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# OPEN MARKET OPERATIONS IN SMALL OPEN ECONOMIES WITH FIXED AND FLEXIBLE EXCHANGE RATES

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# Open Market Operations in Small Developing Economies: The Barbados and Jamaican Experiences

## 1. Introduction

It used to be accepted that open market operations could only be successfully undertaken in a small number of industrial countries with well-developed capital markets. Central banks in the developing world depended on direct interventions such as reserve requirements and credit rationing. Perhaps because these measures were taken too far they have now become widely discredited. Developing countries have fallen back on market-driven policies which a few Central Banks have always maintained alongside direct credit interventions. However, market imperfections continue to stymie open market operations and other market-driven policies.

If capital markets were perfect monetary policy would have no effect in small open economies with fixed exchange rates. Where exchange rates are not fixed, monetary expansions would be inflationary but in the long run they would have no other effect. Monetary policy is possible for small open economies because of capital market imperfections. To assess the effects of open market operations we need a model which includes capital market imperfections.

Market imperfection allows a zone around the equilibrium or fundamental interest rate or money supply where there is room for domestic monetary discretion. In a fixed exchange rate regime there are significant transactions and information costs to be covered before capital flows kick in to neutralize exogenous monetary expansion or contraction. In a floating exchange rate regime there are additional costs of exchange rate, price and interest rate uncertainty. This allows a corridor within which monetary policy may be used for domestic demand management before automatic balance of payments correctives begin to take effect. This corridor is analagous to exchange rate target zones, discussed in recent literature on the European Community (For example, Svensson, 1992[1]).

This paper seeks to determine how much scope capital market imperfections allow for autonomous monetary policy in fixed and flexible exchange rate regimes. The discussion will be illustrated by the experiences of Barbados, which maintains a fixed exchange rate, and Jamaica, with a flexible exchange rate.

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[1] Svensson, Lars, 1992. 'An Interpretation of Recent Research on Exchange Rate Target Zones,' Journal of Economic Perspectives, 6:4, Fall, pp. 119-144.

## 2. Theory and Model

### *2A Monetary Autonomy with a Fixed Exchange Rate*

If domestic interest rates are not equal to foreign interest rates, capital movements will equilibrate the two when the domestic interest rate strays outside a corridor defined by:

$$r = r_f \pm c \tag{1}$$

r is the domestic interest rate. $r_f$ is the ruling international interest rate and c is a cost variable covering currency conversion costs, brokerage costs, switching costs, information costs, adverse selection etc.

Outside this zone of monetary autonomy open market operations are ineffective. Open market sales by the central bank to tighten the money supply result in an increase in domestic interest rates which suck in capital; this leads to an increase in the money supply which neutralizes the open market sale.

Within the zone of monetary autonomy the success of open market operations depends on the interest sensitivity of expenditure. In order to effect a purchase of securities from the monetary authority, either directly or via financial institutions,

the private sector must switch from expenditure to holding financial assets. If the private sector fails to switch, purchase of the monetary authority's securities by one institution will result in some other institution's sale of an equal amount to the monetary authority. When the purchaser's cheque clears, his bank has to sell securities from its own portfolio to restore its liquidity. An open market sale will "take" only if the purchaser cancels some payment to another private sector entity in order to make room for the security purchase.

Open market operations may be ineffective despite capital market imperfections because the interest elasticity of expenditure has often been found to be negligible. In practice, the monetary authority is unable to effect net open market sales unless the interest premium rises sufficiently to attract capital inflow to fund the private sector purchase of government securities. In these circumstances there will be no monetary contraction. Typically banks increase their net foreign assets and trading companies switch from domestic credit to foreign trade credit.

Excess liquidity in the banking system does not increase monetary discretion. High and variable levels of excess cash are typical of small developing countries and they are a manifestation of the cost of currency conversion. It does not suit

a financial institution to increase foreign assets where domestic credit demand is low and the supply of other domestic financial assets is inadequate because of the cost of switching between currencies. In effect, the cost of reducing cash balances is greater than the expected return from shifting the portfolio. The excess liquidity of financial institutions is often the target of open market sales. However, this may be expansionary rather than contractionary because it exchanges securities on which the monetary authority pays interest for financial liabilities on which no interest is paid. However, this expansion is significant only at high interest rates.

