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THE BEHAVIOR OF INTEREST RATE DIFFERENTIALS UNDER SHIFTING EXCHANGE RATE REGIMES: THE EXPERIENCE OF CHILE, COLOMBIA AND ISRAEL*

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This paper studies the dynamics of the interest rate differential across band and floating exchange rate regimes in Chile, Colombia and Israel, and in a benchmark group composed of Italy, Portugal and Spain. Significant differences in the interest rate-exchange rate link are found between the two groups, irrespective of regime. However, in all countries, except Italy, the interest differential ceased to behave anti-cyclically against output after the adoption of floating, possibly because of a perceived need to gain credibility for the new system in the context of an ongoing disinflation process.

JEL: E43, E52, F31.
Keywords: Interest Rate Differentials, Exchange Rate Regimes.

1. INTRODUCTION

A widespread phenomenon of shifting exchange rate regimes across developed and emerging market economies has taken place recently, giving way to the idea that countries are increasingly moving to the poles of currency arrangements –i.e., free floats and hard pegs– at the expense of a middle ground composed of bands, fixed but adjustable rates, and the like.[1] Chile, Colombia and Israel, the countries initially studied by Williamson (1996), have been a part of this

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[1] For recent estimates of the extent of this phenomenon, see Calderón and Schmidt-Hebbel (2003). For a contrary view based on a distinction between de jure and de facto regimes, see Rogoff *et al.* (2003), Calvo and Reinhart (2002) and Hausmann *et al.* (1999).

trend; in particular, after several years of having so-called crawling bands, toward the end of the 1990s these countries adopted floating exchange rate regimes –or, in the case of Israel, a band so wide that it may for practical purposes be considered a float.

Analytically, there is a strong presumption that a country's choice of exchange regime can have a significant impact on its macroeconomic performance. It is well known, for instance, that a flexible exchange rate allows for a stricter control of domestic monetary aggregates under conditions of international mobility of capital or, perhaps more controversially, that a fixed rate facilitates disinflation. It has long been recognized, however, that purely theoretical considerations cannot offer a definite answer to the question of the likely macroeconomic consequences of choosing a particular exchange system, because the relative performance of alternative regimes depends on the type of shocks affecting the economy, and therefore on the specific characteristics of each country.

More recent work has stressed this point by noting that: a) the effects of exchange rate variations on output are of a complex nature, involving income-distribution, trade-balance and balance-sheet effects (see e.g. Ocampo 2000 and Céspedes *et al*. 2002); b) typically, authorities care not only about output stability but also about inflation performance, which implies that exchange rate stability may by itself be a goal of monetary policy; and c) important types of shocks, such as those generated in the capital account of the balance of payments, may combine both real and nominal elements (see e.g. Calvo 2000). As a consequence, some of the most recent empirical studies on the link between exchange rate regime and macroeconomic performance explicitly take an open-minded perspective and seek to determine which of potentially conflicting factors appear to dominate particular periods and country samples (see Rogoff *et al*. 2003).

Given this background, the purpose of this paper is to study the effects of a shift from an exchange rate band to a floating system on the behavior of interest rate differentials, and in particular on the response of the latter to exchange rate and output fluctuations. As can be deduced from the previous discussion, the motivation for the paper comes from the fact that the regime shift can have conflicting effects on interest rate dynamics. On one side, the adoption of a floating system involves a gain in monetary autonomy because the central bank will no longer be committed to defend specific limits to the exchange rate; as a consequence, the interest rate may become detached from the latter and respond more forcefully, in counter-cyclical fashion, to changes in output. On the other side, though, abandoning a band may imply the loss of an anchor for private expectations; this may lead to the emergence of bandwagon effects in the formation of exchange rate expectations and force authorities to use monetary policy to stabilize the currency. As a result, a positive correlation between the interest rate and the exchange rate may arise, with a consequent lack of response of the interest rate to output.

The analysis focuses on the experience of Chile, Colombia and Israel, which henceforth will be referred to as the CCI group. These countries were singled out by Williamson (1996) because of having a distinct regime of explicit, wide, crawling bands, which were set up with the purposes of avoiding long-term real misalignment and facilitate short-run stabilization policy. From this, it may be presumed that the adoption of a floating system did represent a significant change of regime in these countries, and could therefore be expected to have notable consequences on macroeconomic performance. Additionally, with the idea of putting its results in a broader context, the paper also considers the case of a group of developed European countries –namely Italy, Portugal and Spain– that underwent a similar regime shift in the early 1990s.

The paper is organized as follows. Section 2 presents the analytical motivation for the study. Section 3 explains the estimation approach, while Section 4 describes the data and discusses the estimation results. The paper ends in Section 5 with a brief summary of results.

2. EXCHANGE RATE BANDS AND INTEREST RATE DIFFERENTIALS

An assessment of floats and bands as alternative regimes must start from the recognition that a relatively wide band already implies a significant degree of exchange rate flexibility. In the countries considered in this paper, the width of the band typically was set between plus/minus 5% to 10% of central parity. In this case, the shift to a float involves a particular version of the well-known credibility versus flexibility trade off: after a country abandons its exchange band, it loses an anchor for exchange rate expectations, but it gets the benefit that its monetary policy no longer has to be committed to keep the exchange rate within certain limits.

The constraint on monetary policy can be substantial, despite the within-band flexibility of the exchange rate. It is a well established fact that, under a band regime, governments frequently engage in intra-marginal intervention (i.e., intervention when the exchange rate is far from the band edges) with the purpose of enhancing the credibility of the band among market participants and in that way reduce the risk of speculative attacks (see Svensson 1992). This means that the use of monetary policy for domestic purposes may be limited by the existence of a band not only when the exchange rate is near the limits but in fact most of the time.

After the shift to float, monetary policy may therefore be used more forcefully to attain domestic goals, for instance to reduce output volatility. Empirically, this would be reflected in the fact that the size, or even the sign, of the coefficient measuring the response of local interest rates to output variations is affected by the regime shift. A more pronounced anti-cyclical policy, for instance, would be shown in a larger, positive output coefficient. By standard term structure theory, it is possible that the sole expectation of such policy response lead to adjustments in the interest rate, even before monetary authorities take any action.

The adoption of a floating regime can also affect the nexus between the local interest rate and the exchange rate. The literature on this nexus is vast, and it is concerned mainly with tests of foreign exchange market efficiency (for a recent survey, see Sarno and Taylor 2002, chapter 1). The starting point of these studies is the so-called uncovered interest parity (UIP) condition, which embodies the idea that, under perfect mobility of capital, bonds of similar characteristics, except for currency denomination, must offer, in expected terms, equal rates of return. This reasoning implies that the interest rate differential between local and foreign bonds of same maturity and risk must be equal to the expected rate of depreciation of the local currency over the investment period, i.e.

(1) $$IRD_t = ln_t\, S_{t+k} - ln\, S_t,$$

where *IRD* is the difference between the local and foreign interest rates, *S* is the nominal exchange rate (defined throughout this paper as the domestic currency price of foreign currency), and ln indicates the natural logarithm. $ln_t\, S_{t+k}$ is the log exchange rate expected today to prevail at the end of the investment period, and therefore the right-hand side of the equation is equal to the expected depreciation rate.[2]

The way the interest differential reacts to fluctuations in the exchange rate may be particularly important when the economy is hit by shocks originating in the capital account of the balance of payments. Say world demand for local assets falls. The exchange rate will rise (i.e., the local currency will depreciate) and domestic economic activity will tend to fall by the reduction in capital inflows (see Greene 2002), and perhaps because of the contractionary effects of the depreciation. This will happen equally in a band or a floating system. The existence of an explicit band, however, will provide a natural focal point for exchange rate expectations. In particular, after the currency depreciates, the actual exchange rate will fall in relation to the central parity and hence expectations of currency appreciation (or of lower depreciation) will materialize. This will push local interest rates down, according to the interest parity condition (see Svensson 1994 and Williamson 2000).

In this way, the band, by providing an anchor for exchange rate expectations, tends to stabilize output, given that the contraction in economic activity is to some extent offset by a fall in interest rates. This anchor is lost in a floating regime, opening the possibility for the emergence (or the reinforcement) of adaptive mechanisms in the formation of expectations. For instance, after reviewing the results from a number of survey-based studies, Takagi (1991) concludes that there is ample evidence pointing to the existence of bandwagon effects in the foreign exchange market. This is exemplified by the stylized fact that "a depreciation tends to be followed by expectations of further depreciations in the short run …" (p. 163). According to equation (1), this would imply that the interest rate differential rises after the currency depreciates. The coefficient linking the interest rate differential to the (perhaps lagged) exchange rate would be positive, instead of negative as an interpretation of the parity condition holding $ln_t\, S_{t+k}$ constant would predict.

[2]Equation (1) may be modified to include a risk premium under conditions of less than perfect mobility of capital or if asset holders are characterized by risk aversion.

In addition, recent related work has advanced the idea that governments typically show "fear of floating", in the sense that they use monetary policy to stabilize the exchange rate, presumably to avoid the potentially disruptive effects on balance sheets and inflation performance of a permanent currency depreciation (see Calvo and Reinhart 2002, and Hausmann *et al*. 1999). This again would produce a positive correlation between domestic interest rates and the exchange rate. In fact, McCallum (1994) had argued earlier that the widespread empirical rejection of the UIP condition (see Froot and Thaler 1990) could be attributed to the policy reaction of governments with the intention of smoothing exchange rate fluctuations.

