DOMESTIC INTEREST RATES AND MONETARY POLICY IN SMALL OPEN ECONOMIES WITH FIXED AND FLEXIBLE EXCHANGE RATES

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November 1995

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Abstract

Although the Mundell/Fleming theorem has strongly influenced thinking about macroeconomic policy, few open economies have stuck to its precepts, because imperfections in international capital markets (due to transactions costs, information costs, exchange rate uncertainty and other factors) make for less-than-perfect capital mobility. By comparing domestic interest rate movements with the international interest rate parity condition and domestic monetary adjustment, we infer the degree of monetary autonomy for a sample of small open economies in the Caribbean. Monetary policy may be least effective as a tool for balance of payments stabilization in precisely those circumstances where it is most urgently needed for that purpose.

JEL Classification: E43

Keywords: interest rate, monetary policy

November 1995

Domestic Interest Rates and Monetary Policy in Small Open Economies with Fixed and Flexible Exchange Rates

Although the Mundell-Fleming thesis (Mundell, 1963; Fleming, 1962) has strongly influenced thinking about monetary policy in open economies, few less developed countries (LDCs) have followed its precepts closely. That is because none of them is perfectly open, and international capital transactions are not without cost. With perfect capital mobility monetary expansion sucks in capital under a fixed exchange rate regime, and appreciates the exchange rate if it is flexible; but if capital is immobile monetary expansion may boost aggregate demand. In practice LDCs with fixed exchange rates frequently target monetary policy on the management of aggregate demand, while those with flexible exchange rates often try to stabilise exchange rates with the help of monetary policy. The former seems to assume a closed economy, while the latter seems based on open economy assumptions.

Up to a point open economies may behave like closed economies because of the costs of international currency transactions. Edwards and Khan (1985) provide a useful framework for thinking about monetary autonomy, combining characteristics of the closed economy with characteristics of the open economy. They model the interest rate as a weighted average of the rate that would result from domestic monetary policy and from the international interest parity rule.

However, transactions costs, information costs, imperfect substitutability of financial instruments and uncertainty insulate the domestic economy and limit the circumstances under which interest rate parity obtains. So long as the absolute value of the difference between the domestic and the foreign interest rate is less than the sum of these costs there is no tendency for a capital flow that would equalize domestic and foreign rates. Within that zone domestic monetary policy has only closed economy effects.

There is an analagous situation when the exchange rate is flexible. So long as the absolute value of the difference between domestic and foreign rates is less than the transactions and other costs there is no tendency for capital flows that may cause the exchange rate to depreciate and therefore no tendency for an equation of domestic and foreign interest rates. Furthermore, in this case, the costs include a foreign currency risk premium based on the variance of the exchange rate. Because of this, the effectiveness of monetary policy as a means of stabilizing the exchange rate may be reduced.

There have been many attempts to measure the extent of international capital mobility. (Montiel (1994) provides a review.) By and large they support casual empiricism that capital movement is high but not perfect. Some tests are inferential: for example, tests of the degree of monetary independence and savings and investments correlations. Others are direct: for example the deviation from the interest parity condition. They provide a rough idea of the scope for monetary independence with a fixed exchange rate and the weakness of monetary policy with a flexible exchange rate.

This paper investigates deviations from interest parity. When the domestic interest rate is not equal to the foreign interest rate it may be in the process of adjusting to the foreign interest rate (if the difference between domestic and foreign interest rates is greater than the sum of the costs of currency conversion) or it may be influenced by the supply and demand for money (if the difference is less than the costs). We therefore model the interest rate as determined sometimes by interest parity with lags and sometimes by domestic monetary conditions. Whereas Edwards and Khan represent the determinants as a weighted average of interest parity and domestic money balances at any instant, in our model the interest rate is determined by either one or the other, never both at the same time.

When the absolute value of the difference between domestic and foreign rates is less than total costs the interest rate is determined by domestic monetary conditions. When the differential exceeds costs the interest rate is determined by the interest parity condition. The costs are not observed; they are not necessarily equal to the difference between domestic and foreign interest rates because of adjustment lags. We derive an estimate of the cost by including both domestic and international determinants of the interest rate in an estimating equation, with dummy variables set to filter out one or the other. The dummy variables are set so as to establish different thresholds for the currency conversion costs - i.e. the point where the determinants of domestic interest switch from domestic to international - in repeated estimation, and the most likely value of the threshold is chosen.