There remains some monetary discretion because of possible timing effects. Although expenditure intentions appear insensitive to small changes in interest rates, spending may be put off for a while if interest rates rise. This opens the possibility that the monetary authority may use open market operations for short-term reversible policy. Success depends on the expectation that policy will subsequently be relaxed. Open market operations may not be used to alter economic fundamentals but they may usefully accommodate seasonality and short-term effects.

It is not the thinness of the market which inhibits open market operations. Open market sales are restricted because there are insufficient numbers of potential purchasers willing to forego consumption or investment in order to purchase securities. The fact that there are only a handful of brokers or financial institutions willing to effect the transaction does not matter. Adding agents, instruments and new mechanisms has no effect unless it seduces the private sector into spending less.

There are symmetrical effects for open market purchases to boost aggregate expenditure. Within the zone of monetary autonomy it is possible to speed up expenditure somewhat provided the monetary authority signals credibly that the expansion is temporary. Aggressive open market purchases lead to a capital outflow and a contraction of the money supply.

*2B Estimating the Width of the Zone of Monetary Autonomy*

The fact that short-term capital flows equilibrate domestic and foreign interest rates outside the zone of monetary autonomy, offers an approach to estimating the width of that zone. The movement of short-term capital flows is given by:

$$\Delta STK = f_1((r-r_f)D,\ Z_i) \qquad (2)$$

D is a filter which eliminates interest rate differentials which are too small to overcome the cost of currency conversion. Such small differentials will have no effect on capital inflows. The $Z_i$ are factors such as institutional arrangements and structural changes in addition to what the economic literature refers to as "news". From this we may derive the following equation which may be estimated:

$$\Delta STK = f_1((r-r_f)D_i,\ \dot{p}-\dot{p}_f) \tag{3}$$

p is an index of domestic prices and $p_f$ is an index of "world" prices. The dots indicate rates of inflation. Differentials in domestic and world rates of inflation indicate to private sector agents circumstances that warrant inward or outward movement of funds depending on expectations about changes in interest rates and the exchange rate. The series for estimation may be segregated or dummy variables introduced to take care of structural changes. This equation is estimated repeatedly for different values of $D_i$. The most likely value is chosen on the basis of a model selection technique.

*2C Monetary Autonomy with a Flexible Exchange Rate*

With a flexible exchange rate, uncertainty widens the zone of monetary autonomy. Open market sales do not induce capital inflows unless yield differentials are sufficient to cover the expected exchange rate depreciation as well as transactions, information and other costs:

$$r > r' \tag{4}$$

$$r' = r_f + e^*_{+j} + c \tag{5}$$

$e^*$ is the expected change in the exchange rate and j is the time period.

There is a much larger zone of monetary autonomy within which open market sales have only temporary effects than in the case of a fixed exchange rate. A substantial interest premium is required to induce capital inflows which increase the supply of foreign exchange and lead to an appreciation of the exchange rate. The cost of using open market sales to stabilize a depreciating exchange rate is high. Furthermore, this policy should be used only when exchange rate depreciation is caused by an excess supply of government securities or central bank lending to government. If the depreciation is caused by an imbalance on the

current account or net long-term capital flows open market sales would not produce an excess supply of foreign exchange except in the short term. In this case, when the monetary authority offers securities for sale financial institutions bid up the discount to cover both the currency conversion costs and the expected exchange rate depreciation. They borrow abroad, sell foreign exchange to the domestic system and use the proceeds to buy the government securities on offer.

