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What determines monetary policy in the Franc zone? : estimating a reaction function for the BCEAO

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What Determines Monetary Policy in the Franc Zone?
Estimating a Reaction Function for the BCEAO

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Abstract

This paper examines to what extent the central bank for the West African Economic and Monetary Union (BCEAO) has used interest rate policy in response to domestic economic developments. We show that while in the long run the BCEAO matches changes in French (Eurozone) interest rates one for one, in the short run it retains freedom to react to domestic economic variables, such as inflation, the output gap, its foreign exchange position and government borrowing.

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1. Introduction

In October 1989 the BCEAO, which is the central bank for the West African Economic and Monetary Union, announced its intention to shift towards using indirect instruments of monetary policy, based on modifications of the central bank discount rate as the primary policy tool. There has been some question whether the BCEAO has actually begun to actively use its discount rate as a monetary policy tool, (see IMF 2001 on this point). This paper asks to what extent the BCEAO modifies its discount rate in response to changing domestic economic conditions, or, alternatively, whether movements in the BCEAO discount rate are driven above all by changes in foreign interest rates. We focus in particular on the period after the January 1994 devaluation of the CFA franc, considering to what extent the BCEAO reacts to changes in domestic inflation and output, to external constraints involving reserve levels and French interest rates, as well as to other relevant variables. While the BCEAO has been criticized in the past for not using its discount rate as an active policy tool, and while it is true that discount rate changes have been infrequent since 1994, we find evidence that the BCEAO does react to domestic economic variables in a limited fashion, and in particular to inflation. Our estimates are consistent with an interpretation that in the long-run, the BCEAO matches changes in French interest rates one for one, but in the short-run it retains a significant freedom to react to domestic economic variables. We arrive at this conclusion using two alternative estimation methods. In the first, we estimate several extended Taylor rules using both quarterly and monthly data. With the second method we use a multinomial logit model to estimate the probability that changes in variables such as inflation, the output gap, or foreign interest rates will lead to a discrete change in the BCEAO discount rate. This second estimation method, which we see as complementary to the first, takes account of the fact that central banks in practice modify their discount rates in discrete steps (usually of at least 25 basis points), rather than as a continuous variable.

In the remainder of the paper we first provide a brief description of the recent evolution of monetary policy in WAEMU. In Section 3 we then estimate an interest rate reaction function for the BCEAO using both quarterly and monthly data. Section 4 extends this inquiry by using a multinomial logit model to estimate probabilities of discrete changes in the BCEAO discount rate. Section 5 discusses the robustness of our interest rate results. Finally, Section 6 concludes.

2. Monetary Policy in WAEMU: 1993-2000

In the period immediately preceding and following the January 1994 devaluation of the CFA franc, monetary policy decisions were determined almost exclusively by the goal of maintaining the CFA franc's peg to the French peg. Before January 1994 BCEAO interest rates were kept high in order to offer holders of CFA assets a risk premium. In the months immediately following the devaluation, BCEAO interest rates were raised significantly as part of the provisions of country IMF programs.

Since 1995 BCEAO interest rates have gone through two distinct periods. During the first period, from December 1994 to October 1996, the BCEAO undertook a series of stepwise rate reductions that resulted in the discount rate falling from 10% to 6.5% (see Figure 1). This was also a period of stepwise reductions in French short-term central bank rates. Between October 1996 and December 2000 BCEAO rates remained within a very narrow range (5.75%-6.5%), in keeping with relative stability in French interest rates, excepting at the end of the period.

3. Estimating an Interest Rate Rule for the BCEAO

As an initial step in our empirical inquiry, we have estimated interest rate rules for the BCEAO central bank where it is assumed that the BCEAO discount rate is a continuous variable.[1] We restrict our attention to the period between January 1995 and December 2000, avoiding the period of the CFA franc devaluation in 1994. We examine how BCEAO interest rates have responded to domestic inflation rates and to the output gap, as is common practice in estimates of interest rate rules for OECD countries. In addition, we consider to what extent the BCEAO authorities

[1] As in Taylor (1993, Clarida *et al* (1998), Aaron and Muellbauer (2000)

have responded to variables that may play more of a role in monetary policymaking in developing countries, and in particular those countries with fixed exchange rate regimes. These include foreign interest rates, levels of foreign assets, and changes in government claims on the central bank. Extended interest rate rules of this sort have recently been considered by Aron and Muellbauer (2000) for South Africa.