This set of effects may have implications again for the response of local interest rates to changes in output. In a float, domestic authorities may direct monetary policy toward the stabilization of the exchange rate –because of the loss of an explicit anchor–, at the cost of neglecting to some extent other goals such as output stability. From this factor, we may expect to see a decline in the coefficient linking interest rates to output.

Thus, on purely analytical grounds, there is ambiguity about the effect that the shift from a band regime to one of floating may have on the response of local interest rates to changes in output: on one side, the greater flexibility brought about by the float may lead to a more decided use of monetary policy (and to expectations of this sort) toward the goal of stabilizing output; on the other, though, the loss of an anchor for exchange rate expectations may force authorities to focus more on ensuring financial stability (maybe by increasing the interest rate when the local currency depreciates) at the cost of a less intense response of local interest rates to output fluctuations. The next two sections turn to an empirical examination of the actual way interest rate differentials have been affected by variations in the exchange rate and output in our sample of countries.

3. ESTIMATION APPROACH

The empirical analysis is based on the estimation of separate regression equations for each country. The first set of equations concentrates on the estimation of the coefficient measuring the impact of exchange rate variations on the interest rate differential, and on testing whether this relationship has been affected by the choice of exchange regime. Thus, each regression equation for the interest differential includes as regressors the nominal exchange rate and an interaction between this variable and a dummy for the floating period; the latter would capture any shift in the coefficient associated to the regime change.

The remaining variables were determined as follows. It has been observed that the inflation rate is a main determinant of the interest differentials in the long run (see Froot and Thaler 1990). This association is clearly seen in the sample of countries considered in this paper (see Figures 1 to 6). A depreciation of the currency may also generate a higher inflation rate and, through that channel, increase the interest differential; this would bias the estimation of the exchange

FIGURE 1
ITALY: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, JANUARY 1988-DECEMBER 1998

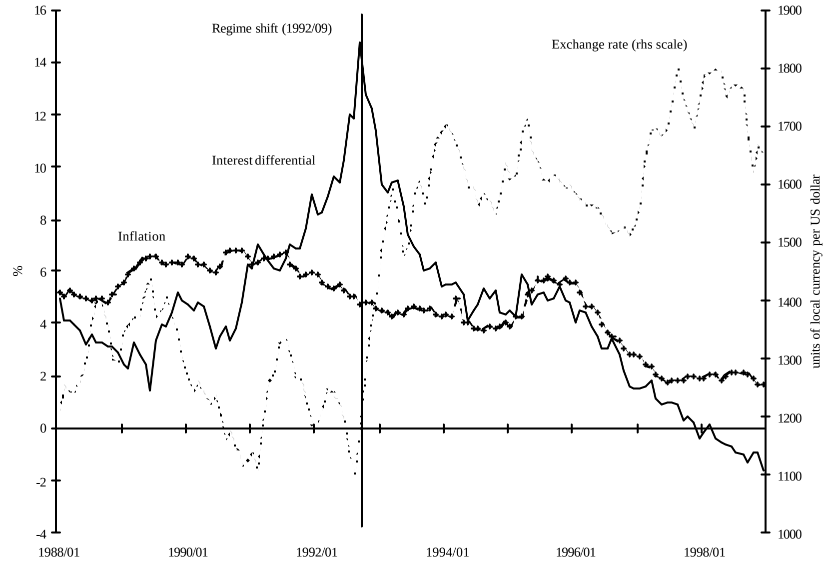


FIGURE 2
PORTUGAL: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, JANUARY 1991-DECEMBER 1998

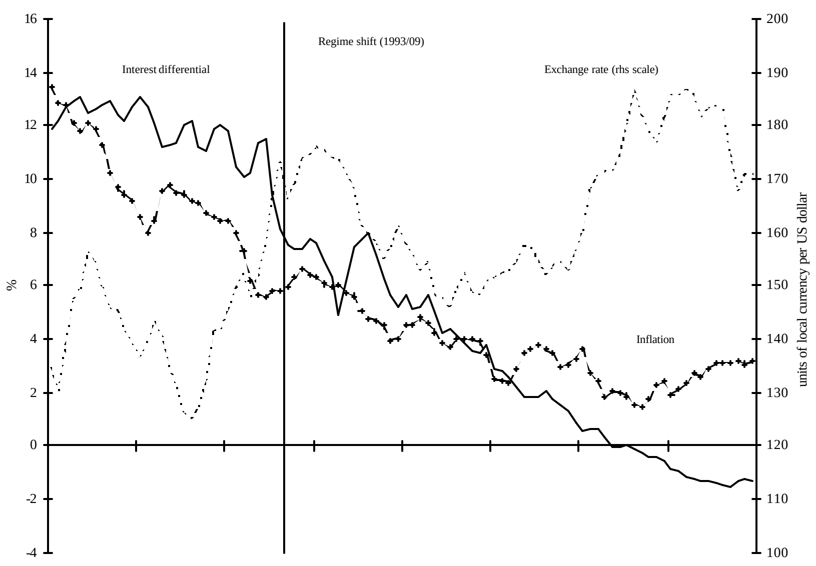


FIGURE 3
SPAIN: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, JANUARY 1990-DECEMBER 1998

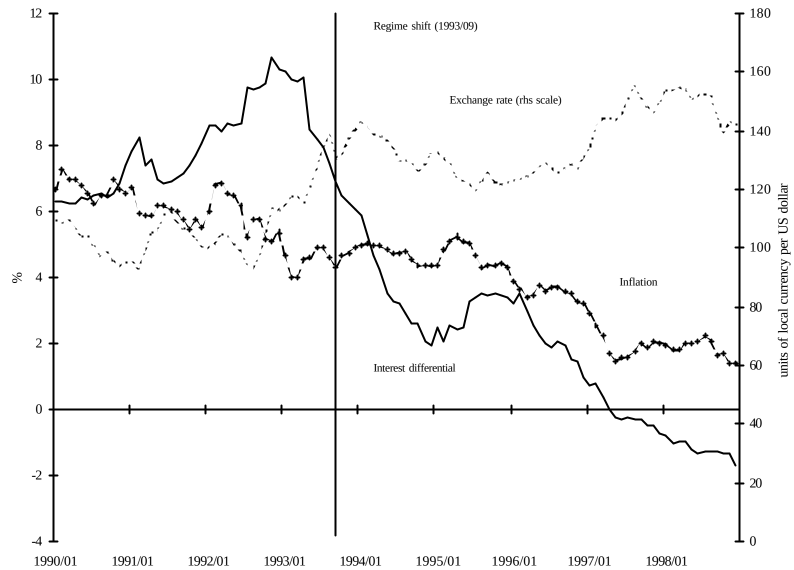


FIGURE 4
CHILE: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, JANUARY 1991-JUNE 2003

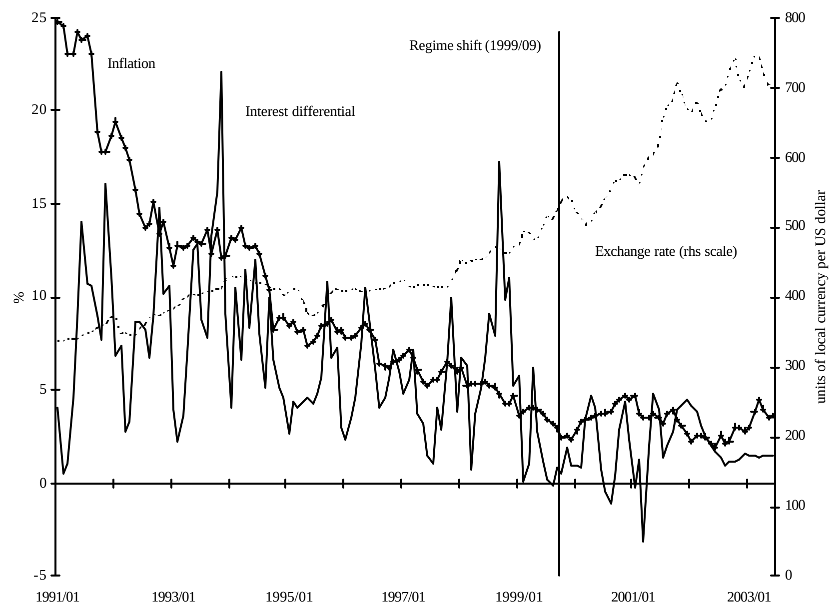


FIGURE 5
COLOMBIA: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, NOVEMBER 1991-JUNE 2003