Open market purchases by the monetary authority have similar and opposite effects if the public sector borrowing requirement does not increase. Within the zone of autonomy, the monetary authority buys securities and the private sector accelerates expenditure with the additional credit now available in expectation that the policy will be reversed and interest rates will rise again. Outside the zone of autonomy, the monetary authority's purchases of securities are large and persistent enough to drive the interest rate below transactions costs and expected exchange rate appreciation risks. The additional liquidity created is invested abroad. This absorbs the excess supply of foreign exchange - if that had been keeping the exchange rate artificially high - or causes a depreciation of an exchange rate which had been driven up by tight monetary policy. Alternatively, the monetary authority goes into the market offering to buy securities at a premium over

prevailing interest rates. If that premium is sufficiently attractive financial institutions sell from their portfolio, buy foreign exchange and invest the proceeds abroad, reducing the excess supply of foreign exchange or depreciating the exchange rate.

Open market purchases may be instigated by financial institutions in response to an increase in the public sector borrowing requirement. Suppose the government writes a cheque causing its operating account with the monetary authority to be in overdraft. Government issues securities at attractive interest rates to cover the overdraft. Financial institutions sell securities to the monetary authority to buy newly issued government paper at the higher interest rate. This open market purchase switches the excess money from the overdraft into government securities. The exchange rate depreciates through the basic balance as the additional expenditure represented by the increase in the public sector borrowing requirement results in an increased demand for imports. An open market purchase whose root cause is an increase in the public sector borrowing requirement has real rather than monetary effects on the exchange rate (apart from credibility effects which are dealt with in the next section).

*2D Estimating the Width of the Zone of Autonomy Under Flexible Exchange Rates*

The exchange rate varies depending on short-term capital flows and on the basic balance of the balance of payments, that is, the balance on current account and long-term capital movements:

$$\dot{e} = f_2(\Delta STK,\ W_i) \tag{6}$$

The $W_i$ are variables that determine the basic balance. Substituting for the determinants of short-term capital flows, gives us:

$$\dot{e} = f_3((r-r_f)D,\ \dot{p}-\dot{p}_f,\ W_i) \tag{7}$$

This equation may be estimated for different values of D as before with the $W_i$ being accommodated by taking account of structural changes, for example, in marketing arrangements or in the composition of exports. For some countries a terms of trade variable may also be important in determining the current account.

*2E Credibility*

The analysis so far excludes the effects of time inconsistency and reputation. In the case of an exchange rate which has remained fixed for a long time this is acceptable. By maintaining a fixed exchange rate through central bank market intervention and without foreign exchange rationing, government demonstrates a commitment to internally consistent policies over time. Government thereby proves to the public that it will not sustain expansionary policies such as open market purchases to fund the public sector borrowing requirement because such policies ultimately generate an excess demand for foreign exchange and lead to exchange rate depreciation.

For countries with a flexible exchange rate no assumption about policy credibility can be made. Where countries have had a history of unexpectedly large exchange rate depreciation, the public comes to believe that government is inclined to finance excess spending today by devaluing the currency tomorrow. The current Bank of Jamaica strategy may be seen as an attempt to re-establish government's reputation for policy consistency by stabilizing the exchange rate through open market operations. To gain insight into the possibilities of such a strategy we

examine open market operations with flexible exchange rates and problems of credibility and time inconsistency.

As before, short-term capital flows are given by:

$$\Delta STK = f_1((r-r_f)D, Z_i) \tag{2}$$

but now the $Z_i$ include an element of exchange rate expectations along with other arguments. There may be a capital outflow because of fears of devaluation beyond what is indicated by the "fundamentals":

$$e^*_{+j} = u^*_{+j} + v^*_{+j} \tag{8}$$

As before $e^*$ is the expected change in the exchange rate. $u^*$ is the "surprise" element of that change while $v^*$ is the rational expectations element justified by the fundamentals and incorporated into the expected cost $(r - r_f)$. $u^*$ is the element that must be included in the $Z_i$. It is determined by factors such as:

$$u_{+j}=^* f_4(CRGMA/Y, \dot{p}-\dot{p}_f, \dot{e}, \dot{e}_{-j}, \theta) \tag{9}$$