The Model

For the fixed exchange rate case we use a variant of the Edwards and Khan model. We begin with the case when interest parity conditions are effective. Equation 1 is definitional:

$$(1) \qquad r = r_{-1} + \Delta r$$

r is the interest rate and Δ indicates a change from one period to the next.

The interest rate is changed in reaction to the previous period's interest differential with a premium added for expected changes in the exchange rate. The speed of adjustment is θ:

$$(2) \qquad \Delta r = \theta(r^f_{-1} - r_{-1} + e^*)$$

r^f is the international interest rate and e^* is the expected rate of depreciation of the currency.

Combining equations (1) and (2) and assuming that e^* is an unspecified function of earlier exchange rate changes gives us an equation of the form:

$$(3) \qquad r = \alpha_0 + \alpha_1 r_{-1} + \alpha_{21} e_{-1} + \alpha_{22} e_{-2} + \ldots + \alpha_3 r^f_{-1} + \epsilon$$

In the case where the interest differential does not reach the level of transactions,

In the case where the interest differential does not reach the level of transactions, information and other costs we begin (as do Edwards and Khan) with Fischer's equation:

$$(4) \qquad r - p^* = \rho - \lambda XMS + \omega$$

The price variable is the expected value of inflation and ρ is the long run equilibrium real interest rate which is assumed to be constant. The variable λ represents the speed of adjustment and ω is a random variable. XMS is a variable which represents the excess of money supply over money demand and is defined as:

$$(5) \qquad XMS = \log MO - \log MD$$

MO is the quantity of money and MD is the demand for real money balances. The arguments of the money demand function are real income (y), unanticipated real interest rate changes (due to inflation) and expected inflation (p^*):

$$(6) \qquad \log MD = a_0 + a_1 \log y + a_2 (\rho - p^*) + a_3 p^*$$

This system may be reduced to an equation of the form:

(7) $r = \beta_o + \beta_1 \log MO + \beta_2 \log y + \beta_{31} P_{-1} + \beta_{32} P_{-2} + \ldots + \zeta$

Expected inflation is assumed to be a function of inflation in earlier periods (P_{-}, P_{-2} ...)

In the case of a flexible exchange rate we define an intervention rule for interest rate policy if the conditions for international interest rate parity hold. The authorities will change interest rates to attract capital inflows to achieve a target rate of depreciation (e^{**}) by increasing the supply of foreign exchange. The interest rate will be increased in response to changes in foreign interest rates so as to achieve a differential large enough to overcome conversion costs as well as to correct deviations from the target exchange rate. This gives:

(8) $\Delta r = \psi_1 (r^f_{-1} - r_{-1}) - \psi_2 (e^{**} - e_{-1})$

where ψ_1 and ψ_2 are speeds of adjustment, the first to narrow the gap between domestic and foreign rates and the second to achieve the exchange rate target.

The exchange rate target is defined by the balance of payments equilibrium condition, measured in foreign exchange:

(9) $P^f x + K = P^f m$

P^f is a foreign price index, x is the volume of current account inflows, K the net capital account and m the volume of foreign exchange outflows. Because the economy is small and open the law of one price rules on export markets and the export quantum is determined entirely by the supply relationship as follows:

(10) $\log x = b_o + b_1 (e - P)$

The demand for imports (which are in infinite supply) is determined by real income as well as relative prices according to:

(11) $\log m = \alpha_o + \alpha_1 \log y - \alpha_2 (e - P)$

The estimating equation which results from the reduction of this system is given by:

$$(12) \qquad r = \gamma_o + \gamma_1 r_{-1} + \gamma_2 r^f_{-1} + \gamma_3 P + \gamma_4 \log y + \gamma_5 e_{-1} + \nu$$

Equations (3), (7) and (12) are the equations used to estimate the determinants of interest rates. In the case of fixed exchange rates interest rates are determined either according to equation (3) or equation (7); the equations are combined, with dummy variables set to filter out either one or the other. Where exchange rates are flexible interest rates are determined either by equation (3) or equation (12).