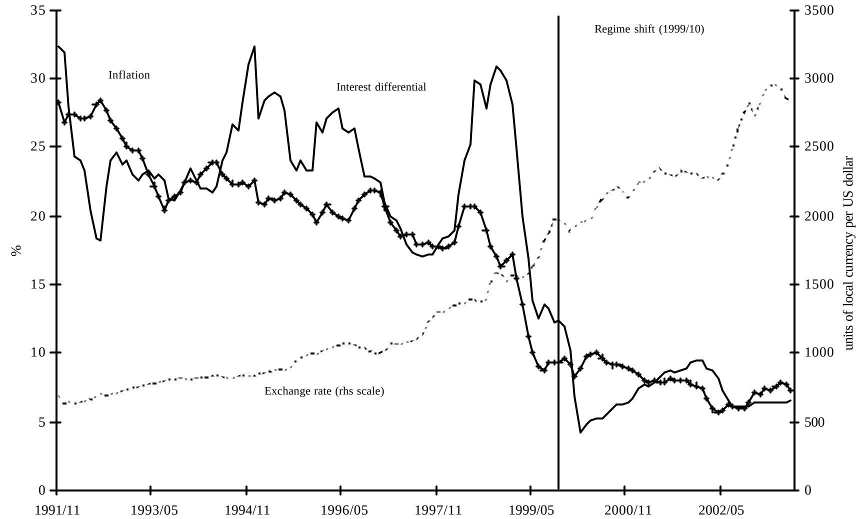
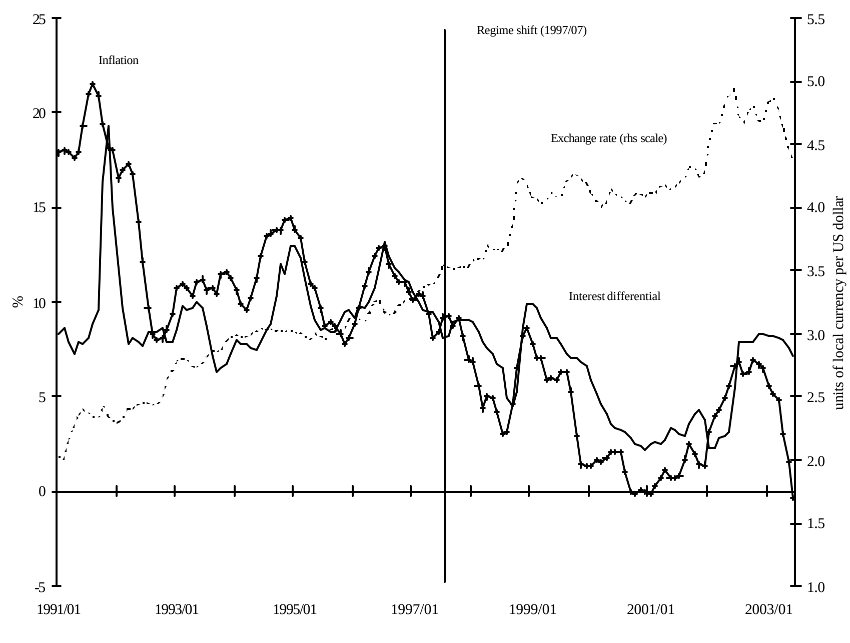


FIGURE 6
ISRAEL: INTEREST RATE DIFFERENTIAL, INFLATION AND EXCHANGE RATE, JANUARY 1991-JUNE 2003



rate coefficient. In addition, the interest rate differential may be affected by variations in domestic liquidity. Therefore, the equations to be estimated include both the inflation rate and the real money supply, adjusted by output, as regressors.[3]

The initial specification has the following autoregressive distributed lag (ADL) form:

$$(2) \qquad IRD_t = a_0 + S\, a_j\; IRD_{t-j} + S\, b_i RI_{t-i} + S\, c_i\; lnM_{t-i} + S\, d_i\; lnS_{t-i} + S\; f_i\; lnS_{t-i} * FLOAT + residual_t\, ,$$

where *S* is the sum operator, *IRD* is the interest rate differential, *RI* the rate of inflation, *M* the real money supply divided by output, *S* the nominal exchange rate, and ln indicates again the natural logarithm. *FLOAT* is a dummy variable that, for each country, takes a value of one for observations corresponding to the period of floating (or very wide bands) and zero otherwise. The lag structure (which lags were included for each variable) was determined separately for each country, starting from an equation with a relatively large number of lags, on the basis of the statistical significance of the coefficients (note that the sub-index "*j*" necessarily starts at 1, whereas "*i*" may start at 0). Sometimes the best fit was obtained by skipping some lags (for instance, the equation for Italy includes lags 1 and 3, but not 2 or 4 nor the contemporaneous value of the money supply). Also, on many occasions, a single lag of a variable was significant (that was the case, for instance, with inflation).[4]

To facilitate interpretation, particularly about whether the size of the coefficients is economically significant, most of the analysis will be carried out in terms of the so-called "long-run" or static version of equation (2). This shows the value of the coefficients with the dynamic effects worked out. It is formed with the estimated value of the coefficients of Equation (1) after imposing the restriction that each variable has converged to a constant value:[5]

$$(3) \qquad IRD_t^{lr} = a + b\,RI_t + c\,lnM_t + d\,lnS_t + f\,lnS_t * FLOAT$$

In this equation:

[3]Naturally, a change in the interest rate may, with some lag, affect other macroeconomic variables such as the inflation rate or aggregate output; this line of analysis, however, is not pursued here.

[4]A balanced specification (i.e., one that included the same number of lags for each variable) was not practical in the present case because the number of coefficients to be estimated became very large, particularly in equations that incorporated output as a regressor (see equations 4 and 6).

[5]This simply means that the effect of shocks has been worked out, and not that the series has a well defined long-run value. This distinction is important particularly in the case of series with unit root.

$a = a_0 / (1 - S\, a_j)$, $b = S b_i / (1 - S\, a_j)$, $c = S\, c_i / (1 - S\, a_j)$, $d = S\, d_i / (1 - S\, a_j)$, and $f = S\, f_i / (1 - S\, a_j)$, are the "long-run" coefficients.[6] These coefficients measure the total, cumulative effect of each regressor on the interest differential once the auto-regressive component of the model [given by the factor $1/(1\text{-}Sa_j)$] is taken into account. It must be kept in mind that, by the way the *FLOAT* dummy is defined, *d* corresponds to the exchange rate coefficient for the band period, while the sum d+f represents the coefficient for the floating period.

Equation (3) also makes it possible to test for the existence of cointegration; this is convenient because the variables included in the analysis are mostly non-stationary and thus there is a risk of obtaining statistically significant but economically spurious results. In any given period, the deviation from long-run equilibrium will be: $DEV_t = IRD_t - IRD_t^{lr}$. According to the so-called residual-based test, if equation (3) is indeed a cointegration equation, then it should be possible to reject the null hypothesis of a unit root in the *DEV* series (see Enders 1995, chapter 6).

As discussed in the previous section, a second major interest of the paper is to test whether the interest rate differential has reacted to protracted variations in real economic activity, and whether this link has changed after the shift to float. Therefore, a second set of equations adds to the original specification the natural log of the left-sided, 3-month moving average of output, lnY. The *ADL* model becomes:

$$(4) \quad IRD_t = a_0 + S\, a_j\, IRD_{t-j} + S\, b_i RI_{t-i} + S\, c_i\, lnM_{t-i} + S\, d_i\, lnS_{t-i} + S\, f_i\, lnS_{t-i} * FLOAT + S\, g_i\, lnY_{t-i} + S\, h_i\, lnY_{t-i} * FLOAT + residual_t\,,$$

with a corresponding long-run version:

$$(5) \quad IRD_t^{lr} = a + bRI_t + c\, lnM_t + d\, lnS_t + f\, ln\, S_t * FLOAT + g\, lnY_t + h\, lnY_t\ * FLOAT,$$

where the long-run coefficients are obtained from the estimated *ADL* model as explained before.

An anti-cyclical interest rate pattern requires the coefficient on the output moving average to be positive; this would imply, for instance, that a fall in economic activity is followed by a decline in local interest rates. According to the theoretical considerations on the flexibility vs. credibility trade off discussed in the previous section, it is possible for this coefficient condition to be satisfied during one regime but not the other.

[6]For a suggestion to derive the «long-run» relation from an ADL model, see Johnston and DiNardo (1997, chapter 8). For this paper, equations of the form of (3) were also estimated directly, yielding results which were similar to those presented below; however, the ADL-based procedure was chosen because it avoided problems of serial correlation, which were pervasive in the more traditional approach, and because it allowed for a dynamic analysis of the effects of regressors on the interest differentials.

To gain further insight into this issue, it will be examined whether the cyclical character of the interest differential depends on the state of the business cycle. Two dummies were used in separate equations to capture this possibility: GROWTH, which takes a value of one if the 12-month percentage change in the output moving average is zero or negative, and zero otherwise; and CYCLE, which takes a value of one if output is equal to or below its Hodrick-Prescott trend and zero otherwise. These dummies are interacted with output. Thus, it will be possible to examine the response of the local interest rate to protracted variations in output, conditioned by the exchange regime and the state of the business cycle. The final equation has the general form:

$$\begin{aligned}(6)\qquad IRD_t &= a_0 + S\, a_j\, IRD_{t-j} + S\, b_i RI_{t-i} + S\, c_i\, lnM_{t-i} + S\, d_i\, lnS_{t-i} + \\ &S\, f_i\, lnS_{t-i} *FLOAT + S\, g_i\, lnY_{t-i} + S\, h_i\, lnY_{t-i}*FLOAT + \\ &S\, m_i\, lnY_{t-i} *STATE + S\, k_i\, lnY_{ti} *FLOAT*STATE + residual_t\ ,\end{aligned}$$

and a corresponding long-run version:

$$\begin{aligned}(7)\qquad IRD_t^{lr} &= a + bRI_t + c\,lnM_t + d\,lnS_t + f\,lnS_t *FLOAT + g\,lnY_t + \\ &h\,lnY_t *FLOAT + m\,lnY_t*STATE + k\,lnY_t * FLOAT*STATE\end{aligned}$$

where *STATE* is equal to either GROWTH or CYCLE. Since both *FLOAT* and either CYCLE or GROWTH are zero-one dummy variables, the coefficients of the interaction variables represent the departure from the coefficient of the benchmark case. For instance, if the equation includes the variable CYCLE, then g represents the effect of output on the interest rate differential when output is above trend and the economy is in a band regime; $g+h$ measures this effect when output is above trend and there is a floating regime; $g+m$ for output below trend and a band regime; and $g+h+m+k$ for output below trend in a floating regime.