Specification and data

We begin by considering a basic monetary policy rule of the form adopted by Clarida, Gali and Gertler (1998) where the interest rate on the central bank's short-term lending facility r^* depends on the long-run equilibrium nominal rate $\bar{r}$, on the difference between the expectation of the inflation rate for period $t+n$ and the policymaker's preferred rate of inflation π^*, and on the difference between the expectation of output growth for period t and the preferred rate of output growth y^*. This is a generalization of the simple interest rate rule that has been proposed by Taylor (1993).

$$r_t^* = \bar{r} + \beta_1 (E_{t-1}[\pi_{t+n}] - \pi_t^*) + \beta_2 (E_{t-1}[y_t] - y_t^*) \qquad (1)$$

Empirical estimations of equation (1) often consider both rules where the central bank reacts to forecasts of inflation in the next period (n=1) and rules where it reacts to the forecast for inflation anywhere from 6 to 24 months into the future. The central bank's information set is taken to include data available in period *t-1*. Based on this assumption, one can then use instrumental variables to incorporate forward-looking expectations into the estimation. Aron and Muellbauer (2000) adopt this technique to estimate an interest rate rule for South Africa. In the case of the West African Economic and Monetary Union, however, there is reason to believe that the appropriate estimation method may be more simple. When using information available at time t-1 to predict inflation at time t (based on monthly data), the only statistically significant predictor is the previous month's inflation rate. That is, when we instrumented for current inflation with different lags of inflation, only the coefficient on inflation lagged one month was significant (and inflation lagged one quarter in the case of our quarterly dataset). There is no available BCEAO data on inflation expectations in WAEMU, and a recent paper by a member of the BCEAO staff (Tenou, 2002) does not include a measure of inflation expectations when estimating an interest rate rule for WAEMU. As a result, in our estimate of the BCEAO interest rate rule we assume that when setting interest rates at time *t*, the BCEAO reacts directly to the inflation rate and the output gap as measured at time *t-1*. As can be seen from the summary statistics in Table 1, monthly inflation rates in WAEMU are extremely volatile, with a standard deviation of 7.8 percentage points.[2] This volatility has potential implications for BCEAO policymaking; to the extent inflation is volatile and difficult to forecast, the BCEAO may give this variable less weight when considering interest rate decisions.

We estimated the overall output gap for the BCEAO using a Hodrick-Prescott filter and quarterly data for GDP.[3] The recent paper by BCEAO staff that estimates an interest rate rule for WAEMU also uses this approach (Tenou, 2002). As was true for inflation rates, the output gap in WAEMU is extremely volatile (see Table 1), and as a consequence, the BCEAO may give less weight to this variable in policymaking than would otherwise be the case. Given that the HP filter is known to have a number of shortcomings, in particularly with accuracy deteriorating towards the end of a series, we also experimented with alternative output gap measures. One option involved calculating trend GDP by using a simple 5-quarter moving average of real GDP growth. The output gap produced using this method turned out to be extremely highly correlated with our existing HP-filter measure (correlation coefficient >0.95).

When considering whether the BCEAO alters interest rates in response to changes in WAEMU inflation and the output gap, we constructed each of these variables by weighting individual country inflation rates and output gaps by GDP.

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[2] Inflation rates show similar volatility in quarterly data, with a standard deviation of 6.4 percentage points over the 1995-2000 period. There also remains nearly as much volatility in the series if one considers a six-month backward looking moving average for inflation rates. Here the standard deviation is 5.0 percentage points. A six-month moving average of this form was a poorer predictor of current inflation than was a one-month lag.

[3] Quarterly data from Fielding *et al* (2003). In addition, because there was evidence of seasonality of output, we regressed the output gap on a set of seasonal dummies and then used the residual from this regression as our final output gap measure for estimation. There was no strong evidence of seasonality in other variables in our dataset, nor was a set of seasonal dummies statistically significant in any of the regressions we performed.