The first variable on the right hand side is net increases in credit to the government by the monetary authority as a ratio to national income. Portfolio managers keep an eye on monetary expansion and shift portfolios between domestic and foreign currency assets depending on the rate of expansion and their view as to whether expansionary policies are likely to be reversed. The second element on the right hand side - the price differential - indicates the need for possible fiscal correction and reflects the public's view as to whether such correction is likely. The recent trajectory of exchange rate movements represented by the inclusion of current and past exchange rate changes also determines the public's view as to the future probability of depreciation. The final element on the right hand side is a measure of pure speculation and other unpredictable influences. Incorporating the $u^*$ into Equation 6 gives us an estimating equation for the flexible exchange rate case which is of the form:

$$\dot{e} = f_5((r-r_f)D_i,\ \dot{p}-\dot{p}_f, CRGMA/Y,\ \dot{e},\ \dot{e}_{-j}, \theta) \qquad (10)$$

## 3. Estimating the Zone of Monetary Autonomy

The zone of monetary autonomy is estimated by including in estimating equations a filter on the interest rate differential which eliminates differentials too small to overcome the cost of transactions, uncertainty, etc. The most probable value is chosen by examining the coefficients of determination in repeated trials. Tests are undertaken for Barbados (with an exchange rate unchanged in terms of US dollars since 1975) for a period from January 1980 to May 1994 and for Jamaica for a period of flexible exchange rates from mid-1983 to December 1992. Data are sourced from the publications of the Bank of Jamaica, the Central Bank of Barbados and the International Financial Statistics. (All series are monthly.)

### 3A Barbados

Tentative results for Barbados show a surprisingly wide zone of monetary autonomy - a differential of five percentage points between domestic and US interest rates in either direction. The dependent variable is monthly changes in the Central Bank of Barbados' net foreign exchange holdings, seasonally adjusted. The explanatory variables are the difference between the Barbados and US three month interest rates on treasury bills and the difference in the twelve monthly rates of inflation of their consumer price indices. Augmented Dicky Fuller tests suggest

that the variables are stationary, the foreign exchange reserves and the price differential with over 99% probability, the interest differential with over 95% probability; the estimation is by ordinary least squares.

Since capital movements may be influenced by the persistence of interest differentials the current interest differentials and three lags are included. Information on inflation comes to hand with some delay so the first inflation differential is lagged three months with two subsequent lags. The Wald test was used to determine whether all lags should be retained. The equation was tested for the likelihood of structural breaks but none was evident.

As an explanation of changes in the central bank's foreign exchange holdings, the equation is not very successful (See Table 1). The overall coefficient of determination is about 10% and the interest differential is the only variable with a statistically significant coefficient. Where the interest rate on Barbados treasury bills is more than 5 points above the corresponding rate in the United States, it appears that the central bank's foreign reserves tend to increase, from which we infer there is a short-term capital inflow. However, it seems this tendency may be reversed if the differential persists for more than two months.

Table 1

## Barbados: Determinants of Foreign Exchange Flows

**Dependent Variable: Change in Central Bank Net Foreign Assets (Monthly)**
**$\Delta FXR$**

| Explanatory Variable | Coefficient | T-Stat. |
|---|---|---|
| Constant | -0.77 | -0.35 |
| $D_5(r - r_f)$ | -1.19 | -0.45 |
| $[D_5(r - r_f)]_{-1}$ | 9.21 | 2.45 |
| $[D_5(r - r_f)]_{-2}$ | -5.72 | -2.29 |
| $(\dot{p} - \dot{p}_f)_{-3}$ | -163.72 | -0.92 |
| $(\dot{p} - \dot{p}_f)_{-4}$ | 256.69 | 1.14 |
| $(\dot{p} - \dot{p}_f)_{-5}$ | -60.18 | -0.34 |
| $\Delta FXR_{-12}$ | 0.21 | 2.65 |

$R^2$ = 11.37 DW = 2.24

SE = 25.36 F = 2.69

Sample: June 1981 - May 1994 N = 156

| Variable | ADF t-stat |
|---|---|
| $\Delta FXR$ | -6.31 |
| $r - r_f$ | -2.99 |
| $\dot{p} - \dot{p}_f$ | -9.08 |

The focus of our interest is the filter which determines the zone of monetary autonomy. The coefficients of determination for different widths of the zone of autonomy are shown in Table 2. The explanatory power of the equation increases somewhat at five percentage points.