Results

Tests were run for interest rate determination in six Caribbean countries: three with a fixed exchange rate, two with a flexible rate and one which changed from a fixed to a flexible rate. The tests were all based on monthly observations. For each country a composite equation was used with dummy variables that filter out either interest parity or closed economy effects. The value of the threshold difference between domestic and foreign rates was changed in repeated estimation until a maximum value of the adjusted R^2 was obtained. This was taken as the most likely value of the threshold. At this value the composite equation provides the best overall explanation of the variation in interest rates, suggesting that we have uncovered the circumstances where the choice of determinants (domestic or external) is appropriate.

The domestic interest rate is the treasury bill rate in each case. The foreign interest rate is the US treasury bill rate because Caribbean capital markets are closely linked with the US, formally and informally. The price variable is the consumer price index. The money variable is the sum of money and quasi-money, deflated by the consumer price index. The output variable is proxied by imports deflated by the consumer price index since no monthly national income data are available. All the data were obtained from the IMF International Financial Statistics on CD-ROM.

Estimates of the probable threshold differentials between domestic and foreign rates are presented in Table 1. They are tentative because the estimates do not meet all the criteria for reliable statistical inference. They should be regarded as first indicators of orders of magnitude.

The costs of capital mobility seem to vary significantly according to the country's circumstances. As might be expected, they are lower for countries with fixed exchange rates. These costs are negligible for Belize; the interest parity condition with zero differential between domestic and foreign rates yields the highest level of significance in repeated estimation. Transactions and other costs allow for a four point differential in the Bahamas and a three point differential in Trinidad & Tobago before interest parity begins to take effect. For Barbados the threshold is relatively high at eight points, despite the fixed exchange rate. The costs of exchange rate uncertainty appear to be quite high: the thresholds for Guyana and Jamaica - the countries with flexible exchange rates - are reflected in 18 and 19 point differentials, respectively.

The equations which yielded the highest adjusted R^2 in each case appear in Table 2. The US treasury bill rate which appears in all equations is integrated of order 1. For the Bahamas the monetary variable is the only one that is stationary; the others are all I(1). It was impossible to obtain a cointegrating vector and we cannot therefore be confident about the estimated value of the coefficients in this equation. The overall level of significance was low, with an adjusted R^2 of 0.2813 and standard error (SE) of 1.81. The low Durbin-Watson (DW) statistic suggests positive correlation between residuals in succeeding time periods. The structure of the residuals was explored using tests whose results are given in Table 3. They confirm that the residuals are correlated and indicate that their variance may not be constant. An examination of the partial autocorrelations and of the coefficients in the Lagrange multiplier test[1] indicates that the serial correlation is mainly due to the first lag.

For Barbados the treasury bill rate, the monetary variable, real income and inflation all appear to be stationary with the US treasury bill the only I(1) variable. There is no cointegrating vector. The overall level of significance is low, though somewhat better than for the Bahamas, and the DW indicates there may be serial correlation. The test results in Table 3 confirm the likelihood of serial correlation and heteroscedasticity of the residuals. The partial autocorrelations suggest the first lag accounts for these effects.

For Belize the treasury bill rate is I(0). The only other variable in that estimating equation is the US treasury bill rate which is I(1). The DW statistic does not help us because we have included the lagged dependent variable on the right hand side, but Table 3 indicates that the residuals from this equation are stationary. However, their variance may not be constant.

For Guyana the money, price and exchange rate variables are I(0) and the treasury bill is I(1). There is no cointegrating vector. However, the overall significance level of the equation is quite high. There does appear to be serial correlation and heteroscedasticity. The strongest correlation appears at the first lag, but there are noticeable serial links at the sixth lag as well.

For Jamaica the treasury bill rate, the exchange rate and the consumer price index are all I(1) variables. The others, except for the US treasury bill rate, are I(0). The overall level of significance is quite high. Serial correlation seems to be present among the residuals, especially at the first and second lags, and the variance is not constant.

For Trinidad and Tobago the treasury bill rate, the exchange rate, the consumer price index and the real import index are I(1) variables and the others are I(0). There is no cointegrating vector. The estimated equation explains much of the variance and suffers from serial correlation, mainly at the first-period lag, and non-constant variance.