Finally, the analysis will distinguish between the initial response of the interest differential to changes in the exchange rate or output (given by the first statistically significant coefficient in the ADL model, e.g. the first d_i coefficient for the exchange rate during a band regime, adjusted by the AR coefficients so as to yield "long-run" values) and the final or cumulative effect (given, for instance, by d in the case of the exchange rate). As mentioned before, the lag structure of the ADL model was determined for each country by the statistical significance of the lags of each variable. Once that was determined, Wald tests were performed to examine the validity of zero-sum hypotheses about the relevant coefficients. This makes it possible to test, for instance, whether coefficients remain jointly significant in statistical terms after there has been a coefficient shift associated to the adoption of a new exchange regime.

Presumably, variables like the interest rate, the exchange rate and the money supply are contemporaneously affected by common macroeconomic shocks. This raises the possibility of an endogeneity bias in the estimation of the corresponding coefficients. In our case, initial exploration showed that, once the autoregressive component of the model was included, only lagged, but not contemporaneous, values of the exchange rate and the money supply were statistically significant regressors in the IRD equations. This made it possible to estimate the models by OLS. The exceptions were Portugal and Italy, where the current value of the exchange rate was highly significant. The chosen alternative was to estimate the equations for these two countries by GMM. However, the results were not satisfactory for Italy, where the coefficients tended to lose statistical significance; therefore, only the OLS estimation results were retained, which must be interpreted with caution. In the case of Portugal, a comparison of equations estimated by OLS and GMM yielded very similar results, as can be verified in Table 3 below (see columns 1 and 2).

4. DATA AND ESTIMATION RESULTS

The definition of the series is presented in Table 1. Data are monthly. The interest rate differential (IRD) corresponds to the gap between a local interest rate and the U.S. federal funds rate. The nominal exchange rate (S) is measured in units of local currency per U.S. dollar. The inflation rate (RI) is the 12-month percentage variation in the consumer price index. The real money supply (M) corresponds to the nominal money supply, divided by the product of the consumer price and industrial production indices. For the estimation of equations such as (4) and (6), output (Y) corresponds to the left-sided, 3-month moving average of industrial production. The money supply, the exchange rate and the output moving average are measured in natural logs. As mentioned before, the GROWTH dummy is equal to one when the 12-month change in the output moving average is zero or negative, while the CYCLE dummy is equal to one when the output moving average is equal or below its Hodrick-Prescott trend.

For Chile, Colombia and Israel, the sample period starts in 1991 and ends in June of 2003. The floating period begins in September of 1999 for Chile, October of 1999 for Colombia, and July of 1997 for Israel; the latter date marks the adoption of a band of plus/minus 14% of central parity, which steadily widened after that. The start of the sample period is January of 1988 for Italy, January of 1990 for Spain, and January of 1991 for Portugal. In all three cases, the sample period ends in December of 1998 with the introduction of the euro. The floating period starts for Italy in September of 1992, when the country dropped out of the European Exchange Rate Mechanism (ERM), and in September of 1993 for Spain and Portugal, with the introduction of bands of plus/minus 15% of central parity.

TABLE 1
DEFINITION OF VARIABLES

IRD	Difference between a local interest rate and the US federal funds rate, in % points. Local interest rates: *European countries:* Italy: Treasury bill rate Portugal: Government bond yield Spain: Bank of Spain rate *CCI group*: Chile: Average of up-to-30 day interbank lending and deposit rates Colombia: 90-day CD rate for banks and corporations Israel: Bank of Israel interest rate.
RI	12-month change in local consumer price index, in %.
lnM	Nominal money supply, divided by the product of the consumer price index and an index of monthly output (see below), in natural logs. The nominal money supply corresponds to M1 in all countries, except Italy (M2). A seasonal effect for August was removed from the series for Portugal.
lnS	Nominal exchange rate (units of local currency per US dollar), in natural logs.
lnY	Left-sided 3-month moving average of an index of monthly output, in natural logs. An index of industrial production was used in all countries, except Chile where an index of overall economic activity was available.
GROWTH	Dummy that equals 1 when the 12-month change in LNOUT is zero or negative, and zero otherwise.
CYCLE	Dummy that equals 1 when LNOUT is below or equal to its H-P trend, and zero otherwise.
FLOAT	Dummy that equals 1 during the period of floating (or a very wide band). The starting date for FLOAT=1 is as follows: *European countries:* Italy: September 1992; Portugal and Spain: September 1993. *CCI group*: Chile: September 1999; Colombia: October 1999; Israel: July 1997.

Sources:
European countries: IMF's International Financial Statistics, February 2003.
For Portugal's industrial production index: National Institute of Statistics.
CCI group: Central banks.

a) The interest rate-exchange rate link

Estimation of equations of the form of (2) for the European sample yields the following results (see column 1 in Tables 2-4):

(8a) Italy:

$$IRD = 179.9 \underline{+ 0.9663\ RI} + \underline{5.5213\ lnM} - 28.6075\ lnS + \underline{0.6721\ lnS*FLOAT}$$

(8b) Portugal:

$$IRD = 53.0 + 3.2467\ CRISIS + 0.9599\ RI - 18.8733\ lnM + \underline{2.3317\ lnS} - \underline{0.2113\ lnS*FLOAT}$$

(8c) Spain:

$$IRD = \underline{-43.1} + 4.0244\ CRISIS + 1.3134\ RI + 15.0236\ lnM - 7.5550\ lnS - \underline{0.2601\ lnS*FLOAT}$$

As can be seen, the equations are presented in long-run version to facilitate the interpretation of the size of coefficients. Underlined are the variables for which the hypothesis of zero sum of coefficients has a p-value larger than 0.10. Thus, it can be seen that several variables have coefficients which are not significant at 10%. Mostly, this lack of significance is the result of the fact that an initially significant effect is later on reversed, i.e., it is transitory. Thus, for instance in Italy, a rise in the real money supply leads to a significant fall in the interest differential (as could be expected), which is later on reversed, eventually leading to a non-significant long-run coefficient. The same pattern explains the lack of significance of the inflation rate and the interaction between the exchange rate and the float dummy (see Table 2, column 1), or the lack of significance of the exchange rate in the Portugal equation (see Table 3, column 1).[7]

Turning to the main point of interest, the equations show that there is a negative link between the interest differential and the exchange rate in this group of countries. In Spain during the band period, the long-run exchange rate coefficient is -7.6, implying that a depreciation of ten percent in the local currency tended to reduce the interest differential in 0.76 percentage points. In Italy, the absolute value of the coefficient is even larger, at -28.6. Moreover, in both cases the dynamic pattern is characterized by an even larger initial negative response of the interest differential, which eventually is partly reversed. In Spain, for instance, the initial adjustment in the interest differential is -28.4 (2.8 percentage points of change in the interest differential for a ten-percent change in the exchange rate).

In Portugal, the interest rate-exchange rate link follows the same pattern: initially, as the currency depreciates, the interest differential falls, and after two periods this movement is fully reversed. In contrast to Spain and Italy, though, the sign of the cumulative exchange rate coefficient is positive; however, a Wald test for the hypothesis that the cumulative value of the exchange rate coefficient is zero, shows a very high p-value of 0.43 (see column 1 in Table 3).

The shift to float did not make a significant difference for the interest rate-exchange rate link in this group of countries, in terms of the cumulative value of the exchange rate coefficient (in all cases, the coefficient for the interaction between the exchange rate and the float dummy is very small and non-significant). However, the dynamic pattern of the response does change. In particular, the initial large negative correlation between the exchange rate and the interest differential essentially vanishes in Italy and Spain (see the results of the Wald tests in column 1 of Tables 2 and 4). Only in Portugal does a transitory negative response of the differential to exchange rate variations remain in the new regime. Thus, in Spain and Italy there is evidence of short-term de-linkage of interest rates from the exchange rate after the adoption of floating, presumably as a reflection of the greater monetary autonomy afforded by the float.

[7]Note that the equations for Spain and Portugal include a 0-1 dummy to pick up the effect of the Fall of 1992 ERM crisis. The dummy is equal to one from September 1992 to June 1993 for Portugal, and from September 1992 to April 1993 for Spain.