Panel C of Chart 1 shows that there were only a few occasions in 1980, 1981 and 1992 when interest differentials were this wide. Panels A and B show the change in foreign exchange reserves plotted against each explanatory variable in turn while Panel D is a test for structural breaks in the equation.

### 3B Jamaica

The zone of monetary autonomy for Jamaica is tentatively estimated at an interest differential of fifteen percentage points between the Jamaica and US three month treasury bill rate. The dependent variable is the percentage change in the value of Jamaica dollars per US dollar. A period of exchange rate stability from the beginning of 1986 to the end of 1988 is filtered out of the series for the explanatory variables. The explanatory variables are the difference in the three month treasury bill rates, the difference in inflation in the US and Jamaican CPI and the change in net advances to government by the Bank of Jamaica as a ratio

Table 2

## Estimates of Zone of Monetary Autonomy

| Barbados | | Jamaica | |
|---|---|---|---|
| $\lvert r - r_f \rvert$ | $R^2$ | $\lvert r - r_f \rvert$ ** | $R^2$ |
| 0 | 7.5 | 0 | 9.5 |
| 2 | 8.2 | 3 | 9.6 |
| 4 | 5.7 | 5 | 9.5 |
| 5 | 11.3 | 7 | 9.6 |
| 6 | 8.6 | 9 | 8.9 |
| 7 | 7.9 | 13 | 11.1 |
| | | 14 | 11.8 |
| | | 15 | 16.3 |
| | | 16 | 14.7 |
| | | 17 | 14.7 |
| | | 20 | 9.5 |

to nominal GDP. The equation also includes the lagged value of the exchange rate.

The exchange rate appears to be a stationary variable as judged by the augmented Dicky Fuller test while the other variables are integrated of the first order. A cointegrating vector was obtained as shown in Table 3. The estimating equation using ordinary least squares includes lags on the interest differential and on the price differential as for the Barbados equation with contemporary values of the monetary variable and two lags. The equation also includes an error correcting mechanism. The Wald test is used as a guide to inclusion of variables. Tests for structural breaks confirmed the difference in behaviour during relatively stable period of exchange rates before 1983 and between 1986 and 1988.

The equation is not much more successful than for Barbados with a coefficient of determination which only just exceeds 15% (See Table 4). It appears that the Jamaica treasury bill interest rate needs to be fifteen percentage points above the US treasury bill interest rate to provoke an improvement in the exchange rate - all things being equal - as shown in Table 2. Furthermore, the effect is temporary.

Table 3

JAMAICA

Engle-Granger Cointegration Test: UROOT(T,2)

| --Cointegrating Vector-- | | |
|---|---|---|
| ERDOT | 1.000000 | |
| JRDIF | 0.003730 | |
| JPDIF | -0.102359 | |
| DMB | -0.022133 | |
| TREND | -0.001111 | |
| Dickey-Fuller t-statistic | | -6.7235 |
| MacKinnon critical values: | 1% | -5.1744 |
| | 5% | -4.5604 |
| | 10% | -4.2479 |

Table 4

## Jamaica: Determinants of Exchange Rate Changes

### Dependent Variable: Change in J$ per US$(%): $\dot{ER}$

| Explanatory Variable | Coefficient | T-Stat |
|---|---|---|
| Constant | 0.0063 | 0.47 |
| $D_{15}(r - r_f)$ | -0.0088 | 2.99 |
| $[D_{15}(r - r_f)]_{-1}$ | -0.0096 | -2.16 |
| $[D_{15}(r - r_f)]_{-2}$ | 0.0010 | 0.31 |
| $(\dot{p} - \dot{p}_f)_{-3}$ | 0.1239 | 0.87 |
| $(\dot{p} - \dot{p}_f)_{-5}$ | -0.1087 | -0.81 |
| $\Delta NAG$ | 0.0044 | 0.16 |
| $\Delta NAG_{-1}$ | 0.0255 | 0.75 |
| $\Delta NAG_{-2}$ | -0.0158 | -0.60 |
| $\dot{ER}_{-1}$ | 0.0163 | 0.16 |
| ECM | 0.0001 | -0.15 |

