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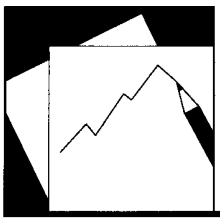

IMF Working Paper

A Macro Model of the Credit Channel in a Currency Union Member: The Case of Benin

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A Macro Model of the Credit Channel in a Currency Union Member: The Case of Benin

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Abstract

This paper applies and extends a theoretical model built by Agénor and Montiel (2007) by exploring the effectiveness of government bonds and monetary policy in a small, open, credit-based economy with a fixed exchange rate. The model is applied to Benin, a member of a currency union, using a general equilibrium model with stochastic simulation. Model calibration replicates the historical pattern for 1996–2009. Policy experiments simulated an increase in government securities in Benin's regional market and a cut in the reserve requirement. Simulations produced mixed results. It appears that, among other factors, excess bank liquidity lowers the effectiveness of monetary policy instruments through the credit channel and that government bonds can help mop up excess bank liquidity.

JEL Classification Numbers: C15, C61, E23, E27, H61, O11

Keywords: Benin; Credit channel, excess liquidity, government bonds, general equilibrium, stochastic simulation.

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I. INTRODUCTION

The literature on macrofinancial linkages in developing countries is sparse. There are several possible reasons for this. For instance, (i) data for single developing countries often are not adequate for empirical studies; (ii) sudden stops, structural breaks, or regime changes in the time series may weaken the force of any policy recommendations from empirical studies; (iii) the vulnerability of a country to policy and exogenous shocks makes predictions about economic prospects uncertain; and (iv) the financial sector and securities markets in developing countries are underdeveloped, segmented, and highly concentrated. Yet financial services ought to be at the heart of the development process, and analysis of the credit channel of monetary transmission through bank balance sheets provides important operational information to guide policy.

Since financial liberalization became general in the late 1980s and early 1990s, most studies on financial sector issues and economic performance in Sub-Saharan Africa have been concerned with financial integration or institutions. However, with renewed interest in macrofinancial linkages, understanding the channel through which monetary policy affects the real economy is a challenge for policymakers and academics alike. It is of particular importance for low-income countries, where economic development is often accompanied by regime shifts, causing recurrent uncertainty about future prospects.

This paper attempts to analyze the extent to which financial services affect short-term real activity in a small open economy with a fixed exchange rate regime, as in countries that are members of currency unions. It applies and extends a theoretical model built by Agénor and Montiel (2007) in their analysis of monetary policy in small, open, credit-based economies; the model emphasizes the role of the credit channel in monetary policy transmission. The original model is extended here by incorporating government bonds and excess liquidity. This paper focuses on Benin, a country where financial systems are dominated by commercial banks and there is no well-functioning securities market—features that characterize most developing countries. We control for excess bank liquidity, which can slow the effective transmission of monetary policy. We also assume that a fixed proportion of

government bonds will be issued and there is no distortion caused by the country's absorptive capacity.

The paper focuses on two financial issues that are central for Benin. The first is the implications of issuing government securities and the second emphasizes the extent of central bank reserve requirements. By 2006, Benin benefited from debt relief from the Heavily Indebted Poor Countries (HIPC) Initiative and the Multilateral Debt Relief Initiative (MDRI) that opened up fiscal space for development expenditures. However, as the country strives to finance its development needs, issuing bonds in the regional market is being considered. At the same time, there was a concern about Benin's relatively high reserve requirement (9 percent) compared to its peers (average 5.57 percent excluding Benin) within the West African Economic and Monetary Union (WAEMU).[2] As is well known in a currency union, this may jeopardize achievement of financial integration. At the same time, a relatively high reserve requirement may squeeze private access to credit.

There are at least two reasons for the focus on a credit-based economy: (i) it is widely recognized that central bank discount rate policies have not been fully effective in channeling monetary policy in developing countries, especially in economies with fixed exchange rate regimes; and (ii) commercial banks are large lenders to the economy, and bank loans and government securities (funds raised in the capital market) are not perfect substitutes. These features are particularly relevant for members of currency unions like Benin.

The paper proposes a general equilibrium model with a stochastic simulation to model monetary policy that focuses on a credit-based fixed exchange rate economy. It combines both forward- and backward-looking analysis by associating estimation (e.g., using full information maximum likelihood estimates to derive model structural parameters) with calibration and simulation together. Few papers have attempted to reconcile these two approaches to capturing macro-financial linkages in developing countries. A typical feature

[2] By June 16, 2009 the distribution of the reserve requirement in WAEMU was as follow: Benin (9 percent), Burkina Faso (7 percent), Côte d'Ivoire (5 percent); Guinea Bissau (3 percent); Mali (7 percent); Niger (7 percent); Senegal (7 percent); and Togo (3 percent).

of developing countries with weak financial markets is that the credit channel of monetary transmission appears to be more effective than, say, the interest rate or the exchange rate, because in general key production sectors are dependent on bank lending, although bank lending and securities are not perfect substitutes. Leading contributions sharing this view are Agénor and Montiel (2007), Greenwald and Stiglitz (1993), Bernanke and Gertler (1995), Carlstrom and Fuerst (1997), Kiyotaki and Moore (1997), and Bernanke, Gertler, and Gilchrist (1999).

The results are generally consistent with the theoretical predictions for developing countries. First, the model calibration replicates the historical pattern for 1996–2009. Experiments that simulated an increase in government securities in the regional market and a cut in the reserve requirement produced mixed results. Consistent with the theoretical findings in Agénor and El Aynaoui (2008) the experiments produce mixed results and indicate that excess liquidity hampers effective monetary transmission. Further analysis shows that government bonds, by mopping up excess liquidity, stimulate short-term demand and support monetary transmission. In what follows, Section II presents the characteristics of the theoretical model, the calibration, and solution methods. Section III discusses baseline assumptions and results. Section IV analyzes the two policy experiments, and Section V draws conclusions.