However, it is plausible that the decision making process within BCEAO might result in different weightings being applied in practice. We investigated two such possibilities. First, there is a possibility that the BCEAO responds only to Ivoirian economic conditions, which would be based on the interpretation that Côte d'Ivoire plays a predominant role in BCEAO decision making. Second, it may be the case that the BCEAO responds to an unweighted average of WAEMU inflation rates and output gaps, which would be based on the interpretation that the BCEAO statutes give countries equal weight in decision making, regardless of the size of their population or their economy. Using these two alternative measures the results did not differ very significantly from those reported here.

In addition to considering the possibility that BCEAO interest rates react to current inflation and the output gap, we follow Aron and Muellbauer (2000) by examining whether interest rates are correlated with several other variables that may logically have an impact on interest rate setting in developing countries, and the BCEAO in particular. Most importantly, given capital mobility and the maintenance of the CFA franc's peg to the French franc (and subsequently the euro), the BCEAO can be expected to react to changes in the French central bank rate. Failure to maintain short-term interest rates at French levels (in addition to compensating for a relative risk premium for holding CFA) will lead to a loss of exchange reserves. To the extent that the French Treasury does not unconditionally support reserve outflows, this will pose a constraint on BCEAO policy. As a result, in our empirical estimates we include the French short-term interest rate as an explanatory variable.[4]

Given the constraint imposed by the CFA peg, the BCEAO should also logically be more likely to increase short-term interest rates in cases where the central bank's foreign assets are low. The BCEAO statutes contain a policy rule requiring credit restrictions whenever gross foreign assets of the BCEAO fall below 20% of sight liabilities (*engagements à vue*).[5] In our empirical estimates we include the

[4] Banque de France Repurchase Rate and subsequently the ECB marginal lending facility.
[5] This includes notes and coins, sight deposits of banks, financial institutions and the treasury, and foreign currency liabilities

variable *a*, which measures the gross foreign assets of the BCEAO as a share of total WAEMU GDP.

Finally, given that the BCEAO has continued to provide a direct credit facility for governments, we also include a variable *c*, which measures total BCEAO claims on governments as a share of total WAEMU GDP. This would be justified to the extent that the facility is automatic (BCEAO cannot limit credit to governments unless this exceeds 20% of annual revenues), and that there are fears that an increase in claims will have to be monetized at some point.[6] To the extent that changes in claims provide a good proxy for the overall fiscal deficit, this variable may also capture the reaction to direct inflationary effects of expansionary fiscal policy.

Results of unit root tests (reported in Table 2) strongly suggest that among our variables WAEMU inflation, claims on government, and foreign assets are stationary over the period considered (the output gap is stationary by construction). In contrast, there is evidence that both the BCEAO discount rate and French short-term central bank rate are non-stationary. Given the theoretical relationship between the BCEAO rate and the French short-term central bank rate, one might expect that if they each have a unit root, they will also be cointegrated. If this is the case, then it makes sense to estimate an error-correction model where BCEAO rates in the long-run depend exclusively on the level of French interest rates (plus a constant reflecting any risk premium), and our other explanatory variables in equation 3 then explain short-run deviations from this long-run tend. A likelihood ratio test based on the Johansen procedure for cointegration suggested this is indeed the case. However, the Johansen procedure is known to have poor properties in small samples, such as we have here. Tests for cointegration based on the method proposed by Engle and Granger (1987) suggested that the null of no-cointegration of French rates and BCEAO rates could not be rejected.

Based on the above tests results, which do not demonstrate unambiguously that BCEAO and French interest rates are cointegrated, we have nonetheless chosen to estimate the error correction model reported in equations (2) and (3), below. This

[6] A similar assumption is made in Fielding (2002) chapter 3.

method produced similar results to those obtained when assuming that all variables are stationary.

$$
\begin{aligned}
&r_t = \alpha + \beta_1 r_t^{FR} + \varepsilon_1 \\
&\Delta r_t = \beta_2 + \beta_3 \Delta r_t^{FR} + \beta_4 \pi_{t-1} + \beta_5 (y_{t-1} - \overline{y}_{t-1}) + \beta_6 (r_{t-1} - (\alpha + \beta_1 r_{t-1}^{FR})) + \varepsilon_2
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
&r_t = \alpha + \beta_1 r_t^{FR} + \varepsilon_1 \\
&\Delta r_t = \beta_2 + \beta_3 \Delta r_t^{FR} + \beta_4 \pi_{t-1} + \beta_5 (y_{t-1} - \overline{y}_{t-1}) + \beta_6 a_t + \beta_7 c_t + \beta_8 (r_{t-1} - (\alpha + \beta_1 r_{t-1}^{FR})) + \varepsilon_2
\end{aligned} \tag{3}
$$