TABLE 2
ITALY: DEPENDENT VARIABLE: IRD.
Sample period: January 1988 - December 1998; size: 132. Method: OLS

	(1)	(2)	(3)	(4)
Constant	14.3496 *	-10.8864	11.2592	15.4491
IRD(-1)	0.9202 ***	0.9257 ***	0.9236 ***	0.9225 ***
(a) RI(-1)	0.3730	0.3402	0.3948 *	0.2512
(b) RI(-2)	-0.6843 **	-0.6670 *	-0.6738 **	-0.5698 *
(c) RI(-3)	0.3884	0.4553 *	0.3615	0.3868
(d) lnM(-1)	-3.2409 **	-2.5422	-2.9442 *	-3.4610 **
(e) lnM(-3)	3.6814 **	4.8340 ***	4.0121 ***	3.9938 ***
(f) lnS	-13.5334 ***	-12.7268 ***	-13.8446 ***	-13.5423 ***
(g) lnS(-1)	11.2510 ***	10.1552 ***	11.5886 ***	11.0528 ***
(h) lnS*FLOAT	13.6692 ***	13.6738 ***	13.9997 ***	14.2336 ***
(i) lnS(-1)*FLOAT	-13.6156 ***	-13.5956 ***	-15.0010 ***	-13.9135 ***
(j) lnY(-2)		13.6455 **		
(k) lnY(-4)		-9.5525 **		
(l) lnY(-2)*FLOAT			15.6990 **	25.0900 **
(m) lnY(-3)*FLOAT				-25.5041 ***
(n) lnY(-4)*FLOAT			-13.9884 **	
(o) lnY(-1)*FLOAT*CYCLE				-23.2519 a/
(p) lnY(-2)*FLOAT*CYCLE				23.2235 a/
- Adjusted R-squared	0.9638	0.9651	0.9649	0.9657
- Q test (lowest p-value in first 12 lags)	0.4546	0.4820	0.4165	0.3379
- Wald tests (p-values):				
(a)+(b)+(c)=0	0.2692			
(d)+(e)=0	0.6515			
(f)+(g)=0	0.0425	0.0235	0.0843	0.0612
(f)+(h)=0	0.9651	0.7574	0.9619	0.8302
(f)+(g)+(h)+(i)=0	0.0406	0.0233	0.0118	0.1393
(h)+(i)=0	0.2551			
(j)+(k)=0		0.1154		
(l)+(n)=0			0.4330	
(l)+(m)=0				0.8691
(l)+(m)+(o)+(p)=0				0.8605
(l)+(o)=0				0.9188
- Cointegration A Dickey-Fuller 1/	-1.9645 ++			
- Cointegration Phillips-Perron 2/	-1.9645 ++			

*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
1/ Without intercept. Number of lags determined by the Schwartz Criterion.
2/ Without intercept. Newey-West bandwidth.
a/ p-value is 0.14.

TABLE 3
PORTUGAL: DEPENDENT VARIABLE: IRD.
Sample period: January 1991 - December 1998; size: 96. Method: OLS a/

	(1)	(2)	(3)	(4)	(5)
Constant	13.1469 ***	13.5434 ***	10.7540 **	6.8505	10.8437 **
CRISIS	0.8048 ***	1.0855 ***	1.1523 ***	1.1389 ***	1.0427 ***
AR	0.7521 ***	0.7162 ***	0.6737 ***	0.6801 ***	0.6805 ***
(a) RI(-3)	0.1583 **	0.1224	0.1312 **	0.1404 **	0.1336 **
(b) RI(-5)	-0.3234 **	-0.3364 ***	-0.2831 **	-0.2963 **	-0.2614 **
(c) RI(-6)	0.4031 ***	0.5000 ***	0.3571 ***	0.3616 ***	0.3422 ***
(d) lnM(-1)	-2.2938 ***	-1.9880 ***	-1.8997 ***	-1.7476 ***	-1.8802 ***
(e) lnM(-4)	-1.9655 **	-1.9289 *	-2.5865 ***	-1.9843 ***	-2.0226 **
(f) lnM(-5)	1.9496 **	0.8243	1.1064	0.9855	1.3805 *
(g) lnM(-6)	-2.3685 ***	-2.1639 ***	-1.8538 **	-1.7357 **	-1.2732
(h) lnS	-3.4017 **	-9.6260 *	-3.2102 **	-3.3684 **	-2.6195 *
(i) lnS(-1)	3.9797 **	10.5101 **	4.9041 ***	5.3295 ***	3.2560 *
(j) lnS(-1)*FLOAT	-4.7840 ***	-5.2242 ***	-6.7178 ***	-7.7557 ***	-6.3473 ***
(k) lnS(-4)*FLOAT	4.8364 ***	5.2812 ***	6.5771 ***	7.5740 ***	6.2148 ***
(l) lnY(-1)			26.8274 ***	28.0152 ***	28.6191 ***
(m) lnY(-3)			-20.2747 ***	-28.4722 ***	-22.5621 ***
(n) lnY(-5)					16.2893 ***
(o) lnY(-1)*FLOAT			-26.9788 ***	-30.1237 ***	-29.4945 ***
(p) lnY(-3)*FLOAT			13.3509 *	22.5778 ***	17.0133 **
(q) lnY(-5)*FLOAT					-15.7649 **
(r) lnY(-3)*STATE					-15.8657 **
(s) lnY(-4)*STATE				13.2528 ***	
(t) lnY(-1)*FLOAT*STATE				35.0572 **	
(u) lnY(-2)*FLOAT*STATE				-47.4240 ***	
(v) lnY(-4)*FLOAT*STATE					12.5550 *
- Adjusted R-squared	0.9953	0.9940	0.9962	0.9968	0.9966
- Q test (lowest p-value in first 12 lags)	0.4105	0.3840	0.4781	0.5237	0.4008
- J test (p-value)	0.4350				
- Wald tests (p-values):					
(a)+(b)+(c)=0	0.0000				
(d)+(e)+(f)+(g)=0	0.0010				
(j)+(k)=0	0.1854				
(h)+(i)=0	0.4343	0.2514	0.0195	0.0169	0.4548
(h)+(i)+(j)+(k)=0	0.3885	0.2120	0.0292	0.0305	0.5518
(l)+(m)=0			0.2017	0.9349	
(l)+(m)+(o)+(p)=0			0.0170		
(l)+(o)=0			0.9690	0.5678	0.8189
(l)+(m)+(s)=0				0.0019	
(l)+(m)+(o)+(p)+(s)+(t)+(u)=0				0.1502	
(l)+(m)+(o)+(p)=0				0.0151	
(l)+(o)+(t)=0				0.0299	
(l)+(o)=0					
(l)+(m)+(n)=0					0.0021
(l)+(m)+(n)+(o)+(p)+(q)=0					0.1020
(l)+(m)+(n)+(r)=0					0.2612
(l)+(m)+(n)+(o)+(p)+(q)+(r)+(v)=0					0.0177
- Cointegration A Dickey-Fuller 1/	-4.6404 +				
- Cointegration Phillips-Perron 2/	-4.3212 +				

a/: except equation (1), by GMM. Lags 1 to 6 of lnS were used as instruments.
*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
1/ Includes intercept. Number of lags determined by the Schwartz Criterion.
2/ Includes intercept. Newey-West bandwidth.
STATE=GROWTH in equation 4, and STATE=CICLO in equation 5.
Sample 91M4-98M12, size: 93 in equation 4.
AR is the sum of autoregressive coefficients, from lags 1 to 6.

TABLE 4
SPAIN: DEPENDENT VARIABLE: IRD.
Sample period: January 1990 - December 1998; size: 108. Method: OLS

	(1)	(2)	(3)	(4)
Constant	-5.8890	-14.1146 *	-13.9647	-8.0182
CRISIS	0.5495 ***	0.7332 ***	0.5641 ***	0.8331 ***
IRD(-1)	0.8635 ***	0.8944 ***	0.9015 ***	0.8876 ***
RI(-1)	0.1793 ***	0.2001 ***	0.1928 ***	0.1674 ***
lnM(-1)	2.0512 ***	2.2495 ***	1.8823 **	2.0277 ***
(a) lnS(-2)	-3.8792 ***	-3.2169 **	-2.8307 *	-2.7819 *
(b) lnS(-3)	2.8477 *	2.8751 *	2.5090 b/	1.8746
(c) lnS(-2)*FLOAT	3.5278 a/	3.1318	3.0277	2.8361
(d) lnS(-3)*FLOAT	-3.5633	-3.9209 *	-3.8129 a/	-2.9312
(e) lnY(-2)			30.0467 **	
(f) lnY(-3)		35.1885 ***		29.7371 **
(g) lnY(-4)		-34.3856 ***	-28.8850 **	-29.3841 **
(h) lnY(-2)*FLOAT			-32.0498 **	
(i) lnY(-3)*FLOAT		-37.6941 **		-37.8638 **
(j) lnY(-4)*FLOAT		38.4971 **	32.8509 **	37.9525 **
(k) lnY(-1)*STATE				50.0440 **
(l) lnY(-2)*STATE			-52.7429 ***	-50.0188 **
(m) lnY(-3)*STATE			52.7367 ***	
(n) lnY(-1)*FLOAT*STATE				-55.8255 **
(o) lnY(-2)*FLOAT*STATE			90.6912 ***	55.7711 **
(p) lnY(-3)*FLOAT*STATE			-90.6830 ***	
- Adjusted R-squared	0.9934	0.9938	0.9940	0.9942
- Q test (lowest p-value in first 12 lags)	0.5221	0.3816	0.3494	0.1957
- Wald tests (p-values):				
(a)+(b)=0	0.0320	0.5902	0.6464	0.1654
(c)+(d)=0	0.1734			
(a)+(c)=0	0.8359	0.9596	0.9065	0.9737
(a)+(b)+(c)+(d)=0	0.0225	0.0797	0.1066	0.1302
(f)+(g)=0		0.5411		0.8160
(f)+(i)=0		0.7557		0.3480
(f)+(g)+(i)+(j)=0		0.2445		0.7875
(e)+(g)=0			0.4018	
(e)+(h)=0			0.7236	
(e)+(g)+(h)+(j)=0			0.2095	
(e)+(l)=0			0.1116	
(e)+(h)+(l)+(o)=0			0.0983	
(e)+(g)+(h)+(j)+(l)+(m)+(o)+(p)=0			0.2107	
(f)+(g)+(k)+(l)=0				0.8052
(k)+(n)=0				0.6133
(f)+(g)+(i)+(j)+(k)+(l)+(n)+(o)=0				0.8020
(e)+(g)+(l)+(m)=0			0.4058	
- Cointegration A Dickey-Fuller 1/	-2.1507 ++			
- Cointegration Phillips-Perron 2/	-3.2180 ++			