II. Background and Benchmark Model

As in other WAEMU countries, the financial sector in Benin is dominated by commercial banks. Of the 14 financial institutions operating in the country other than the pension system, 12 are commercial banks. The four largest banks together collect more than 82 percent of deposits, lend more than 51 percent of total credit to the private sector—and hold more than 64 percent of nonperforming loans. Financial services in Benin are growing at a moderate pace and are confined primarily to the capital city, Cotonou. Bank products and services are limited to funding commercial operations through loans, deposits, and service payments. Although the number of bank accounts, both individual and commercial, has been increasing at an annual rate of 12 percent, only 6 percent of the population at the end of 2006 had access to financial services. It is expected that the growing number of banks will improve access to financial services and spur development of new financial instruments over the medium term.

The government has recently consolidated its financial position, which has opened up access to credit for the private sector. Net bank credit to the government is declining as fiscal consolidation continues, and Benin was granted HIPC and MDRI debt relief. Government use of the regional financial market as an additional source of financing has also opened up space for credit to the private sector. Nevertheless, financial depth in Benin, measured by the ratio of M2 to GDP, is below the average for Sub-Saharan Africa.

The model is set up in three steps: (1) A solution is found using a deterministic and stochastic-dynamic simulation to replicate the historical path. (2) The baseline solution path for 2010–11 is determined. (3) Two policy experiments are run and an assessment is made in terms of deviation from the baseline scenario, shock to government bonds, and a cut in the reserve requirement. The model allows for several experiments to assess the macroeconomic implications and bank balance sheet effects of policy shocks. It is built on a small open economy producing a single good with five markets (currency, bank deposits, credit, bonds, and goods markets) and four agents (households, commercial banks, government, and the central bank). The discussion focuses on bank operations (deposits and credits) and their relations with the government (through bonds) and households. The analysis departs from the original Agénor and Montiel (2007) model in considering bank excess liquidity and the cost to banks of servicing loan payments (see also Agénor and El Aynaoui, 2008).[3] This approach allows for risk concentration or credit rationing. It treats bank profits as non-monotonic as a result of adverse selection and expects that the probability of repayment will be a decreasing function of bank loan rates. Also, compared to Agénor-Montiel, it does not account for land.

[3] Liquidity is defined as the sum of bank reserves at the central bank (required reserves, deposits placed in negative auctions, current accounts, and cash). *Excess* liquidity is defined as the sum of the current account plus cash.

Table 1. Model Variables

Number	Symbol	Definition	Status
		Aggregate demand and price	
1	C	Real private consumption	Endogenous
2	GDP	Real gross domestic product	Endogenous
3	I	Real domestic investment	Endogenous
4	X	Real exports	Endogenous
5	M	Real imports	Endogenous
6	P_D	Inflation or domestic price index	exogenous
		Household	
7	F^H	Household financial wealth	Endogenous
8	$BILL$	Household currency holding	Endogenous
9	D	Household bank deposit	Endogenous
		Central bank	
10	MB	Monetary base	Endogenous
11	RR	Reserve level	Endogenous
12	E	Exchange rate (CFAF : US$)	Exogenous
13	i_B	Refinance rate	Exogenous
14	μ	Reserve requirement ratio	Exogenous

Table 1(continued). Model Variables

		Commercial banks	
15	L^F	Loans to firms	Endogenous
16	L^B	Borrowing from central bank	Endogenous
17	i_D	Deposit rate	Endogenous
18	i_L	Lending rate	Endogenous
19	V	Excess liquidity	Exogenous
		Government	
20	G	Real government expenditure (current and investment)	Exogenous
21	L^G	Government bonds	Exogenous
22	I_G	Government investment	Endogenous

Households

Households consume, and their financial wealth (F^H) consists of holding, domestic currency, which bears no interest (*BILL*) and deposits (D) in domestic commercial banks. D is a function of the interest rate on deposits (i_D), the domestic price (P), and household consumption (C). Thus:

$$F^H = BILL + D \quad (1)$$

We assume that:

$$BILL = \exp(-\theta_1 i_D) P^{\theta_2} C^{\theta_3} \quad (2)$$

D is determined residually through (1); F^H is determined over time as a fixed proportion of change in private saving.[4]

[4] An OLS regression of F^H on change in private saving suggests an elasticity of 0.27 (with a t-statistic of 3.39).

Commercial banks

Banks convert household deposits (*D*), loans from the central bank, the BCEAO (L^B), and (structural, voluntary, or precautionary) excess liquidity (*V*) into credit to the private sector (L^F), government bond holdings (L^G), and required reserves at BCEAO (*RR*), which are proportional to *D*.[5] Thus:

$$D + L^B = L^G + L^F + RR + V \quad (3)^6$$

$$RR = \mu D \quad (4)$$

The challenge for banks is to maximize their expected profit, Π, given that there is a probability ($1 - q$) that their loans will not be repaid; *q* is measured by the ratio of bank nonperforming loans to total credit to the private sector, and we assume that banks face a fixed cost, *K*, to service their loans. Assuming that banks will face zero cost in servicing their loans, their expected profit is given by[7]

$$\Pi = qi_L L^F(i_L) + i_G L^G - i_D D(i_D) - i_R[L^F(i_L) + L^G - (1-\mu)D(i_D) + V(i_G)] \quad (5)$$

They must also solve the following problem:[8]

$$\underset{i_D, i_L, i_G}{MAX}\, E(\Pi) = qi_L L^F(i_L) + i_G L^G - i_D D(i_D) - i_R[L^F(i_L) + L^G - (1-\mu)D(i_D) - V(i_G)] \quad (6)$$

where i_D is the nominal interest rate on deposits, i_L is interest on bank loans, and i_G is the rate on government T-bills. The probability of default associated with government bonds is assumed to be zero.