$R^2$ = 16.31 DW = 1.28

SE = 0.09 F = 1.93

Sample: November 1983 - December 1992 N = 110

| Variable | ADF t-stat |
|---|---|
| ER | -6.27 |
| $\Delta(r - r_f)$ | -5.32 |
| $\Delta(\dot{p} - \dot{p}_f)$ | -4.56 |
| $\Delta\Delta NAG$ | -7.56 |

After a one month lag the coefficient for the interest differential is negative, significant and large enough to eliminate the immediate gain.

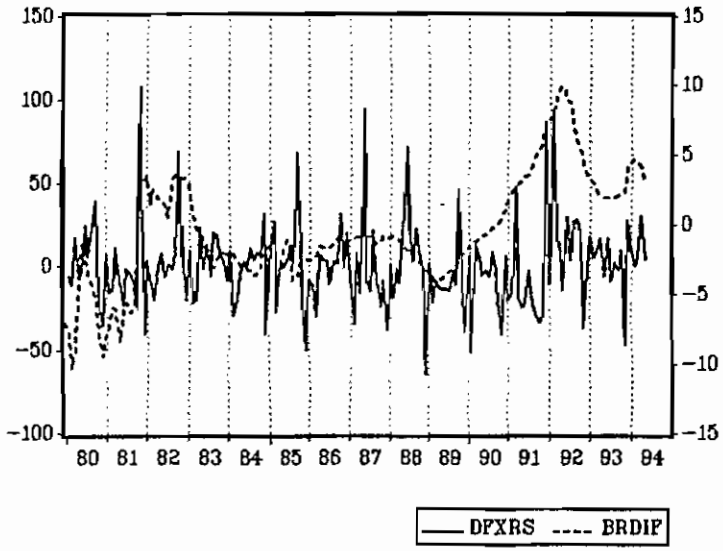
Panels A, B and C of Chart 2 plot the explanatory variables in turn against the exchange rate changes. Panel D shows that the 15 point interest rate differential between US and Jamaican treasury bills was exceeded almost continuously from late 1989 onwards.

## 4. Implications

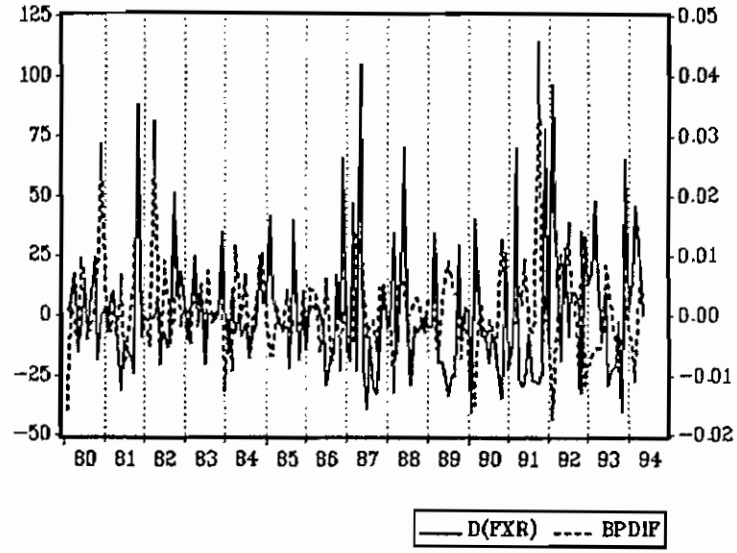
The Barbados results suggest there may be transactions costs, information costs and switching costs that inhibit short-term capital movements to a much greater degree than is usually assumed. If true, this would allow for more aggressive open market policies without fear of destabilizing the balance of payments. Whether such policies are useful is a separate issue not addressed in this paper. In Jamaica the focus of monetary policy in recent times has been to stabilize the exchange rates. Results suggests that this may be costly, requiring the Bank of Jamaica to sustain domestic interest rates over 15 points higher than corresponding rates in the United States. Even such high differentials may sustain the value of the Jamaica dollar only temporarily.