Implications of the Results[2]

Belize is the only economy in the sample that exhibits the features of a perfectly open capital market. Attempts by the Belize Monetary Authority to expand the money supply or to reduce the interest rate will result in an immediate capital outflow with no effect on domestic prices or output. For other countries with a fixed exchange rate - the Bahamas and Barbados - some scope exists for the use of monetary policy as a tool of domestic demand management without affecting the balance of payments. That scope is exhausted when the domestic interest rate deviates from the comparable interest rate by 4 points for the Bahamas and by 7 points for Barbados. The effectiveness of monetary policy - which depends on the elasticities of demand for credit and financial liabilities, the extent of credit rationing, frictions in the market for finance, etc. - are not addressed in this contribution.

Countries with a flexible exchange rate have much greater scope to use monetary policy for domestic demand management because of higher thresholds for the effects of capital movements in search of interest rate parity. Ironically, this proves to be a serious disadvantage because the principal objective of monetary policy in small countries with flexible exchange rates is to stabilize the balance of payments and the exchange rate through monetary policy and interest rate movements. Monetary policy becomes less effective as a stabilization tool in precisely those circumstances where it is most urgently needed for that purpose.

References

Edwards, Sebastian & Mohsin Khan, 1985. 'Interest Rate Determination in Developing Countries: A Conceptual Framework,' IMF Staff Papers, 32:3, September, pp. 377-403.

Fleming, J. Marcus, 1963. 'Domestic Financial Policies Under Fixed and Floating Exchange Rates,' IMF Staff Papers, November, pp. 369-379.

Montiel, Peter J., 1994. 'Capital Mobility in Developing Countries: Some Measurement Issues and Empirical Estimates,' World Bank Economic Review, 8:3, pp. 311-350.

Mundell, Robert, 1963. 'Capital Mobility and Stabilisation Policy Under Fixed and Flexible Exchange Rates,' Canadian Journal of Economics and Political Science, November.

Table 1

Estimates of Cost Thresholds

Bahamas		Barbados		Belize	
$\|r-r^f\|$	Adjusted R^2	$\|r-r^f\|$	Adjusted R^2	$\|r-r^f\|$	Adjusted R^2
0	0.2107	0	0.0509	0	0.9718
1	0.2720	1	0.0476	1	0.8030
2	0.2474	2	0.0933	2	0.7948
3	0.2501	3	0.2347	3	0.6285
4	0.2813	4	0.3416		
5	0.2217	5	0.4127		
6	0.1868	6	0.4455		
		7	0.4647		
		8	0.4717		
		9	0.4675		
		10	0.4568		

Table 1 (Cont'd)

Estimates of Cost Thresholds

Guyana		Jamaica		T'dad & T'bgo	
$\lvert r-r^f \rvert$	Adjusted R^2	$\lvert r-r^f \rvert$	Adjusted R^2	$\lvert r-r^f \rvert$	Adjusted R^2
0	0.0381	0	0.6251	0	0.6871
5	0.8655	5	0.5992	1	0.6353
10	0.8655	10	0.5926	2	0.6794
15	0.8655	15	0.6213	3	0.6937
18	0.8655	18	0.6327	4	0.6864
19	0.8536	19	0.7405	5	0.6592
20	0.8460	20	0.7290	8	0.3218
25	0.3405	25	0.7113		
		30	0.7046		

Table 2

The Estimates

Bahamas

$$r = \underset{(-4.18)}{-4.80} + \underset{(8.72)}{0.85}\, D1{*}r^f + \underset{(19.10)}{4.88}\, D2 + \underset{(0.62)}{2.40} D2{*}\Delta\log MO + \underset{(2.55)}{15.38} D2{*}P(-1) + \underset{(0.24)}{1.41}\, D2{*}P(-2)$$