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[5] For simplicity's sake, we consider bank cash and vault holdings to be (precautionary) excess liquidity. As a result, given the highly precautionary behavior of banks, we also assume that the bank loan supply is what private borrowers take.

[6] Changes in commercial bank net foreign assets are assumed to be zero.

[7] The maximization is based on Agénor and Montiel (2008). Although this is beyond the scope of the study, results remain unchanged assuming that banks face a non-zero fixed cost of servicing their loans.

[8] Based on Agénor and Montiel (2008) and extended to government bonds.

First-order conditions of equation 6 are:

$$\partial\Pi/\partial i_D = D + (i_D - (1-(1-\mu)i_R)\partial D/\partial i_D = 0 \quad (7)$$

$$\partial E(\Pi)/\partial i_L = qL^F + (qi_L - i_R)\partial L^F/\partial i_L = 0 \quad (8)$$

$$\partial E(\Pi)/\partial i_G = (L^G + i_G \partial V/\partial i_G) + (i_G - i_R)\partial L^G/\partial i_G = 0 \quad (9)$$

From equation (7),

$$i_D = (1+\frac{1}{\eta_D})^{-1}(1-\mu)i_R \quad (10)$$

$$i_L = (1+\frac{1}{\eta_L})^{-1}\frac{i_R}{q} \quad (11)$$

$$i_G = (1+\frac{1}{\eta_G})^{-1}(1-\frac{\eta_V}{\eta_G}\frac{V}{L^G})i_R \quad (12)$$

Where η_D, η_L, η_G, and η_V are respectively the interest elasticity of household deposits, bank loans, government bonds, and excess liquidity. Implicitly, then, bonds and loans are not perfect substitutes; otherwise we would have an arbitrage condition that equates i_G and i_L, adjusted, of course, for the cost of providing loans. In equilibrium, the interest rate differential reflects the average credit default risk associated with extending loans to the economy.

The central bank

Central bank assets consist of loans to banks and net foreign assets; liabilities include currency in circulation and required reserves.

$$MB = L^B + ER^* = BILL + RR \quad (13)$$

Government

We assume that the government issues bonds to finance public investment (though it could be any component of spending). The bonds are issued through a Dutch auction; each bank bids for the amount of bonds it wants at its preferred rate, and the least expensive combinations of rates and quantities that reach the government target, $L^{G,}$, are selected. As a result, bonds are held below i_L we thus assume that

$$I_G = \lambda L^G + c \tag{14}$$

Aggregate demand

Household consumption, *C*, has a positive effect on output and real wealth and a negative effect on the real interest rate on deposits.

$$LogC = \alpha_1 Log(Y(-1) - \frac{F^H}{P_D}) + \alpha_2 (i_D - \pi^a) \tag{15}$$

π^a is the expected inflation, and α_1 is the marginal propensity to consume out of revenue *Y*. We also assume that real private investment depends negatively on the real lending rate.[9] And we assume that the nominal value is partly financed by bank lending. Thus:

$$I = \beta_1 LogY(-1) + \beta_2 (i_L - \pi) + \beta_3 LogI_G \tag{16}$$

$$L^F = \upsilon L_0^F + \tau PI \tag{17}$$

Where L_0^F is the (assumed) private sector debt to the banking sector at the beginning of the period. Let X and M be the export and import functions respectively. *X* is a function of

[9] Samake (2007) found the private sector crowding-in effect of public spending in Benin.

previous period output, which reflects the one- year lagged effect of cotton production on exports, the real interest rate on bank loans, and the real exchange rate. [10]

$$X = \phi_1 LogY(-1) + \phi_2 (i_L - \pi^a) + \phi_3 Log(E/P) \quad (18)$$

M is a function of the real interest rate on loans and the real exchange rate:

$$M = \omega_1 (i_L - \pi^a) + \omega_2 Log(E/P) \quad (19)$$

Equilibrium in the goods market is automatic, and output is thus determined on the demand side by:

$$Y = (C + G) + (I + I_G) + (X - M) \quad (20)$$

The bank sets the price (lending rate) and has an elastic supply curve (L_B determined residually). The residually determined equilibrium condition is the money market condition. The model solutions are summarized in Table 2.

Table 2. Model Solution Equations

Equation #	Variable	Equation Formulation	Source
		Equilibrium in the goods market	
1	*C*	$LogC = \alpha_1 Log(Y_{-1} - \frac{F^H}{P_D}) + \alpha_2 (i_D - \pi^a)$	From (15)
2	*I*	$I = \beta_1 LogY(-1) + \beta_2 (i_L - \pi) + \beta_3 LogI_G$	From (16)
3	*X*	$X = \phi_1 Y_0 + \phi_2 (i_L - \pi^a) + \phi_3 (E/P)$	From (18)
4	*M*	$M = \omega_1 (i_L - \pi^a) + \omega_2 (E/P)$	From (19)
5	*Y*	$Y = C + G + I + I_G + X - M$	From (20)
		Equilibrium in the currency market	
7	*BILL*	$BILL = \exp(-\theta_1 i_D) P^{\theta_2} C^{\theta_3}$	From (2)
8	*MB*	$MB = BILL + RR$	From (13)

[10] The primary sector in Benin contributes to about one-third of total value added and cotton generates about one quarter of export receipts. As a general rule in Benin, cotton production is accounted for in GDP at time t, while exports take place at time t+1.