Chart 1.

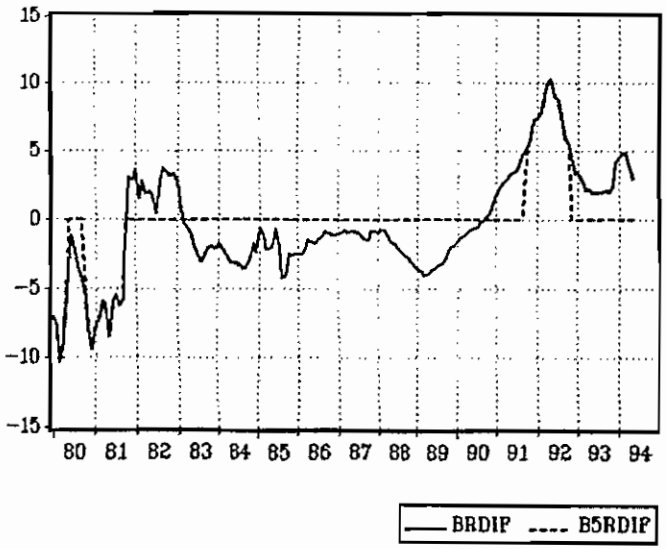
Reserve changes and interest differentials




Reserve changes and price differentials




Interest differentials greater then 5% points




Cumulative sum of squares test for structural breaks

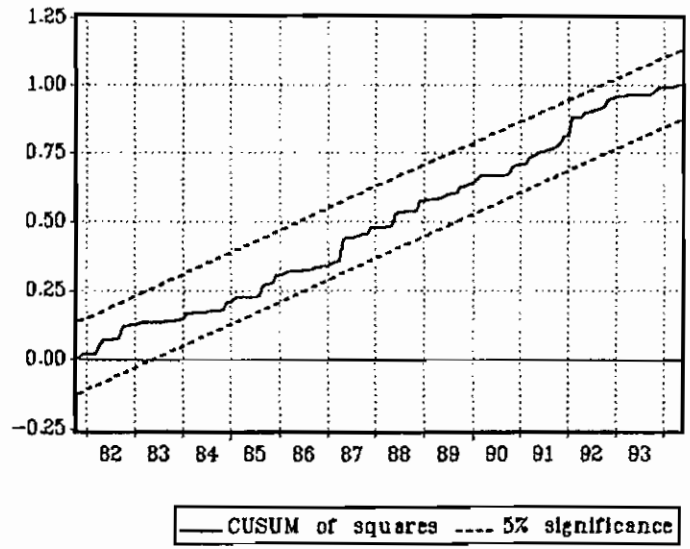
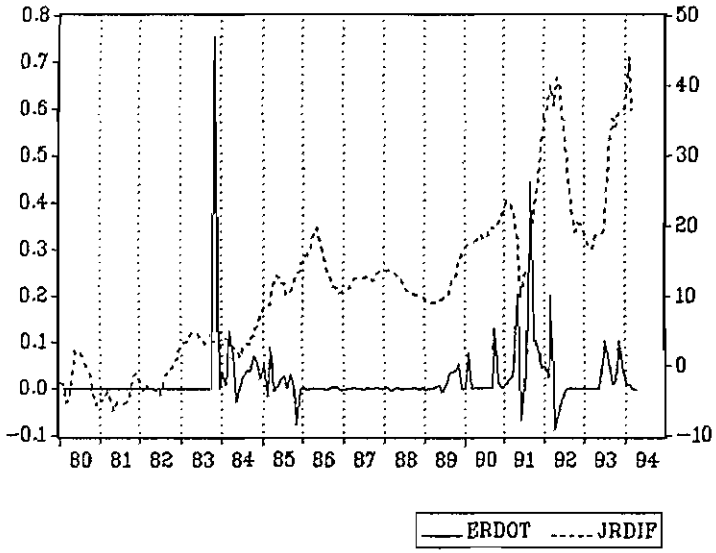
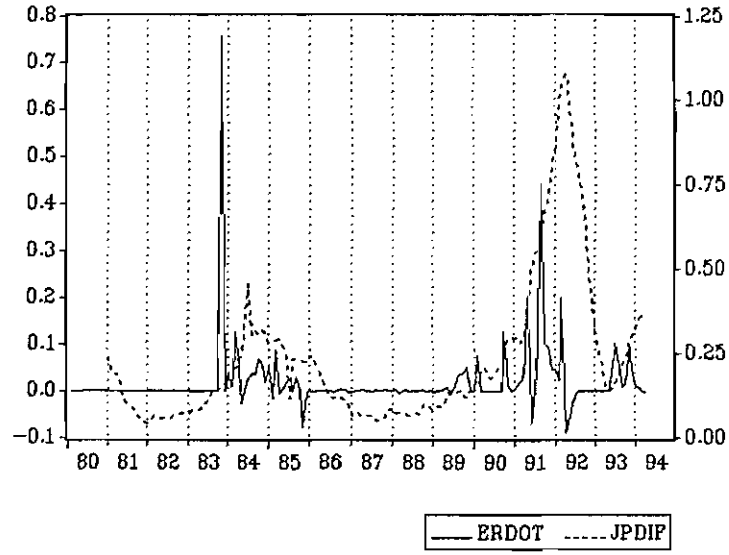