Estimates using quarterly data

Regressions 1 and 2 in Table 3 report estimates of equations (2) and (3) using quarterly data for the period 1995-2001. We begin with a simple rule that considers the relationship between BCEAO interest rates, inflation, the output gap, and French interest rates (equation 2). In this regression the coefficient on French interest rates is highly significant, and given the confidence interval for this coefficient, this result is also consistent with the proposition that in the long-run, a change in French interest rates will have to be matched by a one-for-one change in BCEAO interest rates. In the short-run equation the coefficient on lagged inflation is of the expected sign and quite large, but it is not statistically significant. The coefficient on the output gap is both large and statistically significant.

We next estimate an extended rule where the BCEAO interest rate also responds to changes in the level of foreign assets held by the BCEAO and to changes in government claims on the central bank (equation 3). In this specification in the short-run equation, the coefficient on WAEMU inflation is not significant either, but the coefficient on the output gap remains of similar magnitude and is significant at the 10% level. The coefficients on the foreign assets variable and the government claims variable have the expected sign, but they are not statistically significant.

Given the results of these regressions using quarterly data, the horizon most frequently used to estimate interest rate rules, it can be suggested that the BCEAO responds strongly to changes in French interest rates, but there is also an indication that in the short-run the BCEAO reacts systematically to lagged inflation and the output gap.

Estimates using monthly data

While the majority of empirical studies of interest rate rules use quarterly data, several authors have observed that it may make more sense to use monthly data for these estimates, because this is the frequency with which central bank governing boards generally meet to consider interest rate changes.[7] Among the variables used in our estimations of equations 2 and 3, the output gap is only available on a quarterly basis, but data for all other variables is available monthly. Models 3 and 4 from Table 3 report estimates of an interest rate rule for the BCEAO using monthly data.[8] In these regressions the output gap has been constructed using a simple interpolation where the output gap in each month is estimated to be equal to the measured output gap for that quarter.

In regression 3 (based on equation 2) there is again evidence that in the long-run the BCEAO responds one for one to changes in French short-term interest rates. In addition, there is now more unambiguous evidence that BCEAO responds to increases in inflation with higher interest rates. A one standard deviation increase in WAEMU inflation (+.078) is estimated to result in a short-run increase of 0.06 in the BCEAO's discount rate. The coefficient on the output gap in regression 3 is also statistically significant, suggesting that a one standard deviation increase in the output gap (0.054) would be associated with a short-run increase in BCEAO rates of 0.03 percentage points. The results for regression 4 (based on equation 3) with regard to inflation and the output gap are quite similar. Once again, there is no evidence that the BCEAO responds to changes in its level of foreign assets or to changes in claims on government.

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[7] This point has been made by Clarida, Gali, and Gertler (1998) as well as Chevapatrakul, Mizen, and Kim (2001).

[8] Given the significance of a number of variables in our regressions using quarterly data, it may make sense to include three lags of our dependent variable in our monthly regressions. We began with this specification but excluded the second and third lags after we found that they were never statistically significant.

In sum, our estimates using monthly data suggest that while changes in French interest rates remain the primary factor to which the BCEAO responds when it sets its discount rate, since 1995 the BCEAO has also reacted to WAEMU inflation and the WAEMU output gap.

4. Estimating Probabilities of Interest Rate Changes

While standard interest rate rules are used to estimate how the *level* of interest rates responds to changes in macroeconomic variables such as inflation and output, and they implicitly assume that interest rates can be modified by any amount, in practice central banks face choices of whether to respond to changing economic conditions with a discrete change in interest rates, generally of at least 25 basis points. As a consequence, rather than using macroeconomic variables to predict the level of interest rates, it may also be useful to use these same variables to predict the direction of change of the central bank's discount rate (cut, no change, or increase). In this section we follow Chevapatrakul, Mizen, and Kim (2001) by using a multinomial logit model to estimate the probability that the BCEAO will cut interest rates, increase rates, or hold them constant in any given month. The multinomial logit model allows us to take account of the fact that central banks are forced to choose between no change in the interest rate, a discrete increase, or a discrete decrease.[9] We view this method as complementary to the method used for estimating the interest rate rules in Section 3, as using both methods will help us to identify the extent to which assumptions about BCEAO behaviour are driven by specific assumptions about whether the BCEAO discount rate is a continuous variable.

