002, "A Survey of Institutional and Operational Aspects of Modern-Day Currency Boards," Working Paper No. 100 (Basel: Bank of International Settlements).

Hoelscher, D., and M. Quintyn, 2003, *Managing Systemic Banking Crises*, IMF Occasional Paper 224 (Washington, D.C.: International Monetary Fund).

International Monetary Fund, 2004, *Financial Stability Assessment: Eastern Caribbean Currency Union*, IMF Country Report No. 04/293, (Washington, D.C.: International Monetary Fund).

International Monetary Fund, 2008, *Eastern Caribbean Currency Union: Selected Issues*, IMF Country Report No. 08/96, (Washington, D.C.: International Monetary Fund).

Krugman, P., 1979, "A Model of Balance of Payments Crisis," *Journal of Money, Credit and Banking*, Vol. 11, pp. 311–25.

Laurens, B.J., 2005, *Monetary Policy Implementation at Different Stages of Market Development*, IMF Occasional Paper 244 (Washington, D.C.: International Monetary Fund).

Persson, T., and G. Tabellini, 2002, *Political Economics: Explaining Economic Policy* (Cambridge MA: MIT Press).

Schinasi, G.J., 2006, *Safeguarding Financial Stability: Theory and Practice*, (Washington, D.C.: International Monetary Fund).

van Beek, F., J.R. Rosales, M. Zermeño, R. Randall, and J. Shepherd, 2000, *The Eastern Caribbean Currency Union Institutions, Performance, and Policy Issues*, IMF Occasional Paper 195 (Washington D.C.: International Monetary Fund).

van den Boogaerde, P. and C. Tsangarides, 2005, "Ten Years After the CFA Franc Devaluation: Progress Toward Regional Integration in the WAEMU," IMF Working Paper WP/05/145 (Washington, D.C.: International Monetary Fund).

Wolf, H.C., A. Ghosh, H. Berger, and A. Gulde, 2008, *Currency Boards in Retrospect and Prospect*, MIT Press, forthcoming, April.

Williams, O., T. Polius, and S. Hazel, 2001, "Reserve Pooling in the Eastern Caribbean Currency Union and the CFA Franc Zone," IMF Working Paper WP/01/104 (Washington D.C.: International Monetary Fund).

Yehoue, E.B., 2007, "The CFA Arrangement—More Than Just an Aid Substitute?," IMF Working Paper WP/07/19 (Washington, D.C.: International Monetary Fund).