SE=1.81, Durbin-Watson(DW)=0.29, F=20.34 Sample 1973.07 to 1994.04

Barbados

$$r = \underset{(14.68)}{15.36} - \underset{(-6.14)}{0.61} D1{*}r^f + \underset{(51.35)}{6.94} D2 + \underset{(0.24)}{0.92}\, D2{*}\Delta\log MO - \underset{(-13.99)}{459.53} D2{*}\Delta\log y + \underset{(2.03)}{14.99} D2{*}P(-1) + \underset{(2.40)}{17.74} D2{*}P(-2)$$

SE=1.72, DW=0.18, F=47.0 Sample 1968.07 to 1994.04

Belize

$$r = \underset{(0.013)}{0.0015} + \underset{(4.00)}{0.042} r^f + \underset{(63.40)}{0.96} r(-1)$$

SE=0.43, DW=1.93, F=3189.3 Sample 1979.01 to 1994.06

Guyana

$$r = \underset{(18.21)}{23.32} + \underset{(4.40)}{1.02D1^*r^f} - \underset{(-5.61)}{13.23D2} - \underset{(-0.12)}{4.86D2^*\Delta logMO} + \underset{(0.72)}{293.49D2^*P(-1)}$$

$$\underset{(-0.18)}{-0.27D2^*E(-1)}$$

SE=2.58, DW=0.62, F=60.21 Sample 1989.03 to 1993.01

Jamaica

$$R = \underset{(5.35)}{20.93} - \underset{(-2.89)}{1.01D1^*r^f} + \underset{(5.55)}{4.00D1^*E(-1)} + \underset{(1.60)}{1.28D1^*P(-1)}$$

$$\underset{(-0.54)}{-2.12D2} + \underset{(0.18)}{3.02D2^*\Delta logMO} - \underset{(-0.35)}{9.87D2^*P(-1)} - \underset{(-1.56)}{7.29D2^*E(-1)}$$

SE=4.13, DW=0.54, F=51.14 Sample 1983.11 to 1994.02

Trinidad & Tobago

$$r = \underset{(-0.19)}{-0.26} - \underset{(-10.41)}{0.35D1^*r^f} + \underset{(6.61)}{2.48D1^*E(-1)} + \underset{(3.91)}{1.31D1^*P}$$

$$+ \underset{(5.80)}{7.85D2} - \underset{(-0.39)}{1.42D2^*logMO} - \underset{(-8.30)}{1.17D2^*log(M/P)}$$

$$+ \underset{(0.30)}{2.35D2^*P(-1)} - \underset{(-0.47)}{1.56\ D2^*E(-1)}$$

SE=0.98, DW=0.11, F=98.94 Sample 1965.01 to 1994.01

Table 3

__Tests on Residuals of Equations of Table 2__
[Probabilities in brackets]

	LM	JB	BP	LB	ARCH
Bahamas	70.27	3.00	1079	1112	25.50
	[0]	[0.2226]	[0]	[0]	[0]
Barbados	129.6	171.1	113.4	1156	110.7
	[0]	[7.16^{-38}]	[0]	[0]	[0]
Belize	1.128	2504	14.47	15.23	1.924
	[0.3406]	[0]	[0.2719]	[0.2290]	[0.0349]
Guyana	5.036	3.126	64.66	77.02	2.896
	[0.0002]	[0.2095]	[0]	[0]	[0.0159]
Jamaica	14.77	10.81	136.55	141.56	3.447
	[0]	[0.0045]	[0]	[0]	[0.0003]
T'dad & T'bgo	261.7	2.759	2034	2076	59.79
	[0]	[0.2517]	[0]	[0]	[0]

Note:
LM: The Lagrange multiplier test (Breusch-Godfrey Statistic)
JB: The Jarque-Bera Statistic
BP: The Box-Pierce Statistic
LB: The Ljung-Box Statistic
ARCH: The autoregressive conditional heteroscedasticity test

ENDNOTES

1. These results are not reported to save space but are available on request.

2. Recent developments in econometric theory offer new techniques for deriving reliable statistical inferences from time series which do not exhibit classical properties. However, these techniques are useful only under certain circumstances, as, for example, when non-stationary variables are cointegrated. In other cases, as for the series in this paper, econometric theory offers no remedy and the researcher must admit the possibility that his/her results may not be the result of any systematic relationship. The results are of interest, nonetheless, and it seems reasonable to draw guarded inferences, while remaining open to new, more statistically reliable results.