Over the period we consider, while the level of the BCEAO's discount rate has varied significantly, changes in the level have tended to occur in large discrete jumps. Over the 73 months in our sample the BCEAO changed rates on 10 occasions, decreasing rates eight times, and increasing rates in two instances. Seven out of these ten modifications involved changes of at least 50 basis points. This distribution

[9] For reasons of tractability we ignore the fact that the BCEAO has made discrete changes of differing magnitudes in recent years.

of outcomes suggests that while it may be possible to predict decreases in the discount rate with some confidence, it may be quite difficult to predict rate increases very accurately. Given this distribution, one might prefer to group together cases of interest rate increases with cases where the rate was held steady and then use a standard logit or probit model to estimate the likelihood of a rate decrease. We also considered this possibility and found that the results were very similar to those obtained with the multinomial logit procedure. As a consequence, we have chosen to report the multinomial logit estimates in Table 4.

Table 4 reports the results of our multinomial logit estimates of the following three outcomes where X_t is a vector of variables that are likely to be correlated with interest rate changes.

$$\Pr(r_t - r_{t-1} < 0 | X_t)$$
$$\Pr(r_t - r_{t-1} = 0 | X_t)$$
$$\Pr(r_t - r_{t-1} > 0 | X_t)$$

For the vector X_t, we use the same set of explanatory variables used to estimate equations (2) and (3), with one exception. Instead of using the level of French short-term interest rates, we use the difference between the BCEAO's discount rate and French short-term rates as an explanatory variable $(r_{t-1}^{BCEAO} - r_{t-1}^{FR})$. While the level of French rates is a likely predictor of the level of BCEAO rates, the probability that BCEAO rates will be changed in any given month is more likely to be a function of the difference between the BCEAO rate and the French rate.

Table 4 reports the results of our multinomial logit estimates. In the reduced model, the coefficient on the difference between BCEAO rates and French rates has the expected sign both for predicting cuts in the BCEAO rate and for predicting increases, and it is statistically significant in the former case. In addition, the level of WAEMU inflation has a statistically significant effect on the probability of a rate cut: higher inflation makes a cut less probable. Contrary to intuition, the coefficient on the output gap is actually positive and significant, suggesting that when GDP is above trend the BCEAO will actually be more likely to cut interest rates.

The "extended model" reported in Table 4 adds claims on government and the level of foreign assets to the central bank's information set. In this extended model the coefficients on WAEMU inflation and on the output gap remain of similar magnitude as in the reduced model. In addition, the levels of BCEAO foreign assets and of its claims on government are significant predictors of a cut in the BCEAO's discount rate. A likelihood ratio test shows that these coefficients are jointly significant. As would be expected, when foreign assets are high and claims on government are low, the BCEAO is more likely to cut rates.

A look at the substantive magnitude of the effects from our multinomial logit estimates provides a mixed picture. Changes in French interest rates have large effects on our estimated probabilities of interest rate changes, and changes in other explanatory variables may also have sizeable effects, but only when they are quite far from their mean values. For each of our explanatory variables, Table 5 reports the predicted probability of a cut in BCEAO interest rates when the variable in question is set at one, two and three standard deviations away from its mean. Other variables remain set at their mean values (when all variables are set at their means the estimated probability of an interest rate cut is 0.001). The value for each of the variables listed is shifted in the direction, which, according to the extended model in Table 4, would be associated with an increased probability of a cut in the BCEAO discount rate. From the table it is clear that an increase in the gap between French and BCEAO interest rates by one standard deviation or more has a very large effect on the estimated probability of an interest rate cut. In contrast, the level of WAEMU inflation or the level of foreign assets only has a sizeable impact on the estimated probability of a rate cut when these variables are at least two standard deviations away from their mean. In the sample we consider, this would apply to only 2% of the observations for foreign assets and 5% of the observations for inflation. Finally, even very large changes in levels of claims on government have no effect on the estimated probability of a rate cut.