*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
a/ p-value is 0.11. b/ p-value is 0.10.
1/ Without intercept. Number of lags determined by the Schwartz Criterion.
2/ Includes intercept. Newey-West bandwidth.
Note: STATE=GROWTH in equation 3, and STATE=CYCLE in equation 4.

The equivalent set of equations estimated for the CCI group is:

(9a) Chile:

$$IRD = \underline{32.9} + 0.3597\ RI - 11.1201\ \ln M + 9.8114\ \ln S - 0.8417\ \ln S{*}FLOAT$$

(9b) Colombia:

$$IRD = \underline{40.8} + 0.7573\ RI - 12.4623\ \ln M + \underline{3.4418\ \ln S} - 0.8908\ \ln S{*}FLOAT$$

(9c) Israel:

$$IRD = \underline{21.4} + 0.6346\ RI - 5.9685\ \ln M + 12.1027\ \ln S - 1.8865\ \ln S{*}FLOAT.$$

The results show a strong contrast with those for the European sample (see also column 1 in Tables 5 to 7). In particular, in the CCI group the initial response of the interest differential is to move in the same direction that the exchange rate (i.e., the interest differential rises after the local currency depreciates). Moreover, the cumulative coefficient remains positive and statistically significant, with the exception of Colombia, where the coefficient is positive but non-significant.

Also in contrast to the European countries, it is not possible to find evidence of de-linkage in the dynamic response of the interest differential to variations in the exchange rate after the CCI countries moved to a floating regime. What we observe is a statistically significant, but very small fall in the exchange rate coefficient; for instance, in Chile the long-run coefficient falls from 9.8 to 9.0, while in Israel it declines from 12.7 to 10.7. These results are consistent with the view that the greater monetary flexibility brought about by the float has given local authorities the opportunity to reduce only on a very incipient scale the positive link between interest and exchange rates.[8]

This contrast between our two groups of countries is an example of a phenomenon documented by Eichengreen and Hausmann (1999) and Hausmann *et al.* (1999): while in developed countries the interest rate tends to move counter-cyclically in relation to the exchange rate, in developing countries the opposite is the truth. In our particular case, the observation seems to imply that, for the CCI countries, the focal point provided by the band was not enough to produce the negative link suggested by the parity condition (1).

Although it is not possible in this paper to discriminate between alternative explanations, we may note that the literature has identified at least two potentially

[8] Despite the fact that there can be a substantial change in the rules of exchange market intervention. Carrasquilla (1998) notes that, during the band period, the Colombian central bank intervened not only at the margins, but also intra-marginally, with the intention of reducing exchange rate volatility, and that preservation of the exchange rate band was given priority over an existing interest rate band (see also Uribe 1999). In Israel, up to February 1996, there was, besides the official exchange rate band, a narrower intervention band (see Leiderman and Bufman 1999). Over time, as the official band became wider, the emphasis shifted from control of the exchange rate to directly targeting the inflation rate (see Leiderman and Bar-Or 2000). In the Chilean context, Morandé and Tapia (2002) observe that exchange market intervention by the central bank has been extremely rare after the shift to float, and that in fact there was no intervention at all in the first two years of floating.

important factors.[9] One is the possibility that the *country* risk premium increases when the domestic currency depreciates (see Berg and Borensztein 2000 and Edwards 2001, figure 4), for instance because of a greater risk of default on liabilities denominated in a foreign currency. A second possible factor is that the credibility of the band is lower in developing countries than in their developed counterparts (see Agénor and Montiel 1999, pp. 266-280). This would imply that when the exchange rate depreciates, a strong rise in realignment risk (that is, the risk of devaluation of the central parity of the band) more than offsets expectations of a future reversion to central parity (see Bertola and Svensson 1993).[10]

To end this subsection, we may note that the results discussed above were obtained from regression equations that included all the variables in levels. As mentioned before, this raises the possibility of obtaining spurious results, given that for these variables in general it is not possible to reject the hypothesis that they contain a unit root. However, the results from unit root tests for the residual of the long-run version of the equations support the regression specification used in the analysis. In particular, in all countries both the Augmented Dickey-Fuller and the Phillips-Perron tests reject at conventional significance levels the unit root hypothesis for the deviation of the actual interest rate differential from its long-run value (see the last two rows in column 1 of Tables 2-7).

[9]In addition to the fact that if, after a depreciation of the currency, the monetary authorities intervene in the foreign exchange market without fully sterilizing the impact on the money supply, then interest rates will tend to go up because of the resulting monetary contraction.

[10]A similar effect would occur if agents expect that the central parity will remain unchanged, but the limits of the band will be widened (as approximately happened in Mexico in December of 1994, when the ceiling of the band was devalued by 20% but the floor was left unchanged).

TABLE 5
CHILE:
DEPENDENT VARIABLE: IRD.
Sample period: January 1991 - June 2003; size: 150. Method: OLS

	(1)	(2)	(3)
Constant	27.9436	-14.0511	-17.2790
AR	0.1518	0.1796	0.1147
RI(-1)	0.3050 ***	0.2639 *	0.2600 *
lnM(-1)	-9.4316 **	-7.6909 **	-11.2690 ***
lnS(-1)	8.3216 **	12.9541 ***	18.3941 ***
lnS(-1)*FLOAT	-0.7139 ***		
(a) lnY(-2)		71.7565 **	42.6381 a/
(b) lnY(-3)		-74.5226 **	-46.3631 b/
(c) lnY(-2)*FLOAT		-22.6347 ***	-31.6757 ***
(d) lnY(-2)*GROWTH			-19.8887 ***
(e) lnY(-2)*FLOAT*GROWTH			18.6690 **
- Adjusted R-squared	0.5962	0.6015	0.6198
- Q test (lowest p-value in first 12 lags)	0.3672	0.5414	0.3944
- Wald tests (p-values):			
(a)+(b)=0		0.5480	0.4122
(a)+(b)+(c)=0		0.0013	0.0000
(a)+(c)=0		0.0926	0.7270
(a)+(b)+(d)=0			0.0051
(a)+(d)=0			0.4924
(a)+(c)+(d)+(e)=0			0.7643
(a)+(b)+(c)+(d)+(e)=0			0.0006
- Cointegration A Dickey-Fuller 1/	-7.4611 +		
- Cointegration Phillips-Perron 2/	-7.0694 +		

*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
1/ Includes intercept. Number of lags determined by the Schwartz Criterion.
2/ Includes intercept. Newey-West bandwidth.
a/ p-value is 0.16. b/ p-value is 0.13.
AR is the sum of autoregressive coefficients, from lags 1 to 6.

TABLE 6
COLOMBIA: DEPENDENT VARIABLE: IRD.
Sample period: November 1991 - June 2003; size: 140. Method: OLS

	(1)	(2)	(3)
Constant	7.6174	12.3104	7.0442
AR	0.8134 ***	0.8905 ***	0.8693 ***
RI	0.1413 **	0.0964	0.1636 **
lnM(-1)	-2.3256 ***	-3.1050 ***	-3.1324 ***
(a) lnS(-1)	16.6599 ***	17.7580 ***	16.3529 ***
(b) lnS(-2)	-16.0176 ***	-17.4422 ***	-15.3883 ***
(c) lnS(-1)*FLOAT	-0.1662 **		
(d) lnY (-2)		32.7142 ***	35.4088 ***
(e) lnY(-3)		-26.1339 **	-25.2752 **
(f) lnY(-2)*FLOAT		-31.3939	-37.9348 *
(g) lnY(-3)*FLOAT		34.1196 *	34.3905 *
(h) lnY(-2)*GROWTH			-13.1123 ***
(i) lnY(-2)*FLOAT*GROWTH			14.7936 a/
- Adjusted R-squared	0.9822	0.9837	0.9845
- Q test (lowest p-value in first 12 lags)	0.4118	0.6353	0.5730
- Wald tests (p-values):			
(a)+(b)=0	0.4898	0.7404	0.3168
(a)+(b)+(c)=0	0.6077		
(d)+(e)=0		0.0140	0.0005
(d)+(f)=0		0.9361	0.8765
(d)+(e)+(f)+(g)=0		0.0553	0.3344
(d)+(h)=0			0.0520
(d)+(e)+(h)=0			0.4754
(d)+(f)+(h)+(i)=0			0.9614
(d)+(e)+(f)+(g)+(h)+(i)=0			0.1884
- Cointegration A Dickey-Fuller 1/	-3.6095 +		
- Cointegration Phillips-Perron 2/	-3.7207 +		

*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
1/ Includes intercept. Number of lags determined by the Schwartz Criterion.
2/ Includes intercept. Newey-West bandwidth.
a/ p-value is 0.14.
AR is the sum of autoregressive coefficients, from lags 1 to 7.