9	RR	$RR = \mu D$	From (4)
		Equilibrium in the deposit market	
10	D	$D = F^H - BILL$	From (1) and (2)
11	i_D	$i_D = (1 + \frac{1}{\eta_D})^{-1}(1-\mu) i_R$	From (10)
		Equilibrium in the credit market	
12	L^F	$L^F = \upsilon L_0^F + \pi PI$	From (17)
13	L^B	$L^B = MAX\left(L^F + L^G - (1-\mu)D + V, 0\right)$	From (3) and (4)
14	i_L		From (11)
15	i_G	$i_G = (1 + \frac{1}{\eta_G})^{-1} i_R$	From (12)

Model Calibration

The model is calibrated on annual data (1960–2006) from the IMF *International Financial Statistics, 2007* and World Bank *African Indicators, 2007*. Parameters for calibration consist of a mixture of regression-based focusing Benin specifics and a benchmark set of parameters from literature on low-income countries (Table 3). The former follow McGrattan, Rogerson, and Wright 1997. Because of data limitations, these calibrations were carried out by block exogeneity guided by behavioral equations for each market equilibrium condition.

Table 3. Structural Parameters for Calibration

Estimating the Model by FIML

	Coefficient	t-value
α_1	0.588	2.340
α_2	0.208	4.210
α_3	0.607	3.820
α_4	-0.066	-1.920
β_1	1.935	3.800
β_2	-0.012	-0.798
β_3	0.374	4.660
ϕ_1	1.884	2.010
ϕ_2	-0.024	-0.871
ϕ_3	0.227	1.955
ω_1	-0.033	-1.170
ω_2	-0.126	-2.890
λ_1	0.963	23.000
λ_2	0.001	0.079
λ_3	0.031	1.68
θ_1	-0.191	-7.87
θ_2	1.105	2.04
θ_3	0.359	3.111
Other parameters used for calibration		
K	0.500	
υ	0.300	
τ	0.270	
μ	0.150	
η_D	0.090	
η_G	0.090	

Model simulation: This consists of two steps:

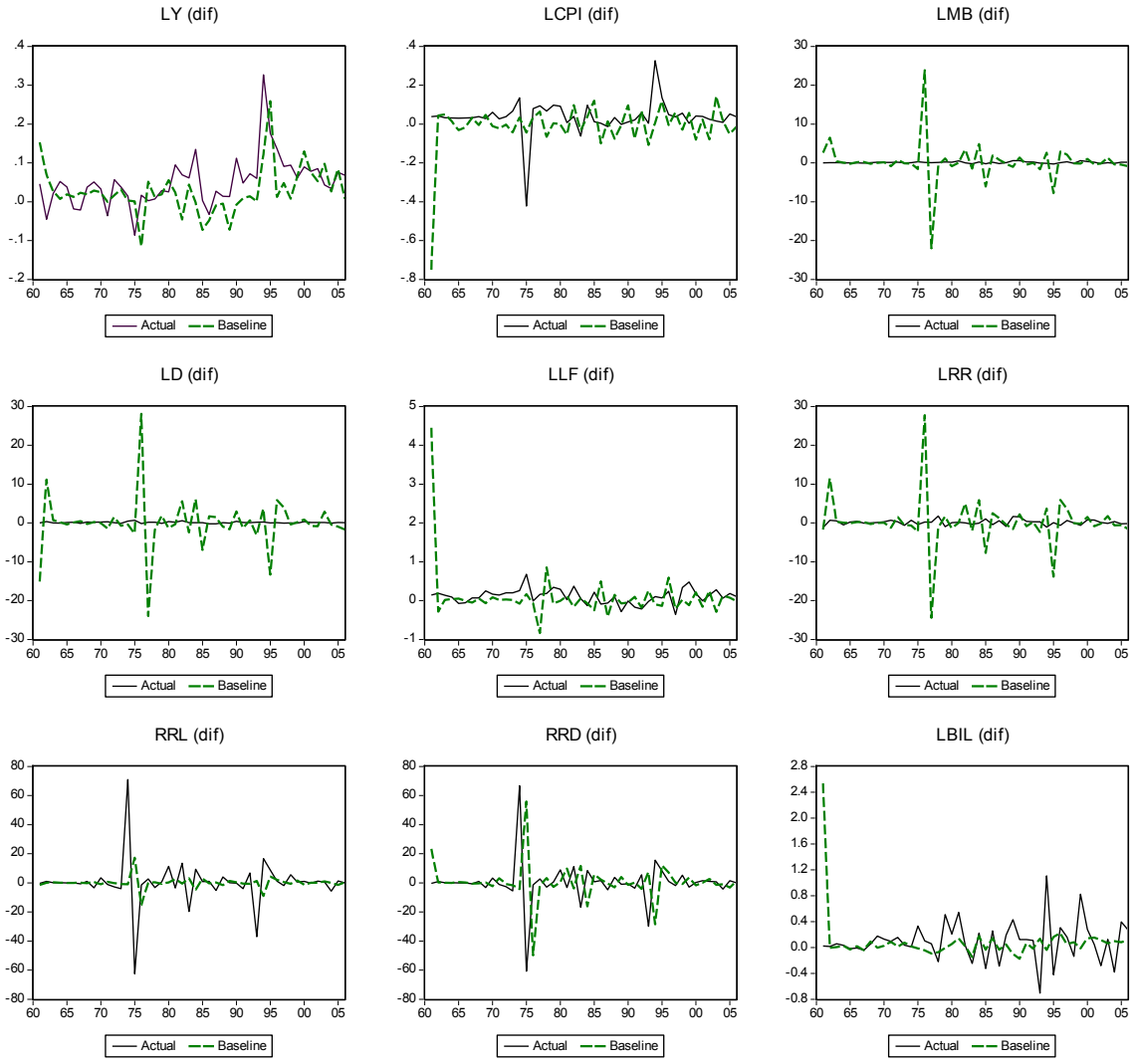
1. A deterministic simulation is used to test for the extent to which the model replicates the historical path. This simulation consists of analyzing block structures of the model and solving the model equation for each observation in the solution sample using an iterative algorithm (Gauss-Seidel and Newton) to compute values for the endogenous variables.
2. A stochastic simulation is employed to simulate policy experiments and predict the impact of shocks. This simulation solves the model repeatedly for different draws of the stochastic component of the model. Errors are generated for each observation in line with the residual and exogenous variable uncertainties in the model during each repetition.