As a final look at the substantive predictions of our multinomial logit estimates, Figure 2 charts the estimated probabilities of a rate cut for each date in our sample (in the shaded columns), and it also indicates the dates on which the BCEAO actually chose to cut interest rates (in the unshaded columns). As can be seen, there is a reasonably close correspondence between a high predicted probability of a cut, and an actual BCEAO decision to cut rates. However, a further look shows that the accuracy of the model is driven above all by the estimated effect of a change in the interest rate differential between WAEMU and France. Figure 3 reports the estimated probabilities from the extended model after we removed the interest rate differential variable from the regression. As can now be seen, there continues to be a correlation between a predicted change in rates and an actual change in rates, but the predicted probability of a change in rates in this model is never greater than 0.5.

5. Robustness of the interest rate results

Before drawing firm conclusions based on our estimates, it is worth considering to what extent these results may be influenced by serial correlation of the errors, by outliers, and by the model specification we adopted. We conclude that our results are robust after considering each of these potential problems.

Standard tests for serial correlation of errors provided mixed conclusions about our Table 3 estimates. Based on a Durbin h test, the null of no first-order serial correlation could not be rejected for either the estimates using quarterly data or those using monthly data. On the other hand, results of a Breusch-Godfrey test, which can be used to test for both first-order and higher-order autocorrelation, suggested that there is first order autocorrelation in both our quarterly and our monthly estimates, and there is also higher order autocorrelation in the quarterly estimates. These results for the quarterly data should probably be qualified by the fact that the sample size is quite small. We examined whether inclusion of additional lags of our explanatory variables could successfully address any potential serial correlation. However, after inclusion of additional lags, the coefficients on these lag terms were not statistically significant, and tests continued to suggest that both first-order and higher-order autocorrelation might be present. As a consequence, in our Table 3 estimates we have reported the standard errors proposed by Newey and West (1987), which are consistent in the presence of both first order and higher order autocorrelation.

We also considered to what extent our empirical results are influenced by the presence of outliers. For the estimates in Table 3 we identified outliers using Cook's distance and then re-estimated the regressions after excluding those observations where this value was greater than 4/(n-k-1). After exclusion of several outliers the results of all four regressions remained similar. For our multinomial logit estimates we identified outliers using the Delta-Beta influence statistic developed by Pregibon (1981). After exclusion of two outliers (January 1995 and June 1996) the estimates for predicting a cut in interest rates remained virtually unchanged. In contrast, in both the reduced and the extended model the estimates for an *increase* in BCEAO rates altered substantially. The coefficients on lagged inflation, the lagged output gap, and claims on government were each statistically significant with the expected sign.

In addition to examining the effect of serial correlation and outliers on our results, it is also worth considering to what extent our conclusions are dependent on the particular specification adopted in our OLS and multinomial logit estimates. As a first possibility, we considered to what extent our results depend on the restrictive assumption that BCEAO does not use a forecast for inflation and the output gap when setting policy. When we re-estimated our regressions while including a forecast of inflation and output (based on instruments available at time t-1), the results were quite close to those reported here.

6. Conclusion

Our empirical results provide a nuanced picture regarding monetary policy in the West African Economic and Monetary Union. Short-term central bank rates in France (now the Eurozone) have continued to be the most important influence on both the level of the BCEAO's discount rate and on decisions to alter the BCEAO discount rate. This is a logical implication of the CFA franc's peg to the French franc (and now the euro). While our estimates suggest that in the long-run the BCEAO may have to match changes in the Bank of France (now ECB) lending rate on a one for one basis, it nonetheless appears to retain flexibility in the short-run to use interest rates to react to changes in WAEMU economic conditions. We have provided evidence that the BCEAO takes into account inflation rates, the output gap, central bank claims on government, and its foreign exchange position when making interest rate decisions. It should be noted, though, that the substantive magnitude of these effects remains relatively small.