TABLE 7
ISRAEL: DEPENDENT VARIABLE: IRD.
Sample period: January 1991 - June 2003; size: 150. Method: OLS

	(1)	(2)	(3)
Constant	5.5848	9.3841 *	8.6658 *
AR	0.7390 ***	0.6752 ***	0.6827
RI(-1)	0.1656 ***	0.1595 ***	0.1644 ***
lnM(-1)	-1.5577 **	-2.1877 **	-1.7338
(a) lnS(-1)	10.0611 ***	10.2943 ***	10.4495 ***
(b) lnS(-2)	-6.9025 *	-6.8272 *	-8.5261 **
(c) lnS(-1)*FLOAT	-0.4923 **		
(d) lnY(-1)		-10.3318 *	-37.5870 ***
(e) lnY(-2)			37.3935 ***
(f) lnY(-3)		31.7875 ***	
(g) lnY(-4)		-21.3661 **	
(h) lnY(-1)*FLOAT		-6.2261 ***	30.4423 *
(i) lnY(-2)*FLOAT			-34.6630 *
(j) lnY(-1)*CYCLE			36.8771 ***
(k) lnY(-3)*CYCLE			31.2076 *
(l) lnY(-4)*CYCLE			-63.7661 ***
(m) lnY(-1)*FLOAT*CYCLE			-44.1283 ***
(n) lnY(-4)*FLOAT*CYCLE			40.4444 ***
- Adjusted R-squared	0.9293	0.9344	0.9399
- Q test (lowest p-value in first 12 lags)	0.3105	0.4388	0.7343
- Wald tests (p-values):			
(a)+(b)=0	0.0000	0.0080	0.2306
(a)+(b)+(c)=0	0.0000		
(d)+(h)=0		0.0081	0.6086
(d)+(f)+(g)=0		0.9583	
(d)+(f)+(g)+(h)=0		0.0308	
(d)+(f)=0		0.0167	
(d)+(e)=0			0.9210
(d)+(e)+(h)+(i)=0			0.1421
(d)+(j)=0			0.9597
(d)+(e)+(j)+(k)+(l)=0			0.0555
(d)+(h)+(j)+(m)=0			0.2480
(d)+(e)+(j)=0			0.0044
(d)+(e)+(h)+(i)+(j)+(m)=0			0.2829
(d)+(e)+(h)+(i)+(j)+(k)+(l)+(m)+(n)=0			0.3048
- Cointegration A Dickey-Fuller 1/	-6.3402 +		
- Cointegration Phillips-Perron 2/	-3.3825 ++		

*** (**) [*] = significant at 1% (5%) [10%] level.
+ (++): Unit root hypothesis rejected at 1% (5%).
1/ Includes intercept. Number of lags determined by the Schwartz Criterion.
2/ Includes intercept. Newey-West bandwidth.
AR is the sum of autoregressive coefficients, from lags 1 to 4.

b) The interest rate-output link

Given the contrast in the interest rate response to exchange rate variations across country groups and exchange regimes, it could be expected that differences in the adjustment of local interest rates to variations in output could also be found. As explained in section 2, this possibility will be explored by introducing, as an additional regressor in the IRD equation for each country, a 3-month, left-sided moving average of a monthly index of output, alone and interacted with the FLOAT dummy, as in equation (4). In addition, in a separate set of equations, the output variable will be interacted with a dummy that reflects the state of the business cycle, i.e., GROWTH or CYCLE, as in equation (6).

Table 8 presents the "long-run" values of the output coefficients, which were calculated from the estimated coefficients of the ADL equations in Tables 2-7. The table distinguishes between the initial response of the interest differential, given by the first statistically significant coefficient in regressions of the form of Equations (4) and (6), and the final, cumulative value of the coefficients. Columns (1) and (2) present the results obtained from regressions of the form of equation (4) (i.e., without the GROWTH or CYCLE dummies), whereas Columns (3)-(6) show the results derived from equations including one of the two dummies. In this latter specification, the GROWTH dummy was statistically significant in Chile and Colombia, whereas for Israel and Italy it was CYCLE that showed the best results. For Spain and Portugal, both variables yielded significant results.

Somewhat surprisingly, given the differences observed in the interest rate-exchange rate nexus, an analysis of the response of the interest differential to output changes reveals important similarities between the CCI and European countries. During the band period, the interest rate differential moved counter-cyclically in relation to output (see Table 8, column 1). This effect is statistically significant in each country. Moreover, it is transitory –as perhaps could be expected in a scenario of short-term stabilization policy–, in the sense that while the initial effect is highly significant, eventually the cumulative effect becomes much smaller and non-significant (in this latter sense, with the exception of Colombia).

As mentioned, this pattern is shared by the European and CCI countries.[11] There are naturally differences in the size of the (initial) coefficients, ranging from 333.2 and 298.9 in Spain and Colombia, respectively, to 87.5 and 82.2 in Chile and Portugal. Thus, the response of the interest differential to a one-percent fall in output ranges from about 3 percentage points in the former countries –always expressed in "long-term" values–, to little less than one point in the latter. There are also dynamic differences between the countries; in particular, the anti-cyclical interest rate response takes 3 periods to become significant in Spain and Israel but only 1 period in Portugal; in the rest of countries it takes 2 periods (see column 2 in Tables 4-7, column 3 in Table 3, and columns 2 and 3 in Table 2).

The behavior of the interest rate differential during the band period appears to be influenced by the state of the cycle, particularly in the CCI group. Within this group, the anti-cyclical pattern observed during the band period is stronger when output is in a "high" phase in Chile and Colombia, but when it is in a "low" phase in Israel.

[11] Corbo (2000) presents evidence that Chilean interest rates responded positively to the gap between actual and potential output during the period 1990Q1-1999Q4, while in Colombia the interest rate reacted negatively to increases in the difference between the actual and trend unemployment rates during the band period.

TABLE 8
"LONG-RUN" OUTPUT COEFFICIENTS

		(1) Band	(2) Float	(3) Band high	(4) Band low	(5) Float high	(6) Float low
CHILE	Initial	87.5**	59.9*	48.2	25.7	12.4	11.0
	Final	-3.4	-31.0***	-4.2	-26.7***	-40.0***	-41.4***
ISRAEL	Initial	66.1**	46.9	-0.6	115.6***	-13.9	-36.8
	Final	0.3	-18.9**	-0.6	13.0*	-13.9	-11.9
COLOMBIA	Initial	298.9***	12.1	271.0***	170.6*	-19.3	-6.5
	Final	60.1**	85.0*	77.6***	-22.8	50.4	63.3
SPAIN I	Initial	333.2***	-23.7	304.9**	-230.3(a)	-20.3	364.8*
	Final	7.6	15.2	11.8	11.7	19.9	19.9
SPAIN II	Initial	333.2***	-23.7	264.6**	445.3**	-72.3	-51.4
	Final	7.6	15.2	3.1	3.4	3.9	3.7
ITALY	Initial	183.7***	205.5**	183.7***	205.5**	323.6***	23.7
	Final	55.1(a)	22.4	55.1(a)	22.4	-5.3	-5.7
PORTUGAL I	Initial	82.2***	-0.5	87.6***	87.6***	-6.6	103.0**
	Final	20.1	-21.7**	-1.4	40.0***	-25.0**	-22.2
PORTUGAL II	Initial	82.2***	-0.5	89.6***	89.6***	-2.7	-2.7
	Final	20.1	-21.7**	69.9***	20.3	-18.5(b)	-28.8**

*** (**) [*]: Wald test rejects the hypothesis of zero sum of coefficients at 1% (5%) [10%].
In columns (3) to (6), "high" means that output is above its H-P trend, or that its annual growth rate is positive, while "low" means that output is below trend (CYCLE=1) or has a negative annual growth rate (GROWTH=1). The CYCLE definition is used for Israel, Spain II, Italy and Portugal II, while the GROWTH definition is used for Chile, Colombia, Spain I and Portugal I. The change in coefficients is estimated with the use of 0-1 dummies, as explained in the text, except in columns (1) and (2) for Italy, where separate equations had to be estimated to get significant results (see equations 2 and 3 in Table 2).
In the country column, "initial" refers to the first statistically significant output coefficient in equations of the form of (4) and (6) in the text, while "final" refers to the cumulative value of all significant coefficients. See text for further details. The exception is Israel and column (6) of Italy, where the first two significant coefficientes are considered in the calculation of the "initial" coefficient, because in these cases this gives a better description of the dynamic response of the interest differential to changes in output.
(a) p-value is 0.11; (b) p-value is 0.10.
Source: Tables 2-7.