Chart 2.

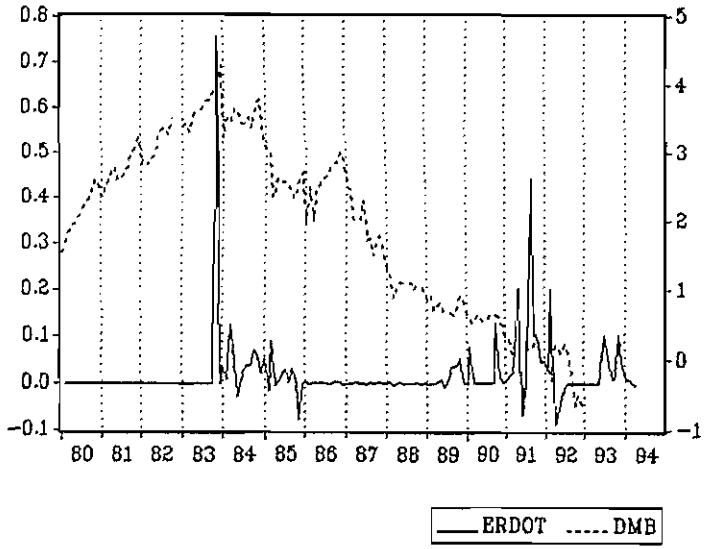
Exchange rate changes and interest differentials

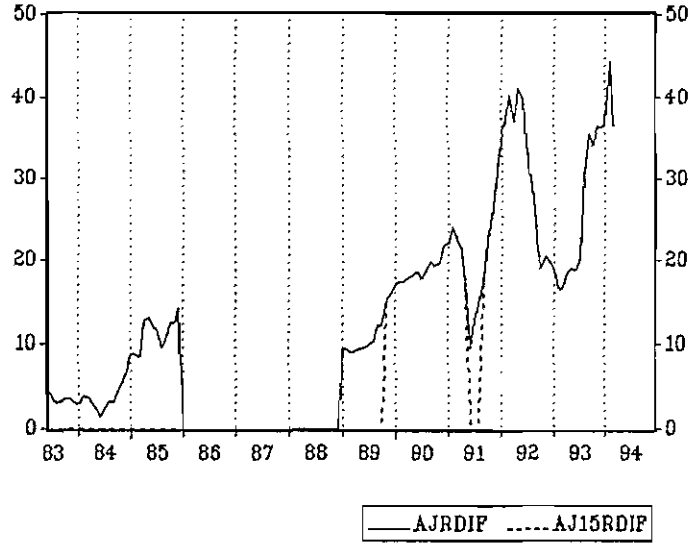



Exchange rate changes and price differentials




Exchange rate changes and money creation




Interest differentials greater than 15% points