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Figure 1: BCEAO interest rates and French interest rates, 1995-2000

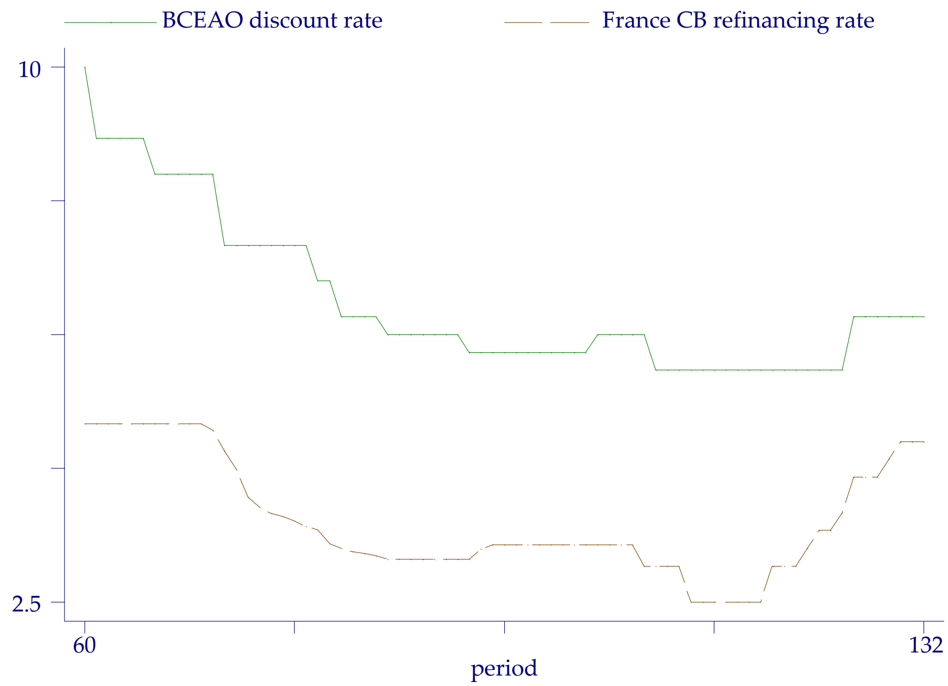

Table 1: Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
BCEAO discount	6.72	1.09	5.75	10.0
French / ECB short term interest rate	3.64	0.80	2.50	5.00
WAEMU inflation	0.028	0.078	-0.131	0.206
Output gap	0.006	0.052	-0.157	0.100
Foreign assets/GDP	0.326	0.045	0.215	0.435
Claims on govt/GDP	0.309	0.034	0.261	0.422

These figures are based on monthly data 1995-2000. Summary figures for the quarterly dataset used in the paper are similar.

Table 2: Unit Root Tests of Regression Variables

	quarterly (no trend)	quarterly (trend)	monthly (no trend)	monthly (trend)
BCEAO discount	-3.82	-0.89	-3.82	-1.73
	p<0.01	p=0.96	p<0.01	p=0.74
French rate	-1.49	-0.05	-1.30	0.43
	p=0.53	p=0.99	p=0.63	p=0.99
WAEMU inflation	-4.06	-4.57	-5.69	-5.85
	p<0.01	p<0.01	p<0.01	p<0.01
Claims on	-5.40	-5.72	-4.63	-5.22
government/GDP	p<0.01	p<0.01	p<0.01	p<0.01
Foreign Assets / GDP	-3.86	-3.57	-3.53	-4.20
	p<0.01	p=0.03	p<0.01	p<0.01

Results are based on Phillips-Perron tests conducted with and without a trend.

Table 3: Estimating an Interest Rate Rule for BCEAO

Regression	**(1)**	**(2)**	**(3)**	**(4)**
Long-Run Equation				
French rate$_t$	1.14	1.14	1.14	1.14
	(0.29)	(0.29)	(0.19)	(0.19)
Constant	2.59	2.59	2.57	2.57
	(0.89)	(0.89)	(0.61)	(0.61)
Short-Run Equation				
Δ French rate	0.39	0.41	0.36	0.36
	(0.16)	(0.19)	(0.18)	(0.19)
WAEMU inflation (t-1)	0.79	-0.07	0.76	0.81
	(0.96)	(1.27)	(0.30)	(0.36)
Output gap (t-1)	1.40	1.76	0.60	0.74
	(0.68)	(1.02)	(0.34)	(0.47)
Claims on government /		1.74		0.69
GDP		(2.80)		(1.25)
Foreign assets / GDP		-2.85		-0.15
		(2.45)		(0.63)
Error-Correction term	-0.28	-0.35	-0.14	-0.14
	(0.09)	(0.07)	(0.04)	(0.05)
Constant	-.013	0.31	-0.06	-0.23
	(0.04)	(1.01)	(0.02)	(0.28)
N=	25	25	73	73
Frequency	quarterly	quarterly	monthly	monthly

Estimation by OLS with Newey-West standard errors (in parentheses).