The solution method allows checking results against the historical path but also looking forward. The approach is a stochastic-dynamic-solution method that is most appropriate for the medium-term projections and policy experiments to be undertaken. It uses forecasts from previous periods, not actual historical data, in assigning values to the lagged endogenous variables of the model. It first tests solutions against annual historical data for 1960–2007 through a nonlinear numerical method that allows for policy experiments. A nonlinear numerical method is a set of time series, one for each system variable, satisfying for each period all conditions in the model through simulations that find a solution for each time series realization of the vector of stochastic process of the exogenous perturbation in the economy. Although there is controversy about linear versus nonlinear general equilibrium models, we prefer the latter as more suitable for forward-looking policy experiments because it is based on projection methods. It also offers ways to address measurement error problems.

The model solution replicates satisfactorily the historical pattern since 1996. It is first tested against historical data using deterministic simulation for a static solution, and stochastic simulation for a dynamic solution. Figure 1 indicates how the model would have performed between 1960 and 2006 relative to actual outcomes. The results suggest that the model performs satisfactorily after 1996. Its poor performance in 1960–95 may be associated with data quality and a variety of structural breaks (oil price shocks in the 1970s, the 1994 CFA franc

devaluation, shallow financial markets, etc.). As a result, relative to actual data the baseline exhibits substantial differences in the first two decades that appear to have died out in the last 10 years. In addition, solutions appear to be stable across both time, and the static and stochastic models for each variable. More importantly, the stochastic simulation method, which is suitable for projections and policy experiments, shows less volatility than the deterministic simulation.

Figure 1. Benin: Simulation Model Solution - Replication of Historical Data, 1960 - 2009



III. BASELINE PROJECTIONS

Of seven exogenous variables the study focuses on shocks to government bonds and the BCEAO reserve requirement. Government bonds are used entirely to finance domestically funded public investment, and the reserve requirement is adjusted to the WAEMU average.

We assume that administrative and absorptive capacity creates no distortion and that resources allocated to investments are used efficiently.[11] The baseline scenario for 2010–11 is consistent with the medium-term Fund–supported program. To ensure consistency, since most economic fundamentals, including GDP and inflation, are endogenous the study projected smooth paths for the exogenous variables.

The baseline bonds are assumed to increase by 0.2 percent of GDP annually for 2008–11. The BCEAO refinancing rate and the reserve ratio are assumed to remain at 2009 levels. On these terms, endogenous real GDP is expected to slow from from 5.0 percent in 2008 to 2.7 percent in 2009 as a result of the global financial crisis. And growth is expected to bounce back and reach 3.2 percent in 2010 and 4.4 percent in 2011. Price inflation is expected to be held at 2.5 percent in 2009–11. Currency in circulation will increase by 6.7 percent a year and the central bank money base by 7.2 percent through 2011.

Finally, it is assumed that in pursuing the MDGs the government will continue to issue bonds on the regional market to sustain high investment spending. Bonds issued are assumed to increase by CFAF 60 billion annually (i.e., to 1.4 percent of GDP in 2009–11). The bonds are assumed to be issued at Dutch auction, which holds bond rates below the rate banks would accept voluntarily.

[11] Samake and Mongardini (2009) show, however, that the extent of absorptive capacity matters.

Figure 2a. Benin: Baseline Stochastic Simulation Model Solutions (1960-2009) and Assumptions (2010 - 2011)