The macroeconomic implications from the lack of sensitivity of the interest differential when output is below trend or its growth rate is negative depend on whether output is rising or falling in each period. In the former case, lack of sensitivity would in fact contribute to a faster recovery; if output is falling, however, the opposite would be the case and recovery would be retarded compared with a scenario of falling interest rates. To the extent that this behavior of interest rates reflects actual or expected policy actions, it corresponds to what sometimes has been termed an "opportunistic" behavior by the government, who would be taking advantage of the disinflationary impact of output contractions to approach an inflation target.

Table 9 presents indicators of the frequency of observations when monthly output is falling and either the annual growth rate is negative (GROWTH=1) or output is below trend (CYCLE=1). The data refers to the CCI countries during the band period, while the business cycle dummy (GROWTH or CYCLE) matches the specification behind the results in Table 8.

It can be seen that in Colombia the number of observations with output falling, as a proportion of the total number of observations with poor growth performance (i.e., when GROWTH is equal to one), is 71.4%. This suggests that, given a situation of poor growth performance, an opportunistic behavior by authorities, as defined above, was frequent. However, it must be noticed that in this country the number of observations with a negative output growth rate represents only 29.5% (20/95) of the total number of observations for the band period. The proportion in Chile is even smaller: only 8.7% of the observations during the band period correspond to the case where the GROWTH dummy is equal to one. Thus, the overall scope for an opportunistic behavior has been relatively small, basically because these countries were most of the time growing.

TABLE 9
SAMPLE DISTRIBUTION FOR CCI COUNTRIES DURING BAND PERIOD

	Chile	Colombia	Israel
(A) Number of observations in band period	104	95	78
(B) Number of observations with "low" output 1/	9	28	34
(C) Number of observations with "low" output and negative monthly output variation	5	20	9
(D) B/A (in %)	8.7	29.5	43.6
(E) C/B (in %)	55.6	71.4	26.5

1/ "Low" output means that the output moving average is below its H-P trend (CYCLE=1) in Israel, or that the annual growth rate of output is negative (GROWTH=1) in Chile and Colombia.

In Israel the proportion of observations with a fall in output in relation to the total number of observations in which output is below trend is low (9/34, or 27%). However, recall that in this country the interest differential behaved counter-cyclically precisely when output was below trend during the band period. As a consequence, in this case the anti-cyclical character of the differential was more frequently a restraint than a push to recovery.

Turning to the influence of the exchange rate regime, it can be seen that as countries adopted a floating system, the nature of the interest rate-output link changed dramatically. In particular, there was a large fall in the size of the output coefficient, which in addition became non-significant. Thus, the original anti-cyclical response of interest rates to variations in output was lost after the shift to float. The only clear exception to this is Italy, where in fact the size of the coefficient increased.[12] Therefore, while the adoption of a floating regime allowed European countries (and very incipiently in the CCI group) to de-link local interest rates from the exchange rate, this did not result in a stronger anti-cyclical behavior of interest rates in relation to output, a feature which instead tended to disappear (except in Italy). Moreover, there is evidence that in the new regime the cumulative change in interest rates became pro-cyclical in Chile, Israel and Portugal.[13]

It could be wondered whether such a result is related to differences in the countries' overall economic performance. For instance, it may be that a weakening of macroeconomic stability could have induced the monetary authorities to adopt more conservative policies, irrespective of the new regime itself. It is beyond the scope of this paper to offer a formal test of such factors, but it is still possible to offer some suggestive observations. Table 10 presents the data. It includes averages from annual series for the inflation rate, GDP growth, the current account balance, the federal government's fiscal balance, and the unemployment rate.

TABLE 10
INDICATORS OF MACROECONOMIC PERFORMANCE

	Inflation	Final inflation	Growth	CA	Fiscal balance	Unemployment rate
Italy 1988-1992	5.8	5.1	2.2	-1.7	-10.3 a/	11.5
Italy 1993-1998	3.6		1.5	2.0	-6.5	11
Portugal 1991-1993	9	6.8	1	-0.3	-5.0	4.6
Portugal 1994-1998	3.4		4	-4.1	-4.1	6.6
Spain 1990-1993	5.8	4.6	1.4	-2.9	-5.2	18.5
Spain 1994-1998	3.3		2.9	-0.2	-4.8	21.8
Chile 1991-1999	10.2	3.3	6.7	-3.1	1.4	6.5
Chile 2000-2002	3.3		3.6	-1.6 b/	0.1 c/	9.2 c/
Colombia 1991-1999	21.7	11.2	2.7	-2.4	-2.9	11.4
Colombia 2000-2002	8.3		2.1	-0.9 b/	-6.4 b/	20.1 c/
Israel 1991-1997	12.1	9.0	5.3	-3.8	-3.6	8.7
Israel 1998-2001	3.2		4.2 d/	-2.0	-1.6	8.9

a/ 1990-1992. c/ 2000.
b/ 2000-2001. d/ 1998-2000.

Inflation: Percent variation in the annual CPI.
Final inflation: Inflation rate during the last year of the corresponding period.
Growth: Percent change in the annual real GDP.
CA: Current account balance as percent of GDP.
Fiscal balance: Percent of GDP.
Source: IMF's International Financial Statistics, February 2003.

[12]In addition, in Chile the initial output coefficient remained (barely) significant although much smaller than during the band period, while in Colombia the initial coefficient turned non-significant but the cumulative coefficient became larger.

[13]To put these results in context, we may note that, contrary to the current international trend, the Colombian central bank has often declared that its monetary policy decisions are guided not only by an inflation target, but also by, among other factors, the unemployment situation (see Hernández and Tolosa 2001; for a more recent statement, see Clavijo 2004). In contrast, Bank of Israel officials have repeatedly stated that the current policy stance is one of strict inflation targeting, which gives no consideration to output behavior (see Leiderman and Bar-Or 2000).

A first thing to notice is that the reduction in the anti-cyclical character of the interest differentials is not associated to any discernible erosion in macroeconomic stability. In particular, in all countries there is a fall in average inflation as we move from band to floating. In fact, it can be noted that while during the band period inflation was higher for the CCI group than for the European countries, during the floating period the countries converged to very similar inflation rates, with an average of little more than 3%. The exception is Colombia, where, despite a process of disinflation, the average inflation rate remained at a comparatively high level of 8.3%.

Similarly, it may be noticed that there was a general fall in the fiscal deficit and the current account deficit after the adoption of floating. The exceptions are Portugal, where the current account deficit rose from 0.3 to 4.1% of GDP, and Colombia, where the fiscal deficit increased from 2.9 to 6.4% of GDP. From this evidence, it could be thought that the increase in the fiscal deficit and the relatively high rates of inflation in Colombia could have led authorities to neglect output stabilization and thus to reduce the response of local interest rates to output fluctuations. Yet it must be recalled that, among the CCI group, Colombia is the only country where the cumulative output coefficient remained significantly positive after the shift to float.

Thus, there is little support for the idea that the sensitivity of interest rates to output declined because of a worsening of macroeconomic stability that would have called for a diversion of monetary policy to deal with such an issue. Rather, the evidence can be read in the opposite direction, that is, in the sense that a decision to focus on disinflation[14] and fiscal adjustment, in the context of a perceived need to gain credibility for the new floating regimes, led to a relative neglect of output stabilization. In fact, it can be seen that in the CCI group the output growth rate declined and the unemployment rate tended to rise after the adoption of the new regime.

5. CONCLUSIONS

The effect of a shift from a band to a floating exchange rate system on the behavior of interest rate differentials is uncertain on purely analytical grounds: the regime shift gives local authorities greater monetary autonomy –particularly if, as is usually the case, there has been significant intra-marginal intervention within the band–, but this comes at the cost of losing an anchor for exchange rate expectations. This trade off may affect the way interest differentials respond to variations in the exchange rate and output.

This paper has shown that the interest rate-exchange rate link in Chile, Colombia and Israel –the countries singled out by Williamson (1996) as examples

[14]As can be seen in Table 9 and figures 1 to 6, in all countries, except Chile, the annual inflation rate at the end of the band period was higher than the average for the floating period.

of well-managed bands– presents a pro-cyclical character, in the sense that a rise in the exchange rate (a currency depreciation) tends to be followed by an increase in the local interest rates. This pattern has persisted, with a minor reduction in its intensity, after the countries moved from crawling bands to floating systems in the second half of the 1990s. In contrast, among a sample of European countries that underwent a similar regime shift in the early 1990s (Italy, Portugal and Spain), the interest-rate response to exchange rate fluctuations was counter-cyclical, particularly during the band period.

A second important result is that in all countries, with the exception of Italy, the shift to float has brought about a reduction in the intensity of the anti-cyclical behavior of the interest differential in relation to output. There is evidence that in some countries the cumulative reaction of the interest differential has even become pro-cyclical. A casual look at basic indicators of macroeconomic performance suggests that the observed de-linkage of the interest differential from output can be interpreted as the result of a policy decision to focus on disinflation and fiscal adjustment, in the context of a perceived need to gain credibility for the new floating regimes, at the cost of a relative neglect of output stabilization.

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