Table 4: Estimating Probability of a Change in BCEAO Interest Rates

Multinomial Logit Estimates

	Reduced model		**Extended model**	
	Cut	**Increase**	**Cut**	**Increase**
$(r_{t-1}^{BCEAO} - r_{t-1}^{FR})$	5.04 (1.88)	-2.50 (1.43)	13.0 (3.7)	-2.70 (1.17)
WAEMU inflation (t-1)	-13.9 (6.1)	8.1 (12.4)	-31.1 (13.7)	8.9 (10.2)
Output gap (t-1)	35.2 (17.5)	5.10 (3.76)	53.0 (18.3)	7.88 (8.63)
Claims on government / GDP			-39.2 (18.6)	15.2 (37.6)
Foreign assets / GDP			75.7 (31.6)	-4.17 (19.3)
Constant	-19.5 (7.0)	2.91 (3.01)	-59.2 (18.3)	1.135 (0.608)
N=	73		73	
Pr>Chi² – H_0: constant only	$p<0.01$		$p<0.01$	
Pr>Chi² – H_0: reduced model			$p=0.064$	

Estimation by multinomial logit with heteroskedastic-consistent standard errors (in parentheses).

Table 5: Predicted probability of an interest rate cut

		$\Pr(r_t - r_{t-1} < 0)$		
Variable	**variable change**	**1 Std. Dev.**	**2 Std. Dev.**	**3 Std. Dev.**
Difference (t-1)	above mean	0.78	0.99	0.99
WAEMU infl. (t-1)	below mean	0.01	0.13	0.62
Output gap (t-1)	above mean	0.02	0.24	0.83
Claims on govt / GDP	below mean	<0.01	0.02	0.06
Foreign assets / GDP	above mean	0.03	0.51	0.93

Based on extended model reported in Table 3. Other variables set at their means. Predicted probability when all variables are set at their means is 0.001.

Figure 2: Estimated Probability of a Rate Cut – Using Gap with French Rates
(actual cut indicated by unshaded column)

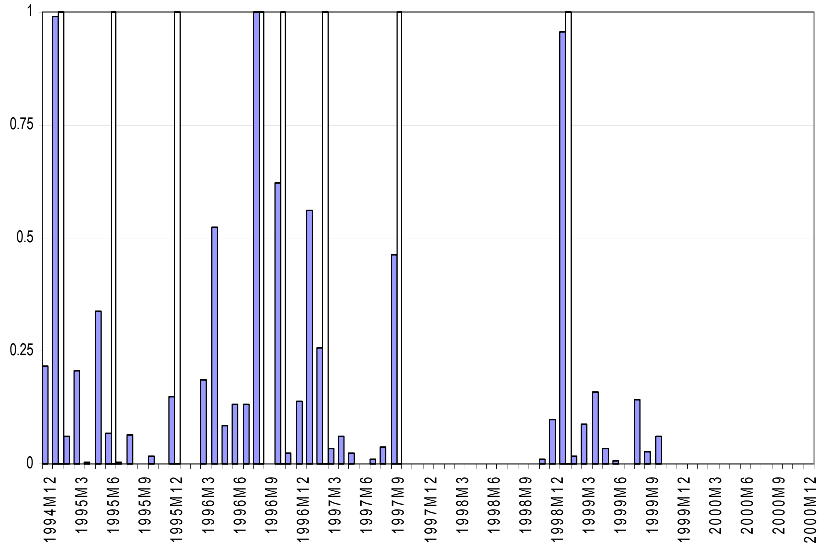

Figure 3: Estimated Probability of a Rate Cut – Domestic Variables Only
(actual cut indicated by unshaded column)