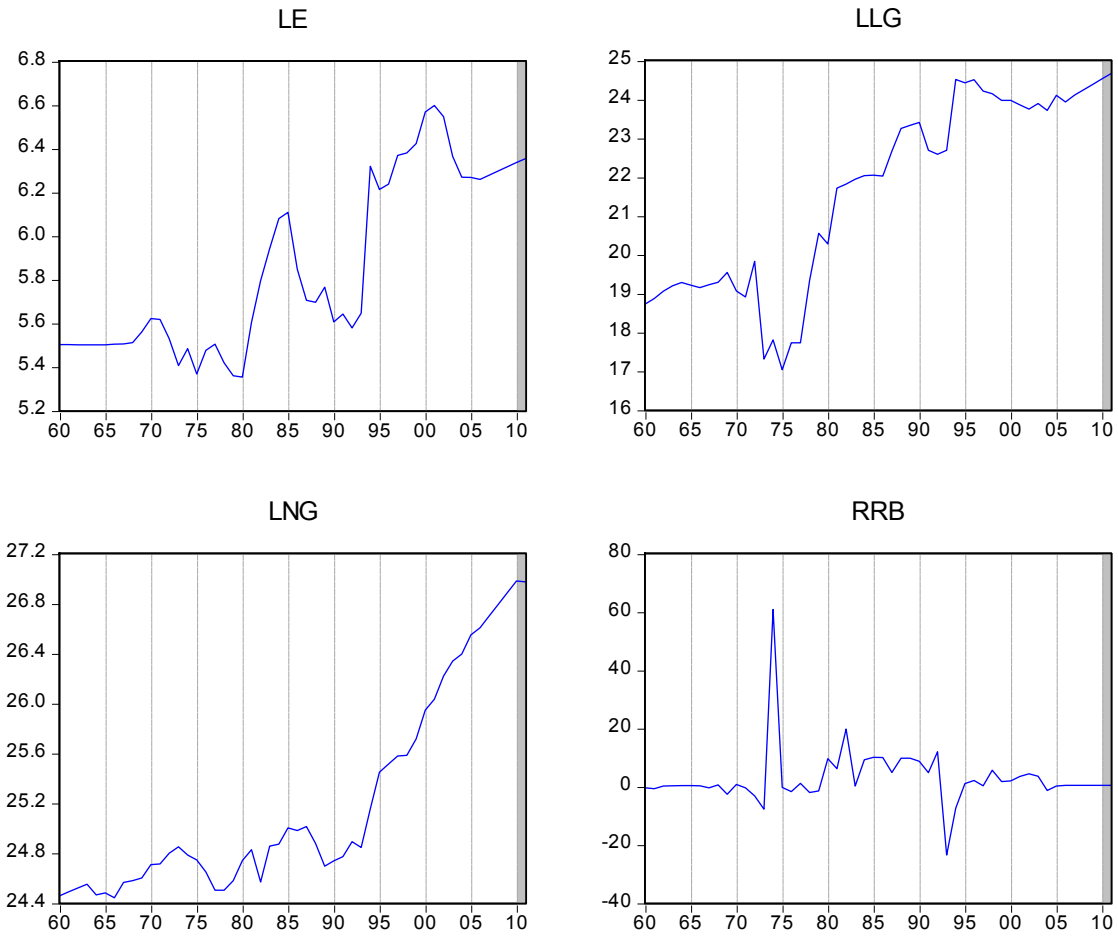
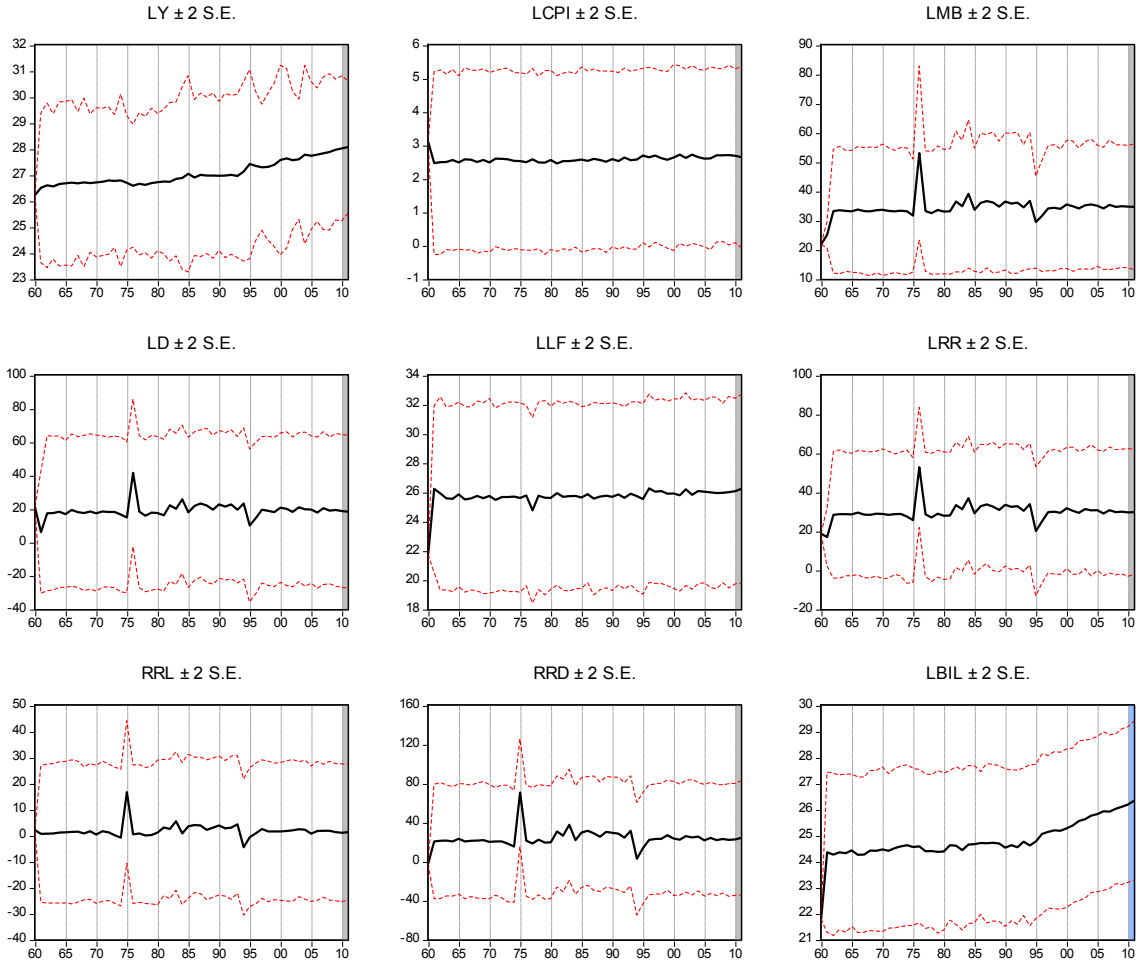


Figure 2b. Benin: Baseline Stochastic Simulation Solutions (1960-2009)
and Projection (2010 - 2011)



IV. Policy Experiments

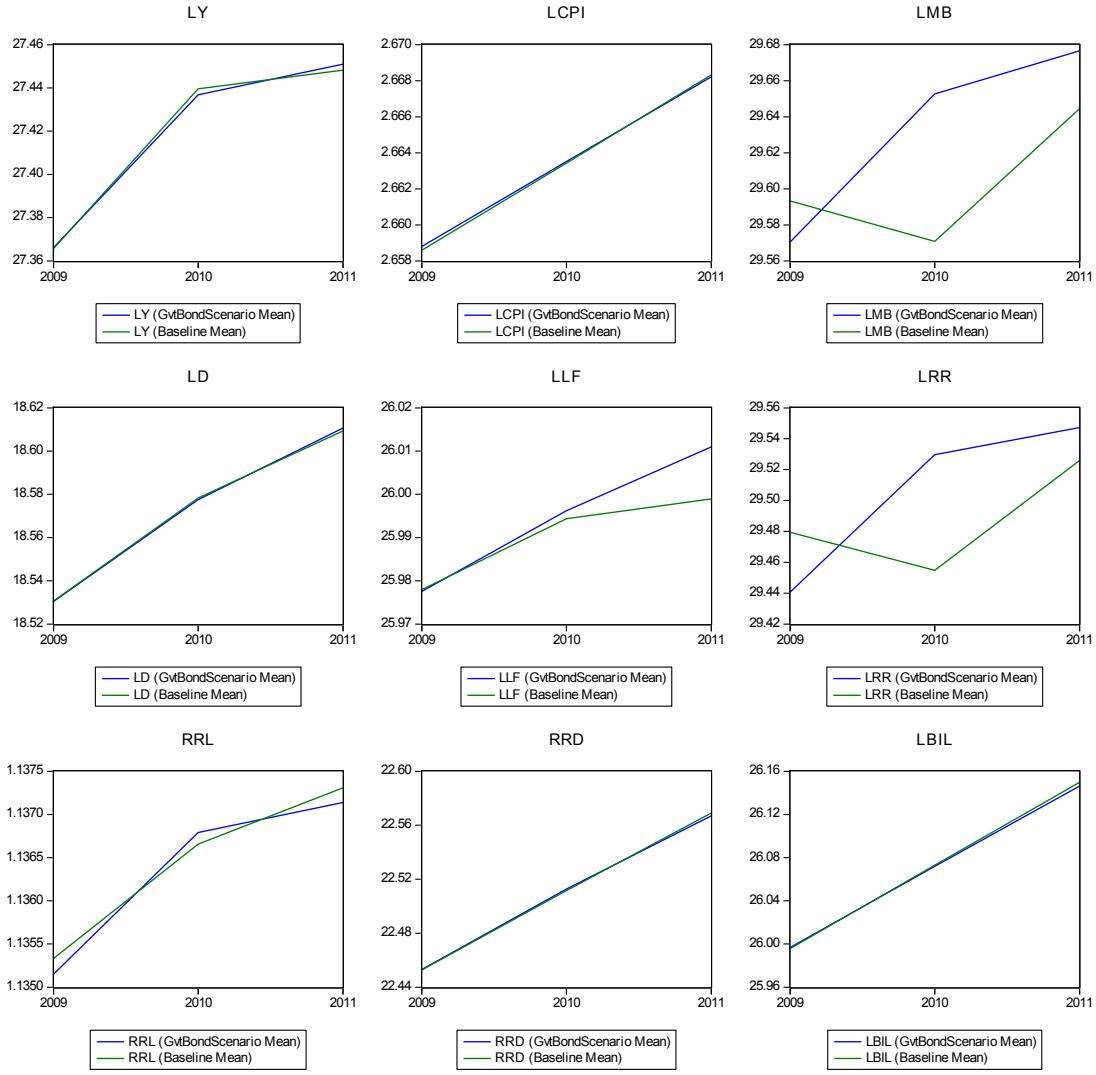
A. Shock to Government Bonds

This experiment assesses how government bonds are increasingly becoming a policy instrument for both fiscal and monetary authorities. Given Benin's large infrastructure bottlenecks, the authorities could envisage scaling up public investment to reach their development goals. They could also rely somewhat on domestic revenues and regional bonds for financing. The government began the latter process in 2007 by issuing fixed-rate bonds. For the monetary authorities, with a credible fiscal policy and continued good fiscal performance and prospects,

issuing medium- and long-term bonds through Dutch auction would tend to hold interest rates below what banks would require in a credit market only.

Simulation results suggest that doubling government bonds to about 7.4 percent in 2008 to finance additional public investment would increase short-term GDP growth (through the demand side) and leave domestic prices unchanged (Figure 3). Figure 3 suggests that in response to government issuance of bonds, only bank loans and output shift up, interest rates on loans decline and total bank lending increases. The impact of bonds on macroeconomic aggregates and bank balance sheets suggests that bonds contain information on the market's expectations for inflation and interest rates. It thus appears that bonds create conditions for increased commercial bank borrowing at a lower rate (lower premium). This is partly because, in addition to loans from the central bank and household deposits, banks use their (precautionary) excess liquidity (which they would not lend to private sector anyway) to invest in bonds.

Figure 3. Benin: Stochastic Simulation - Reponse to Goverenment Bonds Shocks to Fund Public Investment, 2009-11



B. Shock to BCEAO Reserve Requirements

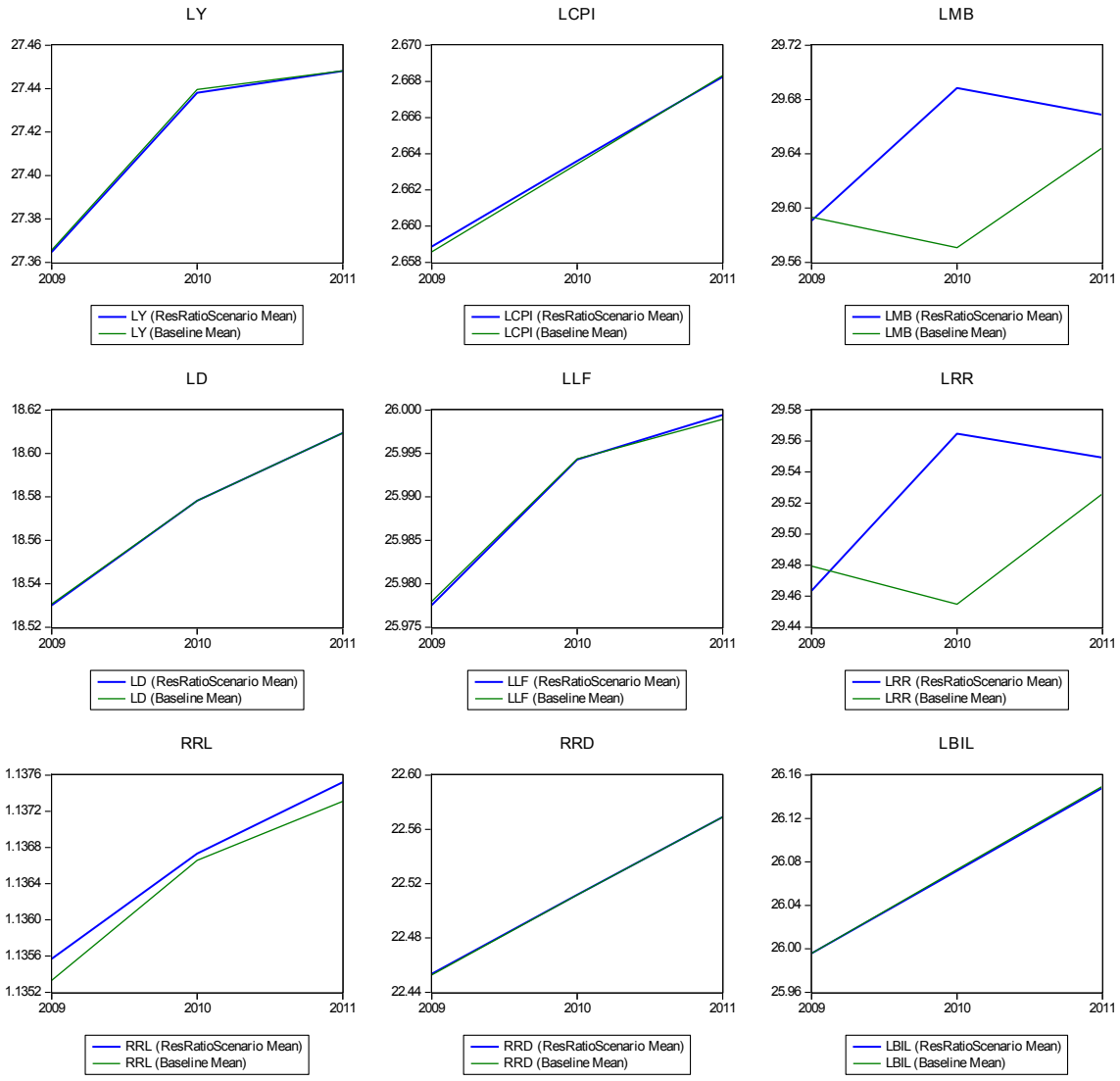
The reserve requirement is one of the main BCEAO policy instruments, but the rate is different for each WAEMU member country (Benin's is the highest). Applying differentiated country rates for a single instrument may complicate the region's objective of building a unified regional financial market and may weaken the effectiveness of monetary policy. It will, however, help slow credit growth in the short run. It is therefore useful to assess the impact of a

reduction in the reserve requirement on bank aggregates and its macroeconomic repercussions in Benin.

This study assumes a 300-basis point cut to bring the Benin's reserve ratio the WAEMU average. The average impact of such a cut is mixed (see Figure 4). The real impact (on growth and inflation) is limited, but it does induce some balance sheet effects, which ultimately could affect banks' lending behavior. It also tends to reduce somewhat the amount of currency in circulation. In theory, it might be expected that lowering the ratio would initially leave banks with excess reserves, which can induce expansion of bank credit and deposits and a decline in interest rates. While bank loans do behave as expected, the response of deposits to a change in the reserve requirement is again puzzling. The impact of changes in reserve requirements is difficult to estimate; each change has the potential to affect thousands of depository institutions in different ways, depending on each institution's customer base.[12].

[12] At the end of 2005, the number of bank customers reached 206,932 individuals (2.8 percent of the population) and 38,620 enterprises of all sizes.

Figure 4. Benin: Stochastic Simulation - Response to Cut in Reserve Requirement Ratio, 2009-11
(- 400 basis points)



V. CONCLUSIONS

A key contribution of this paper is to explore the effectiveness of issuing government bonds in the domestic market and examine the transmission mechanism of monetary policy in a small open economy with a fixed exchange rate regime where banks dominate the financial system. Employing and extending the model of Agénor and Montiel (2007), the paper also looks at excess bank liquidity. The model is calibrated to the Benin economy using a general equilibrium model with a stochastic simulation method that makes it possible to test the model against the historical path and, looking forward, simulate policy experiments related to an increase in government securities in the regional market and a cut in the reserve requirement ratio.

The results are generally consistent with the theoretical prediction that is typically tailored to developing countries. It is shown that, abstracting from distortions related to administrative and absorptive capacity and to the extent that investment is efficiently used, government issuance of bonds in the domestic market is effective. Furthermore, it can improve monetary policy transmission by mopping up excess bank liquidity without crowding out the private sector. However, excessive use of bonds can jeopardize fiscal sustainability. A cut in bank reserve requirements affects banks' balance sheets and the level of excess liquidity. Its impact on balance sheets, however, is mixed because the extent of excess liquidity can interfere with the effectiveness of the bank refinancing rate.

The scope of study, however, is limited, and other factors can complicate operation of the monetary transmission channel, such as debt collection and foreclosure on collateral, governance and judiciary system capacity problems (Singh *et al*., 2009). In addition, the simulation results should be considered more qualitatively than quantitatively because, while the general equilibrium model provides a consistent integrated framework for exploring the policy experiments, there are significant uncertainties about the long-term inferences that can be made.

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